

Test&Motion
Application Module

**KU 14 – Test of rubber properties – adhesion to rigid
substrates (D429-08)**

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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 7/10®.

This manual does not deal with the **Test&Motion software** in general but with the application module **KU 14** 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 meaning.

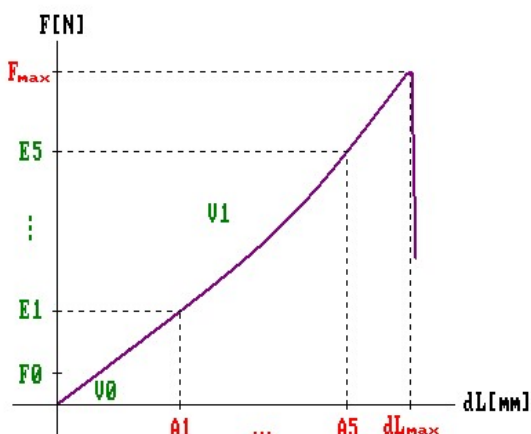
Symbol	Meaning
	Safety Instructions: In order to avoid interruptions in the work flow as well as damages to man and machine, follow the safety instructions at all cost.
	Job/work instructions: Instructive part of the document with precise work instructions. Here you are asked to do something.
	Information: 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 KU 14 - Test for rubber properties – adhesion to rigid substrates (acc. to ASTM D429-08)

2.1 Field of application

Determination of the adhesional strength of rubber to rigid materials (in most cases metals). Here, we have the test methods A .. H.

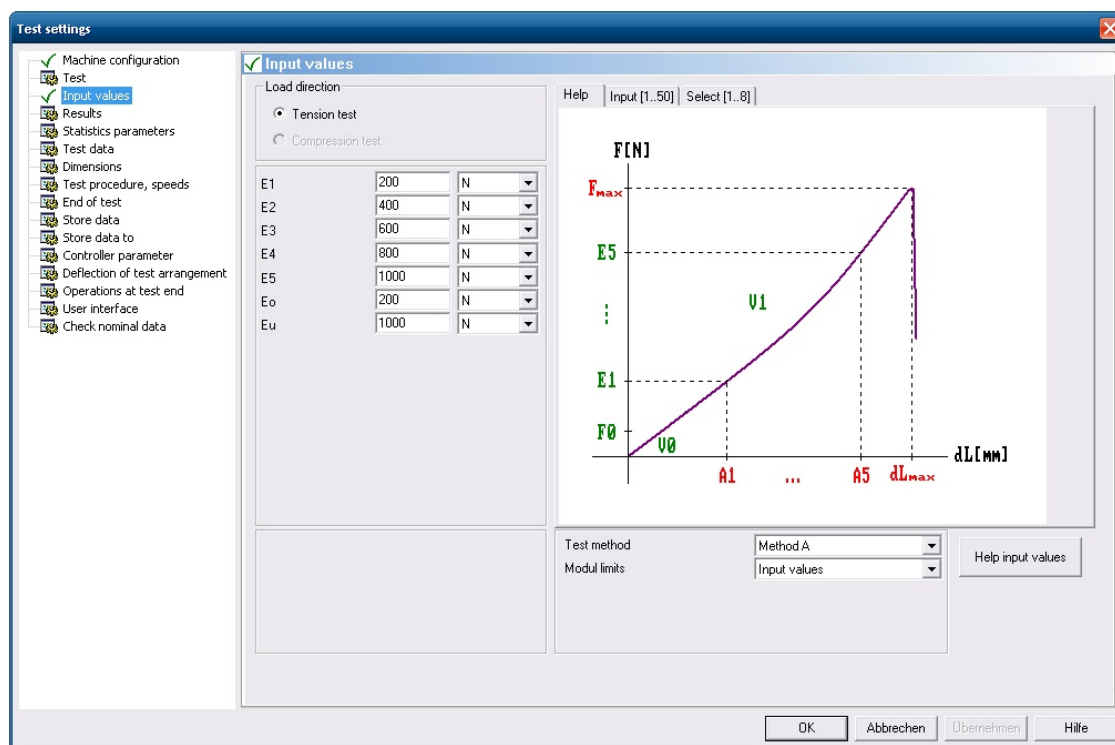
2.2 Test graphic KU 14



2.3 Input values KU 14



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



The button 'Help input values' opens a help page containing all input values and their meanings, as they are explained in the following tables, also.

Table 2: Input values for test KU 14.

Parameter	Meaning	Dimension / Selection possibilities
E1	Reference value 1	[N, kN], [N/mm ²], [mm_S], [mm_dL], [%], [s, min, h], [Dim User1], .., [Dim User4]
E2	Reference value 2	dimensions analogue E1
E3	Reference value 3	...
E4	Reference value 4	...
E5	Reference value 5	dimensions analogue E1
Eo	Young's modulus upper limit	[N, kN], [N/mm ²]
Eu	Young's modulus lower limit	
The following input values can be found in dialog Test procedure, speeds (Menu Test → Command Settings)		
F0	Preliminary force	
V0	Test rate until preliminary force F0 is reached	
V1	Test rate after reaching of preliminary force F0	

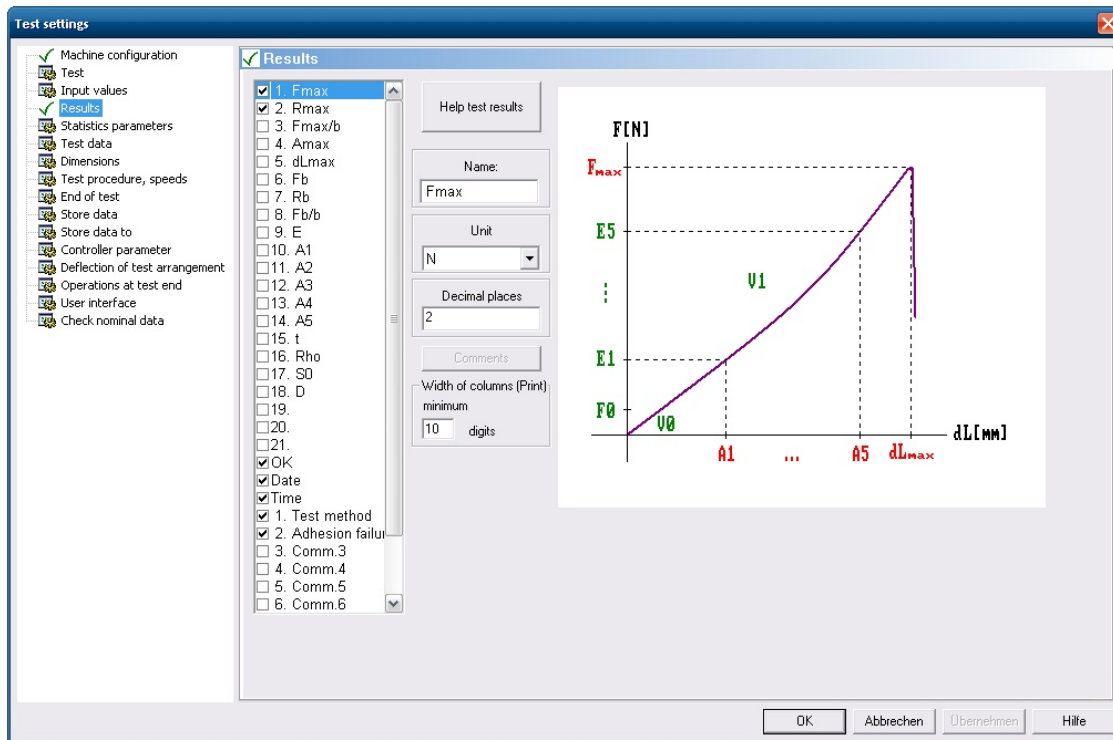
Table 3: KU 14 Selections and their meanings.

Selection	Meaning
Test method	
A	Rubber part assembled between two parallel metal plates
B	90° stripping test - Rubber part assembled to one metal plate
C	Measuring adhesion of rubber to metal with a conical specimen
D	Adhesion test - Post vulcanisation (PV) Bonding of rubber to metal
E	90° stripping test - Rubber tank lining - Assembled to one metal plate
F	Rubber part assembled between two parallel convex shaped metal plates
G	Measuring bond durability for rubber to metal bonded components with a double shear cylindrical specimen
H	Measuring bond durability for rubber to metal bonded components with a quadruple shear specimen
Modulus limits	
Input values	Eo + Eu define modulus limits
Automatic search	Secant modulus or regression modulus

2.4 Results KU 14



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



3. By clicking on one of the test results in the list, you can change its unit, decimal places and width of colums for the printout in the fields beside the list, if necessary.

The button 'Help test results' opens a help page containing all output values and their meanings, as they are explained in the following tables, also.



Note: You have to select the parameters "test method" and "Adhesion failure" from the results list.

Table 4: Results for test KU 14.

Parameter	Meaning
Fmax	Maximum force
Rmax	Adhesion value
Fmax / b	Maximum force / width
Amax	Extension at maximum force
dLmax	Elongation at maximum force
Fb	Force at break
Rb	Stress at break
Fb / b	Force at break / b
E	Young's modulus
A1	reference value at E1
A2	reference value at E2

A3	reference value at E3
A4	reference value at E4
A5	reference value at E5
t	Duration of test (time from F0 to end of test)
S0	Test piece section
PA1	Test piece sample 1 (not for all test piece shapes)
PA2	Test piece sample 2 (not for all test piece shapes)
Comment1	Select test method
Comment2	Adhesion failure terminology

2.5 Notes for test KU 14

2.5.1 Preliminary force F0

For the test control the elongation and the strain are set to zero at this point.

It is the switching over point of the test rate from V0 to V1.

The measuring length is corrected to $L0' = L0 + dL(F0)$

whereas

$L0'$ corrected measuring length

$L0$ measuring length

$dL(F0)$ sample deformation at F0

2.5.2 Input values E1 ... E5

For each input value (E1 ... e%) you can define one reference value (A1, A2, .. , A5), giving you the possibility to mark the 'measured value curve' with five reference values. The meaning of the results is related to their units:

Table 5: Dimensions of values and their meanings.

Dimension of the input value / result	Meaning
N, kN	Force
N/mm ²	Strength (stress)
%	Strain (extension)
mm_dL	Elongation
mm_S	Crosshead travel path
s, min, h	Time
Dim User1	Userdefined value 1
Dim User2	Userdefined value 2
Dim User3	Userdefined value 3
Dim User4	Userdefined value 4

2.5.3 Adhesion Failure Terminology

- R indicates the failure is in the rubber
- RC indicates the failure is at the rubber - cover cement interface
- CP indicates the failure is at the cover cement - prime cement interface
- M (can also be denoted as CM) indicates the failure is at the metal - prime cement interface

You can select these settings from combobox and change it after that.

- R-50, RC-50 means that roughly one half or 50% of the area showed failure in the rubber and the other 50% showed failure in the rubber cover cement interface.
- R-25, RC-25, M-50 means three types of failure
- Tests with constant load must be ended after a time or path (deformation), tests with constant deformation must be ended after a time or decrease in force (dF) (test end criterion).