Test&Motion

Application Module:

ME 1A – Compression test Metals acc. DIN 50106

Version 1.0 (State 20160819)

DOLI Elektronik GmbH

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1 Introduction

Dear customer, thank you for choosing a product of **DOLI Elektronik GmbH**. **Test&Motion** is a modern application for the operating systems Microsoft Windows XP/7/8/10©.

This manual does not deal with the **Test&Motion software** in general but with the application module Plastics Tensile Test ME 1A in particular. Hence, it is recommended to read the **Test&Motion** application manual in order to get familiar with the software. Please follow the demands and safety hints listed in the manual!

1.1 Symbols

The different symbols in this manual will allow you to find your way more easily.

Table 1: Symbols and their meanings.

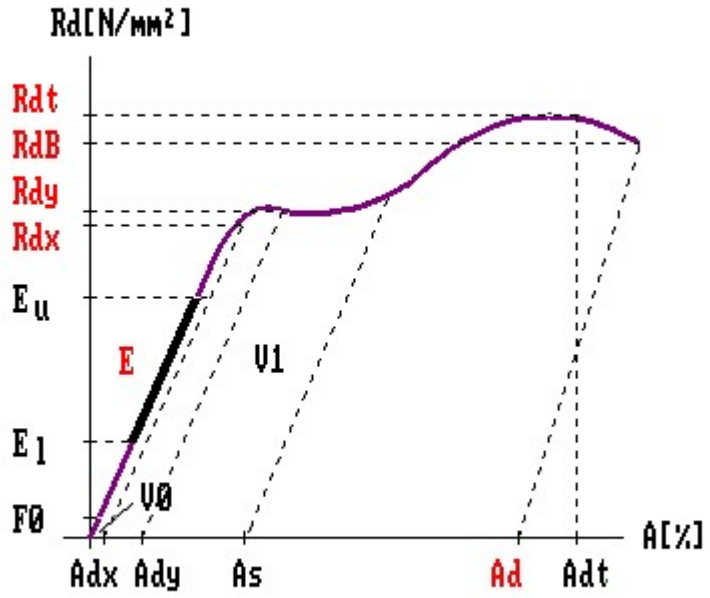
Symbol	Meaning
	**Safety Instructions:** **In order to avoid interruptions in the work flow as well as damages to man and machine, follow the safety instructions at all cost.**
	**Job/work instructions:** **Instructive part of the document with precise work instructions.** **Here you are asked to do something.**
	**Information:** **General information and descriptions of working procedures, etc.**
	**Note:** **Important note for the operation, the function or for the working procedures.**
	**Tip:** **Gives tips for easy handling of the Test&Motion Software, the EDCs or the testing instrument.**

2 Application module ME 1A: Compression test Metals acc. DIN 50106

2.1 Field of application

Determination of compression strength, compression limits, compression at fracture and Youngs modulus during compression test on metallic materials as per DIN 50 106.

2.2 Test graphic ME 1A



2.3 Input values ME 1A

1. Click Menu Test → Command Settings → Input values. Here you can find expedient input values for this test regulation, already. If necessary adjust the values to your needs.

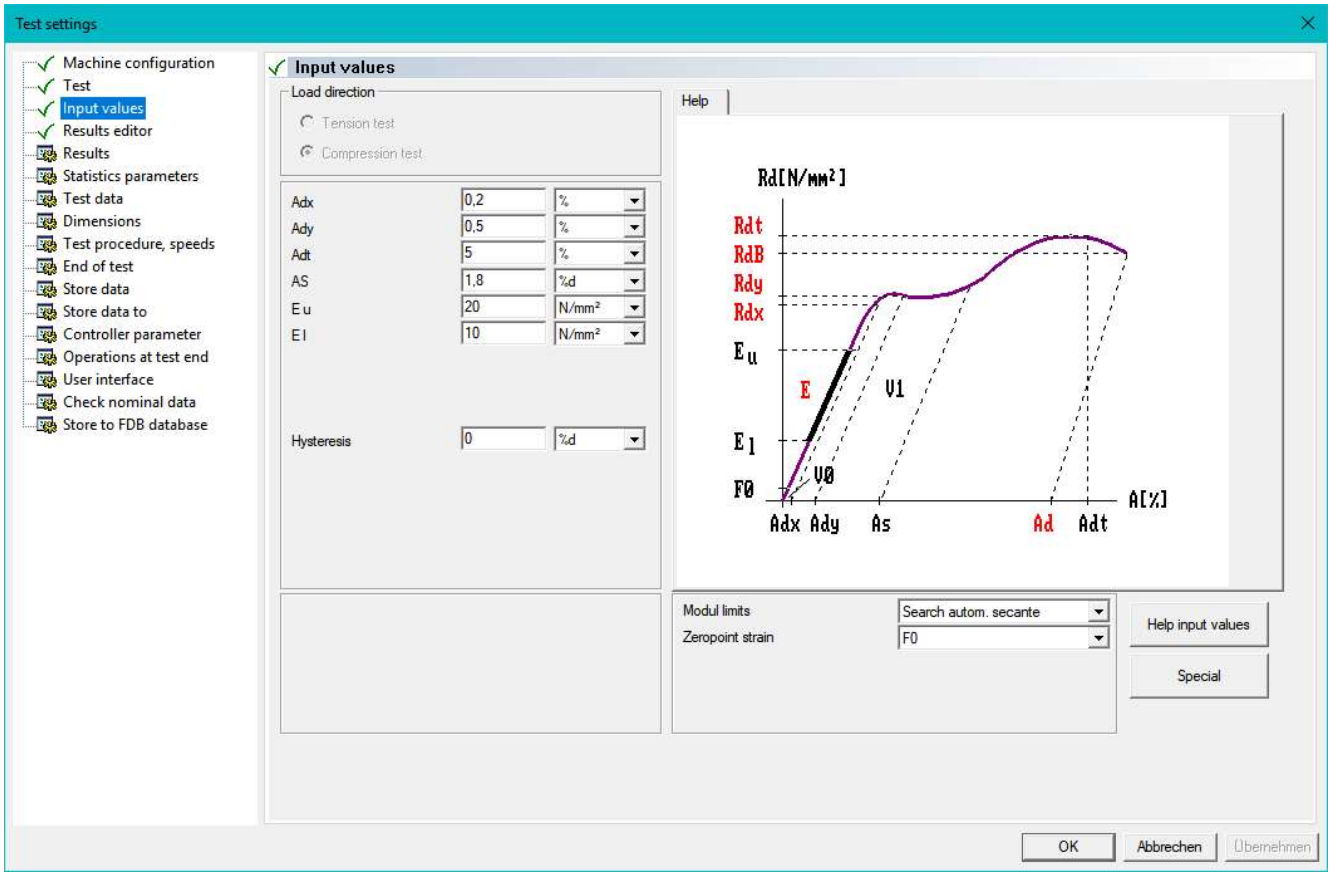


Table 2: Input values for test ME 1A.

Parameter	Meaning	Dimension / Selection possibilities
Adx	Non-proportional elongation at compression limit Rdx	[%]
Ady	Non-proportional elongation at compression limit Rdy	[%]
Adt	Total compression	[%]
As		[%d]
E u	Upper force/strength limit to determine Young's modulus	[N, kN], [N/mm²]
E l	Lower force/strength limit to determine Young's modulus	[N, kN], [N/mm²]

Choice:	Tensile modulus limits	• Search autom. 'secant' • Input value Fo, Fu • Search autom. regress. line
Zero point at	Zero point of elongation, strain at	• F0 • Intersection of modulus and x-Axis

2.4 Results ME 1A

1. Click Menu Test → Command Settings → Results. Here you can already find expedient results. If necessary, adjust the values to your needs.

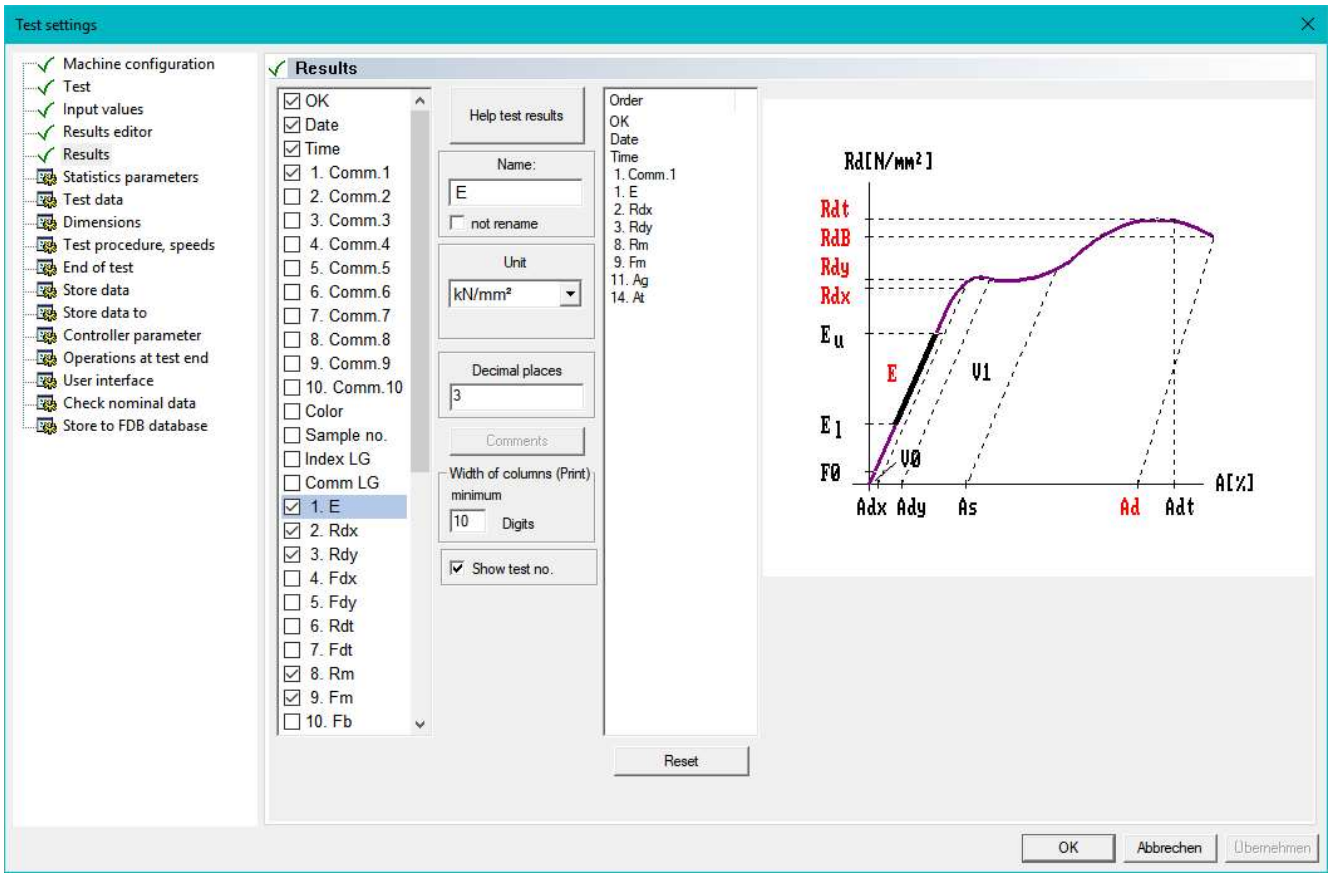


Table 3: Results for test ME 1A.

Parameter	Meaning	Dimension
E	Elasticity module	[kN/mm²], [GPa]
Rdx	Compression limit at Adx	[N/mm²], [MPa]
Rdy	Compression limit at Ady	[N/mm²], [MPa]
Fdx	Force at Adx	[N]
Fdy	Force at Ady	[N]

Rdt	Compression strength at total linear compression Adt	[N/mm²], [MPa]
Fdt	Force at total linear compression Adt	[N]
Rm	Maximal compression strength	[N/mm²], [MPa]
Fm	Maximal force	[N]
Fb	Force at break	[N]
Ag		[%]
Ad	Compression at fracture	[%]
Agt		[%]
At		[%]
L0	Gauge length	[mm]
S0	Sample cross-section	[mm²]]
PA1	Sample dimension 1 (not for all sample shapes)	[mm]
PA2	Sample dimension 2 (not for all sample shapes)	[mm]

2.5 Hints for the test ME 1A

2.5.1 Pre-load F0

For the test control, the elongation and the strain will be set to zero when pre-load F0 is reached (see explanations about elongation and strain further down, also).

The measuring length then will be corrected to **L0' = L0 + dL(F0)**

whereas
L0' *corrected measuring length*
L0 *measuring length*
dL(F0) *sample deformation at F0*

2.5.2 Yield stress criteria

The following criteria are applied to the load-elongation-curve *F = f(dL)* in order to determine the yield limits. If the first one does not lead to the detection of a yield limit, the next one will be applied, in the order you see below.

1. **Local load maximum, local load minimum**

   A local load maximum is a yield limit, if the load drops with at least 0.5%, and then increases again with at least 1%.

2. **Local load maximum, point of inflexion**

   A local load maximum is a yield limit, if the load drops with at least 0.5%, followed by a point of reflexion in the curve (i.e. a change from falling direction to increasing direction).

3. **Load plateau**

   If a range with constant load is found while elongation increases, the beginning of this range represents a yield limit. Pre-condition: The load must not deviate with more than 0.5% over a elongation range of 0.2% of the measuring length.

2.5.3 Tensile modulus limits

The tensile modulus limits can either be detected automatically or pre-defined by the user.

Automatic detection: On the load-elongation-curve *F = f(dL),* within the range between pre-load F0 and maximum load FM, the software searches the steepest increase line over an elongation range of 0.2% of the measuring length L0 (normally, between 0.05% and 0.25% strain). Then, the tensile modulus Et will be calculated between the end points of this line. Whereas the tensile modulus Et can be calculated either as secant or regression line. In case the elongation range of 0.2% L0 will not produce a reasonable tensile modulus, the modulus will be calculated over a range of 10% of Fmax instead.

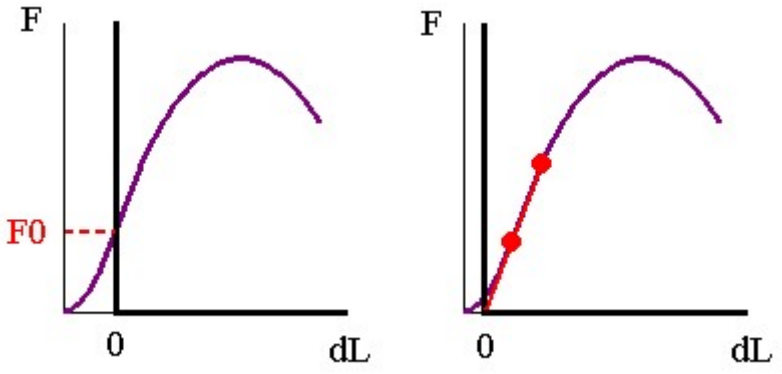
Manual detection: In case the tensile modulus should not be detected automatically, you can define the end points of the tensile-modulus-line via the input values M1 and M2 by yourself.

2.5.4 Elongation, strain

During the test: Elongation and strain are identical untill reaching the pre-load F0 = 0 (see left picture below). The elongation is the increase in length of the sample from the point F0. The strain will be calculated out of the elongation via the following formula:

$$Ax = \frac{dL(Fx) - dL(F0)}{L0} * 100\%$$

After the test: At the end of the test, elongation and strain will be calculated again. Hereby, the zero point of elongation is defined by extending the tensile-modulus-line until it reaches the x-axis in the load-elongation-diagram (see right picture below).



2.5.5 Behaviour at Av

The elongation/strain can be detected either via the crosshead travel or by using an extensometer. As a option, a width extensometer can be used to detect the change in sample width during the test, in order to detect the Poisson's ratio of the sample. The software offers the possibillty to remove the extensometer for length as well as the one for width during the test. This happens at strain value Av.

When strain value Av is reached, the test can be continued in one of the following manners:

1. **Continue test:** The test will be continued in a normal manner. Av has no influence.
2. **Stop test:** The test will be stopped at reaching Av.
3. **Pause test, drop extensometer:** The test will be interrupted. Now, the user can remove the clip gauge before continuing the test. An automatic extensometer will be removed automatically before the test continues.
4. **Continue, drop extensometer:** The test will not be interrupted. A message will inform the user about the possibility to remove the clip gauge. However, the test will continue during removing. An aotomativ extensometer will be removed automatically during the test.

Note: **Please note that the tensile characteristics of plastics do very much depend on the test speed. Hence, we recommend to prefereably not interrupt a test if possible!**