USER GUIDE

WX-010-0048

Radwag

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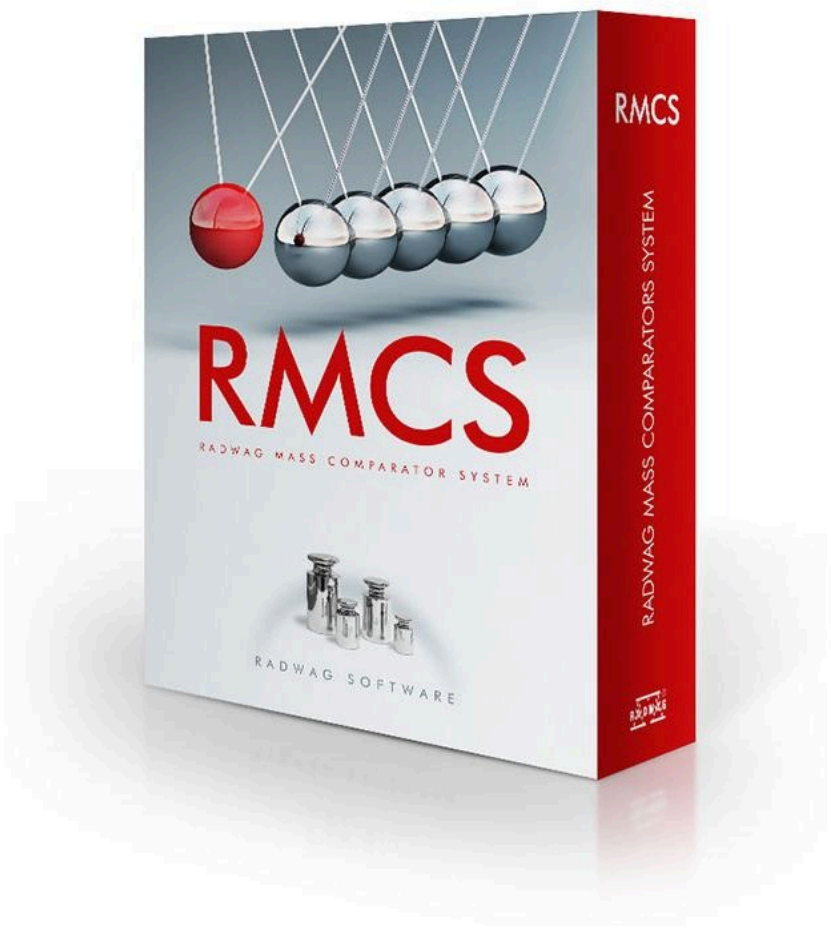
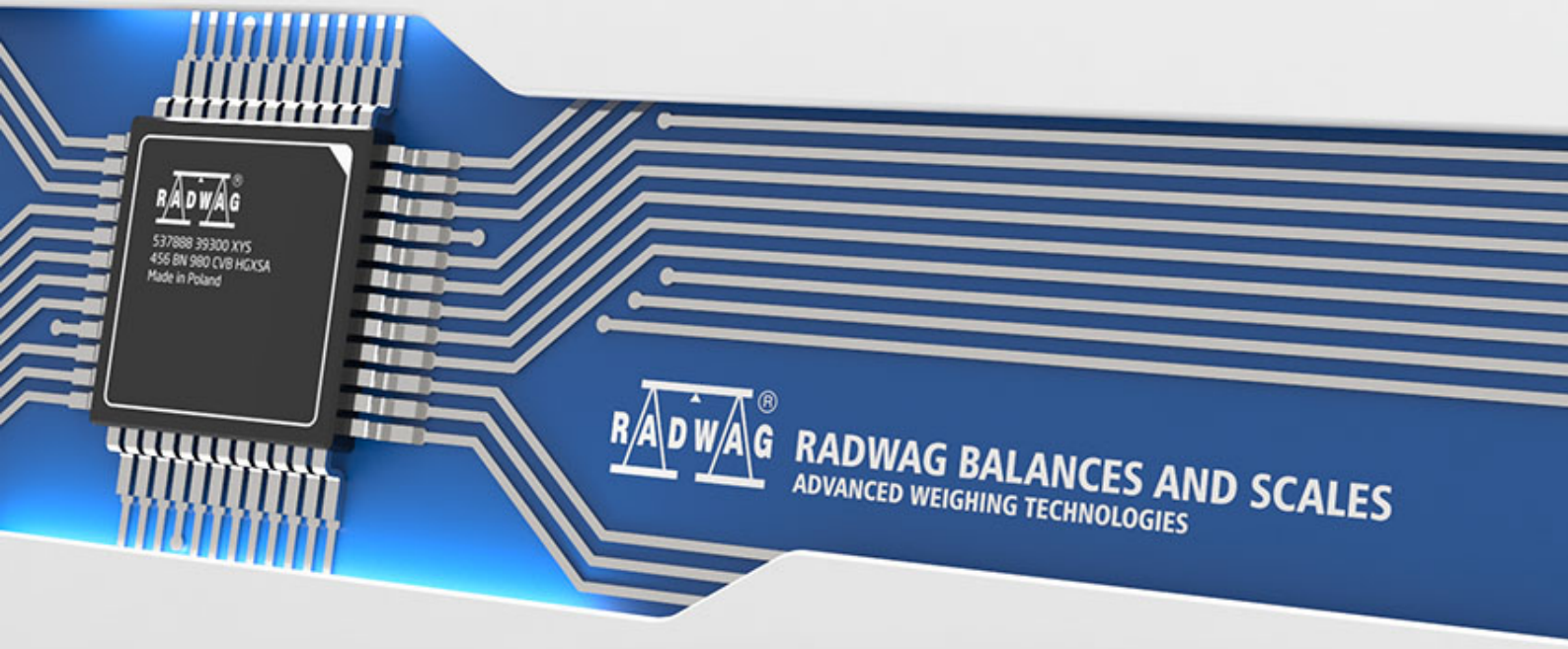


RMCS

Radwag Multiple Comparator System

Software Manual

RMCS-01-01-11-21-EN



May 2019

"The drawings, photos and graphics used are for illustrative purposes only."

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1. General information

1.1. Intended use

RMCS system has been designed to support comparison processes. Owing to modular structure the system is flexible which allows its adjustment to either particular company characteristics and needs or to individual requirements of any customer.

RMCS is especially useful for record of mass calibrations performed by means of RADWAG mass comparators which are connected via Ethernet and recorded into hardware database.

Weighing network can comprise one or several types of mass comparators.

RMCS SYSTEM based on Ethernet network

RMCS system allows to edit databases on the computer exclusively, it is not possible to edit databases using balances.
Upon establishing communication between a computer and a balance, the system transfers databases (e.g. standards, operators etc.) to each balance.
Weighing results are sent to a computer database in a form of weighing records. Using collected weighing records it is possible to generate any report that can be printed or exported to various file formats (pdf, csv, xls and more).

Caution:

1. *Due to updates there might be an insignificant divergence between this user manual content and an actual software state.*
2. *RADWAG shall not be responsible for effects and potential errors being a result of inappropriate use of the program.*

1.2. Database

Installed database may operate on the basis of any Microsoft SQL Server (MS SQL 2014) version. Taking into account performance, scalability and system reliability, it is recommended to use commercial SQL Server platform, e.g.: SQL Server 2014.

1.3. Hardware requirements

For correct software operation the hardware shall include:

- 2 GHz dual-core processor, or faster,
- 2 GB internal memory or more.
- At least 20 GB of free hard drive space,
- Computer running Windows 7 (excluding Starter version); Windows Server 2003 Service Pack 2; Windows Server 2008 Service Pack 2; Windows Server 2008 R2; Windows Vista Service Pack 2; Windows XP SP 3, Windows 10.
- Compliance with .Net Framework 4.0,
- Screen with resolution of at least 1024x768 pixels,
- DVD drive,
- Printer working in Microsoft Windows,

Caution:

1. *It is not recommended to install any other user software on the computer.*
2. *If the software is to be installed on a computer being users property, not on a computer delivered with the software by RADWAG than it is necessary to:*
    - *Install SQL server (if not installed earlier),*
    - *Attach databases (if SQL server has been installed)*
3. *If the software is to be installed on a computer being users property, it is the user (computer's owner) who takes responsibility for any potential hardware and software failures.*
4. *RADWAG company does not bare any responsibility for:*
    - *Potential effect of RMCS System and SQL server on other software installed on the computer (if there are any other programs installed),*

- *Inappropriate operation of RMCS System and SQL server affected by other programs installed on the computer (heavily overloaded system).*

1.4. Balances intended for cooperation

Due to the adopted data exchange protocol, **RMCS** software can cooperate with **RADWAG** manufactured balances exclusively. The series intended for cooperation with **RMCS** software are: APP, AKM, WAY, UYA, MYA, UMA.

Prior to software operation it is necessary to set parameters of each network connected balance in order to provide demanded measuring accuracy and right cooperation with the software. Description of settings for particular balance parameters is to be found in a user manual of a respective balance.

2. SOFTWARE INSTALATION

2.1. Database

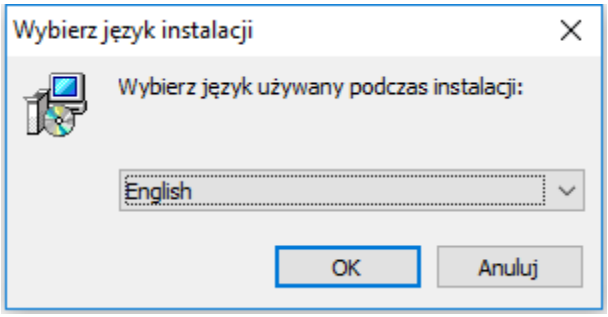
Installed database operates on the basis of **Microsoft SQL Server 2014 - Express.**

2.2. Installation of RMCS

This user manual refers to **„RMCS RR.MM.DD”** installation version.

Caution!
Prior to installation it is necessary to provide at least 2 GB free space on a disc partition of the operating system (disk C in most cases), otherwise correct installation of a complete system will not be possible.

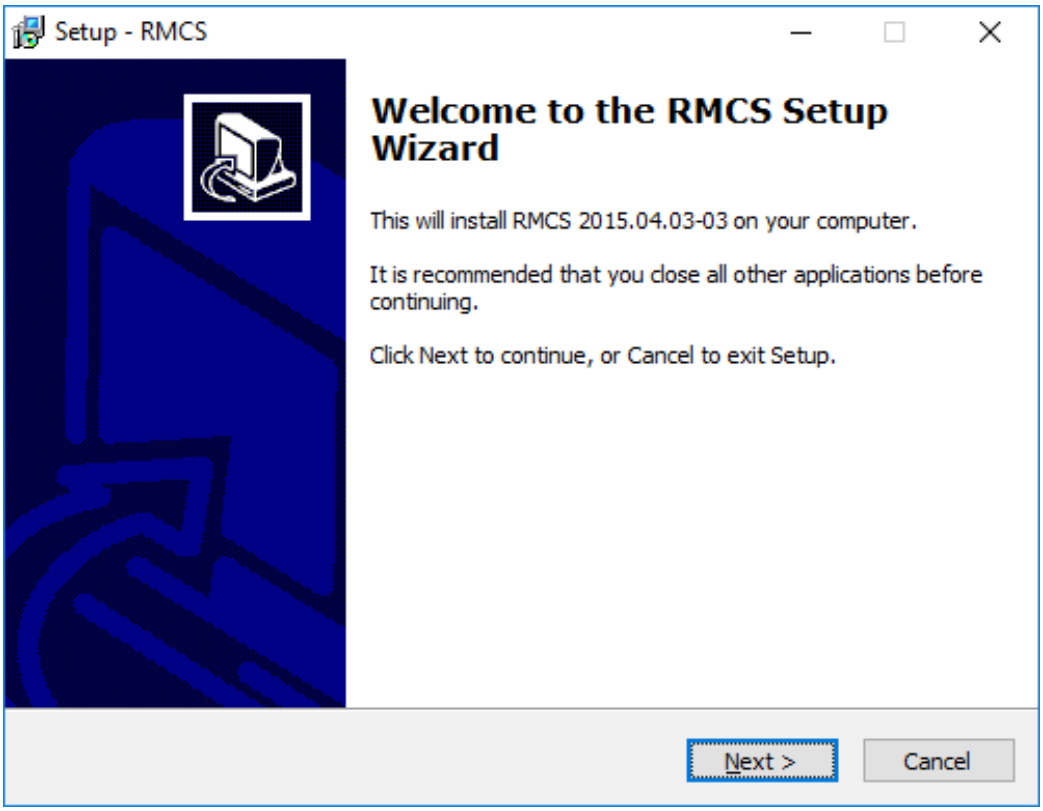
Upon running the installation file, you will see a window providing option for language selection, select the language you want to use during installation:



Press **„OK”** button.

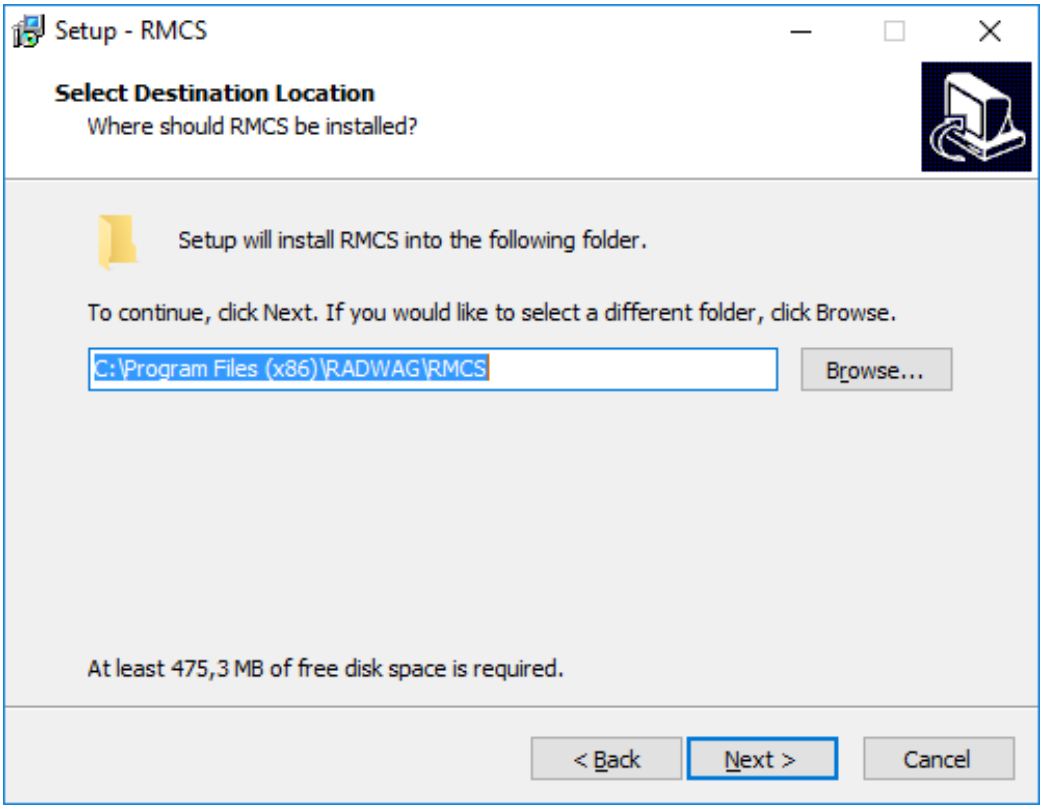
Proceeding with installation, follow the instruction displayed in the following windows.

Start-up dialog window of the installation wizard:



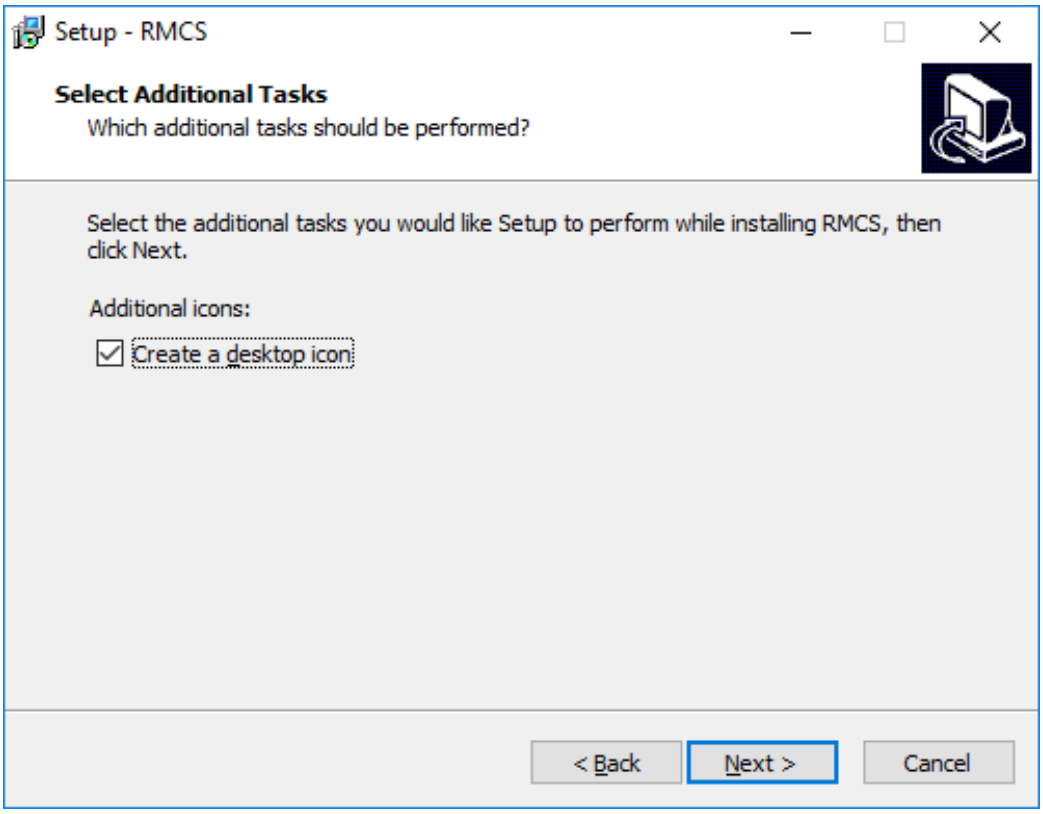
To proceed, press **„Continue”** button.

Dialog window for selection of installation directory:



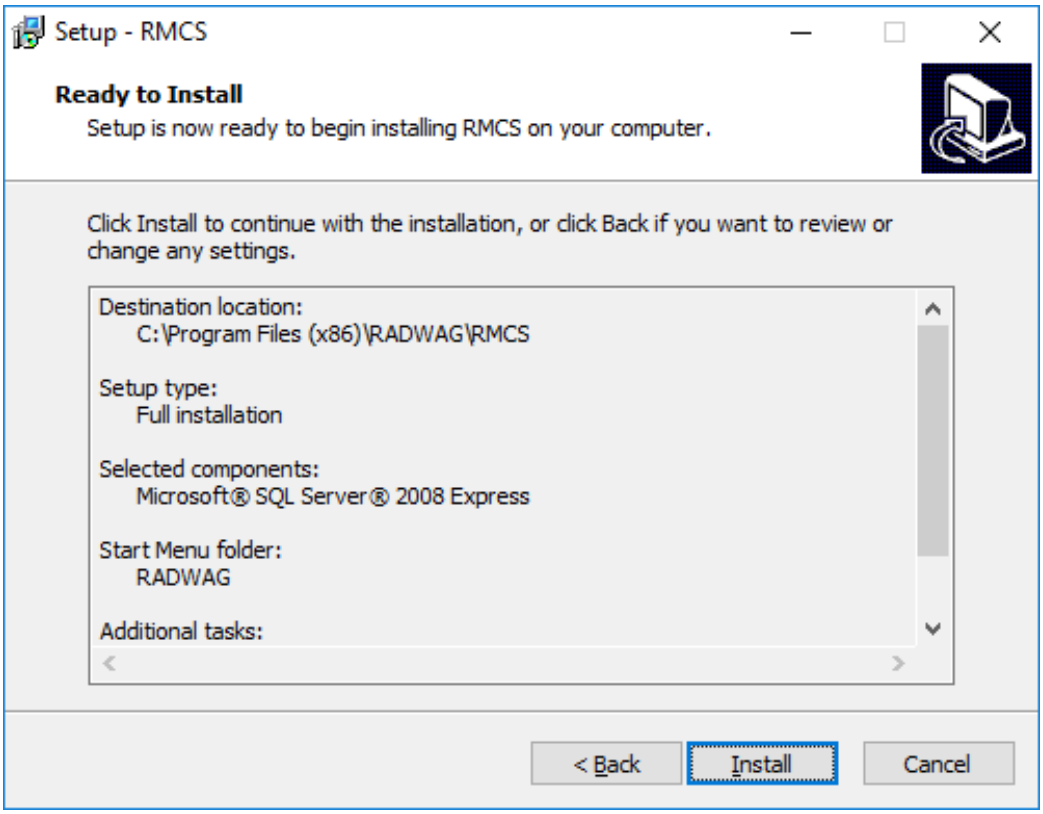
Select a directory for the software (it is recommended to use the default directory), next press **„Continue”** button.

Dialog window for selection of installation components:



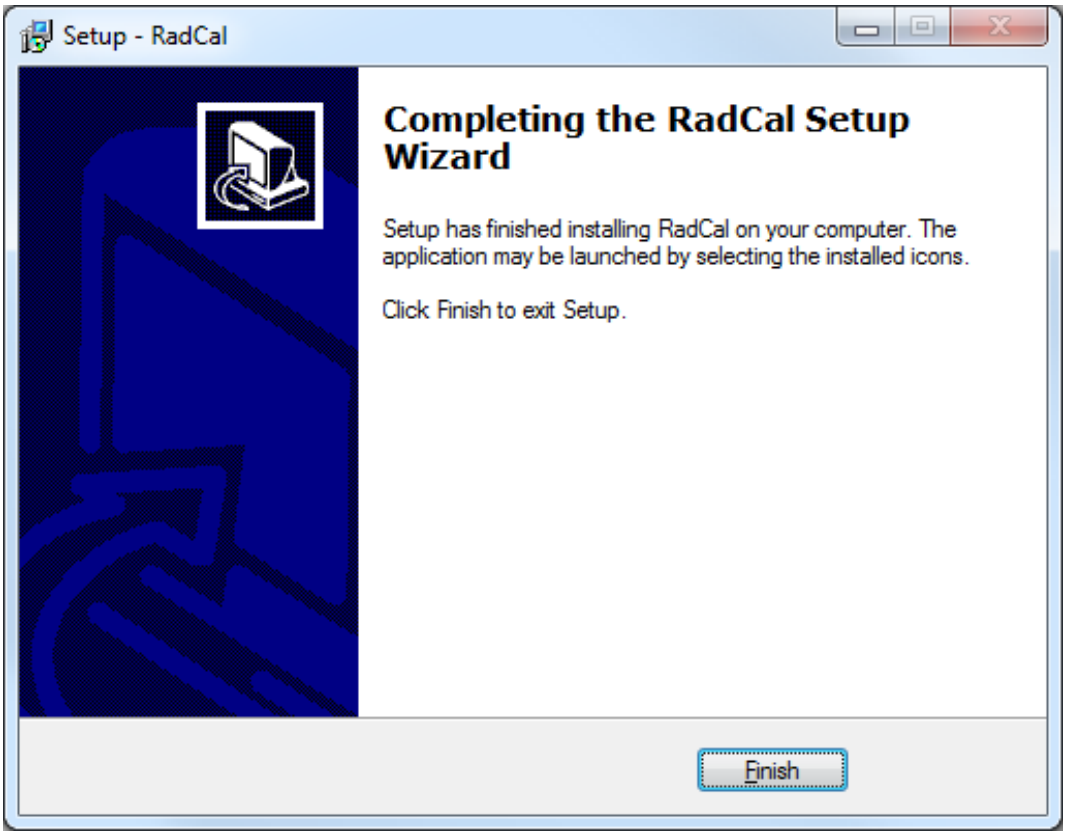
Using this window select the components that are to be installed (in case of a server keep to default settings), next press **„Continue”** button.

Ready to Install window:



Press **„Install”** button in order to start the software installation.

Dialog window for finishing the software installation:



Upon completed installation it is required to restart the computer, the computer is restarted by default.

In order to finish, press **„Finish”** button.

CAUTION
Having noticed an error message regarding .NET Framework environment, restart your computer again. If this does not help, install .NET Framework 4.0.

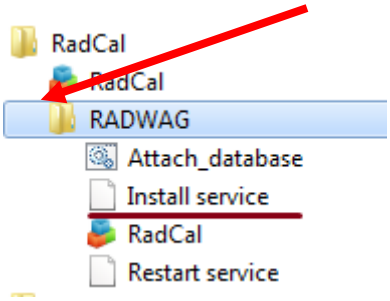
3. RMCS SYNCHRONIZER

RMCS Synchronizer software is designed to provide transfer of recorded measurements to **MS SQL** database and to monitor state of mass comparators.

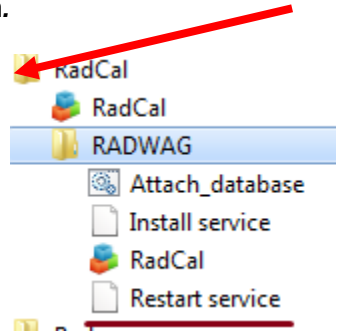
The software operates in a service mode – when correctly configured no user operation is required. It runs automatically next to Windows system start-up. This means that the user does not see the software, the software does not require logging procedure to be performed after Windows system start-up. Upon software activation, connection with a particular database is established. Next databases are transferred to balances and simultaneously weighing results are collected from the balances.

Running RMCS Synchronizer server:

1. Using menu Start, press **Install service** button.



2. Next press ***Restart Server*** button.

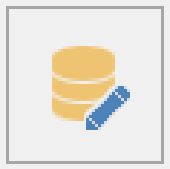


4. Database setup and logging procedure

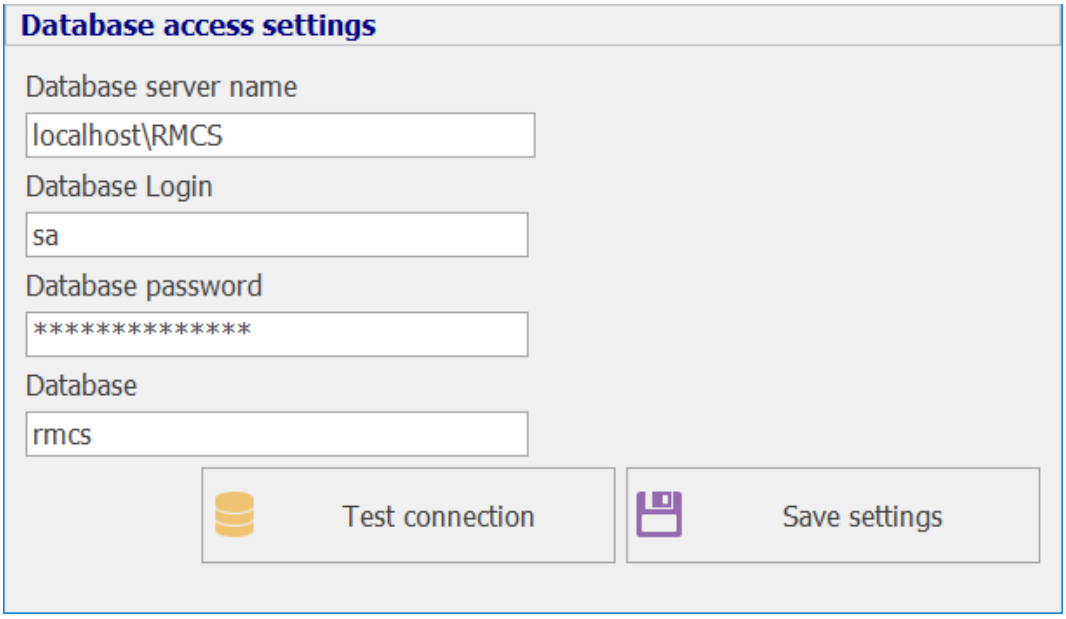
For correct software operation it is necessary to set database parameters. Parameters such as server name, database login, password and database name shall be provided by a system administrator or by a person implementing the system.

4.1. Setting database parameters

Prior logging to system, press database button.



You shall see window for connection setup.



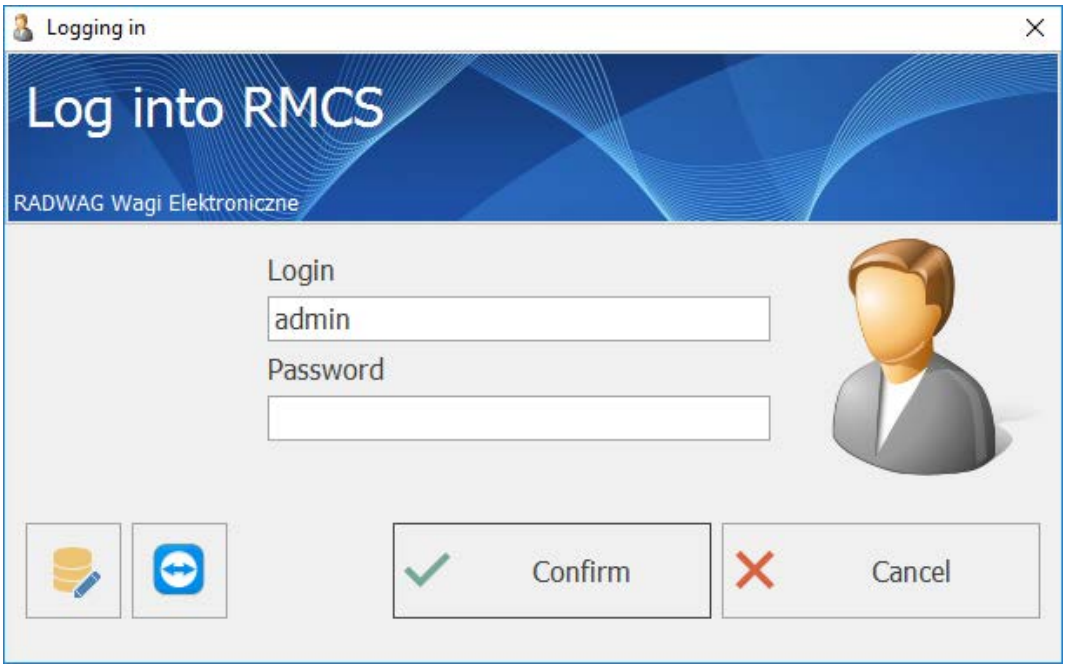
Upon entering correct data, perform connection test. If the connection has been successfully completed the settings can be saved.

4.2. Activating licence

Licence activation is done via button in the login window.

4.3. Logging to the system

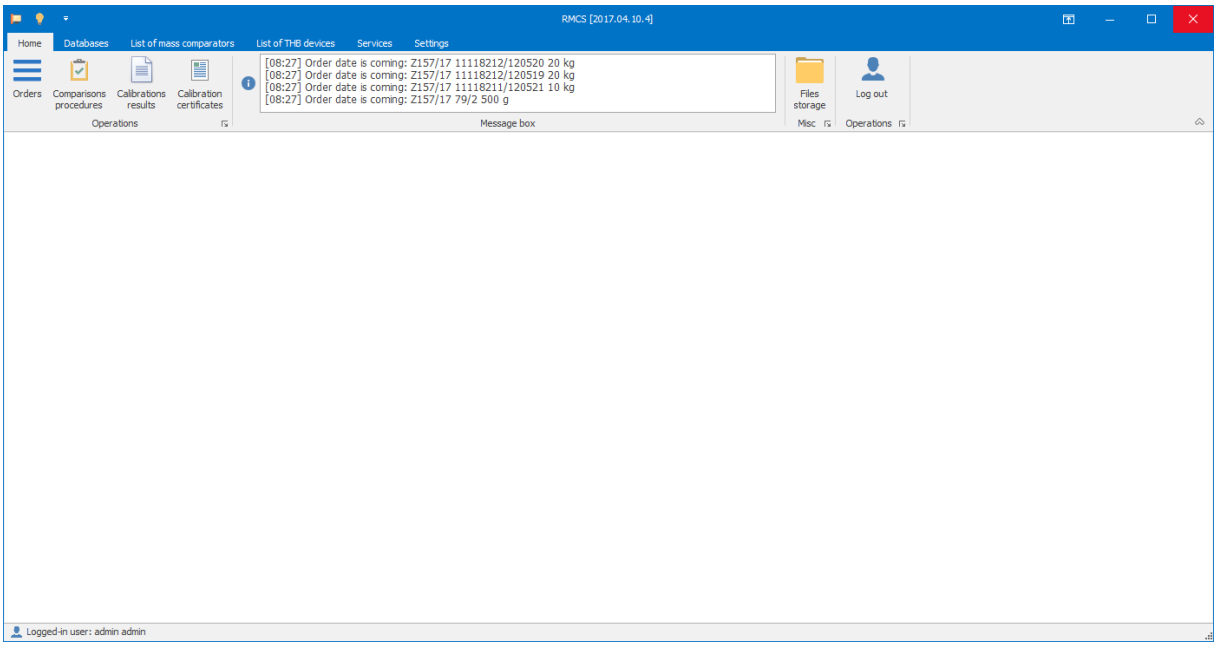
In order to log in to the system you need to enter a login and password provided to you by the system administrator.



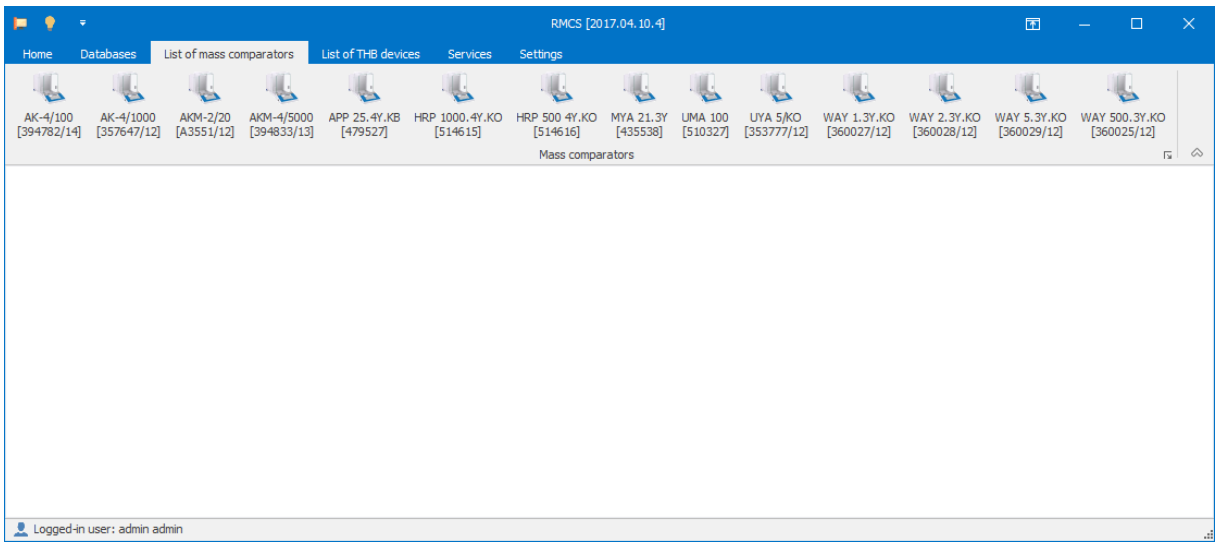
In course of the first system start-up, use the default login: admin and the default password: admin. For safety reasons the password for admin user must be changed. The system administrator gives permissions to particular users. Permissions specification and means for assigning them has been described in later sections of this user manual.

5. Home screen of the software

RMCS system is divided into several tabs. The *'Home'* tab features buttons for user logout, creation of new orders and comparison procedures, and accessing calibration results and certificates.



'List of mass comparators' tab displays status of all connected mass comparators.
Mass comparator icon marked with red symbol means either lack of connection or incorrect configuration.



Data is updated in a real time. Owing to TCP/IP protocol characteristics, devices that have been inappropriately disconnected may still be detected as connected ones, this state can take few minutes.

6. System databases

RMCS system comprises set of databases that store data in the system. Standards, Users and Tasks databases are synchronised with comparators.

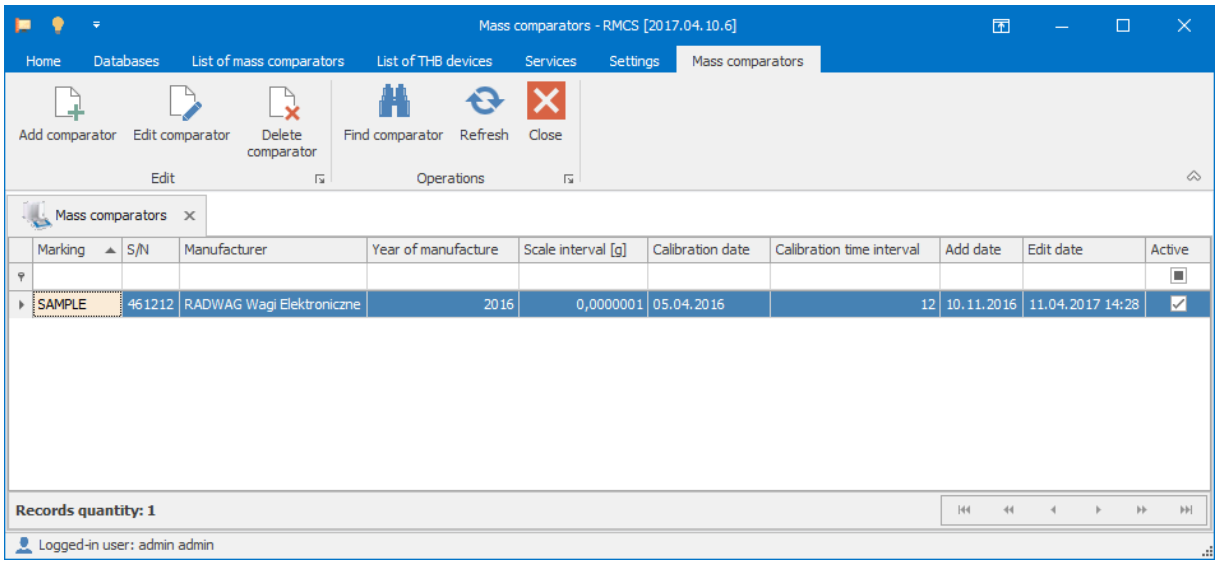
6.1. Comparators database

Go into *'Databases'* tab and find *'Mass comparators'* button.

Comparators database contains list of comparators used by the system. The comparators may be divided into 3 groups:

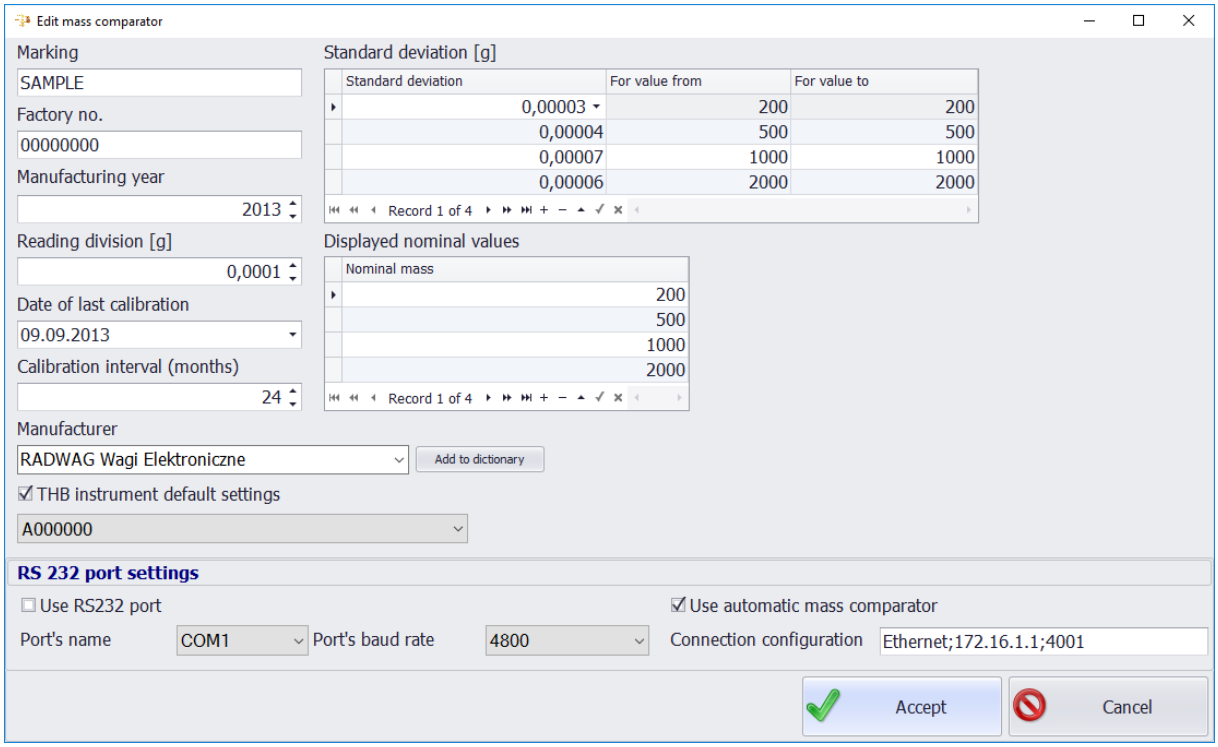
- RADWAG automatic comparators (on-line data synchronization)
- RADWAG manual comparators (on-line data synchronization)
- RADWAG manual comparators (no data synchronization)

In order to perform data synchronization and to carry out manual comparison it is necessary to add comparator into the system.



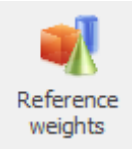
Comparator's data provides the following information:

- comparator's marking
- serial number
- manufacturer
- year of manufacture
- reading unit
- last calibration date
- calibration frequency
- standard deviation for specified data
- data of connected THB device
- communication data specified for a comparator.

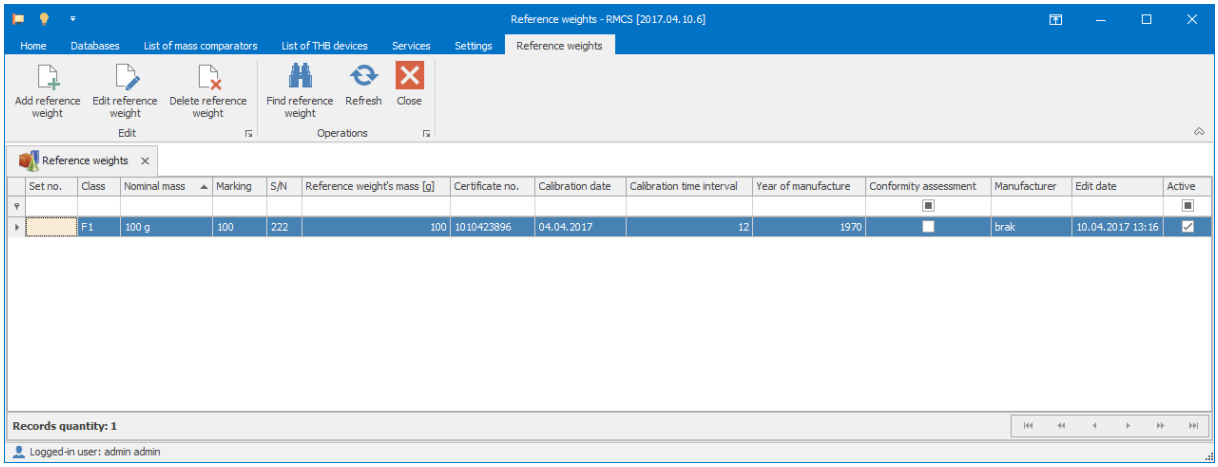


Comparator's settings offer two types of communication – RS232 and Ethernet. Comparator type determines communication settings. Manual comparators, with no option for data synchronization, require RS232 port to be set. For automatic comparators set Ethernet port following the presented scheme:
Ethernet;10.10.1.1;4001
Where 10.10.1.1 stands for comparator's IP address, 4001 stands for comparator's IP port.

6.2. Mass standards database

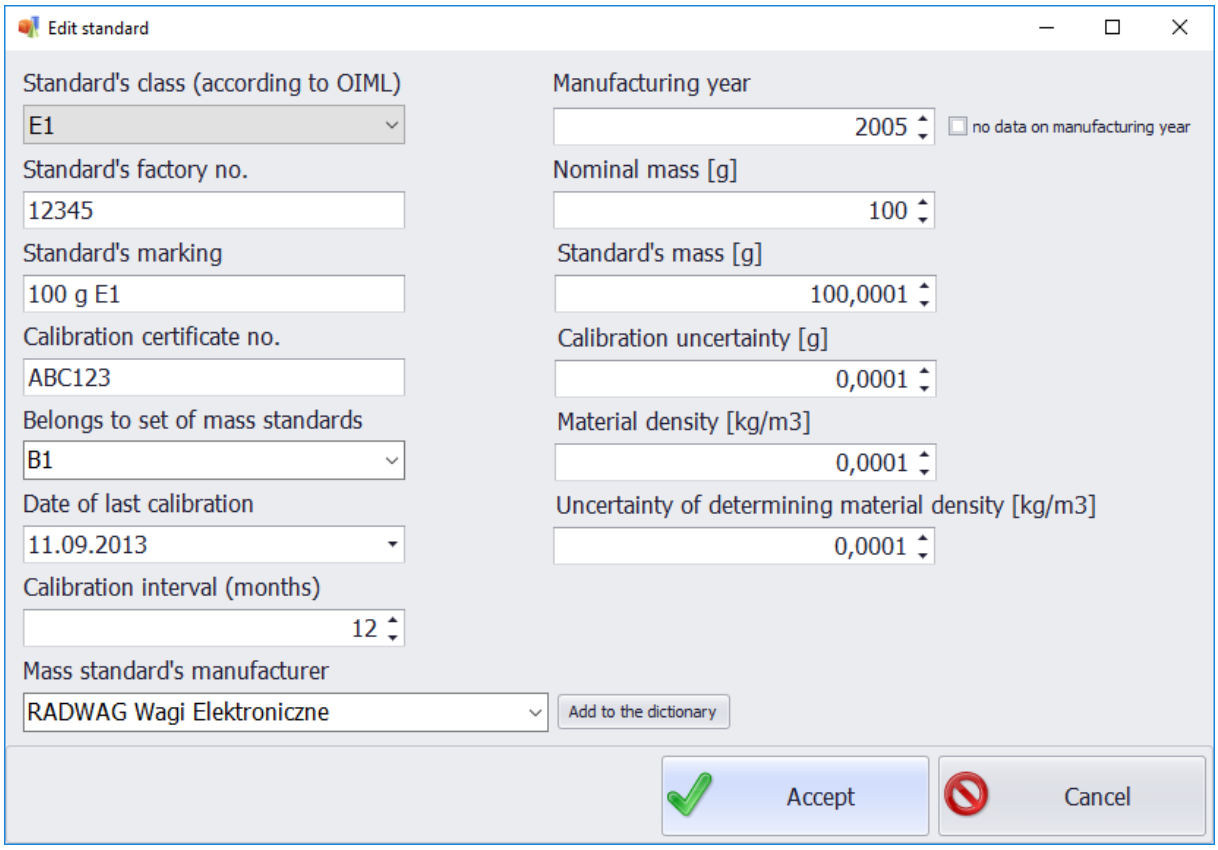


RMCS system comprises database of mass standards that are synchronized with comparator terminals.



Mass standard data provides the following information:

- mass standard class
- serial number
- mass standard marking
- calibration certificate number
- mass standard set number
- last calibration date
- calibration frequency
- mass standard manufacturer
- year of manufacture
- nominal mass
- mass standard weight
- calibration uncertainty
- material density
- uncertainty of material density determination



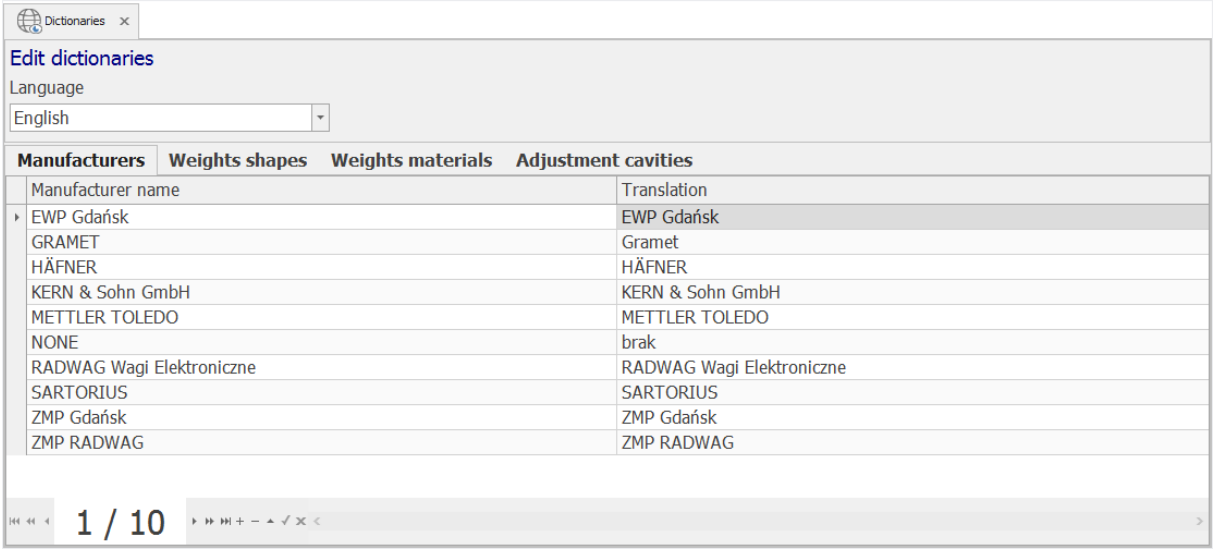
When performing calibration for the first time, enter mass standard set number in order to designate mass standard set. For next mass standards, select the number from a combo box. The entered set number is automatically added to the system.

Data such as mass standard weight, calibration uncertainty, material density and uncertainty of material density determination are used to do calculations that are presented on a calibration certificate.

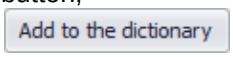
Mass standard manufacturer is taken from Data Dictionary.

6.3. Data Dictionary database

Data Dictionary database specifies data such as manufacturer, mass standard shapes, mass standard material, calibration type for a particular mass standard.



Data can be introduced into database in real time, it is done by pressing ‘Add to Data Dictionary’ button,

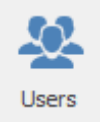


or by entering the data dictionary and pressing ‘+’ button at the bottom of the window.

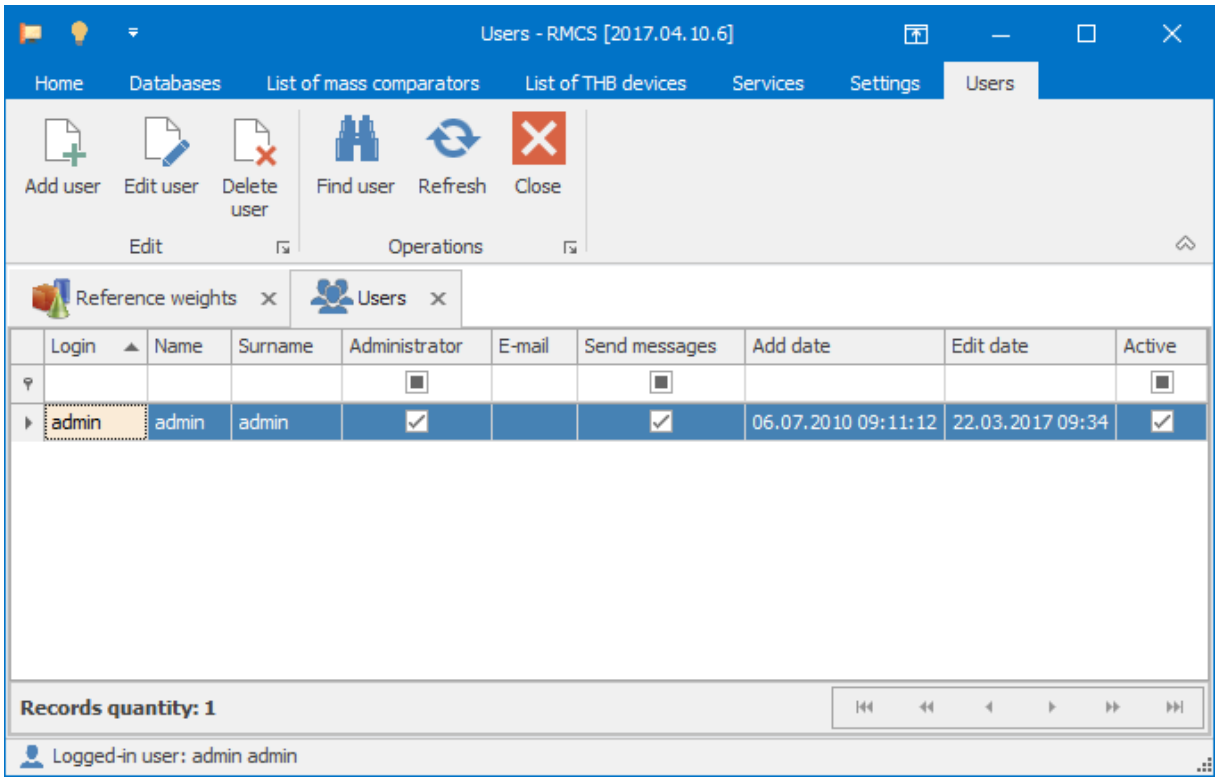
If you want to edit a particular record, click it twice and modify the introduced text.

If you want to remove a particular record, press ‘-‘ button at the bottom of the window.

6.4. Operators database

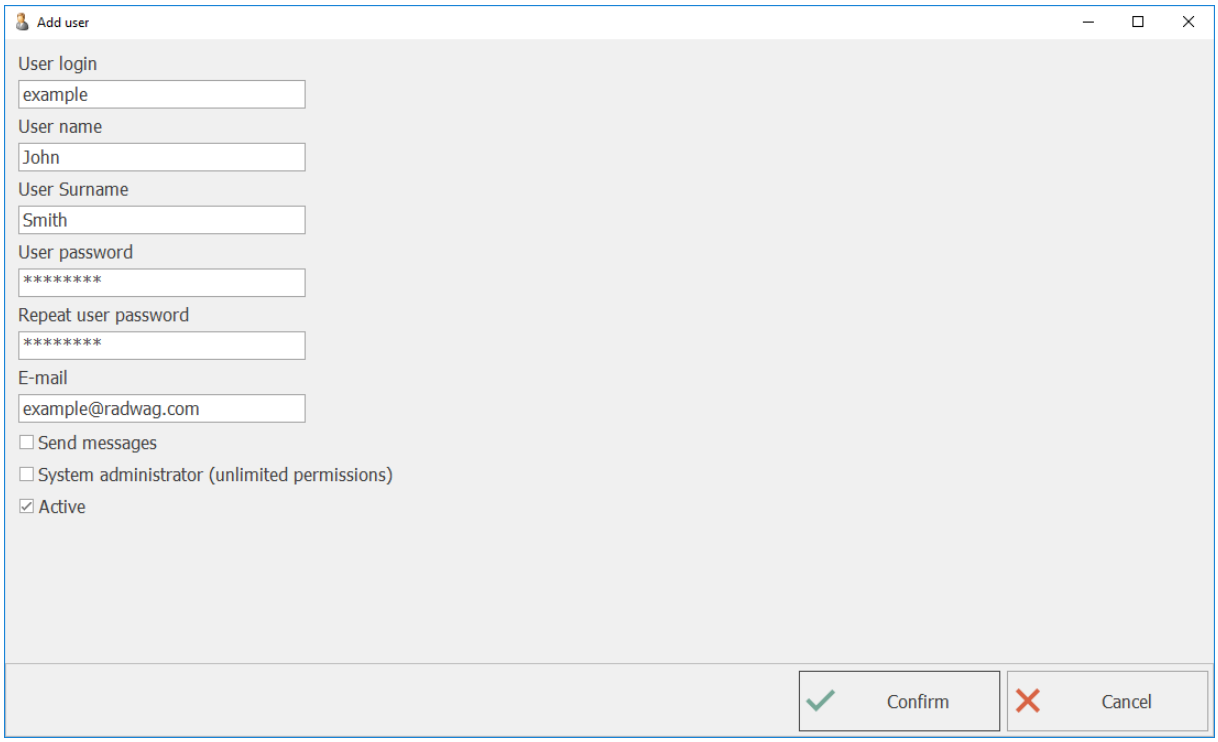


Operators database is designed to provide identification of a particular operator in course of operation, and to specify permissions level for system resources.



Users data provides the following information:

- user login
- user first name
- user last name
- user password
- date of granting permissions
- permissions level

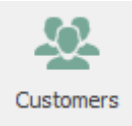


There are two permissions levels, manager and administrator. Administrator is granted unlimited access rights, the extent of access for manager is limited to functions necessary for mass comparison purposes.

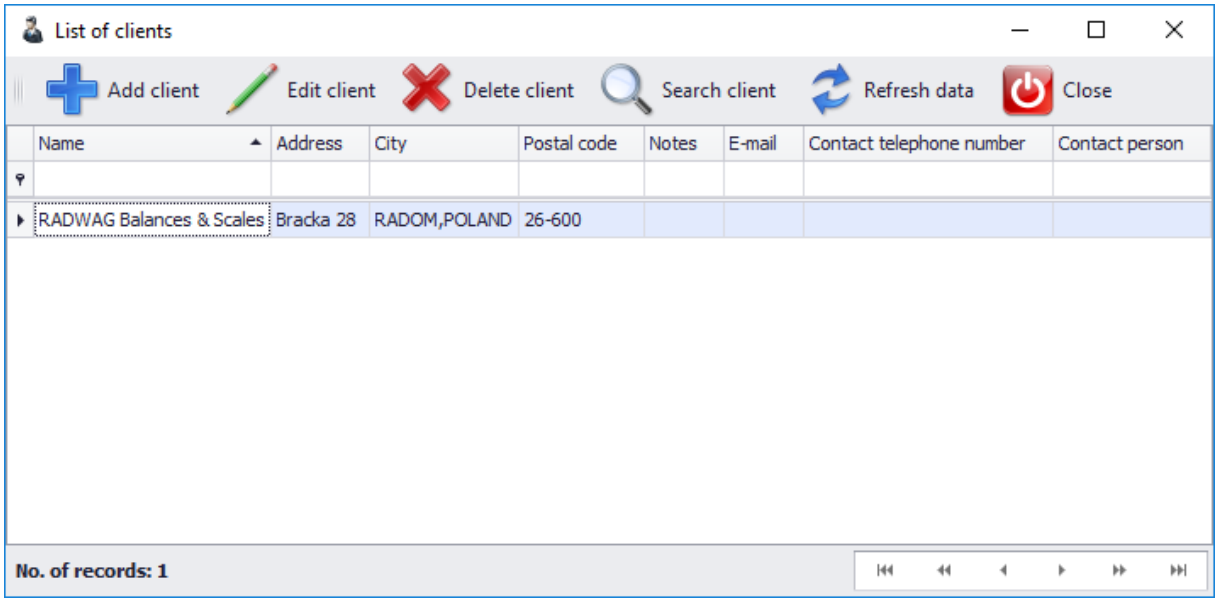
List of permissions for manager:

- Tasks – window preview enabled, new tasks introduction disabled
- Orders – window preview enabled, new orders introduction disabled
- Clients – window preview enabled, new clients introduction disabled
- List of tasks – unlimited access
- Calibration results – unlimited access
- Testing weights without orders – unlimited access
- List of definitions of orders – unlimited access
- Data Dictionaries – unlimited access
- Comparators – window preview enabled, new comparator introduction disabled
- Operators - window preview enabled, new operator introduction disabled
- Data record - window preview enabled, record of data disabled
- THB settings - window preview enabled, THB settings modification disabled
- Settings – settings modification enabled, company data modification disabled

6.5. Customers database

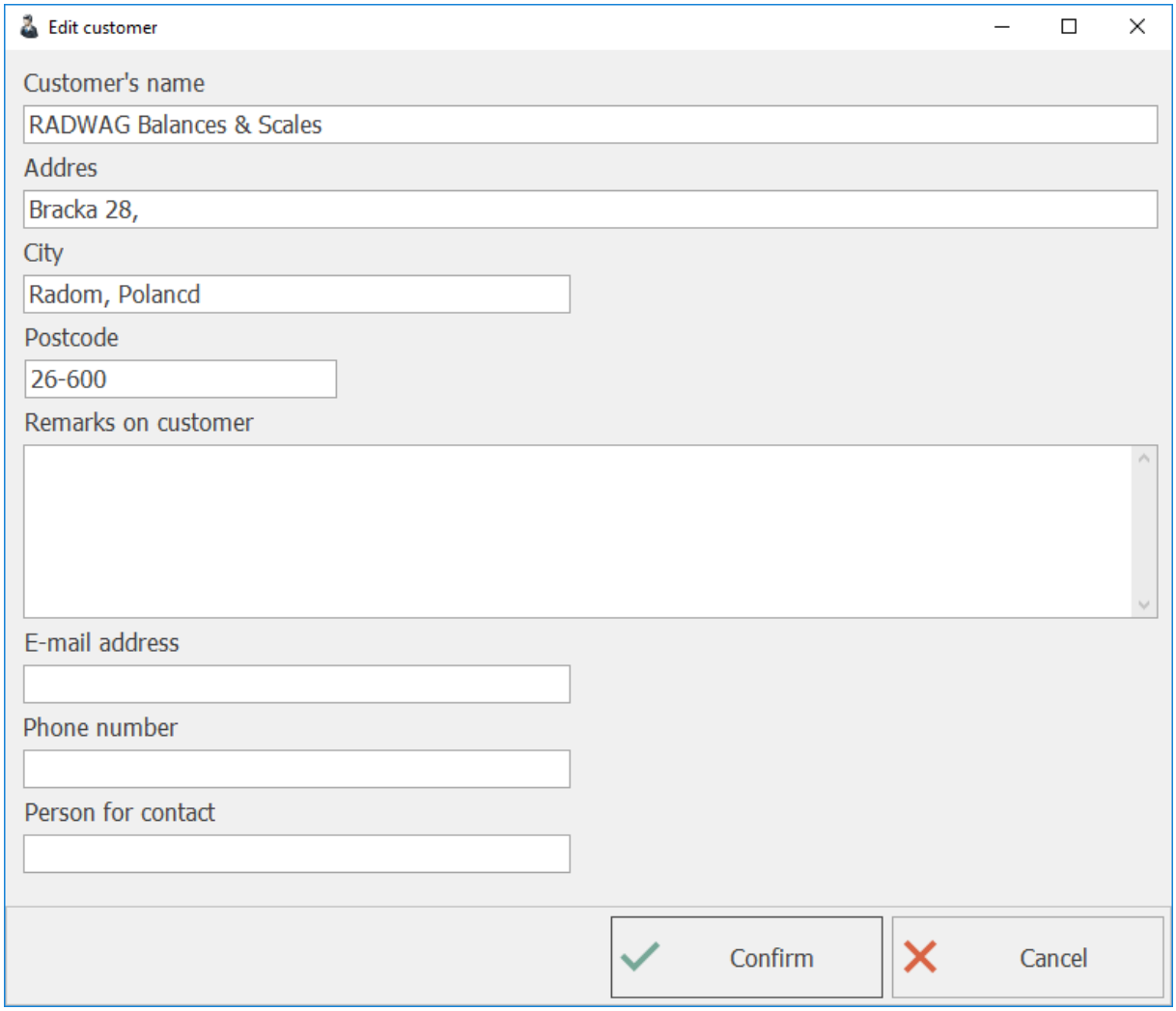


Customers database of **RMCS** system is designed to provide identification of orders and to enable creation of reports and calibration certificates.

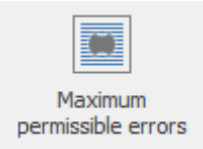


Clients data provides the following information:

- client's name
- client's address
- client's town/city
- client's postal code
- notes referring to the client
- client's e-mail address
- client's phone number
- contact person



6.6. Maximum permissible errors database



RMCS system features database of maximum permissible errors (MPE), specified by OIML. The MPE database cannot be modified directly. If you

do need to introduce modifications contact RADWAG, the company will implement a new table.

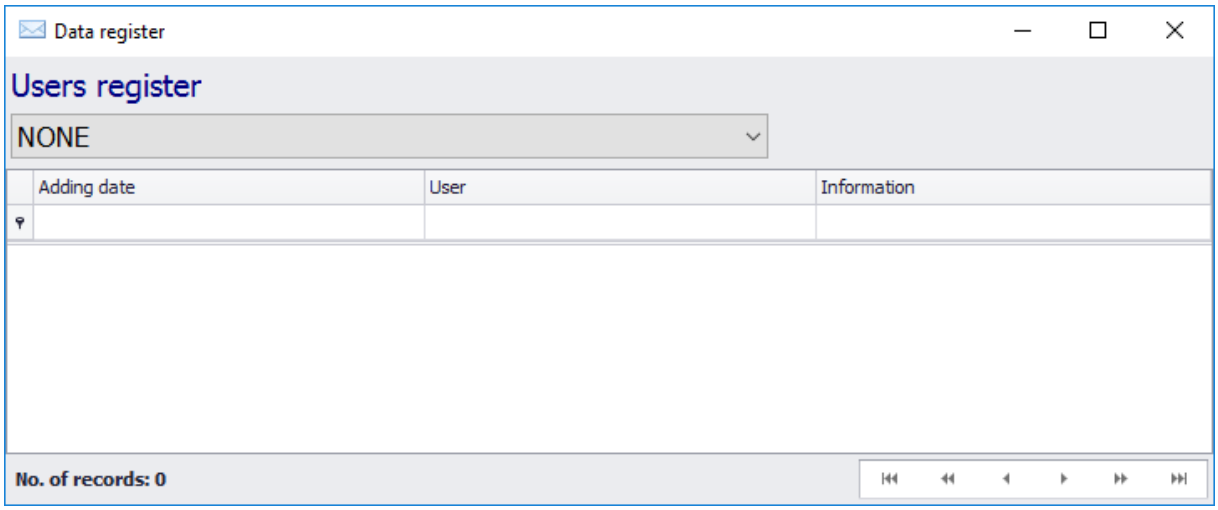
Maximum Permissible Errors

MAXIMUM PERMISSIBLE ERRORS FOR MASS STANDARDS/WEIGHTS

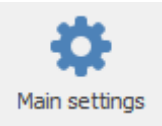
Nominal value [g]	E1 [mg]	E2 [mg]	F1 [mg]	F2 [mg]	M1 [mg]	M1-2 [mg]	M2 [mg]	M2-3 [mg]	M3 (OIML)
50000	25	80	250	800	2500	5000	8000	16000	25000
20000	10	30	100	300	1000		3000		10000
10000	5	16	50	160	500		1600		5000
5000	2,5	8	25	80	250		800		2500
2000	1	3	10	30	100		300		1000
1000	0,5	1,6	5	16	50		160		500
500	0,25	0,8	2,5	8	25		80		250
200	0,1	0,3	1	3	10		30		100
100	0,05	0,16	0,5	1,6	5		16		50
50	0,03	0,1	0,3	1	3		10		30
20	0,025	0,08	0,25	0,8	2,5		8		25
10	0,02	0,06	0,2	0,6	2		6		20
5	0,016	0,05	0,16	0,5	1,6		5		16
2	0,012	0,04	0,12	0,4	1,2		4		12
1	0,01	0,03	0,1	0,3	1		3		10
0,5	0,008	0,025	0,08	0,25	0,8		2,5		
0,2	0,006	0,02	0,06	0,2	0,6		2		
0,1	0,005	0,016	0,05	0,16	0,5		1,6		
0,05	0,004	0,012	0,04	0,12	0,4				
0,02	0,003	0,01	0,03	0,1	0,3				
0,01	0,003	0,008	0,025	0,08	0,25				
0,005	0,003	0,006	0,02	0,06	0,2				
0,002	0,003	0,006	0,02	0,06	0,2				
0,001	0,003	0,006	0,02	0,06	0,2				

6.7. Information register

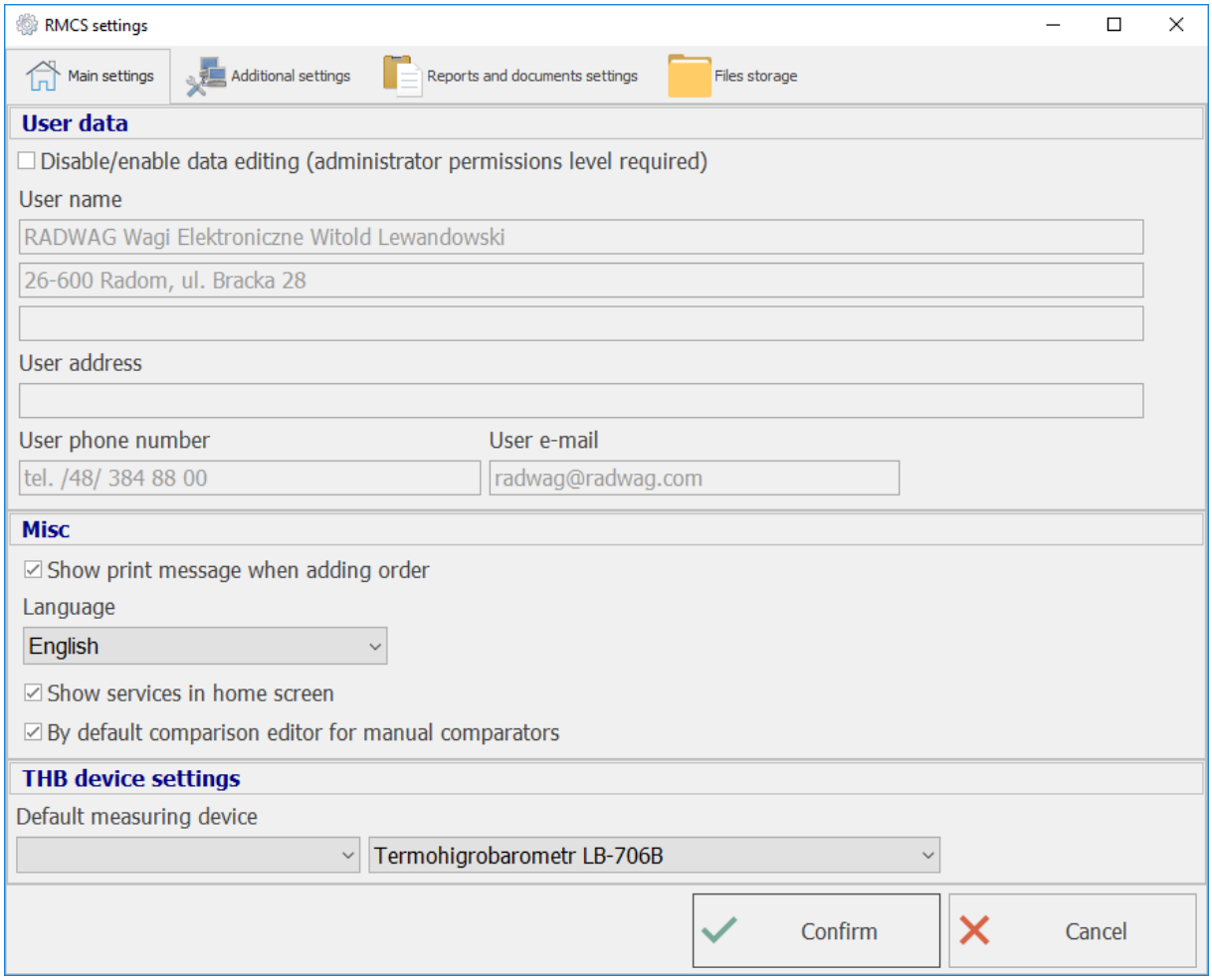
RMCS system features register of the most important information. Information on adding, editing and deleting of databases is recorded next to errors occurring in course of logging and other system events.



6.8. Setup

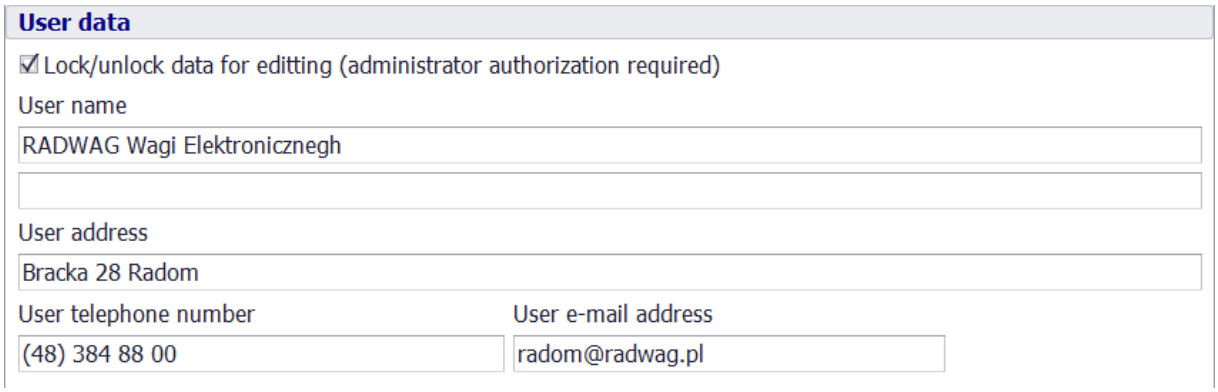


The settings window, accessed by using *'Main settings'* button in the *'Settings'* tab, allows customized configuration of **RMCS** system, respective to a particular company needs.



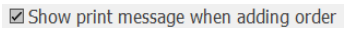
Upon completed installation, RMCS system setup is required. First enter identification data of company owing the software. The data can be introduced by an administrator exclusively. The administrator shall provide the following information:

- company name,
- company address,
- phone number,
- e-mail address.



RS232 port settings determine comparator-computer communication for manual comparison with the use of computer. RS232 port number and baud rate have to be set.

Language menu serves to determine language for the software.

By ticking 

option, the user determines whether he/she wants the system to ask operator adding a new order if the order shall be printed or not.

6.9. THB setup

RMCS system supports ambient condition recorders manufactured by RADWAG. The software detects THB devices, providing they have been added and configured.

THB devices

Device no.	Device description	IP address	Temp. correction	Temp. uncertainty	Hum. correction	Hum. uncertainty	Press. correction	Press. correction	Modification date	Calibration date	Edit date	Active
927/3924	Termohigrobarometr LB-706B	172.16.10.200	0,01	0,12	0,4	0,6	0,1	0,2	23.03.2017	07.02.2017	23.03.2017 08:43	☑
356/2065	Termohigrobarometr LB 706B	172.16.10.200	0	0,12	0,1	0,6	0	0,2	22.03.2017	13.07.2016	22.03.2017 21:51	☑

Records quantity: 2

Data stored by device that is directly connected to a computer can be presented using the RMCS software. Data recorded by THB devices connected to comparators can be previewed using comparator's terminal.

THB data shall provide the following information:

- device number
- device name
- IP address for the device
- temperature corrections
- temperature uncertainty
- humidity corrections
- humidity uncertainty
- atmospheric pressure corrections
- atmospheric pressure uncertainty
- IP address for the device (of THB software)

Edit device

Device no.
356/2065

Device description
Termohigrobarometr LB 706B

Temperature - correction
0

Pressure - correction
0

Temperature - uncertainty
0,12

Pressure - uncertainty
0,2

Humidity - correction
0,1

Humidity - uncertainty
0,6

Last calibration date
13.07.2016

Calibration time interval (months quantity)
24

☑ THB devices operating in local net

Device IP Address
172.16.10.200

Address
0

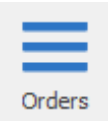
☑ Active

Confirm

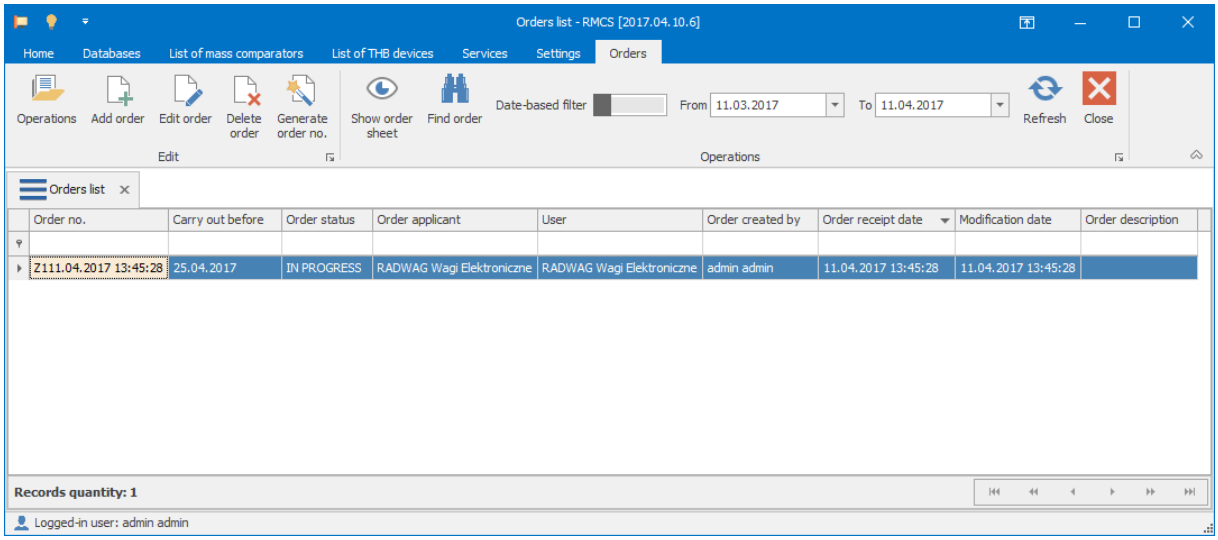
Cancel

The entered information is used for calculations and for presentation of data on a calibration datasheet and on a calibration certificate.

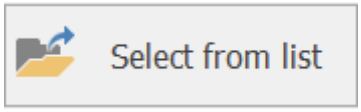
7. Orders



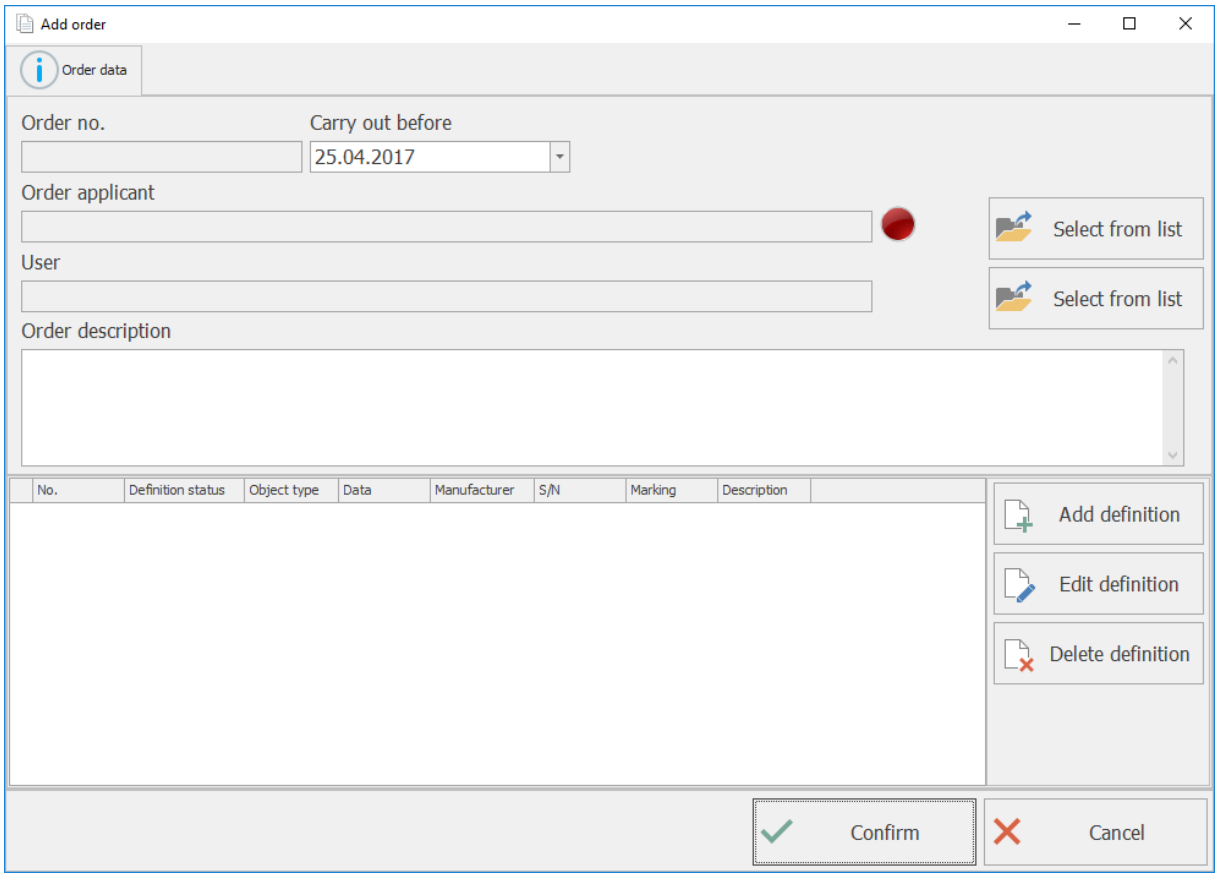
RMCS system is based on orders which are used to comparation procedures. Introduce an order storing any necessary data on the client, performance date, order description and list of standards for testing.



Data such as customer and mass standard user form basis for an order. If no mass standard user is selected then customer is treated as the mass standard user automatically. Both customer and the mass standard user are selected from the table of clients by means of "*Select from the list*" button.



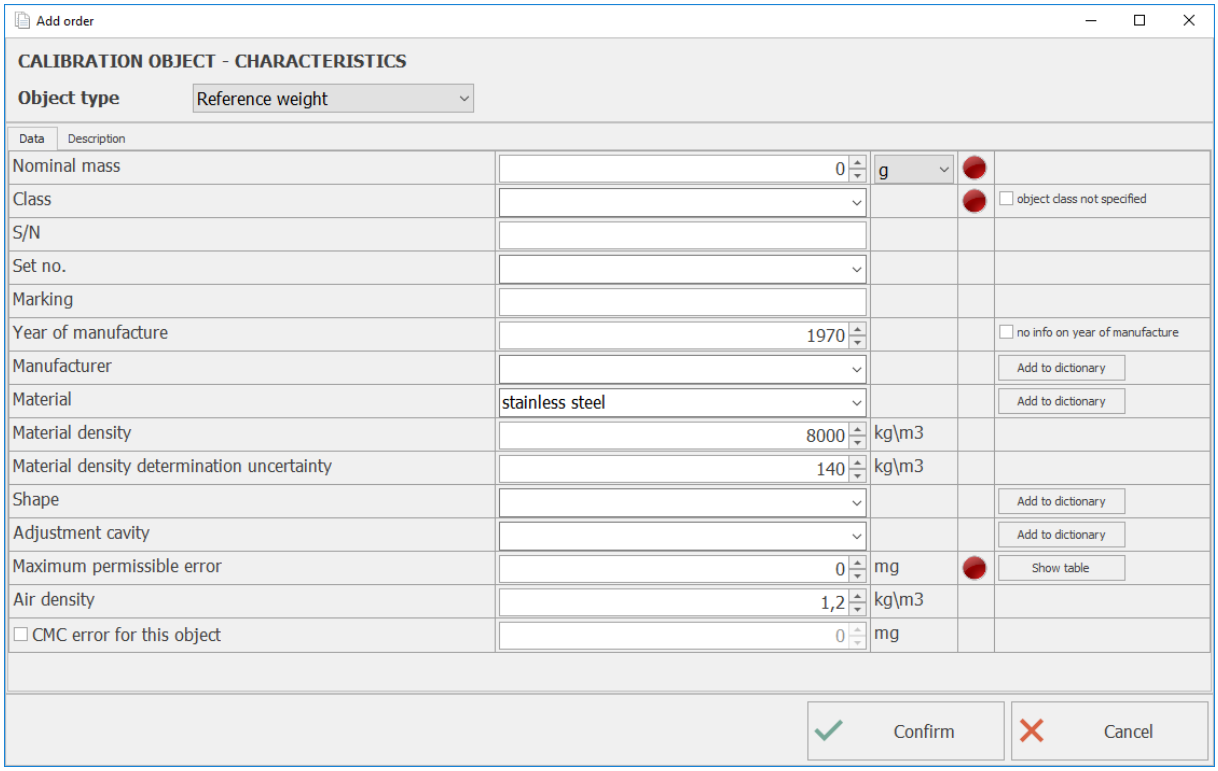
It is necessary to add mass standards for testing to the order. Adding, editing and deleting are operations that can be performed for mass standards.



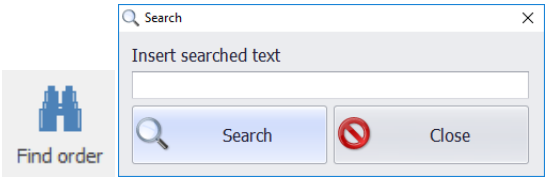
While adding mass standard specify the following parameters:

- nominal mass
- mass standard class
- serial number
- mass standard marking
- year of manufacture
- manufacturer
- material
- shape
- calibration
- maximum permissible error
- density

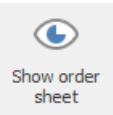
When you select nominal mass and mass standard class, the maximum permissible error is determined automatically. If there is such a need you can enter the error value manually or select it from the MPE table.



The main desktop features option enabling user to search orders,

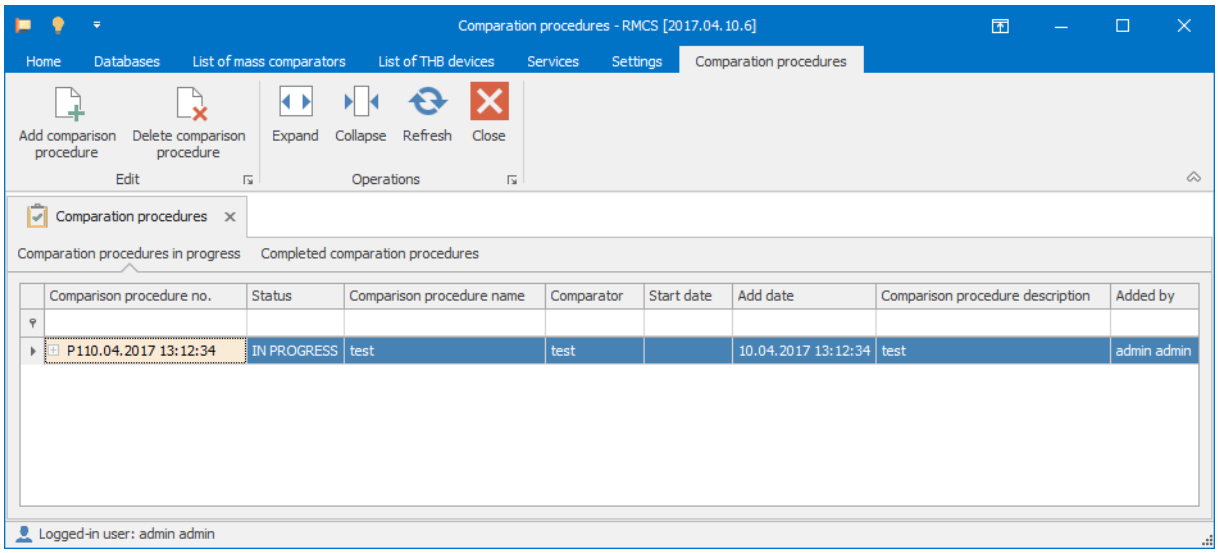


and to print them.



8. Comparation procedures

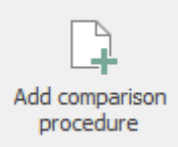
Synchronization in **RMCS** system is carried out on the basis of tasks assigned to a particular device or comparator. Any task can be assigned to a specified comparator or user. The tasks can be divided into such ones that can be carried out by means of weighing terminals and those that can be performed using computer workstation.



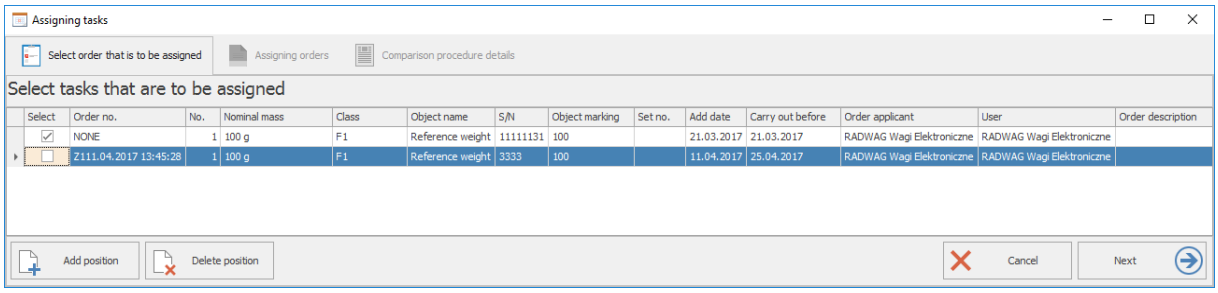
The window has been divided into two sections. Top section contains tasks that are not assigned. Bottom section features tasks that are currently being carried out and tasks that have already been performed.

Orders serve as a basis for tasks. Add an order in a window designed for tasks, records on the basis of which tasks are formed shall be generated automatically.

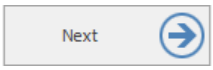
In order to add a new procedure press “Add new task” button.



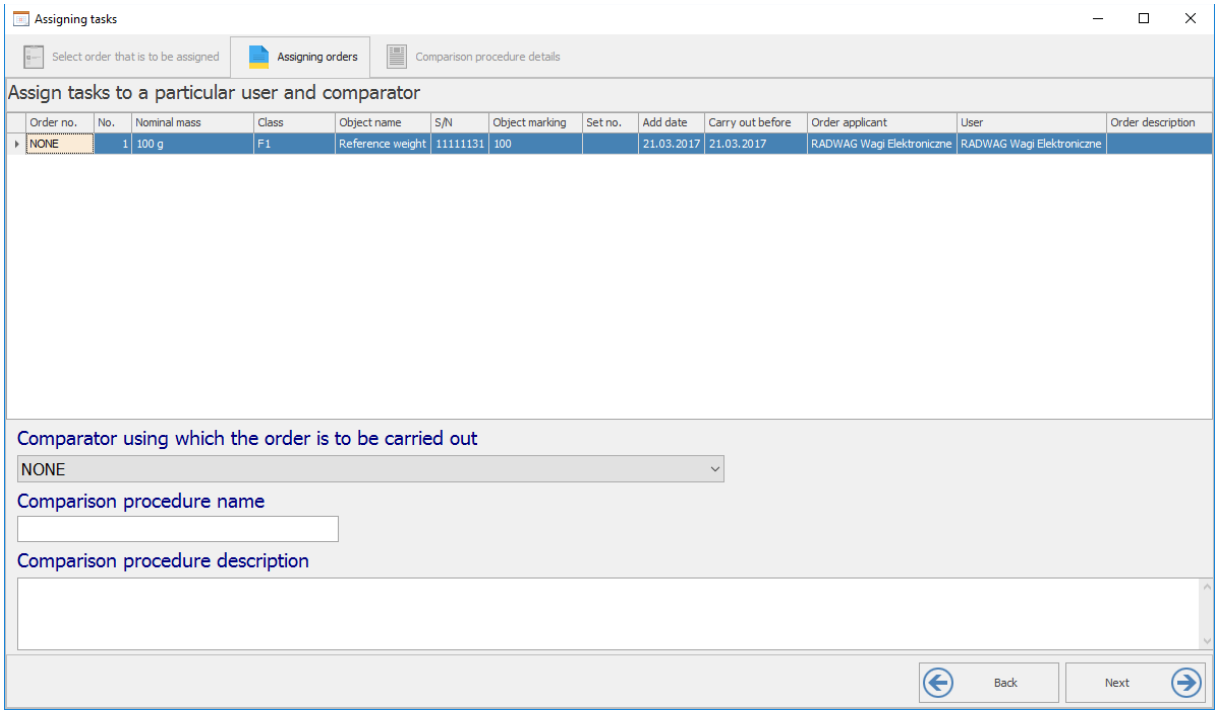
Choose orders to add to the newly created procedure.



Press ‘next’ button.

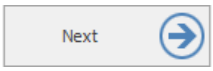


Select comparator to which tasks are to be assigned, chose an operator that is to carry out the tasks. When sending the tasks to a comparator terminal it is not necessary to appoint the operator.

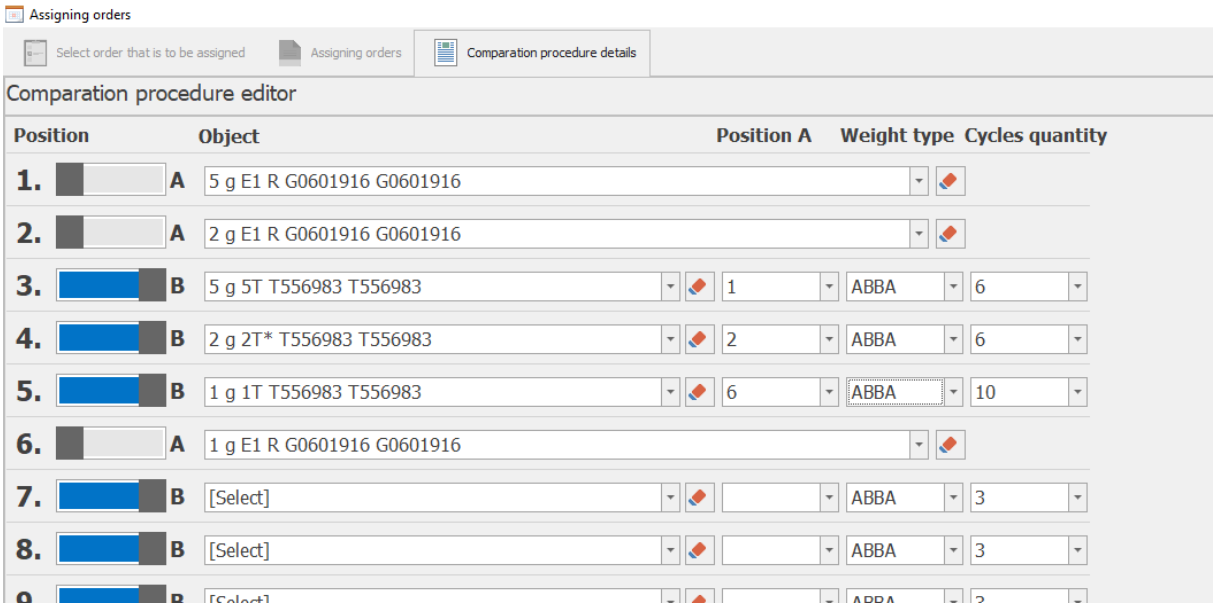


You can provide task description, having completed configuration press ‘tick’ button for confirmation.

Press ‘next’ button.



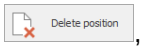
The next window allows assigning test weights (marked as ‘B’) with reference weights (marked as ‘A’), select a method and number of cycles to be performed.



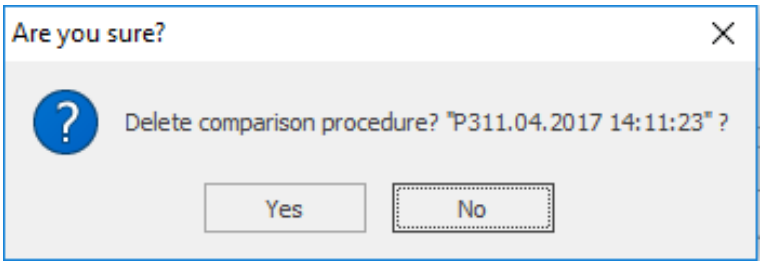
After all test weights are assigned confirm the procedure.

Data is automatically displayed in a window featuring tasks to be performed, the tasks are automatically sent to comparators terminals.

In order to delete a particular task that is to be performed or such one that has been performed first select the task, next press delete button,



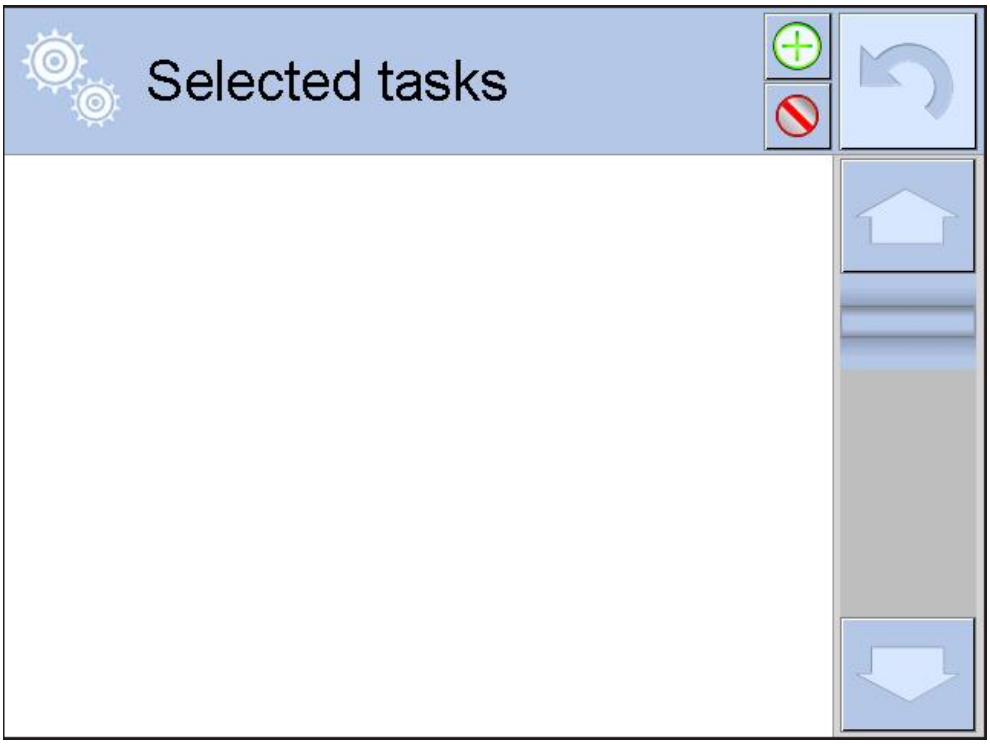
, and finally confirm the operation.

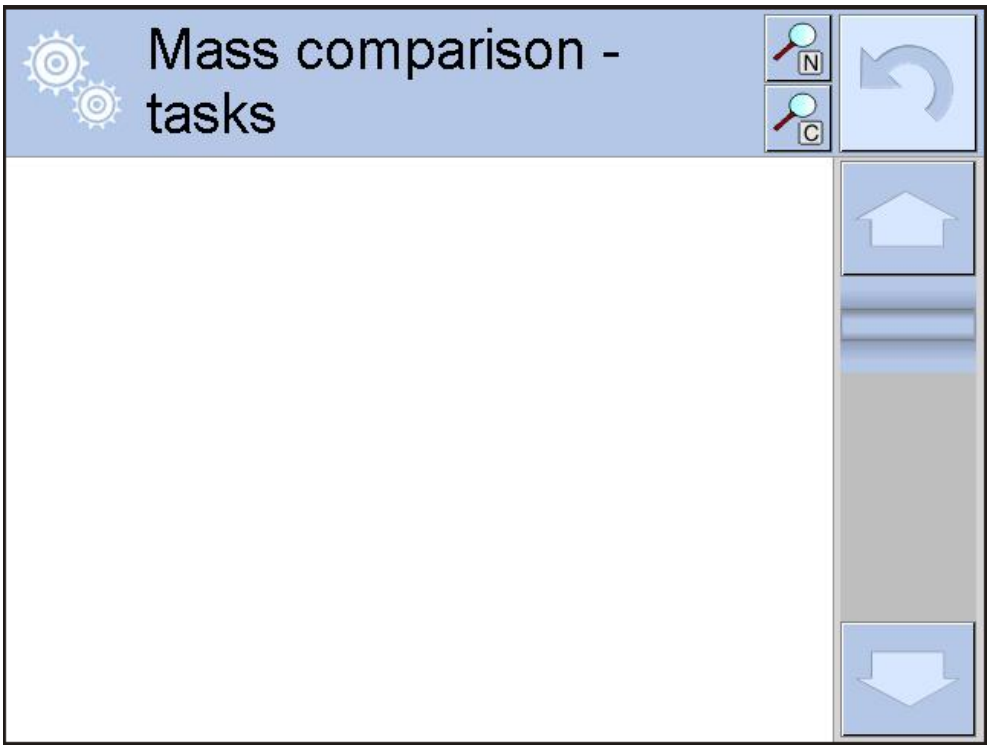


9. Calibration by means of a mass comparator terminal

Calibration can start when synchronization of data with comparator terminal has been completed. First it is necessary to specify comparison method and number of comparison cycles.

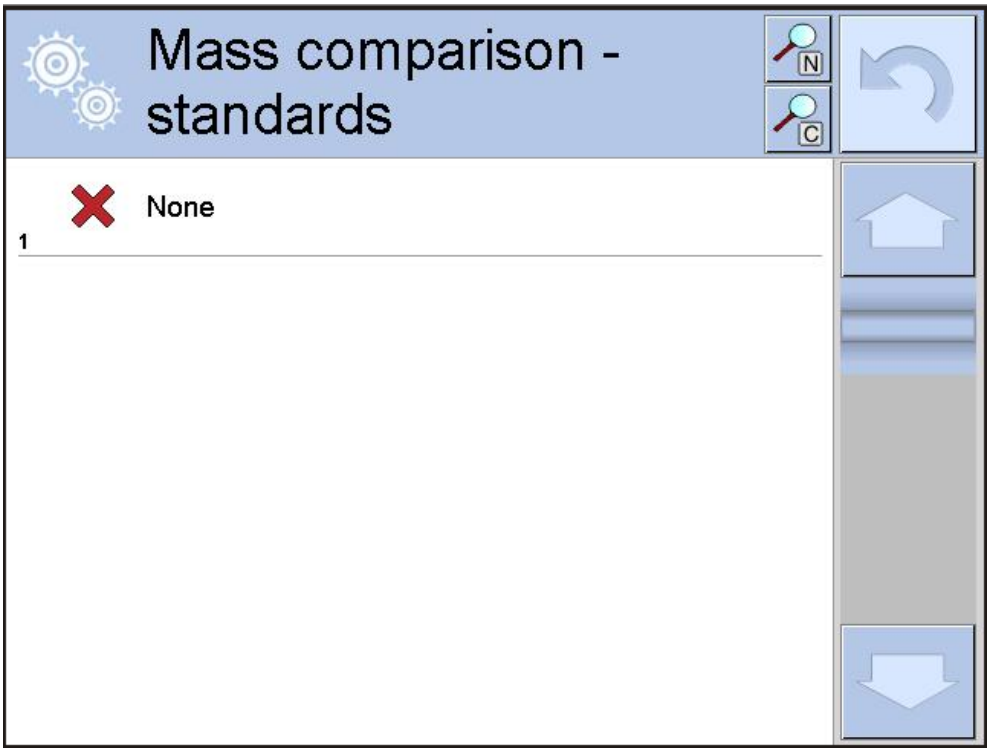
Next, the operator shall select a task . Window with tasks is displayed. By pressing button, select particular tasks.





When the task has been selected, choose mass standard for comparison. To choose the appropriate mass standard press the following button,

next select the appropriate weight.

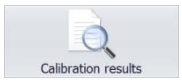


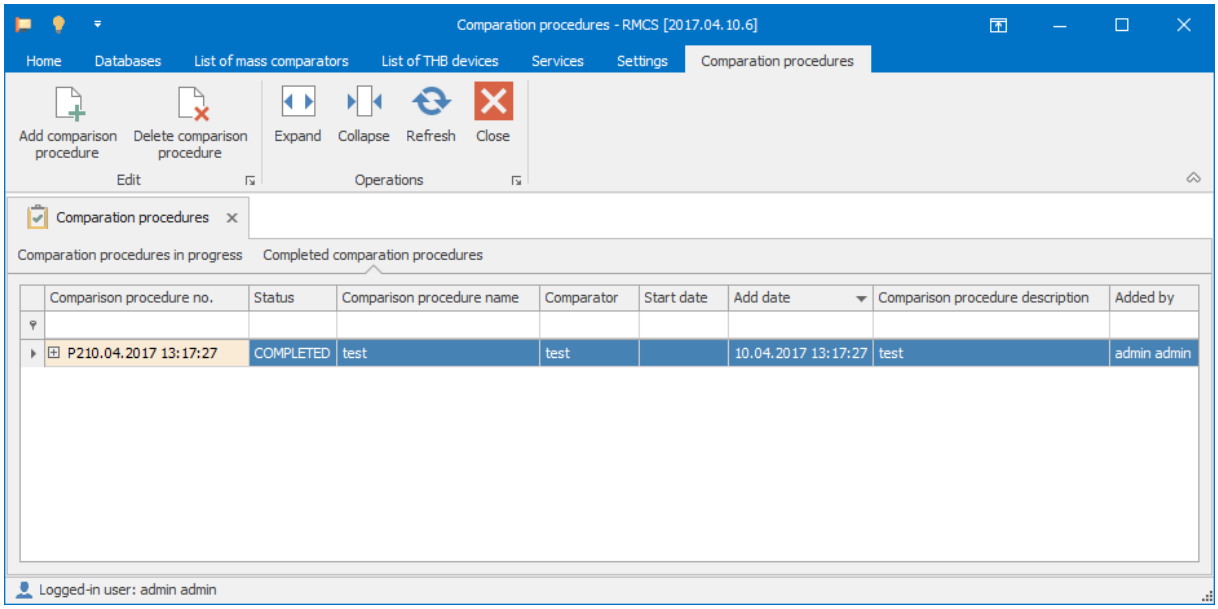
Having started comparison follow the wizard of comparator terminal. Automatic comparators start and perform comparison process automatically.

Press button located on your comparator, with this comparison starts. Upon completed comparison all data is automatically sent to RMCS system.

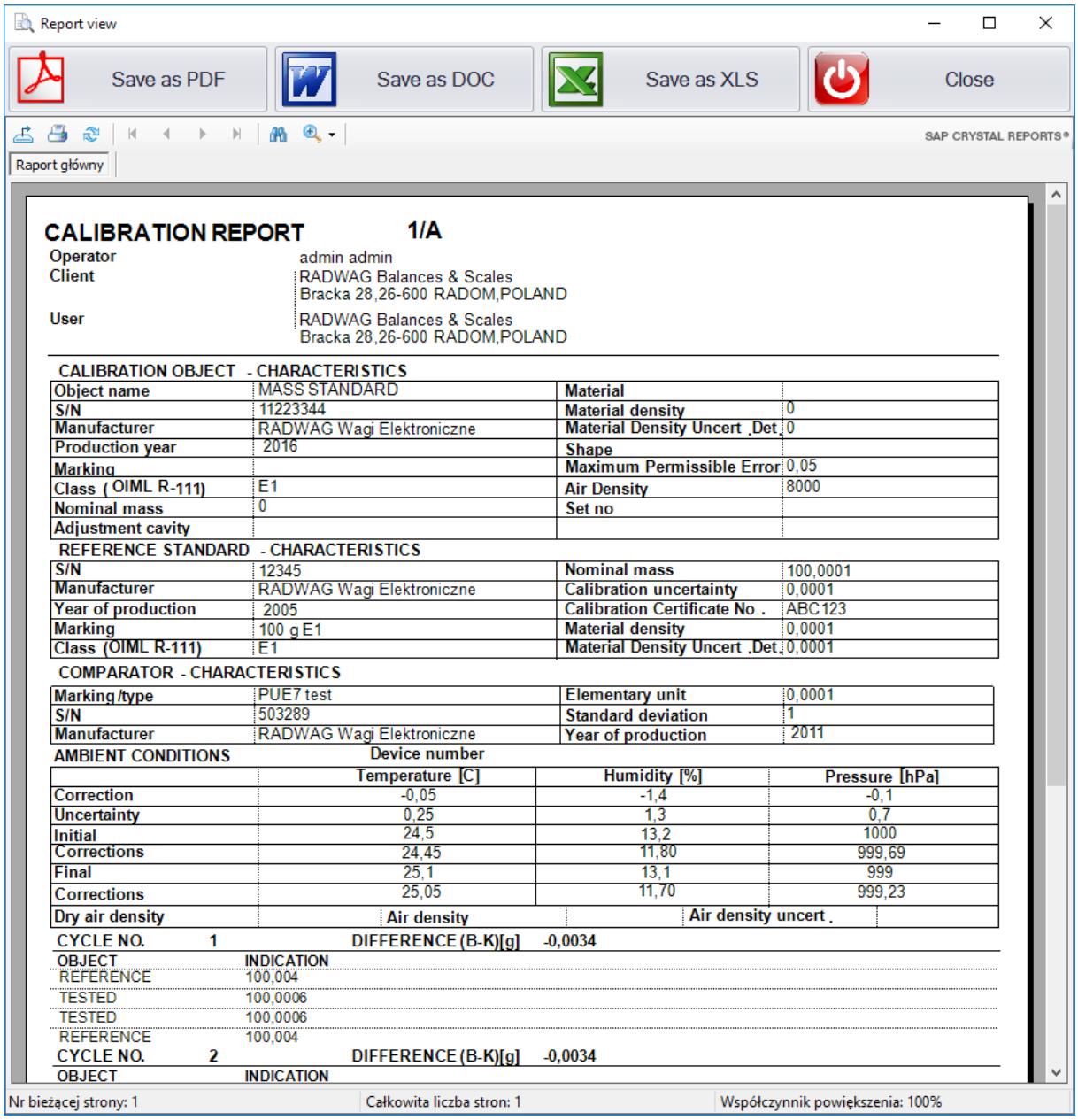
10. Reports

Reports are a result of calibration process performed in RMCS system. Using them the operator can preview calibration process and generate report-based calibration certificates. Reports window opens by pressing the following button.





The window features two bookmarks: calibration results and calibration certificates. It is possible to preview calibration datasheet, which is useful prior to printout or export operations. The datasheet can be exported to Word, Excel or Pdf formats.



Report view

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SAP CRYSTAL REPORTS®

Raport główny

CALIBRATION REPORT **1/A**

Operator	admin admin
Client	RADWAG Balances & Scales Bracka 28,26-600 RADOM,POLAND
User	RADWAG Balances & Scales Bracka 28,26-600 RADOM,POLAND

CALIBRATION OBJECT - CHARACTERISTICS

Object name	MASS STANDARD	Material	
S/N	11223344	Material density	0
Manufacturer	RADWAG Wagi Elektroniczne	Material Density Uncert .Det .	0
Production year	2016	Shape	
Marking		Maximum Permissible Error	0,05
Class (OIML R-111)	E1	Air Density	8000
Nominal mass	0	Set no	
Adjustment cavity			

REFERENCE STANDARD - CHARACTERISTICS

S/N	12345	Nominal mass	100,0001
Manufacturer	RADWAG Wagi Elektroniczne	Calibration uncertainty	0,0001
Year of production	2005	Calibration Certificate No .	ABC123
Marking	100 g E1	Material density	0,0001
Class (OIML R-111)	E1	Material Density Uncert .Det .	0,0001

COMPARATOR - CHARACTERISTICS

Marking /type	PUE7 test	Elementary unit	0,0001
S/N	503289	Standard deviation	1
Manufacturer	RADWAG Wagi Elektroniczne	Year of production	2011

AMBIENT CONDITIONS Device number

	Temperature [C]	Humidity [%]	Pressure [hPa]
Correction	-0,05	-1,4	-0,1
Uncertainty	0,25	1,3	0,7
Initial	24,5	13,2	1000
Corrections	24,45	11,80	999,69
Final	25,1	13,1	999
Corrections	25,05	11,70	999,23

Dry air density		Air density		Air density uncert .	

CYCLE NO. 1 DIFFERENCE (B-K)[g] -0,0034

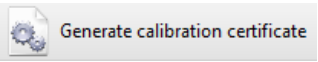
OBJECT	INDICATION
REFERENCE	100,004
TESTED	100,0006
TESTED	100,0006
REFERENCE	100,004

CYCLE NO. 2 DIFFERENCE (B-K)[g] -0,0034

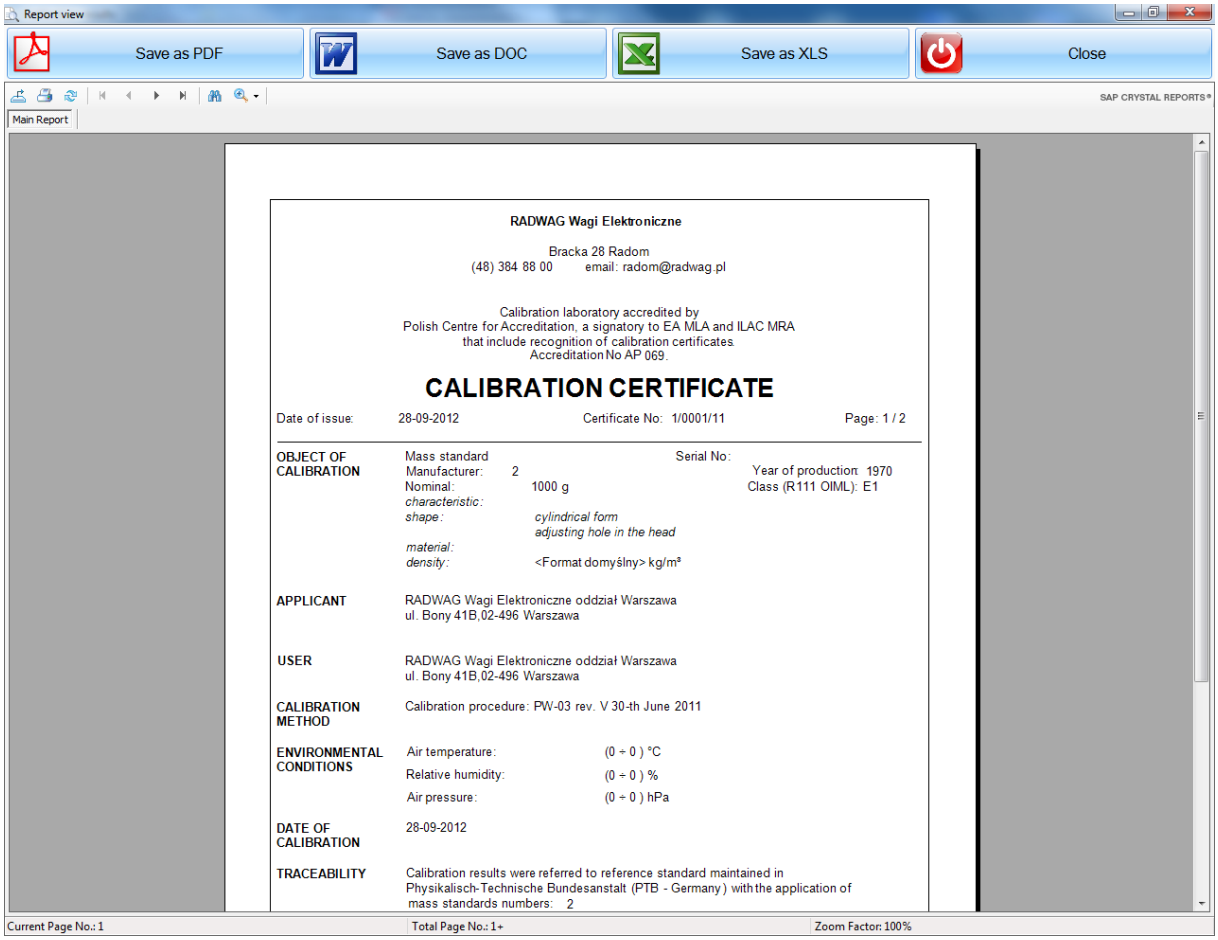
OBJECT	INDICATION

Nr bieżącej strony: 1 | Całkowita liczba stron: 1 | Współczynnik powiększenia: 100%

Calibration datasheet forms the basis for calibration certificate. In order to generate calibration certificate the operator has to tick respective calibration datasheets and press “generate calibration certificate” button:



Generated calibration certificates can be previewed in „Calibration certificates” bookmark. The certificates can be either printed or exported to various file formats.



Report view

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Main Report

SAP CRYSTAL REPORTS®

RADWAG Wagi Elektroniczne

Bracka 28 Radom
(48) 384 88 00 email: radom@radwag.pl

Calibration laboratory accredited by
Polish Centre for Accreditation, a signatory to EA MLA and ILAC MRA
that include recognition of calibration certificates.
Accreditation No AP 069.

CALIBRATION CERTIFICATE

Date of issue: 28-09-2012 Certificate No: 1/0001/11 Page: 1 / 2

OBJECT OF CALIBRATION	Mass standard	Serial No:
	Manufacturer: 2	Year of production: 1970
	Nominal: 1000 g	Class (R111 OIML): E1
	characteristic:	
	shape:	*cylindrical form*
		adjusting hole in the head
	material:	
	density:	<Format domyślny> kg/m³
APPLICANT	RADWAG Wagi Elektroniczne oddział Warszawa ul. Bony 41B,02-496 Warszawa	
USER	RADWAG Wagi Elektroniczne oddział Warszawa ul. Bony 41B,02-496 Warszawa	
CALIBRATION METHOD	Calibration procedure: PW-03 rev. V 30-th June 2011	
ENVIRONMENTAL CONDITIONS	Air temperature:	(0 ÷ 0) °C
	Relative humidity:	(0 ÷ 0) %
	Air pressure:	(0 ÷ 0) hPa
DATE OF CALIBRATION	28-09-2012	
TRACEABILITY	Calibration results were referred to reference standard maintained in Physikalisch-Technische Bundesanstalt (PTB - Germany) with the application of mass standards numbers: 2	

Current Page No.: 1 Total Page No.: 1+ Zoom Factor: 100%

11. Other

Procedure for calculation:

1. Calculation for ABBA mass indications difference

The following calculations is being carried out with reference to number of cycles:

$$\bar{r} = \bar{B} - \bar{A}$$

where: r – B-A indications difference
B – balance/comparator indication for a tested mass standard
A – balance/comparator indication for a reference mass standard

Mean value is given as a final result of r value, it is refered to number of cycles.

Calibration result is as follows:

$$m = m_N + \bar{r}$$

where: m – mass of a tested mass standard after calibration
m_n – nominal mass of a tested mass standard

2. Calculations for uncertainty of measurements

Expanded uncertainty for mass standards calibration:

$$U = k \cdot \sqrt{u_w^2(\Delta \bar{m}_c) + u^2(m_{cr}) + u_b^2 + u_{ba}^2}$$

where: $u_w(\overline{\Delta m_c})$ - standard uncertainty related to a weighing process:

$$u_w(\overline{\Delta m_c}) = \frac{s(\Delta m_{ci})}{\sqrt{n}}$$

where: $\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(\Delta m_{ci} - \overline{\Delta m_d})^2}$
n – number of ABBA cycles

$$u(m_{cr}) = \sqrt{\left(\frac{U}{k}\right)^2 + u_{inst}^2(m_{cr})}$$

- standard uncertainty related to reference mass standard

where: U – expanded uncertainty of reference mass standard (taken form calibration certificate of reference mass standard)

k – expansion coefficient for calibration of reference mass standard (taken form calibration certificate of reference mass standard)

u_b^2 - uncertainty related to air buoyancy

$$u_b^2 = \left[m_{cr}\frac{(\rho_r - \rho_t)}{\rho_r \rho_t}\cdot u(\rho_a)\right]^2 + \left[m_{cr}(\rho_a - \rho_0)\right]^2 \cdot \frac{u^2(\rho_t)}{\rho_t^4} + m_{cr}^2(\rho_a - \rho_0)\left[(\rho_a - \rho_0) - 2(\rho_{al} - \rho_0)\right]\cdot\frac{u^2(\rho_r)}{\rho_r^4}$$

where: m_{cr} – tested mass standard weight

ρ_r – density for reference mass standard

ρ_t – density of tested mass standard

$u(\rho_a)$ - standard uncertainty related to air density

$$u(\rho_a) = \frac{0{,}12}{\sqrt{3}}$$

ρ_a – air density (measured air)

ρ_0 – reference air density = 1,2 kg m^{-3}

$u(\rho_t)$ – uncertainty for density of tested mass standard

ρ_{al} – air density for previous calibration of reference mass standard

$u(b)$ - standard uncertainty related to balance/comparator:

$$u(b) = \sqrt{u_s^2 + u_d^2 + u_E^2 + u_{ma}^2}$$

where: u_s^2 - uncertainty related to balance sensitivity

$$u_s^2 = (\overline{\Delta m_c})^2 \cdot \left(\frac{u^2(m_s)}{m_s} + \frac{u^2(\Delta I_s)}{\Delta I_s^2}\right)$$

where: ΔI_s – indication variation related to balance sensitivity

$u(\Delta I_s)$ – uncertainty related to ΔI_s

$\overline{\Delta m_c}$ – average difference of indications (r)

k – expansion coefficient

RADWAG BALANCES AND SCALES

ADVANCED WEIGHING TECHNOLOGIES