

Based Supply and Analyzing Unit
GMV2 V5.0



Operating Instructions



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1 General information

1.1 Description

GMV2 is a microprocessor-based measuring, control and analysing unit for the most common applications in screwing and laboratory technology. 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 angle of rotation, speed and power and/or angle of rotation
- For torque transducers from 1 Ncm to 100 kNm full scale value
- Shut off according to torque and angle of rotation (optional)
- 1000 measured value storage
- Storage for 50 parameter sets
- Eight hour battery operation as an option, integrated charger or mains operation with 100V ... 230V
- RS-232 serial port for printer
- Measured value transfer to PC
- EMC sealed housing

2 Startup

2.1 Important notes

If the unit is opened or dismantled within the guarantee period the guaranteed 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 guarantee.

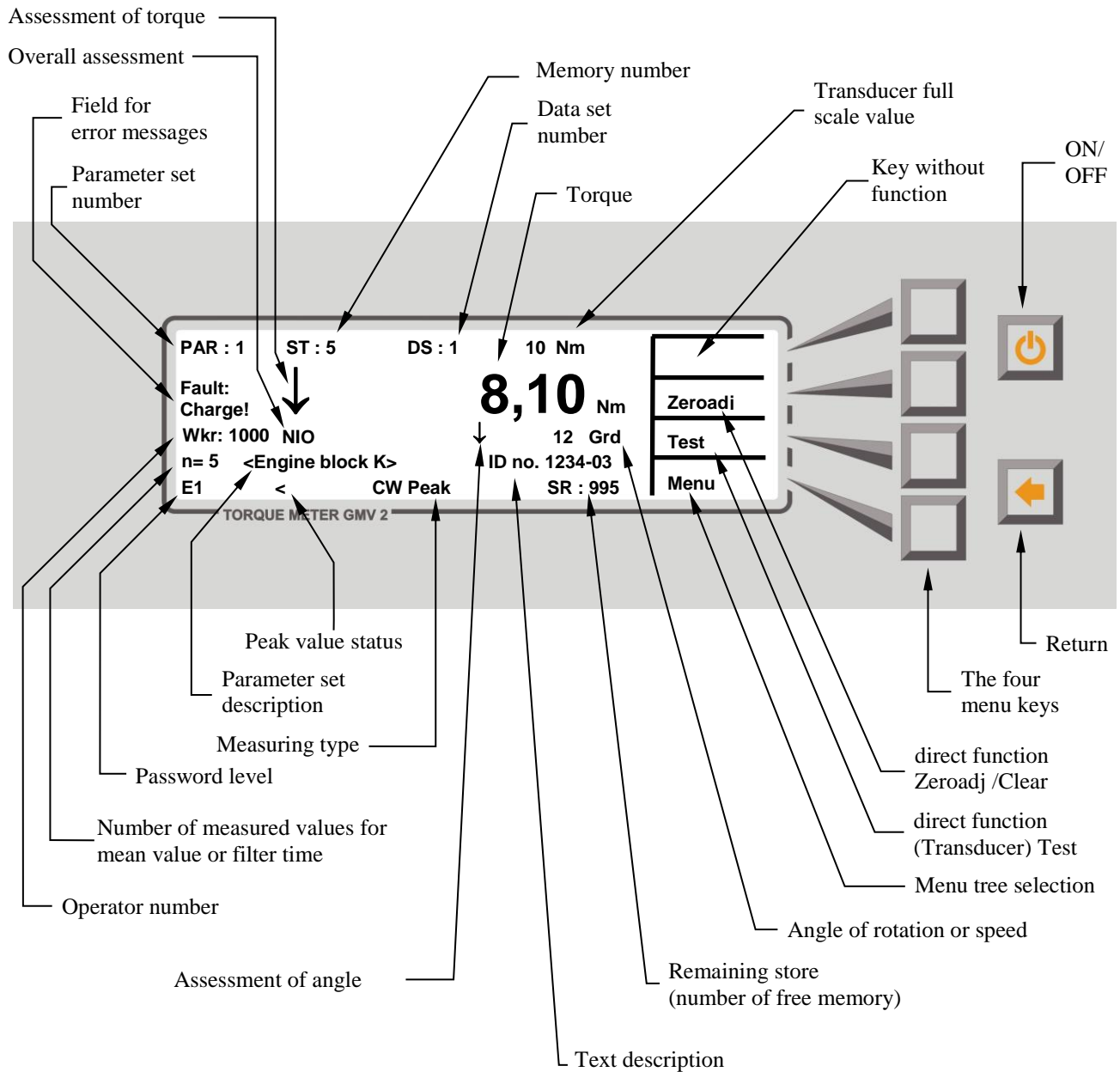
The unit is not earthed during battery operation. Should current-carrying equipment be connected to the unit they must be earthed according to technical regulations.

The full scale value of the transducer displayed on the screen must always correspond with the actual transducer being used.

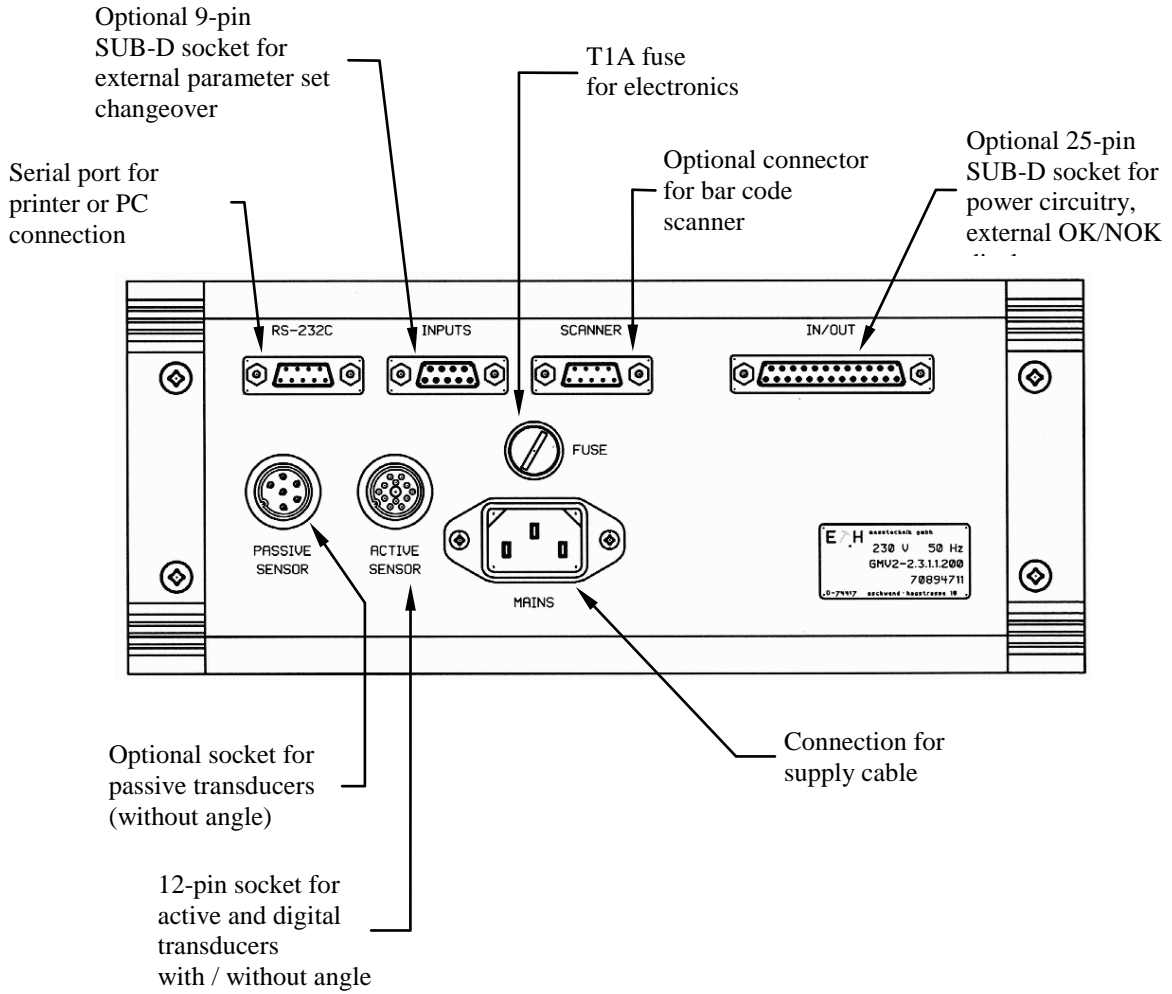
Where there is a risk of injury to persons and damage to equipment, the user must take appropriate safety measures (for example, use covers, overload protection devices) (relevant accident prevention regulations should be observed!).

The unit is not approved for service in Ex areas.

2.2 Front panel of unit



2.3 Rear of unit




2.4 Connecting the torque transducer

Suitable connection cables are available for different types of torque transducers!

This GMV2 version has been designed for use with active transducers with a signal of $\pm 1.25V$ to $\pm 10V$. A passive input with $\pm 0.5mV/V$ to $\pm 4mV/V$ is available as an option. Please use the appropriate cable only which can be obtained from **ETH**.

2.5 Switching on

You can switch on the unit 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 transducer is now zeroed. The unit is then ready.

If the error message "Charge!" appears now, please connect the supply 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 somewhat longer during switch-on, the time, software version and optional functions will be displayed. The abbreviations have the following meaning:

- V x.xx Software version
- "_"
- ax Active input with adjustable input range
- px Passive input with adjustable input range
- d Digital input
- "_"
- W Angular measurement
- D Output for Digimatic printer
- T PC transmission
- E Inputs/outputs

Notes:

- 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 Sec. 5) satisfy your requirements.
- If the battery is not charged fifteen minutes after the first charge message, the unit switches itself off.
- If the calibration interval of the GMV2 has expired, the error message: "Fault: calibr. date" will appear. Please send the unit in to ETH in this case.

2.6 Switching off

The unit is switched off using the  key. In addition, the unit can switch off automatically after a longer period not in use through the energy-saving function (adjustable). If the unit is faulty and can no longer be operated or switched off, the fuse can be removed on the rear of the unit. In this case, however, data loss cannot be excluded.

3 Changes in version 5.0 (V4.1 and onwards)

3.1 Improved angle resolution

Angle measurement now has a resolution of $\frac{1}{4}$ **degree**. In the display, an angle smaller than 100 degrees is shown in $\frac{1}{4}$ degree resolution, otherwise in whole degrees. Internal measurement is always with $\frac{1}{4}$ degree.

3.2 Universal input range for active and passive input

Menu path:

- "Menu -> Parameter -> Par set -> change -> edit"
- "Menu -> Parameter -> Transducer-> "Type" or "Sig./UA"

The inputs can now be flexibly adjusted to the output signal of most sensors. This can be programmed separately for each parameter set. If a fixed value is set in the pre-settings, this value is used without query. The exact value can be entered for each parameter set using the pre-setting "input" (see Sec. 3.6, page 9): In the case of passive transducers, the calibration value is entered.

Input range:

Active input: $\pm 1.25\text{V}$ to $\pm 10\text{V}$, (5V, 10V or in steps of 1mV))

Passive input: $\pm 0.5\text{mV/V}$ to $\pm 4\text{mV/V}$, (1mV/V, 2mV/V, 4mV/V or in steps of 1 $\mu\text{V/V}$))

3.3 Adjustable overload range

- "Menu -> Parameter -> Par set -> change -> edit"
- "Menu -> Measurement -> Overload"

The measuring range can now be significantly larger than the nominal transducer signal. The overload range can be programmed separately for every set of parameters, from 0% to 100% of the transducer full scale value; the accuracy of the displayed measured value is then reduced accordingly to the set measuring range. To be able to program different values, "input" must be set in the pre-settings for the overload range (menu path: "Menu -> Parameter -> Settings -> Pre-settings -> Overload" , see Sec. 3.6.1, page 9).

Caution

- If the mechanical overload resistance of the torque transducer is exceeded even only briefly, this can lead to the transducer being destroyed!
- A large overload range reduces the unit resolution.

3.4 Automatic zero tracking

In the case of torque sensors, the zero voltage changes slightly with the temperature. This means that the zero point drifts

after switch-on until the sensor has reached its operating temperature.

This automatic function detects this drift in the unloaded state and compensates it. Normal measuring operation is not interfered with. When zero tracking is active, an "A" (Automatic) is indicated at the bottom of the display.

3.5 Impulse screwdriver measuring mode

Is very similar to peak value measurement. The correction factor is available here in addition, but angle measurement is not possible.

3.6 Tightening the input of parameter sets

3.6.1 Pre-settings

Menu path: "Menu -> Parameter -> Settings -> Pre-settings"

With the pre-settings, it is possible to choose between a fixed value and "input". A fixed value in the pre-setting **is taken over automatically without further query** when a parameter set is programmed.

With "input" as pre-setting, the required value can be entered during the programming of a parameter set (see Sec. 9.8, page 21).

There are pre-settings available for:

- Input sensitivity of the active and passive input
- Overload range
- Automatic zero tracking

Examples:

- If you always work with screw-type transducers (DRFS..., DRFN...) select active, 5V
- If you only connect transducers with 4mV/V for example, select passive, 4mV/V

Note:

- **A change in pre-setting does not have an immediate effect on the current parameter set!**
The pre-setting is not taken over until the parameter set is edited or programmed.
- Already programmed parameter sets are **not** changed when the pre-settings are changed.

3.6.2 Fading out unused functions

Menu path: "Menu -> Parameter -> Settings -> Functions"

Functions not used very often can now be faded out in such a way that they are switched off during the programming of a parameter set without further query. This shortens the time required to enter a parameter set.

During direct parameter input via "Menu -> Measurement ... / parameters..." they are always available.

- The menu "parameter set text, data set marking and operator number" can be faded out together for all measuring modes ("**other**").
- The angle, speed and power measurements can be deactivated during tracking measurements.

Note:

- **A change in the functions does not affect already existing parameter sets!**

3.6.3 Correction factor

A correction factor can now only be entered in the (new) measuring mode "pulse screwdriver", see Sec. 3.5, page 9.

3.6.4 Filter for peak value measurement

This function is no longer available in version V5.0!

3.7 Dynamic key repeat rate

The keys (+, -, select, ...) now have a repeat function if they are kept pressed for longer. The repeat speed increases with time.

3.8 Deletion of measured values

Menu path: Menu -> Delete MV...

A selection can now be made as to whether all measured values, the measured values of a parameter set or only individual data records are to be deleted (see Sec. 11.5, page 27).

3.9 Transducer detection and change of measuring range

In the case of transducers from ETH with memory chip, the GMV2 detects when the transducer is unplugged, plugged in or the measuring range changed. The unit is automatically zeroed in this case, and a check is made as to whether the settings in the parameter set match the transducer.

3.10 Power-saving function (stand-by)

Menu path: Menu -> Parameter -> Settings -> Basic settings -> Standby

In order to reduce power consumption, the LCD lighting and the GMV2 switch off automatically after a certain set time without a key being pressed. This function can also be disabled if required. Adjustable values for the lighting switch-off: 1 min - 1 hour, for unit switch-off: 1 min – 3 hours

Note:

- If measured values are stored or outputted, the timer is restarted.
- In the case of continuous output, the power-saving function is switched off

3.11 Analogue output

The optional analogue output is now zeroed with the zeroing key. Automatic zero tracking is also effective. The output signal is scaled to $\pm 5V$ independently of the input signal (passive, active & digital). For this, however, the overload range must be set to 7% (standard).

3.12 Battery protection

To protect the battery from deep discharging and thus from damage, the unit automatically switches off when the voltage level of the battery is too low.

4 Menu structure

4.1 Introduction

The GMV2 offers extensive measuring, control and setting features.

A so-called hierarchical menu system has been realized to allow simple, self-explanatory operation. A menu offers a list of selections.

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 Sec. 18, page 41. The real 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 and can be switched off again. In addition to status information, torque, and if necessary angle and OK /NOK assessment (arrows) are displayed in the first and last lines (see Sec. 2.2 page 6) 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 arranged to the right beside the display.

Use the return key to move back again to the left, or forward a step .

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

During normal operation 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 disables the direct function keys.

- **Memory 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 (manual single printout).
- 3.) Start - Stop: You can start ("continue" appears in the bottom line") or stop the continuous measured value printout here.


- **Delete - Zero adjust:**

- 1.) Clear the measured peak value. Torque and angle of rotation are reset to "0", Counters are reset and restarted. The unit restarts the measuring process from the beginning. The measurement is not stored! Press the memory key beforehand for manual saving!
- 2.) Zeroadjust transducer and display. The offset voltage for the transducer is compensated so that, with no loading, the value "0" appears on the screen. Zeroadjust should be repeated often as every transducer drifts with temperature. The transducer must be completely unloaded during Zeroadjust! When the automatic zero tracking function is used (see Sec. 3.4) this is not necessary.

Notes:

- If the offset voltage is greater than the adjusting range of the unit, an error message is output to the screen. In which case accurate measurements cannot be taken!
This fault may be caused by loading the transducer during Zeroadjust, or it indicates that the transducer (overloading) or the connection cable are defective.
- The transducer is automatically zeroed when the unit is switched on and when you return from the menu level.
- **Test:**
"Test" serves to test the transducer. It outputs its maximum signal, the full scale value for the transducer is displayed on the screen. However, this test cannot be performed in the measuring type peak value measurement with counter-clockwise rotation!

The "ON / OFF" key  is also available.

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

4.3 Measure menu

For direct and fast changeover of measuring type:

Peak, track, torque wrench or speed measurement without having to program a parameter set. Parameter set "0" is selected automatically! Parameter set "0" contains the settings for the actual parameter set.

Notes:

- 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 Sec. 9.7, page 26.
- A power-operated screwdriver cannot be switched off during tracking measurements!
- For torque wrench measurements the yielding moment should be at least 5% of the transducer full scale value.

4.4 Menu delete measured value

Menu path: Menu -> Delete MV...

See Sec. 11.5, page 34.

4.5 Output menu

Measured values and parameter sets can either be displayed on the screen (see Sec. 11.4 and 9.4) or printed out through the serial interface (see Sec. 12 and 9.5). Alternatively they can be transmitted to a computer. (see Sec. 13.1)

The LCD display lighting can be switched on and off with "Menu -> Output -> Display -> Light" and the contrast can be set manually with "Menu -> Output -> Display -> Contrast".

4.6 Parameter menu

4.6.1 Transducer

Menu path: Menu-> Parameter-> Transducer

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

- The full scale value is set with the Entry editor (see Sec. 8.4).
- The "Angle" menu can be used to define whether the transducer used allows an angle measurement. Angle decoders with 360 impulses 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 transducer types can be selected in the "Type / Sig./Ua" menu depending on the configuration level of the unit. GMV2 has an active input as standard. A passive input and a digital input are available as an option. Once the type has been selected, the transducer output signal is entered in Volt or mV/V.
- Automatic zero tracking can be switched on and off in the "zero adjust" menu.

4.6.2 Limits

Menu path: Menu-> Parameter-> Limits

Limits can be set 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 counter-clockwise rotation.
- The limit evaluation display (arrow) uses the angle value (unsigned).
- "Limit max" and "Limit min" define 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!

Notes:

- All limits are also entered for counter-clockwise 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 of the measuring range 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 limits:

In contrast to the torque limits, angle limits are entered with the Entry editor (see Sec. 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 transducer 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 counter-clockwise rotation as unsigned numbers.
- The limit evaluation display (arrow) uses the angle value (unsigned).
- "Limit max" and "Limit min" define maximum and minimum allowed angle of rotation (OK window). Counting begins when the trigger moment 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 Sec. 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 tapping screws.

The value "0" disables the timing, so that GMV2 is always ready for operation.

The "After Time" defines how long the peak measuring and angle counting remain active after the power-operated screwdriver has been switched off. 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.

Please use default "0" if possible! Only change the time period as required (the longer the period, the better)!

4.6.3 Settings

- The settings for GMV2 are explained in more detail. in Sec. 3 ff and 5.

4.6.4 Parameter set

This is the most important menu. You have to create (program) a parameter set before you can start testing or screwing. This topic is so extensive that it is treated in a separate section. For more details see Sec. 9.7 and 9.8.

5 Settings

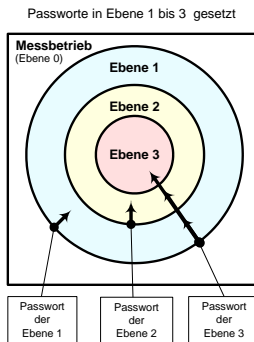
5.1 Functions

Menu path: "Menu -> Parameter -> Settings -> Functions"

You can switch various functions on or off. See Sec. 3.6.2, page 11.

5.2 Password

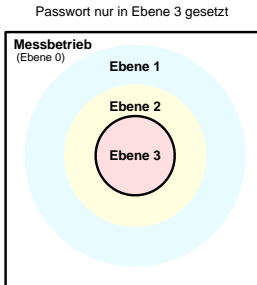
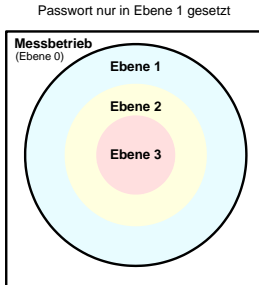
Menu path: "Menu -> Parameter -> Settings -> Password"



To protect device settings against unauthorized changes, you can assign passwords to three menu levels (maximum 4-digit number). First of all you have to clear level 3 if appropriate. After that you can choose the level for which you want to change the password. You will now be requested to enter the password. If you enter any number other than 0, the password protection is enabled and you will be requested to note this number. The password protection on a particular level is disabled if you program a 0 as the password. You will then be informed that the "lock is cancelled". The level areas are highlighted in colour in the menu structure (Sec. 18, page 52). You can always see which level is cleared in the bottom left-hand corner of the display.

If the password is programmed for the first level, all the keys except for the on/off key and the password request are locked. **To return to the 0 level, press the "Return" key again in measuring operation.**

It is also possible to move from level 0 straight to level 3 by entering the appropriate password (see diagram).



In addition, you can only protect one level with a password, which means the protection can be adapted very flexibly to different user groups.

Example:

If the password is only programmed for the third level (right-hand diagram), anyone can use the functions on level 1 and 2 without a password having to be entered. Since there is no password stored for the first and second level, they merge with measuring operation. A password is necessary for the

third level.

Notes:

- **Always assign a password to the third level to prevent unauthorized persons assigning passwords!**
- If you forget passwords we can send you instructions on how to delete all passwords.

5.3 Initial settings

See Sec. 6, page 17.

5.4 Pre-settings

See Sec. 3.6.1, page 9.

6 Initial settings

6.1 Language

Menu path:

Menü -> Parameter -> 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 are realized in this software version.

Note:

Further languages can be realized at customer request.

6.2 Time of day and Date

Menu path:

Menu-> Parameter-> Settings-> Initial settings -> Clock

The current time of day is displayed at the bottom of the screen. A flashing underline (cursor) indicates what can be changed. You can use the keys "+" and "-" only to change the digits as a whole, i.e. there is no separate selection of tens and units. If you keep the keys pressed for longer, the digits change more and more quickly (dynamic).

Use the "<==>" key to change between minute, hour, day, month and year. Always press the OK key to take over the time! The setting is rejected using the return key.

Notes:

- **Date and time of day are briefly flashed on the screen when the unit is switched on – which allows you to check them.**
- When you keep the "+" and "-" keys pressed here, the digits change more and more quickly.

6.3 Printer (serial interface)

Menu path:

Menu-> Parameter-> Setting -> Initial setting -> Printer

Procedure:

First select the desired printer. For "Stndrd" and "Star 4x" the system prompts you for the baud rate. No baud rate setting is required for DP-1 HS.

1.) Selecting the printer:

- "Stndrd" key for standard printer, (PC transmission with the program "Hyperterminal")
- "Star 4x" key for label printer with cutter.
- "DP-1 HS" key for Digimatic mini-processor printer with statistics functions (optional with version "-D")
- "====> PC" key for measured value transfer to 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 aborts the change and jumps to the "program" menu.

Notes:

- **Factory default: baud rate 2400 Bd (suitable for printers supplied by us!), standard printer.**
- Transmission format:
8 data bits, no parity, 1 stop bit, XON-XOFF, text transmission
- See Sec. 16 for pin assignment.

Other formats can be realized at customer request.

6.4 Standby (power saving function)

See Sec. 3.10., page 10.

6.5 Display illumination

Menu path:

Menu-> Output-> Display-> Light

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

Note:

- When the power-saving function is used (standby), the LCD lighting is switched off after no keys have been pressed for a certain time (see Sec. 3.10). A brief keystroke (control, return, ...) switches the lighting back on again.

6.6 Screen contrast

Menu path:

Menu -> Output -> Display -> Contrast

The contrast can be optimally set using the "+" and "-" keys. If it is set too high, the background will be dark. If it is too low, the digits will be faint.

Note:

- It only makes sense to change the contrast for extreme ambient temperatures

7 Measuring types

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 depending on the filter setting.

If limits are set, the assessment is displayed as an arrow.

Notes:

- **Speed measurement** and **power measurement** can be activated here, if angle measurement has been de-activated
- The shut off function is not available here!
- You may also program an adjustable filter (in parameter set programming only).
- The angle counter (option) is permanently enabled. It is reset when the transducer is zeroed.
- The direct setting of shut-off torque, trigger, de-activation after angle, and timing is not possible here.

7.2 Filter

Menu path: "Menu -> Param -> Par set -> new -> program"

Under laboratory conditions, the torque and the speed often do not remain constant during one rotation, which makes it difficult to read off the display. This filter is based on the gliding mean value and can filter out these fluctuations. The time over which the measured values are determined can be set from 0.1 seconds to 10 seconds. It is effective for the torque and for the speed, and thus also for power measurement. Optimum filtering is achieved if the filter time is set according to the following formula and as large as possible:

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

Example:

At a speed of 30 rev/min you should select a time between 2.0 sec and 10.0 sec.

Note:

It must be taken into consideration, however, that twice the filter time has to pass before the display has achieved the final value.

7.3 Continual measured value output

Menu path: "Menu -> Param -> Par set -> new -> program"

In the case of tracking measurement, the measured values can be outputted continually or stored. The interval time can be selected between 0.2 sec and 900 sec (15 min). In the case of print-out, however, the maximum output rate is usually determined by the printer speed.

7.4 Speed measurement

This type of measurement is a variant of tracking measurement and not a separate operating mode! It is only a function in its own right in "Menu -> Measurement -> Tracking -> Speed" (parameter set no. 0). During parameter set programming, speed measurement is activated by selecting tracking measurement without angle measurement and then switching on the speed by clicking "yes". There is a choice between 60 and 360 pulses per revolution, which makes speed recording on torque transducers with angle measurement also possible.

Notes:

- The speed is averaged over one second.
- Accuracy: $n \leq 30000$ rev/min: ± 1 digit;

7.5 Power measurement

This type of measurement is an addition to tracking measurement and not a separate operating mode! It is only a function in its own right in "Menu -> Measurement -> Tracking -> Power" (parameter set no. 0). Power measurement can be activated during parameter set programming after speed measurement has been switched on. The maximum displayable power is selected when the format is specified. When the display range is exceeded, "-----" appears in the display.

Notes:

- The accuracy of power measurement comprises the accuracy and resolution of both the torque and speed measurement.
- Since the speed per second is measured, additional measuring errors are the result of quick changes due to time lapses. **For this reason, a large enough filter should always be switched on in addition.**

7.6 Peak measuring

This measuring type is mainly used in screwing technology. Not only does it allow the largest occurring torque to be detected, but it offers numerous functions for assembly automation:

Time-based measuring, screwdriver control, OK / NOK assessment with setpoint values, automatically storing and erasing measured values.

The measurement status is shown at the left on the bottom of the screen. See Sec. 2.2, page 6.

The symbols have the following meaning::

- * new measurement, but no measurement before the suppression threshold
- t suppression active, no measurement
- 1 ready for measurement, peak value hold
- < angle threshold value exceeded. angle counter running
- 0 switch off activated (and overshoot time may be started)
- X measurement stopped (overshoot time elapsed), for torque wrench: bend detected
- ! error state, not ready
- not ready

The adjustable parameters are explained in Sec. 9.8 "Editing parameter set". The sequence 10.1.

7.7 Torque wrench measurements

This operating mode has been specially designed to check the torque values of torque wrenches. 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 precisely determined by slowly and evenly operating the torque wrench.

Status "1" appears at the beginning of the measurement to indicate that the system is ready. If a bend is detected status "X" appears. A transducer must be selected so that the minimum wrench torque to be measured is at least 5% of the transducer full scale value.

A transducer must be selected so that the torque set on the wrench is greater than 1/10th of the transducer full scale value.

If a parameter set is programmed, all memory settings such as erasure time can be made.

Note:

- For torque wrench without drop in torque (slipper), peak value measurement must be used
- The angle measurement is always de-activated here.
- For torque wrenches which only emit an acoustic signal when the set torque is reached, an additional sensor is available for attachment to the torque wrench.

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 possible settings
- it checks your entries.

Value entry and selection are different, the entry of the transducer full scale value is a combination of both. The operation is explained fully in the following sections and examples are given.

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 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 Entering numbers

Torque values, angles, time periods and numbers are entered in a very similar manner. However, the transducer full scale value is entered somewhat differently (see Sec. 8.4, page 22).

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

Every time the "+" key is pressed the complete number is increased by the value of this position (reduced with "-"). Should the number of digits be reduced during this process, 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 cancels the changes, restores the old value and moves the cursor to the lowest position.

Tips:

- Pressing the return key (maybe twice) resets the old value and you can start the entry again.
- To change the previous position again, you can reduce the higher position to 0 by pressing "-". This will set the cursor to a lower position other than 0.
- If you would like to set the highest possible value, you can press "<==" as often as necessary until a five-digit value e.g. "10000" appears. Monitoring is triggered by pressing the OK key. After a error message, the unit corrects to the highest possible value. Entry is completed by pressing the OK key again
- Similarly, you will get the smallest possible value if you set 0 and press OK

Small values can also be entered conveniently using the "+" and "-" keys, since these react dynamically

8.4 Transducer full scale value

The Entry editor is active during parameter set programming too. You may also set the unit and number of decimal places here.

The transducer full scale value is entered by selecting the 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 and bar.

8.5 Alphanumeric texts

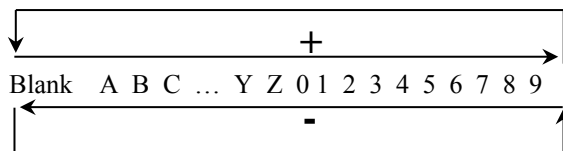
The maximum length of the identifying text and the description text (see page 10 and 11) is 12 characters.

A - Z, blank and numbers 0 - 9 are allowed

You may enter the texts on the keyboard or with a bar code scanner (see below).

Keyboard:

Use the "+" and "-" keys to scroll through blank, the letters A - Z and numbers 0 - 9:



The "+" and "-" keys react dynamically. In other words, a short keystroke changes the number slowly. The number changes quicker when you hold the key pressed longer. Move the cursor () and thus the entry position to the right with the "=="> key". After the 12th character the cursor returns to the beginning of the text. With the Return key you can delete text and confirm the text entry with the OK key.

Bar code scanner (optional):

A bar code scanner offers you a more convenient and quicker way of entering these texts. The scanner can be ordered from ETH as an accessory. Please read the "User's manual" to operate the scanner. The scanner can also scan the minus, period and slash characters (standard). Extended code 39 makes the entire ASCII character set available to you.

When the text has been scanned in, it can be changed from the keyboard. You only have to acknowledge any changes with the OK key. For connection to GMV2 see page **Fehler! Textmarke nicht definiert.**

9 The parameter set

9.1 Introduction

GMV2 allows complex measurements in screwing technology and offers numerous monitoring and control functions. The torque can also 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 fifty 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 -> Param -> Par set -> new -> program (for newly created parameter sets)

Menu -> Param -> Par set -> change -> edit (to change existing parameter sets)

In order to make selection easier and avoid faulty operation, it makes sense to assign a use-related descriptive text to the parameter sets. This is displayed at the bottom of the screen. The alpha-numerical text is maximum 12 characters long and is entered at the end of parameter set programming.

Note:

"Further settings" must be activated in the function settings (Menu -> Param -> Settings -> Function)!

9.3 Parameter set "0"

Menu -> Measurement

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. Parameter set "0" is overwritten when another set is selected because it always contains the actual settings. It can however be copied to another number. See Sec. 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 number "0"! It only serves to determine the individual parameters experimentally.

This set cannot be directly selected: it is therefore disabled. In the event of direct changes to individual values in a stored parameter set, the parameter set changes automatically to "0". This can be seen on the parameter set display on the top left of the screen. See also Sec. 4.3 and 4.4.

9.4 Display parameter set

Menu paths:

1.) Menu-> Parameter-> ParSet-> Display

2.) 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 displayed on the LCD display in a maximum of six pages. You can scroll through the pages within a parameter set using "page +" or "page -". After the last page has been shown, the first page is shown again. Empty pages are automatically missed out. A word in [...] means that the word is only displayed when the function is active.

1. "Settings1": Information on the transducer, operating mode, correction factor, memory settings and, the length of the data set are displayed here.
2. "Settings2": Settings for filter time, speed, power and continuous output are displayed
3. "Settings3": Parameter set text, settings for data set text and operator number
4. "Torque": All torque values are displayed here
5. "Angle": All angle limits are displayed here (optional: for version -AW only)
6. "Timing": All timings are displayed (for peak measuring only)

The display begins with the first page of the actual 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.

You can scroll within a set with "scroll +" or "scroll -". When the last page has been output the first page is displayed again. Empty pages are skipped automatically .

9.5 Printout of parameter sets

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:

<pre> Output Param PAR: 1 active Transd: 10 Nm Mode: Peak Rot Dir: CW Torque - Lim max: - - - Lim min: - - - ShutOff: - - Angle: no Timing - Suppr: - - - After: - - - EraserTm: 2 sec Store Setting: RS 232 DataSet Length: undef. PAR: 2 active Transd: 300 Nm Mode: Peak Rot Dir: CW Torque - Lim max: 150.1 Nm - Lim min: 100.0 Nm - ShutOff: 120.0 Nm - Trigger: 30.0 Nm Angle - Lim max: +100 Degree - Lim min: +30 Degree - ShutOff: - - Timing - Suppr: - - - After: 1500 ms - EraserTm: 1 sec Store Setting: CanTime DataSet Length: undef. PAR: 3 active Transd: 20 kNm Mode: Peak Rot Dir: CCW Torque - Lim max: -15,00 kNm - Lim min: -10,00 kNm - ShutOff: -12,00 kNm Angle: no Timing - Suppr: - - - After: 1500 ms - EraserTm: 1 sec Store Setting: CanTime DataSet Length: 5 </pre>	<pre> PAR: 4 active Transd: 1000 Nm Mode: Peak Rot Dir: CCW Torque - Lim max: -800 Nm - Lim min: -300 Nm - ShutOff: - - - Trigger: -200 Nm Angle - Lim max: -3600 degree - Lim min: +0 degree - ShutOff: -2000 degree Timing - Suppr: - - - After: 1000 ms - EraserTm: - - Store Setting: manual Data set length: undef PAR: 5 active Transd: 1.2 inlb Mode: Track Speed: yes Torque - Lim max: 1.000 inlb - Lim min: 0.600 inlb Store Setting: no DataSet length: undef PAR: 6 active Transd: 12 ftlb Mode: Track Torque - Lim max: - - - Lim min: - - Angle - Lim max: +1000 degree - Lim min: +0 degree Store Setting: manual Data set length: 3 </pre>
---	---

9.6 Selection

Menu path:

Menu-> Parameter -> ParSet-> choose

A parameter set becomes the actual 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. The "return" key aborts the selection!

Notes:

- The parameters are copied internally to set number "0" with this function. Direct entries are thus overwritten.
- In the case of switchable transducers with several measuring ranges and measuring range marking by chips, the required parameter set must be programmed or selected in the GMV2 first when switching the measuring range, then the transducer can be switched over. Subsequently, the error message is deleted by pressing the "return" key and the measuring level is reached.
- In the case of transducers with two measuring ranges, the transducer is automatically switched to the required measuring range by entering the respective 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-> Parameter -> 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. 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 "Set -" and "Set +". 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.

Notes:

- When a parameter set is first created, it is automatically selected and becomes the actual 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 must be connected up for this.

9.8 Editing

Menu path:

Menu-> Parameter -> 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 editing a stored parameter set, the measured values stored under this parameter set 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.

Only the necessary parameters are prompted depending on the selected measuring type and can be set with the Entry Editor (Sec. 8). 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 and the value is automatically corrected so that it is within the permissible range!

Thanks to fixed values in the pre-settings and fading out of functions (see Sec. 3.6.1 and 3.6.2, page 9 and

11), some queries may be passed over.

All available parameters are detailed below:

- **Transducer(-type):**

The input changeover is not available with all software versions!
Changeover between "active"(channel 1 and channel 2), "passive" and "digital".
You can determine the input sensitivity from the parameter set printout.

- **Active/passive sign./Ua:**

Setting of the measured input to the nominal transducer signal (Ua).
- active: $\pm 1.250V \dots \pm 10V$ or selection of standard values ($\pm 5V, \pm 10V$)
- passive: $\pm 0.5mV/V \dots \pm 4mV/V$ or selection of standard values ($\pm 1mV/V, \pm 2mV/V, \pm 4mV/V$)

- **Overload:**

Percentage by which the measuring range of the GMV2 is larger than the nominal transducer signal.
Thus torques can be measured that are greater than the full scale value of the transducer. This can be used together with the correction factor for pulse screwdrivers. The standard value is 7%. The adjustable range is 0% ... 100%

Caution

- **Even only a very brief excess load on the transducer greater than its overload resistance (see data sheet) will lead to its immediate destruction!**
- At more than 50% overload the specified measuring accuracy of the transducer is no longer guaranteed.
- The resolution of the GMV2 deteriorates accordingly

- **Transducer full scale value:**

Greatest allowed transducer torque.
Setting range: 1.000 Ncm to 20000 kNm; 1.000 inlb to 20000 inlb / ftlb

- **Operating mode:**

- Track: Continuous display of actual torque, angle of rotation or speed and power..
- Peak: The highest value is stored. See Sec. 10 for screwing operations.
- Torque wrench: The peak torque before yielding point is reached is stored. See also Sec. 7.7.
- pulse screwdriver: especially for pulse screwdrivers and impact wrenches (peak value measurement with correction factor).

- **Filter:**

- Peak measurement: "mean value n = 0"; 0: filter off, otherwise mean value of last 'n' peak values. setting range: n = 0 to n = 10.

- **Correction factor:**

Only available in operating mode pulse screwdrivers. The correction factor is a percentage of the indicated measured value. Setting range: 50% to 150%. The default setting 100% disables the correction factor.

With pulse screwdrivers, the measured torque deviates strongly from the torque directed into the screw.

The correction factor is used to adapt the display value. It is calculated as follows:

Correction factor = 100% * (torque in the screw / non-corrected measured value)

- **Direction:**

- For peak measurement only: clockwise or anti-clockwise rotation.

- **Torque (processing):** choose between

- "Display": display only,
- "Monitoring": with limits (OK/NOK assessment), without shut off,
- "Shut off": same as monitoring, with shut off of 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 including overload range, NOK assessment is carried out. Allowed setting range is 5% to 100% of transducer full scale value. Counter-clockwise rotation: unsigned number entry!

A correction factor will cause a change to the allowed setting range!

- **Torque Limit min:** If the measured torque is less than this limit value including overload range, NOK assessment is carried out. Allowed setting range is 5% to 100% of transducer full scale value, however maximum "Torque Limit max"!
Counter-clockwise rotation: unsigned number entry!
A correction factor will cause a change to the allowed setting range!
- **Shut Off torque:** If the torque is greater than this limit value including overload range, the power-operated screwdriver is shut off by an external power circuitry. Allowed setting range is 5% to 100% of transducer full scale value.
Counter-clockwise rotation: unsigned number entry! A correction factor will cause a change to the allowed setting range! Only available with inputs/outputs option!
- **Angle (processing):** choose between
 - "no": The transducer does not have an angle counter or it is out of use.
Speed measurement can also be activated with this setting.
 - "Monitoring": with limits (OK/NOK assessment), without shut off,
 - "Shut 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.
- Notes:
 - The angle measurement is only available with option "W"!
 - **Counter-clockwise rotation: unsigned number entry!**
 - The passive transducers connected to the 6-pin socket have no angle measurement.
- **Speed:** Speed measurement is activated with "yes". This is only available when "no angle" is selected for tracking measurement. The speed is determined at 60 impulses/rev for the duration of a second.
You may also select an angle decoder with 360 impulses/rev or a speed decoder with 60 impulses/rev for the transducer.
Accuracy: $n < 30000 \text{ rev/min}$: ± 1 digit; maximum speed: 30000 rev/min!
- **Power:** Start power measurement with "Yes". Speed must be selected first. Then, set the maximum power to be measured with unit and decimal places. Setting range: 1.9999 mW to 19999 kW. You should set the filter time to several seconds so that the readout is steady.
- **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 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 10000 milliseconds (10 seconds).

Warning:

The suppression time also disables shut off! The protective shut off for transducer overload remains 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 that the default "0" is used. However, should you set a non-zero value for after time, it should not be too low, otherwise very small torques will be measured! The appropriate value must be determined experimentally as it also influences the angle counting and depends on the screwing task at hand.
Choose a long time period!
The allowed setting range is 10 to 10000 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. This time defines how long a peak stays on the screen.
The allowed setting range is 0.1 to 120 seconds (2 minutes).
The setting "**RS-232**" is similar to the erasure time: the difference being that the measured value is not stored internally, but is printed out.
"**continue**" allows you to continuously print measured values during tracking measurements.
The allowed setting range here is 0.2 seconds to 900 sec. (15 min.).
- **Data set length:** The number of similar screwing operations to be stored in one data set. Many measured values can thus be sensibly subdivided and printing and archiving are easier. Particularly useful for cylinder heads and wheel rims. The actual data set 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 set length of "1" should be avoided.
The allowed setting length ranges from "0" to the remaining memory capacity (maximum 1000 measured values).
- **Automatic zero adjust (zero tracking):**
Slight displacements in transducer zero points e.g. caused by changes in temperature, are automatically compensated. As soon as a load is placed on the transducer, this function "sleeps". Can only be selected when the pre-setting is "input".
- **Parameter set text:** You may enter a designation text for the parameter set here (alphanumeric - 12 characters maximum). The text appears at the bottom of the LCD display, see page 6. Type in the text with the entry editor, see page 22. A more convenient alternative is to read in the text with a bar code scanner available from ETH! (see page 23 and 7). Only available when "further" is activated for function selection.
- **Text description for data sets:** You can enable/disable the prompt for the ID with the key "ID-DS". The actual text is entered before the measurement. The system prompts you again for a text at the beginning of a new data set. A bar code scanner can be used here as well to read in the text.
The current text appears to the right of the parameter set text (see page 6). Only available when "further" is activated for function selection.
- **Operator number:** Use key "OP no." to enable/disable the prompt for operator number.
The system prompts you for this number at the beginning of a new data set and stores it in the data set. The current operator number is displayed at the left-hand margin of the screen (see page 6). You have to acknowledge the settings for texts and operator number with the "OK" key. Only available when "further" is activated for 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 Erase

Menu path:

Menu-> Parameter -> ParSet-> change-> erase

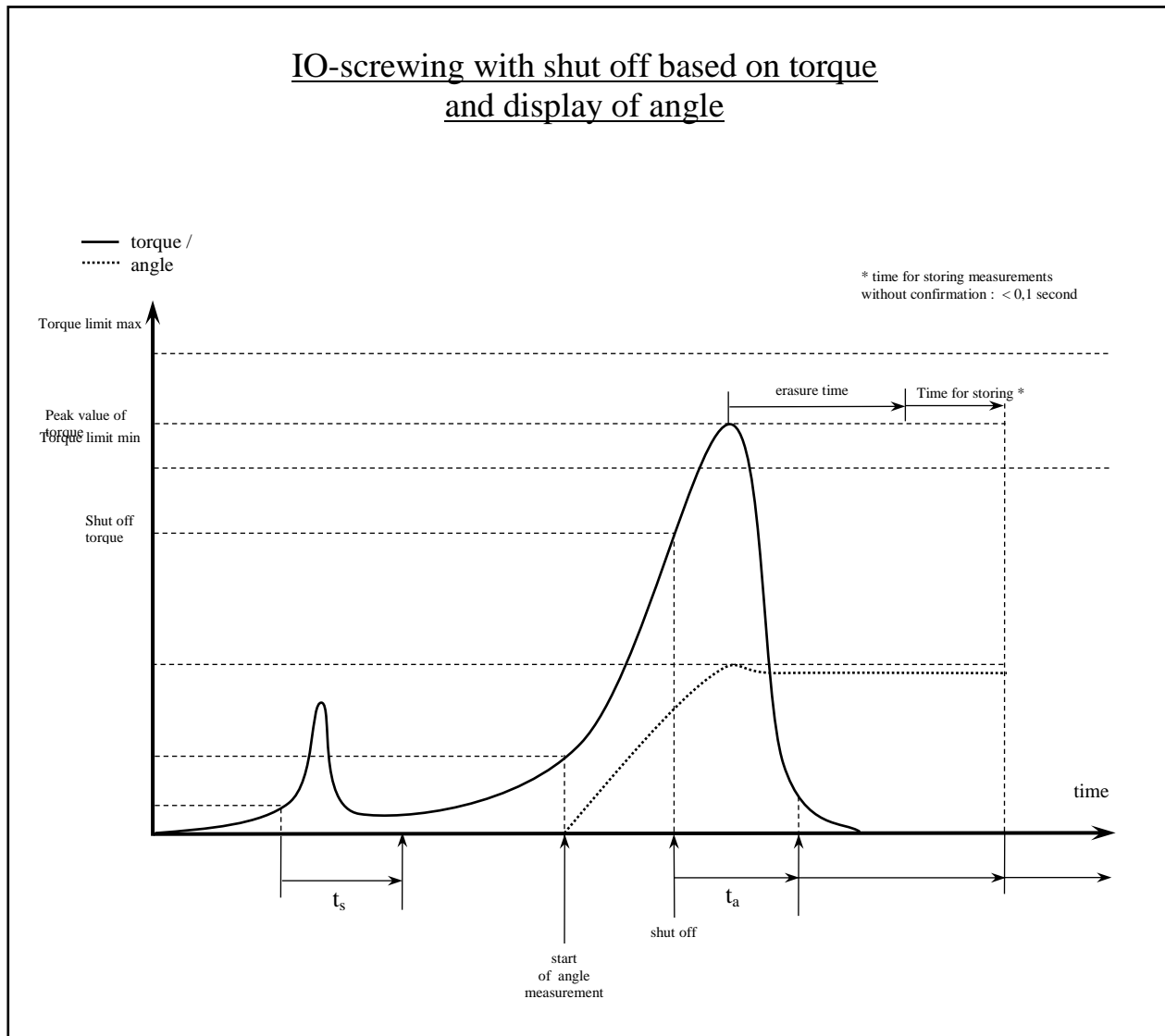
You can select a parameter set with "Set +" and "Set -" before erasing. The number is displayed on the top left of the screen. As a security measure erase must be confirmed with "yes". This parameter set is now free and will be re-used when recreated. The error message "ParSet used" indicates that measured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

Note:

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

10 Screwing technology

10.1 Time-based sequence diagram



10.2 Timing

- t_s : The suppression phase is started once when the torque exceeds 5% of the transducer 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_s de-activates the function.
- t_a : 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 securely recorded.
We recommend using the default "0", otherwise use a long time period!

Note:

Without shut off the measurement is not limited by t_a and runs on until the peak value is erased. Even in the case of long after time the maximum value for angle and torque is displayed and stored.

- 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 transducer.

The allowed angle range is ± 6000 degrees. Clockwise or counter-clockwise 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 Storing measured values

11.1 The measured value storage

One thousand measured values can be stored in GMV2 for the documentation and evaluation of screwing operations. 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 memory key or automatically by means of an erasure time (see Sec. 11.3 Settings). The storing of NOK screwing operations that are outside the selected limits must be confirmed. If the values are not stored, a re-run can be started. In which case the peak is erased, whereas the memory remains.

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 sets (DS:) facilitate the assignment of measured values to the workpiece. Similar screwing operations are assembled to a group in one data set, 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 page 6).

11.2 The data set

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 set in the parameter set. Screwing operations 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 to be stored subdividing them in data sets facilitates selection for display and printout, as described in the following sections.

If a data set is fully assigned, a new set is selected automatically. "ST:" defines the screw for the workpiece as the "ST:" numbering of the memory starts at the beginning with each data set. The data set number thus defines the workpiece.

You may also enter and save a text description and an operator number for each data set, see page 26, Sec. 9.8.

If the started data set is not fully assigned when the parameter set is changed, the remaining spaces are filled with "No measurement". The data set number is counted from "1" with every new parameter set. If the number of screwing operations is unknown, any number can be set with the length of the data set "0" (standard setting!). A new data set is then started automatically when parameters or the date are changed. A length of "1" is not recommended.

11.3 Memory settings

See above.

Menu path:

Menu-> Parameter -> ParSet-> change-> edit

The following settings are available:

- **"no"**: Storage disabled. This is mandatory for parameter set "0". However, you can print out the values shown on the screen with the key "Output" (level 0).
- **"manual"**: The "Store" key stores the actual 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 1 to 240 seconds (4 minutes).
- **"RS-232"**: Similar to erasure time, however the measured value is not stored, but is printed out.
- **"continue"**: You may select "continuously" for tracking measurements. Then select "Memory" for internal storage or "RS-232" for continuous measured value printout. The time determines the interval. The allowed range is 0.2 seconds to 900 seconds (15 minutes).

Notes:

- 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 again temporarily during screwing, the erasure time must be selected sufficiently large.

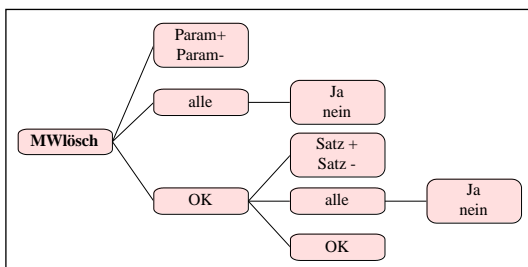
11.4 Display the stored measured values

Menu path:

Menu-> Output-> Display-> Store

In addition to the torque, the angle of rotation or speed and the power may also be displayed. The parameter set, memory and data set number are also displayed in the top status line. The parameter set text, the text description for data sets and underneath that the date and time of day of the measurement are displayed in the bottom lines.

The used parameter set is selected first with "Param +" and "Param -" for output and confirmed with "OK". Use "Set +" and "Set -" to select the next data set, and use "value +" and "value -" to select the next value. The output is sorted according to data set number. It begins in the first data set with the first measured value. A short beep indicates that the end or beginning of memory has been reached.



Menu delete measured

11.5 Erase measured values

Menu path:

Menu-> MVDel->

You can select which measured values you want to delete:

- All measured values completely
- The measured values of a parameter set

First the parameter set is selected (or "all"), then the data set (or "all").

Notes:

- If you still require some measured values, you can transfer data sets to a personal computer as described in Sec. 12 or 13.1 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 of this parameter set.

12 Printing out the stored measured values

Menu path:

Menu-> Output-> RS-232-> Store

Measured values are always printed out here in sets and are ordered first according to the used parameter set number and then according to the data set 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 "Set + / Set - / all / OK" whether you want to print out all data sets in the selected parameter set or only a particular one. The "all" key starts the printout immediately, it must not be confirmed with "OK"!

Notes:

- 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 Sec. 13.13.4):

Examples

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

Sample format of the measured value printout:

```

=====
DS: 1 PAR: 1 21.04.99
IO Nr Md/Wkl Zeit
  1 5,95 Nm 09:41
  2 6,40 Nm 09:41
  3 7,65 Nm 09:41
  4 8,73 Nm 09:41

=====
DS: 1 PAR: 2 24.12.02
IO Nr Md/Wkl Zeit
N 1 56,5 Nm 09:33
I 2 101,5 Nm 09:33
I 3 125,3 Nm 09:34
I 4 131,4 Nm 09:34
I 5 133,9 Nm 09:34
N 6 154,8 Nm 09:34

=====
DS: 1 PAR: 6 21.04.99
IO Nr Md/Wkl Zeit
  1 -9,39 ftlb 09:39
  I -145 Grad
  2 -9,75 ftlb 09:39
  I -179 Grad
  3 -10,27 ftlb 09:39
  I -212 Grad

=====
PAR: TESTTEXT P5
=====
DS: 1 PAR: 5 22.10.02
IO Nr Md/Wkl Zeit
  1 133 Nm 11:00
    833 U/Min
    11,601 kW
  2 274 Nm 11:00
    333 U/Min
    9,554 kW
  3 900 Nm 11:01
    100 U/Min
    9,424 kW
    
```

```

=====
PAR: MOT BLOCK WMB
=====
DS: 1 PAR: 4 06.01.03
IO Nr Md/Wkl Zeit
I 1 19,58 Nm 14:36
I 2 19,64 Nm 14:36

=====
Wkr: 1001

.....

=====
PAR: RADKRANZ9112
DS: ID3000197028
=====
DS: 1 PAR: 6 06.01.03
IO Nr Md/Wkl Zeit
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

=====
Wkr: 12

.....

=====
PAR: RADKRANZ9112
DS: ID3000197111
=====
DS: 1 PAR: 6 06.01.03
IO Nr Md/Wkl Zeit
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

=====
Wkr: 12

.....
    
```

Notes:

- Words are separated by blanks
- End-of-line is "CR" and "LF"
- The line length is less than 30 characters
- Blank lines are composed of either a number of "CR/LF"s or one "CR" with a number of "LF"s
- At least one blank line is appended to the printout
- For transmission format and protocol see Sec. 14

13 Optional functions

The hardware and software options, time and date are displayed when you keep the switch-on key pressed. See Sec. 2.5, page 8.

13.1 Battery operation

The unit can be fitted with a battery. Because the torque transducer is also powered from the battery, you can operate the unit when disconnected from the mains.

The integrated PB-Gel rechargeable battery is maintenance-free; it is protected against overcharging and is recharged indefinitely from the mains. One complete recharge takes up to eight hours during normal operation, and up to five hours when switched off. The unit can then run continuously for at least nine hours. The GMV2 has a battery watchdog. If the battery capacity is almost used up, this outputs the alarm message "Charge!" once a minute and sounds a bleeper. The message is shown permanently at the bottom of the screen to the right. You should then recharge the battery as soon as possible (however, the unit will continue to operate if connected to the mains).

Notes:

- If the battery is completely discharged, the unit will switch off and cannot be switched on again.
- It can continue to be operated using a mains power connection, however.
- **If the unit is in storage or out of service for a longer period (1/2 year) you will need to recharge the battery before use.**

13.2 Passive input

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

For details, see Sec. 0, page 8. The socket assignment can be found in Sec. 16, page 45 ff.

13.3 Digital input

This option allows you to connect the torque sensors with digital output supplied by ETC. They are connected to the active socket.

13.4 Measured value transfer GMV2 → PC

13.4.1 Description

The EXCEL files (with program macros) that come with the system handle data transmission from GMV2 to the PC, statistical data analysis, and data archiving and printing. Furthermore, test reports can be generated automatically. They contain a sample log for torque wrenches. You are free to add other logs, or adapt existing ones to your purposes.

You may also add further sheets to the file or access all sheets through formulae.

The first page in the file is the measured value table. **Measured values can only be read in here.** The other tables and diagrams access them.

Important notes:

- ! If an error message appears when you open the file, **run the program "Setup.Exe" stored on the CD.**
- ! Before transmission ensure that "====> PC" is set as printer on the GMV2 (Menu-> Param-> Setting-> Program-> Printer-> "====> PC"); select baud rate using "+" and "-".
- ! Existing pages should not be deleted or renamed!
- ! The programming of macros is protected

13.4.2 Menu bar

When you have opened the file, an additional menu bar is blended in. This bar is the same as other menu bars and can be moved, enabled, and disabled. You can select the number of the serial data interface from a

list. The displayed baud rate must correspond to the set baud rate, the pre-set value of 2400 baud should not be changed.

13.4.3 Data transmission

The "Read" button activates the RS-232 interface and makes the PC ready to receive.

If the table contains measured values, you will now be asked by the system whether you want to overwrite the measured values or save them. If you choose to save the measured values, they will be appended to the existing measured data.

The button then changes to "Complete?".

Tip:

You can also overwrite individual measured values by selecting another cell before transmission.

The selected cell must be **in the first column** of the line that you want to overwrite. You can now transmit individual measured values, an individual data set, or all data sets to GMV2.

With "Menu – Output – RS232 – Memory" you can select which data are to be transmitted. You can then monitor the measured values on the PC as they are read into the table.

When the transmission is completed, you must acknowledge the operation with a mouse click on "Complete?".

However if you send "all" measured values (all or all values from a parameter set), the transmission is automatically completed. The button then changes back to "Read" and the measured value table is processed:

- empty columns are removed, used columns blended in
- measured values are separated with lines as per parameter set number and data set number
- NOK measured values (outside limit values) are coloured red
- Print area and page are automatically set (!)

13.4.4 Measured value table

Some columns can be removed from the measured value table. Columns "B" to "L" are removed automatically. Leave column "M" empty, as it separates the subsequent comment columns. You can use the comments column as you please, hide and display them, and use them to hold notes for reading measured values. They are not changed by the program, **and do not appear in the printout!**

The print area is automatically set for all measured values. If you only wish to print out a part of the data, you have to change the print area beforehand.

Tip:

- To print out comments as well, you can insert any character in the column "M" in the first line and set the column width to zero. Only when a comment column is completely empty, will it be removed.

13.4.5 Statistical analysis

In the "Statistics" page you can select which measured values you want to use for calculation and the values you want to appear in the diagram with reference to parameter set and data set.

You can arrange the head of the page down to the selection fields as you will. The area should not be changed!

The print area is pre-defined on this page but can be changed.

Note:

- **Anti-clockwise rotation** is assumed when both limit values are negative.
A measured value that is more negative than the limit value, is therefore taken to be **too big!**
Similarly, a positive value is too small!

13.4.6 Measured value diagram

The data range for the first series of measured values (and for the limit values) is automatically defined in the

dropdown selection fields (see 5.). Scaling is also carried out automatically. Values for a (fixed) manual scaling can also be entered, however.

You can change the diagram layout (colours, line thickness...) to suit your requirements. The simplest thing to do is to click on the relevant element with the right-hand mouse key (context menu).

Notes:

- When you position the mouse exactly over a corner point on the curve, the numerical values will be displayed.
- You can of course insert other diagram (and table) pages yourself.

13.4.7 Torque wrench log

This page is intended as the basis for your own test reports. It accesses the measured value table with formulas. You can change this page as you wish.

13.4.8 General

The GMV2 comes with two EXCEL files:

- "GMV2-PC-Trans.xls": This is a **permanent file**, and you should **always** have it on the system. When you want to save measured values, save the file **first (!)** with a meaningful name ("Save as").
- "Example-PC-Trans.xls": This sample file contains some measured values for testing the program and trying out any changes.

Should you have any queries please contact ETH by phone on: +49 (0) 7972 - 9310 0

13.5 Barcode scanner

A barcode hand-held scanner can be connected for the quick and convenient entering of texts (parameter set text, data set marking). This can be purchased from ETC. It is connected to the 9-pole SUB-D socket "Scanner".

Only code 39 is supported for barcodes! The scanner must be setup 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 provides potential-free inputs and outputs for control tasks and displays. This is the pre-requisite for the options described in the following Sections **Fehler! Verweisquelle konnte nicht gefunden werden.** to **Fehler! Verweisquelle konnte nicht gefunden werden.**

13.7 Shut off

A floating optical isolator output is available at pins 6 and 19 in the 25-pin IN/OUT socket (see Sec. 16). 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 Sec. 9.7). Loading capacity of the output: maximum 30 V DC with maximum 150 mA. The shut off delay is ≤ 0.5 ms with a load current of 50 mA. It is ≤ 0.7 ms for a load current of 1 mA (for shut off based on torque). Shut off based on angle is delayed without rise in torque.

13.8 Connecting the power circuitry

A 25-pin "IN / OUT" socket is situated on the rear of the unit to connect the power circuitry. See next section for more details.

13.9 OK output

Should the torque and, if appropriate, 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 Sec. 16). It can be loaded with maximum 1 Ampere at 25 V AC / 30 V DC. In other words this 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 contact at pins 12 and 24 on the 25-pin IN/OUT socket (see Sec. 16) is closed with an 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 13.9.

13.11 Analogue output

The analogue torque signal of the transducer 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 plotters, storage oscilloscopes and so forth (see Sec. 16). The reference potential is GND at pin 5. Ensure that no ground loops are formed as this earth is not electrically separated from the unit. The output can be loaded with maximum 5 mA. It is not protected against overvoltages.

If the overload range is set to "7%" (standard), the analogue output is always scaled to ± 5 V, independent of the input and the input sensitivity!

Zeroadjusting the GMV2 also zeroes the signal of the analogue output!

Peak value retention is not performed.

13.12 External control

13.12.1 Switching 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. 16). 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 Zero adjust

A GMV2 zero adjust can be externally triggered from a programmable controller using the floating optical isolator input pins 2 and 5 in the 25-pin IN/OUT socket (see Sec. 16).

An ON 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 Storing / Printing / Erasing

Storing/printing/erasing can be externally triggered from the 25-pin SUB-D socket (see Sec. 16 Pin Assignments). The exact function depends on the operating mode and the memory settings.

Function of external control:

Memory settings:		Operating mode:
Memory setting	Track	Peak
None	Printout	Printout and erase
Manual	Store	Store and erase
Erasure Time	- - -	deletes NOK values without storage
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 switched externally. Limits are required for many of the statistics functions. The transmission is described in the following section.

13.13.3 Transmission of limits

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. If not, choose the selected parameter set again.

If you answer with "yes", follow the instructions on the GMV2 screen:

The old limits are printed out when you press the CL and then the TOL.LIMIT key. Wait until the print-out is finished, then quickly confirm with "yes" on the GMV2. Now press the data key on the printer. The following error message may appear "NO DATA". Please ignore this message! Then confirm 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 print-out is finished before pressing another 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 sets from a single parameter set (you may need to press the CL key first)

Notes:

- 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 but be previously selected with the "Stndrd" setting.
 - Most statistics functions require limits. They should be transmitted first (see **Fehler! Verweisquelle konnte nicht gefunden werden.**)
 - 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	Transducer data cannot be read	Warning
Transducer	Internal error when changing the transducer model	Warning
Transducer...	...model, values, full scale, angle, speed, 60/360 Imp → transducer data different from parameter set	Warning
Transducer overload	1.) when inserting the transducer. 2.) transducer was overloaded or damaged. 3.) cable break, wrong connection cable, or a strong noise signal.	Warning
Output ==>PC	Transmission of parameter sets to PC failed	Warning
CRC MemChip	CRC fault when reading out the transducer memory chip	Info
Printer	Error with data transmission to printer	Warning
Data entry	The scanned-in text is longer than 12 characters	Info
Setting	Error in the settings cleared.	Warning
EPROM memory	Error in the internal GMV2 program memory	Serious error
Calibr. date	The calibration period has elapsed. Please return the GMV2 for calibration	Warning
Calibr. memory	Error in the calibration memory cleared.	Info
no angle	Without the angle measurement option, the function for setting the angle limits is disabled.	Info
no calibr.	The calibration is destroyed.	Serious error
Short-circuit MemChip	The transducer memory chip has a short-circuit	Info
Load!	The battery is almost flat and must be recharged! The unit switches off automatically after 15 minutes.	Info
MemChip type	Unknown type of memory chip	
Zeroadjust	1.) the transducer is loaded. → Unload and zero again! 2.) the transducer was overloaded. → It is faulty and must be repaired.	Warning
Param.	An attempt was made to switch a parameter set externally while a peak value was stored. → Delete peak value first.	Info
ParSet used	An attempt was made to change a parameter set with which values were already stored. → Clear memory, or copy parameter set to another number.	Info

ParSet no.	Parameter set no. 0 cannot be deleted.	Info
ParSet invalid	A non-existent parameter set was selected externally	Info
Passwrd	Error while entering password: Does PWD already exist?	Info
Password invalid	Wrong password entered	Info
Angle overflow	Measured angle > ± 6000 degrees	Warning

15 Disposal information

The evaluation unit can be returned to us free of charge complete with measuring cable. As soon as you have packed the unit, send a memo to info@eth-messtechnik.de. We will then inform our parcel service to collect the unit.

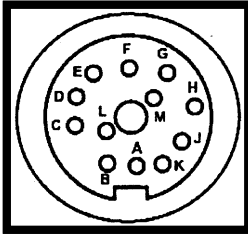
Unfortunately we cannot accept parcels returned to us unfranked without prior notice.

16 Pin Assignments

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

Active and digital transducer socket

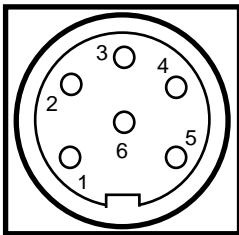
(12-pin round socket)



Pin	Assignment	Pin	Assignment
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	Supply & angle GND	L	Torque 2
F	Supply +12V	M	NC (reserved)

Passive transducer socket (optional)

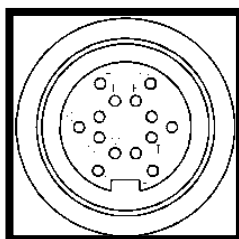
(6-pin round socket)



Pin	Assignment	Pin	Assignment
1	Supply: GND	4	Torque: output
2	Supply: +12V	5	Torque: GND
3	Shielding	6	Calibration

Passive transducer socket with angle (optional)

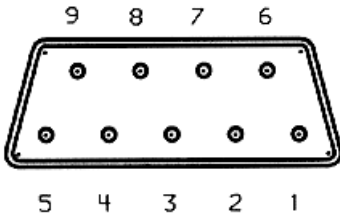
(14- pin round socket)



Pin	Assignment	Pin	Assignment
M	+ Bridge supply	A	Memory chip
N	Reserved: (+Sense)	C	5V-Supply angle
O	Reserved: (-Sense)	E	GND angle & chip
P	- Bridge supply	G	Angle track A
R	+Signal	J	Angle track B
S	-Signal	L	NC (reserved)
T	Test	U	NC (reserved)

RS-232C / Digimatic mini-processor printer connection

(9-pin SUB-D connector)



Pin	Assignment	Pin	Assignment
1	DP-1 HS (option)	4	DP-1 HS (option)
2	RXD (input)	5	GND
3	TXD (output)	9	DP-1 HS (option)

Transmission format and protocol (RS-232C):

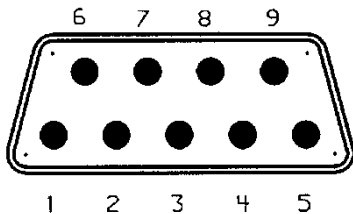
XON-XOFF, no parity, 8 data bits, 1 stop bit, 2400 baud (preset for printer!)

Notes:

- 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 Sec. 9.5 and 12.

"INPUTS" Connection (Optional)

(9-pin SUB-D socket)



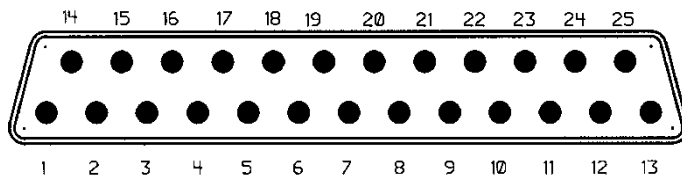
Pin	Assignment / value	Pin	Assignment / value
1	bit 0 / 1 _d	6	bit 5 / 20 _d
2	bit 1 / 2 _d	7	bit 6 / 40 _d
3	bit 2 / 4 _d	8	+12V
4	bit 3 / 8 _d	9	GND
5	bit 4 / 10 _d		

Notes:

- Coding: 7 bit BCD (3 bit tens, 4 bit units, see values)
- The input pins are not electrically isolated!
- Signal level: TTL to +12V.
- Input current per pin: at least 0.5 mA, maximum 10 mA
- +12V (pin 8) is non-stabilized(!), unfused (!!) and without electrical isolation (!). maximum current 50 mA.

IN / OUT Connection (optional)

(25-pin SUB-D socket)



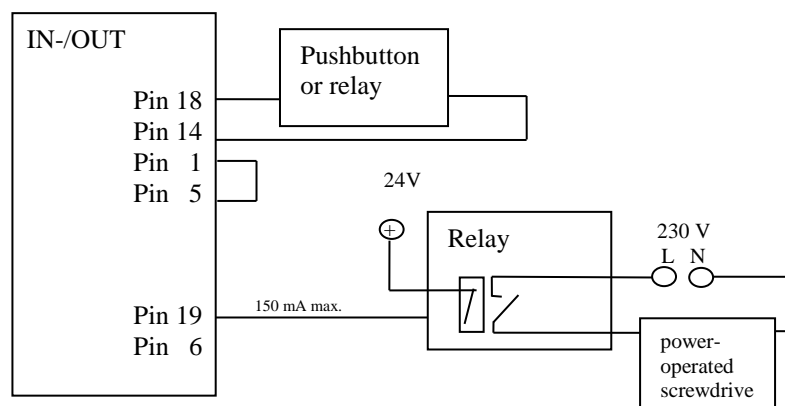
Standard use	Pin	Assignment	Pin	Assignment
Ext. storing/ printing/erase	1	Opto input 1 (-)	14	Opto input 1 (+)
External Zeroadjust	2	Opto input 2 (-)	15	Opto input 2 (+)
	5	GND (without electrical isolation!)	18	+12V (non-stabilized, max. 100 mA)
Shut off	6	Opto output 1 (-)	19	Opto output 1 (+)
	7	Opto 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

Notes:

- Inputs and outputs as well as the socket are optional and are not available with all units.
- **Level of inputs: de-activated:** < +1.5V; **active:** +4V ... +30V(DC) / ≤ 5 mA; "floating inputs".
- **Optocoupler outputs:** (electrically isolated N/O contacts) maximum 150 mA / +30V(DC) (switch-off contact, pin 19 – pin 6, opens when switch-off value is exceeded)
- **Relay outputs:** (unassigned N/O contacts) maximum 1 A / 25V AC/ ±30V DC

Typical circuit

Pushbutton for deleting the peak value and shut-off control of a power screwdriver



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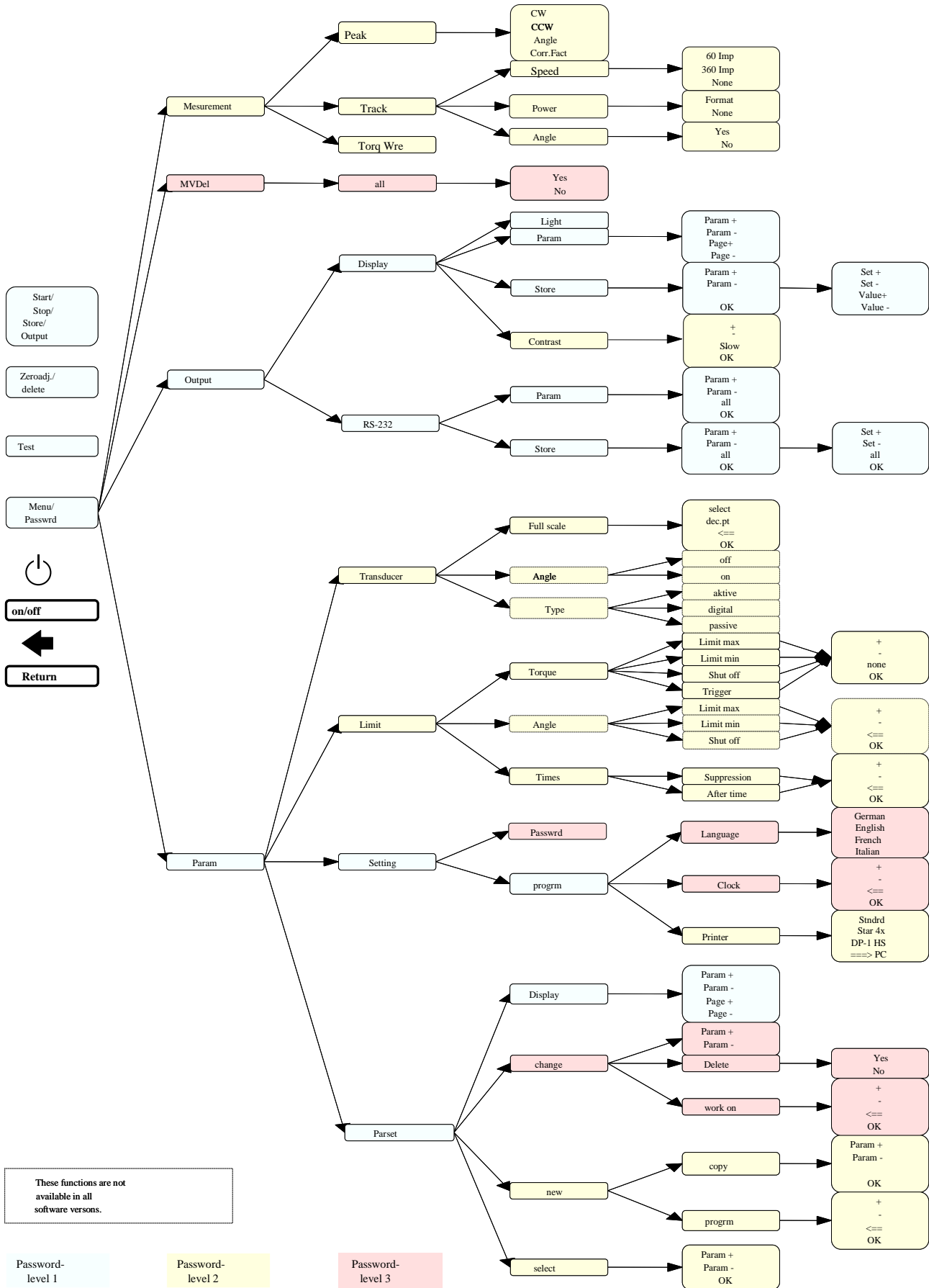
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18 Overview of the GMV2 Menu Structure (Version 5.0)



These functions are not available in all software versions.

Password-level 1
Password-level 2
Password-level 3



... a successful
connection!

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