

# Matching a balance to actual ambient conditions

RADWAG Wagi Elektroniczne

The majority of presently manufactured balances feature a set of filters and other ancillary settings enabling optimization of instrument's operation in ambient conditions. Effective application of balance's features requires knowledge and a lot of practical experience. Therefore, some of the users are unable to properly utilize these mechanisms in practice. On such occasions, RADWAG offers technical support, here available in a form of a diagnostic function Filter Autotest, now available in balances series "Y".

The function is to automatically test balance repeatability of indications and determine the amount of time required for measurements in all combinations of filter → value release settings. The user can set up to 5 filtering levels and 3 value release levels. Thus, the whole test if carried out manually, would take extensive amount of time.

Filter	Value release	choice
Very fast	Fast	<input type="radio"/>
	Fast + reliable	<input type="radio"/>
	Reliable	<input type="radio"/>
Fast	Fast	<input type="radio"/>
	Fast + reliable	<input type="radio"/>
	Reliable	<input type="radio"/>
Average	Fast	<input type="radio"/>
	Fast + reliable	<input type="radio"/>
	Reliable	<input type="radio"/>
Slow	Fast	<input type="radio"/>
	Fast + reliable	<input checked="" type="radio"/>
	Reliable	<input type="radio"/>
Very Slow	Fast	<input type="radio"/>
	Fast + reliable	<input type="radio"/>
	Reliable	<input type="radio"/>

Repeatability, expressed as standard deviation is calculated from a series of 10 measurements carried out with application of internal adjustment mass, and below formula:

$$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$$

where:  $s$  – standard deviation  
 $x_i$  – the following measurement  
 $\bar{x}$  – arithmetic mean from a series of measurements  
 $n$  – number of repetitions of a measurements in a series

Standard deviation is a measure of value distribution with regard to the average – true value. As the test applies internal adjustment mass, the standard deviation is determined as deviation occurring while weighing a sample with similar mass. It is assumed here, that any ambient conditions which may influence the measurement, like electrostatics are absent.

For much lighter loads, which mass is 10 % of balance's Max capacity, repeatability is much better, and its determination requires individual approach.

Evaluated time of measurement is a form of approximation of how fast a measurement can be carried out with consideration of:

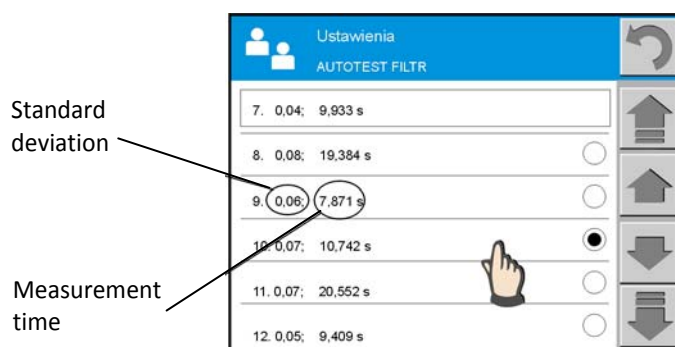
- the measurements if carried out automatically with mass built in a balance. Therefore the test conditions are practically repeatable in 100 %. In real test conditions (with external weight) it is almost impossible to ensure extremely repeatable conditions, as balance's weighing pan may be subject to a shock while placing a test load.
- measurement time as an average value from a series of 10 repetitions
- in case of balances with installed anti draft shield, there is no door opening and closing process, thus there is no air movement. The test procedure verifies only one parameter, while other are constant.
- in practice, the mass measurement process refers to objects like flasks, beakers, weighing vessels, etc. with various volumes and dimensions, thus the test procedure may be affected by influence of ambient conditions.

An analysis of test report enables selection of the optimal settings for specific ambient conditions with consideration of:

- measurement time or
- determined repeatability

If assumed, that ambient conditions are stable in time, then the optimization of parameters becomes obligatory. If ambient conditions change, or balance workstation changes, that the optimization of balance operation parameters should be inspected.

On completion of the test procedure, balance's display indicates a report listing all tested settings and test result. Below there is an instance of a report:



When clicking an optional report field, it is possible to view specific settings of a tested parameter. Below there is an instance of such statement:

Balance type	AS/Y
Factory no.	265322
Software rev.	DLY 1.11.13
Date	28-02-2011
Time	14:32:09
No. of measurements	10
Readability	0,0001 g
Internal adjustment mass	148 g
Filter (selected)	slow
Value release (selected)	fast+reliable
T start	23.65
T stop	23.72
Filter (test)	average
Value release (test)	fast+reliable
Repeatability [sd]	0,07 mg
Stabilization time	10,742 s

Autotest FILTER function is accessible in all balances series „Y” manufactured from March 2011 independently on model and readability.