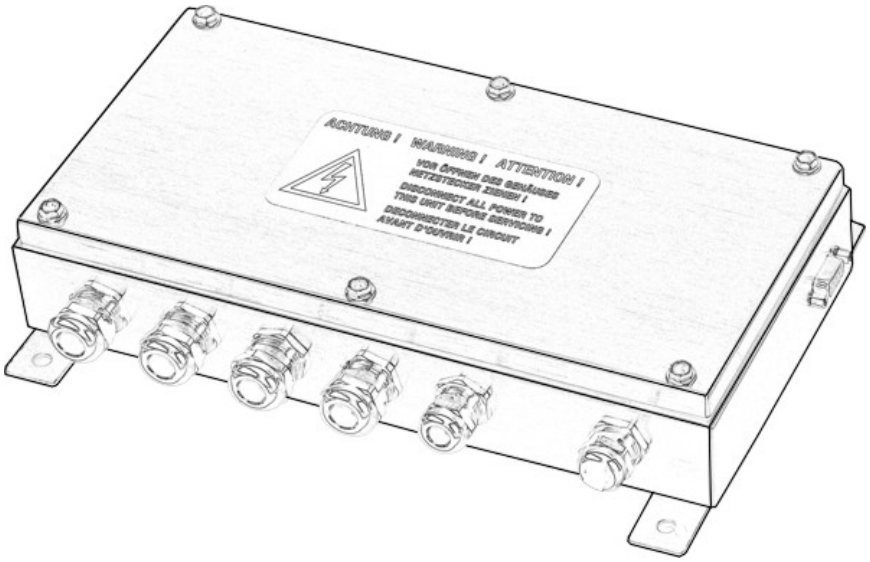
SysTec Systemtechnik und Industrieautomation GmbH

Technical Manual

ProfiBox

(CPU3000AP)



Weighing Electronics
With Profibus DP Interface

June 2016

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Technical Manual ProfiBox CPU3000AP
Weighing Electronics With Profibus DP Interface

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Please Note:

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The publisher is grateful for any information and/or advice that may contribute to correct errors or omissions in following editions.

Contents

1 Introduction

1.1 About This Manual

This manual contains information and Technical Data for the installation and operation of the ProfiBox weighing electronics / batching module.

1.2 Safety Symbols Used In This Manual

Safety relevant information is shown with corresponding symbols as follows:

W A R N I N G
Failure to observe this precaution could result in serious injuries or fatal accidents. Please make absolutely sure that these precautions are observed in order to ensure safe operation of the equipment.

CAUTION
- **Failure to observe this precaution could result in damage to or destruction of the equipment or bodily harm! Please make absolutely sure that these precautions are observed in order to ensure safe operation of the equipment.**

Note: This indicates an advice for the designated use of the equipment and/or additional information to avoid improper handling.

1.3 Safety Advice

W A R N I N G
Disconnect all power to this instrument before opening the housing! Risk of electrical shock!

W A R N I N G
Exercise utmost care when making checks, tests and adjustments that can actuate movable parts such as feeding devices, gates, flaps, conveyors, etc. Make absolutely sure that nobody is within reach of movable parts.

W A R N I N G
This unit must not be operated in a potentially explosive atmosphere!

It is the sole responsibility of the user to classify the area of installation and make sure that absolutely no potentially explosive atmosphere can be present at any time!

CAUTION
- **Input voltage of the instrument must comply with local mains supply!**

CAUTION
- **If the line cord with connector is used as the means to separate the instrument from the mains, the wall outlet must be installed close to the instrument and must be easily accessible! If a permanently connected mains cable is used, an easily accessible separator must be included in the supply circuit!**

CAUTION
- **The power supply unit of the weighing terminal provides SELV voltages in accordance with EN 60950. Make sure that any peripheral device connected to the weighing terminal containing its own power supply also uses SELV voltages!**

CAUTION
- **This unit must be installed, serviced and operated in strict compliance with all locally applicable safety regulations and the rules for the prevention of accidents!**

CAUTION

- **When this unit is included as a component part of a system, the resulting system design must be reviewed by qualified personnel who are familiar with the construction and operation of all individual components in the system and the potential hazards involved.**

CAUTION

- **If this device is used in an automatic or manual filling cycle, all users must provide a hard wired emergency stop circuit outside the device circuitry.**

CAUTION

- **This module and its associated equipment must be installed, adjusted and maintained by qualified personnel only!**

W A R N I N G

- **The device uses the short-circuit / overcurrent protection of the on-site mains supply.**

Note:

- The unit does not have a mains switch and is operational immediately after connection to the mains supply!
- Only permit qualified personnel to operate this instrument!
  Disconnect all power to this instrument before cleaning and servicing!
- All switch gear connected to the unit and/or installed close to it, such as relays and contactors, must be fitted with appropriate components (RC-modules, diodes) to suppress interference.
- In order to avoid static discharge, all metallic parts of a system must be thoroughly grounded. Movable parts, such as portable scales on plastic wheels, must be grounded with earth clamps or earth leads of appropriate diameter.
- Keep this manual for future reference!

1.4 General

ProfiBox is a weighing / batching module for installation at the weighing location, e.g. at the weigh hopper or the platform. Up to 16 analog strain gauge loadcells, with an impedance of 350 Ω each, can be connected. An optional shift adjust board with potentiometers for the connection of up to 4 loadcells is available. An additional junction box to connect the loadcells is then not required.

Weight values and status information are transferred to the PLC or host system via Profibus DP.

The weighing electronics can be used for scales of any range with a resolution of up to 30,000 increments.

ProfiBox is suitable for all applications requiring precise weight measurements but without the need to operate the unit locally via keyboard and display, since weight values are processed centrally in a PLC or host system. The weighing accuracy is equal to that of W&M approved systems.

Calibration and setup is made via a PC. Zero setting, taring and feeding / discharging can be activated via Profibus.

1.5 Construction

ProfiBox is incorporated in a stainless steel IP65 housing for installation close to the weighing site. Loadcell cables and power supply are connected through cable glands, connection of Profibus DP is made at a female 9-pin DSUB connector.

See section dimensions for details.

2 Quick Start

In spite of its many applications, setup and installation of ProfiBox is quite simple.

Just 3 steps are required:

1. Installation / connection of scale
2. Calibration of scale
3. Setting of Profibus DP slave address.

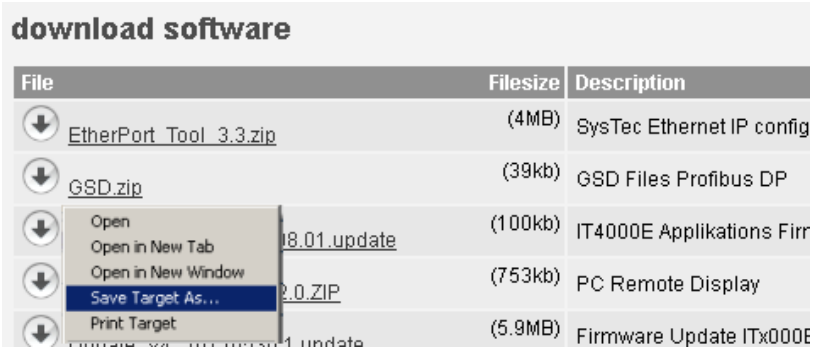
This manual is structured accordingly, with additional chapters explaining the data exchange over the Profibus and a description of technical details for service purposes.

For calibration and the setting of the slave address a PC is required with the program 'PC *RemoteDisplay*' installed and running. This PC must be connected via a serial data cable to the DSUB connector at the ProfiBox. After completing the installation, the data cable is removed and the Profibus cable connected instead.

To connect the module to the mains, a line cord with grounding type plug is provided. The DC version (option) is supplied without line cord.

For the configuration of the Profibus master, a GSD file is required that you can download from our website 'www.systecnet.com'.

- Follow the link 'Service' and from there to 'download software'.



- Download the file 'GSD.ZIP' (click right on the link and choose 'Save Target As...). Unpack the ZIP file on your hard disk.

3 Installation

3.1 Safety Advice

W A R N I N G
Disconnect all power to the instrument and/or unplug line cord prior to opening the housing! Failure to observe this precaution could result in bodily injury!

Notes:

- Transport and storage of electronic components such as boards, EPROMs, etc. must only be made in suitable anti-static ESD bags or cases.
- Shielding measures for the connection of cables must absolutely be adhered to. Insufficient shielding may cause interference and could result in malfunction of the instrument.

3.2 Mains Supply

W A R N I N G
Input voltage of the instrument must comply with local mains supply. Factory setting: 110 (–15%) to 240V (–10%); 50/60Hz.

Before connecting the instrument to mains supply please note:

- Install mains supply for the instrument separate from supply for machines and equipment generating noise and/or interference (motors, relays, heatings, etc.). Even short spikes and/or drop-outs may affect the correct function of the instrument and result in defects. If problems of this nature are encountered, the installation of a voltage stabilizer or an uninterruptible power supply unit (UPS) may help to overcome the difficulties.
- Connection to the mains supply is made via the factory installed line cord with VDE-approved safety connector (length of cable 2.5m). Make sure that wall outlet is correctly grounded.
- ProfiBox does not have a mains switch and is operational as soon as the line cord is plugged into a wall outlet.

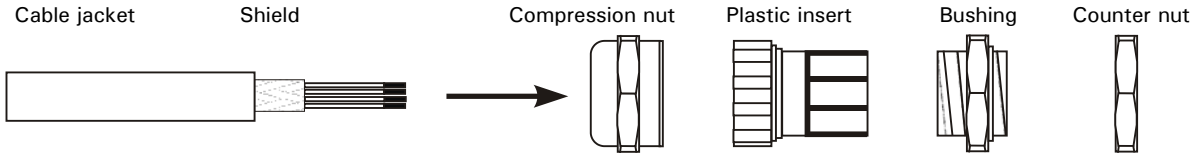
Ambient temperature for operating the unit may range from –10°C to +40°C, at a maximum of 95% relative humidity, without condensation. Exposure to direct sunshine should be avoided.

3.3 Opening Of The Housing

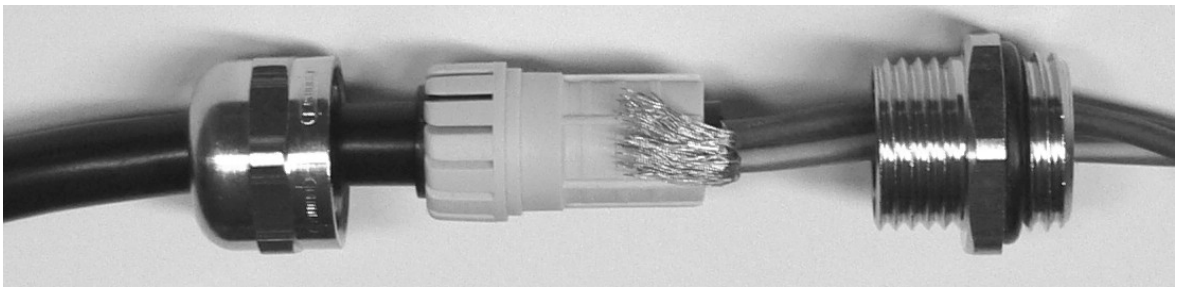
To open the housing a size 7mm wrench is required.

3.4 Connection Of Cables

All cables are led into the housing through cable glands.



1. Slide compression nut over cable jacket;
2. Slide plastic insert (retainer) over cable jacket until inner end is aligned with cut end of jacket;
3. Unravel shield, bend over retainer and push into retaining comb to ensure good conductive contact with housing. Cut wires of shield to length of comb, avoid protruding wires that would endanger tightness of cable gland;



4. Insert retainer with cable into bushing;
5. Screw compression nut onto bushing and use wrench to tighten securely.

W A R N I N G
Cut cable ends as short as possible and make sure that they cannot touch any parts (mains cable, power supply) conducting mains voltage!
Use wire end ferrules with plastic collar on stranded cables and avoid protruding wires!

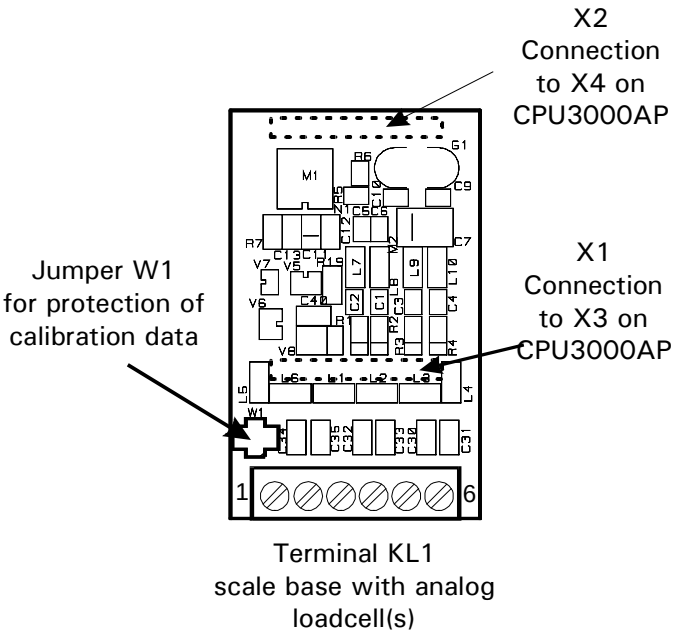
3.5 Connection Of Scale

3.5.1 Supported Understructures And Loadcells

The ADM scale interface in the ProfiBox provides connection for weighing platforms and loadcells as specified below:

- Max. 16 strain gauge loadcells 350 Ω each,
  (4 loadcells with optional shift adjust board)
- Overall impedance 21.5 Ω ... 4500 Ω
- Displayed resolution up to 30,000d, internal resolution 524,000d
- Update rate 50 updates / second
- Loadcell excitation: 5 V ±5%. (gated power supply).

3.5.2 Terminal Assignment On Scale Interface Module ADM



Terminal KL1
scale base with analog
loadcell(s)

Terminal KL1	Assignment
1	+ Excitation
2	– Excitation
3	+ Sense
4	– Sense
5	+ Signal
6	– Signal

Connection of 4-wire loadcell:

To connect loadcells without sense lines (4-wire connection), two jump leads must be connected at terminal strip KL1 between terminal 1 and 3, and between terminal 2 and 4.

Important note:

W A R N I N G
ProfiBox is *not* designed to connect to analog weighing platforms in hazardous area via zener barriers!

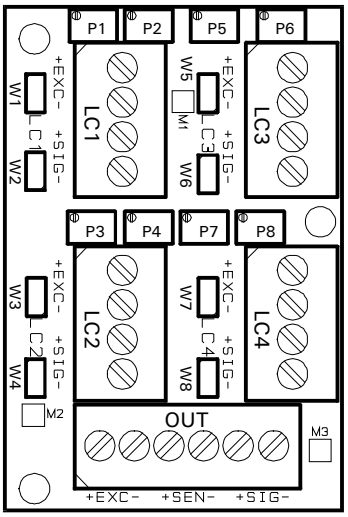
For the installation of connection cables for analog weighing platforms please follow the recommendations listed below:

- Only use suitable loadcell cable,
  (e.g. SysTec order-No. 10KAB214, 3 x 2 x 0,75mm², shielded)
  Nominal voltage of cable ≥250V.
  Unsuitable loadcell cable may affect accuracy.
- The shield of the loadcell cable must be connected all around the cable in the cable gland of the weighing terminal (see also chapter 'Installation' / 'Connection Of Cables'). If an extension of the loadcell cable is required use only metal junction boxes and cable glands. The shield on both sides must be connected in the same way as at the terminal. Loadcells and/or weighing platforms, junction boxes and the terminal must be included in the potential equalization of the components of a weighing system. Depending on the situation on site this may require the installation of a separate earth lead of appropriate diameter (e.g. 16mm²) in parallel to the loadcell cable.
- To extend the length of the loadcell cable use metal junction boxes only and connect shield of both cables in the cable glands.
- Distance between loadcell cables and power lines: ≥0.5m. Loadcell cables to be installed in grounded metal conduits, metal hoses or metal cable trays.
- Maximum length of connection cable between weighing platform and ProfiBox: 200m
- If tension load is applied to loadcells instead of compression load, connection for +Signal and –Signal must be transposed.

3.5.3 Shift Adjust Board

Via the optional KFW board up to 4 loadcells can be connected and shift adjusted by means of potentiometers.

Connection of loadcell cables on KFW board



Connection of loadcell 1 to 4 at terminal strips LC1 to LC4

Connection to ADM module via terminal strip OUT.

Terminal assignment

Terminal strip LC1 - LC4 (loadcell 1 - loadcell 4)

Terminal	Assignment
+EXC	+ Excitation loadcell
–EXC	— Excitation loadcell
+SIG	+ Signal loadcell
–SIG	— Signal loadcell

Terminal strip OUTPUT (connection to ADM scale interface)

Terminal	Assignment
+EXC	+ Excitation ADM
–EXC	— Excitation ADM
+SEN	+ Sense ADM
–SEN	— Sense ADM
+SIG	+ Signal ADM
–SIG	— Signal ADM

Connection of 6-wire analog loadcells

To connect 6-wire loadcells with sense lines, the corresponding lines for Excitation and Sense must be connected in parallel at the terminals LC1 to LC4.

Potentiometers and jumpers for shift adjust

For shift adjust (cornering) potentiometers are provided on the KFW connecting board, which are normally short-circuited with jumpers (no shift adjust).

Assignment of loadcells to potentiometers and jumpers

Loadcell	Terminal	Potentiometer	Jumpers
1	LC1	P1, P2	W1, W2
2	LC2	P3, P4	W3, W4
3	LC3	P5, P6	W5, W6
4	LC4	P7, P8	W7, W8

3.5.4 Shift Adjust

Default setting:

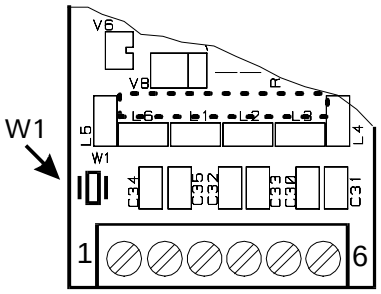
With factory setting all jumpers are closed. In this position shift adjust is disabled.

How to perform shift adjust:

- Open all jumpers.
- Turn all potentiometers counter-clockwise to end.
- Load corners one after the other with test weight (approx. 25% of capacity) and take down readings.
- Start adjustment at the corner with the highest reading. Apply the test weight and turn potentiometers -pertaining to this corner- clockwise until reading matches that of the corner which showed the lowest weight. Note: always turn both potentiometers symmetrically with the same number of revolutions. Adjust the next two corners in the same way.
- Repeat complete cycle if required.

3.5.5 Securing Calibration Data

The scale parameters are stored in EEPROM and secured by setting the jumper W1:



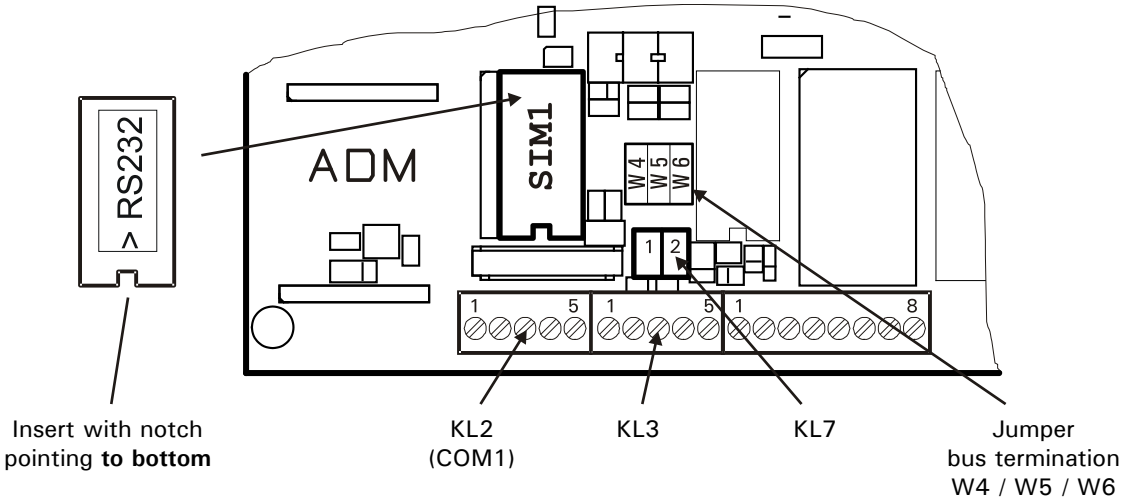
ADM

Calibration data secured

Securing the calibration data with jumper W1 is not mandatory but recommended to prevent unintended modifications during tests and trouble shooting. To enable download of calibration data from the host system the jumper must be set to position 'not secured'.

3.6 Serial Interfaces

Connection of serial interface on the main module



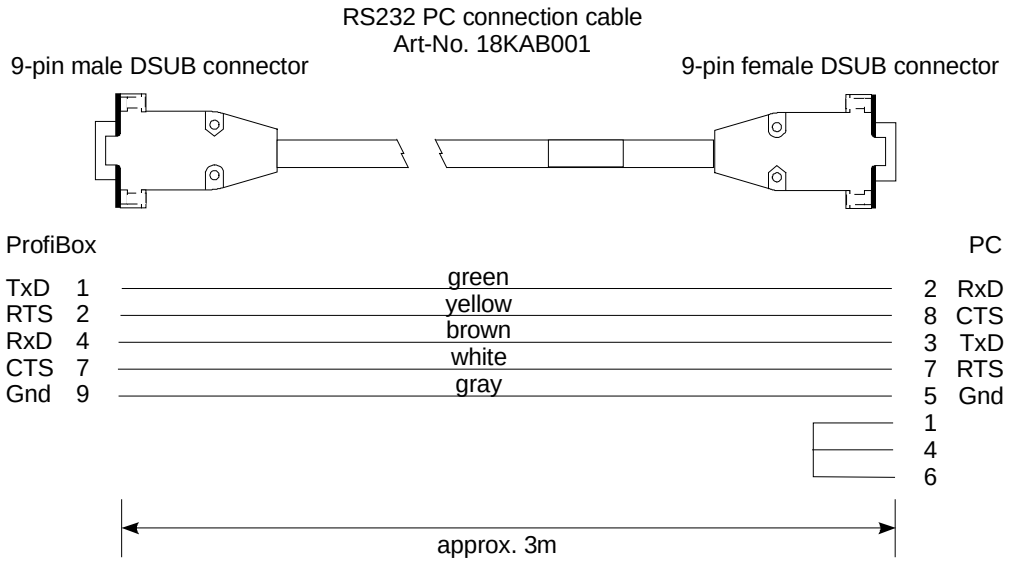
The connections of both interfaces are available on a 9-pin female DSUB connector (IP65) at the side of the housing.

3.6.1 Connection Of Service Interface

The service interface for the connection of a PC for calibration and setup is activated by inserting an RS232 driver module.

Terminal assignment interface COM1:

Assignment KL2: Serial Interface 1 (COM1)	
Terminal	**Service Interface RS232**
1	TxD
2	RTS
3	RxD
4	CTS
5	Gnd



3.6.2 Connection Profibus DP Interface

The Profibus address is set with two rotary switches (see further below). For the configuration of the Profibus master, a GSD file is required (see chapter 'Quick Start').

Terminal assignment Profibus DP interface:

Terminal Strip KL3: Profibus DP	
Terminal	**Profibus DP**
1	RTS
2 / 4	B line
3 / 5	A line

Connector KL7: Profibus DP	
Pin	**Profibus DP**
1	+5V
2	Gnd (5V)

Pin assignment DSUB connector:

Both interfaces, COM1 (as service interface) and Profibus DP are available on the 9-pin female DSUB connector:

9-pin DSUB female connector COM1 / Profibus DP			
Pin	**Service (RS232)**	**Profibus DP (RS485)**	**Color**
1	TxD	–	green
2	RTS	–	yellow
3	–	B line	red
4	RxD	–	brown
5	–	Gnd (5V)	black
6	–	5V	pink
7	CTS	–	white
8	–	A line	blue
9	Gnd	–	gray

Bus termination:

If the ProfiBox is installed at the physical end of the bus, the lines must be terminated by means of the jumpers W4 - W6 on the CPU3000AP board.

Jumper	Profibus DP Interface
W4	Pull-up resistor
W5	Termination resistor
W6	Pull-down resistor

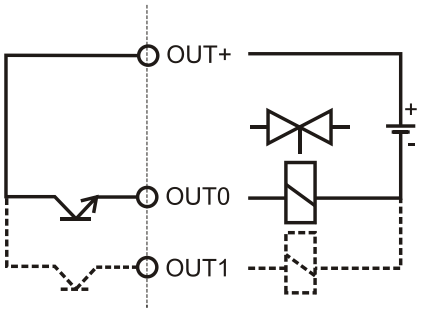
The bus is terminated when the jumpers are closed.

3.7 Connection Of Parallel I/Os

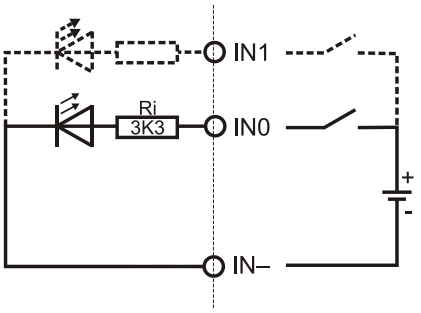
The parallel input/outputs on the CPU3000AP can be activated by inserting a plug-on module. The module provides drivers for two opto-isolated inputs and two opto-isolated outputs.

Rating of outputs: 24VDC, 100mA; rating of inputs: 7mA @ 24VDC.

Principal schematics:

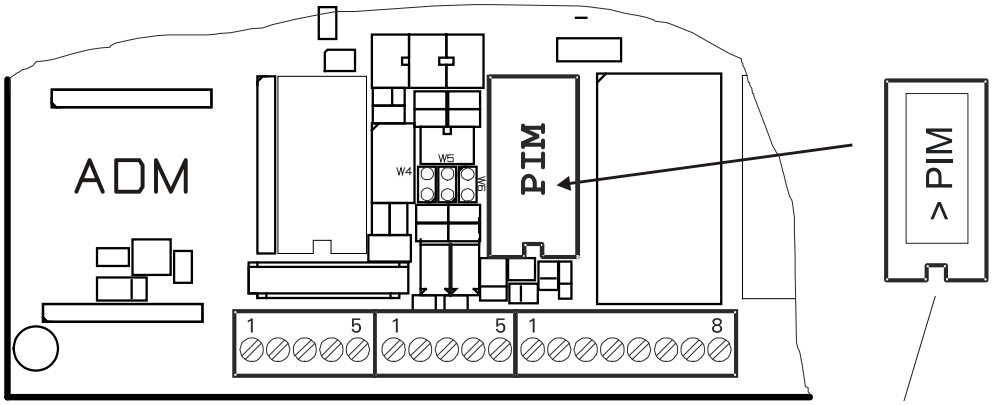


Parallel output



Parallel input

Position and assignment of parallel inputs/outputs on CPU3000AP board:



Terminal KL4

Insert with notch pointing to **bottom**

Terminal assignment: Terminal strip KL4: parallel inputs and outputs		
1	OV	
2	+ 10V	for external switches only!
3	IN0	*input IN0*
4	IN1	*input IN1*
5	In–	for IN0 - IN1
6	OUT0	*filling fast*
7	OUT1	*filling slow*
8	OUT +	for OUT0 - OUT1

Note: The internal 10VDC supply (KL4, terminal 2) may be used to connect switches and push buttons to the digital *inputs* (15mA max.). The step-up regulator that generates this voltage is short circuit proof for 1 sec max. External devices connected to the digital *outputs* must always be supplied from an external 24VDC power supply.

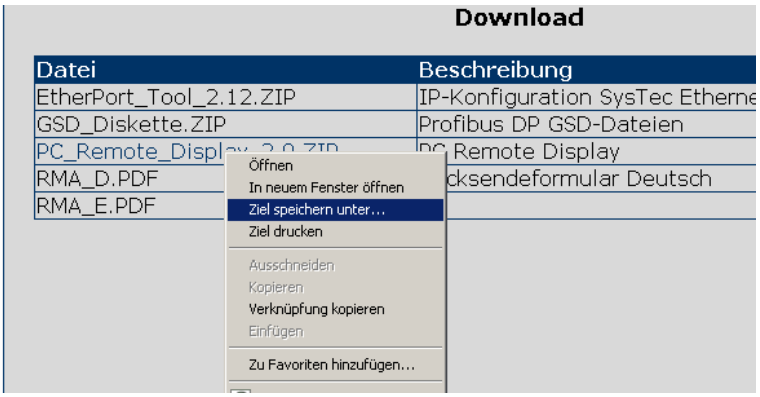
4 Service Mode

4.1 Graphical User Interface PC *RemoteDisplay*

Calibration and configuration is made on a PC, with the program 'PC *RemoteDisplay*' installed and running. PC *RemoteDisplay* runs under Windows 9x, NT, 2000 and XP.

You can download the program 'PC *RemoteDisplay*' from our website 'www.systecnet.com'.

Follow the link 'Service' and from there to 'download software'.



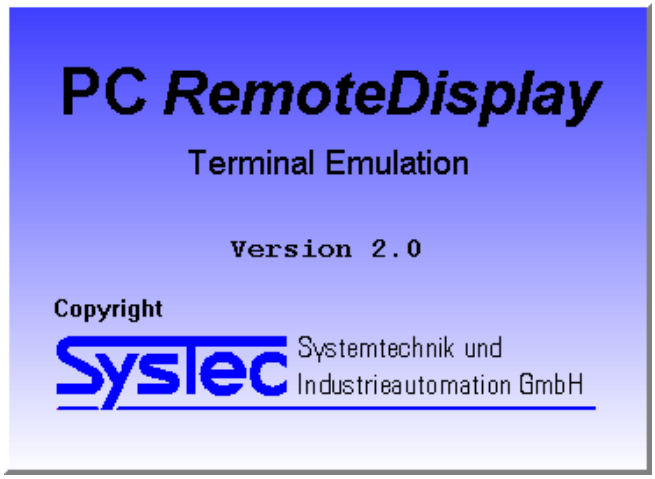
Download the file 'PC_Remote_Display.ZIP' (click right on the link and choose 'Save as...').

Unzip the program on your harddisk and start the program PCRemoteDisplay.EXE.

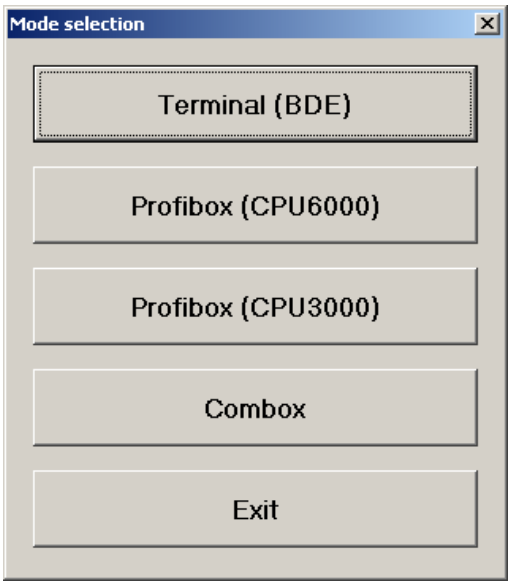
The working window of the program emulates the keyboard / display unit of a weighing terminal with single-line display and keyboard (IT3000). All functions, that are usually accessible on the weighing terminal, can be reached in the emulation via mouse click on the corresponding field in the window or direct via key stroke on the PC keyboard.

The PC is connected to the ProfiBox via a serial data cable.

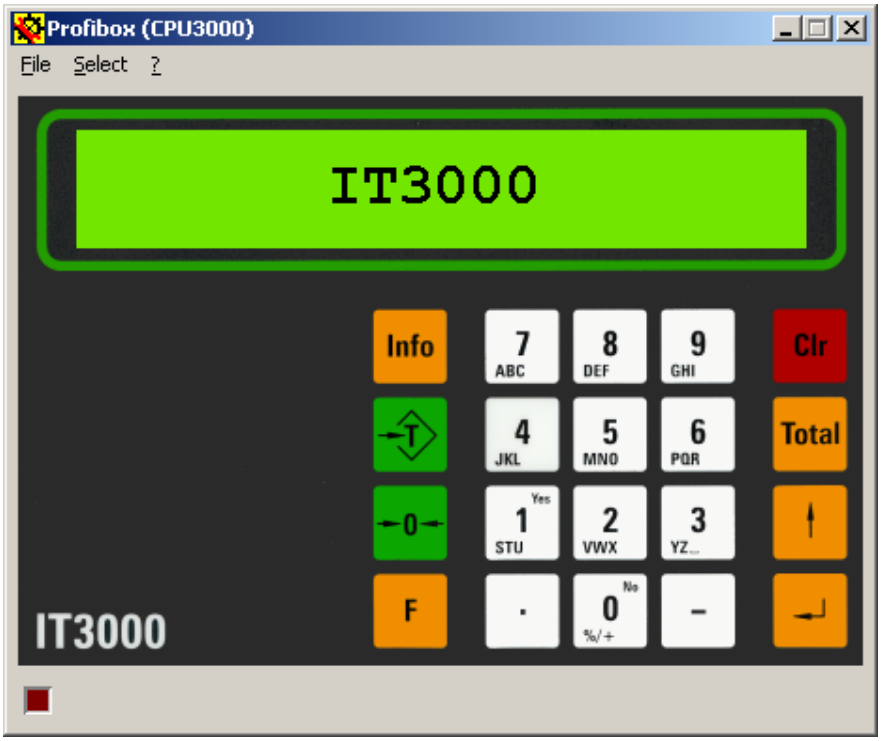
After the start of the program the opening window appears for about 3 sec:



Followed by the select menu:



Click on menu item 'ProfiBox (CPU3000)' to open window of terminal emulation:



The indicator box in the lower left-hand corner shows:

Green: Communication between ProfiBox and PC running (e.g. during normal operation when the weight value is updated continuously);

Red: No communication (e.g. when the ProfiBox is waiting on an input during calibration).

4.1.1 Entries Via PC Keyboard Or Mouse

Entries can either be made by click on the respective key in the emulation window or via the PC keyboard.

	PC keyboard	Simulation with mouse	
Display:			Display of gross / net weight or parameter group or display of prompts (left justified) and entries (right justified), respectively.
Function keys:	**F1 - F8**	**F1 - F8**	F0 = display with tenfold resolution F1 = call up monitor input words F2 = call up monitor output words F8 = abort ONLINE mode (the other function keys are not used)
	↑	↑	Return to previous program step
	F10	→T←	Autotare scale, clear tare if scale is tared
	F11	→0←	Set gross weight to zero (within zero setting range)
	F12	**Total**	Total-key
	Pos1	**Info**	Scrolling
	Clr	**Clr**	Clear entry
Enter-key:	**Enter**	↵	Confirm entry, continue in next step of program

4.1.2 Settings For PC *RemoteDisplay*

3 menu items can be selected from the menu bar:

File with the entries:
Settings (with the sub menus *Devices* and *Language*)
End (to terminate the program);

Select with the list of the connections enabled under *Settings / Devices*;

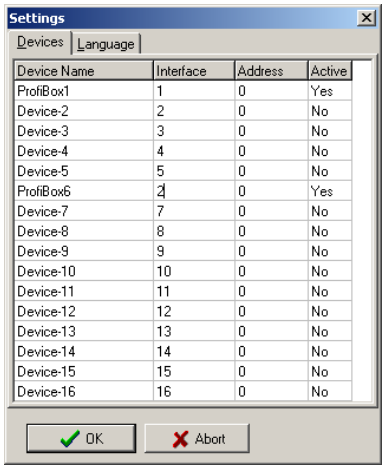
? to display opening window and version-No.

In detail:

Settings / Devices

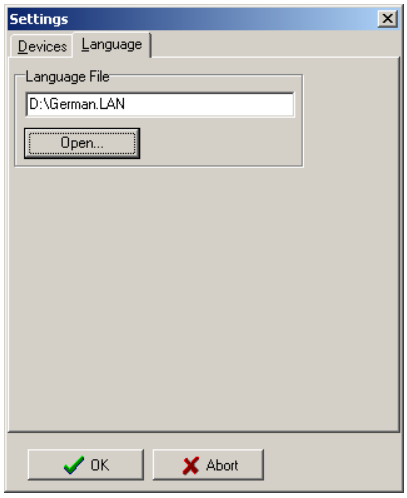
If the PC is equipped with several serial interfaces (or a multiplexer board), the assignment of the individual devices (16 max.) to the physical interfaces can be made in this table. The fields 'Device name' and 'Interface' can be edited, the field 'Active' can be toggled Yes/No with double click. For multidrop operation the address of the participant (1 - 30) is entered in the field 'Address'.

Example: ProfBox1 on interface 1 active, ProfiBox6 on interface 2 active, all other units either not present or disabled.



Settings / Language

The language of the graphical interface for messages and prompts can be changed by loading a different language file. After choosing the menu item 'Language' a file select window is opened where a language file (file extension .LAN) can be selected and loaded. For the time being, language files are available in English and German.



Select

One of the devices activated under 'Settings / Devices' can be selected here.

4.2 General

The Service Mode is a program for configuration of the ProfiBox. The Service Mode includes the calibration of the scale and functional tests of the ProfiBox hardware.

The following sections give an introduction on how to operate the ProfiBox with the PC program PC *RemoteDisplay* and describe the individual functions of the Service Mode.

Notes:

- ProfiBox and its associated equipment must be installed, adjusted and maintained by qualified personnel only!
- Before accessing the Service Mode all peripheral devices must be installed and configured!
- Access to the Service Mode is protected by the Service Password (see also last page of this manual).
- Inappropriate changes of Service Mode settings may lead to malfunction and errors in the operating sequence!

4.3 Operator Prompting

The following sections describe the operating sequence with operator prompts and the requested entries. Since ProfiBox does not have its own display and keyboard, prompts and entries refer to the PC tool PC *RemoteDisplay* that is used for configuration, calibration and test of ProfiBox.

The contents of the display is shown in a frame on the left hand side. Next to the display the possible operator entries are listed, on the right hand side comments and explanations are shown.

Example:

`Password ????`	Entry of 4-digit Service Password
	↑ Return to normal operation

Prompts or entries that apply only under certain conditions are shown in an extra frame. The condition is shown in bold face in the upper left hand corner of the frame:

Saving not possible:

`Calibration Locked`	Calibration data cannot be stored

This message appears only if jumper is still in position 1 - 2.

↵-key and ↑-Taste

In all program steps, unless otherwise specified, the enter key ↵ leads to the next step. Pressing the ↑-Key (Up-key) leads to the previous step.

4.4 Overview

After power up, the messages with display of program version and operating mode are displayed. After that the program proceeds to the initial step. By pressing the Info-key while the power up messages are displayed, the Service Mode is called up. The Service Mode contains the routines for calibration, setup and hardware test.

`Version 9.99 999999`		Display for approx. 1.5 sec.
	Info	Call up Service Mode
`Application: ONLINE`		Display for approx. 1.5 sec.
	Info	Call up Service Mode
`Password ????`		Entry of 4-character Service Password
	↑	Return to normal operation
`Service: Calibrate`		Calibrate scale; (see chapter 5 'Calibrate Scale')
	Info	Use Info-key to scroll and select with ↵-key
`Service: Test`		Test hardware; (see chapter 8 'Hardware Test')
	Info	Use Info-key to scroll and select with ↵-key

While the 'ONLINE' program is running, the window of the emulation shows:

`O1 25,60 kg`	Display of gross weight in the operating mode 'ONLINE'. For multiple-range scales the active range is shown on the left-hand side (e.g. O1.2), for scales with one range only always O1 is displayed.

Functions in the operating mode 'ONLINE':

→0←	Set gross weight to zero, only within zero setting range (factory setting ±2%)
F1	Call up monitor input words
F2	Call up monitor output words
F8	Terminate operating mode 'ONLINE' and switch to 'Simple Weighing' mode (for test purposes only).

When Service Mode is exited, the entered or modified parameters are stored.

`Saving...`	Exit Service Mode and save changes, return to normal operation.

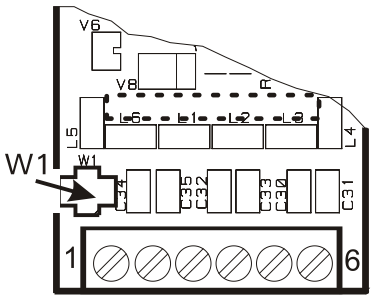
Functions in the operating mode 'Simple Weighing' (for test purposes only):

W1 25,60 kg	Display of gross weight in the operating mode 'Simple Weighing' (W1 is indicated on the left-hand side). Bit 15 in data word IW4 is not set, exchange of information over data words is disabled.
↑	Return to operating mode 'ONLINE'
F0	Display weight with tenfold resolution
X10 25,604 kg	Display with tenfold resolution. Display is switched back after 5 sec.
→0←	Set gross weight to zero (only within selected range for pushbutton zero).
→T◇	Autotare: By pressing the tare-key the scale is tared
W1 0 kg NET	
→T◇	Clear tare and return to indication of gross weight
W1 25,60 kg	
Tara Input _____1	Manual tare: After pressing a numeric key, entry of manual tare is enabled,
↵	after entry of a complete tare weight and pressing the Enter-key the net weight is displayed.
W1 15,40 kg NET	
Info	Use Info-key to display tare weight.
10,20 kg TAR	Tare weight when scale was autotared
10,20 kg PT	Tare weight when scale was manually tared
↵	Return to display of net weight
→T◇	Clear tare and return to display of gross weight

5 Calibrate Scale

The ProfiBox calibration mode offers a variety of options for specific applications. In practice, however, it is almost always sufficient to use factory settings and calibrate load (weighing range) and preload (weight on scale when zero is to be indicated). This is done by calling up group 1 and subsequently group 2 of calibration mode and entering the appropriate values. This simplified method is described below, for the expert a detailed description of all options can be found in chapter 'Options For Calibration'.

Prior to power up the jumper W1 must be removed. Only with this jumper setting can the changed parameters be stored in memory after the calibration.



ADM

Calibration released

Note: Since ProfiBox is not used for applications subject to W&M approval, it is not mandatory to set the jumper to the secured position (1 - 2), however it is recommended to do so in order to prevent unintended modifications of the settings.

5.1 Select Group

After entering the calibration mode, the first menu item is displayed:

`Service:Calibration`	Calibrate scale

If jumper W1 is still in position:

`Calibration Locked`	Warning: jumper not in calibration position, parameters cannot be saved!
↵	Enter calibration mode without saving (e.g. to check settings)

`Select Group 1-7`	Select parameter group:
1	**Scale Parameters**
2	**Calibration**
3 *)	Linearization
4 *)	Zero Adjust
5 *)	Adaptation
6 *)	High Resolution
7 *)	Reset Parameters
Info	Scrolling forward
↑	Save changes and return to menu

*) For the quick start method these groups can be ignored.

After pressing the ↑-key in step 'Select Group 1-7', the display shows the message:

Save Parameters? Y	Save parameters in EEPROM Y: Save parameters N: Ignore all changes, do not save data
Info	Scrolling

If jumper W1 is still in position:

Error Calibr.Jumper	Error message: jumper not in calibration position, parameters cannot be saved!
↵	Exit calibration without saving parameters

5.2 Example

The following example shows how simple it is to enter the parameters for weighing range / increment size and to calibrate the scale.

Example: floor scale with weighing range 6000 kg, increment size (division) 2 kg.

Follow the instructions below and ignore all other options. First call up group 1 of calibration mode and acknowledge suggested settings with ↵-key or choose different setting for your application with Info-key and confirm then with ↵-key. Capacity and interval can be entered freely via keyboard.

Select Group 1-7	**1 Scale Parameters**
Single Range	Single Range: scale with one range
One Interval	One Interval: scale with one interval (increment size) over the full range
Capacity 999999	Entry of weighing range, 6 digits max. Example: 'Capacity 6000'
Interval 999999	Entry of increment size, 6 digits max. Example: 'Interval 2'
Unit kg	Choose unit sign Example: 'Unit kg'

This completes settings for weighing range and increment size. In the next step call up group 2 for calibration of preload and load.

Select Group 1-7	**2 Calibration**
Geo Value 99	Entry of Geo Value, factory setting for calibration at location of use = 20
Calibrate Zero? Y	Scale Zero Calibration. Unload the scale and confirm to start the calibration.
Calibrating...	Measuring Zero signal. Message for approx. 6 sec
Zero: 9999999	Display of actual weight with tenfold resolution (for verification).

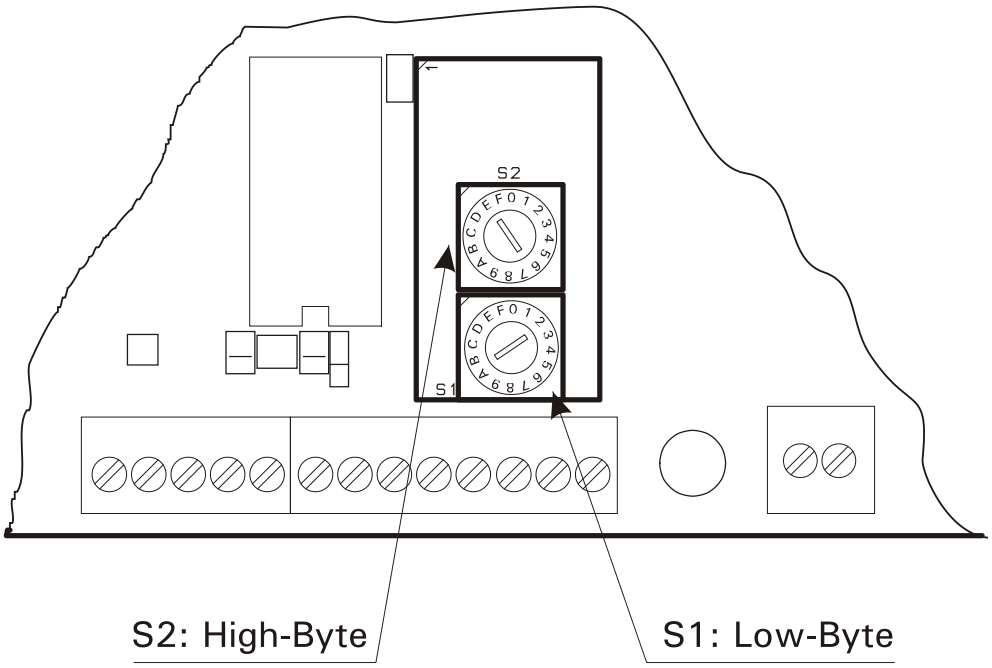
`Zero(mV/V): 9999999`		Display of rated signal (e.g. 0.23785)
`Calibrate Load?  Y`		Load calibration weight on scale. For best results use the highest possible calibration load.
`Calibr.Weight999999`		Default calibration weight (= weighing range), 6 digits
	Clr	Clear displayed default value and enter desired calibration weight.
	↵	Apply load and start calibration
`  Calibrating...`		Measuring load signal. Message for approx. 3 sec.
`Load:  999999`		Display of actual weight with tenfold resolution (for verification).
`Load(mV/V):  999999`		Display of rated signal (e.g. 0.52243)

This completes the calibration and you can now exit the calibration mode.
A detailed description of all options is given further below in this manual.

6 Set Slave Address

For the setting of the slave address a piggy-back board (PAS) with two rotary switches is installed on the CPU3000AP. Setting is made in hexadecimal form with low byte (switch S1) and high byte (switch S2) within a valid range from 01 (slave address = 1) to FF (slave address = 255).

Position of PAS board with rotary switches S1 and S2 on CPU3000AP:



To determine the hexadecimal address, the decimal value is divided by 16, the integer part of the result is the high byte. This part must be multiplied with 16 and the result of this operation subtracted from the original decimal value; the result is the value of the low byte.

Example: decimal address = 127

127 : 16 = 7.9375; integer part = 7, multiplied with 16 = 112, difference to127 = 15,

i.e. hexadecimal address = 7F (high byte = 7, low byte = F).

To convert the setting of a hexadecimal address to the corresponding decimal value, the total is calculated over high byte times 16 plus low byte.

Example: hexadecimal address = 5E

5 x 16 + E = 80 + 14 = 94

i.e. decimal address = 94.

7 Connection To Host System

During normal operation all functions of the ProfiBox are remotely controlled from the host system over Profibus DP. Transmission of data and commands is made via the exchange of data words.

7.1 Representation Of Input And Output Words

Weights are always represented without decimal point, trailing decimals are shown as per scale calibration (weight indication in the upper line of the emulation display).

Important note: The bit address in the I/O range of a PLC is organized byte-wise, i.e. IW0 (input word 0) is split into EB0 and EB1 (input byte 0 and 1) with EB1 containing the less significant bits!

Numerical representation as 16-bit binary number or bit pattern:

Word-No.	**n**															
Byte-No.	**n (High-Byte)**								**n + 1 (Low-Byte)**							
Bit-No.	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Value	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}

The range of values for 16-bit integer numbers is –32768 to 32765.

7.2 Input And Output Words

The following tables show an overview on the contents of the data words supported by ProfiBox:

7.2.1 Input Words Of PLC

IW	*Word Contents*	*Word Type*	*Bit Addr.*	*Bit Contents*
0	Digital inputs *)	Discr. bits	.0 .1	Input E0 Input E1
1	Digital outputs *)	Discr. bits	.0 .1 .2	Output A0 Filling fast Output A1 Filling slow Discharging
2	Net weight	Integer number		
3	Gross weight	Integer number		
4	Status	Discr. bits	.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 .10 .11 : .15	Gross under zero Overload Scale in motion Error scale Number of trailing decimals 2^0 Number of trailing decimals 2^1 Number of trailing decimals 2^2 Weight x10 Handshake Status (1 = command carried out) Out of tolerance Material flow too low *reserved* Ready for start
5	Step counter (status of program during filling)	Integer number		0 Ready 1 Taring 2 Filling fast 3 Filling slow 4 Tolerance check disabled 5 Tolerance check 6 Jogging 7 Out of tolerance
6	Net weight	IEEE format		High word
7	Net weight	IEEE format		Low word
8	Gross weight	IEEE format		High word
9	Gross weight	IEEE format		Low word
10	Step counter (status of program during discharging)	Integer number		0 Ready 1 Discharging 2 Extended discharging 3 Wait on no motion

*) See note at the end of the table.

IW	Word Contents	Word Type	Bit Addr.	Bit Contents
11		Integer number		Filling / discharging quantity
12		Integer number		Preact after correction
13				*reserved*
14 : 23				Parameters of calibration for upload from ProfiBox → PLC
24				*reserved*

The data word 0 mirrors the state of the two parallel inputs E0 and E1 of the ProfiBox, when an optional PIM module is installed.

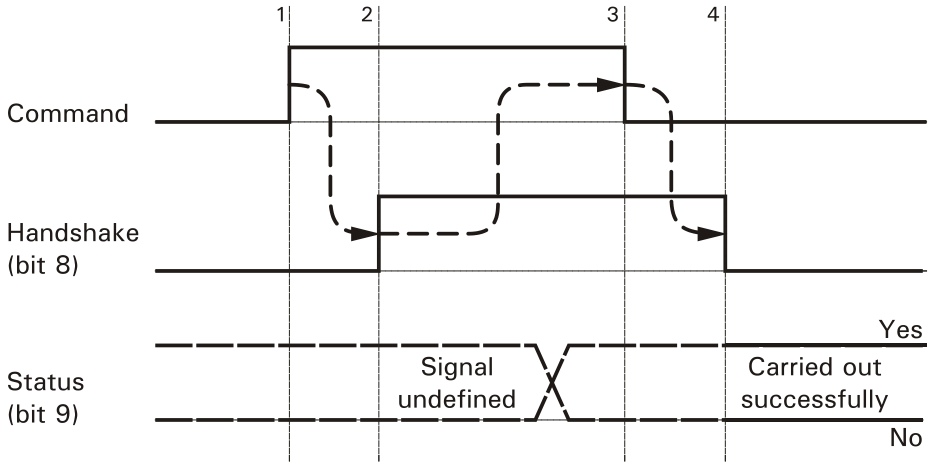
The data word IW1 contains -corresponding to the program sequence- the signals for 'Filling Fast', 'Filling Slow' and 'Discharging'. When an optional PIM module is installed, the signals 'Filling Fast' and 'Filling Slow' are also output on the parallel outputs A0 and A1. The signal 'Discharging' cannot be output by the ProfiBox directly and must be set by the PLC.

7.2.2 Output Words Of PLC

OW	*Word Contents*	*Word Type*	*Bit Addr.*	*Bit Contents*
0	Commands	Discr. bits	.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 .10 .11 .12 .13 .14 .15	Set zero Autotaring Clear tare Set tare Filling without taring Start filling Start discharging Interrupt filling / discharging Abort filling / discharging Acknowledge out-of-tolerance Stop before tolerance check *reserved* Set digital outputs *reserved* *reserved* Scale function: read / write calibration data
1	I/Os (PIM 0,1)	Discr. bits	.0 .1	1 = On, 0 = Off 1 = On, 0 = Off
2	Tare value	Integer number		
3	Target weight	Integer number		
4	Preact fast	Integer number		
5	Preact slow	Integer number		
6	+Tolerance	Integer number		
7	−Tolerance	Integer number		
8	Settling time in ms	Integer number		
9	Jog pulse in ms	Integer number		
10	Weight difference for flow rate check	Integer number		
11	Time interval for flow rate check in ms	Integer number		
12	Zero range	Integer number		
13	Extended disch. time in ms	Integer number		
14				*reserved*
15				*reserved*
16 : 25				Parameters of calibration for download PLC → ProfiBox
26	Password for calibration data; without match, calibration data can only be read.	Integer number		0000 Reading 2238 Writing 2239 Calibration at zero 2240 Calibration at load 2241 Calibration at partial load 2242 Reading (optional) 2243 Writing (optional)

7.3 Exchange Of Control Signals

Receipt and execution of commands (see also output word 0) is acknowledged through bits 8 and 9 of data word 4 with handshake as per the following diagram:



Explanation: The receipt of a command (rising edge 1) is acknowledged with bit 8 (command received, rising edge 2). After that the command can be reset (falling edge 3). Once the command is reset and the instruction carried out, bit 8 is reset and bit 9 is set to a defined state (falling edge 4). If bit 9 is '1' that means that the instruction could be carried out correctly, if it is '0' that indicates an error, e.g. timeout.

Handshake signaling as described above applies to the commands (bits in output word 0) as follows:

.0 Set zero
.1 Autotaring
.2 Clear tare
.3 Set tare
.5 Start filling
.6 Start discharging
.15 Read / write calibration data.

Please note: In the tables below abbreviations apply as follows: IW = input word, OW = output word, as seen from host system.

7.3.1 Read Weight Values

The values for net and gross weight are continuously updated and written into the input words 2 and 3. The weights are represented as signed integer values. For a correct interpretation of the weight, the status information in input word 4 must be evaluated.

Write:	----	----	
Read:	IW 2		Net
	IW 3		Gross
	IW 4	.0	Gross under zero
		.1	Overload
		.2	Scale in motion
		.3	Error scale
		.4 - .6	Number of trailing decimals (e.g. 010 for two decimals)
		.7	Weight x10 (e.g. for increment size 50kg)

Input Word 2: **Net**

The data word 2 contains the current net weight of the scale. The net weight is represented as a signed integer value and it corresponds to the measured value without decimal separator. The net weight is updated continuously.

Example: Net 1.000 kg Value 1000

Input Word 3: **Gross**

The data word 3 contains the current gross weight of the scale. The gross weight is represented as a signed integer value and it corresponds to the measured value without decimal separator. The gross weight is updated continuously.

Example: Gross 60,00 kg Value 6000

The data word 4 contains additional status / error information.

Bit

0: The gross weight is under zero.

1: The gross weight exceeds the capacity, load must be removed.

2: Scale is in motion, weight is not stable.

3: Malfunction in weighing electronics, or insufficient loadcell signal, or faulty connection to load sensor.

4 - 6: The bits 4, 5 and 6 indicate in binary encoded form the number of trailing decimals (decimal places right to the decimal point) as per the scale's calibration. (Bit 4 = 2^0; Bit 5 = 2^1; Bit 6 = 2^2), e.g. 010 for 2 trailing decimals.

Additionally, the weight values are available in data words 6/7 and 8/9 in IEEE format. This format corresponds to the weight as shown on the display and does not require evaluation of trailing decimals.

7.3.2 Set Scale To Zero

If the weight is within zero setting range, the scale can be set to gross zero by means of bit 0 in data word 0.

Write:	OW 0	.0	Command for scale function 'Set Zero'
Read:	IW 4	.8 .9	Handshake signal Confirmation

7.3.3 Autotare Scale

Write:	OW 0	.1	Command for scale function 'Autotare'
Read:	IW 4	.8 .9	Handshake signal Confirmation

7.3.4 Clear Tare (Set To Gross)

Write:	OW 0	.2	Command for scale function 'Clear Tare'
Read:	IW 4	.8 .9	Handshake signal Confirmation

7.3.5 Tare Scale With Specified Value

Write:	OW 0	.3	Command for scale function 'Manual Tare'
	OW 2		Tare value
Read:	IW 4	.8 .9	Handshake signal Confirmation

The scale is tared with the value handed over in data word 2.

7.3.6 Filling A Single Component

The host system can control a complete filling cycle with all pertaining parameters.

Write:	OW 0	.5 .7 .8 .9	Command for scale function 'Filling' Interrupt filling Abort filling Acknowledge out-of-tolerance
	OW 3		Target weight
	OW 4		Preact fast
	OW 5		Preact slow
	OW 6		+ Tolerance
	OW 7		– Tolerance
	OW 8		Settling time in ms
	OW 9		Jog pulse in ms (if value is 0, jogging is disabled)
	OW 10		Weight difference for flow rate check (if value is 0, flow rate check is disabled)
	OW 11		Time interval for flow rate check in ms
Read:	IW 1	.0 .1	Filling fast Filling slow
	IW 4	.8 .9 .10 .11	Handshake, command received Confirmation, command carried out Out of tolerance Flow rate too low
	IW 11		Actual filling quantity
	IW 12		Preact slow after correction

Output Word 0: Commands

The bits in this data word can be used by the host to set control instructions:

Bit

5: Start Filling. A filling cycle is started. Prior to the start the data words 3 - 11 must be loaded with the appropriate values.

7: Interrupt. This bit is used to interrupt a filling or discharging cycle. Cycle is continued when bit 7 is reset.

8: Abort. When bit 8 is set, the filling or discharging cycle is terminated immediately.

Note: OW 0.12 (set digital outputs) must not be set during filling or discharging.

Output Word 3: Target Weight

The data word 3 contains the integer value of the target weight for a filling cycle. Cut-off points are calculated as follows:

Cut-Off Point Fast = Target – Preact Fast – Preact Slow

Cut-Off Point Slow = Target – Preact Slow

The resolution of the target value is equal to the resolution of gross, tare and net weight. I.e. a comparison with a weight value can be made with the contents of the parameters as they are.

After the filling cycle has been completed, the actual value is written into data word 11. This value remains stored until the next cycle is started.

Output Word 4: Preact Fast

The data word 4 contains the integer value of the preact fast for a filling cycle. Cut-off points are calculated as follows:

Cut-Off Point Fast = Target – Preact Fast – Preact Slow

Cut-Off Point Slow = Target – Preact Slow

The resolution of the preact fast is equal to the resolution of gross, tare and net weight. If preact fast is set to '0', filling fast is skipped and filling is made in slow speed only.

Output Word 5: Preact Slow

The data word 5 contains the integer value of the preact slow for a filling cycle. Cut-off points are calculated as follows:

Cut-Off Point Fast = Target – Preact Fast – Preact Slow

Cut-Off Point Slow = Target – Preact Slow

The resolution of the preact slow is equal to the resolution of gross, tare and net weight.

The preact slow is corrected after each filling cycle and written into IW 12. The correction value depends on the size and the trend of the deviation. To prevent overshooting, deviations greater than 10% of target are ignored.

For the next filling cycle, the host system either transmits the corrected value (i.e. preact correction enabled) or the the original value (i.e. preact optimization disabled).

Output Word 6: + **Tolerance**

The data word 6 contains the permissible tolerance value by which the target value may be exceeded after filling. The tolerance value is relative to the target value. Example:

Target	6000
+ Tolerance	0002
Permissible Max. Weight	6002

A filling quantity of 6002 is still accepted, the error message 'Out Of Tolerance' is output when the filling quantity exceeds 6002.

An out-of-tolerance condition is always reported as exception and must be acknowledged by the host system (see also command bit 9, data word 0).

Output Word 7: – **Tolerance**

The lower tolerance value determines the smallest permissible filling quantity. Data word 7 contains the minus tolerance as difference to the target.

If minus tolerance is detected, the system either reports the out-of-tolerance condition or automatically starts jog feeding to correct the filling. Jog feeding is only performed when the parameter in data word 9 (Jog Pulse) contains a value greater 0.

An out-of-tolerance condition must be acknowledged by the host system (see also bit 9, data word 0).

Output Word 8: **Settling Time (ms)**

Data word 8 specifies a delay (integer value in milliseconds) between the completion of filling and the start of the tolerance check. After the settling time (which may also be zero) has elapsed, the system checks whether the scale has settled and only proceeds if this is the case. Otherwise it waits for the scale to settle. The settling time is started only when the bit 10 in data word 0 (stop before tolerance check) is zero, or after it has been set to zero.

Note: The parameter for the settling time is also used to determine the pause between two pulses for jog feeding.

Output Word 9: **Jog Pulse (ms)**

In most cases, minus tolerance can be avoided simply by activating jog feeding. The valve (or other appropriate feeding device) for slow filling is opened pulse-wise to reach the target value. The time for opening the valve is determined with the contents of data word 9 (in milliseconds).

After each pulse of the valve the settling time, specified in data word 8, must elapse. Subsequently, tolerance is checked again and a further jog pulse is released if weight is still in minus. This sequence is repeated until weight has exceeded the lower tolerance limit.

Output Word 10: **Quantity For Flow Rate Check**

Output Word 11: **Time Interval For Flow Rate Check**

Parameters in data words 10 and 11 belong together and are used to check the flow rate. Minimum flow rate is defined as quantity (data word 10) per interval (data word 11). The resolution of the quantity corresponds to the resolution of the other weight values (e.g. target weight). Time is indicated in milliseconds.

Example:

Display	1.000 kg
Parameter data word 10	1000
Parameter data word 11	10000

The minimum flow rate for filling and/or discharging is 1kg/10sec. When the flow rate falls short of the minimum rate, output signals for filling or discharging remain on but the error condition is reported to the host in data word 4 (status), bit 11.

Input Word 1: **Feeding Signals**

In this data word the feeding signals are transmitted that the host system must read and mirror on its own outputs to control the feeding device.

Bit

0: Feeding fast

1: Feeding slow.

Input Word 11: **Filling Quantity**

After the filling or discharging cycle has been completed, the actual value is written into data word 11. This value remains stored until the next cycle is started.

Input Word IW: **Preact Slow After Correction**

In a typical filling sequence the filling device is switched off *before* the target weight is reached to compensate for the amount of material that is still in flight. The value for this preact is transferred in data word 5 (preact slow). The preact correction algorithm optimizes this value dependent on the size and the trend of the deviation and writes the corrected preact value into data word 12.

7.3.7 Discharge Scale

The host system can control the discharging of a filled hopper.

Write:	OW 0	.6 .7 .8	Command for scale function 'Discharging' Interrupt discharging Abort discharging
	OW 10		Weight difference for flow rate check
	OW 11		Time interval for flow rate check
	OW 12		Zero range
	OW 13		Extended discharge time in ms
Read:	IW 1	.2	Discharging
	IW 4	.8 .9 .11	Handshake, command received Confirmation, command carried out Flow rate low
	IW 11		Discharged quantity

Note: OW 0.12 (set digital outputs) must not be set during filling or discharging.

Output Word 0: **Commands**

The bits in this data word can be used by the host to set control instructions:

Bit

6: Discharging is started. Prior to the start the appropriate values must be written into the data words 10 - 13.

7: Interrupt. This bit is used to interrupt a discharging cycle. Cycle is continued when bit 7 is reset.

8: Abort. When bit 8 is set, the discharging cycle is terminated immediately.

Output Word 10: **Quantity For Flow Rate Check**

Output Word 11: **Time Interval For Flow Rate Check**

Parameters in data words 10 and 11 belong together and are used to check the flow rate. Minimum flow rate is defined as quantity (data word 10) per interval (data word 11). The resolution of the quantity corresponds to the resolution of the other weight values (e.g. target weight). Time is indicated in milliseconds.

Example:

Display	1.000 kg
Parameter data word 10	1000
Parameter data word 11	10000

The minimum flow rate for filling and/or discharging is 1kg/10sec. When the flow rate falls short of the minimum rate, output signals for filling or discharging remain on but the error condition is reported to the host in data word 4 (status), bit 11.

Output Word 12: **Zero Range**

After the start of a discharging cycle the discharging valve is opened. Discharging is controlled by the parameters in data words 12 (zero range) and 13 (extended discharging time). The valve is closed after the zero range has been reached and the extended discharging time has elapsed.

Output Word 13: **Extended Discharge Time (ms)**

After reaching the zero range the closing of the valve is delayed by the extended discharging time. The value is specified in milliseconds. If the time is '0', the discharging valve is closed immediately when the gross weight reaches the zero range (as specified in data word 12).

Input Word 1: **Discharging**

In this data word the discharging signal is read by the host system and mirrored on its own output to control the discharging device:

Bit

2: Discharging.

The discharging signal is on until the zero range has been reached and the extended discharge time has elapsed.

Input Word 11: **Discharging Quantity**

After the completion of a discharge cycle, data word 11 contains the discharged quantity as integer value. The value remains stored until the next filling or discharging cycle is started.

7.3.8 Read Data Of Scale Calibration

By uploading and storing calibration data it is possible to replace a defective module, download the calibration and continue operation without the need to recalibrate the scale. For reading the data the password in data word 26 must be 0000 or unequal to any other valid password.

Write:	OW 0	.15	Command for scale function 'Calibration Data'
	OW 26		Password for *reading* calibration data, must be 0000 or *unequal* to any other valid password
Read:	IW 4	.8 .9	Handshake, commando received Confirmation, commando carried out, must be 0 *)
	IW 14		Number of increments, e.g.: Calibration 30 x 0.01 → IW 14 = 3000 60000 x 10 → IW 14 = 6000
	IW 15	.0 (2^0) : .7 (2^7)	Increment size: 1, 2, 5, 10, 20, 50 (1 byte, integer); e.g.: increment size 5 = 00000101
		.8 (2^0) : (2^1) .10 (2^2)	Number of trailing decimals, e.g.: Calibration 30 x 0.01 → IW 15.8 - 15.10 = 010 60000 x 10 → IW 15.8 - 15.10 = 000
		.11 (2^0) .12 (2^1)	00 = kg 01 = g 10 = t 11 = lb
	IW 16		Parameter zero adjust 1 **)
	IW 17		Parameter zero adjust 2 **)
	IW 18		Parameter span adjust 1 **)
	IW 19		Parameter span adjust 2 **)
	IW 20		Motion window 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	IW 21		Filter size 0 to 20
	IW 22		Auto zero range 0 = OFF 1 = 0,5d 2 = 1,0d 3 = 2,0d 4 = 3,0d
	IW 23		Number of increments for overload blanking

*) This status bit must be 0! If it is 1 after carrying out the command, this indicates that a matching password was transmitted and thus calibration data were *written* and not *read*.

**) The contents of data words 16/17 and 18/19, respectively, represent a 32-bit integer number, corresponding to the calibration values. A value of 1.99889 mV/V for span adjust, for instance, is transmitted as data word 18 = 3 and data word 19 = 3281.

7.3.9 Read Data Of Scale Calibration (Option)

Additional settings of the calibration can be read via a second set of parameters, which also includes the values for 'motion window', 'filter setting' and 'auto zero range' that are already part of the first set. The password for reading the second parameter set is 2242.

Write:	OW 0	.15	Command for scale function 'Calibration Data'
	OW 26		Password for *reading* the second parameter set of calibration (2242)
Read:	IW 4	.8 .9	Handshake, commando received Confirmation, commando carried out, must be 0 *)
	IW 14		Motion window 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	IW 15		Motion counter
	IW 16		Filter size 0 to 20
	IW 17		Auto zero range 0 = OFF 1 = 0,5d 2 = 1,0d 3 = 2,0d 4 = 3,0d
	IW 18		Range for push button zero (+)
	IW 19		Range for push button zero (—)
	IW 20		Range for power up zero
	IW 21		Number of increments for overload blanking

*) This status bit must be 0! If it is 1 after carrying out the command, this indicates that a matching password was transmitted and thus calibration data were *written* and not *read*.

7.3.10 Download Data Of Scale Calibration

Please note (1): all functions for calibration and/or download of parameters via Profibus DP require that the jumper W1 be set to the position 2 - 3 (data not secured). In the secured position (1 - 2) writing is not possible. In this case a writing attempt is answered with a negative response (bit 9 in data word 4 not set).

By downloading the stored calibration data it is possible to replace a defective module and continue operation without the need to recalibrate the scale. For writing the data the valid password (2238) must be loaded into dataword OW 26.

Please note (2): after downloading calibration parameters a cold start (switch ProfiBox off and on again) is required before the changed settings take effect.

Write:	OW 0	.15	Command for scale function 'Calibration Data'
	OW 16		Number of increments, e.g.: Calibration 30 x 0.01 → OW 16 = 3000 60000 x 10 → OW 16 = 6000
	OW 17	.0 : .7	Increment size: 1, 2, 5, 10, 20, 50 (1 byte, integer); e.g.: increment size 5 = 00000101
		.8 (2^0) : (2^1) .10 (2^2)	Number of trailing decimals, e.g.: Calibration 30 x 0.01 → OW 15.8 - 15.10 = 010 60000 x 10 → OW 15.8 - 15.10 = 000
		.11 (2^0) .12 (2^1)	00 = kg 01 = g 10 = t 11 = lb
	OW 18		Parameter zero adjust 1 *)
	OW 19		Parameter zero adjust 2 *)
	OW 20		Parameter span adjust 1 *)
	OW 21		Parameter span adjust 2 *)
	OW 22		Motion window 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	OW 23		Filter size 0 to 20
	OW 24		Auto zero range 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	OW 25		Number of increments for overload signal
	OW 26		Password for *writing* of calibration data (2238)
Read:	IW 4	.8 .9	Handshake, commando received Confirmation, commando carried out

*) The contents of data words 18/19 and 20/21, respectively, represent a 32-bit integer number, corresponding to the calibration values. A value of 1.99889 mV/V for span adjust, for instance, is transmitted as data word 20 = 3 and data word 21 = 3281.

7.3.11 Download Data Of Scale Calibration (Option)

Additional settings of the calibration can be downloaded via a second set of parameters, which also includes the values for 'motion window', 'filter setting' and 'auto zero range' that are already part of the first set. The password for writing the second parameter set is 2243.

Please note: after downloading calibration parameters a cold start (switch ProfiBox off and on again) is required before the changed settings take effect.

Write:	OW 0	.15	Command for scale function 'Calibration Data'
	OW 16		Motion window 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	OW 17		Motion counter
	OW 18		Filter size 0 to 20
	OW 19		Auto zero range 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	OW 20		Range for push button zero (+)
	OW 21		Range for push button zero (—)
	OW 22		Range for power up zero
	OW 23		Number of increments for overload blanking
	OW 26		Password for *writing* second set of calibration data (2243)
Read:	IW 4	.8 .9	Handshake, commando received Confirmation, commando carried out

7.3.12 Calibrate Zero

An option is provided to calibrate Zero Load of the scale from the host system. Data word 26 must contain the password for this operation (2239). After completion the new calibration parameters are returned in data words 16 and 17.

Write:	OW 0	.15	Command for scale function 'Calibration Data'
	OW 26		Password to *perform* zero calibration (2239)
Read:	IW 4	.8 .9	Handshake, commando received Confirmation, commando carried out
	IW 14		Number of increments, e.g.: Calibration 30 x 0.01 → IW 14 = 3000 60000 x 10 → IW 14 = 6000
	IW 15	.0 (2^0) : .7 (2^7)	Increment size: 1, 2, 5, 10, 20, 50 (1 byte, integer); e.g.: increment size 5 = 00000101
		.8 (2^0) : (2^1) .10 (2^2)	Number of trailing decimals, e.g.: Calibration 30 x 0.01 → IW 15.8 - 15.10 = 010 60000 x 10 → IW 15.8 - 15.10 = 000
		.11 (2^0) .12 (2^1)	00 = kg 01 = g 10 = t 11 = lb
	IW 16		Parameter zero adjust 1
	IW 17		Parameter zero adjust 2
	IW 18		Parameter span adjust 1
	IW 19		Parameter span adjust 2
	IW 20		Motion Window 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	IW 21		Filter size 0 to 20
	IW 22		Auto zero range 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	IW 23		Number of increments for overload blanking

7.3.13 Calibrate Load

An option is provided to calibrate Full Load of the scale from the host system. Data word 26 must contain the password for this operation (2240). After completion the new calibration parameters are returned in data words 18 and 19.

Write:	OW 0	.15	Command for scale function 'Calibration Data'
	OW 26		Password to *perform* load calibration (2240)
Read:	IW 4	.8 .9	Handshake, commando received Confirmation, commando carried out
	IW 14		Number of increments, e.g.: Calibration 30 x 0.01 → IW 14 = 3000 60000 x 10 → IW 14 = 6000
	IW 15	.0 (2^0) : .7 (2^7)	Increment size: 1, 2, 5, 10, 20, 50 (1 byte, integer); e.g.: increment size 5 = 00000101
		.8 (2^0) : (2^1) .10 (2^2)	Number of trailing decimals, e.g.: Calibration 30 x 0.01 → IW 15.8 - 15.10 = 010 60000 x 10 → IW 15.8 - 15.10 = 000
		.11 (2^0) .12 (2^1)	00 = kg 01 = g 10 = t 11 = lb
	IW 16		Parameter zero adjust 1
	IW 17		Parameter zero adjust 2
	IW 18		Parameter span adjust 1
	IW 19		Parameter span adjust 2
	IW 20		Motion window 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	IW 21		Filter size 0 to 20
	IW 22		Auto zero range 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	IW 23		Number of increments for overload blanking

7.3.14 Calibrate With Partial Load

Instead of calibration with full load, it is also possible to calibrate with partial load. Data word 26 must contain the password for this operation (2241). After completion the new calibration parameters (for the full range) are returned in data words 18 and 19.

Write:	OW 0	.15	Command for scale function 'Calibration Data'
	OW 16		Number of increments corresponding to *partial* load, e.g.: Calibration 10 x 0.01 → OW 16 = 1000 20000 x 10 → OW 16 = 2000
	OW 26		Password *perform* load calibration with partial load (2241)
Read:	IW 4	.8 .9	Handshake, commando received Confirmation, commando carried out
	IW 14		Number of increments, e.g.: Calibration 30 x 0.01 → IW 14 = 3000 60000 x 10 → IW 14 = 6000
	IW 15	.0 (2^0) : .7 (2^7)	Increment size: 1, 2, 5, 10, 20, 50 (1 byte, integer); e.g.: increment size 5 = 00000101
		.8 (2^0) : (2^1) .10 (2^2)	Number of trailing decimals, e.g.: Calibration 30 x 0.01 → IW 15.8 - 15.10 = 010 60000 x 10 → IW 15.8 - 15.10 = 000
		.11 (2^0) .12 (2^1)	00 = kg 01 = g 10 = t 11 = lb
	IW 16		Parameter zero adjust 1
	IW 17		Parameter zero adjust 2
	IW 18		Parameter span adjust 1
	IW 19		Parameter span adjust 2
	IW 20		Motion window 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	IW 21		Filter size 0 to 20
	IW 22		Auto zero range 0 = OFF 1 = 0.5d 2 = 1.0d 3 = 2.0d 4 = 3.0d
	IW 23		Number of increments for overload blanking

7.4 Data Word Monitor

With the data word monitor it is possible during normal operation to check the contents of input and output data words. The monitor is called up in the emulation program PC *RemoteDisplay* with the function keys F1 (input words) and F2 (output words), respectively.

```
01          1234 kg
```

Display in operating mode 'ONLINE'.

Except for the function keys listed below, the keyboard is locked.

F0 Switch weight display to tenfold resolution, automatic reset after approx. 5 sec.

F1 Call up monitor for input words

F2 Call up monitor for output words

F8 Exit operating mode 'ONLINE'

→0← Set gross weight to zero (within permissible zero setting range)

Data word monitor called up with F1:

```
IWØ          16 $0010
```

Monitor for input words (as seen from PLC), display of data word 0 (decimal and hexadecimal)

↵ Continue with next data word

↑ Return to previous data word

0..9 Enter number of data word whose contents is to be displayed

Info Exit data word monitor

```
IW6          1147.$448F
```

Example: Net weight = 1147kg, High word in data word IW6

For weight values that are transmitted in IEEE format, the weight value is shown on the left hand side (as it appears on the display). Separated by a decimal point, on the right hand side the IEEE format is shown in high word or low word, respectively.

↵ Continue with next data word

```
IW7          1147 $6000
```

Example: Net weight = 1147kg, Low word in data word IW7

Data word monitor called up with F2:

```
OWØ          16 $0010
```

Monitor for output words (as seen from PLC)

↵ Continue with next data word

↑ Return to previous data word

0..9 Enter number of data word whose contents is to be displayed

Info Exit data word monitor

8 Hardware Test

W A R N I N G
Exercise utmost care when making checks, tests and adjustments that can actuate movable parts such as feeding devices, gates, flaps, conveyors, etc. Make absolutely sure that nobody is within reach of movable parts.
Failure to observe this precaution could result in bodily injury!

```
Service: Test
```

Select hardware test

```
DIn: 10  DOut: 01
```

Display state of the two optional digital inputs and outputs (1 = input/output set).

With the keys 0 and 1 of the numeric keypad, the outputs 0 (key 0) and 1 (key 1) can be set / reset.

The picture on the left shows the state:

input 0	= Off	input 1	= On
output 0	= On	output 1	= Off

```
Com1:  ok Com2: nok
```

Test of serial interfaces (RS232 and RS485-4-wire);

RS232: jump lead from terminal 1 to 3 and from terminal 2 to 4 (connect RTS with CTS and TxD with RxD).

RS485.4: jump lead from terminal 1 to 3 and from terminal 2 to 4 (connect TxD+ with RxD+ and TxD– with RxD–).

Note: Test of RS485 2-wire and 20mA interfaces is not possible.

```
AIn:  1.234 mV/V
```

Display of analog input signal from scale (for verification and plausibility check).

9 Options For Calibration

9.1 General Parameters

In most applications the ProfiBox is calibrated as single-range scale with one interval (increment size), however, it is also possible to calibrate as multiple-range and multi-interval scale.

9.1.1 Multiple-Range Scale

Calibration is possible as Single, Dual or Triple Range Scale. The different ranges have different capacities and scale intervals.

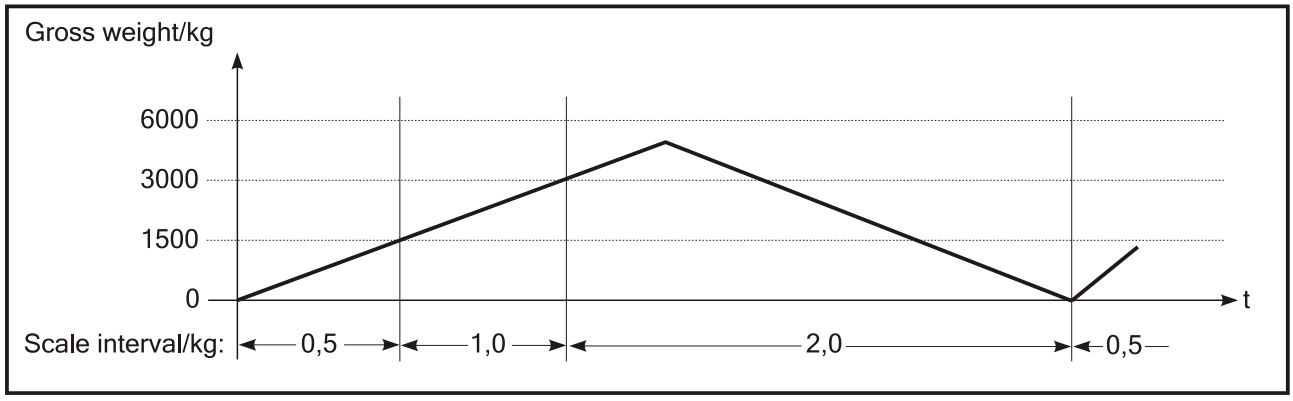
Example: Triple Range Scale with a resolution of 3000 increments for each range:

First range:	0 – 1500kg / 0.5kg
Second range:	0 – 3000kg / 1.0kg
Third range:	0 – 6000kg / 2.0kg

When a Multiple Range Scale is loaded, the scale display changes automatically from a lower to a higher range. During unloading of the scale, the scale display remains in the higher range. If the scale was tared (weighing in net mode), on return to gross zero the tare is only cleared when the tare key is pressed. Only after clearing the tare, the display returns to gross mode and switches back to the smallest range.

Automatic switching back to the smallest range on reaching zero is only carried out if the scale was not tared (weighing in gross mode).

Example of a weight curve for loading and unloading a Multiple Range Scale showing the weight and the displayed scale interval:



When the scale is loaded further after it was tared, the tare weight is rounded automatically to the next scale interval as soon as the display is switched from one range to the next.

The Multiple Range Scale provides weighing of light and heavy loads on the same scale with a high degree of accuracy.

As a restriction for the configuration of scale intervals, the decimal point location must be identical for all ranges. Example: Use 0.5kg and 1.0kg instead of 0.5kg and 1kg.

The maximum resolution of the loadcells (e.g. 3000d) must not be exceeded in any of the scale ranges.

9.1.2 Multi-Interval Scale

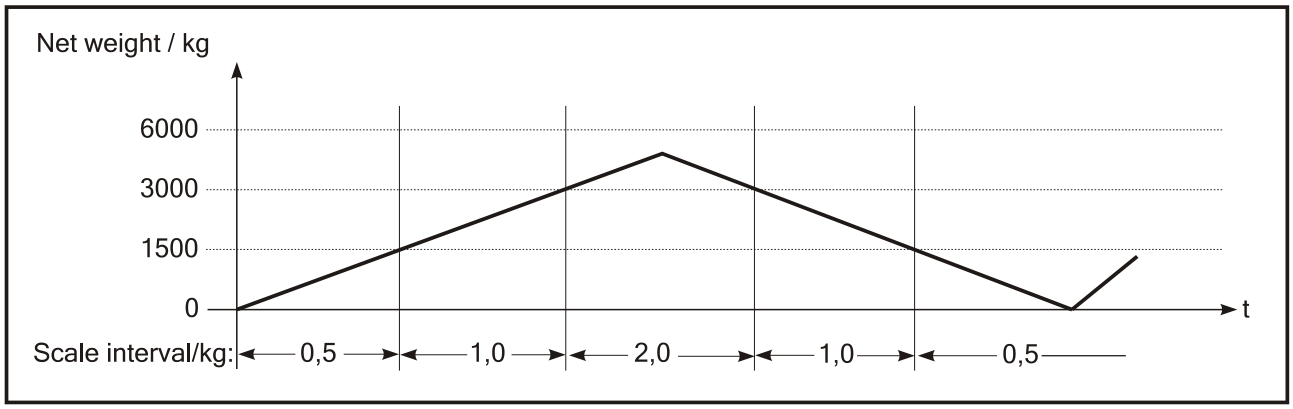
A Single Range Scale can be configured as Multi-Interval Scale with two or three different interval ranges.

Example for a triple Interval Scale:

First interval range:	0kg	–	1500kg / 0.5kg
Second interval range:	1500kg	–	3000kg / 1.0kg
Third interval range:	3000kg	–	6000kg / 2.0kg

The scale display changes automatically from one interval range to the next during loading and unloading of the scale.

Example weight curve for loading and unloading a Multi-Interval Scale showing the weight and the scale interval displayed:



After taring the scale, the scale display shows the net weight with the smallest scale interval. Small weights are shown with the highest accuracy, even when the scale is already loaded to a higher weighing range. Restriction: The max. permitted tare weight must not exceed the weight of the range with the smallest interval.

A Multi-Interval Scale is configured by entering the capacity and the scale interval of the smallest interval range. The other ranges are configured automatically.

Example for configuring a Dual Interval Scale:

Scale capacity	1500kg
Smallest scale interval required	0.2kg

Using a loadcell, suitable for multi interval scales with 3000d resolution, the smallest interval range is calculated as follows:

Smallest capacity = smallest scale interval x resolution = 0.2kg x 3000 = 600kg

The second range is automatically configured with the next highest interval: 0.5kg. The second interval range is calculated as follows:

Second capacity = next higher interval x resolution = 0.5kg x 3000 = 1500kg

As a result, the two interval ranges for the Dual Interval Scale are:

First interval range:	0	–	600kg / 0.2kg
Second interval range:	600	–	1500kg / 0.5kg

9.1.3 Adaptation To Scale Environment

The following parameters can be set to obtain optimum weighing results:

- Motion window size and number of measurements for motion detector
- Filter strength of the digital filter for unstable scales
- Auto Zero Range for Auto Zero Function
- Pushbutton Zero Range for Zero-key
- Power Up Zero Range
- Overload Threshold for display blanking.

9.1.4 Setting Of Geo Value

Before calibrating the scale, the Geo Value must be entered, e.g. Great Britain = 21 (see also chapter Geo Values). If the scale is calibrated at one location and moved to another location later, it is sufficient to re-enter the Geo Value of the new location.

9.1.5 Factory Setting

Default settings in the group 'Adaptation' are as follows:

- Motion Window: 0.5d
- Motion Counter: ≥7
- Auto Zero Range: 0.5d
- Pushbutton Zero: ±2%
- Power Up Zero: ±2% or ±10%
- Overload: max. 9 d

This corresponds to the settings of W&M approved industrial scales.

9.2 Scale Parameters

In this group the weighing ranges, scale intervals and the scale unit are selected. The scale can be configured as Single Range, Dual Range or Triple Range Scale. A Single Range Scale can be configured as Multi Interval Scale with two or three different scale intervals.

Select Group 1-7	**1**	Scale Parameters
Single Range	**Info**	Select number of scale ranges: Single Range: Single Range Scale with one, two or three intervals Dual Range: Scale with two ranges Triple Range: Scale with three ranges

If 'Single Range' has been selected:

One Interval	**Info**	A Single Range Scale can be configured as Single- or Multi-Interval Scale: One Interval or Two Intervals or Three Intervals or Additive Tare = Single Range scale with additive tare (not for W&M approved applications)
Capacity 999999		Single Range capacity entry (6 digits). If 'Two Intervals' or 'Three Intervals' has been selected, entry of the smallest interval range. (See also chapter Multi Interval Scale). Example: 'Capacity 1500'
Interval 999999		Single Range scale interval entry (6 digits). If 'Two Intervals' or 'Three Intervals' has been selected, entry of the smallest scale interval. (See also chapter Multi Interval Scale). Example: 'Interval 0.5' Scale interval list: 0.0001, 0.0002, 0.0005, 0.001, 0.002, 0.005, 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50

If 'Dual Range' has been selected:

High Capacity 99999	Entry of capacity of the highest scale range (6 digits): Example: 'High Capacity 6000'
High Interval 99999	Entry of interval of the highest scale range Example: 'High Interval 2'
Low Capacity 999999	Entry of capacity of the lowest range (6 digits): Example: 'Low Capacity 3000'
Low Interval 999999	Entry of interval of the lowest scale range. Example: 'Low Interval 1' **Note**: The number of trailing decimals must be identical in both ranges.

If 'Triple Range' has been selected:

High Capacity999999	Entry of capacity of the highest scale range (6 digits) Example: 'High Capacity 6000'
High Interval999999	Entry of interval of the highest scale range Example: 'High Interval 2.0'
Mid Capacity 999999	Entry of capacity of the medium scale range (6 digits) Example: 'Mid Capacity 3000'
Mid Interval 999999	Entry of interval of the medium scale range (6 digits) Example: 'Mid Interval 1.0'
Low Capacity 99999	Entry of capacity of the lowest scale range (6 digits) Example: 'Low Capacity 1500'
Low Interval 999999	Entry of interval of the lowest scale range Example: 'Low Interval 0.5' **Note**: The number of trailing decimals must be identical in all three ranges.

If 'Single Range' has been selected with 'Additive Tare':

TotalCapacity 99999	Entry of total scale capacity. Example: 'Total Capacity 1500'
Capacity 999999	Entry of weighing range. Example: 'Capacity 300'
Interval 999999	Entry of increment size. Example: 'Interval 0.1'

Unit kg	**Info**	Select a unit. Options: kg, g, t, lb
	↵	Return to 'Select Group'

9.3 Calibration

The zero calibration and maximum load calibration are performed in this group. Instead of calibrating to maximum load, a calibration with partial load is also possible.

The Geo Value entry permits the calibration at one place even if the scale is to be operated at a different location. This compensates for the different forces of gravity without recalibration (not for W&M approved applications). By means of entering the rated signals (mV/V), a scale can also be precalibrated without test weights (see also chapter 'Precalibration').

Select Group 1-7	**2**	**Calibration**
Geo Value 99		Entry of Geo Value. Enter the applicable Geo Value of the *calibration* location (see also chapter Geo Values). If Geo Value of place of *installation* is different, that can be changed later.
Calibrate Zero? Y		Scale Zero Calibration. Unload the scale and confirm to start the calibration.
	Info	Scrolling Yes: Calibrate Zero No: Continue in step 'Zero(mV/V)'
	↵	Zero Calibration
Calibrating...		Measuring Zero signal. Message for approx. 6 sec
Zero: 9999999		Displays actual weight with tenfold resolution (for verification).
	↑	Return to step 'Geo Value'
	↵	Continue
Zero(mV/V): 9999999		Display of rated signal (e.g. 0.23785)
	↑	Return to step 'Select Group'
	Clr	Clear value and enter new one
	↵	Continue with Span calibration

Please note: If Zero calibration parameters are to be stored **before** the Span calibration, the Setup must be exited at this point of the sequence (return to step 'Select Group' and from there to step 'Setup'). Answer question 'Save Parameters?' with 'Yes'. After that Group 2 can be selected again to proceed

with calibration, Zero calibration can now be skipped.

`Calibrate Load?  Y`		Load calibration weight on scale. For best results use the highest possible calibration load.
	Info	Scrolling Yes: Calibrate Load No: Continue in step '`Load(mV/V)`'
	↑	Return to step '`Calibrate Zero?`'
	↵	Continue
`Calibr.Weight 99999`		Default calibration weight (= weighing range), 6 digits
	Clr	Clear displayed default value and enter desired calibration weight.
	↵	Apply load and start calibration
`Calibrating...`		Measuring load signal. Message for approx. 3 sec.
`Load:  9999999`		Displays actual weight with tenfold resolution (for verification).
	↑	Return to step '`Calibrate Load?`'
	↵	Continue
`Load(mV/V):  999999`		Display of rated signal (e.g. 0.52243)
	Clr	Clear value and enter new one
	↵	Return to step '`Select Group`'

If the internal resolution is insufficient, an error message is displayed:

`Resolution Error`		The internal resolution should be at least 10 times higher than the entered resolution. Check calibration values and repeat calibration if required.
	↵	Return to '`Select Group`'

To store calibration parameters exit step 'Select Group' and answer question 'Save Parameters' with 'Yes'.

Note: If changes of calibration parameters are to be ignored, setup must be exited and question 'Save Parameters?' answered with 'No' before any other group of the calibration may be called up.

9.4 Linearization

Certain weighing inaccuracies are the result of the inherent non-linearity of the load sensor. Up to 6 linearization points can be set freely to compensate this imperfection, although in practice. Linearization points should be entered at the points of the weighing curve where the greatest deviations (i.e. max. non-linearity) are experienced.

Linearization points must be smaller than the max. weighing range. The linearization algorithm interprets the sections between two neighboring linearization points as a straight line.

`Select Group 1-7`	**3**	**Linearization**

Linearization points already entered:

`Fixpoint n:  999999`		Display of linearization points (1 - max. 6)
	↑	Return to previous linearization point or step '`Select Group`', respectively
	↵	Continue with next linearization point
	Clr	Delete existing linearization point

Clr-key pressed in step 'Fixpoint n: 999999':

`Delete Fixpoint?  N`			
	Info	Scrolling Yes:	Delete linearization point
		No:	Do not delete linearization point
	↑	Return to previous linearization point or step '`Select Group`', respectively	
	↵	On Yes:	Proceed to step '`New Fixpoint?`'
		On No:	Continue with next linearization point

After deleting an existing fixpoint, the remaining ones are renumbered in rising order.

After display of the last linearization point or if no fixpoints have been entered yet:

`New Fixpoint?  N`			
	Info	Scrolling Yes:	Enter new fixpoint
		No:	Do not enter new fixpoint
	↑	Return to previous linearization point or step '`Select Group`', respectively	
	↵	On Yes:	Continue
		On No:	Return to step '`Select Group`'
`Enter Fixpoint99999`			Enter linearization weight
`Linearization..`			Measuring the linearization signal Message appears for approx. 6 sec
`Weight:  9999999`			Displays actual weight with tenfold resolution (for verification)
	↑	Return to previous linearization point or step '`Select Group`', respectively	
	↵	Continue in step '`New Fixpoint?`'	

A new fixpoint can be inserted between existing ones, after that all fixpoints are renumbered in rising order.

9.5 Zero Adjust

In this group the scale's Zero point is readjusted. This feature is useful when the calibration load was applied on an auxiliary test rig (e.g. for overhead track scales). After removing the test rig, the absolute Zero point can be adjusted.

Select Group 1-7	**4**	**Zero Adjust**
Unload Scale		Unload test rig or other loads
	↵	Start Zero Adjust
Adjusting...		Measuring the Zero signal. Message appears for approx. 6 sec
Zero: 9999999		Display of the new zero point with tenfold resolution (for verification)
	↑	Return to 'Unload Scale'
	↵	Continue in step 'Select Group'

9.6 Adaptation

In this group parameters are entered to adapt the scale to its environment.

Select Group 1-7	**5**	**Adaptation**
Motion Window OFF	**Info**	Entry of Motion Window Size. A stable weight is detected (no motion) when the number of consecutive weight readings (specified in the next step) are within this window. OFF: motion detector off Window size: 3.0D, 2.0D, 1.0D, 0.5D
MotionCounter 99		Entry of number of weight readings for motion counter. Specify the number of consecutive weight readings for no motion detection. (Factory setting: 20)
Filter Size OFF	**Info**	Entry of Filter Strength (for digital weight filter). OFF: filter off 1 to 20: light to strong filtering Default setting: 11 If the scale is very unstable (e.g. livestock scale) a strong filtering is recommended.

Auto Zero Range0.5D	**Info**	Select range for Automatic Zero Adjust. (E.g. enter 0.5D for a range from –0.5D to +0.5D.) Zero tracking is enabled within the selected range. OFF: Disable Zero Adjust 0.5D, 1.0D, 3.0D: zero tracking range
PbZero (%) + 999		Select +range for Pushbutton Zero and Auto Zero Tracking. The scale can be set to Zero by pressing the Zero-key within the specified range. Factory setting: 2%
PbZero (%) - 999		Select –range for Pushbutton Zero and Auto Zero Tracking. The scale can be set to Zero by pressing the Zero-key within the specified range. Factory setting: 2%
PowerUp Zero +/-10%	**Info**	Select range for automatic Zero setting after power up. (E.g. enter 2% for a range from –2% to +2% of the scale capacity). After power up the scale will be automatically set to Zero if the weight is within the selected range. OFF: Disable Power Up Zero ±2%, ±10%: range
Overload 99		Select the threshold for overload blanking. (E.g. enter 9 to set the limit to capacity + 9d). The scale display shows '–––––––' when the scale weight exceeds the selected limit. Example: 'Overload 9'
	↵	Return to 'Select Group'

9.7 High Resolution

In this group the weight is shown with tenfold resolution. Use this group to check the scale accuracy.

Select Group 1-7	**6**	**High Resolution**
Weight: 9999999		Displays the actual weight with tenfold resolution (for information only)
	→0←	Set scale to zero
	↵	Return to step 'Select Group'

9.8 Reset Parameters

In this group the scale parameters can be reset to default values. After resetting the parameters the scale must be reconfigured.

Select Group 1-7	**7**	**Reset Parameters**

Reset Parameters? N	**Info**	No:	Do not reset parameters
		Yes:	Reset parameters (see table)

Factory Settings:

Group	Parameter	Default	Calibration
1 (Scale Parameters)	Single/Dual/Triple Range	Single Range	
	Capacity	3000	
	Interval	1	
	Unit	kg	
2 (Calibration)	Geo Value	20	
	Zero (mV/V)	0.00000	
	Load (mV/V)	2.00000	
5 (Adaptation)	Motion Window	0.5D	
	Motion Counter	20	
	Filter Size	11	
	Auto Zero Range	0.5D	
	Pushbutton Zero (+)	2%	
	Pushbutton Zero (–)	2%	
	Power Up Zero	OFF	
	Overload	9D	

9.9 Factory Calibration

The calibration parameters of the A/D converter are stored in a powerfail safe EEPROM.

During testing and check out of a weighing terminal, the A/D converter is factory calibrated. I.e. correction factors (Gain and Offset) are measured by means of precision simulators and stored to equalize the different amplification values of the individual boards.

When a scale is calibrated, the rated values (mV/V) are measured for Zero (preload) and Load (preload plus weighing range). Due to the factory pre-calibration (and resulting near-identical amplification), these rated values can be transferred from one ADM scale interface module to another one, if there is a need to do so, e.g. in the event of a break down to minimize down time. However, it is strongly recommended to check the accuracy of the scale with test weights as soon as possible. Recalibration with certified test weights is mandatory for scales that are subject to Weights & Measures approval.

Entry of rated values is made in Calibration Mode, Group 2, in the steps '`Zero(mV/V)`' and '`Load(mV/V)`'.

9.10 Calibration Without Test Weights

If the rated output signal of a scale's loadcell(s) is known, calibration can be made without test weights. This information is available, for instance, for loadcell types D1, C2 and C3 OIML, for which test reports are issued by the manufacturer stating rated output at Zero and Capacity.

Rated signals (preload and weighing range) of an arrangement of loadcells can be calculated as follows:

$$\textbf{Zero [mV/V]} = \frac{\textbf{PL [kg,t]} \times \textbf{C}_{LC}\textbf{ [mV/V]}}{\textbf{N}_{LC} \times \textbf{Cap}_{LC}\textbf{ [kg,t]}}$$

and:

$$\textbf{Span [mV/V]} = \frac{\textbf{WR [kg,t]} \times \textbf{C}_{LC}\textbf{ [mV/V]}}{\textbf{N}_{LC} \times \textbf{Cap}_{LC}\textbf{ [kg,t]}}$$

with:

Span	Rated signal of the arrangement
C $_{LC}$	Rated signal of loadcell(s)
Cap $_{LC}$	Capacity of loadcell(s)
N $_{LC}$	Number of loadcell(s)
WR	Weighing range of scale
PL	Preload

If more than one loadcell is connected, C_{LC} must be calculated as the arithmetical mean value of the individual loadcells.

If the rated signal at Zero can be measured, the calculation is not required. Load is calculated as follows:

$$\textbf{Load [mV/V]} = \textbf{Span [mV/V]} + \textbf{Zero [mV/V]}$$

The value for Load [mV/V] can then be entered in the appropriate step of the calibration sequence.

9.11 Geo Values

The Geo Value feature provides compensation for the different forces of gravity in different regions. A scale can be calibrated at one location (with the Geo Value of this location) and shipped to a location with a different Geo Value (= different force of gravity). To adjust the scale to its new environment it is then sufficient to enter and store the Geo Value of the new location.

Please note that this feature is not available for scales that are subject to W&M approval.

Examples for Geo Values by Country:

Country	Geo Value
France	20
Finland	24
Belgium	21
Denmark	23
Germany	20
Great Britain	21
Ireland	22
Norway	24
Netherland	21
Austria	19
Switzerland	18
Sweden	24
Spain	15

Table of Geo Values

Northern or southern terrestrial latitude in degrees and minutes	Height above sea level (in meters)										
	0 325	325 650	650 975	975 1300	1300 1625	1625 1950	1950 2275	2275 2600	2600 2925	2925 3250	3250 3575
	Height above sea level (in feet)										
	0 1060	1060 2130	2130 3200	3200 4260	4260 5330	5330 6400	6400 7460	7460 8530	8530 9600	9600 10660	10660 11730
0° 0' - 5° 46'	5	4	4	3	3	2	2	1	1	0	0
5° 46' - 9° 52'	5	5	4	4	3	3	2	2	1	1	0
9° 52' - 12° 44'	6	5	5	4	4	3	3	2	2	1	1
12° 44' - 15° 6'	6	6	5	5	4	4	3	3	2	2	1
15° 6' - 17° 10'	7	6	6	5	5	4	4	3	3	2	2
17° 10' - 19° 2'	7	7	6	6	5	5	4	4	3	3	2
19° 2' - 20° 45'	8	7	7	6	6	5	5	4	4	3	3
20° 45' - 22° 22'	8	8	7	7	6	6	5	5	4	4	3
22° 22' - 23° 54'	9	8	8	7	7	6	6	5	5	4	4
23° 54' - 25° 21'	9	9	8	8	7	7	6	6	5	5	4
25° 21' - 26° 45'	10	9	9	8	8	7	7	6	6	5	5
26° 45' - 28° 6'	10	10	9	9	8	8	7	7	6	6	5
28° 6' - 29° 25'	11	10	10	9	9	8	8	7	7	6	6
29° 25' - 30° 41'	11	11	10	10	9	9	8	8	7	7	6
30° 41' - 31° 56'	12	11	11	10	10	9	9	8	8	7	7
31° 56' - 33° 9'	12	12	11	11	10	10	9	9	8	8	7
33° 9' - 34° 21'	13	12	12	11	11	10	10	9	9	8	8
34° 21' - 35° 31'	13	13	12	12	11	11	10	10	9	9	8
35° 31' - 36° 41'	14	13	13	12	12	11	11	10	10	9	9
36° 41' - 37° 50'	14	14	13	13	12	12	11	11	10	10	9
37° 50' - 38° 58'	15	14	14	13	13	12	12	11	11	10	10
38° 58' - 40° 5'	15	15	14	14	13	13	12	12	11	11	10
40° 5' - 41° 12'	16	15	15	14	14	13	13	12	12	11	11
41° 12' - 42° 19'	16	16	15	15	14	14	13	13	12	12	11
42° 19' - 43° 26'	17	16	16	15	15	14	14	13	13	12	12
43° 26' - 44° 32'	17	17	16	16	15	15	14	14	13	13	12
44° 32' - 45° 38'	18	17	17	16	16	15	15	14	14	13	13
45° 38' - 46° 45'	18	18	17	17	16	16	15	15	14	14	13
46° 45' - 47° 51'	19	18	18	17	17	16	16	15	15	14	14
47° 51' - 48° 58'	19	19	18	18	17	17	16	16	15	15	14
48° 58' - 50° 6'	20	19	19	18	18	17	17	16	16	15	15
50° 6' - 51° 13'	20	20	19	19	18	18	17	17	16	16	15
51° 13' - 52° 22'	21	20	20	19	19	18	18	17	17	16	16
52° 22' - 53° 31'	21	21	20	20	19	19	18	18	17	17	16
53° 31' - 54° 41'	22	21	21	20	20	19	19	18	18	17	17
54° 41' - 55° 52'	22	22	21	21	20	20	19	19	18	18	17
55° 52' - 57° 4'	23	22	22	21	21	20	20	19	19	18	18
57° 4' - 58° 17'	23	23	22	22	21	21	20	20	19	19	18
58° 17' - 59° 32'	24	23	23	22	22	21	21	20	20	19	19
59° 32' - 60° 49'	24	24	23	23	22	22	21	21	20	20	19
60° 49' - 62° 9'	25	24	24	23	23	22	22	21	21	20	20
62° 9' - 63° 30'	25	25	24	24	23	23	22	22	21	21	20
63° 30' - 64° 55'	26	25	25	24	24	23	23	22	22	21	21
64° 55' - 66° 24'	26	26	25	25	24	24	23	23	22	22	21
66° 24' - 67° 57'	27	26	26	25	25	24	24	23	23	22	22
67° 57' - 69° 35'	27	27	26	26	25	25	24	24	23	23	22
69° 35' - 71° 21'	28	27	27	26	26	25	25	24	24	23	23
71° 21' - 73° 16'	28	28	27	27	26	26	25	25	24	24	23
73° 16' - 75° 24'	29	28	28	27	27	26	26	25	25	24	24
75° 24' - 77° 52'	29	29	28	28	27	27	26	26	25	25	24
77° 52' - 80° 56'	30	29	29	28	28	27	27	26	26	25	25
80° 56' - 85° 45'	30	30	29	29	28	28	27	27	26	26	25
85° 45' - 90° 0'	31	30	30	29	29	28	28	27	27	26	26

9.12 Adapt-Mode

The Adapt Mode provides options to optimize the digital filtering of the captured weight:

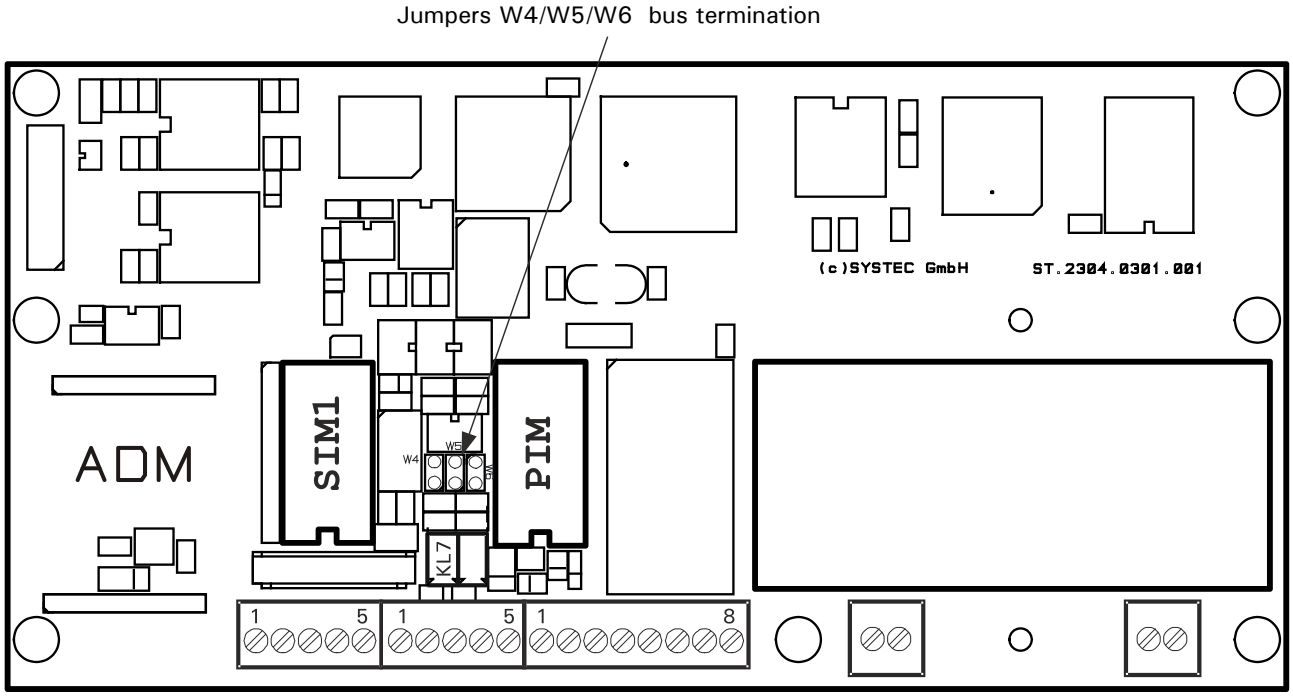
Service: Calibrate	**F1**	**Adapt Mode**
Damping: 0	**Info**	**Damping** With this parameter the 'Filter Size' as set in the calibration can be changed by up to +5 or −5 steps. Default setting is 0. **−5 to +5: Adaptation of filter size**
Vib. Filter: DOSING	**Info**	**Filter type** Choose the filter type for the application. 'DOSING' is optimized for filling applications when changes of the load must be processed without delay. 'WEIGHING' is better suited for static weighing when fast changes of the weight must be captured, but small deviations - such as vibrations- must be filtered. **Dos.** **Optimized for filling** **Weigh** **Optimized for static weighing**
Vib. Size: 1	**Info**	**Working window of vibration filter** If extreme vibrations are experienced, this parameter serves to adapt the working window of the vibration filter. Default setting is 1. Caution! Do not increase this setting unless a stable display could not be reached with the Adapt Mode parameter 'Damping' and the Calibration Mode parameters 'Filter Size' and 'Update Rate'. **1 to 8: Increase working window**

10 Description Of Components

10.1 Main Module CPU3000AP

The CPU3000AP module is the core of the ProfiBox. Sockets are provided for the optional installation of a serial interface (RS232 service interface COM1) and 2 parallel I/Os (PIM).

Layout of components on CPU3000AP main module:



Terminal KL2
Interface 1

Terminal KL4
digital I/Os

Terminal KL6
PE

Terminal KL5
Power supply

Socket for
scale interface
ADM

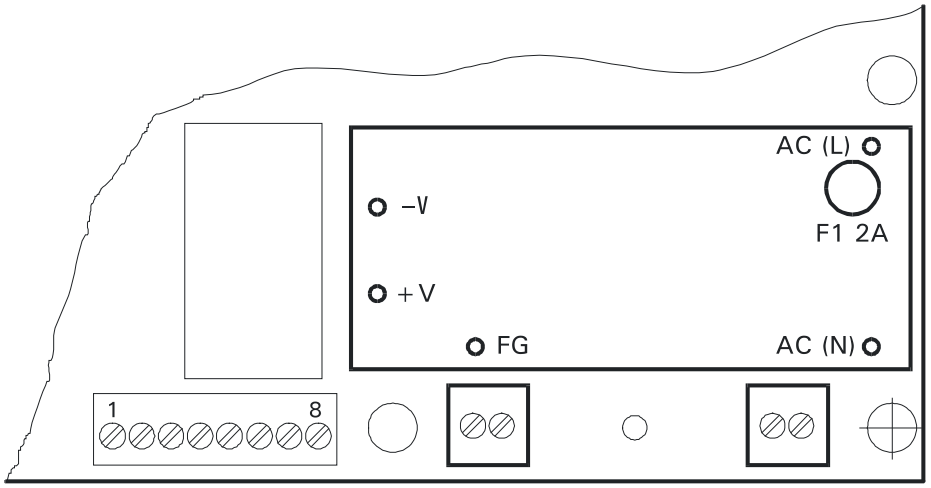
Terminal KL3 /
Connector KL7
Profibus DP

10.2 Power Supply 110 - 240 VAC

The auto sensing switching mode power supply unit operates on an input voltage ranging from 110 Volt (–15%) to 240 Volt (+10%), 50/60 Hz. The output rating is 1A at 5VDC.

W A R N I N G
Parts of the power supply unit are directly connected to dangerously high voltages!
A defective power supply unit can only be replaced. Disconnect all power to the instrument before servicing!

Position of soldering pins for input and output voltages:



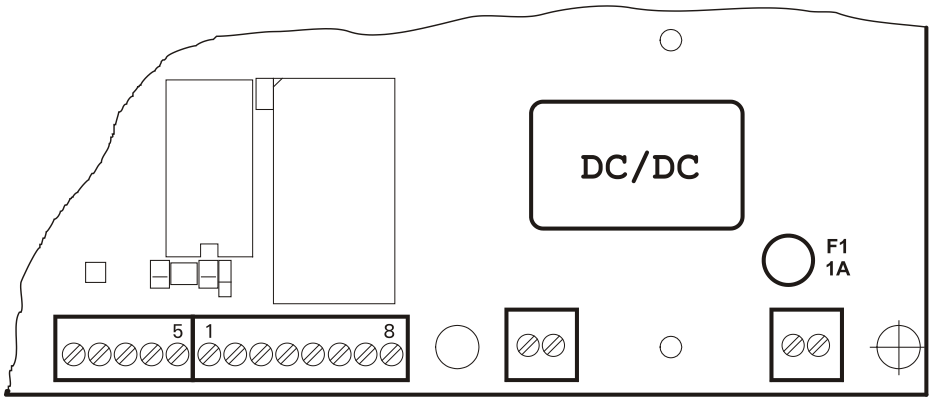
PE
Terminal KL6

L1 N
Terminal KL5
110V (-15%) to 240V (+10%),
50/60Hz

The power supply has a fused input (2A slow blow).

10.3 Power Supply 12 - 30 VDC

Alternatively, ProfiBox is available in a version that operates on 12 V (–15%) to 30 VDC (+10%). For this version a DC/DC converter is installed on the main module instead of the AC power supply. The DC version has a fused input (1A slow blow). The output rating of the converter is 5VDC at 600mA.



+V Gnd
Terminal KL5
12 - 30 VDC

11 Transport And Maintenance

11.1 Transport

Notes:

- Transport and storage of the ProfiBox shall only be made in the original packing with foam cushion. The module must not be exposed to shock or vibration.
- Transport and storage of electronic components such as boards, EPROMS, etc. must only be made in suitable anti-static ESD bags or cases.
- Storage temperature –25 to +70°C at 95% max. relative humidity without condensation.

11.2 Maintenance

CAUTION

- This unit and its associated equipment must be maintained by qualified personnel only, who are familiar with the construction and operation of all equipment in the system and the potential hazards involved. Failure to observe these precautions could result in bodily injury!

  Disconnect all power to this unit before servicing!

The ProfiBox is designed to require a minimum of maintenance and service, however, depending on the environmental conditions a visual inspection at regular intervals is recommended (e.g. twice a year). At these inspections it should be made sure that all connected cables are undamaged and that all connectors are tightly fastened.

Maintenance of scale platforms is required at regular intervals depending on use and environment. The accuracy of scales can be affected by dirt, foreign objects, etc. and appropriate maintenance is strongly recommended. Also recommended is the calibration with certified test weights at regular intervals.

12 Trouble Shooting

CAUTION

- **This unit does not contain any customer serviceable parts!**

  Only permit qualified personnel to service this equipment. Exercise care when making checks, tests, and adjustments!

If any problem arises that has not been explained above, please follow this check list:

- Power supply on and line cord undamaged (visual inspection)?
- All cables connecting to scales and peripheral devices undamaged (visual inspection)?
- Connectors fitted correctly and tightly secured at peripheral devices (visual inspection)?

If operational difficulties are encountered that cannot be rectified by means of this manual, obtain as much information as possible regarding the particular trouble, as this may eliminate a lengthy, detailed checkout procedure.

If possible, try first to determine the conditions under which the problem occurs. Try to find out whether the appearance of the difficulties can be reproduced under the same conditions.

For the systematic analysis of an unknown problem the information as listed below is required:

- Serial-No. of the unit and its peripheral components
- Exact wording of any error message displayed *)
- Program version as displayed on power up *)
- Type and model of peripheral devices related to the problem.

*) With emulation program PC *RemoteDisplay* installed and running.

To obtain professional assistance contact your service station stating the information listed above.

CAUTION

- **It is suggested that assistance from trained service personnel be requested in the event a problem should arise that is beyond the scope of this instruction manual.**

12.1 Error Messages

If an error occurs during calibration or normal operation, error messages are output as follows:

Error Message	Possible Cause	Corrective Measure
During calibration:		
Calibration Locked	• Jumper for protection of calibration parameters in position 'protected'	• Set calibration jumper to calibration position
Error Calibr. Jumper	• Parameters cannot be saved, jumper in wrong position	• Set jumper to correct position, repeat calibration
Error ADC TIMEOUT	• No data received from A/D converter	• Replace A/D converter
	• Short circuit in L/C cable	• Check cabling
Error ADC OVERRANGE	A/D converter out of range, because:	
	• Wiring error in L/C connection	• Check cabling
	• L/C defective	• Check L/C
Resolution Error	• Internal resolution too small, must be at least tenfold the displayed resolution	• Select bigger increment size • Use L/C with lower capacity
During normal operation:		
ADC Error	• No data from A/D converter	• Replace A/D-converter
	• Short circuit in loadcell cable	• Check cabling
ADC Over	A/D converter overrange:	
	• Wiring error loadcell	• Check wiring
	• Loadcell defective	• Check loadcell
	• Scale heavily overloaded	• Unload scale

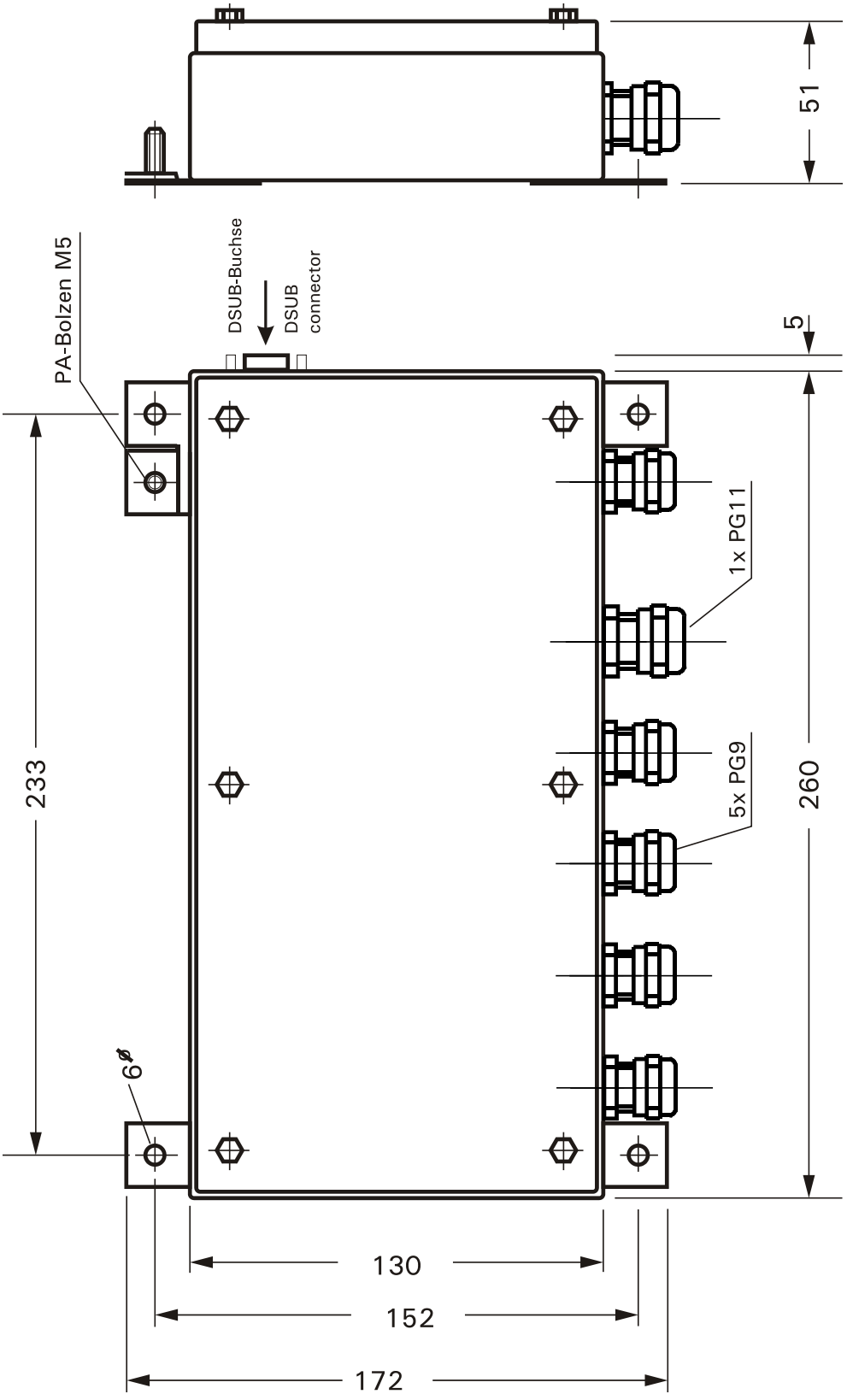
Error Message	Possible Cause	Corrective Measure
W1 --------	• Scale in overload • CPU does not receive data from weighing interface	• Unload scale • Check internal and external wiring and cabling
Power Up Zero Over	• Error power up zero. This message appears on power up if the weight on the scale exceeds the power up zero range as set in the calibration (+2%, +10%).	• Unload scale
Power Up Zero Under	• Weight below power up zero range. This message appears on power up if the weight on the scale is below the power up zero range as set in the calibration (–2%, –10%).	• Apply dead load
Motion	• This message appears on power up if the scale is in motion and a stable weight reading cannot be obtained within the power up zero range as set in the calibration (±2%, ±10%).	• Settle scale
Load Factory Scale	• Error A/D converter (factory calibration lost)	• Call service
Load.Serv.Par	• Error Service Mode parameters	• Call service

Further self-explanatory messages may appear.

13 Technical Data

Housing:	Stainless steel housing, protected to IP65, weight approx. 1.5kg
Temperature Range:	Storage: –25°C to +70°C at 95% relative humidity max. without condensation Operation: –10°C to +40°C at 95% relative humidity max. without condensation
Power Supply:	Wide range AC input 110 V (–15%) to 240 V (+10%), 50/60Hz Option: wide range DC input 12 VDC (–15%) to 30 VDC (+10%) Power consumption max. 15 VA
Fieldbus:	Profibus DP (baud rate 12MBit/sec)
Electrical Safety:	Separation between primary and secondary circuits SELV, in accordance with EN 60950, over-voltage category II
CPU Module:	32 kByte data memory 64 kByte program memory
Options:	1 serial interface, RS232 or RS485 as service interface
	2 optoisolated digital inputs, 2 optoisolated digital outputs

14 Dimensions



15 Service Password

The service password is required to access the Service Mode.

The password is: 2234

If you want to prevent unauthorized access to the Service Mode, remove this page from the manual and keep it in a safe place.