TGM 5 Door Closing Meter

Instruction Guide

12.18 glasmacher electronic GmbH • Hof Sonnenborn • 58802 Balve • Germany
email@glasmacher-electronic.de • www.glasmacher-electronic.de • ☎ +49 2375 688 • ✉ 689

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Introduction

To use this device is not as difficult as this very detailed instruction guide may suggest. Easy things often sound complicated when they are written down as in this case.

On the last two pages („Brief instructions“) we have tried to explain as concisely as possible the steps for a measurement or test.

Task

The Door Closing Meter TGM 5 is a helpful device for checking the production quality in the car industry.

The closing speed is an objective measure of the quality of the car door.

The Door Closing Meter TGM 5 has 2 modes:

- **Measuring** (as TGM 4)
- **Testing** (**new**)

The „Measuring“ mode ist used for determining the exact door closing speed. The door closing speed is the lowest speed at which the door closes properly. The measurement takes place at a point just before the door speed is braked by the door seal. If the door is installed correctly, the speed required to close the door firmly should not be above a model-specific limit.

The “Testing” mode is new and is used for quick quality control. In this mode the door speed is compared with model-specific pre-set limits V_{min} and V_{max} . A green LED lights up when the door speed is within these limits. It is not necessary to press any buttons during the testing mode.

A door is o.k. , if it closes properly and the green LED lights up.

Scope of supplies

The case contains:

- Control Unit (with a 9 V accumulator installed)
- Measurement sensor (connected via a cable to the contol unit)
- Magnetic holder
- Suction cup
- Measuring edge
- Power supply 110 - 230 V~ / 9 V=
- Instruction Guide
- Calibration certificate

Setup

The Door Dlosing Meter TGM 5 consists of a control unit and a measurement sensor, which are connected via a cable.

Measurement sensor

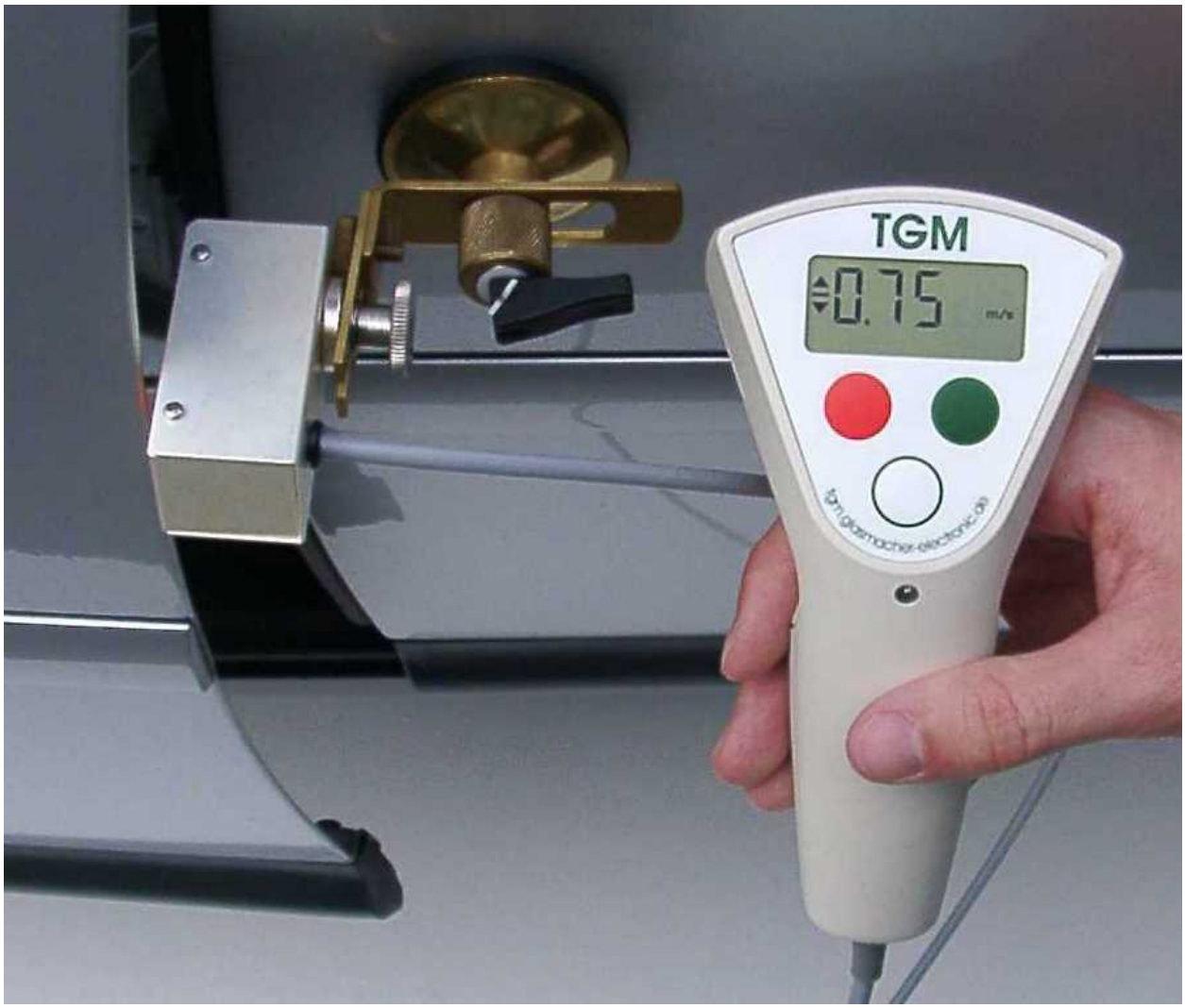
On the front side of the measurement sensor, there is a red arrow which indicates the direction of measurement. The device measures the speed of any magnetizable objects which move within a distance of < 10 mm to the measurement sensor in the direction of the arrow. Greater distances should be avoided. The distance between the moving door and the two outer edges of the measurement sensor should be equal. But even if the measurement sensor is installed inaccurately, e.g. one edge has a distance of 5 mm to the door and the other 10 mm, the measurement error will be within the tolerance of +\0,05 m/s.

The door speed must be measured **outside of the braking area** of the door, where the door swings freely.

Depending on the model of car, the braking area begins at an open door gap of about 15 cm. When choosing which type of holder to use, the distance to the car body must be taken into consideration.

Installing the measurement sensor

The case conains two stands with which the measurement sensor can be attached to a smooth, flat surface in order to be able to carry out measurements and tests. These stands are the „TGM Magnetic Holder“ and „TGM Suction Cup“. Both can be ordered under these designations.



It is advisable to mount the sensor on a stand which is adapted to a particular car model with a stop bar so that it can be installed quickly with precise distance from the door edge to the body for serial tests and measurements. The sensor is fixed and aligned to the body so that the door edge passes the sensor at a distance of less than 10 mm. The red arrow points in the direction of the car body, i.e. in measuring direction.

Attention! It is very important to keep the foot of the stand clean, otherwise it is possible that dirt or metal particles can **damage the paint work** of the car.

There are special, poor sticking labels (by ZWECK-FORM, DECAdry, ..), which can be removed easily and so are good to use as a protection for the paint work.

Even on non magnetic surfaces or plastics, it is possible to mount the measurement sensor by means of a strong suction cup. BOHLE (42781 Haan, Germany) offers a large range of suction cups. The TGM suction cup

supplied is custom made by BOHLE of the type SILBERSCHNITT (modified article 670.1).

The TGM magnetic holder is a rubber-coated magnet, Typ GS43 or GU12, made by IBS-Magnete (12105 Berlin, Germany). So with this rubber-coated magnet, the measurement sensor can be mounted quickly and reliably on the car.

Due to the electronic design of the TGM 5 Door Closing Meter, the measurement sensor can only measure magnetizable objects. There is a „TGM Measurement Edge“ with suction cup (see left side of the photo) for non-magnetizable doors. Alternatively one can use any piece of metal and fix it any way one wants, e.g. by means of double-sided adhesive tape .

Control Unit

The front panel of the control unit has an LC display, red, green and white buttons, a green test LED and a reference to the website with the german and englisch TGM 5 Instruction Guides.
On the right hand side of the control unit is an opening for connecting the

charger / power supply.

The included power supply unit reacharges the installed NiMH-7,2 V accumulator within 15 hours or supplies the power for stationary use. A full GP300 accumulator (7,2 V / 300 mAh) permits about 20 hours battery-operated use. The battery symbol „BAT“ in the LC display shows that the battery voltage is below 7.2 V. Anything above 5.2 V is enough for the device to work correctly.

When the white and red buttons are pressed simultaneously, the current battery voltage is displayed for review.

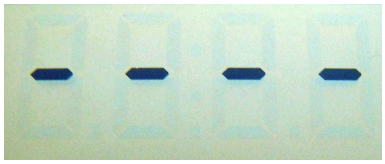
The battery is located in a compartment on the back of the unit. To replace the battery first unscrew the cross-head screw on the battery compartment. When changing the battery, pay attention to the polarity of the battery.

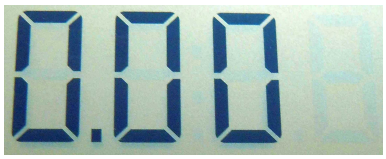
When the white and green buttons are pressed simultaneously the serial number of the TGM 5 is displayed. The serial number is also found in the battery compartment.

This instruction guide and the specifications of the TGM 5 can be downloaded as a PDF file from the website tgm.glasmacher-electronic.de.

Switching on

The device is switched on by pressing any button. During the warm-up phase the LC display shows "----" and then "0.00".





Switching off

The device is switched off by pressing the white button until the LCD displays "OFF". Release.

To conserve the battery, the TGM 5 automatically switches off after 5 minutes of inactivity. The last measured values are deleted.

Display

The LC display shows the measured speeds and assists the user by means of additional symbols

Sensor-Puls 1:
closing door

Sensor-Puls 4:
opening door

Operating modes

The new TGM 5 has two modes:

- Testing
- Measuring

The Testing mode is new and allows quick and easy verification of proper door-closing quality.

The Measuring mode corresponds to the function of the predecessor model TGM 4 and is used for the accurate determination of the door closing speed, i.e. the lowest speed at which the door closes properly.

Mode selection

This is achieved by adjusting the red value.

Two values can be set, which we call the *green value* and the *red value* because they are selected by the red or the green button. The table shows the meaning of the red and green values for the two operating modes:

Mode	red value	green value	LED
Measuring	0	V_{delta}	off
Testing	V_{min} (> 0)	V_{max}	on

The setting of the red or green value is as follows:

1. Press and hold the white button until "OFF" and then "SEL." for selection is displayed.
2. Release white button.
3. Press red or green button to select the red or green value.
4. The default value for the red or green value is displayed with an down- or upward-pointing arrow. The percent sign "%" indicates that the TGM 5 is in the "value adjustment" mode.
5. With a short or long press on the red or green button, the value will now be reduced or increased. If the red value is 0, the TGM 5 will enter the "Measuring" mode. Otherwise it operates in the "Testing" mode.
6. When the white button is pressed briefly, the preset value is stored permanently in the flash memory.

„Testing“ Mode

For each closing of the door the speed is shown. The green LED and the up arrow ("thumbs up") signals immediately that this measurement is within the set points V_{min} and V_{max}.

A door is o.k. , if it closes properly and the green LED lights up.

The LED goes off automatically after 5 seconds to conserve battery power.

The preset values for V_{min} and V_{max} can be checked by pressing the red or green button. The value is displayed along with a percent sign [%]. At the same time the green LED lights up for control.

Control with key combinations	▲▼ %	Green LED	White Button	Red Button	Green Button
Delete the current display *keep pressing for „OFF“ to shut the device down or „SEL“ to change the mode*			○		
Display preset Vmax	▲ %	LED			●
Display preset Vmin	▼ %	LED		●	
Meausred Speed **out** (faster or slower) of target range *Directly after the measurement, no keys necessary*	▼				
Meausred Speed **in the** target range *Directly after the measurement, no keys necessary*	▲	LED			
Battery voltage			○	●	
Serial number			○		●

„Measuring“ Mode

The door closing speed is the lowest speed at which the door closes properly.

To detemine the door closing speed, push the door a couple of times with different force. Once the edge of the door has passed the measuring sensor, the LC display will show the door speed in meters/second [m/s]. In front of the figure two arrows flash to show that either the red or the green button has to be pressed. The force with which the door is closed determines the door speed. The tester decides if the door is closed firmly or not. If it is closed, he has to press the green, otherwise the red button.

Control with key combinations	▲ ▼	White Button	Red Button	Green Button
Start a new measurement	Irrelevant	○		
Highest speed with „Door open“			●	
Lowest speed with „Door closed“				●
Differentialspeed V_diff *Difference between highest speed „Door open“ and lowest speed „Door closed“*			●	●
Push if: Door is open	Flash		●	
Push if: Door is closed	Flash			●
Speed determined, successful measurement	Permanent			
Battery voltage		○	●	
Serial number		○		●

If the green button has been pressed, the value shown is compared to the current closing speed (that is the lowest speed in a measurement series, at which the door is firmly closed). The smaller one of these two values is the new door speed and will be shown on the display as long as the green button is pressed. The door speed is identified by two arrows pointing up and downwards.

If the red button is pressed, the value shown is compared to the current non-closing speed (that is the highest speed at which the door did not close firmly). The higher one of these two values is the new non-closing speed and is shown on the display as long as the red button is pressed. The non-closing speed is identified by the down arrow.

Then the device compares the door closing speed with the non-closing speed. If both values are so close together as specified by the Precision value (see below) that there is no need for more measurements, the measured door closing speed is shown on the display and identified by the two arrows (not flashing). The tester can now finish the measurement series by pressing the white button. All door speed values are cleared and the display shows the value „0.00“.

If no arrows are blinking, You can press the red or green button to see the actual closing or non-closing speed.

Precision value V_{delta}

The difference V_{delta} between the lowest closing speed and the highest non-closing speed, at which all arrows light up to show, that the door closing speed is determined, can be chosen freely. When the device is supplied, the precision value V_{delta} (*green value*) is set to 0.05 m/sec. For changing the precision value V_{delta} see mode selection (page 11).

Differential speed V_{diff}

The differential speed V_{diff} is the difference between the fastes speed “Door open” and the slowest speed “Door closed”.The current differential speed can be seen by pushing the red and green button simultaneously (TGMs after 2018). The door closing speed is determined as soon as the differential speed V_{diff} is smaller or equals the preset precision value V_{delta}.

Example „Measure“:

Measu-rement	$V_{measure}$	Door	green	red	V_{closed}	V_{open}	V_{diff}
1.	1,37	closed	press		1,37		
2.	0,97	open		press	1,37	0,97	0,4
3.	1,20	open		press	1,37	1,20	0,17
4.	1,41	closed	press		1,37	1,20	0,17
5.	1,27	closed	press		1,27	1,20	0,07
6.	1,11	open		press	1,27	1,20	0,07
7.	1,33	closed	press		1,27	1,20	0,07
8.	1,18	open		press	1,27	1,20	0,07
9.	1,29	closed	press		1,27	1,20	0,07
10.	1,23	open		press	1,27	1,23	0,04

The door closing speed 1,27 [m/s] is determined and can be shown by pressing the white button. If the white button is released a new measurement will start.

$V_{measure}$ = actual measured and displayed door speed [meter/second]
green = green button
red = red button
white = white button
V_{open} = current „door open“ speed (= door not closed)
V_{closed} = current „door closed“ speed (= door closed)
V_{diff} = current speed difference between V_{open} and V_{closed}

With a preset precision value V_{delta} of 0.05 [m/s] see example below:

1. Measurement
Display: 1.37 m/sec (= door speed)
The door is closed, the tester presses the green button.
Display: 1.37 m/sec (= current door speed)
The tester releases the green button.
Display: 1.37 m/sec (= door speed)

2. Measurement
Display: 0.97 m/sec (= door speed)
The door is not closed, the tester presses the red button .

Display: 0.97 m/sec (= current non-closing-speed)
The tester releases the red button.
Display: 0.97 m/sec (= door speed)

3. Measurement
Display: 1.20 m/sec (= door speed)
The door is not closed, the tester presses the red button.
Display: 1.20 m/sec (= current non-closing-speed)
The tester releases the red button.
Display: 1.20 m/sec (= door speed)

4. Measurement
Display: 1.41 m/sec (= door speed)
The door is closed, the tester presses the green button.
Display: 1.37 m/sec (= current door speed)
The tester releases the green button.
Display: 1.41 m/sec (= door speed)

5. Measurement
Display: 1.27 m/sec (= door speed)
The door is closed, the tester presses the green button.
Display: 1.27 m/sec (= current door speed)
The tester releases the green button.
Display: 1.27 m/sec (= door speed)

6. Measurement
Display: 1.11 m/sec (= door speed)
The door is not closed, the tester presses the red button.
Display: 1.20 m/sec (= current non-closing-speed)
The tester releases the red button.
Display: 1.11 m/sec (= door speed)

7. Measurement
Display: 1.33 m/sec (= door speed)
The door is closed, the tester presses the green button.
Display: 1.27 m/sec (= current door speed)
The tester releases the green button.
Display: 1.33 m/sec (= door speed)

8. Measurement
Display: 1.18 m/sec (= door speed)
The door is not closed, the tester presses the red button.

Display: 1.20 m/sec (= current non-closing-speed)
The tester releases the red button.
Display: 1.18 m/sec (= door speed)

9. Measurement
Display: 1.29 m/sec (= door speed)
The door is closed, the tester presses the green button.
Display: 1.27 m/sec (= current door speed)
The tester releases the green button.
Display: 1.29 m/sec (= door speed)

10. Measurement
Display: 1.23 m/sec (= door speed)
The door is not closed, the tester presses the red button.
Display: 1.23 m/sec (= current non-closing-speed)
The tester releases the red button.
Display: 1.27 m/sec + arrow (= door speed)

The door speed is found
The measurement series is finished, the tester presses the white button.
Display: 1.27 m/sec (= door speed)
The tester releases the white button.
Display: 0.00

Power Supply and Charger

The TGM 5 is supplied with a power supply and charger, with an output of > 50 mA by **12 V=** . The TGM 5 is connected to the power source by a barrel connector (inner diameter: 2.1 mm). The outside of the plug is minus (-) the inside is plus (+).

Any adapter which supplies around 12 V DC (10 <= V <= 12) and a minimum of 50 mA current can be used. It is also possible to use a laboratory power supply which is set to about **12 V=** .

The TGM 5 control unit works with an internal voltage of 3.3 V=, the sensor with 5 V =. The factory-supplied 8.4 V block battery (type: ANS 300) is charged by a regulated current and can not be overloaded or damaged if the included **12** volt battery charger is used.

Accumulator / Battery

By default, the TGM 5 door closing meter is shipped with a NiMH battery with a capacity of 300 mAh. We recommend the accumulator ANS 300 (8.4 V, 300 mAh, model no.: 5035453) of the manufacturer "ANSMANN". Charging the TGM 5 is very simple and effective; I-charging with I_10 = 30 mA, so that the accumulator of the TGM 5 cannot be damaged by overcharging, for example on a weekend.

A capacity of 300 mAh is sufficient for a (theoretical) operating time of 37 hours. In fact, accumulators are rather critical components because their capacity can vary depending on the number of charging cycles and the way of charging.

Instead of using the rechargeable battery provided, it is possible to use alkaline batteries, which have the advantage of a far higher capacity [Ah] and thus a longer operating time, but they cannot be recharged and must be replaced after use.

Error messages and diagnostics

The following error messages can appear:

Display	Meaning
Err. 1	incorrect button pressed
Err. S	faulty measurement (sensor)
Err. 9	excessive number
Err. C	**C**alibration value damaged
Err. F	**F**lash memory impaired

In normal operation only the errors 1 and S occur. The error message disappears when a button is pressed or a new measurement happens.

The error **1** is displayed when an incorrect button combination is pressed, such as the red and green button simultaneously.

An incorrect measurement is displayed as error **S** and indicates that the sensor is mounted in a so unfavorable way that only one of the two sensor devices in the sensor head detects the passing door. This measurement error is evident from the fact that the sensor pulse SP1 for the outside edge or SP4 for the inside edge does not flash just as it does for a proper measurement, but is displayed for about 2 seconds.

The errors **9**, **C** and **F** are system errors that should not occur. Error **9** indicates a software error. The errors **C** and **F** are caused by a defective microchip. In the event that error messages 9, C and F are displayed, the device should be returned to us with a description of the error and we will inspect the device and carry out

necessary repairs free of charge.

The battery voltage can be displayed and checked by pressing simultaneously the white and red buttons.

The serial number is displayed by pressing simultaneously the white and green buttons. In addition, there is a sticker with the type designation and serial number inside the battery compartment resp. in the handle.

Calibration

The TGM 5 door closing meter can be calibrated by the manufacturer only. For technical reasons, a re-adjustment of the TGM 5 is not absolutely necessary. Nevertheless, it is advisable to check the equipment every two years. (see section *Calibration Cycle*)

Innovations

- New Testing mode with a bright green Test LED for quick quality control.
- The electronic circuit consumes less power at lower voltages, allowing the battery life to be tripled, to more than 20 hours.
- The housing of the TGM 5 control unit is ergonomically designed and is therefore easy to handle.
- The electronic circuit in the sensor head is completely sealed, so that it is impervious to moisture and condensation.
- In addition, the electronic circuit has been up-dated so that the sensor head can be used within the industrial temperature range of -40 ° C to + 85 ° C.
- The control unit of the TGM 5 is prepared for the installation of a digital / analog converter to output a voltage value correspondig to the door speed reading on the LC display. In versions with built-in digital / analog converter and analog output respectively, the designation is extended by the letter "-A"; e.g. TGM-A 5.

Option: TGM/USB

This chapter explains how to install the TGM/USB interface cable and its drivers and how to use the TGM/USB program (TGMUSB.exe). A quick reference guide can be found at the end of this chapter.

Introduction

This program is extremely easy to use. Even simple things can often sound complicated when explained in writing. Please be patient as we take you through it step by step.

Function

The TGM/USB Measurement Data Import is an add-on option for the TGM 5 Door Closing Meter and enables the easy input of measurement data in all (Windows) programs by which data can be entered using the keyboard.

Scope of Supplies

- 1 x TGMx/USB cable with integrated electronics
  - TGM4/USB cable with 9-pole SubD socket
  - TGM5/USB cable with 3-pole jack plug
- 1 x TGM/USB CD contains:
  - TGM/USB operating manual as PDF file
  - USB drivers for the installation
  - TGM/USB import program: TGMUSB.exe
- 1 x TGM/USB operation manual

TGM/USB Cable

There are two TGM/USB cables that differ from each other with regard to the connector plugs to the TGM:

TGM Version	*TGM*	*Level*	*PC*
TGM 4	D-Sub, 9-pole	+5/-5 V	USB
TGM 5	Jack plug, 3-pole	+3.3/0 V	USB

The TGM/USB cable contains integrated electronics in the USB plug that adapts the USB signal levels for the TGM 4 or TGM 5 and converts the simple RS232 protocol into the complex USB protocol.

Installation of USB drivers for Windows XP

Since Windows 7, drivers are generally automatically installed with an active internet connection as soon as the USB cable is connected.

For Windows XP and previous versions, only the USB drivers need to be installed. For this, it is optional for the TGM to be connected to the TGM/USB cable.

Shortly after the TGM/USB cable is connected to the USB port of the computer, the Windows „Found New Hardware Wizard“ starts. Place the enclosed TGM/USB CD in the CD drive and confirm all Windows prompts with [Continue]. The installation process will run twice because two different USB driver types need to be configured.

If any problems should occur during the installation process, contact us immediately at +49-2375-688. We are available for your queries at all times.

Installation of Software

The TGM/USB-Import-Programm (TGMUSB.exe) requires no installation. The program can be directly started from the installation CD. It is advisable to copy the TGMUSB.exe program from the CD onto the desktop or to another location or file, where it can be promptly found and started. TGMUSB.exe can also be started from a USB storage device or a network.

TGM/USB Measurement Data Import

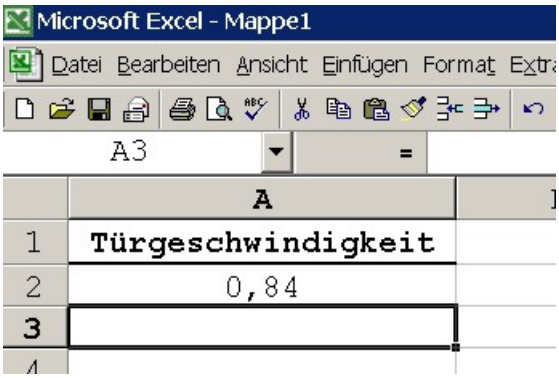
Preparation

Connect the TGM Door Closing Meter to the data collection computer via the TGM/USB cable. Wait until the Windows operating system recognises the new USB device. Otherwise, the harmless error report „TGM → USB cable not connected. Device not found ...“ could be somewhat confusing.

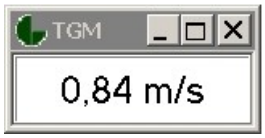
Measurement Data Import

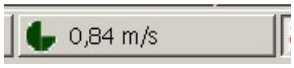
After starting the TGMUSB.exe program, the adjacent window will appear in the middle of the screen.

Start the program in which you would like to input the measurement data, for example Microsoft EXCEL. Place the cursor for example in the A2 field. Run a measurement using the TGM which is connected via the USB. When you have determined the door-locking speed, press the white button on the TGM.



The TGM now sends a measured value. It will be received by the TGMUSB program and entered into the A2 field as if you keyed-in „0.84“ using the keyboard. The cursor then moves to the next field A3; ready to receive the next measured value. The received measured value will also be display on the TGMUSB program window and on the Windows toolbar at the bottom of the screen. The TGMUSB program window can be minimised without affecting the program function.





Concluding Remarks

The TGM Measurement Data Import works with all programs that accept input via the keyboard such as the Microsoft WORD text editor, the data bank program ACCESS, programs for data analysis like DiaDEM, LABview, FlexPro and many others. We hope you can import your TGM measurement data without any problems.

Quick Reference for TGM/USB Data Import

! = Operation 💻 = Display

1.) ! Connect TGM to PC through TGM/USB cable

2.) ! Start TGMUSB.exe

PC 💻 „USB o.k.“

3.) ! Place the cursor in the import program

(i.e. EXCEL, WORD, DiaDEM, MathCad, etc.)

4.) ! Determine door-locking speed

TGM 💻 Door-locking speed

5.) ! Press the white button on the TGM

PC 💻 Door-locking speed

TGM 💻 „0,00“

Option: Analog Output

The TGM 5 analysis device is equipped with an analog-output to represent the TGM5 door speed as a voltage. For versions with the Analog-Output option, the printed label also bears the letter “A”, for example TGM-A + serial number.

Output Voltage Range and Measured Value Scale

The output signal can receive measurements from 0 – 2,50 V. The resolution amounts to 12-bits, which corresponds to 0,61 mV / 1 digit. The scale or ratio of the door speed value to the output signal is 2 [m/sec] / 1 [V]. Door speed measurements greater than 5 m/sec are indicated with the maximum output signal of the Digital-to-Analog converter of 2,50 V.

The examples in the following table illustrate this relation:

Door speed	Output signal
0.00 m/sec	0.00 V
1.00 m/sec	0.50 V
2.00 m/sec	1.00 V
5.00 m/sec	2.50 V
> 5.00 m/sec	2.50 V

Measurement direction and Output Signal

The TGM only measures in the direction which is marked with a red arrow on the front side of the measuring head.

As soon as the measurement has been registered, the value on the LCD display is represented as an analog signal, or more specifically, a voltage.This voltage remains until a new, valid measurement in the closing direction is registered.

When the measurement object for example, an opened door, sweeps past the measuring head in the opposite direction, the LCD display is deleted or more specifically, shows “0.00”. The output signal remains unchanged to allow for easier programming of the connected PLC.

Please inform us if this behavior is undesirable. In certain situations, it is desirable that the analog output switches to 0 V when a door is opened, to recognize that the door is correctly and completely opened. Alternatively, the opening speed could also be measured. If desired, we could replace the processor firmware of the TGM measuring program to suit your requirements (usually free of charge).

Automatic shutdown

The TGM normally shuts off after 5 minutes of inactivity. This behavior may be

undesirable in stationary operation and in endurance tests. The firmware of the TGM-A (with analog output) is programmed to detect the connection of a charger. The display shows the symbol "Pa" (= "**P**ower **a**ttached") and the TGM-A does not switch off automatically.

Analog Port and Analog Connection Cable

The analog output signal is run on a 2-pole, 2,5mm jack plug. It is located on the upper front side of the analysis device. A 2 m long connector cable with a 2,5mm jack plug, which has tin-plated bare ends for easy connection to a PLC, is included in the scope of supplies. The outer metal braiding is grounded. The inner white cable and the head of the jack plug is *V_out* (Output signal). Please contact us if you need analog connector cables of different lengths, which we shall be pleased to supply free of charge.

Known problems

It has occasionally happened that, the LC display turns itself off and then on again, i.e. „----“ appears and then „0.00“. The cause is a loose connection on the 9 V accumulator. The TGM 5 uses best battery connectors but unfortunately the press contacts of most 9 V accumulators are inferior. To solve this problem, remove the accumulator, bend the minus connector slightly to the inner side and then reinstall the accumulator.

If it happens, that the TGM 5 doesn't switch on despite pressing a button, open the battery compartment, disconnect the battery clip, wait a few seconds and then re-connect the battery again.

Strong mechanical stress on the fine copper wires in the cable between the control unit and the measurement sensor may result in wear and tear. This results in sporadic measurement dropouts. In this case we recommend, that the cable be replaced by your electronics department or by us free of charge.

It is unfortunately common to wrap the cable around the control unit before placing it in the case. This practice is bad for the cable.

The best way is to place the cable loosely in the case.

We are usually very accommodating with regard to repairs and eliminate minor errors or faulty cable, even after the expiry of the warranty period free of charge.

Final remark

We trust that our TGM 5 door closing meter will work to your satisfaction. However, if you do encounter any difficulties or if any questions arise, or if You have

any suggestions for improvement or have any unusal measuring or testing tasks, do not hesitate to contact us. We will do our best to help you. If necessary we can adapt the TGM 5 to your special needs or develop and supply special measurement devices for new tasks.

We will try our utmost to satisfy you.

Technical specifications

Measurement range:	0.13...5.00 m/s				
Measurement tolerance:	+/- 0,05 m/s				
Section of measurement:	55 mm				
Measurement frequency:	1 MHz				
Door speed	v	[m/s]	0,13	1,00	5,00
Measurement time	t	[s]	0,423	0,055	0,011
Resolution +/-	Δv	[m/s]	0,01	0,01	0,01
	Δt	[µs]	4230	550	110

max. distance between the measurement sensor and the edge of the door: 10 mm

Display:	3 digit LCD, 12 mm high
Display unit:	m/s
Processor:	TI MSP430F449
Program/Data memory:	60 kB / 2 kB
Computational accuracy:	32 bit
Operating voltage:	3,3 V= / 5 V=
Current consumption:	ca. 8 mA
Accumulator:	9 V Block
Type:	ANS 300
Voltage:	8,4 V=
Capacity:	300 mAh
Charging current:	30 mA (16 hours)
Power adapter:	100 – 230 V~ / 9 V=
Temprature range:	
Control unit:	0 – 70 °C
Measurement sensor:	-40 – 85 °C
Dimensions:	
Control unit:	145 * 80 * 36,5 mm
Measurement sensor:	60 * 60 * 30 mm
Connection cable:	2 m
Weight:	
Control unit:	230 g (incl. accumulator)
Measurement sensor:	60 g

Cycle of calibration

Device	TGM
Version	5
Manufacturer	glasmacher electronic GmbH

Accuracy-defining components:

1. Processor quartz frequency: +/- 3 ppm/Year (= 0,0003 %)
2. Section of measurement (= Dimensions of the sensor case): +/- 0 %
3. Conversion factor (saved in the processor): +/- 0 %

ad 1.) The ageing effect of the oscillating quartz in the processor is negligible.

ad 2.) The distance between the sensors cannot change unless the case of the measurement sensor is mechanically deformed by extraneous cause.

ad 3.) The conversion factor for calculating the door closing speed is stored permanently in the (non-volatile) Flash memory of the processor. It is backed by a control value.

The cycle of calibration also depends on the following factors:

- The demands on the devices.
- Regulations of the quality assurance department in the company.

Because of the above mentioned reasons, a re-adjustment of the TGM 5 door closing meter is not absolutely necessary. Nevertheless it is advisable to check the device regularly.

Advised cycle of calibration: 24 months

Brief instruction for measuring

! = Action 💻 = Display **?** = Options

💻 " 0.00"

1.) ! Install and adjust the measurement sensor on the car body.

The distance to the edge of the door should not be greater than 10 mm.
The red arrow points in the direction of measurement.

2.) ! Close the door

💻 door speed + flashing double-arrow

3.) ? Door closed?

? yes : **!** press the green button

💻 Closing speed + arrow upwards

? no : **!** press the red button

💻 non closing speed + arrow downwards

4.) ! release button

💻 last door speed

5.) ? double-arrow in the display?

? no : back to **2.)**

? yes : door speed determined!

💻 door speed

! press the white button

6.) ! release button

💻 " 0.00"

glasmacher electronic GmbH • Hof Sonnenborn • 58802 Balve • Germany
email@glasmacher-electronic.de • www.glasmacher-electronic.de ☎ +49 2375 688 • ✉ 689

Brief instruction for testing

! = Action 💻 = Display **?** = Options

💻 " 0.00"

1.) ! Install and adjust the measurement sensor on the car body.

The distance to the edge of the door should not be greater than 5mm.
The red arrow points in the direction of measurement.

2.) ! Close the door

💻 door speed (+ flashing double-arrow)

3.) ? Door closed?

? no : back to **2.)**

? yes :

4.) ? door speed within the permissible range ?

💻 door speed

? green LED off: back to **2.)**

? green LED on : **Door o.k.**