

Operator manual

Microprocessor-Based
Power Supply and Analyzing Unit
for Torque sensors

GMV2 V5.1



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1. General information

1.1. Description

GMV2 is a microprocessor-based measuring, control and analyzing unit for the most common screwing and laboratory applications. Due to its compact design and optional battery operation, the unit is very suited for portable use. Measured values can be stored and printed out with date and time of day. The power-operated screwdriver can be automatically switched off with separate power circuitry.

1.2. Features

- Menu-assisted operation and setting
- Recording torque, angle of rotation, rpm and power
- For torque sensors from 1 Ncm to 100 kNm full scale value
- Shut off according to torque and/or angle of rotation (optional)
- 1000 measured-value storage
- 50 parameter set storage
- Mains operation (100V – 240V) or optional integrated charger, 8-hour battery operation.
- RS-232 port for printer
- Measured-data transmission to PC
- EMC sealed housing

2. Startup

2.1. Important notes

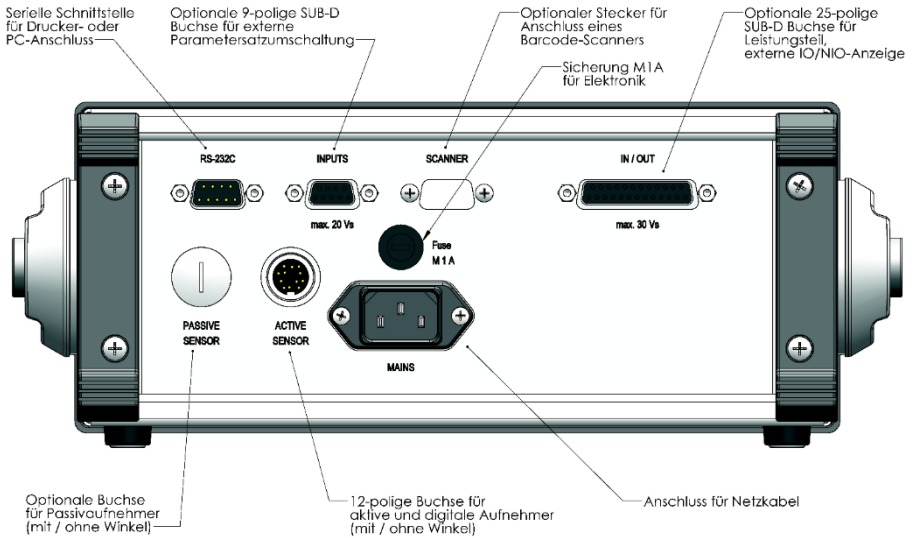
If the unit is opened or dismantled within the warranty period, the warranty will be rendered null and void. The unit should only be opened by qualified staff.

Only cables designed for use with the unit may be connected to it. Damage caused by connecting incorrect cables are not covered by the warranty. The unit is not grounded during battery operation. Should current-carrying equipment be connected to the unit they must be grounded according to technical regulations. The full scale value displayed on the screen must always correspond with the actual sensor being used. Where there is a risk of injury to persons and damage to equipment, the user must take appropriate safety measures (for example, use covers, overload protection devices) (relevant accident prevention regulations should be observed!).

Warning! Due to the use of surge arresters (Varistors) an insulation measurement according to VDE 0701/0702 is not possible. Please use the differential current measurement method according to VDE 701/702 as a replacement.

The unit is not approved for service in hazardous areas.


2.3. Overview of the rear



2.4. Connecting the torque sensor

Suitable connection cables are available for different types of torque sensors!
 This standard GMV2 unit has been designed for use with active sensors with a $\pm 1.25V$ to $\pm 10V$ signal. A $\pm 0.5mV/V$ to $\pm 4mV/V$ passive input and a digital input are available as an option. Please use the appropriate cable only which can be obtained from **ETH**.

2.5. Switching on


You can switch the unit on with the  button when you have checked that the cable has been correctly connected. After a short self-test all settings valid before the unit was switched off are reloaded. The sensor is now zeroed. The unit is then ready. If the error message "Charge!" appears now, please connect the power cable. You can now power the unit from the mains or switch it off and let it charge for approximately five hours. If you keep the key pressed while switching on the device, time of day, software version and the optional functions will be displayed. The following abbreviations appear:

- V x.xx Software version
- ax Active input with adjustable input range
- px Passive input with adjustable input range
- d Digital input
- W Angle measurement
- T PC transfer
- E I/Os
- D Output for Digimatic printer

Note:

- When the unit is being switched on the outputs are operated for a short period. The manual switch for the power-operated screwdriver should therefore be switched off during power-up.
- Check before the first measurement that the initial settings for the unit (see chapter 6) meet your requirements
- If the battery is not charged within 15 minutes of the first charging notification, the device switches itself off.
- If the calibration period for the GMV2 has elapsed, the error message "Error: Calibration date" appears when the device is switched on. In this case, please send the device to ETH

2.6. Switching off

You can switch off the device with the  button. If the power-saving function (standby) is enabled, the device switches itself off if it unused for a set period. If, due to a fault, you cannot operate or switch off the unit, you can remove the fuse from the raer (data may however be lost in this case).

3. What's new in software version V5.1 (after V4.1)

3.1. Dynamic repeat rate for keys

The keys (+, -, choose, etc.) now have a repeat function when pressed for longer periods. The repeat rate increases continually.

3.2. Automatic conversion of the sensor full scale value to other units

When a sensor with integral chip is connected to the device, a unit that is different to the sensor unit may be selected in the parameter set. The sensor full scale value is automatically converted to the selected unit. Only the available units can now be used!

E.g.:

- Sensor with 10 Nm, selected unit "InLb" → displayed full scale value: 88.51 InLb
- Sensor with 10 Nm, selected unit "Ncm" → displayed full scale value: 1000 Ncm

Note: If, when programming a parameter set, a particular unit is not available, disconnect the sensor and then choose the wanted unit.

3.3. Supporting sensors with two measuring ranges

Sensors with two measuring ranges can now be connected to the active socket.

The small measuring range appears in the menu as "**akt2rng, standard_range**".

The large **measuring range** appears in the menu as "**akt2rng, high_range**".

Note:

- This is an optional function and is not available in all devices
- Select the "Standard_range" option for sensors with only one measuring range!

3.4. Improved support for a number of inputs

When the GMV2 supports inputs for a number of sensor models, each of the available inputs can be selected as required. The GMV2 socket designation, the sensor model and, if applicable, the measuring range (stdnrt / large) will be displayed.

In addition, this information is also output when the parameter set is displayed or printed out.

Note: This is an optional function and is not available in all devices

3.5. Universal input range for the active and passive input

Menu paths:

- „Menu → Param → ParSet → Change → Edit“
- „Menu → Param → Sensor → “Model” or “Sig./Ua”

The inputs can be adjusted easily now to the output signal from most sensors. They can be programmed separately for each parameter set. If a default value is available, it will be used without the system asking for confirmation. The correct value can be entered for every parameter set with the setting **“Enter” for Ua.** (see chapter 3.9.1.) This is how the calibration value is entered for passive sensors.

Input range:

Active input: $\pm 1,25V \dots \pm 10V$ in steps of 1mV, or 5V, 10V

Passive input: $\pm 0,5mV/V \dots \pm 4mV/V$ in steps of 1 $\mu V/V$, or 1mV/V, 2mV/V, 4mV/V

3.6. Adjustable overload range

Menu paths:

- „Menu → Param → Param set → Change → Edit “
- „Menu → Measure → Overload

The measuring range can now be much larger than the nominal signal of the sensor. The overload range can be programmed separately for each parameter set from 0% to 100% of the sensor end value – however, the resolution of the displayed measurement is reduced in proportion to the selected overload range. Different values can be programmed by selecting “Enter” in the defaults under overload range.

(Menu path: „Menu → Param → Setting → Defaults → Overload“ see chapter 3.9.1.).

Caution

If the mechanical overload capability of the torque sensor is exceeded for even a short period, this will immediately destroy the sensor!

3.7. Automatically tracking zero-point drift

The zero voltage on torque sensors varies slightly as a function of temperature: the zero-point drifts when the device is switched on until the sensor reaches its operating temperature.

In the zero-load condition, the system detects and tracks this drift and compensates for it accordingly. The device continues to take correct measurements. When the tracking function for zero-point drift is active, an “A” (Automatic) appears at the bottom of the screen.

3.8. Pulse-type screwdriver mode

This function is very similar to the peak measuring function: additionally, a correction factor is available in this mode, but angle measurements cannot be taken.

3.9. Streamlining parameter set entry

3.9.1. Default settings

Menu path: „Menu → Param → Settings → Defaults “

In “Defaults” either a fixed numerical value or “Enter” may be selected. The **desired value may be entered** when programming a parameter set and when “Enter” is set.

When a **fixed numerical value** is the default setting, it is **automatically loaded without confirmation from the user** when a parameter set is programmed. This saves multiple data entries.

A default setting is available for each of the following:

- input sensitivity of the active and passive input
- overload range
- automatic tracking of zero-point drift

Examples:

- If you always use thread adapter sensors (DRFS..., DRFN...), select active - 5V
- If you always use laboratory sensors (DRL), select active - 10V
- Select passive, Enter for passive sensors

Note:

- **Changes to the default setting do not immediately impact the current parameter set! The default setting is not loaded until a parameter set is processed or programmed.**
- Parameter sets that have already been programmed are not changed when defaults are changed.

3.9.2. Hiding unused functions

Menu path: „Menu → Param → Settings → Function“

Functions that are seldom used can be hidden, so that they are disabled (without user confirmation) when a parameter set is programmed. The process of entering the parameter set is thus shortened.

The functions are always available in the direct parameter entry menu.: “Menu → Measure ... / Parameter.”.

E.g.:

- The “Parameter set text, data record ID and operator number” menu can be hidden for all operating modes (“**More**”).
- Angle, rpm and power measurement are disabled during tracking measurements.

Note: Changing the functions does not immediately impact the currently available parameter sets!

3.9.3. Correction factor

A correction factor may only be entered in the (new) operating mode “impulse wrench” (see chapter 3.8.).

3.9.4. Filter for peak measuring

This function is no longer available in version V5.2!

3.10. Deleting measured values

Menu path: Menu → MVclear...

The operator can now choose whether he wants to delete all measured values, the measured values in a parameter set, or only single data records (see chapter 11.5.).

3.11. Detecting new sensors and new measuring ranges

When ETH sensors that are equipped with a memory chip are used, the GMV2 detects the removal and insertion of the sensor, and when the measuring range is changed. The device is subsequently zeroed and the system checks that the settings in the parameter set match the sensor settings.

3.12. power-saving function (standby)

Menu path: Menu → Param → Settings → Initial setting → Standby

To save power, the LCD illumination and the GMV2 power themselves off after set time periods, which can be adjusted. This function may also be disabled.

Adjustable delay times for switching off the LCD illumination are: 1 min – 1 h. Adjustable delay times for switching off the device are: 1 min – 3 h.

Note:

- These delay times are reset when measured values are saved or output.
- The standby function is disabled when the output is continuous.

3.13. Cancel serial transmission

Serial transmission can be cancelled with the OFF key.

3.14. Continuous output with a minimum 0.5 second interval period

The minimum cycle time has been increased to 0.5 seconds due to the enhanced functionality of the GMV2.

3.15. Analog output

The optional analog output is now zeroed with the Zeroadjust key. Additionally, the automatic tracking of zero-point drift is enabled.

Note:

- The output signal is scaled to $\pm 5V$ independently of the input signal (passive, active & digital).
- **The overload range must be set to 7% (standard).**

3.16. Battery protection

To prevent the battery from totally discharging and thus protect it from damage, the device powers itself off when the battery is low.

4. Menu structure

4.1. Introduction

The GMV2 offers extensive measuring, control and adjusting features. A hierarchical menu system is available to allow simple, self-explanatory operation.

A menu offers a list of selection options similar to a menu in a restaurant. Each selection in turn offers further selections (and so on). A structure is generated that is similar to the branching of a tree. The menu structure is shown in chapter 17. The actual functions are situated at the end of the "branches".

When the unit is first switched on it is in normal operating mode, that is, in level 0 in the menu structure. The GMV2 is only ready here. In addition to status information, torque, and if necessary, angle and OK /NOK assessment (arrows) are displayed in the first and last lines (see chapter 2.2.) on the screen.

Use the "Menu" key to enter the menu tree. You may navigate to the right in the tree, that is, to a higher level with the four menu keys on the right beside the screen.

Use the return key  to move back again to the left or to the next lower level.

The menu path is described as "X→ Y→ Z", which means: When you press menu key ("X"), you reach the next menu. When you press the "Y" key here you reach a menu, where you can select "Z".

4.2. Direct function keys

In normal operation (level 0) there are three keys with which a function is immediately executed when pressed. Some direct function keys are assigned multiple functions. The assigned function depends on the settings selected. When no function is assigned to the key there is no inscription and the key is disabled.

Note: The password for the first level also blocks the direct function keys.

• Store - Output / Start - Stop:

- 1.) Store: The value displayed on the screen is stored in the measured-value memory every time the key is pressed (manual save).
- 2.) Output: The value displayed on the screen is printed out through the RS 232 serial port every time the key is pressed (one-off manual printout).
- 3.) Start - Stop: Continuous measured-value output can be started ("contin" appears in the bottom line) or stopped.


- **Clear / Zeroadjust:**


- 1.) Clear the measured peak value. Torque and angle of rotation are reset to "0", Counters are reset and restarted. The unit starts the measuring process from the beginning. The measurement is not stored! Press the Store key beforehand for manual saving!
- 2.) Zeroadjust sensor and display. The offset voltage for the sensor is compensated so that, with no loading, the value "0" appears on the screen. Since every sensor drifts with the temperature, the zeroing must be repeated several times or the automatic function must be switched on (see chapter 3.7.). The sensor must be completely unloaded during Zeroadjust!

Note:

- If the offset voltage is greater than the adjusting range of the unit, an error message is output to the screen, and the procedure must be repeated. Otherwise, accurate measurements cannot be taken! This fault may be caused by loading the sensor during Zeroadjust, or it indicates that the sensor (overloading) or the connection cable are defective.
- The sensor is automatically zeroed when the unit is switched on and when you return from the menu level.

- **Test:**

"Test" serves to test the sensor. It outputs its maximum signal, the full scale value for the sensor is displayed on the screen. However, this test cannot be performed in the peak measuring mode with counterclockwise rotation! The "On/Off" button  is also available.

The "Return" key  serves to return to the previous a level in the menu. Typically, to return to normal operation this key must be pressed a number of times. If you are in normal operation when you press the "Return" key, you will return to password level 0.

4.3. Measure menu

For direct and fast changeover of the peak, track, torque wrench or rpm measurement modes without having to program a parameter set. Parameter set "0" is selected automatically! Parameter set "0" contains the settings for the current parameter set.

Note:

- This menu is only suited for determining screwing parameters. Measured values and parameters cannot be saved! Finally, you should create a new parameter set with these settings. (See chapter 9.7.)
- A power-operated screwdriver cannot be switched off during tracking measurements!
- For torque wrench measurements the yielding moment should be at least 2% of the sensor full scale value

4.4. Menu: Delete measured value

Menu path: Menu→ MVclear ...

(See chapter 11.5.)

4.5. Menu: Output

Measured values and parameter sets can be either displayed on the screen (see chapter 11.4. and 9.4.) or printed out through the serial interface (see chapter 12. and 9.5.). Alternatively, they can be uploaded to a computer. (see chapter 13.4.).

In "Menu → Output→ Display→ Light" the LCD display illumination can be switched on/off and in "Menu → Output→ Display→ Contrast" the display contrast can be set manually.

4.6. Menu: Parameter

4.6.1. Sensor

Menu path: Menu→ Param→ Transducer

This menu allows the values for the torque sensor to be set directly in the test phase (parameter set no. 0). It subdivides into "Full scale value", "Angle" and "Type" or "Sig./Ua" and "Zeroadjust".

- The full scale value is set with the Entry editor (see chapter 8.4.).
- The "Angle" menu can be used to define whether the sensor used allows an angle measurement. Angle decoders with 360 pulses per revolution are supported in this version.
The limits must be entered to display the angle on the screen! (Menu→ Parameter→ Limit→ Angle)

Note: Angle measurement is only available in the software version with suffix "W".

- Different inputs for different sensor types can be selected in the "Type" / "Sig./Ua" menu depending on the configuration level of the unit. GMV2 is equipped with an active input as standard. A passive input and a digital input are available as an option. If the type is selected, the sensor output signal can be entered in volts or mV/V.
- Automatic tracking of zero-point drift can be enabled/disabled in the "zero" menu.

4.6.2. Limits

Menu path: Menu → Param → Limits

Limits can be set directly in this menu in the test phase (parameter set no. 0). It subdivides into "Torque", "Angle" and "Timing".

Torque limits:

- All limits are also entered as unsigned numbers for counterclockwise rotation.
- The limit evaluation display (arrow) uses the angle value (unsigned).
- "Limit max" and "Limit min" define the maximum and minimum allowed torque (OK window).
- "Shut off" determines the torque at which the power-operated screwdriver is switched off. However, the "Inputs/outputs" option and external power circuitry are required for this function and it is only enabled for peak measuring.
- "Trigger" defines the torque at which angle counting begins. This is normally the joining torque.

Operation:

The torque limits are not entered here with the entry editor! The current value appears on the screen. You can increment or decrement this value with the "+" and "-" keys. A brief keystroke changes the last digit by a minimum amount. The longer you hold the key pressed, the quicker the display runs. You should therefore release the key briefly before the desired number to allow you to make the fine adjustment more slowly. The "no" key disables the limit value. Confirm the entry with "OK", because the return key aborts the changes!

Note:

- All limits are also entered for counterclockwise rotation as unsigned numbers.
- Torques are entered here without a plausibility check. This means that the minimum value can be set greater than the peak. The user is responsible for the correctness of the entries here.
- All torques must exceed 5% of the full scale value so as to be detected! If you enter "0" as a trigger, the torque must exceed 5% of the full scale value for peak measuring, so that angle counting can begin.

Angle limit:

In contrast to the torque limits, angle limits are entered with the Entry editor (see chapter 8.3.). This means that the angle entry can only be terminated with "OK". The previous menu level is then automatically selected. If the return key is pressed during entry the previous value is reloaded. There is also no plausibility check here. However, if a sensor without angle is selected, the angle menu is disabled and an error message is output. You can activate the angle functions with "Menu→ Parameter→ Transducer→ Angle→ on".

- All limits are also entered for counterclockwise rotation as unsigned numbers.
- The limit evaluation display (arrow) uses the angle value (unsigned).
- "Limit max" and "Limit min" define the allowed maximum and minimum angle of rotation (OK window). Counting begins when the trigger torque is exceeded. You can define this with the torque limits.
- "Shut off" defines the angle of rotation at which the power-operated screwdriver is switched off. However, the "Inputs/outputs" option and external power circuitry are required for this purpose.

Note: The "Angle limits" menu is only available in the variant with suffix "W".

Timing:

The times are also entered with the Entry editor (see chapter 8.3.)

Undesirable torque peaks that can occur at the beginning of screwing are suppressed during the "**Suppression phase**". This occurs when the power-operated screwdriver is being mounted, and especially with self-tapping screws. The value "0" disables the timing.

The "**After Time**" defines how long the peak measuring and angle counting remain active after the power-operated screwdriver has been switched off. The value "0" disables the time period so that the GMV2 is always ready. It should not be too small. Otherwise, the power-operated screwdriver with its centrifugal mass runs on when the measurement has been stopped. In which case too small a value would be displayed. This time period depends on the screwing application and must be determined for each individual case. **If possible, therefore, you should use the default setting "0"! If it has to be changed, select a long period!**

4.6.3. Parameter set

This is the most important menu. A parameter set must be created (programmed) before measurements can be taken or screws can be screwed. This topic is so comprehensive that it is dealt with in a separate section. (See chapter 9.)

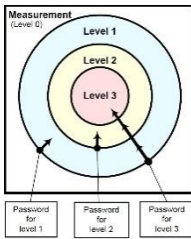
5. Settings

5.1. Functions

Menu path: „Menu → Param → Settings → Function “

5.2. Password

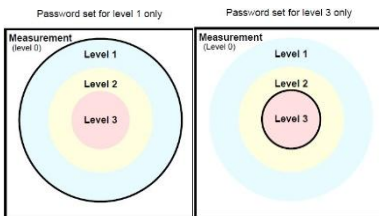
Menu path: „Menu → Param → Settings → Password “



You can program a password (maximum 4-digit number) for each of the three levels as a protection for the device settings against unauthorized change. First, you need to enable level 3. You can then select the level, for which you want to change the password. The system prompts you to enter the password. As soon as you enter a number greater than zero, password protection is enabled and you will be prompted to note down this number. The password protection in the level is disabled if you enter a zero as password. The system will then also display the message “Protection disabled”. The sections in the levels of the menu structure (Chapter 17.) are highlighted in color. The enabled level is shown on the bottom left of the screen.

If the password is programmed in the first level, all keys, except the On/Off key and the password prompt are disabled. **To return to level 0, press the “Return” key again in measuring mode!**

You can jump from level zero to level 3 by entering the password for level 3 (see diagram).



Additionally, only a certain level may be protected with one password, which means that different levels of password protection can be assigned to different user groups.

Example:

If only the password for the third level is programmed (left diagram), everyone has access to

the functions on levels 1 and 2 without a password. Since there is no password available for the first and second levels, they merge with the measuring mode. A password is needed for the third level.

Note:

- You should assign a password, at least, to the third level to prevent unauthorized persons from setting passwords!
- Should you forget your passwords, we can provide you with instructions on how to delete all passwords

6. Initial settings

6.1. Language

Menu path: Menu → Param → Settings → Initial settings → Language

The unit is fully multilingual. If the language is changed, screen texts, key labels and date format are adapted accordingly. The setting becomes effective when the language key is pressed (Caution!) German, English, French and Italian have been realized for this software version.

Note: Other languages can be realized at customer request.

6.2. Time and date

Menu path: Menu → Param → Settings → Initial settings → Clock

The actual time of day is displayed at the bottom of the screen. A flashing underline (cursor) indicates what can be changed. You can change the complete numbers only with the “+” and “-“ keys, i.e. you cannot change the units and tens separately. The longer you keep the keys pressed, the quicker numbers will change (dynamic).

Use the “<==” key to move between minute, hour, day, month and year. Don't forget to press the OK key to save the time of day! Press the return key to cancel the setting.

Note: Date and time of day are briefly flashed on the screen when the unit is switched on – which allows you to check them.

6.3. Printer (Serial interface)

Menu path: Menu → Param → Settings → Initial settings → Printer

Procedure:

First select the desired printer. For "Standard" and "==> PC" the system prompts you for the baud rate. No baud rate setting is required for DP-1 HS.

1.) Selecting the printer:

- "Standard" key for standard printer, (PC transmission with the program "Hyperterminal")
- "==> PC" key for measured-value transmission in an EXCEL® file (optional)
- The keystroke makes the selection immediately effective and item 2. is selected).

2.) Setting the baud rate:

- Default values 1200 baud to 19200 can be selected in succession with "+" and "-" keys.
- The OK key accepts the selected setting.
- The return key cancels the change and jumps to the "Initial setting" menu.

Note:

- **Factory default: baud rate 4800 Bd (suitable for printers supplied by us!), standard printer.**
- Transmission format: 8 data bits, no parity, 1 stop bit, XON-XOFF, text transmission
- Other formats are available at customer request

6.4. Display lighting

Menu path: Menu → Output → Display → Light

LCD lighting is turned on and off by pressing the "Light" key.

Note: In standby mode, display illumination is switched off after a set period if no keys are pressed (see chapter 3.12.). Press a key (Test, Return, ...) to switch illumination back on again.

6.5. Contrast of display

Menu path: Menu → Output → Display → Contrast

Use the "+" and "-" keys to set the contrast. If the contrast is too high, the background will be dark; if the contrast is too low, the figures will be pal.

Note: The contrast should only be changed for extreme ambient temperatures

7. Measuring modes

7.1. Tracking measurements

Appropriate for continuous display of static or very slowly changing torques and angles. To read the values, the tracking measurements must be slow. The display follows fast changes in torque with a delay, which depends on the filter setting, see the next section.

Note:

- Rpm measurement and power measurement can be activated here if angle measurement has been de-activated.
- The switch-off function is not available here!
- An adjustable filter can also be programmed (0.1 to 10 s).
- If switched on, the optional angle counting function is permanently enabled. It is reset when the sensor is zeroadjusted.

7.2. Filter

Menu path: „Menu → Param → Param set → New → Program“

In the laboratory, very often the torque and the rpm do not remain constant during a revolution – this makes it difficult to read the display. This filter is based on the moving average and it can filter out these fluctuations. The range of the time period over which the measured values are averaged can be set between 0.1 s and 10 s. This time period applies to the torque, the rpm and thus to the power measurement. Filtering is optimized by selecting the filter time according to the following formula and by making it as big as possible:

Filter time[s] = $n * 60 / \text{rpm}[\text{min}^{-1}]$; $n = 1, 2, \dots$

Example: For a rpm of 30 rev/min, select a time between 2.0 s and 10.0 s.

Note: Please keep in mind that double the filter time must elapse before the final value appears on the display.

7.3. Continuous measured value output

Menu path: „Menu → Param → Param set → New → Program“

Tracking measurements can be continuously printed out or saved. The allowed interval time ranges from 0.5 s to 900 s (15 min). Typically, the maximum output rate is determined by the printer rpm.

7.4. Rpm measurements

This measuring mode is a variation of the tracking measurement and is not a separate operating mode! It is only a function in its own right in "Menu→ Measure→ Track→ Speed" (parameter set no. 0). During parameter set programming, rpm measurement is activated by selecting tracking measurement without angle measurement and finally starting rpm measurement with "yes". You can select between 60 and 360 pulses per revolution: this allows you to record the rpm for torque sensors with angle measurement.

Note:

- The rpm is determined for the duration of a second.
- Maximum rpm: 30, 000 -1
- Accuracy: ± 1 digit

7.5. Power measurements

This mode is an extra function under tracking measurements and is not an operating mode in its own right! It is only a separate function under „Menu→ Measure→ Trackf → Power“ (parameter set 0). Power measurement can be started when programming the parameter set after rpm measurement has been enabled. Selecting the format determines the maximum power that can be displayed. If the scale range is exceeded, "-----" is displayed.

Note:

- The accuracy of the power measurement function is a function of the accuracy and resolution of the torque and rpm measurements.
- Since the rotation per second is measured, additional measurements errors may occur from the time shift during periods of rapid rpm changes. **A sufficiently large filter should be used as a remedial measure here.**

7.6. Peak measuring

This measuring mode is mainly used in screwing technology. Not only does it allow the largest occurring torque to be detected, but also offers numerous functions for assembly automation: time-based measuring, screwdriver control, OK/NOK assessment with setpoint values and automatic storing and erasing of measured values. The status of the measurement is shown to the left on the bottom of the screen. See chapter 2.2.

Explanation of symbols:

- * new measurement, before start-up suppression
- t start-up suppression is running, no measurement
- 1 ready for measurement, peak storage
- < angle trigger exceeded, angle counting operative
- 0 shutoff activated
- X Measurements stopped ("after time" terminated) / bend detected on torque wrench
- ! error condition, device not ready for measurements
- device not ready (zeroadjust, etc.)

The adjustable parameters are explained in Sec. 9.8 "Parameter set processing". The time-based sequence is shown in chapter 10.1.

7.7. Torque wrench measurements

This operating mode has been specially designed to check the torque values of torque wrenches. **Only clockwise measurements can be made.** The peak torque until the yielding point is reached is displayed. Any further increase in torque after this point has no effect on the measurement results. Due to the mechanical properties of the wrench, **the yielding torque can only be determined precisely by slowly and smoothly operating the torque wrench.** Status "1" – indicating that the device is ready – is displayed before the measuring process starts. If a bend is detected, "X" is output as status. The sensor should be selected, so that the minimum wrench torque to be measured is at least 2% of the sensor full scale value. If a parameter set is programmed, all memory settings such as erasure time can be made.

Note:

- Peak measuring has to be used for torque wrenches not having any torque drop
- The angle measurement is always de-activated here.

8. The entry editor

8.1. introduction

The entry editor is used to enter torques, angles, times or to make a selection. Operation is thus standardized.

The editor has three important functions:

- it accepts your entries and allows you to change existing values with the four menu keys
- it allows you to choose between different settings
- it checks your entries.

Value entry and selection are different, the entry of the sensor full scale value is a combination of both. Operating the editor is fully explained in the following sections.

8.2. Select settings

To program a parameter set you must select from a series of possible settings. You move to the next selection with the "choose" menu key. The list is always repeated from the beginning. Should you press the key too many times, continue to press the key until the desired setting appears again between the angle brackets (> <) or is displayed with a flashing underline (cursor). The entry must be confirmed and terminated with the OK key! The return key reinstates the old selection and returns to the entry. A short bleep is output as a warning.

8.3. Number input

Torque values, angles, time periods and numbers are entered in a very similar manner. However, the sensor full scale value is entered somewhat differently.

The heading explains what is being set. The current value is displayed with the predefined unit. The number of decimal points is fixed and cannot be changed. The entry is made **from right to left!** That is, first the units, then the tens, then the hundreds and so forth.

The cursor is an important part of the entry. It appears as a flashing bold underline under a number, which indicates that this position can now be changed.

Every time the "+" key is pressed the complete number is increased by the value of this position (reduced with "-"). If the position number is reduced during this operation, the cursor automatically moves to a lower position!

The "<==" key serves two purposes. It shifts the cursor to the left by one position (from the fifth position back to the first position). If the first positions are 0, a one is carried. This means that when the initial value is 0 the number 100 can be entered by pressing "<==" twice.

The entry must be confirmed with "OK" and then terminated. The return key aborts the changes, restores the old value and moves the cursor to the lowest position.

Tips:

- By pressing the Return key (you can press it twice), the old value is restored and you can restart the entry
- To change the previous position again, you can reset the higher position to 0 with "-". The cursor will then be moved to a lower non-zero position.
- Should you wish to set the maximum possible value, keep pressing "<==" until a five-digit number, for example "10000", appears. A plausibility check is started with the OK key. An error message is output and the system corrects the setting to the maximum possible value. Press OK again to terminate the entry.
- In a similar manner you will obtain the minimum possible value, when you set zero and press OK
- You can enter small numbers conveniently with the "+" and "-" keys, as they respond dynamically

8.4. Sensor full scale value

The data entry editor is active here as well. You may also set the unit and the number of decimal places here.

The sensor full scale value is entered by selecting unit, decimal places and by entering the numerical value. These steps are described in the previous sections. The following units can be chosen in this version: Ncm, Nm, kNm, inlb, ftlb, Bar, N and kN.

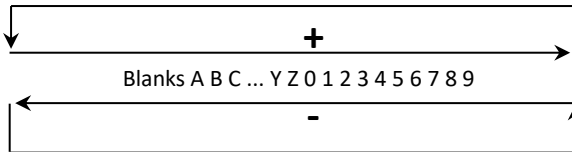
8.5. Alphanumeric texts

The data entry editor is active here as well. You may also set the unit and the number of decimal places here.

The sensor full scale value is entered by selecting unit, decimal places and by entering the numerical value. These steps are described in the previous sections. The following units can be chosen in this version: Ncm, Nm, kNm, inlb, ftlb, Bar, N and kN.

8.5.1. Keyboard:

Use the “+” und “-” keys to select blank, the letters A – Z and numbers 0 – 9:



The “+” and “-” keys react dynamically, i.e. a brief keystroke changes the number slowly. The number changes quicker when you hold the keys pressed longer. By hitting the “==> key” you move the cursor () – as well as the data entry position – to the right. After the 12th character the cursor is repositioned at the beginning of the text. You can delete existing text with the Return key and terminate the text input with the OK key.

8.5.2. Barcode scanner (optional):

You can input these texts more conveniently and quicker with a barcode scanner. You can order a barcode scanner as an accessory from ETH. Please read the user manual for the scanner before using it. The scanner allows you to use the characters minus, period and slash (standard). The extended Code 39 allows you to use the entire ASCII character set. When the text has been scanned, you can still edit it from the keyboard. It has to be acknowledged with the OK key. For connection to the GMV2 see chapter 2.3.

9. The parameter set

9.1. Introduction

GMV2 allows complex measurements in screwing technology and offers numerous monitoring and control functions. The torque can be evaluated in very different ways. All values and settings that influence the procedure and type of measurement and processing are called parameters.

Typically, the parameters are precisely adapted for the screwing task at hand. It makes sense to assemble all individual parameters for a screwing sequence in one parameter set. GMV2 can save 49 such parameter sets. A wide range of screwing operations can thus be carried out conveniently and in quick succession. When the system is switched on, the last actual set is selected. A parameter set must therefore be programmed before measurements can be taken.

9.2. Description text for parameter sets

Menu paths:

- Menu → Param → Param set → New → Program (for newly created parameter sets)
- Menu → Param → Param set → Change → Edit (to edit existing parameter sets)

We recommend you write a small text describing the parameter set in order to make it easier to choose a particular set and to avoid operator errors. This text is displayed at the bottom of the screen. The maximum 12 character long alphanumerical text is entered at the end of the parameter set programming.

Note: "More settings" must be enabled in the function settings (Menu→ Param→ Settings → Function)!

9.3. Parameter set „Nr. 0“

Menu path: Menu → Measure

Even when you enter limits directly, you use a parameter set. Please note that set number "0" has different features with respect to other sets. Since parameter set "0" contains the current settings, it is always overwritten when another set is selected. It can however be copied to another number. See chapter 9.7.

The evaluation of the measurement is based on the values in the parameter set, however changes can be made to set number "0" at any time. The measured values cannot therefore be stored for parameter set number "0"! It only serves to determine the individual parameters experimentally.

This set cannot be selected directly: it is therefore disabled. Parameter set "0" is automatically selected when individual values are changed in a stored parameter set. This can be seen on the parameter set display on the top left of the screen.

9.4. Parameter set display

Menu paths:

- Menu→ Param→ Param set→ Display
- Menu→ Output→ Display→ Param

The function for displaying individual parameters in a set can be called up in two different ways. A parameter set is output to the LCD display in a maximum of six pages: You can page through a parameter set with "Page+" or "Page-". As soon as the last page is displayed, the first page is displayed again. Empty pages are automatically skipped. A word in [...] means that this word is only displayed when the function is enabled.

1) **Setting 1:**

Input:	Socket designation, Input type
Transducer:	Transducer full scale value, [measuring range] Input signal, overload range, [automatic zeroing]
Mode:	[Direction], measuring mode, [correction factor]
Memory setting:	Memory setting
DatRec length:	Data record length

- 2) **Setting 2:** [Displays the settings for filter time, rpm, power and continuous output]
3) **Setting 3:** [Parameter set text, settings for data record ID and operator number]
4) **Torque:** All torque values are displayed here
5) **Angle:** [Displays all angle limits values (optional: only available with Version AW)]
6) **Times:** Displays all times (only available for peak measurements)

The display begins with the first page of the current set. Another parameter set can be displayed now with "Param +" or "Param -". The page selection is not affected. Parameters from different sets can thus be compared with each other.

9.5. Print out of the parameter set

Menu path: Menu→ Output→ RS232→ Param

All parameter sets are printed out in succession by pressing the "all" key. You may also select an individual set with "Param +" and "Param -". Hit the OK key to print out this set.

Parameter sets cannot be printed out on the DP-1 HS (optional)!

Sample printout of parameter sets:

```
Output Param
-----
Component 0815-01
PAR: 3
Transd:      200 Nm
Input
Type:      5V Cur2Ran
           large_range
Zeroadjust: automatic
Overload:   25 %
Op. mode:  Peak
Rot Dir:   CW
Torque
- Lim max: 150.0 Nm
- Lim min: 100.0 Nm
- Shutoff: 120.0 Nm
Angle:     none
Timing
- Suppr.:  - -
- After:   undef.
ErasrTm:  - -
Store setting: none
Data record length: undef.
```

```
-----
Wheel rim-III
PAR: 5
Input: 3.320V active
Zeroadjust: automatic
Overload: 50 %
Transducer: 1000 Nm
Mode: Pulse screwdr
Rot Dir: CCW
Co. fact: 86 %
Torque
- Lim max: -800 Nm
- Lim min: -300 Nm
- Shutoff: - -
- Trigger: -200 Nm
Angle: none
Timing
- Suppr.: - -
- After: 1000 ms
- ErasrTm: 1 s
Op. no.: yes
DR ID: yes
Store setting: CanTime
Data record length: 6
```

9.6. Selection

Menu path: Menu→ Param→ ParSet→ Choose

A parameter set becomes the current set when selected and confirmed with "OK". The measurements will be made with these settings. The number of the selected set is displayed on the top left of the screen to the left. The "return" key aborts the selection!

Note:

- The parameters are copied internally to set number "0" with this function. Direct entries are thus overwritten.
- When working with switchable sensors with numerous measuring ranges and measuring-range detection per chip, the desired parameter set must be programmed and e.g. selected in GMV2 before the measuring range can be changed over. Then, the error message is removed and the measuring level is reached by pressing the Return key.
- When you are working with sensors with two measuring ranges the sensor is switched automatically to the desired measuring range by entering the required measuring channel in the parameter set.
- If the DP-1 HS (optional) is selected as printer and the parameter set contains torque limits, the system prompts you to transmit the limits to the printer.

9.7. Create new

Menu path: Menu→ Param→ ParSet→ New

To quickly set all necessary parameters for the analyzing unit, a parameter set should be created for this purpose. GMV2 can store 49 different sets. The sets are not lost when the unit is switched off.

A new parameter set is automatically assigned the number of the first free memory area. Gaps arising when individual sets are erased can thus be re-assigned. You may now start programming ("program" menu) or use an existing parameter set as a template ("Copy" menu). A set, including set number "0", can be selected for copying with "Param - " and "Param +". After confirmation with "OK" you should start programming. All settings are displayed and the values are checked. A parameter set is programmed in the same way as with editing. A more detailed description is given in the following section.

Note:

- When a parameter set is first created, it is automatically selected and becomes the current set.
- If the DP-1 HS (optional) is selected as printer and the parameter set contains torque limits, the system prompts you to transmit the limits to the printer. The printer has to be connected in this case.

9.8. Editing

Menu path: Menu→ Param→ ParSet→ Change→ Edit

Settings in existing parameter sets may be altered in this menu. However, if measured values have already been stored with this set it is protected against changes and an error message will be output. Before a stored parameter set can be used, measured values stored in this parameter set in the device have to be deleted.

To ensure that all parameters are entered, the user is forced to enter the parameters in succession and to confirm with "OK". This entry loop cannot be aborted prematurely! However, you can always confirm with "OK" and thus quickly reach the end of the loop. In which case you must also confirm the last prompt "All entries correct? "" with "yes". Otherwise, the loop will run through again.

The order has been arranged so that a plausibility check of interdependent values is made. If entries are incorrect, an error message is displayed after confirmation, an acoustic alarm is output and the value is automatically corrected so that it is within the permissible range! Some queries can be skipped by having fixed values in the defaults and by hiding functions (see chapter 3.9.1. and 3.9.2.).

All available parameters are detailed below:

- **Sensor(type):**

The input changeover is not available with all software versions! Changeover between "active", "Cur2Ran", "passive" and "digital". Different sockets can be selected as well.

- **active-/passive- Sign./Ua:**

Adjusting the measurement input to the sensor nominal signal (Ua).

- active: ±1.250V to ±10V or selection of standard values (±5V, ±10V)

- passive: ±0.5mV/V to ±4mV/V or selection of standard values (±1mV/V, ±2mV/V, ±4mV/V)

- **Overload:**

This is the percentage by which the measuring range of the GMV2 is greater than the nominal sensor signal. This allows torques that are greater than the full scale value of the sensor to be measured. It can be used with pulse-type screwdrivers with the correction factor. The standard value is 7%. The adjustable range is 0% to 100%

Caution

- **If the mechanical overload capability of the torque sensor is exceeded for even a short period (see data sheet), this will immediately destroy the sensor!**

- The specified accuracy of sensor is not guaranteed at more than 50% overload

- The GMV2 resolution worsens accordingly

- **Sensor full scale value:**

Nominal sensor torque.

Setting range: 1.000 Ncm to 200 kNm; 1.000 inlb to 1999 inlb / ftlb.

- **Operating mode:**

- Track: Continuous display of current torque, angle of rotation or rpm and power.

- Peak: The highest value is stored. See Sec. 10. for screwing's See chapter 10.

- Torque wrench: **For clockwise rotation only.** The peak value before yielding point is reached is stored. See also chapter 7.7.

Pulse-type screwdriver: Specially designed for pulse-type and impact screwdrivers (peak measuring with correction factor)

- **Filter:**

Tracking measurements: "Average value for n s". 0 s: Filter disabled, otherwise average value over a period of n seconds. Setting range: 0.1 s to 10.0 s.

- **Correction factor:**

Only available in "Pulse-type screwdriver" mode. It is the ratio of the indicated value to the measured value in percent. Setting range: 50% to 150%. The default value 100% disables the correction factor.

The measured torque for pulse-type screwdrivers deviates significantly from the torque applied to the screw. The indicated value can be adapted with the correction factor. It is calculated as follows:

Correction factor = 100% * (measured torque in the screw / uncorrected measured value)

- **Direction:**
Peak measuring only: clockwise or counterclockwise rotation.
 - **Torque (processing):** choose between
 - „Display“: display only,
 - „Monitoring“: with limits (OK/NOK assessment), without shut off,
 - „Schut off“: same as monitoring, with shut off power-operated screwdriver by external power circuitry, however only available for peak measurement!
 - **Torque Limit max:** If the measured torque is greater than this limit value, NOK assessment is carried out. Allowed setting range is 5% to 100% of sensor full scale value including overload range.
Counter-clockwise rotation: unsigned number entry! A correction factor alters the valid setting range!
 - **Torque Limit min:** If the torque is greater than this limit value, the power-operated screwdriver is shut off by an external power circuitry. The allowed setting range is 5% to 100% of sensor full scale value including overload range. Counter-clockwise rotation: unsigned number entry! A correction factor alters the valid setting range accordingly! Only available with the Inputs/Outputs option!
 - **Shut-off torque:** If the torque is greater than this limit value, the power-operated screwdriver is shut off by an external power circuitry. The allowed setting range is 5% to 100% of sensor full scale value including overload range. Counter-clockwise rotation: unsigned number entry! A correction factor alters the valid setting range accordingly! Only available with the Inputs/Outputs option!
 - **Angle (processing):** Choose between
 - „no“: The sensor does not have an angle counter or it is out of use. **Rpm measurement can also be activated** subsequently with this setting.
 - „Monitoring“: with limits (OK/NOK assessment), without shut off,
 - „Schut off“: The same as monitoring, with power-operated screwdriver switched off by external power circuitry, however only available for peak measurement! Switching off according to angle of rotation depends on the setting for torque processing.
- Note:
- The angle measurement is only available in the version "W"!
 - Counter-clockwise rotation: unsigned number entry!
 - **Rpm:** Rpm measurement is activated with "yes". This is only available when "no angle" is selected for tracking measurement. The rpm is determined for the duration of a second. You can select an angle encoder with 360 pulses/rev or a rpm encoder with 60 pulses/rev for the sensor. Accuracy: ± 1 digit; max. rpm: 30,000 rev/min!
 - **Power:** The power measurement is started with "Yes". It is only available when rpm was selected beforehand. Subsequently, the maximum power to be measured must be set with unit and decimal places. Setting range: 1.9999 mW to 19,999 kW. A filter time on the order of a few seconds must be programmed beforehand for a stable read-out.

- **Suppression time:** To suppress undesirable high torque peaks that can occur at the beginning of the screwing process. This occurs when the power-operated screwdriver is being mounted, and especially with self-tapping screws. Timing is started as soon as the torque is greater than 5% of the full scale value. Peak measuring is disabled until the suppression time has elapsed. If suppression is not required, the value can be set to "0". The allowed setting range is 0 to 10,000 milliseconds (10 seconds).

Warning:

The suppression time also disables shut off! The protective shut off for sensor overload remains continues to be enabled, however. The angle trigger can also be delayed, so that too small an angle is displayed.

- **After Time:** The centrifugal mass of the power-operated screwdriver causes it to run on and the torque increases further even after shut off. The after time defines how long peak measuring and angle counting continues after the power-operated screwdriver has been switched off. The measurement is then stopped and the values saved. The value "0" disables this time.

In most cases, we recommend you use the default setting 0. If you select a value for the after time, it should not be too short to avoid measuring torques that are too small! This value should be determined experimentally, as it also impacts the angle measurement and is dependent on the screwing operation at hand.

Choose a long time period!

The allowed setting range is 10 to 10,000 milliseconds (10 seconds).

- **Memory setting:** Choose between "no": measured values are not stored, and "Manual": the measurement must be saved with the "Store" key. Then reset the peak to zero with the "erase" key. "Erasure time" saves and erases the peak automatically if OK. This time defines how long a peak stays on the screen. The allowed setting range is 0,1 to 240 seconds (4 minutes). The setting "RS 232" is like the erasure time: the difference being that the measured value is not stored internally but is printed out. For tracking measurements: "contin" is still available for continuous printing. The permissible setting range is 0.5 s to 900 s (15 min).
- **Data record length:** The number of similar screwing's to be stored in one data record. Many measured values can thus be subdivided sensibly and printing and archiving are easier. Particularly useful for cylinder heads and wheel rims. The current data record number is displayed on the right of the screen beside the memory number. If no special subdivision is required, the value can be reset to "0". A data record length of "1" should be avoided. The allowed setting ranges from "0" to the remaining memory capacity (maximum 1,000 measured values).
- **Automatic Zeroadjust (tracking zero-point drift):** Slight sensor zero-point drifts e.g. due to temperature changes are compensated for automatically. As soon as the sensor is put under load this function is put in abeyance. Only available when the default setting is "Enter".
- **Parameter set text:** You can enter a description for the parameter set (alphanumeric with maximum 12 characters). This text appears at the bottom of the LCD display, see chapter 2.2. You can input the text with the input editor. Alternatively, the text can be entered conveniently with a barcode scanner available from ETH. This facility is only available when "More" is selected during function selection.

- **ID text for data records:** The ID prompt can be enabled/disabled with the “DescDR” key. The actual text is entered before the measurement. The operator is prompted again at the beginning of a new data record. In this case, the text can be input with a barcode scanner. The current text appears to the right beside the parameter set text (see chapter 2.2.). This facility is only available when “More” is selected during function selection.
- **Operator number:** The operator number prompt can be enabled/disabled with the “OperatorNo” key. The system prompts you again to enter this number at the beginning of a new data record and is saved in the record. The current operator number appears to the left of the screen (see chapter 2.2.). The texts setting and the operator number must be acknowledged with the “OK” key. This facility is only available when “More” is selected during function selection.

All necessary parameters have now been entered. Confirm the "All entries correct?" prompt with "yes" to exit the entry loop; the settings then become immediately effective. You can repeat the entries with "no".

If DP-1 HS (optional) has been selected as printer and the parameter set contains torque limits, you will be prompted to decide whether the limits should be transmitted to the printer.

9.9. Delete

Menu path: Menu → Param → ParSet → Change → Erase

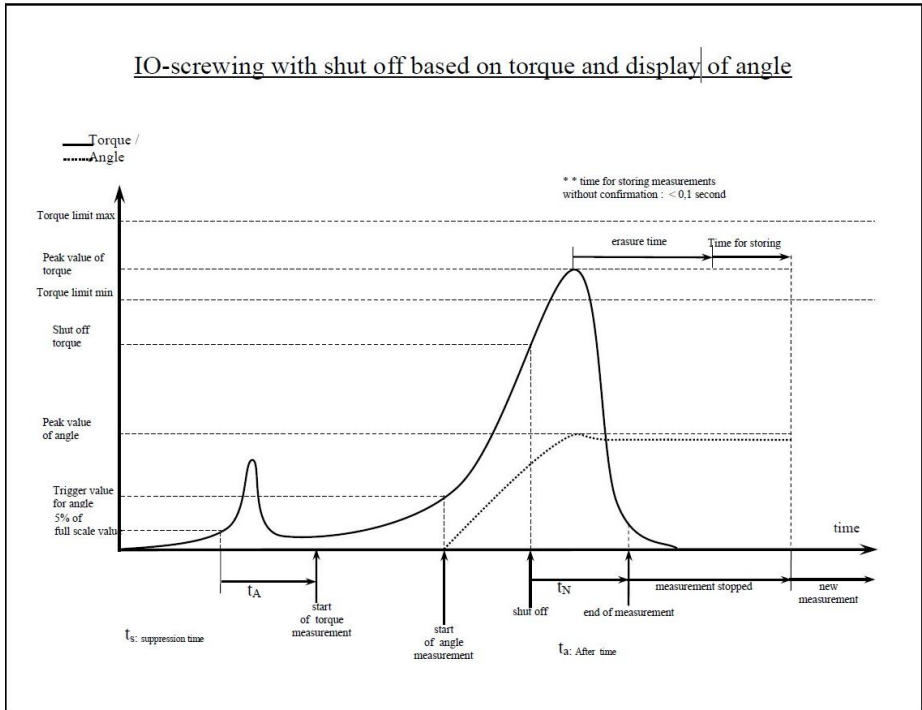
You can select a parameter set with "Param +" and "Param -" before erasing. The number is displayed on the top left of the screen. As a security measure erase must be confirmed with "yes". This parameter set is now free and will be re-used when recreated. The error message "ParSet used" indicates that measured values have been stored with it and that it is thus protected against modification.

Note:

- When the current parameter set is erased, the previous set automatically becomes the current set.
Tip: To erase several successive parameter sets, start with the highest number. This means that a selection for each one is not required.
- Set number "0" cannot be erased.

10. Screwing technology

10.1. Time based sequence diagram



10.2. Timing

- **t_A**: The suppression phase is started once when the torque exceeds 5% of the sensor full scale value. The torque values are suppressed during this period. This period should not be too long, because when no starting peak occurs, the time period begins shortly before the screw head is mounted. Angle counting could thus be delayed. Shut off is also suppressed. The value "0" for t_A de-activates the function.
- **t_N**: The after time is started once when the shut off has been activated. When this time has elapsed, angle counter and torque peak measurement are disabled. The after time must be set to suit the screwing sequence dynamics, so that the power-operated screwdriver run-on is recorded.

We recommend that the default setting "0" is selected. Otherwise select a long time period!

Note:

Without shut off the measurement is not limited by t_N and runs on until the peak value is erased.

The maximum value for angle and torque is always displayed and saved for a long after time.

- The **erasure time** is always restarted with increasing torque. It defines how long the value should remain on the screen after the final peak. The measurement is then saved, peak values are reset and a new measurement is started.
- The **storing time** is negligible for an OK screwing. However, if measured values are outside the setpoint values (NOK), storing must be confirmed – thus delaying the procedure.

10.3. Angle

Shut off based on angle is also possible with GMV2. This is independent of an additional torque shut off and operates in the same way. Angle counting in the peak operating mode begins when the trigger torque is exceeded. The maximum angle of rotation is measured. The angle can be reset by clearing the peak value or by zeroadjusting the sensor.

The allowed angle range is $\pm 6,000$ degrees. Clockwise or counterclockwise rotation is possible with peak measuring. Shut off based on angle is delayed without rise in torque (screw breaking off).

Note: Angle measurement is only available in version "W"!

11. Saving measured values

11.1. The measured value memory

One thousand measured values can be stored in GMV2 for the documentation and evaluation of screwing's. In addition to torque a measured value contains further information, such as, angle of rotation, OK/NOK assessment, and date and time of measurement. The values can be saved manually with the save key or automatically by means of an erasure time. The storing of NOK screwing's that are outside the limit values must be confirmed. The memory values are permanently stored even after the unit has been switched off; they can be displayed at any time, printed out or transmitted to a personal computer. The measured values are linked to the appropriate parameter set as they depend on the selected settings. Thus, the parameter set is protected against changes as soon as values are stored with it. The numbering of memories (ST:) and the subdivision into data records (DR:) facilitate the assignment of measured values to the workpiece. Similar screwing's are assembled to a group in one data record, see next section. The remaining memory, that is the number of free memories, is displayed in the lower status line on the screen with "SR:" (see chapter 2.2.).

11.2. The data record

Typically, the same screwing operation must be repeated a fixed number of times for each workpiece in assembly lines. This number can be set as the length of the data record in the parameter set. Screwing's are the same when they are performed in succession with the same parameter set and on the same day.

Especially when many measured values are stored subdividing them in data records facilitates selection for display and printout, as described in the following sections.

If a data record is fully assigned, a new record is selected automatically. "ST:" defines the screw for the workpiece as the "ST:" numbering of the memory starts at the beginning with each data record. The data record number thus defines the workpiece. One ID text and one operator number may also be entered and saved per data record see chapter 9.8.

If the started data record is not fully assigned when the parameter set is changed, the remaining spaces are filled with "No measurement". The data record number is counted from "1" with every new parameter set.

If the number of screwing's is unknown, any number can be set with the length of the data record "0" (standard setting!). A new data record is then started automatically when parameters or the date are changed. A length of "1" is not recommended.

11.3. Memory settings

Menu path: Menu→ Param→ ParSet→ Change→ Edit

The following settings are available:

- „**no**“: Storage disabled. This is mandatory for parameter set "0". However, you can then print out the values shown on the screen with the key "Output" (level 0).
- „**manual**“: The "Store" key stores the current indicated value in the measured-value memory. For peak measuring the peak must then be reset with "erase".
- „**erasure time**“: Automatic storing and erasing the peak value when an adjustable time period has elapsed. The erasure time starts when the torque drops below the maximum value. The allowed range is 0.1 to 240 seconds (2 minutes).
- „**RS 232**“: Similar to erasure time, however the measured value is not stored, but is printed out.
- „**Contin.**“: “: “continuously” can be selected in tracking measurements. Then, “Memory” is selected for internal storing or “RS-232” for continuous measurement output. The time defines the time period. The permissible range is 0.5 seconds to 900 seconds (15 minutes).

Note:

- If the measured value lies outside the setpoint values (NOK), storing must be confirmed, which in turn interrupts the erasing procedure.
- If the torque drops temporarily during screwing, the erasure time must be selected sufficiently large.

11.4. Displaying the saved measured values

Menu path: Menu→ Output→ Display→ Store

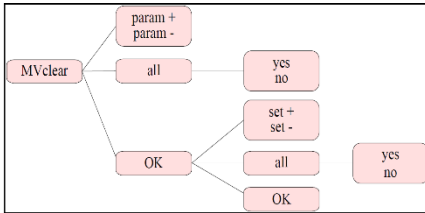
In addition to the torque, the angle of rotation or rpm and the power may also be displayed. The parameter set, memory and data record number are also displayed in the top status line. The parameter set text, the ID text for data records, and below them, the date and time of day of the measurement are shown in the bottom line. The used parameter set is selected first for output and confirmed with "OK".

Then, use "Record +" and "Record -" to select the next data record, and use "value +" and "value -" to select the next value.

The output is sorted according to data record number. It begins in the first data record with the first measured value. A short bleep indicates that the end or beginning of memory has been reached.

11.5. Delete measured values

Menu path: Menu → MVclear...



Menu: Delete measured value

You can choose which measured values you want to delete:

- all measured values
- the measured values in a parameter set
- the measured values in a data record

The parameter set will be selected first (or “all”), then the data record (or “all”)

Note:

- If you still require some measured values, you can upload data records to a personal computer as described in chapter 13.4. using a null modem cable and archive them there.
- To edit a parameter set with which values have already been stored, you can enable the parameter set by erasing the measured values in this parameter set.

12. Printing out the saved measured values

Menu path: Menu → Output → RS-232 → Store

Measured values are always printed out here in sets and are ordered firstly according to the used parameter set number and secondly according to the data record number.

You can choose to print out the entire measured-value storage in the first menu "Param + / Param - / all / OK". Use "Param +" and "Param -" to choose a particular parameter set. Observe the "PAR:" display. "OK" terminates this selection and branches to the next menu. You can decide now in the menu "Record + / Record - / all / OK" whether you want to print out all data records in the selected parameter set or only a particular one.

The "all" key starts the printout immediately, it must not be confirmed with "OK"!

Note:

- An individual measurement can be printed out with the direct function key "Output", when "No storing" is set.
- Some limitations apply to DP-1 HS (optional) (see chapter 13.13.):

Examples:

- Print out all stored measured values:
Menu → Output → RS-232 → Store → all.
- Print out all data records that have been measured with the first used parameter set:
Menu → Output → RS-232 → Store → OK → all.

Example of a measured-value printout:

<pre>===== DR: 1 PAR: 1 21.04.99 OK No Md/Wkl Time 1 5,95 Nm 09:41 2 6,40 Nm 09:41 3 7,65 Nm 09:41 ===== DR: 1 PAR: 2 24.12.02 OK No Print Time N 1 56,5 Bar 09:33 I 2 101,5 Bar 09:33 I 3 125,3 Bar 09:34 I 4 131,4 Bar 09:34 I 5 133,9 Bar 09:34 N 6 154,8 Bar 09:34 ===== DR: 1 PAR: 6 21.04.99 OK No Md/Wkl Time 1 -9,39 ftlb 09:39 -145 degrees 2 -9,75 ftlb 09:39 -179 degrees ===== PAR: TESTTEXT P5 ===== DR: 1 PAR: 5 22.10.02 OK No Md/Wkl Time 1 133 Nm 11:00 833 rev/min 11,601 kW 2 274 Nm 11:00 333 rev/min 9,554 kW 3 900 Nm 11:01 100 rev/min 9,424 kW</pre>	<pre>===== PAR: MOT BLOCK WMB ----- DR: 1 PAR: 4 06.01.03 OK No Force Time I 1 19,58 N 14:36 I 2 19,64 N 14:36 ----- Op no: 1001 ===== PAR: WHEELRIM9112 DR: ID3000197028 ----- DR: 1 PAR: 6 06.01.03 OK No Md/Wkl Time I 1 76,75 Nm 14:38 I 2 76,11 Nm 14:41 I 3 75,64 Nm 14:48 N 4 74,25 Nm 14:51 ----- Op no: 12 ===== PAR: WHEELRIM9112 DR: ID3000197111 ----- DR: 1 PAR: 6 06.01.03 OK No Md/Wkl Time I 1 77,75 Nm 14:38 I 2 76,43 Nm 14:41 I 3 78,02 Nm 14:48 I 4 75,05 Nm 14:51 ----- Op no: 12</pre>
---	---

Notes:

- All clearances between words are blanks
- The end-of-line comprises "CR" and "LF"
- The line length is less than 32 characters
- Blank lines comprise several "CR"s / "LF"s
- The printout is terminated with at least one blank line
- See chapter 15 for transmission format and protocol.

13. Optional Functions

By keeping the power button pressed, the available hardware and software options, the time of day and the date will be displayed. See chapter 2.5.

13.1. Battery operation

The device is fitted with an optional battery. The device can run solely on battery power as the torque sensor will also be powered from the battery.

The lead acid battery requires no maintenance, is protected against overcharging and is automatically recharged during permanent mains operation. It takes up to a maximum of 12 hours to completely recharge during normal measurement mode; when the device is switched off it takes up to a maximum of 5 hours to recharge the battery. The device can then run for at least 6 hours in continuous measurement mode.

The GMV2 has a battery monitoring feature. If the battery is almost completely discharged, the message "Recharge!" will be displayed every minute and a beep is sounded as well. The warning message appears permanently at the bottom of the screen on the right. You should recharge the battery then as soon as possible (you can now run the device with the mains cable).

Note:

- If the battery charge is very low, the device will switch itself off and it cannot be switched on again.
- The device will function, however, if connected to the mains power system
- **If the device is in storage or is unused over a longer period (1/2 year) the battery will have to be recharged.**

13.2. Passive input

All passive measuring bridges with a resistance $\geq 350\Omega$ and a signal of 0.5mV/V to 4mV/V can be connected to the device.

The pin assignment for the socket is shown in chapter 15.

13.3. Digital input

You can connect the torque sensors fitted with digital output you receive from ETH with this option.

They are connected to the active socket (ACT/DIG).

13.4. Measured value transmission GMV2 → PC

13.4.1. Function

The supplied EXCEL® files (with program macros) are used for data transmission from GMV2 to PC, for statistical data analysis, for archiving and printing out the data. Test logs can also be generated automatically. A sample log for torque wrenches is supplied with the system. You may add other logs or adapt existing ones as you wish. The first page in the file contains the measurement table. **The measured values can only be scanned in here.** The other tables and diagrams access them.

Important notes:

- ! If an error message is displayed when you open the file, **you should run the “Setup.Exe” program on the accompanying CD.**
- ! Before transmission, ensure that “==> PC” is set as printer on the GMV2 (Menu→ Param→ Settings → Program→ Printer→ „==> PC“), select baud rate with “+” and “-”.
- ! The existing pages should not be deleted or renamed!
- ! The programming of macros is restricted

13.4.2. Menu bar

An additional menu bar appears on the screen when the file is opened. This menu bar behaves like the other menu bars: it can be moved and faded in and out. You can select the number of the serial port being used from a list. The displayed baud rate must be the same as the baud rate selected in GMV2. We recommend using a baud rate of 4800.

13.4.3. Data transmission

The “Scan” button activates the RS-232 port and renders the PC ready to receive data. If the table already contains measured values, the system prompts you to enter whether you want to overwrite these measured values or keep them. In the latter case, the scanned measured values will be appended to the existing ones.

The button then changes to “Finished?”.

Tip:

You can overwrite individual measured values before transmission by selecting another cell. The selected cell must be **in the first row** of the cell that you want to overwrite. Now you can transfer single measured values, a single data record, or all data records to the GMV2.

In “Menu – Output – RS232 – Store” you can select which data you wish to transmit. You can then see the measured values being scanned into the table on the PC.

When transmission is complete, you need to acknowledge this by clicking on “Finished?”

If you transmit “all” measured values (all measured values or those from one parameter set), the transmission is automatically terminated. The button then changes back to “Scan” and the measured-value table is processed:

- empty rows are hidden, used rows are shown
- the measured values are divided according to parameter set and data record numbers by means of dividing bars
- NOK measured values (outside the limits) are stored in red
- Print area and page are automatically set up (!)

13.4.4. Measured value table

Some of the unused rows may be hidden in the measured-value table. This happens automatically with rows “B” to “L”. Leave the row “M” empty, as it separates the subsequent rows of comments. You can use the rows of comments as you will: hide or show them and use them for notes for reading in measured values. They are not altered by the program, **and typically do not appear in the printout!**

The print area is automatically set for all measured values. Should you wish to print out some of the data only, change the print area beforehand.

Tipp:

If you wish to print comments as well, you can enter any character in the first line in the “M” row and then set the row width to zero. A comments row is only hidden when it is completely empty.

13.4.5. Statistical analysis

In the “Statistics” page, you can select – according to the parameter set and the data record – which measured values should be used in the calculation and shown in the diagram.

You can adjust the head of the page, up to the selection fields, as you wish. Do not alter the section containing the statistics!

Although the print area is pre-defined on this page, it can still be altered.

Note:

When both limit values are negative, **counterclockwise** rotation is assumed. A measured value that is more negative than the limit value, will then be interpreted as being **too large!**

Similarly, a more positive value is too small!

13.4.6. Measured value diagram

The data range for the first row of measured values (and for the limits) is automatically set in the dropdown selection fields. Scaling is also set automatically. You can, however, enter values for (fixed) manual scaling.

You may arrange the diagram (colors, line thickness, ...) as you wish. The best way to do this is to right-click on the desired element (context menu).

Note:

- By pointing the mouse exactly over a vertex of the curve, the numerical figures will be shown.
- You may insert more self-defined diagram (and table) sheets.

13.4.7. Protocol torque wrench

This page is intended as a starting point for your own test logs. It accesses the measured-value table via formulas. This is why you can alter this page as you wish.

13.4.8. General information

Two EXCEL® files are supplied:

- “GMV2-PC-Trans.xls”: This is the **original file**, which you **should always receive**. When you wish to save measured values, **first (!)** save the file under a different name (Save under).
- “Example-PC-Trans.xls”: This example file contains some measured values, which you can use to test the program and make changes.

Should you have any queries, please call us on: +49 (0) 7972 / 9310-0

13.5. Barcode scanner

You can connect a barcode handscanner, which you can obtain from ETH, to the system to input texts (parameter set text, data record ID) quickly and conveniently. It is connected to the 9-pin plug USB-D socket "Scanner".

Only Code 39 is supported as barcode type! The scanner must be set up as follows:

Baud rate 9600, 8 data bits, 1 stop bit, no handshake, no parity (mark), message terminator selection: CR/LF, RS-232C, Code 39 (extended)

13.6. Inputs / Outputs

This option makes floating inputs and outputs available for control and display purposes. This is the prerequisite for the options in chapter 13.7. to 13.12.

13.7. Shut off

A floating optical isolator output is available at pins 6 and 19 in the 25-pin IN/OUT socket (see chapter 15). This can operate a power-operated screwdriver or a valve by means of an external power circuitry. In order to activate the shut off however, a shut off limit must be programmed in the parameter set (see chapter 9.8).

Loading capacity of the output: maximum 30 V DC with maximum 150 mA. The shut off delay is ≤ 0.5 ms. Shut off based on angle is delayed without rise in torque

13.8. Connecting the power pack

A power pack can be connected to the 25-pin plug socket "IN / OUT" at the rear of the device. Refer to the next section for more information

13.9. OK output

Should the torque and, if necessary, the angle be within the programmed limits (total OK), a relay is operated. A floating make contact is available at pins 13 and 25 on the 25-pin IN/OUT socket (see chapter 15). It can be loaded with maximum 1 Ampere at 25 V AC / 30 V DC. It is not a heavy-duty relay! It is however suited for controlling a programmable controller or a contactor.

13.10. NOK output

This output signals an NOK screwing under the following conditions:

- 1.) At least one limit window (torque / angle) has been programmed.
- 2.) The measured value must be stored: either with "erasure time", "RS 232" or "manual".
The "RS 232" function can be used when the NOK output is required, however without saving the values. In this case no printer should be connected.
- 3.) The torque or possibly the angle lies outside the programmed limits.
- 4.) The erasure time has elapsed.

The relay at pins 12 and 24 on the 25-pin IN/OUT socket (see chapter 15) contact is closed with a NOK screwing when the erasure time has elapsed. At the same time the prompt "Store yes / no" is displayed on the screen. The contact is opened again after confirmation. The electrical characteristic values are the same as described in the previous section.

13.11. Analog output

The analog torque signal is available with this option at pin 11 on the 25-pin IN/OUT socket so that the torque can also be evaluated on external equipment such as characteristic curve plotters, storage oscilloscopes and so forth.. The reference potential is GND at pin 5. Ensure that no ground loops are formed as this ground is not electrically isolated from the unit. The output can be loaded with maximum 5 mA. It is not protected against overvoltage's.

The analog output is only scaled to ± 5 V when the overload range is set to "7%" (standard). However, it is then independent of the input and from the input sensitivity!

When the GMV2 is zeroadjusted, the output signal is zeroed!

Peak storage is not performed.

13.12. External control

13.12.1. Selecting parameter sets

In a similar manner to the Switchbox, the parameter sets can be selected externally using the optional 9-pin INPUTS socket (see Sec. 2.3). Parameter set numbers 1 to 49 are valid. Coding is carried out with 1 $\frac{3}{4}$ -position BCD. A TTL level (+5 V), and at least 1 mA are required however. The maximum allowed input current is 10 mA for each input line. You may have to use a series resistor!

13.12.2. Zeroing

A GMV2 zeroadjust can be triggered externally from a programmable controller using the floating optical isolator input pins 2 and 5 in the 25-pin IN/OUT socket (see chapter 15). An ON signal level of 4 V to 30 V DC with at least 3 mA is required for control. The OFF signal must be less than 1.5 V.

13.12.3. Saving / Printing / Deleting

Storing/printing/erasing can be externally triggered from the 25-pin SUB-D socket (see chapter 15). The exact function depends on the operating mode and the memory settings.

Function of external control:

Memory setting	Track	Peak
None	Printout	Printout and erase
Manuel	Store	Store and erase
Erasure Time	---	Erases NOK values without storing!
RS 232	---	not allowed!

13.13. Measured value printout to the Digimatic DP-1 HS

13.13.1. Introduction

Torque measured-values can be printed out and statistically evaluated with the "Digimatic Mini-Processor DP-1 HS" printer. The statistics functions contain:

off-limit condition, number of measurements, max. & min. values, range, mean value, standard deviation, number of defects, percentage defects, producible index, D board, histogram, random samples.

Parameter sets or angles of rotation cannot be printed out, however.

13.13.2. Connection and preparation

The 10-pin, rectangular connector on the cable is inserted in the INPUT socket on the Digimatic printer. The 9-pin SUB-D connector on the cable is connected with the RS-232 C socket on the GMV2.

DP-1 HS must be selected on the GMV2 under "Menu / Parameter /Setting / Initial setting / Printer". The baud rate need not be set.

The CL key must be pressed on the printer before the measured values are printed out, when no limits have been previously transmitted. This is very important when the parameter sets are selected externally. Limits are required for many of the statistics functions. The transmission is described in the following section.

13.13.3. Transfer of limit values

If you select or edit a new parameter set in which limits are entered and if you have selected the DP-1 HS as printer (see previous section), the system will prompt you to transmit the limits to the printer. When not, reselect the selected parameter set. If you answer with "yes", then follow the instructions on the GMV2 screen:

The old limits are printed out when you press the CL followed by the TOL.LIMIT key. Wait until the printout is finished, then quickly confirm with "yes" on the GMV2. Now press the data key on the printer. The "NO DATA" error message may appear. Please ignore this message!

Then acknowledge with "yes", press the TOL.LIMIT key again and confirm with "yes" on GMV2. The transmission is thus terminated; the new limits will be printed out.

Note:

- **Wait until the printout is finished before hitting the next key on the GMV2!**
- Once the transmission is started it cannot be aborted!

13.13.4. Printing out the measured values

The following printout options are also available with the DP-1 HS setting:

- Single-value printout
- Printout over erasure time (setting: "RS-232")
- Printing out one or more data records from a single parameter set (you may need to press the CL key first)

Note:

- The printer can only process one numeric range. Should the position of the decimal point or the sign change when a new parameter set is selected, the CL key must be pressed before the first printout.
- If torque and angle of rotation are measured, only the torque can be printed out.
- The **parameter sets** can still be output to a standard printer or to the PC with the **appropriate cable!** The baud rate must be previously selected with the "Standard" setting.
- Most statistics functions require limits. They should be transmitted first.
- Torque values are printed out without units.
- No angle values are printed out!

14. Error messages

14.1. General

The GMV2 has been designed so that operator errors are almost impossible. Invalid settings are not displayed when selected and inhibited keys have no inscription.

A plausibility check is performed during parameter set programming so that, for example, the minimum value cannot be set greater than the peak. The system also ensures that no over-range is possible. An incorrect entry is indicated with an error message and, if possible, the value is corrected. Invalid operating states are also displayed.

An error message is output at the left-hand side of the LCD display. A beep is also sounded.

There are three different types of messages:

- **Notes**: For minor faults. This error message is automatically cleared after one second.
- **Warnings**: One or more functions cannot be started. All GMV2 functions are stopped until this message is cleared with the return key
- **Major faults**: The GMV2 is not functioning properly. The unit must be switched off and the fault cleared.

14.2. Errors and causes

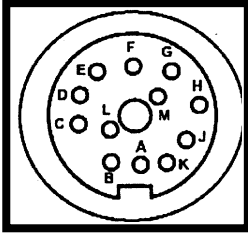
Error Message:	Causes and Error Elimination:	Type:
Transducer MemChip	Sensor data cannot be scanned	Warning
Transducer	Internal fault when changing to an invalid sensor type	Warning
Transducermodel, values, final value, angle, rpm, 60/360 pulses → Sensor data do not match the parameter set	Warning
Transducer overload	1.) When plugging in the sensor. 2.) The sensor has been overloaded or damaged. 3.) With a cable break, with a wrong connection cable, or with a strong unwanted signal.	Warning
Output ==>PC	The parameter sets cannot be uploaded to the PC	Warning
CRC MemChip	CRC error when reading the sensor memory chip	Info
Printer	Error during data transmission to printer	Warning
Input	The scanned text is longer than 12 characters	Info
Setting	Error in the settings has been rectified.	Warning
EPROM Memory	Error in internal GMV2 program memory	Major fault
Calibr. date	The calibration interval has elapsed. Please return the GMV2 for calibration	Warning
Calibr. memory	Error in calibration memory has been eliminated.	Info
No angle	Setting angle limits is inhibited without the angle measurement option	Info
No calibration	The calibration has been destroyed.	Major fault
Short-circuit MemChip	The sensor memory chip has a short-circuit	Info
Charge!	The battery is almost fully discharged and must be recharged! The device will switch itself off after 15 minutes.	Info
MemChip model	Unknown memory chip model	
Zeroadjust	1.) The sensor is loaded. → Unload and zero again! 2.) The sensor has been overloaded. → It is faulty and must be repaired	Warning
Param	An attempt has been made to switch a parameter set externally, while a limit is being saved. → First, delete limit.	Info
ParamSet used	An attempt has been made to alter a parameter set with which values have already been stored. → Erase memory, or copy parameter set to another number.	Info
Param set no.	Parameter set no. 0 cannot be erased.	Info
Param set invalid	A nonexistent parameter set has been selected externally	Info
Password	Error during password entry: Does this PWD exist?	Info
Password invalid	Incorrect password entered	Info
Angle overflow	The measured angle is greater than ±6000 degrees	Warning

15. Pin assignments

The description of the pin assignments refers to the unit and are on the rear, as seen from outside.

15.1. Active and digital sensor socket

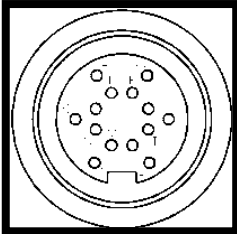
(12-pin round socket)



Pin	Signal	Pin	Signal
A	Digital Input (Optional)	G	Angle Track A
B	Angle Track B	H	Memory chip
C	Torque	J	Memory chip 2
D	Torque GND	K	Test
E	Power supply & angle GND	L	Torque-2
F	Power supply +12V	M	NC (reserved)

15.2. Passive sensor socket with angle (optional)

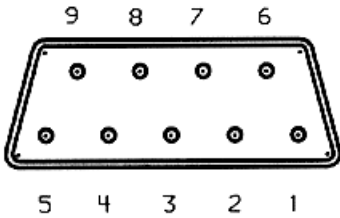
(14-pin round socket)



Pin	Signal	Pin	Signal
M	+ Power supply bridge	A	Memory chip
N	Reserved: (+Sense)	C	5V angle supply
O	Reserved: (-Sense)	E	Angle und chip ground
P	- Power supply bridge	G	Angle Track A
R	+Signal	J	Angle Track B
S	-Signal	L	unused
T	Test	U	unused

15.3. RS-232C / Digimatic mini-processor printer connection

(9-pin SUB-D connector)



Pin	Assignment
1	DP-1 HS (Option)
2	RXD (Input)
3	TXD (Output)
4	DP-1 HS (Option)
5	GND
9	DP-1 HS (Option)

Transmission format and protocol (RS-232C):

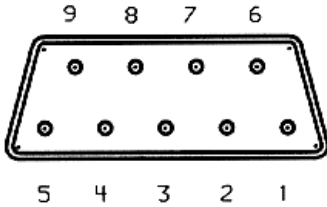
XON-XOFF, no parity, 8 data bits, 1 stop bit, 4800 baud (preset for printer!)

Note:

- You can use a serial cable, provided for the PC, as printer cable.
- A null modem cable is required for data transmission to the PC.
- A special cable from ETH must be used for the mini-processor DP-1 HS.
- A sample printout is given in chapter 9.5. und 12.

15.3. RS-232C / Digimatic mini-processor printer connection

(9-pin SUB-D connector)



Pin	Belegung
1	DP-1 HS (Option)
2	RXD (Eingang)
3	TXD (Ausgang)
4	DP-1 HS (Option)
5	GND
9	DP-1 HS (Option)

Transmission format and protocol (RS-232C):

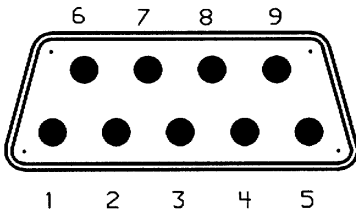
XON-XOFF, no parity, 8 data bits, 1 stop bit, 4800 baud (preset for printer!)

Note:

- You can use a serial cable, provided for the PC, as printer cable.
- A null modem cable is required for data transmission to the PC.
- A special cable from ETH must be used for the mini-processor DP-1 HS.
- A sample printout is given in Secs 9.5 and 12.

15.4. "INPUTS" Connection (Optional)

(9-pin SUB-D socket)



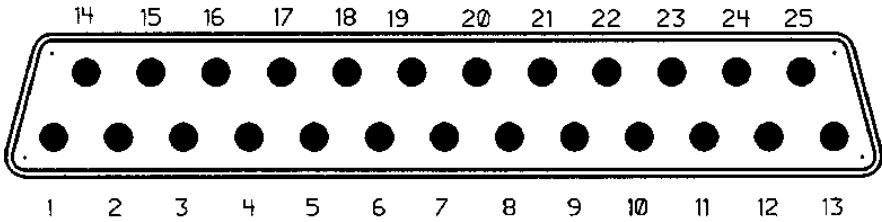
Pin	Assignment / Value
1	Bit 0 / 1_d
2	Bit 1 / 2_d
3	Bit 2 / 4_d
4	Bit 3 / 8_d
5	Bit 4 / 10_d
6	Bit 5 / 20_d
7	Bit 6 / 40_d
8	+12V
9	GND

Note:

- Coding: 1 $\frac{3}{4}$ -position BCD (see significance)
- The input pins are not electrically isolated!
- Signal level: TTL up to +12V.
- Input current per pin: at least 0.5 mA, maximum 10 mA
- +12V (pin 8) is non-stabilized, unfused!! and is not electrically isolated, maximum current 50 mA

15.5. IN / OUT Connection (Optional)

(25-pin SUB-D socket)



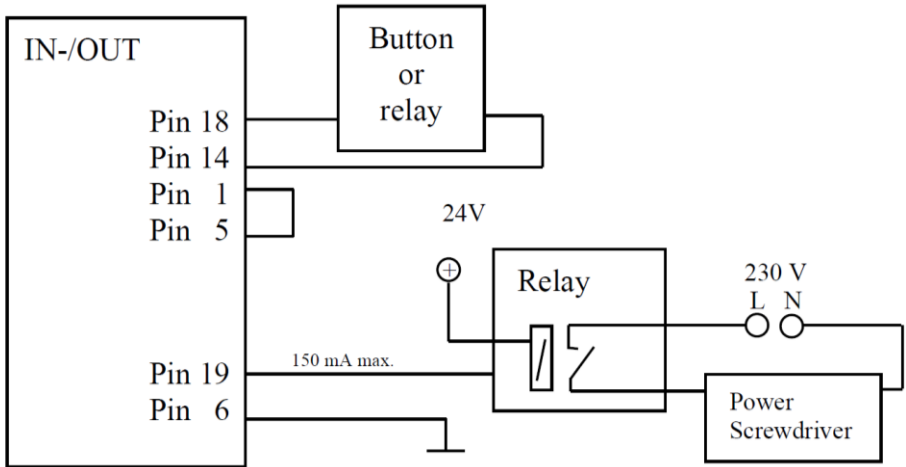
Standard use	Pin	Assignment	Pin	Assignment
Ext. storing/ printing/erase	1	Opto input 1 (-)	14	Opto input 1 (+)
External Zeroadjust	2	Opto input 2 (-)	15	Opto input 2 (+)
	5	GND (without electrical isolation!)	18	+12V (non-stabilized, max. 100 mA)
Shut off	6	Opto output 1 (-)	19	Opto output 1 (+)
	7	Opto output 2 (-)	20	Opto output 2 (+)
Torque output	11	Analog output GND: Pin 5	21 - 23	Reserved
NOK assessment	12	Relay output 2	24	Relay output 2
OK assessment	13	Relay output 1	25	Relay output 1

Note:

- Inputs and outputs as well as the socket are optional and are not available with all units.
- Signal level of inputs: inactive: < +1.5V; active: +4V to +30V(DC) / ≤ 5 mA; “floating inputs”.
- Optocoupler outputs: (electrically isolated normally open (N/O)) maximum 150 mA / +30V(DC) (disconnecting contact, pin 19 – pin 6, opens when switch-off value is exceeded)
- Relay outputs: (free normally open (N/O) contacts) maximum 1 A / 25V AC/ ±30V DC

15.6. Circuit example

Pushbutton for deleting the peak value and switching-off controller for a power screwdriver

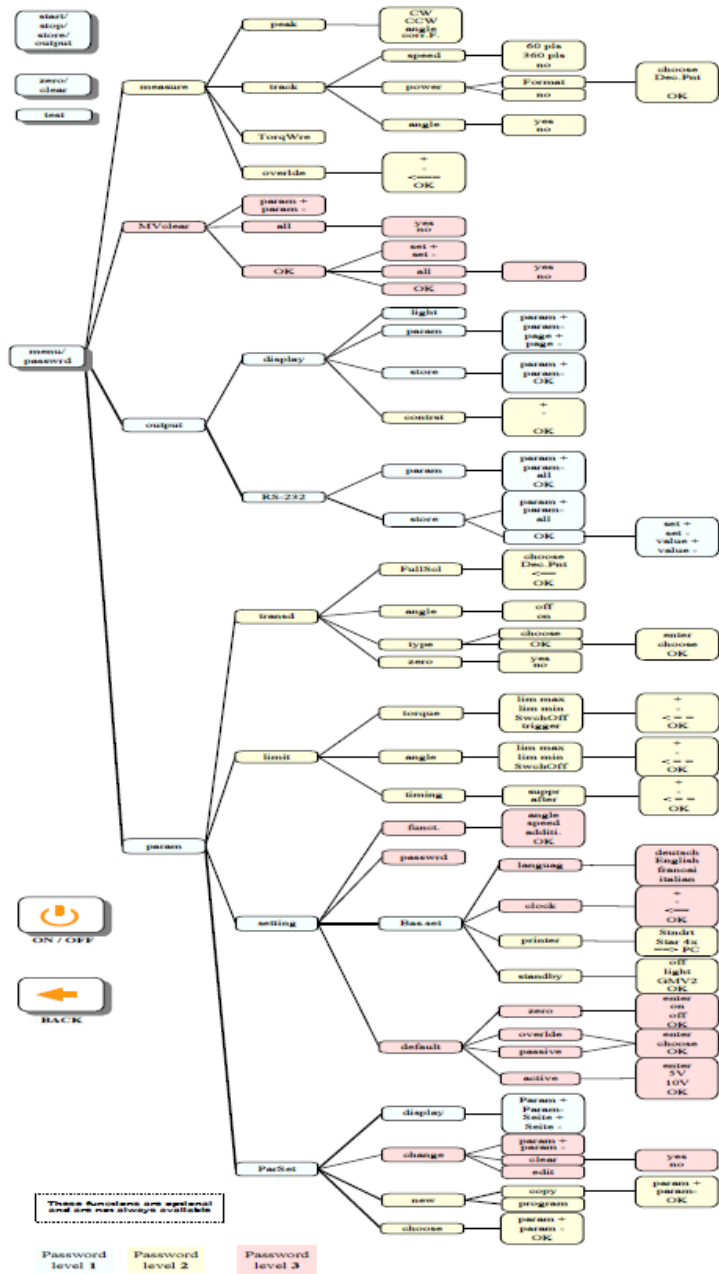


16. Instructions for disposal

You may return the evaluation device complete with measuring cable to us for disposal free of charge. As soon as you have packed the device, let us know at: info@eth-messtechnik.de. We will then have the package picked up by our parcel service.

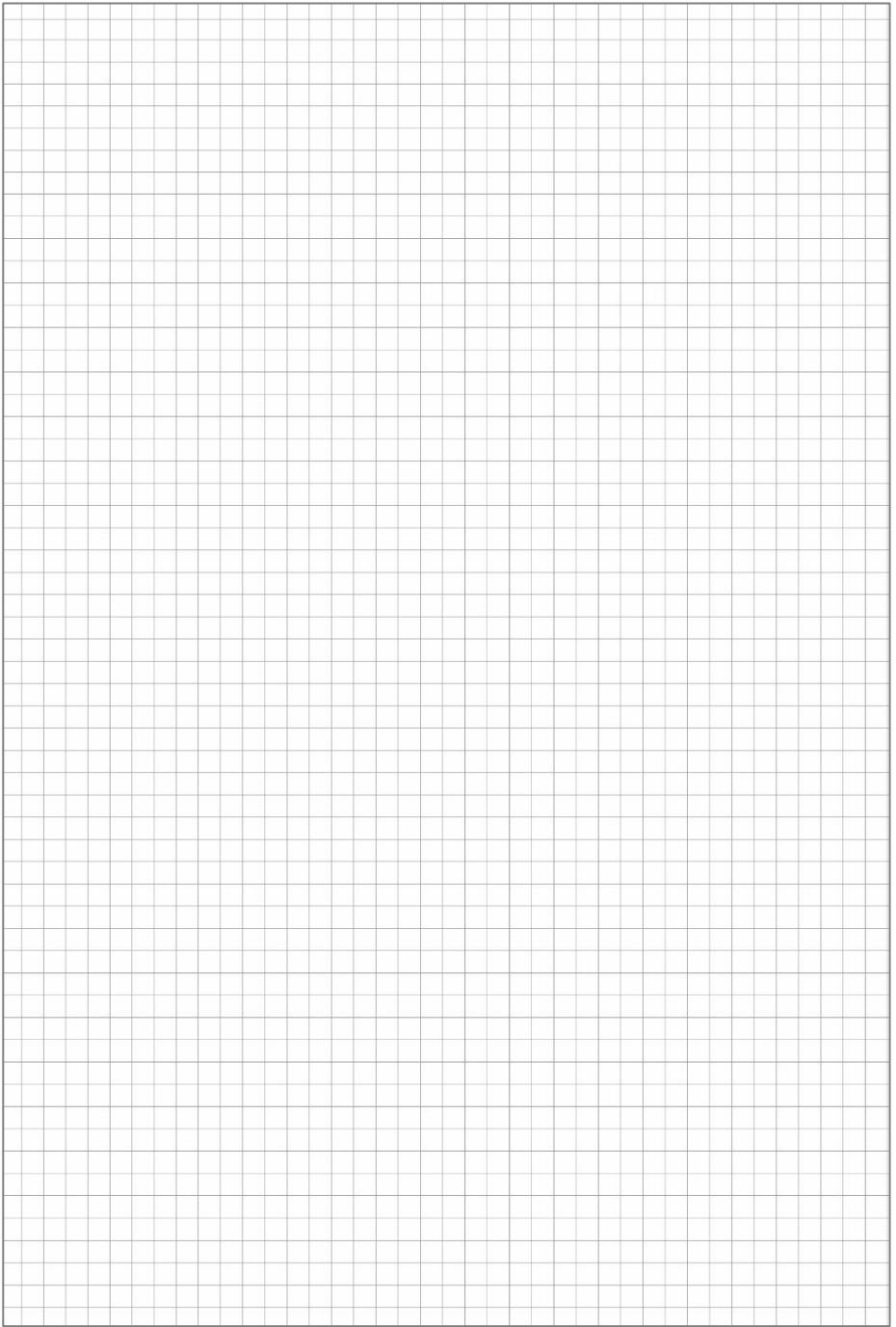
We are unable to accept packages returned to us unannounced and by freight collect. Thank you for your understanding.

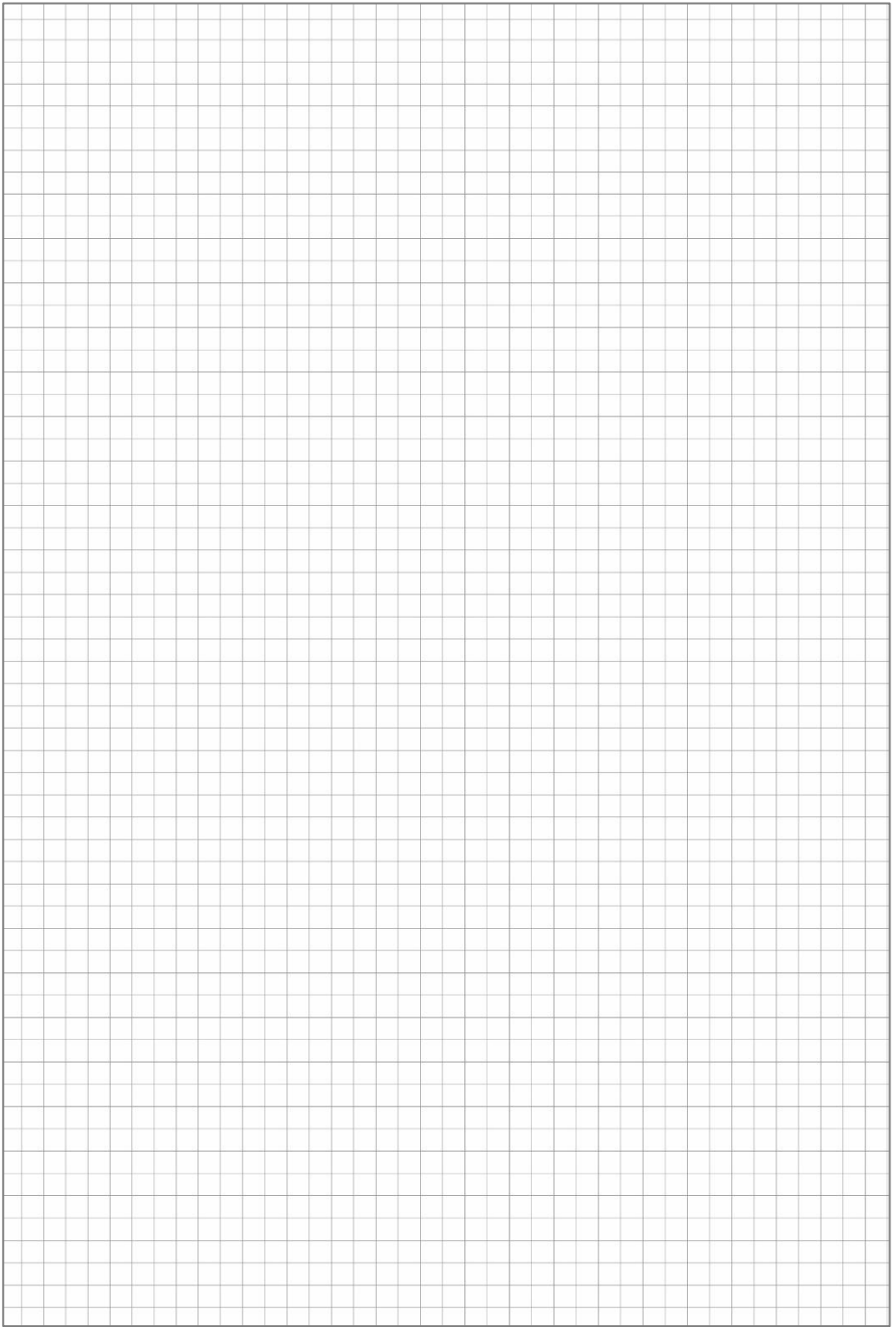
17. Overview of the menu structure of the GMV2 V5.1

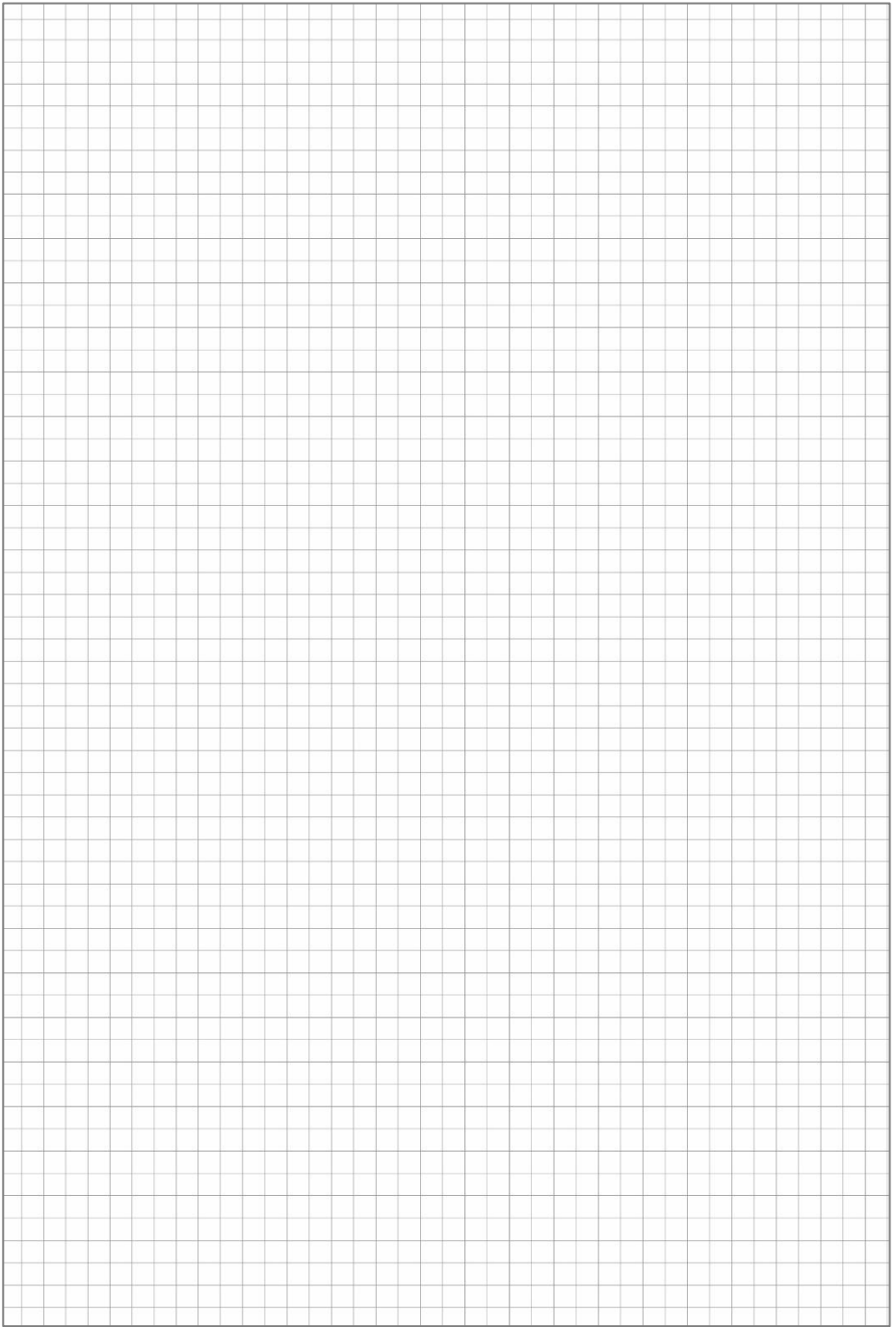


These functions are optional and are not always available

Password level 1
Password level 2
Password level 3









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