Robotic Mass Comparator

## e100

METTLER TOLEDO

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1 Introduction

In purchasing this automated mass comparator, you have chosen a talented, highly professional weighing machine. Combining METTLER TOLEDO's world-class weighing sensor technology and robotic expertise **e100 comparator** - automated 100 g mass comparator - sets new standards in the field of high-resolution weighing.

Performance and reliability on the one hand, productivity on the other are of concern to metrologists. These aspects were given great attention throughout the development of the **e100 comparator**. This product offers new ways with respect not only to direct comparison, but to down-/upward calibration as well. **e100 comparator** and its smart, versatile **e100**control software will become in no time indispensable to any mass standards laboratory.

To ensure that we can offer you personal service and provide you with the most efficient support, this product is accorded special treatment: not only the complete installation of the automated mass comparator, but also the instruction are handled by a specialist from Mettler-Toledo GmbH, Greifensee (Switzerland) or by a specialist from your country who has been specially trained.

Disclaimer for comparators

In this document "balance" is a terminology preamble and stands for comparators.

Due to the high resolutions and differential weighing application, comparators are tested with differential measurement only. Therefore the specification values defined are to be tested with differential methods only.

Software version

This document refers to the initially installed software version V 4.95.

Finding more information

▶ http://www.mt.com/lab-robotic-MC

Search for documents ▶ www.mt.com/library

For further questions, please contact your authorized METTLER TOLEDO dealer or service representative.

▶ www.mt.com/contact

Conventions and symbols

Key and/or button designations and display texts are shown in graphic or bold text (e.g. ⌂, **OK**).

Refers to an external document.

📝 **Note**   For useful information about the product.

Elements of instructions

- Prerequisites
1 Steps
2 …
    ⇨ Intermediate results
⇨ Results

2 Safety Information

Two documents named "User Manual" and "Reference Manual" are available for this instrument.

- The User Manual is printed and delivered with the instrument.
- The electronic Reference Manual contains a full description of the instrument and its use.
- Keep both documents for future reference.
- Include both documents if you transfer the instrument to other parties.

Only use the instrument according to the User Manual and the Reference Manual. If you do not use the instrument according to these documents or if the instrument is modified, the safety of the instrument may be impaired and Mettler-Toledo GmbH assumes no liability.

2.1 Definitions of signal warnings and warning symbols

Safety notes contain important information on safety issues. Ignoring the safety notes may lead to personal injury, damage to the instrument, malfunctions and false results. Safety notes are marked with the following signal words and warning symbols:

Signal words

WARNING	A hazardous situation with medium risk, possibly resulting in death or severe injury if not avoided.
CAUTION	A hazardous situation with low risk, resulting in minor or moderate injury if not avoided.
NOTICE	A hazardous situation with low risk, resulting in damage to the instrument, other material damage, malfunctions and erroneous results, or loss of data.

Warning symbols

 Electrical shock   Heavy object   Crushing hazard

 General hazard: read the User Manual or the Reference Manual for information about the hazards and the resulting measures.

Personal protective equipment

 Chemical resistant safety gloves are intended to protect hands against aggressive chemicals.

 The protective goggles protect the eyes from flying parts and liquid splashes.

2.2 Product specific safety notes

Intended use

This instrument is designed to be used in laboratories by trained staff. The automated mass comparator is intended for measuring calibration weights using direct comparison or down-/upward calibration.

Any other type of use and operation beyond the limits of technical specifications without written consent from Mettler-Toledo GmbH is considered as not intended.

Responsibilities of the instrument owner

The instrument owner is the person holding the legal title to the instrument and who uses the instrument or authorizes any person to use it, or the person who is deemed by law to be the operator of the instrument. The instrument owner is responsible for the safety of all users of the instrument and third parties.

METTLER TOLEDO assumes that the instrument owner trains users to safely use the instrument in their workplace and deal with potential hazards. METTLER TOLEDO assumes that the instrument owner provides the necessary protective gear.

Trained personnel

Persons performing weighing processes must fulfill the following basic knowledge requirements regarding the handling of METTLER TOLEDO instruments and associated software:

• Are able to complete the tasks entrusted to them and independently detect and avoid any possible dangers.

• Have expertise and experience as well as their familiarity with all applicable regulations.

• Able to prove that they have undergone training.

Safety notes

⚠ **WARNING**

Death or serious injury due to electric shock

Contact with parts that carry a live current can lead to death or injury.

1　Only use the approved METTLER TOLEDO power supply cable and AC/DC adapter with a current-limited SELV output.

2　Connect the power cable to a grounded power outlet, ensure correct polarity.

3　Keep all electrical cables and connections away from liquids and moisture.

4　Check the cables and power plug for damage and replace damaged cables and power plugs.

⚠ **CAUTION**

Freely accessible parts, which can move automatically

Injuries due to crushing are possible when reaching into the working area of the robot arm during adjustment procedures or during normal operation.

–　Do not reach into the working area when the robot arm is moving.

⚠ **CAUTION**

Damage on instrument due to incorrect moving or unsuitable location site

Moving the instrument yourself might lead to injuries or might damage the instrument.

1　Contact a METTLER TOLEDO representative before changing the location of the instrument.

2　Do not carry the instrument yourself. It's total weight exceeds the acceptable limit in accordance to the applicable regulations.

NOTICE

Damage due to inappropriate use

Inappropriate use of the instrument may lead to significant material damage.

1　Installation, adjustment and repair work shall be carried out exclusively by specialists from METTLER TOLEDO. Never undertake any installation, adjustment or repair, unless duly instructed by the above mentioned specialists.

2　Do not open the instrument, the control units or the robot system. They do not contain any parts which can be maintained, repaired, or replaced by the user. If you ever have problems with your instrument, contact your METTLER TOLEDO dealer.

3　Use only original parts supplied or approved by the manufacturer.

A listing of all parts can be found in the Reference Manual (RM).

2.3 Warning notices on the instrument

The following symbols are attached to the instrument. They relate to the direct environment where they have been put up.

> ⚠ **CAUTION**
>
> **Illegible signage**
>
> Stickers and signs can get dirty or become illegible. The risks can no longer be recognized and necessary operating instructions can no longer be adhered to. This presents a risk of injury.
>
> 1 Always keep safety, warning and operating notices in good legible condition.
> 2 Immediately replace damaged signs or stickers.
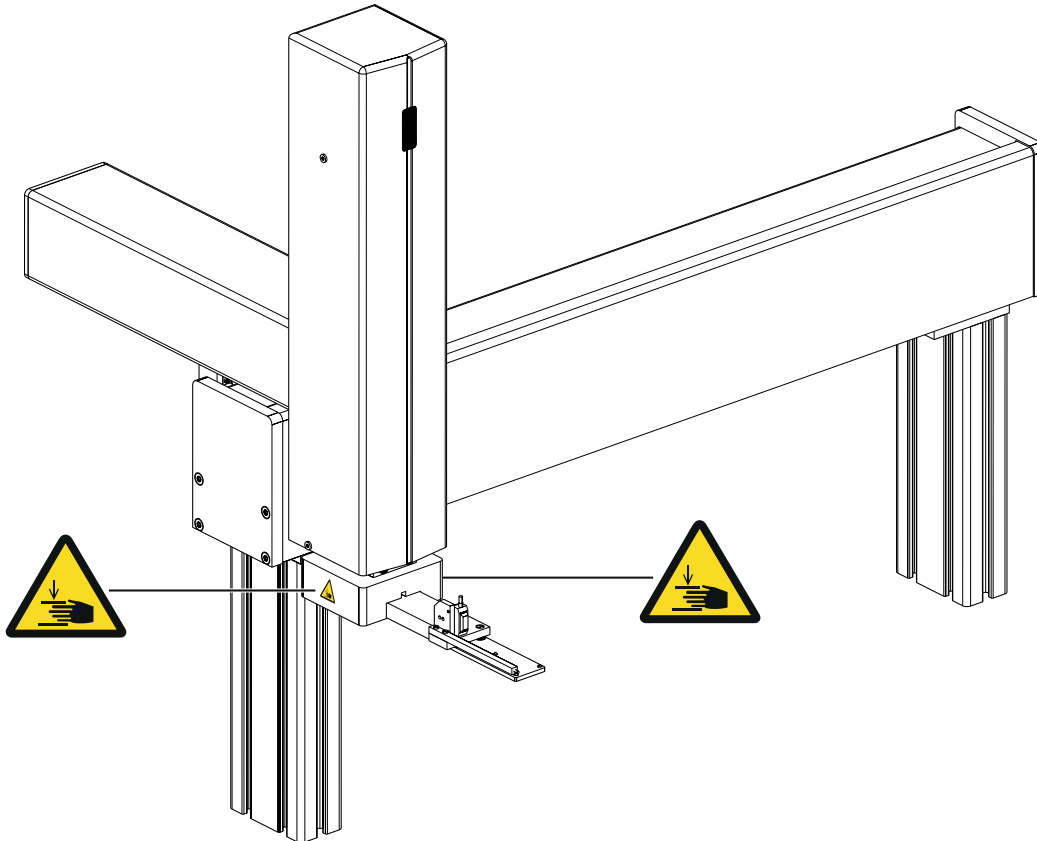
Symbol	Meaning
	Indicates the possibility of personal injury due to crushing when the robot hand is moving up and down. Pay attention that the robot hand may move without any prior warning. Do not reach into the working area when parts of the instrument are moving.

2.4 Stopping in case of emergency

To stop the instrument in case of an emergency, proceed as follows:

1 Switch off the power supply by pulling out the power plug.
2 Secure the instrument against switching on again.
3 Have fault repair performed by expert personnel or personnel of METTLER TOLEDO.
4 Before starting up again, check the instrument and make sure that there is no risk of danger.

3 Design and Function

3.1 Overview instrument
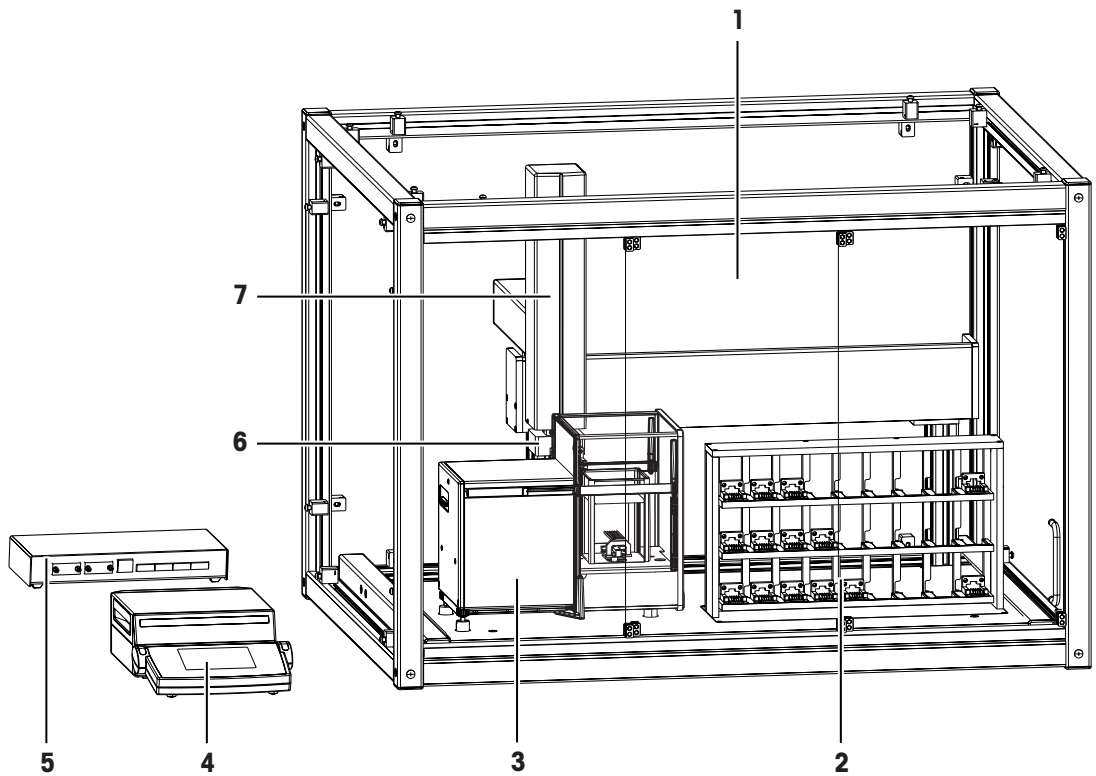
Legend overview instrument

1	Weighing chamber accessible through sliding door	**2**	Weight magazine with 27 weight carriers
3	Balance (AX106 mass comparator)	**4**	Balance control unit
5	Robot system control unit	**6**	Robot hand with light barrier
7	3-axis robot system		

3.2 Component descriptions

3.2.1 Overview AX106 balance

As balance the AX106 comparator is used.

For full information, always consult and download the Operating Instructions (OI).

► www.mt.com/ax-comparator-OI
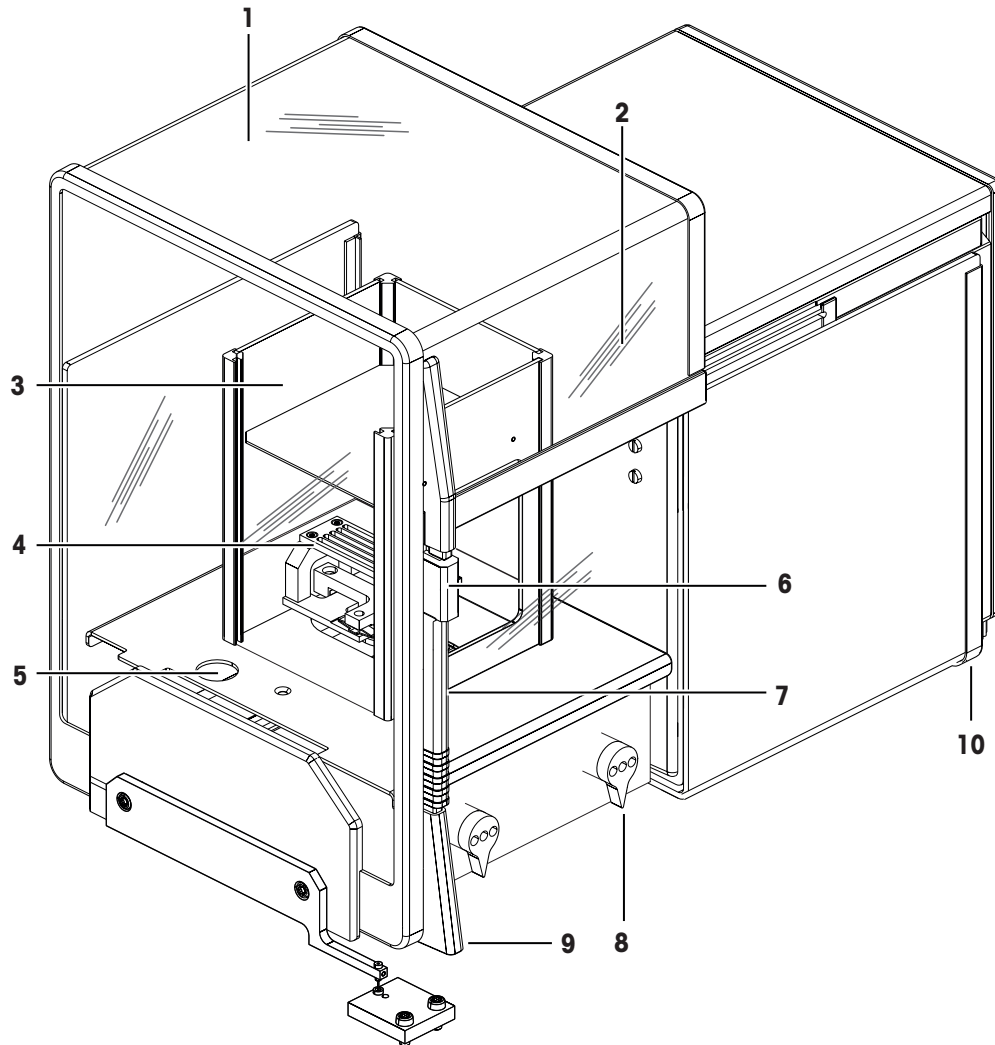
Legend overview balance

1	Glass draft shield	**2**	Type name
3	Inner draft shield	**4**	Weighing pan
5	Level indicator	**6**	Door coupling element
7	Door handle	**8**	Control knobs for dial weights
9	Door follower handle	**10**	Leveling screw

3.2.2 Overview balance control unit
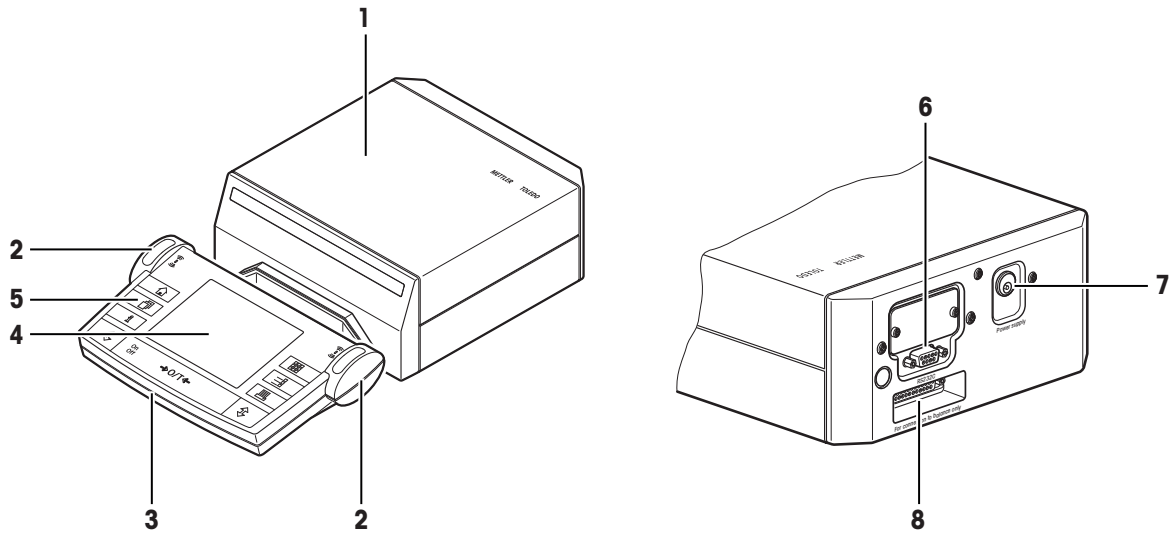
Legend overview balance control unit

1	Balance control unit	2	SmartSens sensors
3	Terminal	4	Display
5	Operating keys	6	RS232C serial interface
7	Socket for AC/DC adapter	8	Connecting socket for weighing cell

📝 Note

No changes must be made on the terminal of the balance. During weighing, the terminal of the balance is disabled.

For full information, always consult and download the Operating Instructions (OI).

► www.mt.com/ax-comparator-OI

### 3.2.3 Overviw robot system
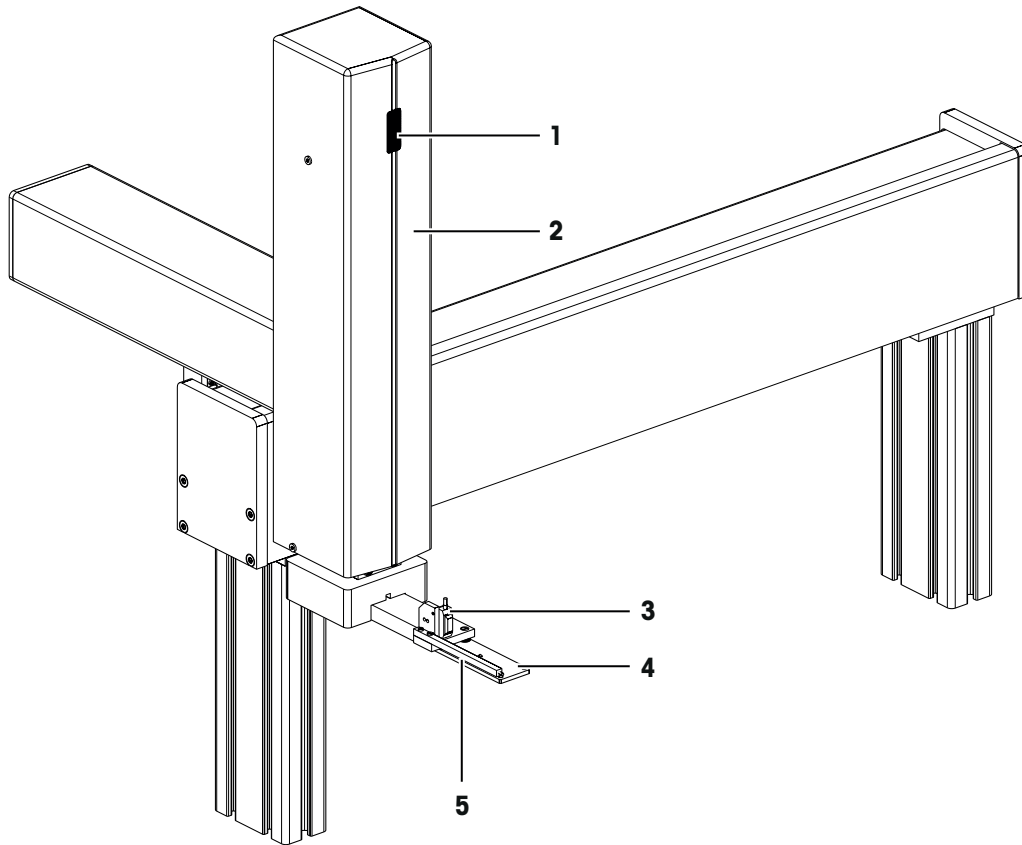
Legend overview robot system

1	Status indication light	**2**	Robot arm
3	Light barrier	**4**	Robot hand
5	Manipulator		

3.2.4 Overview type plate

The type plate of the robot system is located on the backside of the robot system next to the socket for the AC/DC adapter.
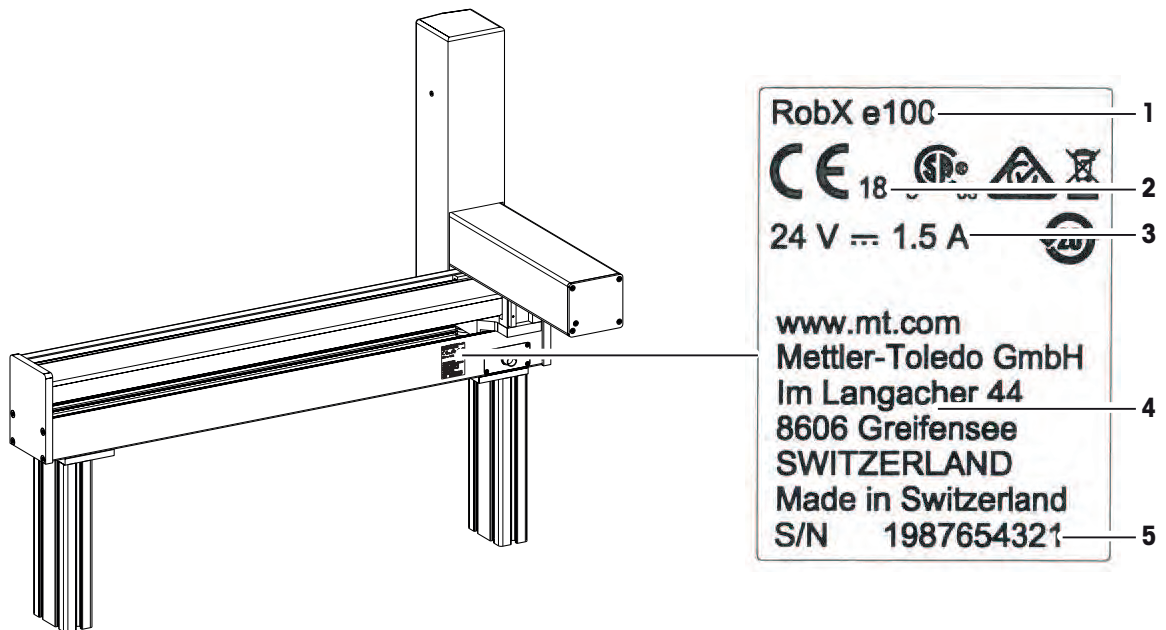
Legend overview type plate

1	Model designation	2	Year of manufacture
3	Power supply	4	Manufacturer
5	Serial number (SNR)		

3.2.5 Overview robot system control unit
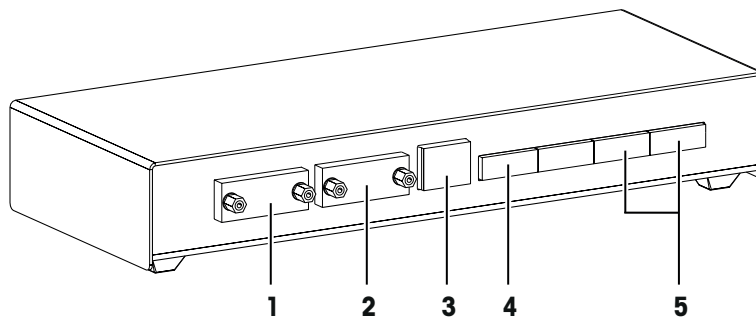
Legend overview robot system control unit

1	RS232C (balance control unit)	2	RS232C (PC with control software)
3	Ethernet (not applicable)	4	Socket for interface cable robot system
5	Sockets for AC/DC adapter		

3.2.6 Control software

All settings and the operation of the instrument are controlled with the software **e100**control. The software is installed on a notebook provided by METTLER TOLEDO.

The software is used to visualize the instrument data and measuring results and to interact with the instrument. The interaction encompasses starting and aborting weighing processes, configuring the instrument and defining process specific data (as comparison scheme etc.).

The following illustration gives an overview about the main functions of the software. For further information **see** [Operation ▶ Page 22]:
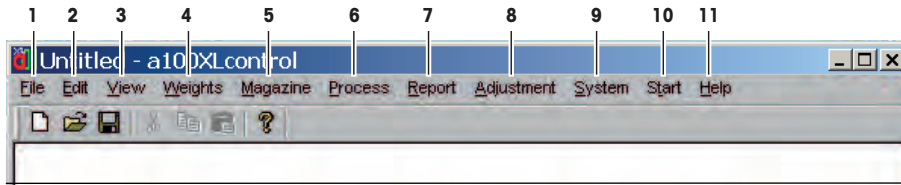
Nr.	Parameter	Description
1	**File**	Contains file related commands like creating a new file, opening an existing file, importing a text file, saving current file, quitting program etc.
2	**Edit**	Contains various functions to edit the file (similar to Windows).
3	**View**	Contains various functions to adapt the view (similar to Windows).
4	**Weights**	Gives access to the weights database which contains all relevant data on your standards and test weights.
5	**Magazine**	Opens the menu to identify and register the weights placed in the weight magazine.
6	**Process**	Opens the menu to set comparisons of which the weighing process shall consist, as well as its precise timing and sequence.
7	**Report**	Gives access to define the content of the report file.
8	**Adjustment**	Allows you to start the adjustment procedure using the built-in balance adjustment weights.
9	**System**	Contains various system settings.
10	**Start**	Hosts the command to start the measurement.
11	**Help**	Contains the help file and further information about the software.

3.3 Wiring scheme

The illustration below shows how the different components of the instrument are connected to each other:
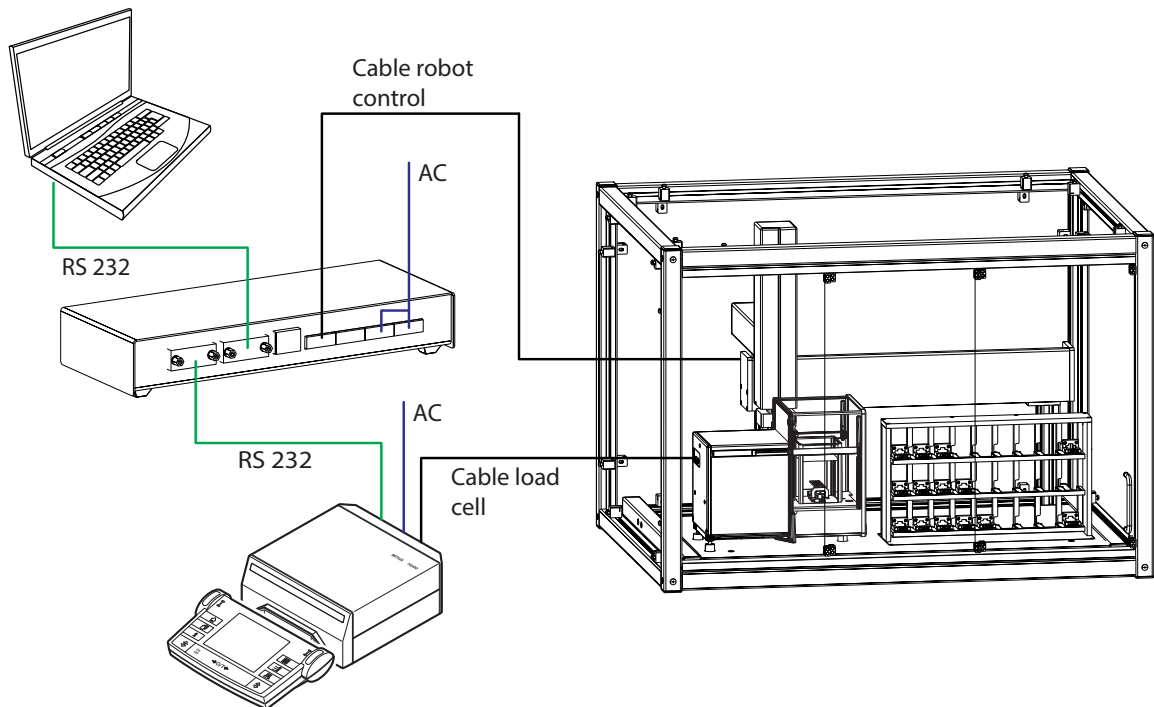
3.4 Safety devices

Light barrier

At the very beginning of the measurement each weight carrier is checked by means of the light barrier located on the robot hand (1). Should a unsuitable weight carrier be detected, the process aborts.
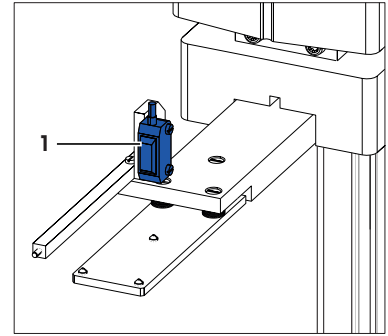
Balance position sensor

The position of the balance is monitored by means of the balance position sensor (1). To avoid crashes, the balance must stay in the position which was precisely defined during system installation. Therefore, never move or reposition the balance (e. g. while cleaning). Should a position error be detected, do contact a METTLER TOLEDO representative.
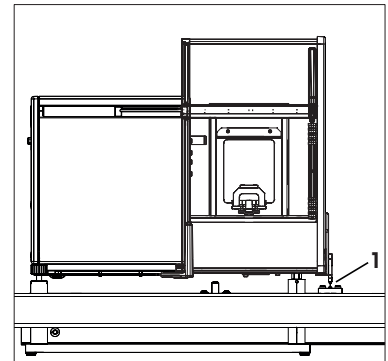
3.5 Status indication light

The robot arm is equipped with a status LED. The LED indicates whether the instrument is enabled or not.

Status LED	Meaning
	LED is off When the LED is off, the robot arm is not in operating mode. No automatic movement of the robot arm is possible.
	LED is on When the LED is on, the robot arm is in operating mode. This means, that the robot arm may move automatically. Proceed with caution when performing manual operations while the LED is on.

4 Installation and Putting into Operation

4.1 Selecting the location

⚠️ **CAUTION**

Damage on instrument due to incorrect moving or unsuitable location site
Moving the instrument yourself might lead to injuries or might damage the instrument.

1 Contact a METTLER TOLEDO representative before changing the location of the instrument.
2 Do not carry the instrument yourself. It's total weight exceeds the acceptable limit in accordance to the applicable regulations.

📝 **Note**

Ensure that at least 30 cm free space is available on the left side of the instrument to position the balance control unit and the robot system control unit. Its recommended to position the notebook on another table in order to avoid interferences due to vibrations.

A balance is a sensitive precision instrument. The location where it is placed will have a profound effect on the accuracy of the weighing results.

Requirements of the location

According to the environmental condition, **see** chapter "General data".

Ensure there is:

- indoor on stable table
- with sufficient distance (> 30 cm)
- in level
- adequate lit
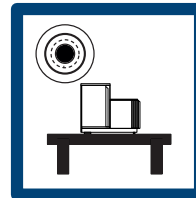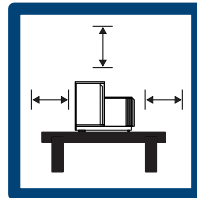
Avoid:

- direct sunlight
- vibrations
- strong drafts
- temperature fluctuations
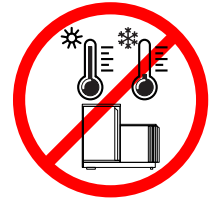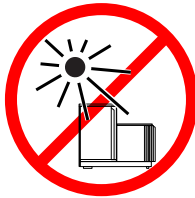
4.2 Scope of delivery

- 3-axis robotic system with all electric components
- 1 Magazine with 27 positions
- 1 AX106 mass comparator
- 1 Draft shield
- 1 Controller (laptop)
- e100control software
- 16 Weight carriers design 1, e100
- 11 Weight carriers design 3, e100

- 3 Weight carrier inserts diameter 26 mm
- 2 Weight carrier inserts diameter 24 mm
- 4 Weight carrier inserts diameter 22 mm
- 2 Weight carrier inserts diameter 20 mm
- 4 Weight carrier inserts diameter 18 mm
- 4 Weight carrier inserts diameter 14 mm
- 4 Weight carrier inserts diameter 10 mm
- 4 Weight carrier inserts diameter 6 mm
- 1 Tweezer for 1 mg to 50 g
- 1 Tweezer for 1 g to 200 g
- 1 Rubber air bellow
- 1 User Manual
- 1 Declaration of conformity
- 1 Production certificate

4.3 Assembling the instrument

⚠ CAUTION

Injury and property damage due to inappropriate assembling and commissioning of the instrument

Errors during the assembling and commissioning can cause life-threatening situations and significant property damage.

1 Only allow assembling and commissioning to be handled by employees of the manufacturer or people authorized by the manufacturer.
2 Do not attempt to handle installation and location changes yourself.
3 Contact METTLER TOLEDO prior to perform any task not described in this manual.

4.4 Connecting and setting up the instrument

⚠ WARNING

Death or serious injury due to electric shock

Contact with parts that carry a live current can lead to death or injury.

1 Only use the approved METTLER TOLEDO power supply cable and AC/DC adapter with a current-limited SELV output.
2 Connect the power cable to a grounded power outlet, ensure correct polarity.
3 Keep all electrical cables and connections away from liquids and moisture.
4 Check the cables and power plug for damage and replace damaged cables and power plugs.

NOTICE

Damage to the AC/DC adapter due to overheating

If the AC/DC adapter is covered or in a container, it is not sufficiently cooled and will overheat.

1 Do not cover the AC/DC adapter.
2 Do not put the AC/DC adapter in a container.

Handling the AC/DC adapters

The balance is supplied with a universal AC/DC adapter or an AC/DC adapter with a country-specific power cable.

- Install the cables so that they cannot be damaged or interfere with operation.
- Insert the power cable in a grounded power outlet that is easily accessible.

📝 Note

When the instrument is connected to the power grid, it starts automatically. To switch off the instrument and to disconnect it from the power supply, the power plug has to be plugged out.

Setting up the instrument

To power and set up the instrument proceed as follows:

> **!** **NOTICE**
>
> **Damaged balance because of weight or weight carriers on robot hand or balance**
> If the robot hand or the balance are not empty during the start up procedure, the balance can get damaged.
> – Make sure to remove everything from the balance and the robot hand before powering on the balance.

- The instrument is complete and fully cabled by the manufacturer. The balance and the robot system power cables are not plugged in yet.
- The robot hand and the balance pan are empty.

1 Make sure both control knobs (2) on the balance are on position **0**. If not, turn them manually to position **0**.
2 Place a 100 g weight on the weighing pan (1).
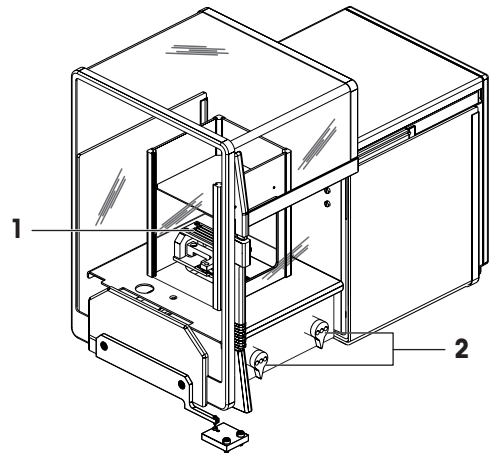
1 Connect the power cable (3) to the balance and the control unit. Plug in the balance power cable (3).
  ⇨ The start-up procedure begins automatically. The balance door opens and closes again.
2 Once the start-up procedure is completed, remove the 100 g weight manually.
⇨ The balance is now powered.
1 Ensure that the cable between the robot system and the robot system control unit (4) is plugged in.
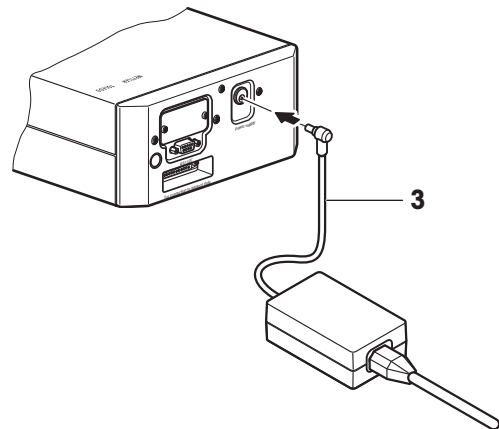
2   Plug in the power cable at the robot system control unit (5).

⇨   The robot system is now powered. The start-up procedure includes the following steps:

•   The carriage of the balance opens and closes.

•   The robot system initializes. Each axis of the robot system is driven to its respective home position.

•   The robot hand opens and closes the balance door.

•   The robot arm moves to its home position.

The instrument is set up and the weights can be loaded on the weight magazine, **see** [Preparing the weight magazine ▶ Page 17]. Prior to start weighing, wait at least 120 minutes after connecting the balance to the power supply. This allows the components to get at room temperature.

4

5
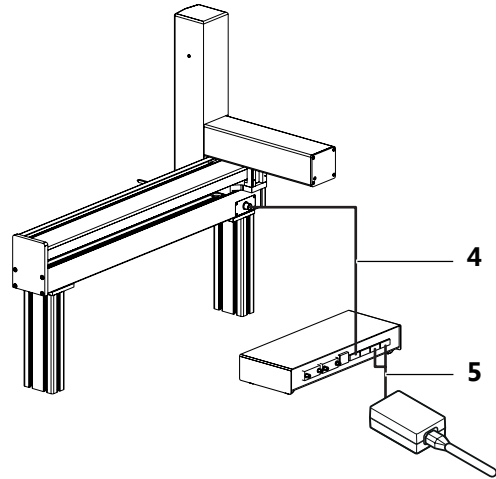
📰 **Note**

•   If any of the following situations is detected, each robot axis is driven to its respective home position but no further action is taken:

   −   Balance is turned off.

   −   Interface connection is inactive.

   −   Balance has been moved from its original position.

To ensure optimum weighing conditions, leave the robot system on all the time.

4.5 Preparing the weight magazine

Each test weight or standard used during the weighing process needs to be placed onto one weight carrier. The selection of the adequate weight carrier type is determined by the weight geometry.

In order to ensure a trouble-free operation of the comparator and to minimize corner load errors, strict rules must be followed when it comes to choose the right carrier type. Consult and follow the weight carrier selection guide each time you load weights onto the magazine.

Pay attention to the following:

•   Do not touch the weight carriers or the weights by hand. Use the delivered tweezers or powder free latex gloves.

4.5.1 Selecting a suitable weight carrier

There are two designs of weight carriers available for this weight magazine.

Design nr. 1: small to medium weights

1   **2**   **3**

5

4

6
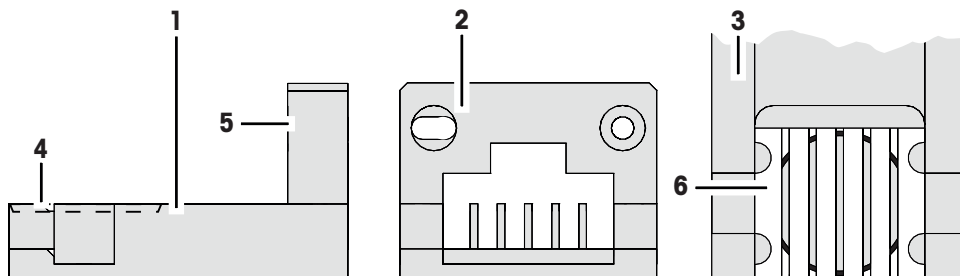
Design nr. 3: medium to big weights
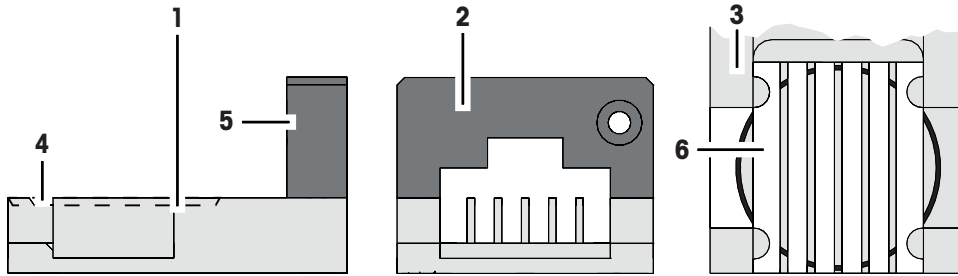
Legend

Nr.	Description
1	Side view
2	Front view
3	Top view
4	Sunken position for cylindrical weights
5	Grey frame for design nr. 1
	Red frame for design nr. 3
6	Interchangeable insert

Choosing the correct insert

📝 **Note**

- Weights which do not fit in one of the categories listed below must not be loaded on the carriers.
- Weights must never be placed over the edge of the sunken position.

In the mode **down-/upward calibration** combinations of up to three weights can be weighed:

- Design nr. 1: up to **three** weights, placed each on its own carrier, can be weighed.
- Design nr. 1 in combination with design nr. 3: up to **two** weights, placed each on its own carrier, can be weighed.

	The weight dimensions are measured including the weight knob.

Design nr. 1

Weight dimension	Figure	Insert
$d_c = 6$ mm $h_c \leq 12$ mm		Ø 6 mm
6 mm $< d_c \leq 10$ mm $h_c \leq 20$ mm		Ø 10 mm

Weight dimension	Figure	Insert
10 mm < d_c ≤ 14 mm h_c ≤ 28 mm		Ø 14 mm
14 mm < d_c ≤ 18 mm h_c ≤ 36 mm		Ø 18 mm

Design nr. 3

Weight dimension	Figure	Insert
18 mm < d_c ≤ 20 mm h_c ≤ 40 mm		Ø 20 mm
20 mm < d_c ≤ 22 mm h_c ≤ 44 mm		Ø 22 mm
22 mm < d_c ≤ 24 mm h_c ≤ 48 mm		Ø 24 mm
24 mm < d_c ≤ 26 mm h_c ≤ 50mm		Ø 26 mm

4.5.2 Loading the weight magazine

To place the weights onto their respective weight carrier in the magazine proceed as follows:

- The instrument has been started successfully, **see** Setting up the instrument.

1 Open the weighing chamber doors.

2 Insert the respective weight carriers design nr. 1 or design nr. 3 into the weight magazine. To position the weight carriers correctly, pay attention to the following:

3 - The carriers must be centered within the sunken frame of the magazine position.

4 - Do not touch the weight carriers by hand. Use the delivered tweezers or powder free latex gloves.
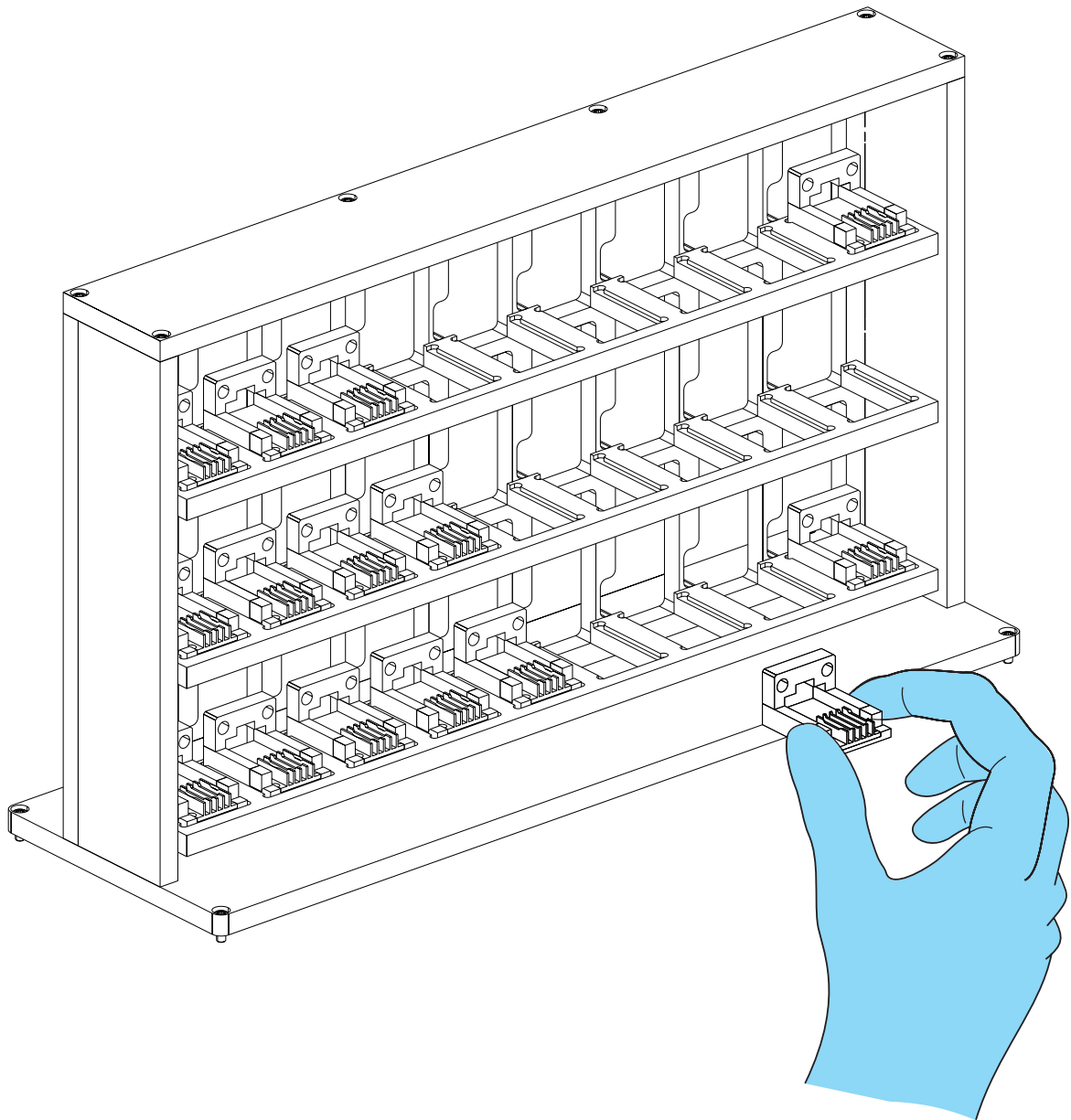
5 Place the weights on the respective weight carriers using the delivered tweezers. Do not touch the weights by hand. Pay attention to place the weights the right way on the right carrier type.
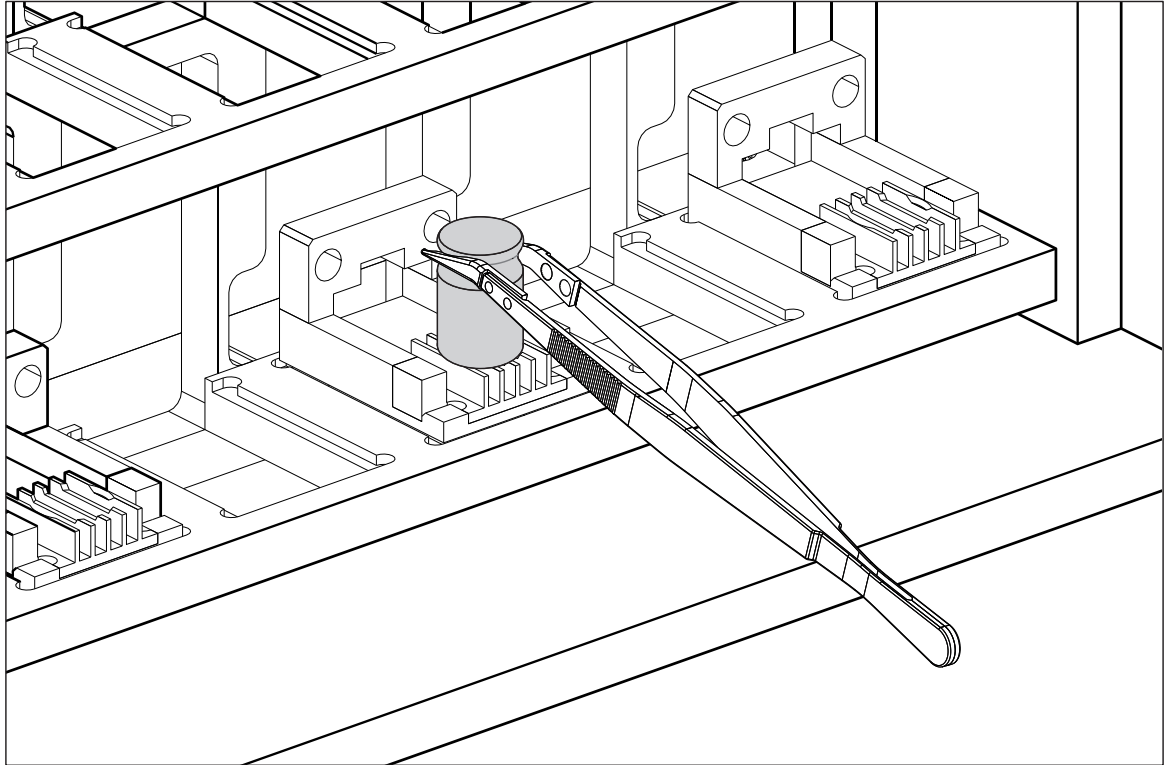
6 Once the magazine is loaded, close the weighing chamber doors.

5 Operation

This section describes the **e100**control software and refers to its version 4.95.

5.1 Starting e100control

Starting e100control

– Double click **e100**control icon (**e100control.exe**) to start **e100**control.

⇨ The program starts and a new, blank settings file named 'Untitled.e100' opens.

Description of the commands

The **e100**control main menu comprises the following items:
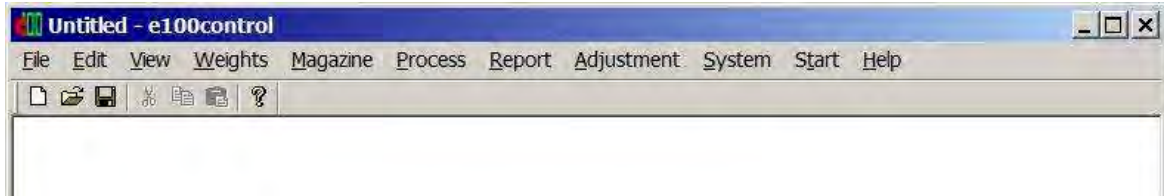
e100control - main window

Edit, **View** and **Help** offer functions and options that are standard in common Windows® applications and therefore may not require further description. **File** lists the following commands:
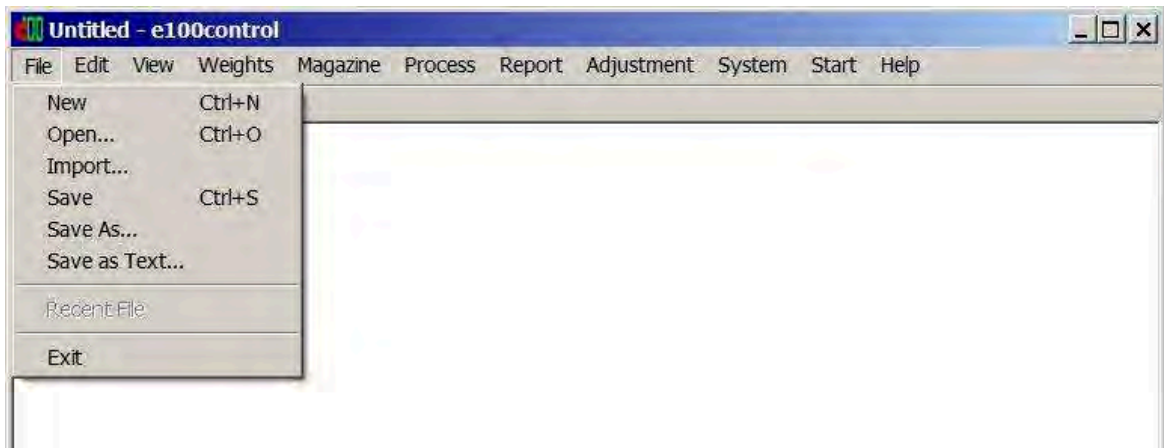
e100control - **File** menu

Command	Description
New	Closes the current settings file and opens a new, blank file named 'Untitled.e100'. If changes were made to the currently open file, you are prompted to save them.
Open…	Prompts you to select and open an existing file. Once a particular file is selected, the currently open settings file closes. If changes were made to it, you are prompted to save them.
Import…	Prompts you to select an existing text file (extension '.imp' or '.txt'), generated by an external application according to a defined format, and converts it into a new standard settings file (extension: '.e100'). The new settings file will immediately be loaded. For details **see** [Remote-controlling the e100comparator ▶ Page 53].
Save	Saves the changes made to the current settings file under the current file name (extension: '.e100').
Save As…	Prompts you to enter a new file name and saves the current settings file under the name you just entered (extension: '.e100').

Command	Description
Save as Text…	This command allows you to select and save, in the current directory but in a separate text file (current name with extension '.txt'), the settings which you may want to be printed out separately and archived in your record. By ticking the adjacent boxes, you may select the following options: • **Standards data for selected sets** [Standards data ▸ Page 23] • **Test weights data** [Test weights data ▸ Page 26] • **Magazine places allocation** [Allocating the weight magazine places ▸ Page 27] • **Weighing process settings** [Weighing process settings ▸ Page 29] • **Series scheme** [Series scheme ▸ Page 31] • **Report heading** [Starting the weighing process ▸ Page 37]
Exit	Prompts you to save the unsaved changes you made and quits **e100**control.

5.2 Entering and editing the weights data

The **Weights** menu gives access to the weights database which contains all relevant data on your standards and test weights. While the data on your test weights are, like other settings, specific to the process and, thus, to the current settings file (extension .e100), the data on your standards are kept in a separate database ('MyStandards.st2'). These data are specific to your mass standards laboratory, not to the weighing process, and, thus, need to be accessible from any settings file.

Noteworthy is the fact that 'MyStandards.st2' must be left in the same directory as your application file ('**e100**control.exe') and your setting files. For safety purpose, you may want to keep a backup file of the standards database.
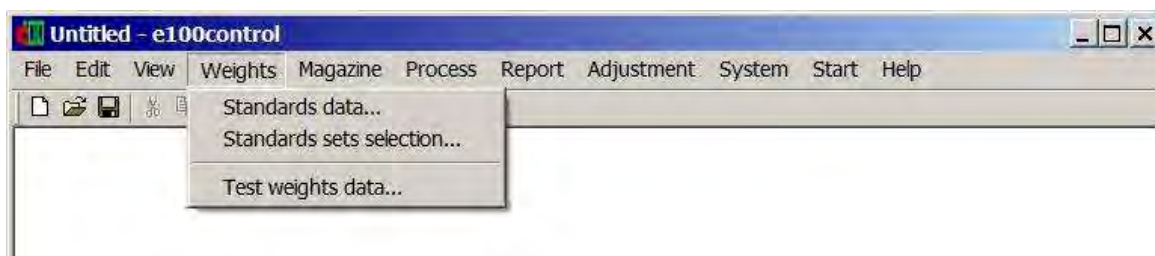
e100control - **Weights** menu

5.2.1 Standards data

Entering standards data

To enter the standards data, proceed as follows:

1 Select **Weights** > **Standards data…**.

⇨ The window shown below is displayed. A list box gives all standards which have been entered. All entries are numbered (column **Pos**) and listed alphabetically by **Set-ID** (identification - limited to 8 characters - of the weight set to which this standard belongs) and by descending nominal values

(**Nom.value [g]**) given in gram only. Besides, each record contains a **Standard-ID** (identification - limited to 8 characters - of this particular standard) and the error (**Error [mg]**), given in mg only, as well as a field for some further information on this standard (**Notes**, limited to 35 characters).
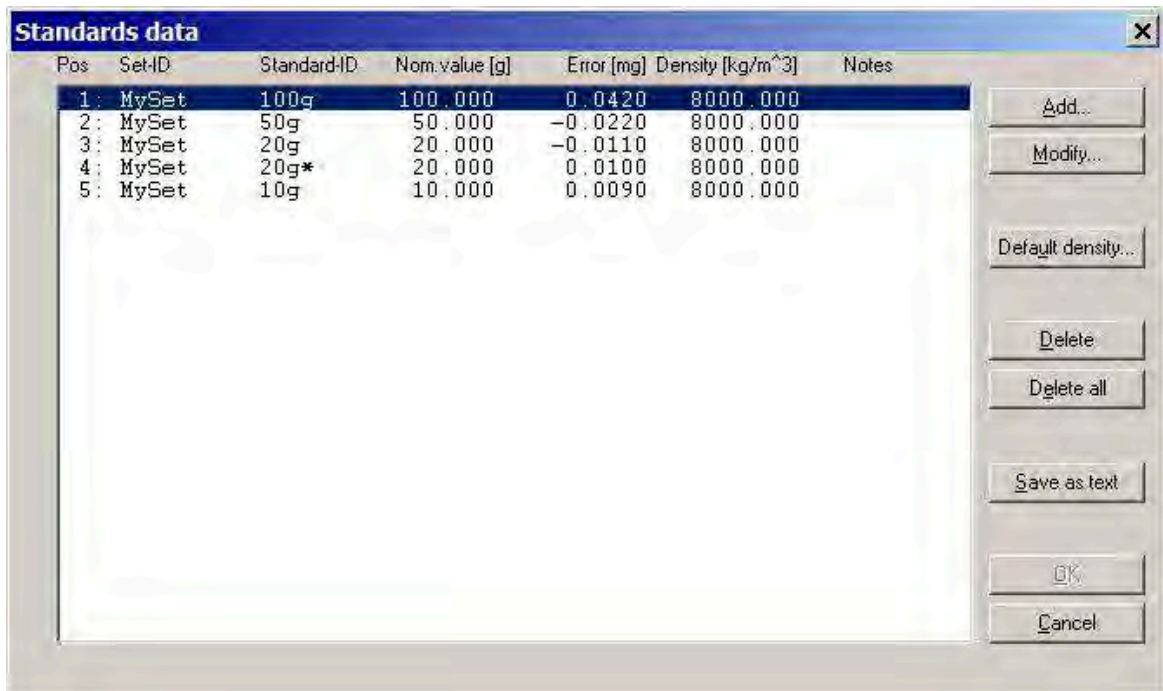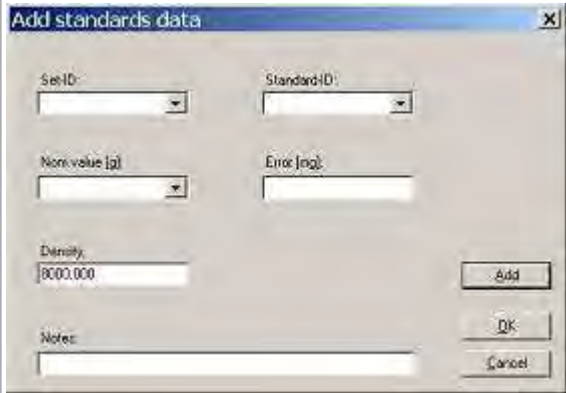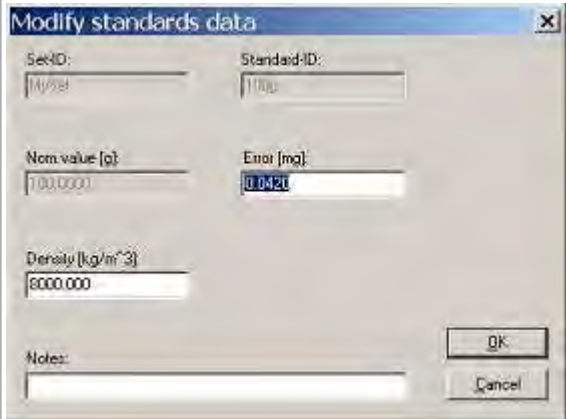
Entering/editing standards data

2   Change the currently stored standards data by clicking either the **Add…**, **Modify…**, **Delete** or **Delete all** command button.

3   Before allowing you to access the data and to modify them, **e100**control prompts you to enter the password. The default password is '' (empty character string = no character). Click **Change…** to change the password. Enter the current password, the new one and, again, the new one as confirmation. The password is limited to maximum 12 characters.

4   Once the password is accepted, you may proceed with the modifications (the access to the data remains free until you close the **Standards data** window by clicking either **OK** or **Cancel**). For information concerning the different commands, see the table below.

5   Once you are satisfied with the changes you have made, return to the main window by clicking **OK**. Should you wish to ignore all the changes made, click **Cancel**.

⇨ The standards data are stored in the file 'MyStandards.st2'.

Overview about the commands

Command	Description
Add…	Opens the **Add standards data** window which allows you to enter a new record in the standards database. Return to the **Standards data** window after confirming your new entry **OK** or ignoring it **Cancel**.
Modify…	Opens the **Modify standards data** window which allows you to modify the error and the notes. Return to the **Standards data** window after confirming the changes **OK** or ignoring them **Cancel**.
Default density…	Opens a window where the default density can be entered. This default density is used when a new standard is added. The button is inactive, if standards and test weights have no density values, **see** [Selecting the application mode ▶ Page 60].
Delete	Deletes the record which is presently selected (to select a particular record from the list, simply click on it).
Delete all	Deletes all database records.
Save as text	This command allows you to save, in the current directory but in a separate text file ('MyStandards.txt') the standards data which you may want to be printed out separately and archived in your record.

Selecting a standards set

As above described, each standard belongs to a particular set, identifiable through its **Set-ID**. In your mass standards laboratory, likely more than one set are available, so that you may wish to select only one (or more) particular set to be used during the weighing process which you are preparing. To do so, proceed as follows:

1 Select **Weights** > **Standards sets selection…**.

   ⇨ The window **Standards sets selection** is displayed.

2 Select in the **Not selected** list the set you want to use for this particular weighing process.

3 Click **«**.

⇨ The weights belonging to the non-selected sets will not appear in any of the windows in which e. g. the magazine places are allocated, the series scheme is designed etc..
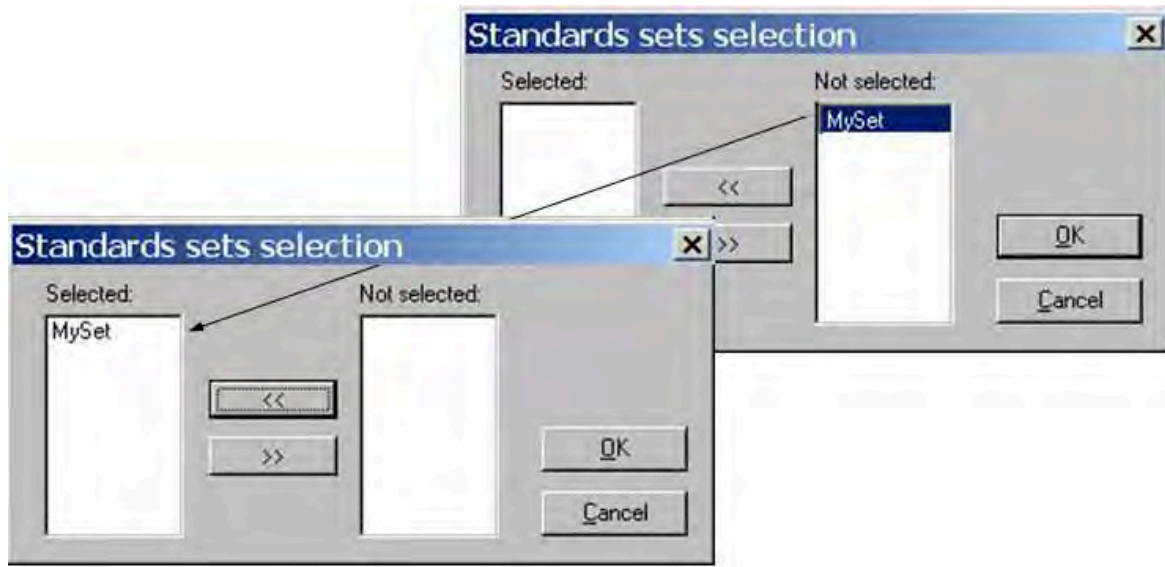
Selecting a standards set

5.2.2 Test weights data

Entering test weights data

To enter the test weights data, proceed as follows:

1 Select **Weights** > **Test weights data…**.

⇨ A window entitled **Test weights data** is displayed. A list box gives all test weights which are to be determined during this particular weighing process. All entries are numbered (column **Pos**) and listed alphabetically by **Set-ID** (identification - limited to 8 characters - of the weight set to which this test weight belongs) and by descending nominal values (**Nom. Value [g]**) given in gram only. Besides, each record contains a **Weight-ID** (identification - limited to 8 characters - of this test weight) and a field for some further information on this test weight (**Notes**), limited to 35 characters.

2 Following the procedure described in [Standards data ▶ Page 23], change the presently stored test weights data by using one of the commands in the table below.

3 Once you are satisfied with the changes you have made, return to the main window by clicking **OK**. Should you wish to ignore all the changes made, click **Cancel**.

Overview about the commands

Command	Description
Add…	Opens the **Add test weights data** window which allows you to enter a new record in the list of test weights. After entering a Set-ID and a nominal value, you may use the **auto numbering** button to create up to 100 test weights all having the same Set-ID and nominal value, and consequent numbers as weight ID's.
	Example: Entering '00145' as first number and '00180' as last number will create 36 test weights, with Weight-ID's '00145', '00146', and so on, up to '00180'.
	Return to the **Test weights data** window after confirming your new entry **OK** or ignoring it **Cancel**.
Modify…	Opens the **Modify test weights data** window which allows you to modify the notes.
	Return to the **Test weights data** window after confirming the changes **OK** or ignoring them **Cancel**.

Command	Description
Change Set ID…	Opens the **Change Set ID** window which allows you to change the Set ID of all test weights belonging to one test weights set. This gives you an excellent possibility to adapt a saved settings file to a new measurement, just by changing the Set-ID of the test weights involved in the measurement.
Default density…	Opens a window where the default density can be entered. This default density is used when a new test weight is added. The command is inactive, if standards and test weights have no density values, **see** [Selecting the application mode ▶ Page 60].
Delete	Deletes the record which is presently selected in the list box (in order to select a particular record from the list, simply click on it).
Delete all	Deletes all records.

5.3 Allocating the weight magazine places

Once the standards and test weights are defined in their respective database, their position on the weight magazine needs to be identified and registered in **e100**control. For this purpose, proceed as follows:

– Select **Magazine** > **Places allocation…**.

⇨ The window **Allocation of weight magazine places** is displayed.
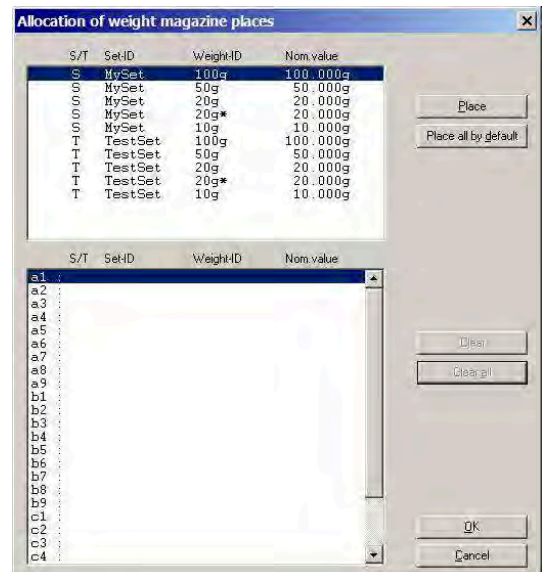
Allocating magazine places

The **Allocation of weight magazine places** window contains two list boxes:

- The upper one shows all defined weights - i. e. all standards which belong to the selected sets [Standards data ▶ Page 23], identified by an 'S' in the 'S/T' column, and all test weights [Test weights data ▶ Page 26] identified by a 'T' in the 'S/T' column.
- The lower list box shows all available magazine places, identified by their number:
    - from a1 (left) to a9 (right) for the most upper magazine row
    - from b1 (left) to b9 (right) for the 2nd magazine row
    - from c1 (left) to c9 (right) for the lowest magazine row

The allocation of one magazine place to one weight selected from the upper list is made as follows:

1. Select the weight by clicking on the proper record in the upper list box.
2. Select, by clicking on the proper line in the lower list box, the magazine place you want to be allocated to the weight you just selected.
3. Click **Place**.
    - ⇨ The selected weight is removed from the upper list box, and entered into the lower one, on the line which carries the number of the magazine place which is now allocated to this particular weight (placing a weight whose nominal value exceeds 111 g is rejected).
4. Should a place be wrongly allocated, clear it again by selecting it in the lower list box and clicking **Clear**. Should all places have to be cleared, click simply **Clear all**.
    - ⇨ The weight data which were contained in the cleared record are transferred back into the upper list box.
5. Once the allocation of the magazine places is completed, click **OK**, if you wish the allocation to be confirmed, or **Cancel**, to ignore it, and return to the main window.
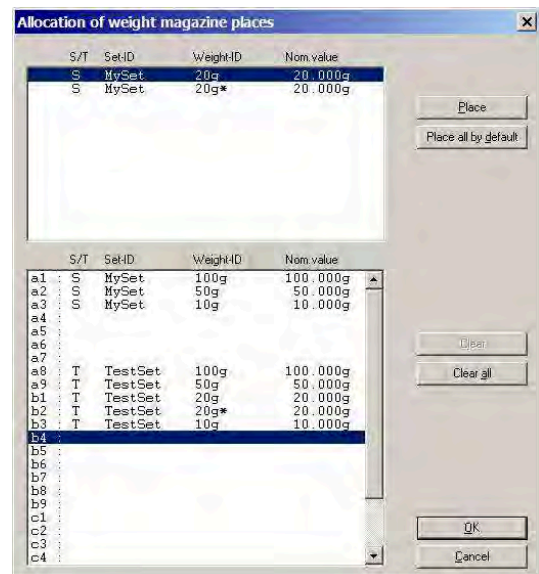
Magazine places allocation completed

Note

- An alternative to the above described procedure - which has to be repeated for each weight to be used during the weighing process - is to place all weights by default. To do so, simply click **Place all by default**.

See also

- Entering and editing the weights data ▶ Page 23

5.4 Determining the weighing process settings and series scheme

After defining standards and test weights and determining on which magazine place each of these weights is located, you need now to set the comparisons of which the weighing process shall consist, as well as their precise timing and sequence.

It might be useful at this point to clarify the terminology used to identify the main phases of any weighing process:

Term	Description
Comparison or (comparison) weighing	Each single comparison between a weight (or a combination of weights) B, and a weight (or a combination of weights) A.
Group	Sequence of n identical and successive comparisons, whose results are statistically exploited.
Series	Sequence of all groups. The comparison (weight B vs. weight A) performed in each group and the sequence of all groups are defined in the series scheme (design).
(Weighing) process	Sequence of n identical and successive series, preceded by the following (if so requested): • Centering phase: centering of all weight carriers on their respective magazine place • Pre-run: check of the nominal value of each weight • Waiting time: start delay

5.4.1 Weighing process settings

1   Select **Process** > **Settings…**.

⇨ The window **Weighing process settings** is displayed.

Setting the process parameters

2   After opening the **Weighing process settings** window, you may determine the following parameters:

Parameter	Description
Weighing mode	Provided your system is equipped with the 'professional' software edition, i. e. **e100**control with option for down-/upward calibration, you can choose between the following options: • **One-vs.-one comparisons**: direct comparisons between a single weight B and a single weight A • **Down-/upward calibration**: comparison between two combinations of up to three weights each The 'standard' software allows **One-vs.-one comparisons** only. Default setting: **One-vs.-one comparisons**
Pre-run requested	By ticking the adjacent check box, the system carries out an initial check which basically consists in comparing the measured value of each weight with its defined nominal value. Any placing error is indicated in a message box and causes the process to abort. It is strongly recommended to activate the **Pre-run requested**. Default setting: **Pre-run requested**: check
History-specific pause requested	By ticking the adjacent check box, the system makes certain that a minimum time elapses between the last measurement of the previous group and the first reported measurement of the current group, under the following circumstances only: • At least one of the weights involved in the current group - but not all of them -, whose nominal value equals or exceeds 10 g, was involved in the previous group as well. • The effective duration of the pause is determined as the duration of the 'history-specific pause' (entered, in minutes, in the adjacent input box) minus the estimated duration of the non-reported pre-weighings of the current group (should this difference be negative, the effective duration of the pause is zero). • This measure eliminates the drift affecting the weight difference between two weights when one of them has reached a higher temperature than the other because of a longer exposure to the environment of the balance weighing chamber which is slightly warmer than the environment of the weight magazine. Recommended and default setting: **History-specific pause requested**: check 20 min
Start delay	Time, entered in hours and minutes, between the end of the initial check(s) (centering and, if requested, pre-run) and the start of the first series. Default setting: 0 h 0 min; max.: 99 h 59 min
No. of nonreported preweighings per group (0-5)	In order to reduce the 'first weighing effect' (drift) noticeable in particular after a change of nominal value, you may want the system to carry out one or several pre-weighing(s) without getting the data reported. Each pre-weighing consists in the sequence A-B, regardless of the selected comparison scheme. Recommended and default setting: '3'
No. of reported comparisons per group (1-20)	Number of statistically independent comparative weighings in each group. Default setting: '5'
No. of series (1-20)	Number of series. Default setting: '1'
Stabilisation time (10-60 s)	Time in seconds between loading the balance pan and start of the reading period whose duration is determined under **Integration time (0-60 s)**. Default setting: '25' s
Integration time (0-60 s)	Time in seconds which runs after the stabilisation time has elapsed and during which the system records one measurement value every second. The average of the recorded values is given as result in the measurement report. Default setting: '5' s

Parameter	Description
Comparison scheme	You may choose either the **A-B-A** or **A-B-B-A** scheme. For details **see** [Calculations ▶ Page 45]. Default setting: **A-B-A**
Sensitivity check	Should you wish to monitor the balance 'sensitivity' (in its electrical weighing range) during the weighing process, select **Check after each series**. The sensitivity check - determination of the value of the check standard (see next item) - will be performed before the first series starts and at the end of each series). Each sensitivity check consists of the non-reported sequence 0-B (pre-check), followed by the reported sequence 0-B-0. Default setting: No check
Sensitivity check standard	Provided the sensitivity check was requested (see previous item), this list box shows all standards whose nominal value does not exceed 11 g and to which a magazine place is allocated. The check standard is chosen by clicking on one of the records.

 Note

- The **Weighing process (total)** is an estimation of the total time needed to complete the weighing process. To save a changed parameter, click **Update**.

5.4.2 Series scheme

As a next step, it remains to determine the series scheme (design), i. e. which comparisons shall be performed and in which sequence. For this purpose, proceed as follows:

– Select **Process** > **Settings…** > **Series scheme…**.

⇨ The window **Series scheme** is displayed.

5.4.2.1 Series scheme in mode 'One-vs.-one comparisons'

If the mode **One-vs.-one comparisons** is selected, the following window is displayed:
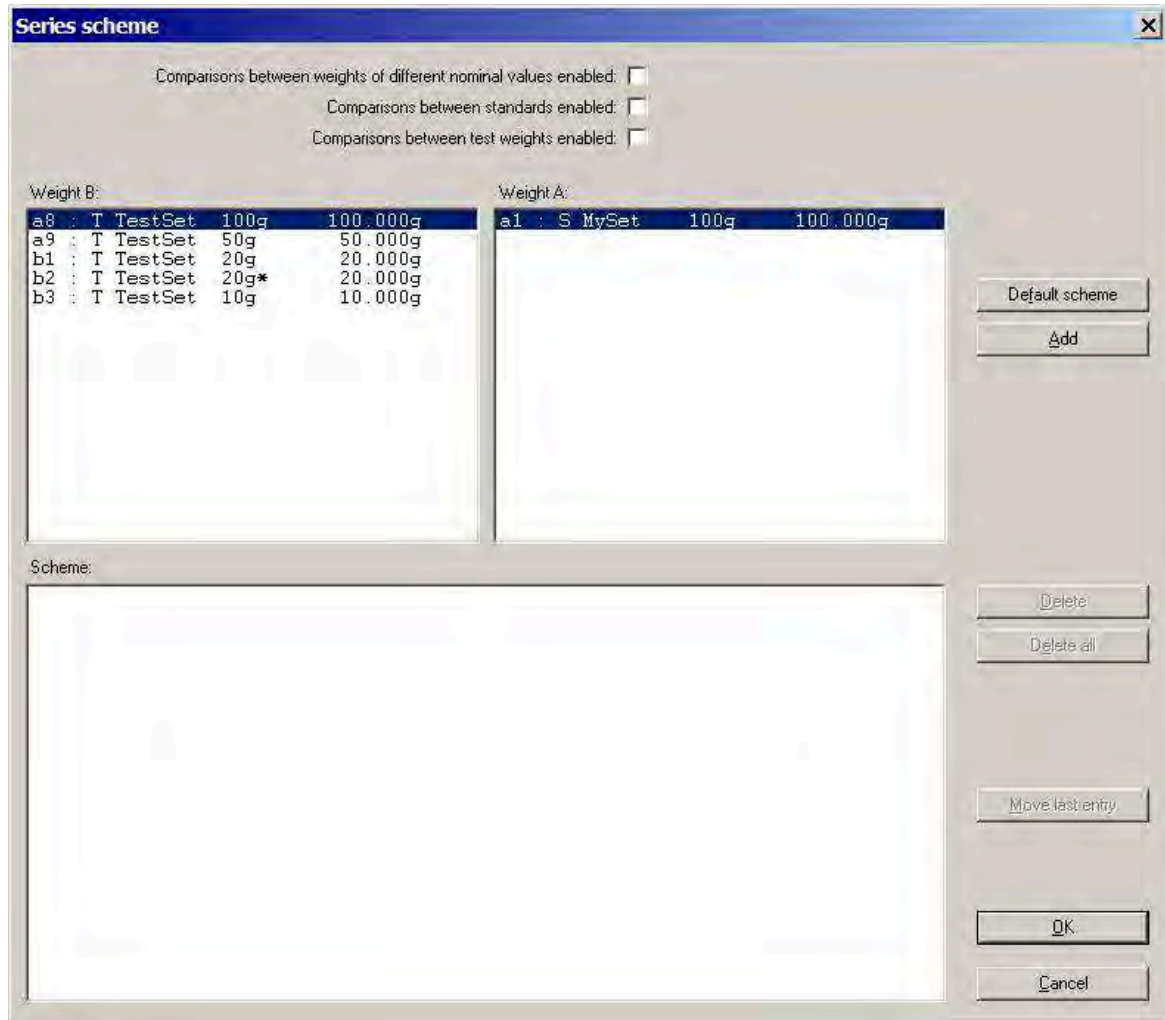
Determining the series scheme in mode **One-vs.-one comparisons**

Before setting the series scheme, you need to consider the following three options:

- **Comparisons between weights of different nominal values enabled**: if so requested, tick it off by clicking in the adjacent check box
- **Comparisons between standards enabled**: if so requested, tick it off
- **Comparisons between test weights enabled**: if so requested, tick it off

The upper left list box (**Weight B:**) contains all the weights which are available as weight B ("test weights"). This list contains either:

- All available test weights to which one magazine place is allocated, provided **Comparisons between standards enabled** are not enabled (middle check box not ticked)
- All available test weights and all selected standards to which one magazine place is allocated , provided **Comparisons between standards enabled** are enabled (middle check box ticked), **see** [Allocating the weight magazine places ▶ Page 27]

The upper right list box (**Weight A:**) contains all the weights which can be chosen as weight A ("standard") for the presently selected (clicked) weight B ("test weight"), according to the values given to the above described check boxes. The series scheme consists of a list of comparisons between two single weights - weight B vs. weight A - which will be performed in the order of their entry (amendments can be made to the sequence as explained below).

Each comparison is entered as follows:

1 Select first the weight B by clicking on the proper record in the **Weight B:** list box.

2 Select the weight A by clicking on the proper record in the **Weight A:** list box.

3 Click **Add**.

⇨ A new comparison - selected weight B vs. selected weight A - is entered in the **Scheme:** list box.

4 Repeat the above sequence until the new series scheme is fully determined.

5 Once the series scheme is completed, click **OK** to store it. By clicking **Cancel**, the modifications are ignored.

Further commands

Command	Description
Default scheme	Instead of entering each comparison one after the other, you may prefer to let **e100**control propose its own scheme. By clicking the command **e100**control selects for each weight B a matching weight A.
	The command is active only if none of all 3 options is enabled.
Delete	To delete a wrong entry in the scheme.
Delete all	To delete all entries in the scheme.
Move last entry	The sequence of comparisons can be changed by moving the last entry up:
	1 Select the line up to which you want the last entry to move.
	2 Click **Move last entry**.
	⇨ The record on the selected line and all records below it are consequently shifted downward.

See also

▤ Weighing process settings ▸ Page 29

5.4.2.2 Series scheme in mode 'Down-/upward calibration'

If the mode **Down-/upward calibration** is selected, the following window is displayed:
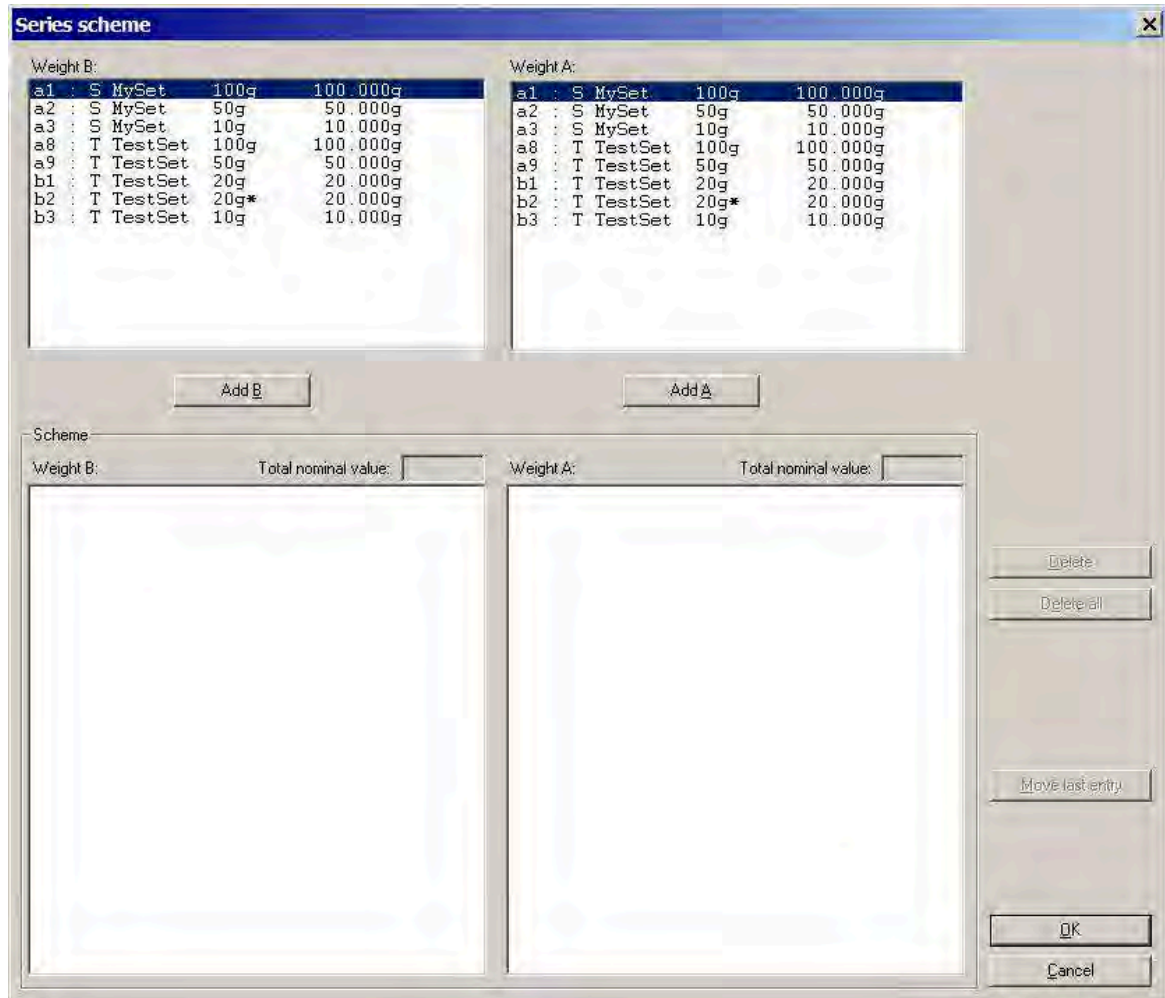
Determining the series scheme in mode **Down-/upward calibration**

The upper list boxes **Weight B:** and **Weight A:** both contain all available weights, i. e. all test weights and all standards to which one magazine place is allocated, **see** [Allocating the weight magazine places ▶ Page 27].

The series scheme, displayed in the lower list boxes (**Scheme** - **Weight B:** and **Scheme** - **Weight A:**), consists of a list of comparisons between two combinations of up to three weights each. These comparisons will be performed in the order of their entry (amendments can be made to the sequence as explained below).

Each comparison is entered as follows:

1 Select first the weight B by clicking on the proper record in the upper **Weight B:** list box.

2 Click **Add B**.

⇨ The selected weight B is entered in the **Scheme** - **Weight B:** list box.

3 If you wish to enter a combination of more than one weight, repeat the previous two steps (the symbol **'+'** in the **Scheme** list boxes indicates that a combination is entered and the total nominal value of the combination is displayed on the top of the **Scheme** list boxes).

4 Once the (combination of) weight(s) B is entered, select the weight A by clicking on the proper record in the upper **Weight A:** list box.

5 Click **Add A**.

⇨ The selected weight A is entered in the **Scheme** - **Weight A:** list box.

6 If you wish to enter a combination of more than one weight A, repeat the two previous steps.

7 Repeat the above sequence until the new series scheme is fully determined.
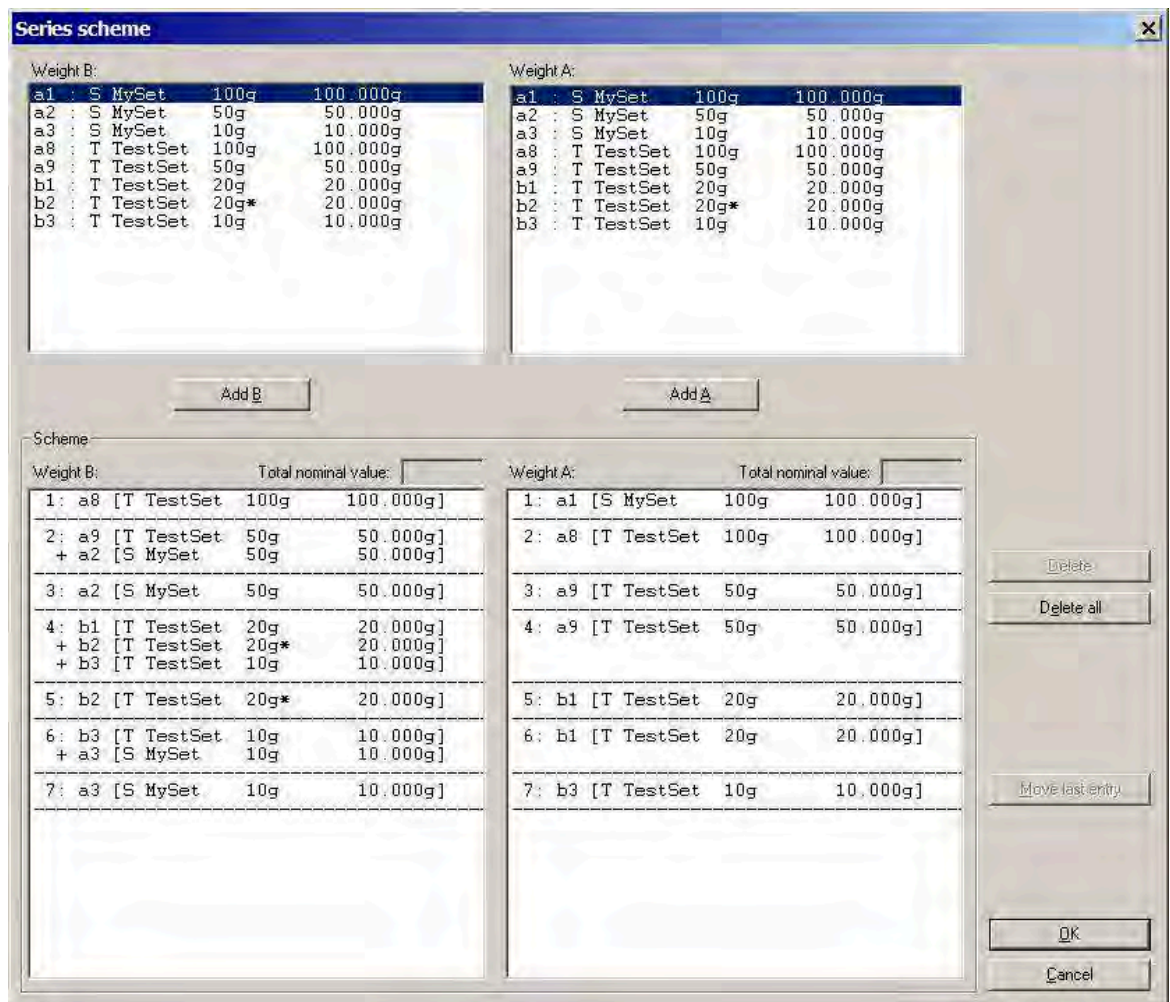
8 Once the series scheme is completed, click **OK** to store it. By clicking **Cancel**, the modifications are ignored.

⊟ Note

• Should the nominal value of a weight combination exceed 111 g, the scheme entry is rejected.

Further commands

| Command	Description
Default scheme	Instead of entering each comparison one after the other, you may prefer to let **e100**control propose its own scheme. By clicking the command **e100**control selects for each weight B a matching weight A. The command is active only if none of all 3 options is enabled.
Delete	To delete a wrong entry in the scheme.
Delete all	To delete all entries in the scheme.
Move last entry	The sequence of comparisons can be changed by moving the last entry up: 1 Select the line up to which you want the last entry to move. 2 Click **Move last entry**. ⇨ The record on the selected line and all records below it are consequently shifted downward.

Complete series scheme in mode **Down-/upward calibration**

See also

🖹 Weighing process settings ▶ Page 29

5.5 Choosing the report contents

Before starting the weighing process, the contents of the report file can be defined. For this purpose, proceed as follows:

1 Select **Report** > **Contents…**.
⇨ The window **Report contents** is displayed.
2 Enter a **User name**.
3 Enter some **Notes** (brief description of the process) which will help ensure an easy traceability of your measurement reports.
4 Define of which information blocks the report, produced both in a text (Microsoft® Word® file: '.doc' extension) and spreadsheet (Microsoft® Excel® file: '.xls' extension) format, shall consist.

See an example of a report printout in [Measurement report ▶ Page 40].

📝 Note

• The report file name itself is not yet entered at this point: **e100**control will prompt you to define it once the **Start** command is given.

Defining the report contents

📝 Note

• An efficient way of exploiting **e100**control's flexibility is to define the settings file (.e100) as a template for a particular measurement (e. g. '100g-10g.e100': settings file for the determination of a 100 g - 10 g weight set) and to describe the job specifics (e. g. reference of the person/organization who is responsible for this particular weighing process, reference of the person/organization who placed the order for these services etc.) in the report under **User name** and **Notes**.

See also

5.6 Adapting system settings

Before starting the weighing process, the serial communication needs to be established and the controller's serial port properly set. Proceed as follows:

1 Select **System** > **Comparator serial port…**.
   ⇨ The window **Serial port** is displayed.
2 Activate the port to which the interface cable 1 is connected.

The other menu points in the **System** menu are explained later in this Reference Manual:

Menu point	Description
Import/Export mode…	**See** [Importing an externally defined settings file into e100control ▸ Page 56]
Application mode…	**See** [Selecting the application mode ▸ Page 60]
Software upgrade…	**See** [Upgrading e100control ▸ Page 52]
Corner load error measurement…	**See** [Measuring the corner load error ▸ Page 49]
Balance pan adjustment...	For METTLER TOLEDO service purposes only.
Email sender configuration…	**See** [Sending emails ▸ Page 66]
ReportTransmitter configuration…	For information how to transmit measurement report data to a TCP/IP server using **ReportTransmitter configuration… see** [Transmit measurement report data to a TCP/IP server ▸ Page 69].
Standard's centering history…	For information how to reduce pre-run/centering time using **Standard's centering history… see** [Reduce pre-run/centering time using 'Standard's centering history' ▸ Page 68].

5.7 Starting and monitoring the weighing process

5.7.1 Starting the weighing process

Preconditions

Prior to start the weighing process, ensure the following:
- The needed weights are positioned on the respective weight carriers in the magazine,
  see [Preparing the weight magazine ▸ Page 17].
- The weights data (test weights and standards data) are entered in **e100**control,
  see [Entering and editing the weights data ▸ Page 23].
- The weight magazine places are allocated in **e100**control,
  see [Allocating the weight magazine places ▸ Page 27].
- The weighing process settings and the series scheme are determined,
  see [Determining the weighing process settings and series scheme ▸ Page 28].
- If needed, the content of the report is defined, **see** [Choosing the report contents ▸ Page 36].
- All system settings are adapted to the instrument, **see** [Adapting system settings ▸ Page 36].

Starting the weighing process

To start the weighing process, proceed as follows:
1 Select **Start** > **Start measurement**.
2 Once the process is started, enter the name and location of the measurement report file.
3 Confirm your entry by clicking **Save** (clicking **Cancel** would abort the process).

4 After creating the report file, **e100**control displays a message box which indicates the process timing, as well as the maximum balance load. Click **OK** to pursue the process (clicking **Cancel** would abort it).

Entering the report file name

5 Monitor the weighing process according to [Monitoring the weighing process ▶ Page 38].
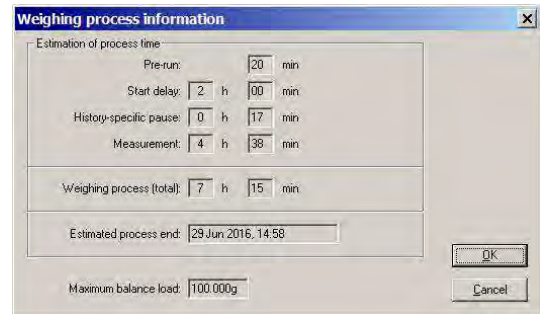
Weighing process information - Timing and maximum balance load

5.7.2 Monitoring the weighing process

Overview

Once the weighing process has been started, **e100**control displays the weighing process monitor which allows you to follow the process on-line, step by step. The two upper boxes **Weight B:** and **Weight A:** show which comparison weighing is currently being carried out - which weight B vs. which weight A. The large text box first reminds you of the process settings you defined; it records every single process step and displays the detailed measurement data, in a format which is similar to the report format. Furthermore, it provides in the 'status field' (area at the bottom left) useful information on the current action, as well as valuable advice with respect to troubleshooting, should an error be detected.

Should an error be detected, do pay careful attention to the information given in the process status field and proceed accordingly.


```
e100control weighing process monitor

Weight B:                                      Weight A:




Day/Time    Meas.no.      Place(s)    Value    Diff.(B-A) Diff.Average WeightB-error Std.dev.
  7: a3 : S MySet    10g      10.000g   0.0090mg  8000.000kg/m^3
vs. b3 : T TestSet  10g      10.000g             8000.000kg/m^3
------------------------------------------------------------------------

Balance settings
------------------------------------------------------------------------
Mass comparator ID                    XP6U
Environment                     very stable
Value release                     very fast
Last adjustment (internal)  29 Jun 2016, 07:52:06

Climate data
------------------------------------------------------------------------
Climate data input                    none

Pre-run start
a3 :  checked
```

Pre-run in progress: 8 weights to check...

Status: Waiting, stabilisation time: 25 sec

Status: Weighing process aborted.

Error: Nominal value check failed.

Progress: Make certain the weights are placed according to the magazine places allocation.

Suspend   Resume   Stop

status field during operation

example of contents of status field after error detection

Info...   Exit

Weighing process monitor

Commands

The following command buttons are available:

Command	Description
Suspend and **Resume**	The **Suspend** command interrupts temporarily the process and allows access to the weighing chamber.
Stop	The **Stop** command aborts the process. You are prompted to chose between aborting the process immediately, and aborting the process after the robot system has brought the weight(s), which is (are) being determined, back to the magazine. Should the process be aborted, the measurement results gathered up to this point as well as the summary table of the completed series are nevertheless documented in the report file.
Info…	**e100**control indicates the estimated date and time of the completion of the measurement process, as well as the time (in hours and minutes) remaining until completion. Please be aware that the process is suspended as long as this information window is open.
Exit	Closes the weighing process monitor and returns to the main window.

Initial checks

The process starts with a centering phase, during which each weight carrier is checked - by means of the light barrier located on the robot hand (1) - and centered on its magazine position. If the pre-run is requested, each weight is weighed and its nominal value checked, after its carrier has been centered.

✍️

The following initial checks are performed during centering/pre-run. Should a failure be detected, the process aborts (except for the dead load check):

• The serial communication is established.

• The authorization was duly given for **Down-/upward calibration**, if selected.

- The authorization was duly given for **Online climate data input**, if selected.
- The robot hand is free of any weight carrier.
- The balance dead load - weight (force) generated by the electromagnetic balance sensor, when the balance pan is free of any weight - has kept stable within an acceptable range since the last process start.
- Each allocated magazine place carries a weight carrier.
- If the mode **Down-/upward calibration** is chosen, no weight involved in a 3-weight combination is placed on a weight carrier of design 3 (red frame, **see** [Selecting a suitable weight carrier ▸ Page 17]) - this check is performed during the centering phase.
- During pre-run only: the difference between measured and nominal weight value does not exceed 10% of the nominal value.

Checks during each weighing

Beside these initial checks, further ones are performed during each weighing. Should a failure be detected, the process aborts:

- The carrier type (design) has not changed.
- The difference between measured and nominal weight (combination) value does not exceed 10% of the (total) nominal value.
- The current group standard deviation, calculated after the second and each following comparison, does not exceed 20 µg.
- The balance shows neither overload nor underload, once the robot hand has lowered the weight or weight combination onto the balance pan.

Monitoring of sensors

Finally, the status of the balance position sensor is permanently monitored (see electrical drawing):

- The balance must stay in the position which was precisely defined during system installation - should a position error be detected, do contact your supplier!

Before weighing, **e100**control sets the position of the four built-in tare weights in function of the nominal value of the weight or weights combination. The set of tare weights consists of two 10 g weights, whose position is set by means of a motor controlled via the balance interface, and two weights, 50 g and 30 g, whose respective position is set by means of a knob controlled by the finger of the robot hand (1).
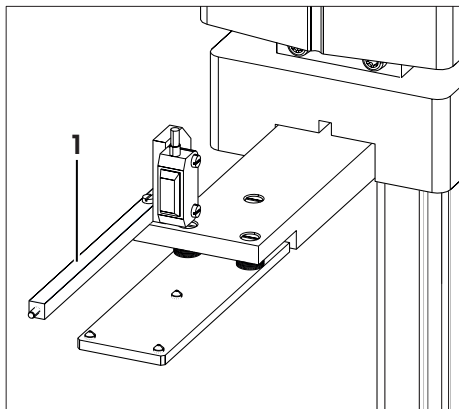
5.8 Analyzing measurement data and report

5.8.1 Measurement report

The following figures show a report generated by **e100**control after running a weighing process consisting of one series of 7 groups of 5 A-B-A comparison weighings. The selected weighing mode is **Down-/upward calibration**.

Figure 'Report - Part 1' shows the report heading, comprising the following information:

- The report file name ('.doc')
- The name of the settings file ('.e100')

- The process start date and start time
- The duration of the process
- The user identification
- Some notes
- The weighing process settings
- The magazine places allocation
- The series scheme
- The balance settings

Note

- Be reminded that the report contents can be adapted to your needs, **see** [Choosing the report contents ▶ Page 36].

Figure 'Report - Part 2' shows the measurement data. Each table line consists of the 8 following fields:

Field	Description
Day/Time	Measurement day and time recorded in day/hours:minutes:seconds.
Meas.no.	Measurement number which indicates the series number, the group number and the weighing number.
	Example: '010203A' stands for series no. 01, group no. 02, comparison no. 03 and weight A. When a sensitivity check is carried out, the measurement number shows the series number and 'sc' (for sensitivity check).
Place(s)	Indicates the magazine place(s) of the weight(s).
	Noteworthy is the fact that, in case of a weight combination, the reported combination (e. g. 'a10 + b2 + b1') differs from the combination entered in the series scheme ('a10 + b1 + b2'): it indicates in which order the weights were put onto the balance pan. **e100**control chooses this order in such a way that the error due to corner load is minimized (see 'Indication of corner load error' further in the current section).
Value	Indicates the recorded weight(s) value in mg. This value is the calculated average of all values collected during the integration time [Weighing process settings ▶ Page 29] and shows therefore an extra decimal place.
Diff. (B-A)	Indicates for each comparison the calculated difference between weight B and weight A. The differences listed for a particular group are statistically independent [Calculations ▶ Page 45].
Diff.average	Indicates for each group the calculated average of all differences [Calculations ▶ Page 45].
WeightB-error	Indicates for each group the calculated error of the weight B, provided the error of the weight A is known - this applies to a single standard only [Calculations ▶ Page 45].
Std.dev.	Indicates for each group the calculated standard deviation of the difference average [Calculations ▶ Page 45].

If the climate data input source is **online via serial port** [Selecting the application mode ▶ Page 60], the program collects online climate data and the measurement data table consists of additional fields: Each sensor enabled to be reported has its own field.

At last, figure 'Report - Part 3' presents the results summary table from which you get, at a glance, the essentials in a compact, but explicit format. Should the process consist of more than one series, the summary table indicates the average of the difference averages (**Average:**).

```
e100control v4.95 - measurement report

File: D:\metrotec\a100comparator\e100control\e100control reports\TestReport.doc

e100control settings defined in: D:\metrotec\a100comparator\e100control\100g-10g.e100

Start date                              23 Jul 2016     User                  metrotec engineering ag
Start time                              17:18:03        Notes       determination of TestSet 100g - 10g
Weighing process time [h:min]           7:30

Weighing process settings
--------------------------------------------------------------------------------------------------------
Pre-run done                            Yes
History-specific pause enabled [min]    20
Start delay [h:min]                     02:00
No. of non-reported pre-weighings per group    3
No. of reported comparisons per group          5
No. of series                           1
Comparison scheme                       A-B-A
Stabilisation time [s]                  25
Integration time [s]                    10
Sensitivity check done                  Yes     a3 : S MySet    10g      10.000g     0.009mg  8000.000kg/m^3

Magazine places allocation
--------------------------------------------------------------------------------------------------------
    a1 : S MySet    100g    100.000g    0.042mg  8000.000kg/m^3
    a2 : S MySet    50g      50.000g   -0.022mg  8000.000kg/m^3
    a3 : S MySet    10g      10.000g    0.009mg  8000.000kg/m^3
    a8 : T TestSet  100g    100.000g             8000.000kg/m^3
    a9 : T TestSet  50g      50.000g             8000.000kg/m^3
    a10: T TestSet  20g      20.000g             8000.000kg/m^3
    b1 : T TestSet  20g+     20.000g             8000.000kg/m^3
    b2 : T TestSet  10g      10.000g             8000.000kg/m^3

Series scheme (B vs. A)
--------------------------------------------------------------------------------------------------------
  1: a8 : T TestSet  100g    100.000g            8000.000kg/m^3
 vs. a1 : S MySet    100g    100.000g    0.042mg 8000.000kg/m^3
--------------------------------------------------------------------------------------------------------
  2: a9 : T TestSet  50g      50.000g            8000.000kg/m^3
   + a2 : S MySet    50g      50.000g   -0.022mg 8000.000kg/m^3
 vs. a8 : T TestSet  100g    100.000g            8000.000kg/m^3
--------------------------------------------------------------------------------------------------------
  3: a2 : S MySet    50g      50.000g   -0.022mg 8000.000kg/m^3
 vs. a9 : T TestSet  50g      50.000g            8000.000kg/m^3
--------------------------------------------------------------------------------------------------------
  4: a10: T TestSet  20g      20.000g            8000.000kg/m^3
   + b1 : T TestSet  20g+     20.000g            8000.000kg/m^3
   + b2 : T TestSet  10g      10.000g            8000.000kg/m^3
 vs. a9 : T TestSet  50g      50.000g            8000.000kg/m^3
--------------------------------------------------------------------------------------------------------
  5: b1 : T TestSet  20g+     20.000g            8000.000kg/m^3
 vs. a10: T TestSet  20g      20.000g            8000.000kg/m^3
--------------------------------------------------------------------------------------------------------
  6: b2 : T TestSet  10g      10.000g            8000.000kg/m^3
   + a3 : S MySet    10g      10.000g    0.009mg 8000.000kg/m^3
 vs. a10: T TestSet  20g      20.000g            8000.000kg/m^3
--------------------------------------------------------------------------------------------------------
  7: a3 : S MySet    10g      10.000g    0.009mg 8000.000kg/m^3
 vs. b2 : T TestSet  10g      10.000g            8000.000kg/m^3
--------------------------------------------------------------------------------------------------------

Balance settings
--------------------------------------------------------------------------------------------------------
Mass comparator ID                      AX106
Environment                             very stable
Value release                           very fast
Last adjustment (internal)   29 Jun 2016, 07:52:06

Climate data
--------------------------------------------------------------------------------------------------------
Climate data input                      online
Climate measuring instrument            Klimet A30
```

Report - Part 1: heading and process settings

```
Measurement data (all values in mg)
-----------------------------------------------------------------------------------------------------------------------------------
Day/Time      Meas.no.   Place(s)      Value    Diff.(B-A)  Diff.average  WeightB-error  Std.dev.  Press.[hPa] rel.Hum.[%] T1[degr.C] T2[degr.C] T3[degr.C] T4[degr.C]

23/19:38:45   00    ac        0       0.0130                                                        972.213     37.94      22.658     22.315     22.691     22.710
23/19:40:05   00    ac        a3  10000.0020                                                        972.213     37.94      22.658     22.315     22.691     22.710
23/19:41:21   00    ac        0       0.0180    9999.9875   9999.9875                               972.177     37.64      22.668     22.336     22.695     22.714

23/19:53:22   010101A        a1     175.9270                                                        972.213     37.94      22.658     22.315     22.691     22.710
23/19:54:42   010101B        a8     175.8134                                                        972.213     37.94      22.658     22.315     22.691     22.710
23/19:56:23   010101A        a1     175.9288   -0.1145                                              972.177     37.64      22.668     22.336     22.695     22.714
23/19:58:04   010102B        a8     175.8140                                                        972.177     37.64      22.668     22.336     22.695     22.714
23/19:59:43   010102A        a1     175.9294                                                        972.203     37.46      22.677     22.348     22.697     22.714
23/20:01:24   010102B        a8     175.8158   -0.1145                                              972.203     37.46      22.677     22.348     22.697     22.714
23/20:03:04   010103A        a1     175.9310                                                        972.207     37.31      22.679     22.353     22.685     22.704
23/20:04:44   010103B        a8     175.8155                                                        972.146     37.16      22.683     22.356     22.678     22.699
23/20:06:24   010103A        a1     175.9310   -0.1155                                              972.146     37.16      22.683     22.356     22.678     22.699
23/20:08:04   010104B        a8     175.8160                                                        972.138     37.11      22.687     22.363     22.677     22.700
23/20:09:45   010104A        a1     175.9319                                                        972.138     37.11      22.687     22.363     22.677     22.700
23/20:11:25   010104B        a8     175.8168   -0.1155                                              972.104     36.97      22.691     22.371     22.680     22.702
23/20:13:06   010105A        a1     175.9331                                                        972.036     36.90      22.706     22.402     22.712     22.731
23/20:14:46   010105B        a8     175.8176                                                        972.036     36.90      22.706     22.402     22.712     22.731
23/20:16:26   010105A        a1     175.9340   -0.1159      -0.1153       -0.0732       0.0007       972.038     36.73      22.716     22.417     22.717     22.739

23/20:38:13   010201A        a8     175.8331                                                        972.213     37.94      22.658     22.315     22.691     22.710
23/20:40:32   010201B     a9 + a2    175.3176                                                        972.213     37.94      22.658     22.315     22.691     22.710
23/20:42:51   010201A        a8     175.8381   -0.5180                                              972.177     37.64      22.668     22.336     22.695     22.714
23/20:45:10   010202B     a9 + a2    175.3240                                                        972.177     37.64      22.668     22.336     22.695     22.714
23/20:47:28   010202A        a8     175.8454                                                        972.203     37.46      22.677     22.348     22.697     22.714
23/20:49:47   010202B     a9 + a2    175.3315   -0.5176                                              972.203     37.46      22.677     22.348     22.697     22.714
23/20:52:05   010203A        a8     175.8526                                                        972.207     37.31      22.679     22.353     22.685     22.704
23/20:54:22   010203B     a9 + a2    175.3366                                                        972.146     37.16      22.683     22.356     22.678     22.699
23/20:56:40   010203A        a8     175.8566   -0.5180                                              972.146     37.16      22.683     22.356     22.678     22.699
23/20:59:00   010204B     a9 + a2    175.3396                                                        972.138     37.11      22.687     22.363     22.677     22.700
23/21:01:19   010204A        a8     175.8597                                                        972.138     37.11      22.687     22.363     22.677     22.700
23/21:03:37   010204B     a9 + a2    175.3411   -0.5184                                              972.104     36.97      22.691     22.371     22.680     22.702
23/21:05:55   010205A        a8     175.8603                                                        972.036     36.90      22.706     22.402     22.712     22.731
23/21:08:14   010205B     a9 + a2    175.3430                                                        972.036     36.90      22.706     22.402     22.712     22.731
23/21:10:31   010205A        a8     175.8630   -0.5186      -0.5181                     0.0004       972.038     36.73      22.716     22.417     22.717     22.739

23/21:22:29   010301A        a9     180.5865                                                        972.213     37.94      22.658     22.315     22.691     22.710
23/21:24:09   010301B        a2     180.7361                                                        972.213     37.94      22.658     22.315     22.691     22.710
23/21:25:50   010301A        a9     180.5860    0.1499                                              972.177     37.64      22.668     22.336     22.695     22.714
23/21:27:31   010302B        a2     180.7355                                                        972.177     37.64      22.668     22.336     22.695     22.714
23/21:29:12   010302A        a9     180.5865                                                        972.203     37.46      22.677     22.348     22.697     22.714
23/21:30:52   010302B        a2     180.7365    0.1495                                              972.203     37.46      22.677     22.348     22.697     22.714
23/21:32:33   010303A        a9     180.5876                                                        972.207     37.31      22.679     22.353     22.685     22.704
23/21:34:14   010303B        a2     180.7374                                                        972.146     37.16      22.683     22.356     22.678     22.699
23/21:35:54   010303A        a9     180.5887    0.1492                                              972.146     37.16      22.683     22.356     22.678     22.699
23/21:37:35   010304B        a2     180.7380                                                        972.138     37.11      22.687     22.363     22.677     22.700
23/21:39:16   010304A        a9     180.5890                                                        972.138     37.11      22.687     22.363     22.677     22.700
23/21:40:56   010304B        a2     180.7381    0.1496                                              972.104     36.97      22.691     22.371     22.680     22.702
23/21:42:37   010305A        a9     180.5887                                                        972.036     36.90      22.706     22.402     22.712     22.731
23/21:44:18   010305B        a2     180.7384                                                        972.036     36.90      22.706     22.402     22.712     22.731
23/21:45:59   010305A        a9     180.5899    0.1491       0.1494                     0.0003       972.038     36.73      22.716     22.417     22.717     22.739

23/22:07:33   010401A        a9     180.6013                                                        972.213     37.94      22.658     22.315     22.691     22.710
23/22:10:29   010401B   a10 - b2 + b1 183.5440                                                      972.213     37.94      22.658     22.315     22.691     22.710
23/22:13:25   010401A        a9     180.6018    2.9425                                              972.177     37.64      22.668     22.336     22.695     22.714
23/22:16:21   010402B   a10 + b2 + b1 183.5460                                                      972.177     37.64      22.668     22.336     22.695     22.714
23/22:19:16   010402A        a9     180.6045                                                        972.203     37.46      22.677     22.348     22.697     22.714
23/22:22:13   010402B   a10 + b2 + b1 183.5465    2.9428                                            972.203     37.46      22.677     22.348     22.697     22.714
23/22:25:08   010403A        a9     180.6070                                                        972.207     37.31      22.679     22.353     22.685     22.704
23/22:28:05   010403B   a10 + b2 + b1 183.5499                                                      972.146     37.16      22.683     22.356     22.678     22.699
23/22:31:01   010403A        a9     180.6084    2.9422                                              972.146     37.16      22.683     22.356     22.678     22.699
23/22:33:58   010404B   a10 + b2 + b1 183.5520                                                      972.138     37.11      22.687     22.363     22.677     22.700
23/22:36:52   010404A        a9     180.6118                                                        972.138     37.11      22.687     22.363     22.677     22.700
23/22:39:48   010404B   a10 + b2 + b1 183.5554    2.9411                                            972.104     36.97      22.691     22.371     22.680     22.702
23/22:42:43   010405A        a9     180.6131                                                        972.036     36.90      22.706     22.402     22.712     22.731
23/22:45:40   010405B   a10 + b2 + b1 183.5560                                                      972.036     36.90      22.706     22.402     22.712     22.731
23/22:48:35   010405A        a9     180.6149    2.9420       2.9423                     0.0003       972.038     36.73      22.716     22.417     22.717     22.739
```

Report - Part 2: measurement data

```
23/23:00:38  010501A       a10   185.1606              972.213  37.94  22.658  22.315  22.651  22.710
23/23:02:19  010501B       b1    185.0224              972.213  37.94  22.658  22.315  22.691  22.710
23/23:04:01  010501A       a10   185.1618    -0.1388   972.177  37.64  22.668  22.336  22.695  22.714
23/23:05:42  010502B       b1    185.0236              972.177  37.64  22.668  22.336  22.695  22.714
23/23:07:23  010502A       a10   185.1634              972.203  37.46  22.677  22.348  22.697  22.714
23/23:09:04  010502B       b1    185.0253    -0.1389   972.203  37.46  22.677  22.348  22.697  22.714
23/23:10:46  010503A       a10   185.1650              972.207  37.31  22.679  22.353  22.685  22.704
23/23:12:28  010503B       b1    185.0268              972.146  37.16  22.683  22.356  22.678  22.699
23/23:14:09  010503A       a10   185.1662    -0.1389   972.146  37.16  22.683  22.356  22.678  22.699
23/23:15:51  010504B       b1    185.0275              972.138  37.11  22.687  22.363  22.677  22.700
23/23:17:32  010504A       a10   185.1675              972.138  37.11  22.687  22.363  22.677  22.700
23/23:19:14  010504B       b1    185.0290    -0.1393   972.104  36.97  22.691  22.371  22.680  22.702
23/23:20:55  010505A       a10   185.1698              972.036  36.90  22.706  22.402  22.712  22.731
23/23:22:37  010505B       b1    185.0315              972.036  36.90  22.706  22.402  22.712  22.731
23/23:24:18  010505A       a10   185.1713    -0.1390   -0.1390    0.0000  972.038  36.73  22.716  22.417  22.717  22.739

23/23:45:59  010601A       a10   185.1788              972.213  37.94  22.658  22.315  22.651  22.710
23/23:48:15  010601B    b1 + a3  183.8570              972.213  37.94  22.658  22.315  22.691  22.710
23/23:50:32  010601A       a10   185.1804    -1.3228   972.177  37.64  22.668  22.336  22.695  22.714
23/23:52:48  010602B    b2 + a3  183.8585              972.177  37.64  22.668  22.336  22.695  22.714
23/23:55:04  010602A       a10   185.1828              972.203  37.46  22.677  22.348  22.697  22.714
23/23:57:21  010602B    b2 + a3  183.8606    -1.3230   972.203  37.46  22.677  22.348  22.697  22.714
23/23:59:38  010603A       a10   185.1838              972.207  37.31  22.679  22.353  22.685  22.704
24/00:01:55  010603B    b2 + a3  183.8614              972.146  37.16  22.683  22.356  22.678  22.699
24/00:04:11  010603A       a10   185.1856    -1.3233   972.146  37.16  22.683  22.356  22.678  22.699
24/00:06:28  010604B    b2 + a3  183.8640              972.138  37.11  22.687  22.363  22.677  22.700
24/00:08:45  010604A       a10   185.1877              972.138  37.11  22.687  22.363  22.677  22.700
24/00:11:01  010604B    b2 + a3  183.8646    -1.3234   972.104  36.97  22.691  22.371  22.680  22.702
24/00:13:16  010605A       a10   185.1870              972.036  36.90  22.706  22.402  22.712  22.731
24/00:15:33  010605B    b2 + a3  183.8645              972.036  36.90  22.706  22.402  22.712  22.731
24/00:17:50  010605A       a10   185.1875    -1.3227   -1.3230    0.0004  972.038  36.73  22.716  22.417  22.717  22.739

24/00:29:21  010701A       b2    57.4070               972.213  37.94  22.658  22.315  22.651  22.710
24/00:30:58  010701B       a3    57.3945               972.213  37.94  22.658  22.315  22.691  22.710
24/00:32:36  010701A       b2    57.4065    -0.0122    972.177  37.64  22.668  22.336  22.695  22.714
24/00:34:14  010702B       a3    57.3947               972.177  37.64  22.668  22.336  22.695  22.714
24/00:35:52  010702A       b2    57.4071               972.203  37.46  22.677  22.348  22.697  22.714
24/00:37:31  010702B       a3    57.3950    -0.0122    972.203  37.46  22.677  22.348  22.697  22.714
24/00:39:08  010703A       b2    57.4076               972.207  37.31  22.679  22.353  22.685  22.704
24/00:40:46  010703B       a3    57.3956               972.146  37.16  22.683  22.356  22.678  22.699
24/00:42:24  010703A       b2    57.4084    -0.0124    972.146  37.16  22.683  22.356  22.678  22.699
24/00:44:01  010704B       a3    57.3964               972.138  37.11  22.687  22.363  22.677  22.700
24/00:45:38  010704A       b2    57.4084               972.138  37.11  22.687  22.363  22.677  22.700
24/00:47:15  010704B       a3    57.3961    -0.0121    972.104  36.97  22.691  22.371  22.680  22.702
24/00:48:52  010705A       b2    57.4080               972.036  36.90  22.706  22.402  22.712  22.731
24/00:50:30  010705B       a3    57.3955               972.036  36.90  22.706  22.402  22.712  22.731
24/00:52:06  010705A       b2    57.4074    -0.0122    -0.0122    0.0001  972.038  36.73  22.716  22.417  22.717  22.739

24/00:56:02  01     ac      0     0.1440                972.036  36.90  22.706  22.402  22.712  22.731
24/00:57:17  01     ac      a3    10000.1320            972.036  36.90  22.706  22.402  22.712  22.731
24/00:58:33  01     ac      0     0.1440    9999.9880  9999.9880  972.038  36.73  22.716  22.417  22.717  22.739
```

Report - Part 2: measurement data (cont'd)

```
Series scheme (B vs. A) and summary of results (in mg)              Begin Day/Time Diff.average WeightB-error  Std.dev.  End Day/Time
--------------------------------------------------------------------------------------------------------------------------------------
1: a8 : T TestSet  100g   100.000g            8000.000kg/m^3 Series 1: 23/19:53:02   -0.1152      -0.0732    0.0007   23/20:16:26
vs. a1 : S MySet   100g   100.000g  0.042mg   8000.000kg/m^3
--------------------------------------------------------------------------------------------------------------------------------------
2: a9 : T TestSet  50g    50.000g             8000.000kg/m^3 Series 1: 23/20:38:13   -0.5181                 0.0004   23/21:10:31
 + a2 : S MySet    50g    50.000g  -0.022mg   8000.000kg/m^3
vs. a8 : T TestSet 100g   100.000g            8000.000kg/m^3
--------------------------------------------------------------------------------------------------------------------------------------
3: a2 : S MySet    50g    50.000g  -0.022mg   8000.000kg/m^3 Series 1: 23/21:22:29    0.1454                 0.0003   23/21:45:59
vs. a9 : T TestSet 50g    50.000g             8000.000kg/m^3
--------------------------------------------------------------------------------------------------------------------------------------
4: a10: T TestSet  20g    20.000g             8000.000kg/m^3 Series 1: 23/22:07:33    2.9423                 0.0003   23/22:48:35
 + b1 : T TestSet  20g*   20.000g             8000.000kg/m^3
 + b2 : T TestSet  10g    10.000g             8000.000kg/m^3
vs. a9 : T TestSet 50g    50.000g             8000.000kg/m^3
--------------------------------------------------------------------------------------------------------------------------------------
5: b1 : T TestSet  20g*   20.000g             8000.000kg/m^3 Series 1: 23/23:00:38   -0.1390                 0.0002   23/23:24:18
vs. a10: T TestSet 20g    20.000g             8000.000kg/m^3
--------------------------------------------------------------------------------------------------------------------------------------
6: b2 : T TestSet  10g    10.000g             8000.000kg/m^3 Series 1: 23/23:45:59   -1.3230                 0.0004   24/00:17:50
 + a3 : S MySet    10g    10.000g  0.009mg    8000.000kg/m^3
vs. a10: T TestSet 20g    20.000g             8000.000kg/m^3
--------------------------------------------------------------------------------------------------------------------------------------
7: a3 : S MySet    10g    10.000g  0.009mg    8000.000kg/m^3 Series 1: 24/00:29:21   -0.0122                 0.0001   24/00:52:06
vs. b2 : T TestSet 10g    10.000g             8000.000kg/m^3
--------------------------------------------------------------------------------------------------------------------------------------
ac: a3 : S MySet   10g    10.000g  0.009mg    8000.000kg/m^3  Start:   23/19:38:43  9999.9875                         23/19:41:21
                                                             Series 1: 24/00:56:02  9999.9880                         24/00:58:33
--------------------------------------------------------------------------------------------------------------------------------------
```

Report - Part 3: summary of results

Indication of corner load error

As above mentioned, **e100**control automatically handles the comparison of two weight combinations in such a way (placing sequence) that the remaining corner load error is minimized. In the case of a comparison '20 g + 20 g + 10 g' vs. '50 g', the combination entered as '20 g + 20 g + 10 g' will be placed onto the balance pan in the sequence '20 g + 10 g + 20 g': the center of gravity of the weights combination is located on the same vertical axis as the 50 g weight and, consequently, the remaining corner load error equals zero. However, in certain cases, in particular when non OIML weights are involved in a combination (e.g. '30 g + 20 g' vs. '50 g'), a certain error due to corner load remains. Knowing the measured corner load error, **e100**control

calculates for each comparison the remaining error due to corner load and, if not zero, indicates it under 'CrLd-err' in the results summary table of the measurement report. The corrected difference average (not indicated in the report) equals 'Diff.average' minus 'CrLd-err'.

Indication of corner load error

See also

▤ Measuring the corner load error ▶ Page 49

5.8.2 Calculations

The figure below schematically represents the reported measurement data and the differences B-A calculated during a weighing process, whose comparison scheme was set to A-B-A and A-B-B-A respectively. The calculations are given below for the series 1, group 01 as example.

The differences B-A are reported in the column **Diff.(B-A)** and, if the comparison scheme A-B-A was selected, calculated as follows (see the figure below, top diagram):

$$\text{Diff}_{010101} = \frac{(\text{Val\_B}_{010101} - \text{Val\_A}_{010101}) + (\text{Val\_B}_{010101} - \text{Val\_A}_{010101'})}{2}$$

$$\text{Diff}_{010102} = \frac{(\text{Val\_B}_{010102} - \text{Val\_A}_{010102}) + (\text{Val\_B}_{010102'} - \text{Val\_A}_{010102})}{2}$$

$$\text{Diff}_{010103} = \frac{(\text{Val\_B}_{010103} - \text{Val\_A}_{010103}) + (\text{Val\_B}_{010103} - \text{Val\_A}_{010103'})}{2}$$

etc.

If the comparison scheme A-B-B-A was selected, the differences B-A, reported in the column **Diff.(B-A)**, are calculated as follows (see the figure below, bottom diagram):

$$\text{Diff}_{010101} = \frac{(\text{Val\_B}_{010101} + \text{Val\_B}_{010101'}) - (\text{Val\_A}_{010101} + \text{Val\_A}_{010101'})}{2}$$

$$\text{Diff}_{010102} = \frac{(\text{Val\_B}_{010102} + \text{Val\_B}_{010102'}) - (\text{Val\_A}_{010102} + \text{Val\_A}_{010102'})}{2}$$

etc.

The difference average is reported, for each group of n comparisons, in the column **Diff.average**, and calculated as follows (for both comparison schemes):

$$\text{Diff.average}_{0101} = (1 / n) \sum_{i=01}^{n} \text{Diff}_{0101\,i}$$

The standard deviation of the difference average is reported, for each group, in the column **Std.dev.**, and calculated as follows (for both comparison schemes):

$$\text{Std.dev.}_{0101} = \sqrt{[1 / (n\text{-}1)] \sum_{i=01}^{n} (\text{Diff}_{0101\,i} - \text{Diff.average}_{0101})^2}$$

Provided the error of the weight A is known, the error of the weight B is reported, for each group, in the column **WeightB-error**, and calculated as follows (for both comparison schemes):

$$\text{WeightB-error}_{0101} = \text{WeightA-error}_{0101} + \text{Diff.average}_{0101}$$

Finally, if a sensitivity check was requested, the value of the selected check standard is reported in the column **Diff.(B-A)**, and calculated as follows (see the figure below, top and bottom diagram):

$$\text{Diff\_SC}_{00} = \frac{(\text{Val\_SC}_{00} - \text{Val\_0}_{00}) + (\text{Val\_SC}_{00} - \text{Val\_0}_{00'})}{2} \qquad \text{(initial check)}$$

$$\text{Diff\_SC}_{01} = \frac{(\text{Val\_SC}_{01} - \text{Val\_0}_{01}) + (\text{Val\_SC}_{01} - \text{Val\_0}_{01'})}{2} \qquad \text{(check done after series 01)}$$

etc.

Val_SC_i denotes the value measured after loading the check standard, Val_0_i and $\text{Val\_0}_{i'}$ denote respectively the zero point before and after loading the check standard.

The corner load error **CrLd-err** reported in the results summary table is calculated as follows ('CrLd_err' instead of 'CrLd-err', to avoid any confusion with the minus sign):

$$\text{CrLd\_err} = \text{CrLd\_err}_B - \text{CrLd\_err}_A$$

$$\text{CrLd\_err}_{A,B} = \frac{1}{2} \cdot (\text{CrLd\_err}_{\text{measured, back}} + \text{CrLd\_err}_{\text{measured, front}}) \cdot \frac{(M_{A,B})^2}{(M_{\text{measured}})^2}$$

$$+ \frac{1}{2} \cdot (\text{CrLd\_err}_{\text{measured, back}} - \text{CrLd\_err}_{\text{measured, front}}) \cdot \frac{M_{A,B}}{M_{\text{measured}}}$$

with:

$$M_A = \sum_{i=0}^{n-1} (\text{weight\_A}_i \cdot \text{ecc\_A}_i), \quad M_B = \sum_{j=0}^{m-1} (\text{weight\_B}_j \cdot \text{ecc\_B}_j),$$

$$\text{and } M_{\text{measured}} = \text{weight}_{\text{measured}} \cdot \text{ecc}_{\text{measured}}$$

Key to above formulas

$\text{CrLd\_err}_{\text{measured, front}}$	Measured corner load error, front position
$\text{CrLd\_err}_{\text{measured, back}}$	Measured corner load error, back position
weight_A_i, weight_B_j	Nominal value in g of the weight i, resp. j, in the combination A of n weights, resp. B of m weights
ecc_A_i, ecc_B_j	Eccentricity of weight i, resp. j in the combination A, resp. B - i.e distance in mm between the center of gravity of the weight and the vertical central axis of the balance pan; this distance is positive for back position and negative for front position
$\text{weight}_{\text{measured}}$	Nominal value in g of the check weight used for the measurement of the corner error
$\text{ecc}_{\text{measured}}$	Eccentricity of the check weight used for the measurement of the corner load error - i. e. distance in mm between the center of gravity of the check weight and the vertical central axis of the balance pan; this distance is positive for back position and negative for front position

The corner load error **CrLd-err** is not reported in the results summary table if its calculated value equals zero. Should the measurement of the corner load error not have been done and the calculated corner load error differ from zero, the results summary table indicates **CrLd-err: unknown**.
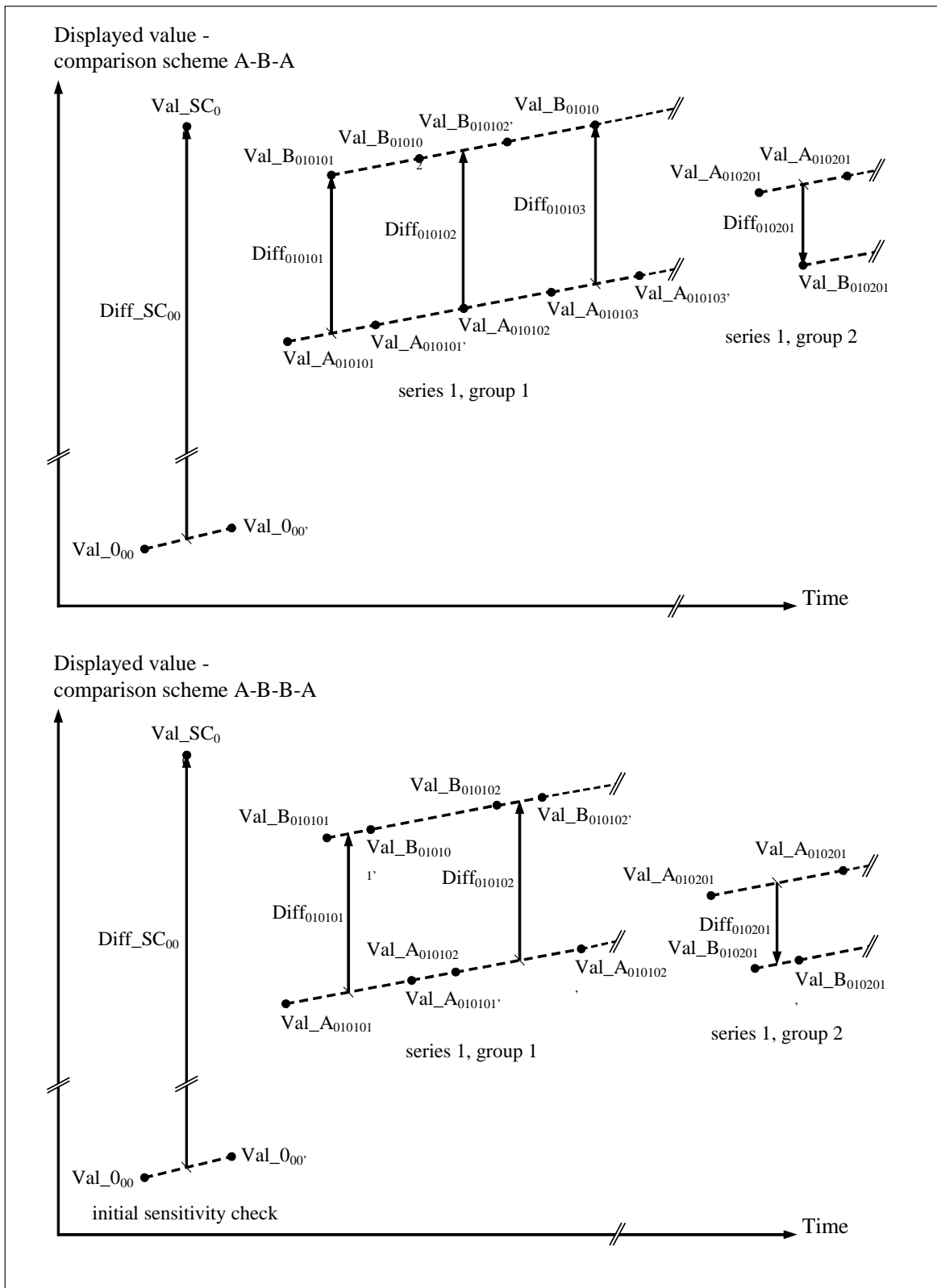
Weighing process and reported measurement data - top diagram: A-B-A, bottom diagram: A-B-B-A scheme

5.9 Adjusting the balance

The adjustment procedure has to be started from **e100**control, and not "manually", i. e. not from the balance control unit. To trigger the adjustment, proceed as follows:

1 Select **Adjustment** > **Internal…**.
   ⇨ The window **Adjustment with internal weights** is displayed. The date and time of the last adjustment are displayed. Under **Tare weight:** the 100 g standard weights, to which a magazine place is allocated, are listed.
2 Select one of the tare weights before starting the adjustment.
3 Click **Start** to trigger the adjustment (or **Cancel** to return to the main window without taking any action).
   ⇨ From this point, the adjustment procedure runs automatically.
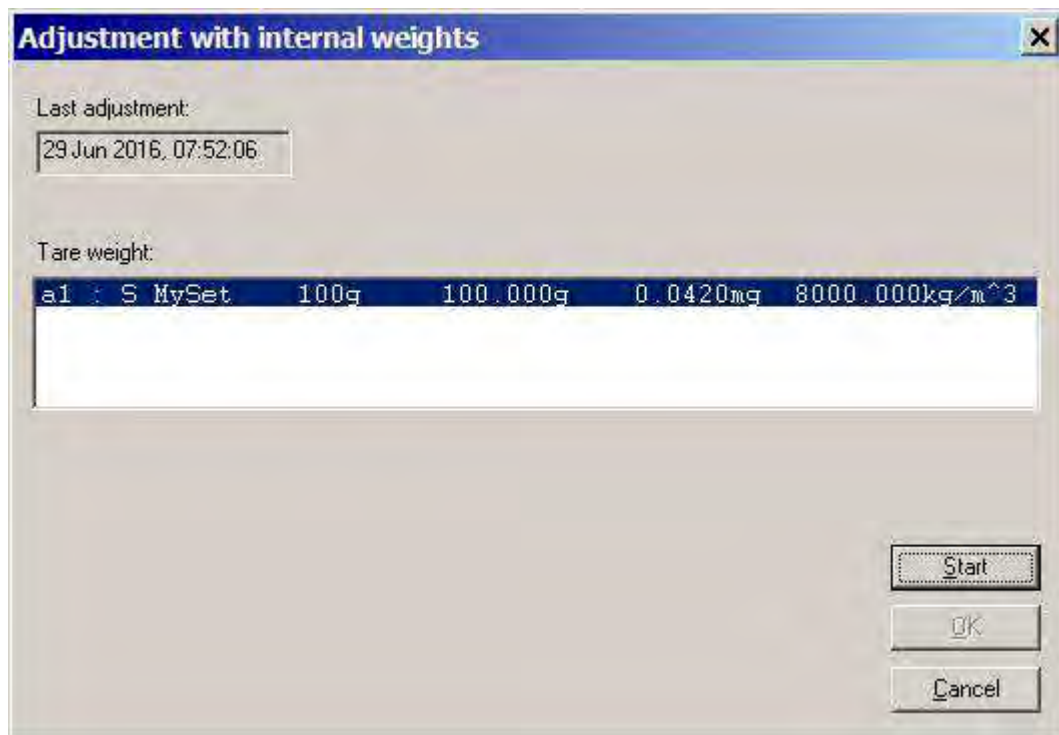
Starting the balance adjustment (with the internal weights)

5.10 Measuring the corner load error

Overview

As long as only direct comparisons are carried out and the selection of the weight carriers is made properly, the error due to corner load is negligible. When combinations of weights are determined, the above statement is not necessarily true; it is actually true only provided both weights combinations involved in the comparison can be arranged on the balance pan in such a way that the centers of gravity of both combinations are located on the same vertical axis (**see Indication of corner load error**, in [Measurement report ▸ Page 40]).

In the previously given example, i. e. '30 g + 20 g' vs. '50 g', the error due to corner load cannot be neglected. Therefore, it is indicated in the report, as presented under **Indication of corner load error**. The indicated corner load error is calculated from the so-called measured corner load error which is to be determined and updated (or at least checked) on a regular - monthly - basis. The measured corner load error (front, back) is the difference between the value of weight of a particular nominal value well centered on the balance pan and the value of the same weight moved 21 or 17 mm (weight carrier of design 1 or 3) forwards, respectively backwards from the vertical central axis of the balance pan.

Since the corner load error does depend not only on the value and the eccentricity of the weight (or weights combination), but also on the distribution of the tare weights currently used, the corner load error values have to be measured for all nominal values involved in your regular weighing processes (nominal values between 10 and 100 g can be selected). Again, the measurement of the corner load error needs to be done only if combinations of weights with values which do not conform to the OIML recommendations are to be determined.

For each of these values, the date of the last corner load error measurement (or **Not measured**, if no measurement has been done yet), as well as the current measured error values and the type of weight carrier used for the measurement, are displayed. Besides, the **Check weights** list box displays all the standard weights, or all weights (according to the setting of the top option button **Check weights to use:**), which are appropriate for this particular measurement.

Measuring the corner load error

In order to determine or update the values saved as measured corner load error, proceed as follows:

1   Select **System** > **Corner load error measurement…**.

⇨   The window **Corner load error measurement** is displayed.
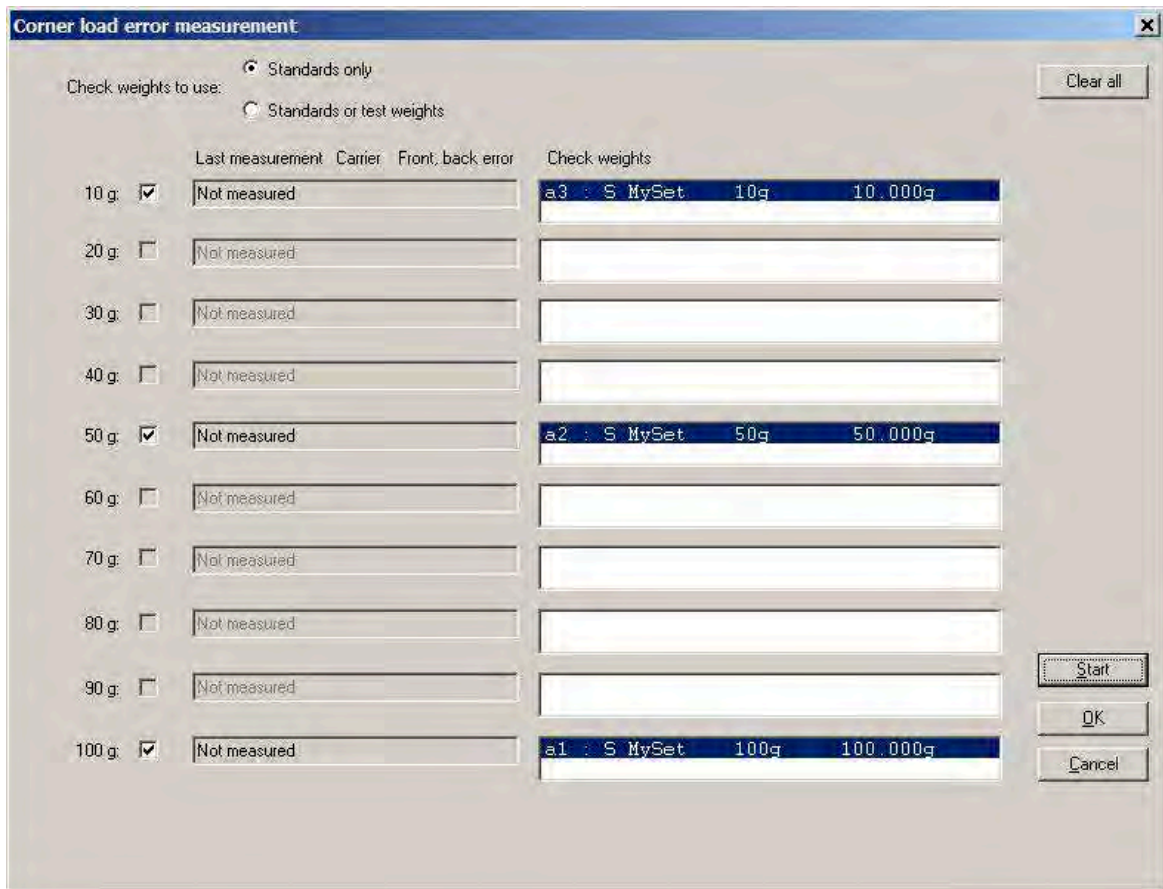
Starting the measurement of the corner load error

2   Click on the appropriate list record in order to select the weight you wish to use.

3 Click **Start** to trigger the corner load error measurement (or click **Cancel** to return to the main window without taking any action).

⇨ From this point, the measurement procedure runs automatically. Its results can be viewed in the **Corner load error measurement - Report** window.
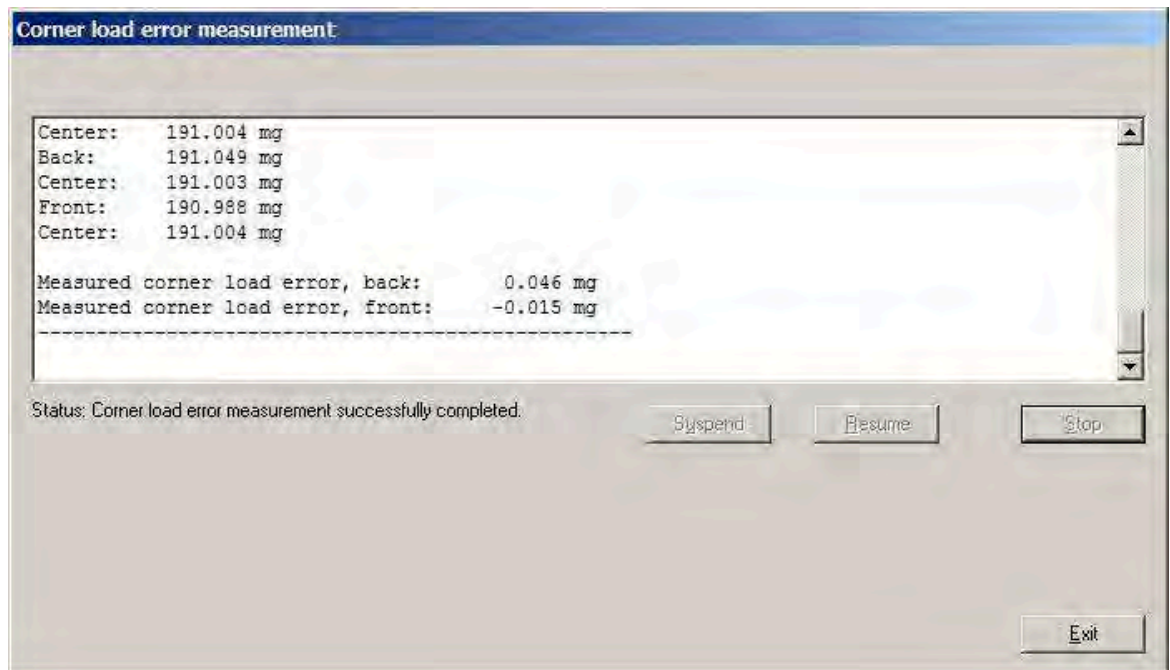
Report on the measurement of the corner load error

4 Once the procedure is completed, click **Exit** to return to the previous window.

⇨ **e100**control displays the values which have just been determined for the measured corner load error, back and front.

5 Accept these values and update the currently saved errors accordingly by clicking **OK**, or reject the new values and keep the currently stored ones by clicking **Cancel**.
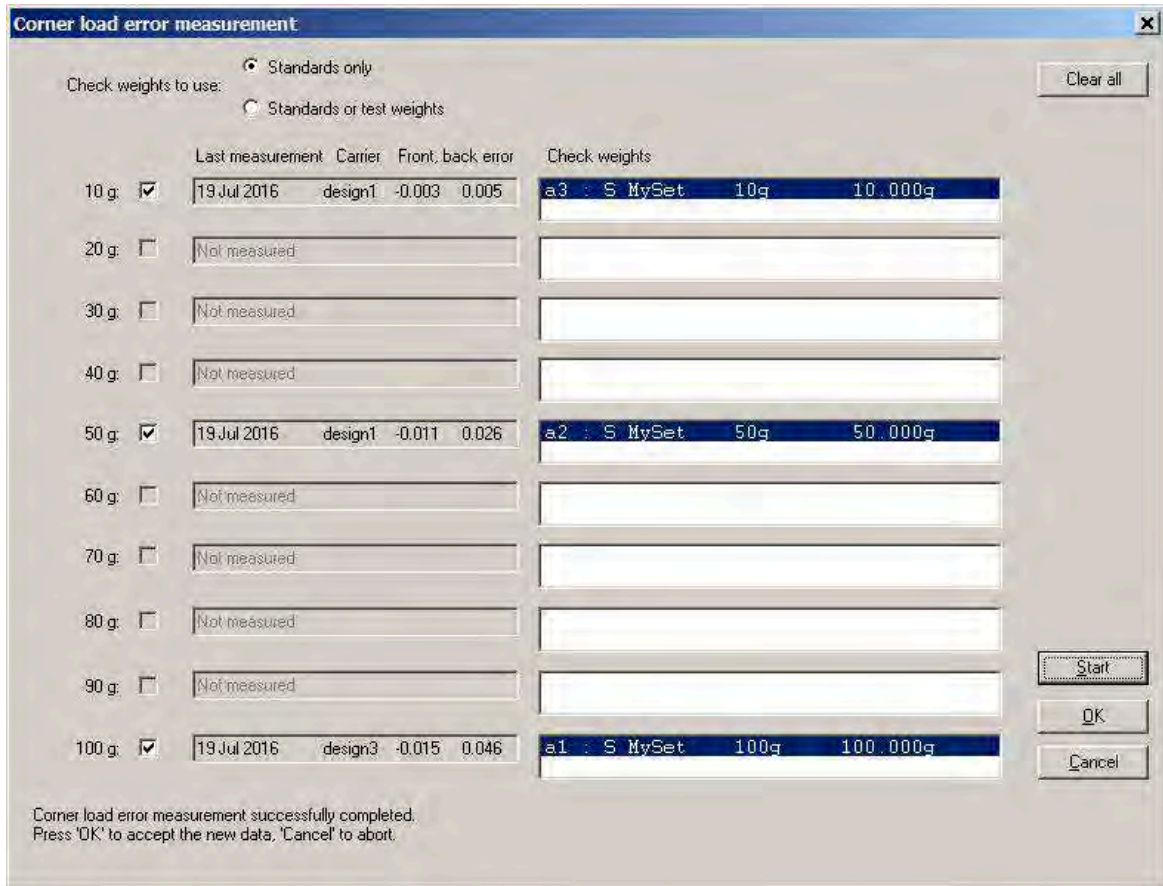
Accepting **OK** or rejecting **Cancel** the new corner load error data

5.11 Upgrading e100control

If you acquired the 'standard' edition of **e100**control and now wish to upgrade it to the 'professional' one, or if you wish to enable online climate data input, proceed as follows:

1 Select **System** > **Software upgrade…**.

⇨ The window **Software upgrade** is displayed.

2 Enter in the **Handler ID** box the last four characters of the serial number of your **e100 comparator** (see sticker on rear panel).

3 Enter the 8-character password you received upon purchase of the software option.

4 Click **OK**.

5 Should **e100**control 'professional' need to be re-installed on a controller, **Handler ID** and **Password** have to be re-entered.

⇨ Your **e100 comparator** is now upgraded.
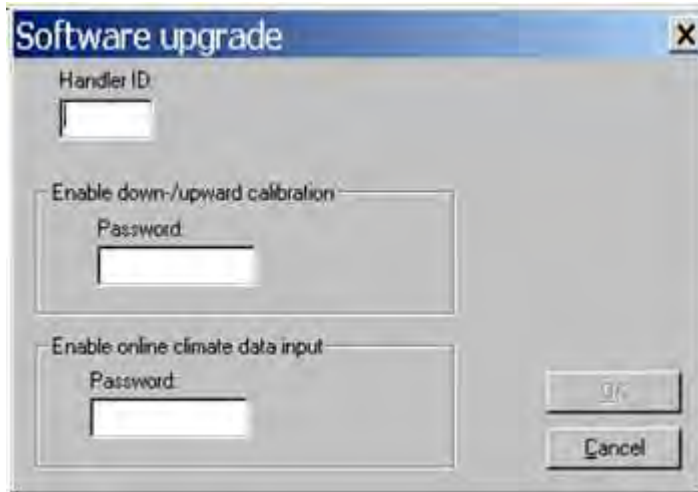
Upgrading the **e100**control software

5.12 Remote-controlling the e100comparator

The weighing process settings may need to be generated by a central laboratory information management system, such as for instance the 'Automated Mass Measurement System' (AMMS) supplied by Measurement Technology Laboratories (Minneapolis, USA), and imported from this system into **e5**control. Furthermore certain commands may need to be sent to **e5**control from this central system, in order to let this system "remote-control" the **e5 comparator**. **e5**control offers such an interface which fully meets these requirements.

5.12.1 Generating a file importable into e100control as settings file

As above mentioned, the ability of **e100**control to import a settings file generated by a central information management system is indispensable to certain laboratories. To achieve this, a text file needs to be produced by this central system according to well-defined format rules, so that it becomes convertible into a regular, **e100**control-compatible settings file.

The figure below presents an example of such a text file, named 'ImportDemo.imp' and containing all necessary settings according to their description and values given earlier on [Determining the weighing process settings and series scheme ▶ Page 28].

```
JOB: ImportDemo
e100control 3
HEADER:
<This is an optional 3-line text block which appears in a message box
when the new settings file (imported and converted into e100control)
is loaded>
END HEADER
PROCESS:
1 1 2 0 3 5 1 A-B-A 25 10 a3 20
END PROCESS
MAGAZINE:
a1 S MySet 100g 100 0.042 8000.0
a2 S MySet 50g 50 -0.022 8000.0
a3 S MySet 10g 10 0.009 8000.0
a8 T TestSet 100g 100
a9 T TestSet 50g 50
b1 T TestSet 20g* 20
b2 T TestSet 10g 10
c1 T TestSet 20g 20
END MAGAZINE
SCHEME:
a8 VS. a1
a9+a2 VS. a8
a2 VS. a9
c1+b1+b2 VS. a9
b1 VS. c1
b2+a3 VS. c1
a3 VS. b2
END SCHEME
REPORT:
metrotec engineering ag
C:\Programs\e100control\DemoOutput
END REPORT
END JOB ImportDemo
```

Example of a text file convertible into a settings file by **e100**control

The format of this text file is defined in the figure below. The words written in upper case, bold letters (followed or not by ':'), such as for instance **REPORT:** and **END REPORT**, are fixed identifiers which indicate the beginning and the end of a parameter definition block. The other "words" are variables, i. e. parameters whose values - numerical values or strings of characters - determine the information and settings specific to the weighing process. The value of the following variables or parameters are to be determined within their respective range. You may note that the prefix of their designation refers to their type:

- 'str' stands for 'string' (string of characters, without spaces unless otherwise specified)
- 'bln' for boolean (0 or 1)
- 'int' for 'integer' (exact whole number)
- 'dec' for decimal (number with decimal)

```
JOB: strJobID<CR LF>
strAppName intDocVersion<CR LF>
[HEADER:<CR LF>
strHeaderLine<CR LF>
[strHeaderLine<CR LF>
[strHeaderLine<CR LF>]]
END HEADER]
PROCESS:<CR LF>
blnWeighingMode blnPreRun intStartDelayHours intStartDelayMinutes
intNonReportedPreweighings intReportedComparisons intSeries
strComparisonScheme intStabilisationTime intIntegrationTime
strSensitivityCheck intHistorySpecificPause<CR LF>
END PROCESS<CR LF>
MAGAZINE:<CR LF>
strPosID strWeightType strSetID strWeightID decNominal[ decError]
[decDensity]<CR LF>
[...]
END MAGAZINE<CR LF>
SCHEME:<CR LF>
strCombination VS. strCombination<CR LF>
[...]
END SCHEME<CR LF>
REPORT:<CR LF>
strUserName<CR LF>
strFileName<CR LF>
END REPORT<CR LF>
END JOB strJobID<CR LF>
```

Format of a text file convertible into an **e100**control settings file (<CR LF> means 'carriage return linefeed' and [ ] optional)

Parameters

Parameter designation	Value (range)	Description
strJobID	<no limitation>	string of characters used as job identification
strAppName	'e100control'	designation of control software used
intDocVersion	3	document version used as internal reference to the settings definition and its history
strHeaderLine	<no limitation>	text appearing in a message box when loading the imported and converted settings file
blnWeighingMode	0	1	'0' = 1 vs. 1 comparisons, '1' = down-/upward calibration
blnPrerun	0	1	'0' = pre-run not requested, '1' = pre-run requested
intStartDelayHours	0 – 99	integer, number of hours in time requested as start delay
intStartDelayMinutes	0 – 59	integer, number of minutes in time requested as start delay
intNonReported-Preweighings	0 – 5	integer, number of non-reported pre-weighings per group
intReportedComparisons	1 – 20	integer, number of reported comparisons per group
intSeries	1 – 20	integer, number of series
strComparisonScheme	'A-B-A'	'A-B-B-A'	comparison scheme
intStabilisationTime	10 – 60	integer, stabilisation time in seconds
intIntegrationTime	0 – 60	integer, integration time in seconds

Parameter designation	Value (range)	Description
strSensitivityCheck	strPosID | 'NO'	mag. place of sens. check standard if check done, 'NO' if not
intHistorySpecificPause	0 − 60	integer, duration of history-specific pause in minutes
strPosID	'a' | 'b' | 'c' | & '1' | '2' | …| '9'	magazine position number: a1 to a9, b1 to b9, c1 to c9
strWeightType	'S' | 'T'	'S' = standard, 'T' = test weight
strSetID	<maximum 8 characters>	string of maximum 8 characters, weight set identification
strWeightID	<maximum 8 characters>	string of maximum 8 characters, weight identification
decNominal	0 − 111	number (with decimal), weight nominal value in g
decError	<no limitation, in principle>	number (with decimal), error in mg given for standards only (i.e. strWeightType = 'S')
decDensity	<no limitation, in principle>	number (with decimal), density in kg/m^3
strCombination	strPosID[+strPosID [+strPosID]]	string consisting of up to 3 different magazine positions, separated by the '+' sign
strUserName	<maximum 54 characters>	string of maximum 54 characters (including spaces), user identification
strFileName	<file location path and name>	name of report file, without extension, and its location on disk

Meaning of the symbols used in the above table

- '< >' delimits a comment on the value of a parameter
- '−' means 'up to'
- ' | ' stands for 'or'
- '[ ]' delimits an optional block
- '&' indicates the concatenation of two strings of characters

5.12.2 Importing an externally defined settings file into e100control

The file generated in the previous chapter (extension '.imp') can now be imported into **e100**control and converted into a settings file (extension '.e100').

Selecting import source

Before importing the file, you need to select the data import mode between importing from file (accessible locally on disk or via local area network) and importing via a serial communication port. Proceed as follows:

1 Select **System** > **Import/Export mode…** > **Import source**.

  ⇨ The window **Import/Export mode** is displayed.

2 Select the appropriate mode (**File** or **Serial port**).

3 Confirm with **OK**.

📝 **Note**

- Should **Serial port** be selected, a second serial communication port has to be available - in addition to the port used for communication to the **e5 comparator** weighing machine [Starting the weighing process ▶ Page 37] - and selected as shown under **Serial port**.

Selecting the import mode 'import via the serial communication port COM2'

Importing the file

Once the appropriate import mode is selected, the previously produced text file 'ImportDemo.imp' can be imported into **e100**control and converted into the setting file 'ImportDemo.e100'. To achieve this, proceed as follows:

1 Select **File** > **Import…**.
   ⇨ The window **Select import file** is displayed.
2 Select the text file you wish to import (extension '.imp' or 'txt').
3 Click [**Open**].

⇨ The selected text file is parsed and checked, syntax-wise (**see** to the rules given in [Generating a file importable into e100control as settings file ▶ Page 53]) and consistency-wise, as follows:

• The value of each parameter must be within the allowed range.
• The document version is currently 3: the document version is an internal reference to the settings definition and its history.
• Should the sensitivity check be requested, the indicated magazine position must be allocated to a particular weight in the 'MAGAZINE' block.
• An error must be specified for all standard weights.
• The number of weights in each combination must not exceed 3 and the total nominal value of each combination must not exceed 111 g; besides, the combinations to be compared must be comparable, i. e. the difference between their respective nominal value must not exceed 11 g (electrical weighing range of the balance).
• All magazine positions mentioned in the scheme must be allocated to a particular weight in the 'MAGAZINE' block.
• The path given for the output file must exist on the **e100 comparator**'s controller.

Should the text file be error-free, it is converted into an **e100**control settings file (extension '.e100'); the window **Save imported file** opens and prompts you to enter the name under which this new settings file shall be saved.

It is important to note that the standards database 'MyStandards.st2' – data on standards locally defined – is not affected in any way when the weighing process settings are imported. The imported file contains all data relevant to the definition of the standards involved in this process.

The imported settings are immediately loaded into **e100**control. You are informed in a message box that the current weighing process settings are based on imported data, and that therefore these settings cannot be altered, except for the **Notes**, **see** [Choosing the report contents ▶ Page 36]. Besides, this message box displays the text defined in the 'HEADER' block of the source file, **see** [Generating a file importable into e100control as settings file ▶ Page 53].

Everything is set, the weighing process can be started, **see** [Starting the weighing process ▶ Page 37]). The measurement will be documented in the output file defined in the source file.

See also

▤ Generating a file importable into e100control as settings file ▶ Page 53

5.12.3 Communicating via the serial port

The '.imp' text file generated by the laboratory information management system (LIMS) can be imported into **e100**control via a serial communication port. For this purpose, the option **Import source**: **Serial port** must be selected in the **Import/Export mode** window.

Importing jobs

1 Select **File** > **Import…**.
    ⇨ The window **Import from serial port** is displayed.
2 Click **Get job list** to get from the LIMS the list of the pending jobs (settings files).
3 Once the pending jobs are listed in the **Jobs:** list box, a particular job can be imported (loaded) into **e100**control and converted into a settings file. For this purpose click **Load job**.
    ⇨ Before converting the job into a settings file, **e100**control parses and checks the text file to be converted. Should it be error-free, it is converted into an **e100**control settings file and the window **Save imported file** opens.
4 Enter the name under which this new settings file shall be saved.
5 If needed, repeat the procedure to import further jobs.
6 When finished, close the **Import from serial port** window by clicking **Exit**.
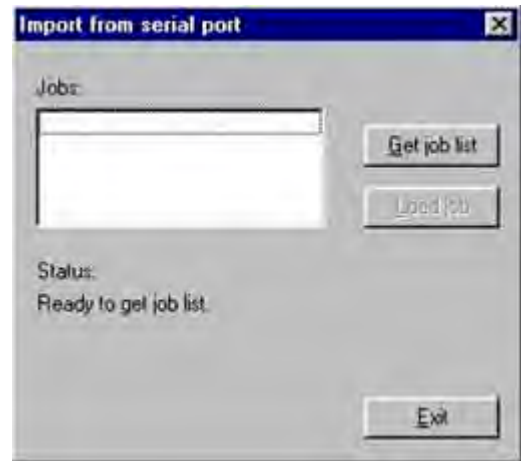
Getting the list of pending jobs from the LIMS and loading a particular job

Set of commands

The communication protocol is fixed: 2400 baud, 7 data bits, 1 stop bit, parity even; besides, a fixed time out of 3 seconds is defined during which the reply to a request for data must be sent. To ensure a smooth exchange of information between the LIMS and **e100**control, the following set of commands is available:

Task, description	Command e100control --> LIMS	Command LIMS --> e100control
Requesting list of pending jobs, clicking **Get job list**	JOB ?<CR LF>	
Sending list of pending jobs (empty list if none available)		JOB[strJobID[strJobID[…]]]<CR LF>
Requesting one particular job, clicking **Load job**	JOB strJobID<CR LF>	
Sending one particular job		<text file as described in [Generating a file importable into e100control as settings file ▶ Page 53]>
Accepting job (file syntax and consistency o.k.), saving job as settings file	JOB strJobID OK<CR LF>	
Rejecting job (file syntax and consistency not o.k.)	JOB strJobID DENIED<CR LF>	

Task, description	Command e100control --> LIMS	Command LIMS --> e100control
Advising of job start and estimated duration, before pre-run/centering starts	JOB strJobID STARTS DURATION: intHours:intMinutes<CR LF>	
Advising of job end, after job successfully completed	JOB strJobID SUCCESSFULLY ENDED<CR LF>	
Advising of job end due to program failure, after program aborted	JOB strJobID ABORTED<CR LF>	
Advising of job end due to 'Abort' command given by user	JOB strJobID ABORTED BY USER<CR LF>	

The output data, i. e. the measurement results, can be sent out via the serial communication port and processed on line by the LIMS. To achieve this, the option **Export mode** - **Online output via serial port** needs to be selected in the **Import/Export mode** window and the serial communication port identified, as demonstrated in the figure below. (If the mode importing via a serial communication port is active, the same port is used for data in- and output.)

Activating the on-line data output via the serial communication port COM2

While the weighing process is running, and provided the **Export mode** - **Online output via serial port** is active, **e100**control sends on line the measurement data - without heading -, contained in the first four columns ('Time', 'Measurement number', 'Place(s)' and 'Value') of the measurement data block of the report presented in the figures below, for example:

```
23/19:38:49   00    sc                0        0.0130<CR LF>
23/19:40:05   00    sc                a3   10000.0020<CR LF>
23/19:41:21   00    sc                0        0.0160<CR LF>
23/19:53:02   010101A                 a1      175.9270<CR LF>
23/19:54:42   010101B                 a8      175.8134<CR LF>
23/19:56:23   010101A                 a1      175.9288<CR LF>
…
24/00:56:02   01    sc                0        0.1440<CR LF>
24/00:57:17   01    sc                a3   10000.1320<CR LF>
24/00:58:33   01    sc                0        0.1440<CR LF>
```

After the weighing process is successfully completed, **e100**control sends out via the serial port a final data block containing the corner load error, in mg, calculated for each measurement group (**see** [Measurement report ▶ Page 40] and [Calculations ▶ Page 45]). The block format is as follows:

```
CORNERLOAD decCrLd_err1[ decCrLd_err2[ decCrLd_err3[ …]]]<CR LF>
```

where 'decCrLd_err1' is the corner load error calculated for the first measurement group, 'decCrLd_err2' the corner load error calculated for the second measurement group etc. Should the error calculated for a particular group equal zero or not have been measured, the value indicated for the error is 'NO' or 'UNKNOWN' respectively. An example of a complete block is given below, advising of the following corner load errors: 0 for the first group, 0.0006 mg for the second group, -0.0005 mg for the third group and 'unknown' because not measured for the fourth and last group.

```
CORNERLOAD NO 0.0006 -0.0005 UNKNOWN<CR LF>
```

5.13 Selecting the application mode

To select the application mode, proceed as follows:

– Select **System** > **Application mode…**.

⇨ The window **Application mode** is displayed.
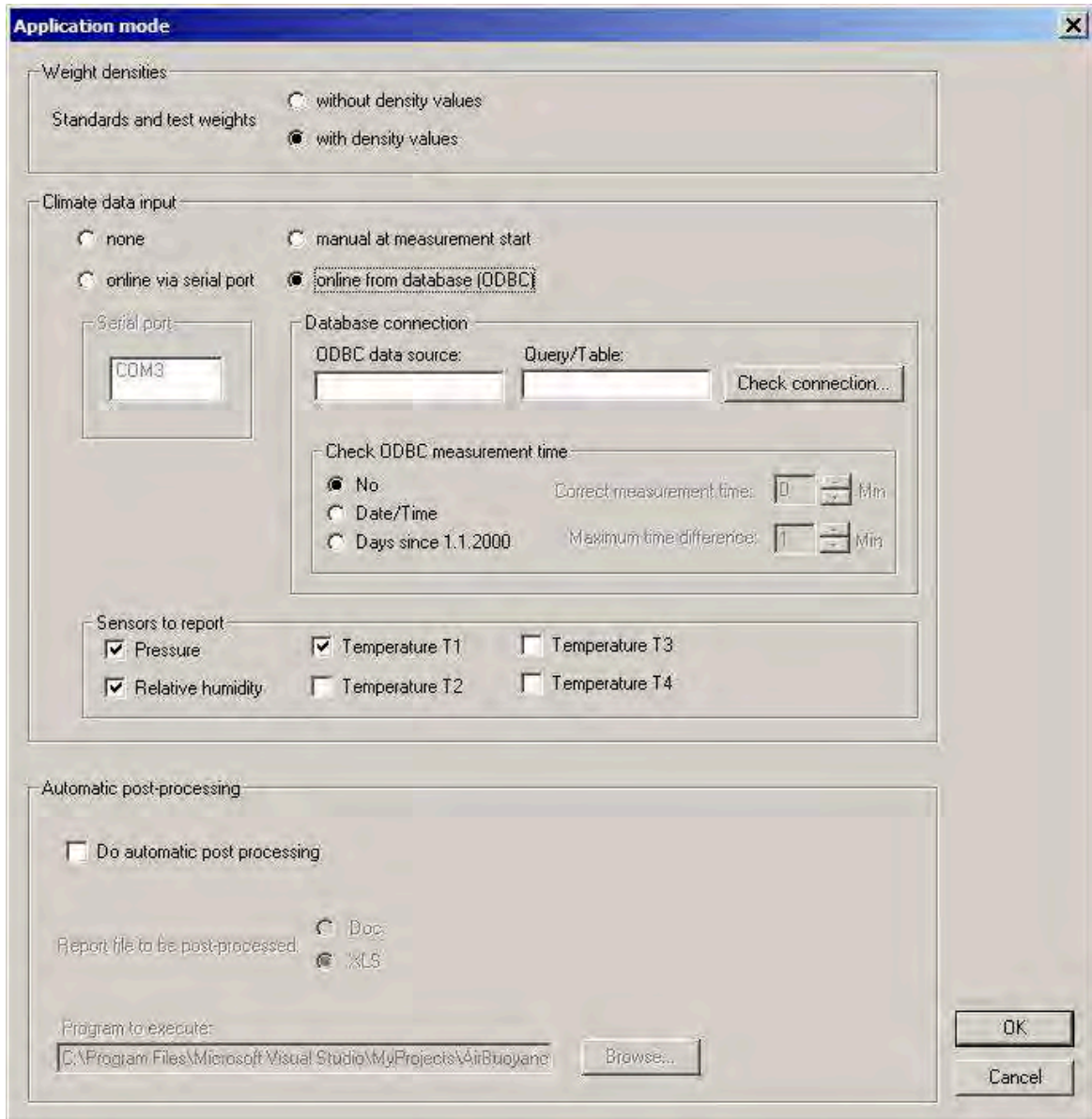
Selections in the application mode

Section	Description
Weight densities	You can select if your standard and test weights have a density value or not. If you choose **with density value**, a valid density value must be entered for each standard and test weight.
	📝 **Note**
	• If you select **with density value** and your standards and/or test weights database already contains weights that have no density values specified, a warning is generated to inform you that the densities of these weights are automatically set to the value 8000 kg/m³.
Climate data input	Here you can specify the climate data input source. Select between the following options:
	• **none**: No climate data input
	• **manual at measurement start**: The climate data can be entered manually in a window at measurement start.
	• **online via serial port**: A climate measurement instrument (Klimet A30 or compatible) can be connected to a serial port and the climate data are collected online. Choose an available serial port from the **Serial port** list, and enable all sensors to be reported by ticking the adjacent boxes.
	• **online from database (ODBC)**: Data will be read from an ODBC data source. See the next sections for further details. Enter the name of the ODBC data source, the name of the **Table/Query** and enable all sensors to be reported by ticking the adjacent boxes. If 'measurement time' is checked, select the appropriate date format, and enter the values for **Correct measurement time** and **Maximum time difference**. Click **Check connection** to make sure the ODBC data can be retrieved successfully.
Automatic post-processing	If you choose weights **with density value** and **Climate data input online via serial port**, the generated measurement report will contain all information needed to perform a buoyancy correction calculation for mass and conventional mass calibration. These calculations can be performed with a post-processing program (not included in the delivery).
	Select **Do automatic post-processing** and click **Browse…** to select your post-processing program. After the weighing process is successfully completed, the report (either the '.Doc'-report in text format, or the '.XLS'-report in Excel-format) will be sent to the post-processing program (more precise: The post-processing program is started, and the name of the report file is passed as a parameter).

– Click **OK**, if you wish the application mode selection to be confirmed, or **Cancel** to ignore any changes, and return to the main window.

5.13.1 Interface to ODBC climate data sources: Overview

ODBC data sources can be installed on a PC to read data from various data sources like text files, Microsoft Excel data sheets, or any databases system like Microsoft Access, SQL-Server, Firebird, Oracle etc.

e100control implement an interface to receive climate data from any ODBC source. This interface has the following characteristics:

- Reads data of all sensors selected to be reported. The names of the data fields correspond to the names of the sensors: T1, T2, T3, T4, P, RH.

- Data is read as text, not as numerical values. Therefore the data source can specify the number of decimal places of the data. However, the data is checked to be numerical, and not more than 4 decimal places will be displayed.

- Additional data fields STATUSNO and STATUSTEXT allow to halt the control program (SATUSNO=1) when a measurement group has ended, or abort it immediately (STATUSNO=2), displaying the STATUSTEXT to give additional information to the user about the reason of the halt or failure.

- Optional measurement time checking: An additional data field MEASTIME can be read (either as date/time value, or as float value indicating the expired days since 1.1.2000). The **Maximum time difference** input specifies the maximum time difference between the controller PC local time when the climate data was read, and the timestamp of the climate data which was imported from the ODBC data source. If the climate data is updated periodically, use the maximum time period as input here.
- Correction of time base shifts between controller PC and climate measurement system: Use the **Correct measurement time** input to shift the measurement time from the ODBC source if the climate data database and the controller PC have different time bases.

5.13.2 Read data via ODBC from an Access database

Suppose your climate measurement system collects data periodically and saves the data to a Microsoft Access database. The sensors used for **e100 comparator** might be named **T_A100**, **P_A100** and **RH_A100**. Each sensor is stored in an individual field of the database table tblClimate. The field name is equal to the sensors name. There is a timestamp generated whenever the data is stored, and this value is stored in the table field CURRENTTIME.

Example of the data table tblClimate in Access:

We want to read the current data from this Access database table and use it as climate data for **e100**control.

Step 1: Create a database query

We have to create a database query in the Access database to let the ODBC driver access the appropriate data. The ODBC driver reads the climate data of all sensors selected to be reported, which field names are 'T1', 'T2', 'T3', 'T4', 'P' and 'RH', and it furthermore reads the Fields 'STATUSNO', 'STATUSTEXT' and 'MEASTIME', **see** [Interface to ODBC climate data sources: Overview ▶ Page 61].

- The query in Access therefore has to rename all database fields and to add STATUSNO and STATUSTEXT fields.
- The query should export only the latest data record. Use the ORDER BY clause to order the records descending.
- The following SELECT query would perform all these tasks:

    SELECT TOP 1 tblClimate.ID, tblClimate.T_A100 AS T1, tblClimate.P_A100 AS P, tblClimate.RH_A100 AS RH, 0 AS STATUSNO, "OK" AS STATUSTEXT, tblClimate.CURRENTTIME AS MEASTIME FROM tblClimate ORDER BY tblClimate.CURRENTTIME DESC;

1 Create a database query as mentioned above.
2 Name this query and store it in Access. We call it 'qry_ClimateData'.
3 Save the database to a file like ClimateData.mdb.

Step 2: Create an ODBC data source to access the database

- This step depends on your Windows operating system as well as on your operation system language.
1 Open the control panel and go to **administrative tools** to find the ODBC data sources.
2 Add a System-DSN.
3 Select the appropriate driver ('Driver for Microsoft access (.mdb)').

4   Select an appropriate name (like 'ClimateServer').

5   Select the database path and choose the database .mdb-file.

Step 3: Access the data in e100control

1   Start **e100**control.

2   Select **System** > **Application mode…**.

3   Select **online from database (ODBC)**.

4   Enter the name of the ODBC data source as created above ('ClimateServer' in the example).

5   As **Table/Query**, enter the name of the Query in brackets: [qry_ClimateData] in the above example.

6   Select the sensors **Temperature T1**, **Pressure** and **Relative Humidity** to be reported.

7   Select **Check ODBC measurement time** = **No** and click **Check connection** to check the connection.

    ⇨   A message box will display the current values, or an appropriate error message.

8   If a MEASTIME value is exported, select **Check ODBC measurement time**. Choose the appropriate format of the value. In the example above, choose **Date/Time**. If the connection fails, check the note below.

📝 **Note**

ODBC drivers may have problems with the translation of **Date/Time** values on different platforms. If you have problems with checking measurement time in **Date/Time** format, you can translate the **Date/Time** value in your database to a float number and export/check this number instead. You have to calculate as follows:

•   Convert the **Date/Time** value to a real number. In Microsoft Access, you can use the CDbl()-Function to perform this task. Other database system will have similar functions.

•   Subtract the corresponding function value of a fix date: 1.1.2000. In Access, you can use the function CDbl(CDate(#2000.1.1#)) to calculate this value.

•   The calculated difference is named MEASTIME.

Using this procedure, you get the MEASTIME value indicating the days (and fractions of a day) since the 1.1.2000. This value will be exported as a real value, which should be easier to read for the ODBC driver.

If the problems remain, you must skip the measurement time checking, therefore setting **Check ODBC measurement time** to **No**.

5.13.3   Read data via ODBC from an Excel sheet

You can enter climate data in an Excel sheet and import them via ODBC into **e100**control.

Step 1: Create the Excel sheet

1   Open a new Excel file.

2 Create a new Excel sheet and name it 'qry_ClimateData'.
   ⇨ The first row contains the name of the sensors as named in **Application mode** dialog in **e100**control.
   ⇨ The second row contains the data.
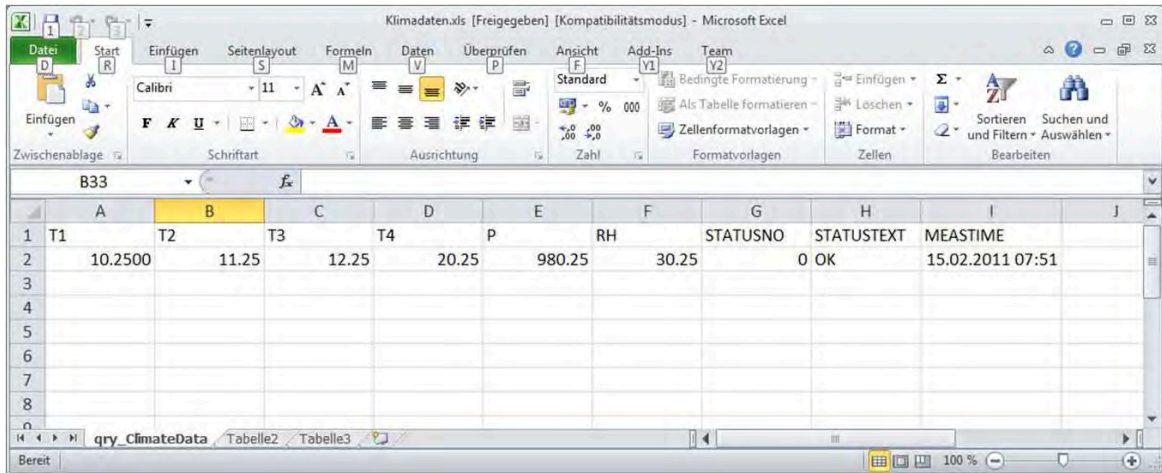
Example of an appropriate Excel Workbook

3 Select **Share Workbook**. If you do not share the workbook, the ODBC driver will report an error when the data is changed in the worksheet and the ODBC driver tries to retrieve the new data before the data is saved manually.

4 Save the file. Name it 'Climatedata.xls', for example.

Step 2: Create an ODBC data source to access the Excel file

• This step depends on your Windows operating system as well as on your operation system language.

1 Open the control panel and go to **administrative tools** to find the ODBC data sources.

2 Add a System-DSN.

3 Select the appropriate driver ('Microsoft excel driver (.xls)').

4 Select an appropriate name (like 'ClimateServerFromExcel').

5 Select the database path and choose the database (Climatedata.xls in the example above).

Step 3: Access the data in e100control

1 Start **e100**control.

2 Select **System** > **Application mode…**.

3 Select **online from database (ODBC)**.

4 Enter the name of the ODBC data source as created above (ClimateServerFromExcel in the example above).

5 As **Table/Query**, enter the name of the Excel worksheet in Brackets, and add a $ at the end: [qry_ClimateData$] in the example above.

6 Select the sensors **Temperature T1**, **Pressure** and **Relative Humidity** to be reported.

7 Select **Check ODBC measurement time = No** and click **Check connection** to check the connection.
   ⇨ A message box will display the current values, or an appropriate error message.

8 If a MEASTIME value is exported, select **Check ODBC measurement time**. Select the appropriate format of the value. In the example above, choose **Date/Time**.

📝 **Note**

If the connection fails, check the note at the end of [Read data via ODBC from an Access database ▸ Page 62].

See also

📄 Read data via ODBC from an Access database ▸ Page 62

5.13.4 Read data via ODBC from a .csv text file

Suppose your climate measurement system exports the current climate data into one .csv file for each comparator. These data can be imported to the control program.

Step 1: Manually create the .csv file

1 Use an editor to create a file looking like the following:
    ⇨ The first row contains the name of the sensors as named in **Application mode** dialog in **e100**control.
    ⇨ The second row contains the data. Separate the values with ;.
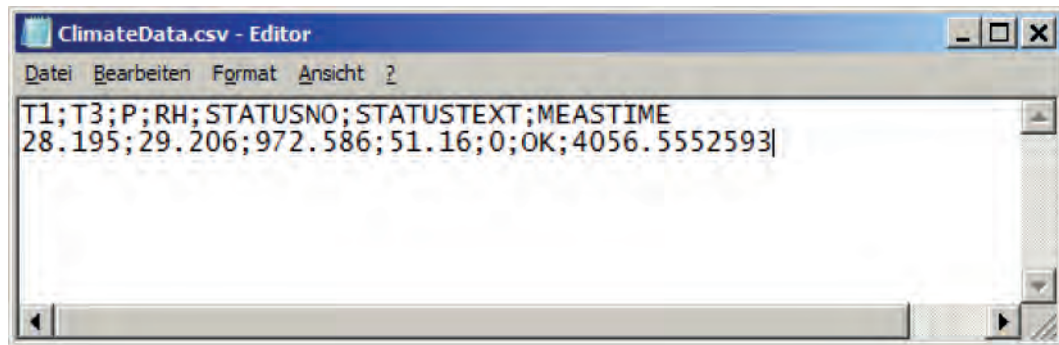
2 Save the file. Choose an appropriate filename like 'ClimateData.csv'.

📝 **Note**

If your climate measurement system automatically updates the data in the file, it should do this as follows:

1 Create e new, temporary file.
2 Write the new data to this new temporary file, close the file.
3 Copy the temporary file (with Windows' **CopyFile** command) to the original file (ClimateServer.csv), which will be replaced. If the copy fails, wait 100msec and then retry to copy.

If you write directly to the ClimateData.csv file, you will temporary block the file for ODBC access. This could force the control program to stop due to ODBC read error.

Step 2: Create an ODBC data source to access the .csv file

• This step depends on your Windows operating system as well as on your operation system language.

1 Open the control panel and go to **administrative tools** to find the ODBC data sources.
2 Add a System-DSN.
3 Select the appropriate driver ('Microsoft text driver (*.txt, *.csv)').
4 Select an appropriate name (like 'ClimateServerTest').
5 Click **Select directory** and choose the directory where your .csv file is located.
6 Select **Options**.
7 Click **Define format**.
    ⇨ At the left hand side, you get a list with all tables (files) in the directory.
8 Select the file you have created before (ClimateData.csv).
9 Select **Column Name Header**.
10 As format choose **Custom delimited**, and enter ';' as delimiter character.
11 Click the **Guess**-Button on the right hand side.
    ⇨ You should get the name of all fields in the right hand list.
12 Select the entry **'T1'** in the list.
13 Select **Data Type** = Char.
14 Enter **Width** = 255.
15 Click the **Change** button.
16 Do the same for all climate values (if used): **T2**, **T3**, **T4**, **P**, **RH**.

17 Check the format of the other parameters (they should be already correctly set):

⇨ STATUSNO must have Data Type = Integer

⇨ STATUSText DataType = Char

⇨ Width = 255

⇨ MEASTIME (if used) must have Data Type = Float

📝 **Note**

- However, Microsoft text drivers do not support **Date/Time** values. Therefore, the MEASTIME must be exported as a float value.

Step 3: Access the data in e100control

1 Start **e100**control.

2 Select **System** > **Application mode…**.

3 Select **online from database (ODBC)**.

4 Enter the name of the ODBC data source as created above (ClimateServerTest in the example).

5 As **Table/Query**, enter the name of the CSV file: ClimateData.csv in the example above.

6 Select the sensors **Temperature T1**, **Pressure** and **Relative Humidity** to be reported.

7 Select **Check ODBC measurement time** = **No** and click [**Check connection**] to check the connection.

⇨ A message box will display the current values, or an appropriate error message.

8 If a MEASTIME value is exported, select **Check ODBC measurement time**. Select **Days since 1.1.2000**.

📝 **Note**

If the connection fails, check the note at the end of [Read data via ODBC from an Access database ▶ Page 62].

5.13.5 Read data via ODBC from other database systems

Any other database system can be treated similar to an Access database system. **See** [Read data via ODBC from an Access database ▶ Page 62] for further details.

However, you must make sure to use the latest ODBC driver from your database vendor. For example, DO NOT use Microsoft's 'ODBC for Oracle' driver to access an Oracle database. Always use Oracle's ODBC driver for these purposes.

5.14 Sending emails

The program is able to send emails to inform the operator about measurement starts, successful measurement completions as well as measurement abortions.

1 Select **System** > **Email sender configuration…**.

⇨ The window shown below is displayed.

2 Configure the shipping of emails. Refer to the table below for information concerning the different fields.

Email sender configuration (typical entries)

Section	Description
Send emails	To globally enable/disable the shipping of emails.
Mail server settings	You need an email account on a mail server to send the emails from. Ask your IT department to get the access information for an email account. The **Mail server settings** contain information about this email account: • **Smtp mail server for mails to be sent** gives the address of the smtp mail server. • **Email account to send mails from** is the email address of the account on the smtp mail server. • **Email account's display name**: The receiver will see this display name in the header of the mail message as the name of the email sender. • **Credentials to access the email account**: Enter username and password to access the email account on the smtp mail server.
Receivers email address(es)	The receivers addresses can be entered. If multiple addresses are used, separate the addresses with semicolon (';').
Messages to send	Here you decide which event will generate an email message: • **Measurement start**: After successful initialization, an email is sent, giving the estimated measurement end time. • **Successful measurement completion**: An email is sent if the measurement is successfully completed. Additionally you can attach a report file to the email message. However, the report file will be sent before **Automatic post-processing** has been executed. Therefore, the report file attached to the email will not be post-processed. • **Measurement abortion**: The error message will be sent.
Email sender's application window	• The email is sent with the help of a separate application: EmailSender.exe, which must be installed separately on your controller pc. • Per default, the EmailSender's application window is hidden, i. e. the program runs in the background.

Sending testmails, troubleshooting

- Use the **Send testmail** button to try to send a testmail.
- The EmailSender's application window (a console window) is shown. If an error occurs, you will see the error message. However, after a few seconds, the application shuts down again. You can find error message details in the log-file of the EmailSender application. Typically, this is the file C:\Program Files \Mettler-Toledo\EmailSender\EmailSender_log.txt.

Important note on mail server settings

An email is sent as follows:

- The control program writes the email data, including all information about mail server settings and receivers addresses, into the file 'EmailSenderMessageToSend.txt'.
- The control program starts the application 'EmailSender.exe'.
- 'EmailSender.exe' opens the file and sends the email to the email account on the smtp mail server.
- The smtp mail server sends the email to the receivers email addresses.

📝 Note

The credentials to access the email account are stored in files and transferred to the smtp mail server in plain text! No encryption is applied!

Therefore we urgently recommend:

- Use an email account on a mail server which is accessible via intranet (in-house).
- Never use an email account which is accessible only via internet!
- Open a new account on the mail server, do not use an existing personal account.

See also

📄 Selecting the application mode ▸ Page 60

5.15 Reduce pre-run/centering time using 'Standard's centering history'

The measurement starts with a centering/pre-run phase of all weights included in the weighing process.

Generally, the standard weights included in the process are re-used for many measurements. Therefore the centering/pre-run of these standard weights could be skipped.

Whenever a standard weight is used in the measurement process, the program stores (in a separate **centering history database**) date and time, magazine position, Set-ID, Standard-ID and nominal value of the standard weight. If the weight is re-used within a certain (maximum) period of days, the standard weight's centering/pre-run can be ignored.

1 Select **System** > **Standard's centering history…**.
    ⇨ The window shown below is displayed.
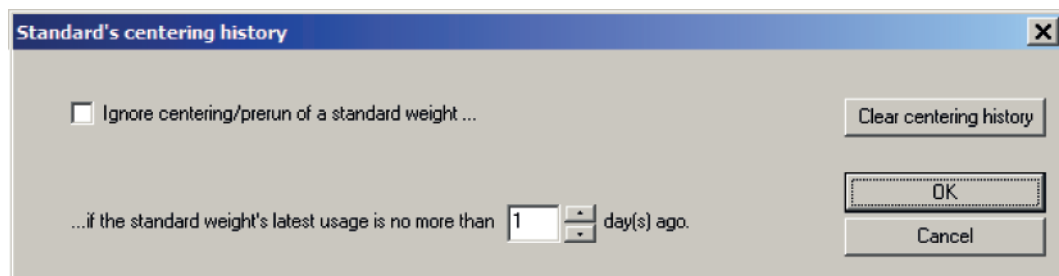
Standard's centering history

2 Select **Ignore centering/prerun of a standard weight** to ignore the centering/pre-run of standard weights.
3 Select the maximum period of days under **if the standard weight's latest use is no more than … day(s) ago**.

The **Clear centering history** button clears all entries in the **centering history database**. This forces the program to redo the centering/pre-run of all standard weights.

Note

By default, this feature is disabled (**Ignore centering/prerun of a standard weight** is not checked), and the maximum period of days is 1.

If you enable the feature, be sure to accept the consequences:

Never touch weight carriers of standard weights in the magazine!

If you occasionally touch a weight carrier of a standard weight, you must delete the **centering history database** by clicking **Clear centering history**. If you don't, the measurement process might abort, as described below.

If the carriers are touched, and due to the fact that the carriers are not centered before the measurement starts, the program might detect wrong carrier types. This will abort the measurement process with one of the following error messages:

- 'Error: Weight carrier changed. Type detected during pre-run different from currently detected one.'
- 'Error: Use of weight carriers of design 3 (red handle) not allowed in case of 3-weight combinations.'
- 'Error: A weight combination in the scheme cannot be loaded on the balance: The load exceeds the balance maximum excentric load.'

If one of these errors occurs, the program will automatically delete the **centering history database**. You can restart the measurement again. The standard weight(s) will be centered again and therefore the carrier type should now be detected correctly.

5.16 Transmit measurement report data to a TCP/IP server

The measurement report data can be sent continuously to a TCP/IP server using the special application called **ReportTransmitter**. To enable this feature, proceed as follows:

Note

- However, if you want to make use of this feature, you must have installed the application **ReportTransmitter** on your controller PC.

1 Select **System** > **ReportTransmitter configuration**.

⇨ The window shown below is displayed.

2 Select **Enable TCP/IP transmission**.

3 Click **Configure ReportTransmitter**.

⇨ This will launch application **ReportTransmitter** and lets you enter the IP address and the IP port of the TCP/IP server to which you want to send the measurement report data.
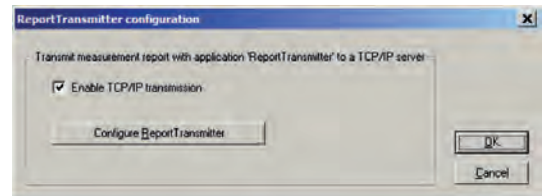
4 You can use the **Check connection** button of the program **ReportTransmitter** to check the connection to the TCP/IP server.

ReportTransmitter configuration

5 Click **OK** in the program **ReportTransmitter** to save the configuration.

6 Click **OK** in the **ReportTransmitter configuration** window to save the selection.

⇨ If **Enable TCP/IP transmission** is selected, the control program will launch application **ReportTransmitter** automatically at measurement start, which is indicated by a small notify icon in the controller pc's task bar (see figure below). However, **ReportTransmitter** rests hidden and does not show its main window. If you ever need to have access to program **ReportTransmitter**, right-click on the notify icon and select **Show ReportTransmitter** from the context menu.
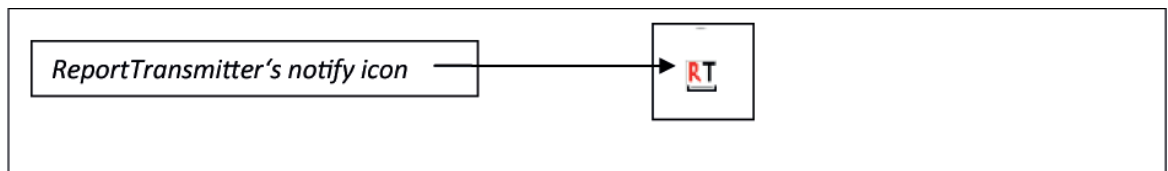
Taskbar shows ReportTransmitter's notify icon

Furthermore, the control program writes measurement data to a special new report file, CurrentReport.txt, located in an application specific folder. This file is regularly parsed by **ReportTransmitter**, and new report data is sent to the TCP/IP server. If **ReportTransmitter** detects the end of the measurement in the report file, it will automatically shut down itself.

6 Maintenance

To guarantee the functionality of the balance and the accuracy of the weighing results, a number of maintenance actions must be performed by the user.

6.1 Maintenance table

Maintenance action	Recommended interval	Remarks
Performing an internal adjustment	• Daily • After cleaning • After leveling • After changing the location	**see** chapter "Internal adjustment"
Performing routine tests (eccentricity test, repeatability test, sensitivity test). METTLER TOLEDO recommends to perform at least a sensitivity test.	• After cleaning	**see** below
Cleaning	Depending on the degree of pollution or your internal regulations (SOP), clean the instrument: • After every use • After change of sample	**see** chapter "Cleaning the balance"

For full information, always consult and download the Operating Instructions (OI).

► www.mt.com/ax-comparator-OI

6.2 Performing routine tests

There are several routine tests. Depending on your internal regulations, specific routine test must be performed by the user.

Mettler-Toledo GmbH recommend to perform a sensitivity test after cleaning and reassembling the balance or after updating the software.

Mettler Toledo can help you to define the routine tests to be performed based on your process requirements. Please contact your local METTLER TOLEDO representative for additional information.

For full information, always consult and download the Operating Instructions (OI).

► www.mt.com/ax-comparator-OI

6.3 Maintaining robot system

Apart from cleaning no regular maintenance is required by the instrument owner.

Please contact your METTLER TOLEDO dealer for details of the available service options. Regular servicing by an authorized service engineer ensures constant accuracy for years to come and prolongs the life of your instrument.

6.4 Cleaning

6.4.1 Cleaning agents

In the following table, cleaning tool and cleaning agents recommended by Mettler-Toledo GmbH are listed.

		Tools			Cleaning agents						
		Paper tissue	Brush	Dishwasher	Water	Acetone	Ethanol (70%)	Isopropanol (70%)	Hydrochloric acid (3-10 %)	Sodiumhydroxide (0.2-1.0 M)	Peracetic acid (2-3%)
Around the balance	Lab bench or weighing table	✓	(R)	n.a.	(R)	(D)	✓	R	(D)	(D)	(D)
	Balance housing	✓	(R)	—	R	—	R	✓	R	R	R
	Top housing	✓	(R)	—	R	—	R	✓	R	R	R
	Bottom housing	✓	(R)	—	R	—	R	✓	R	R	R
	Back housing	✓	(R)	—	R	—	R	✓	R	(R)	R
	Feet	R	(R)	—	R	—	R	✓	R	R	R
Balance terminal	Terminal	✓	—	—	✓	(R)	(R)	(R)	R	R	R
	Display	✓	—	—	✓	(R)	R	R	R	R	R
Balance draft shield	Glass pans	R	(R)	✓	R	(R)	R	R	R	R	R
	Glass free pans	R	(R)	—	R	—	✓	R	R	R	R
	Non-removable handles and frames	✓	(R)	—	R	(R)	(R)	✓	R	R	R
Weighing area	Weighing pan	✓	(R)	—	R	(R)	✓	R	R	R	R
	Drip tray	R	(R)	✓	R	—	(R)	(R)	—	—	R

Symbol descriptions:

✓: Best recommendation by Mettler-Toledo GmbH, can be used without limitation.

R: Recommended by Mettler-Toledo GmbH, can be used without limitation

(D): Depending on the material used: individual durability and resistance to acid and alkali must be evaluated.

(R): Partially recommended by Mettler-Toledo GmbH (for selected balance line only, please check the respective operating instructions, might also depend on your internal regulations).

— Not recommend

6.4.2 Cleaning the components

Overview

Periodically, clean the following parts of the instrument:

System part	Task	Tool	Notes
Weighing chamber	Free from dust.	Soft cloth	
Balance: • Weighing pan • Drip tray • Housing • Terminal	Free from dust.	Supplied brush	Make sure the position of the balance remains absolutely unchanged.
Weight magazine: • Weights • Weight carriers	Free from dust.	Soft brush	Make sure the centering holes underneath the carriers are clean as well. Do not leave weight carriers, which are not in use in the weight magazine. Store them in a dust free environment.
Robot system: • Robot hand • 3 carrier-centering cones	Free from dust.	Soft brush	Do not use compressed air or petroleum-based solvents
• Robot hand light barrier	In case of a malfunction of the robot hand light barrier, clean light barrier.	Soft brush	Do not use any solvent or ethanol!

⚠ **WARNING**

Death or serious injury due to electric shock

Contact with parts carrying a live current can lead to injury and death.

1 Disconnect the instrument from the power supply prior to cleaning and maintenance.

2 Prevent liquid from entering the instrument, terminal or AC/DC adapter.

NOTICE

Damage due to improper cleaning

Improper cleaning can damage the weighing cell or other essential parts.

1 Do not use any cleaning agents other than the ones specified in the Reference Manual or Cleaning Guide.

2 Do not spray or pour liquids on the instrument. Always use a moistened lint-free cloth or a tissue.

3 Always wipe out from inside to outside of the instrument.

Protective equipment:

• Gloves

• Goggles

The following procedures describe the cleaning of the weighing pan and all components.

Around the balance

– Remove any dirt or dust around the balance and avoid further contaminations.

Cleaning the balance

1 Use a lint-free cloth moistened with a mild cleaning agent to clean the surface of the balance.
2 Remove powder or dust at first with a disposable tissue.
3 Remove sticky substances with a damp lint-free cloth and a mild solvent (e.g. isopropanol or ethanol 70%).

Cleaning all removable parts

– Clean all removed part with a damp cloth or a tissue and a mild cleaning agent or clean them in a dishwasher up to 80 °C.

Note

Useful details to avoid soiling are described in the METTLER TOLEDO "SOP for Cleaning a Balance".

7 Technical Data

7.1 General data

Automated weight handler

Weight handler	For automatic determination of test weights, by direct comparison of one test weight with one standard, or, as an option, by down- / upward calibration - comparison between combinations of up to three weights, as described in Selecting a suitable weight carrier
Measuring time (typical)	15 min. for a series of 5 'one-vs.-one' A-B-A comparative weighing, 30 min. for a series of 5 'three-vs.-one' A-B-A comparative weighing
Test weights / standards	Cylindrical, knob-shaped weights with a nominal value of 1 g - 100 g and geometry as follows Selecting a suitable weight carrier:

- single weight and 2-weight combination: weight diameter ≥ 6mm - ≤ 26 mm, height ≤ 50 mm
- 3-weight combination: weight diameter ≥ 6 - ≤ 18 mm, height ≤ 36 mm

Weight magazine	27 places
Control software	Microsoft® Windows®-based **e100**control, compatible with WindowsXP®, Windows®7, Windows®8 and Windows®10
Data interface	RS232C to controller

Balance - METTLER TOLEDO AX106 Comparator

Readability:	1 µg
Maximum capacity:	111 g
Electrical weighing range:	11 g
Repeatability:	Determined as standard deviation of 5 x A-B-A comparative weighing:
	$s ≤ 1.6$ µg - typical value: 1.3 µg
Linearity:	± 8 µg
Setting time (typical):	20 s
Adjustment:	Motorized adjustment of the electrical range at a keystroke (built-in 2 x 10 g adjustment weights)

Power supply

Balance AC/DC adapter:	Primary: 100 – 240 V AC, -15%/+10%, 50/60 Hz Secondary: 12 V DC ±3%, 2.5 A (with electronic overload protection)
Balance power consumption:	12 V DC ±3%, 2.25 A, maximum ripple: 80 mVpp
Polarity:	⊖─⦿─⊕ with a current limited SELV (Safety Extra Low Voltage) output
Robot system AC/DC adapter:	Primary: 100 – 240 V AC, ±10%, 50/60 Hz Secondary: 24 V DC, ±5%, 2.1 A (with electronic overload protection)
Robot power consumption:	24 V DC ±5%, 1.5 A
Cable for AC/DC adapter:	3-core, with country-specific plug
Power consumption robot system:	36 VA max. (24 V DC 1.5 A)

Protection and standards

Overvoltage category:	II
Degree of pollution:	2
Protection:	Protected against dust and water
Standards for safety and EMC:	See Declaration of Conformity
Range of application:	For use in closed interior rooms only

Environmental conditions

Height above mean sea level:	Up to 2000 m
Ambient temperature:	17 – 27 °C (± 0.5 °C / 12 hour)
Relative air humidity:	45 – 60 %, non-condensing
Vibrations:	A set-up in a ″vibration-free″ room is required
Warm-up time:	**24** hours after connecting the balance to the power supply; when switched on from standby-mode, the balance is ready for operation immediately.

Dimensions

Instrument (robot system and balance) (w x d x h / net weight)	1280 mm x 900 mm x 760 mm / 60 kg

7.2 Dimensions
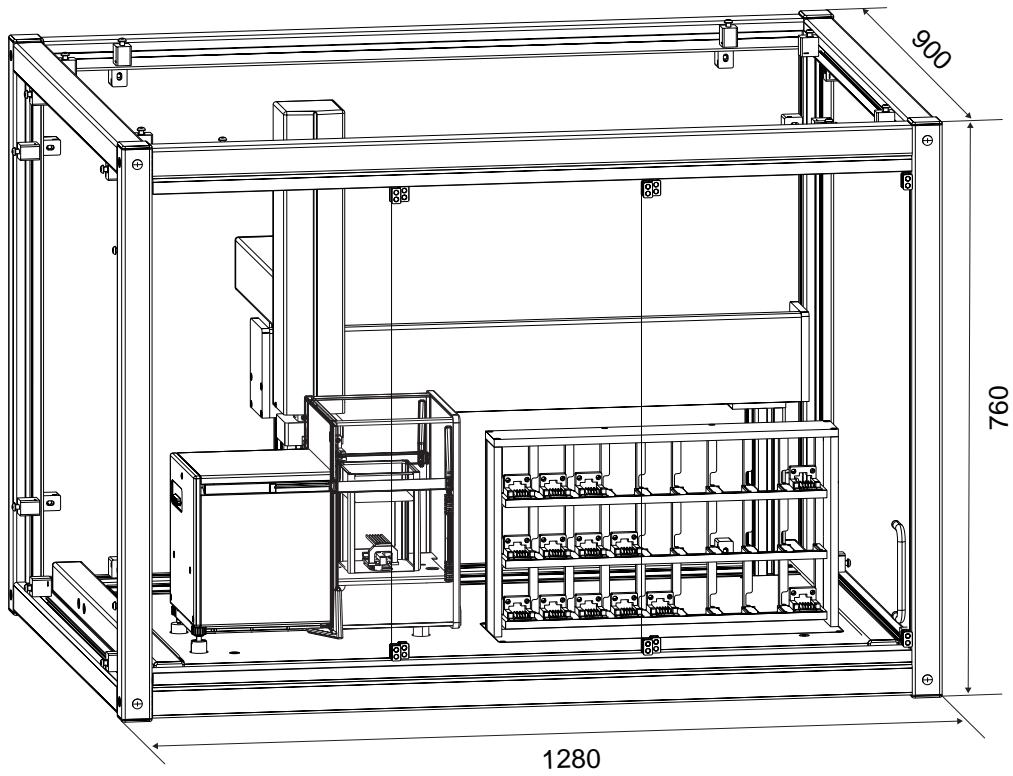
8 Accessories
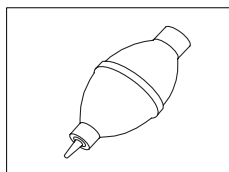
	Air bellow, for weight cleaning	11116548
	Brush, suitable for all environments	158799
	Micro fibre cloth, suitable for all environments	158798
	Nylon gloves, pair, suitable for all environments	11123098
	Software control professional (for dissemination / weight combinations)	11107519
	Software efficiency pack (calculation of True Mass and Conventional Mass + execution of multiple weights sets sequentially)	11116875
	Tweezers, bent tips, for weights 1 g – 1 kg, length 210 mm	15901
	Weight carrier design 1, e100	11147610
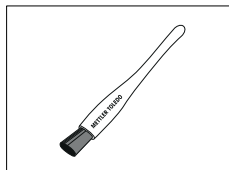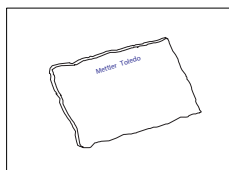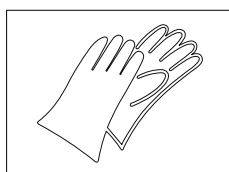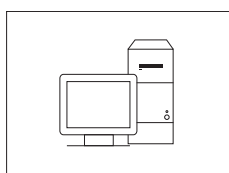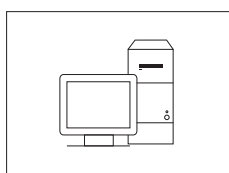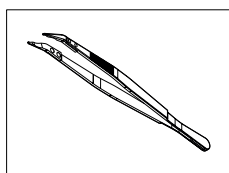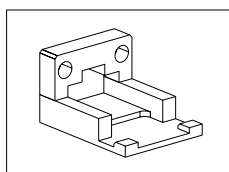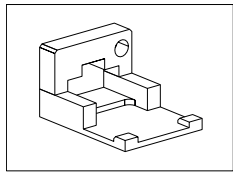
	Weight carrier design 3, e100	11147620
	Weight carrier insert diameter 6 mm	11147614
	Weight carrier insert diameter 10 mm	11147615
	Weight carrier insert diameter 14 mm	11147616
	Weight carrier insert diameter 18 mm	11147617
	Weight carrier insert diameter 20 mm	11147624
	Weight carrier insert diameter 22 mm	11147625
	Weight carrier insert diameter 24 mm	11147626
	Weight carrier insert diameter 26 mm	11147627
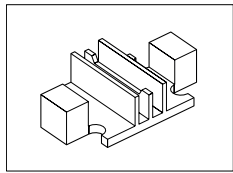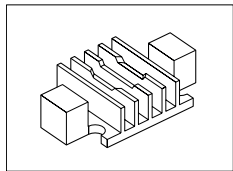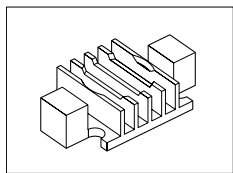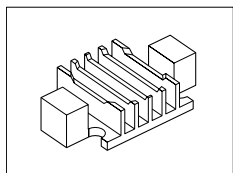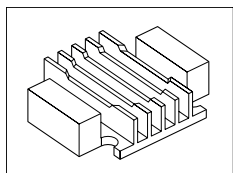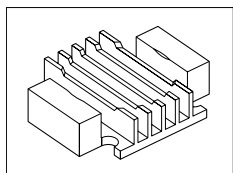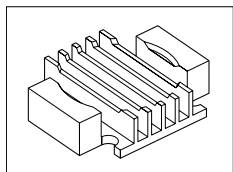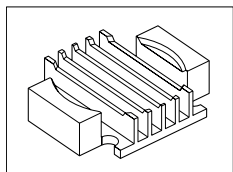
	ClimaLog30 certified	30078423
	DataLog30 certified with 2 temperature sensors	30078424
	Weight set 1 mg – 200 g E1 wooden box - certified	159341

9 Disposal

In conformance with the European Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) this device may not be disposed of in domestic waste. This also applies to countries outside the EU, per their specific requirements.

Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment. If you have any questions, please contact the responsible authority or the distributor from which you purchased this device. Should this device be passed on to other parties, the content of this regulation must also be related.

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GWP®
Good Weighing Practice™

GWP® is the global weighing standard, ensuring consistent accuracy of weighing processes, applicable to all equipment from any manufacturer It helps to:
• Choose the appropriate balance or scale
• Calibrate and operate your weighing equipment with security
• Comply with quality and compliance standards in laboratory and manufacturing

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For more information

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