

MAVO-FSA

Measurement of Voltage Fluctuations and Flicker
Optional Function for MAVOWATT® 45 Energy and Power Disturbance Analyser

3-349-079-15
2/6.99



```
FlickerNum, S 13:17:27
```

	L1	L2	L3
396			
Pst	0,639	0,613	0,327
dnax/%	3,32	2,6	3,37
dc/%	1,65	2,15	1,69
dL>3%/s	3,47	4,32	4,63
1p			
Plt	0,429	0,126	0,566

```
>Num, >S/H
```

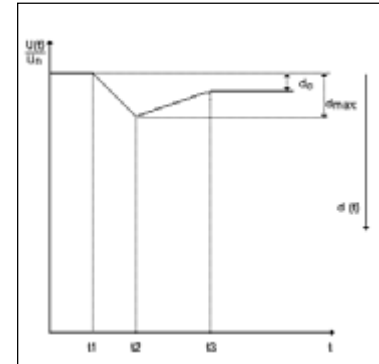
```
flickersetup S 17:53:40
```

```
> rangeU 600U-urativ
```

```
fli,int 0600
```

```
printer off
```

```
>num, >setup
```



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1 Installation

Note:

Chapters 1.1 to 1.4 are obsolete for instruments with option MAVO-FSA being installed ex works. For updating the firmware at a later date see chapters 1.2 and 1.3. Further information can be taken from the operating manual of the basic unit, chapters 2.2 ff.

1.1 Requesting a Password

In order to unlock the optional MAVO-FSA function, a password is required which is linked to the device serial number. You will receive your password after submitting the filled in registration card included in the delivery package of the option MAVO-FSA. Please request the password for your device as follows:

- ☞ Make a note of the device serial number (see the serial number plate at the bottom of the housing).
- ☞ If the serial number in the number plate is not accessible or serial number plate is illegible, please proceed as follows:
- ☞ Connect the instrument to mains voltage.
- ☞ Switch the instrument on by observing the LCD. The serial number appears at the LCD beneath the company logo during initialization.
- ☞ A registration card is included with the option package. Enter the device serial number into the appropriate field.
- ☞ Send the complete registration card to the address or the telefax number indicated in the card.
- ☞ The registration card will be returned to you with the password filled in.

1.2 Preparation for Installation

A computer which runs under DOS is required for installation of the MAVO-FSA option or a firmware update.

- ☞ Connect the MAVOWATT 45 to the mains supply.
- ☞ If the device is equipped with a printer module (SECUTEST PSI) disconnect it from the instrument.
- ☞ If a memory card (PC Card) has been inserted into the MAVOWATT 45, it must be removed as well.
- ☞ Connect the interface port at the MAVOWATT 45 labeled »RS232« to the COM1 serial port at your PC.

Use the signal cable included with the instrument for this purpose (extension cable, 9-pole socket to 9-pole plug, 1:1 through-connected, no zero-modem cables!).

- ☞ Switch the MAVOWATT 45 on and make certain that the printer function is deactivated: Setting: *printer off* in MENU > Limits and L1 > Setup.
- ☞ At your PC close all background programs in order to prevent interruptions during data transfer and enter DOS.
- ☞ Insert the installation diskette into the floppy disk drive at your PC and enter the designation for the floppy disk drive at the DOS entry prompt (e.g. A:).
- ☞ The installation diskette contains packed files. For installation of a firmware update into the MAVOWATT 45 these files must be unpacked into a directory of your PC harddisk. Further informations are given in the text file README.TXT on the diskette.

1.3 Installing the Firmware Update

The firmware update must be installed if your instrument is running firmware version 3.xx or lower.

Instruments running version 4.00 or higher do not require a firmware update for activation of the FSA option. If this is the case, please continue as of chapter 1.4.

Note: The installed firmware release is briefly shown on the MAVOWATT display after power-on: e.g. REV. 3.20. The firmware release on the installation diskette is stated on the diskette label.

ATTENTION!

Do not overwrite the firmware installed to the MAVOWATT 45 by a possibly older version from the diskette!

- ☞ Set the function switch on the MAVOWATT to the L1 position.
- ☞ At the DOS prompt enter the command to change to directory containing the firmware files (e.g. CD C:\MAVOWATT\FIRMWARE).
- ☞ Uploading of the operational firmware is started by executing the file: *LOAD[language].BAT*.

[language] = Designation for the desired language:

	using COM1	using COM2
German / English:	<i>LOAD.BAT</i>	<i>LOAD_2.BAT</i>
French / English:	<i>LOADF.BAT</i>	<i>LOADF_2.BAT</i>
Italian / English:	<i>LOADI.BAT</i>	<i>LOADI_2.BAT</i>
Spanish / English:	<i>LOADS.BAT</i>	<i>LOADS_2.BAT</i>

- ⇒ The initialization sequence is displayed at the PC monitor as a series of semicolons (; ; ; ; ;). Uploading of the firmware is represented by a series of points (. . . .) which extend over several lines at the PC monitor. Uploading takes several minutes and may not be interrupted.
If problems appear during transmission, this procedure must be repeated, possibly using a different PC.
- ⇒ The cursor reappears at the DOS entry prompt after uploading has been successfully completed.
- ⇒ The MAVOWATT 45 is rebooted automatically, after which it is ready for operation with the new software.

Note

After transmission check the measuring and device parameters (language, time, date, mains type, tariff times etc). These may have been changed during uploading!

The display contrast setting may also have been reset, so that the display is illegible. If this is the case, proceed as follows:

- ☞ Switch the instrument off.
- ☞ Set the function switch to MENU.
- ☞ Switch the instrument on.
- ⇒ A signal sounds after initializing and the cursor blinks at the first contrast setting position.
- ☞ Contrast can now be adjusted with the scroll keys, even if nothing is visible at the display.
- ☞ Confirm the *contrast* setting with ↵.

1.4 Unlocking Option MAVO-FSA

- ☞ Set the function switch on the MAVOWATT to the MENU position.
- ☞ Start the enabling sequence at the PC with the command *FSAKEY* <Enter>
- ⇒ You will then be requested to enter your password. The password is a several digit number.
- ☞ Enter the password and press <Enter>.
- ⇒ After the enabling process has been completed, »FSA unlocked« appears at the PC monitor.
- ☞ Switch the MAVOWATT 45 off.
- ⇒ When the MAVOWATT 45 is switched back on, the newly installed function is ready for use.

With the function switch in the MENU position, the configurations menu for general instrument parameters now includes an entry for *flicker* with the setting options *on / off*.

```
menu general
> contrast 60
language english
time 11:34:37
date 05.10.1997
mains 2/4-Wire
TCM off
flicker off

>general
```

Note

Installed options remain enabled even after a firmware update has been performed.

2 Function and Applications

The Option MAVO-FSA serves for measuring the flicker severity and associated voltage fluctuations.

Flicker is defined as the subjective impression of brightness fluctuations at light fixtures caused by supply voltage fluctuations.

Fluctuations of this type can be measured and analyzed with the help of a flicker meter. EN 61000-4-15 (former EN 60686) defines the basic functional principle of the flicker meter, which simulates via an appropriate algorithm functional transfer characteristic of incandescent lamp → human eye → human brain. The flicker severity resulting from that serves as a measure for the human perception of disturbance caused by fluctuation of light intensity.

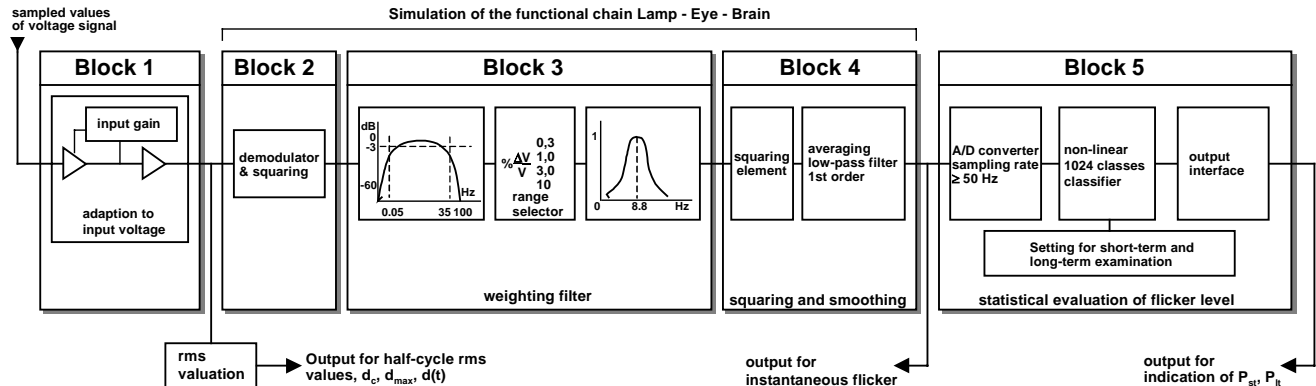
The values for the resulting measured quantities P_{st} (*short-term flicker severity*) and P_{lt} (*long-term flicker severity*) are simultaneously calculated for all three phases on an individual basis.

An evaluation of mains voltage quality in accordance with EN 50160 can be performed on the basis of these measurement values.

Additionally, this function also allows for the acquisition of the *largest relative change in voltage* d_{max} , *relative constant voltage deviation* d_c and the *maximum duration of deviation* $dt > 3\%$ for voltage changes of greater than 3% within the short-term measuring interval.

These measured quantities are required for type testing for electrical devices in accordance with EN 61000-3-3. The observance of the limit values set forth in this standard will be absolutely essential for branding electrical equipment with rated current $\leq 16A$ with the CE mark as of 1 January 2001.

2.1 Measuring Principal of a Flicker Meter (as of EN 61000-4-15)



2.2 Measured and Analyzed Quantities

The MAVO-FSA option offers the following measured and analysed quantities simultaneously for the three phase voltages:

- Pst – Short-term flicker

The flicker severity determined within a short-term interval (1 or 10 minutes selectable).

Unit of measure: none

FlickerNum _s	S 13:17:27		
396	L1	L2	L3
Pst	0,639	0,613	0,327
dmax / %	3,32	2,6	3,37
dc / %	1,65	2,13	1,69
dt>3% / s	3,47	4,32	4,63
12			
P1t	0,429	0,326	0,566
>Num _s	>S/H		

- Plt – Long-term flicker

The flicker severity determined within a long-term interval. It results from 12 consecutive Pst values.

Unit of measure: none

- dmax – Maximum relative voltage change

Within the short-term interval: the maximum difference between the highest and lowest level (10ms rms values) of a voltage variation course¹⁾.

Unit of measure: %

- dc – Relative constant voltage deviation

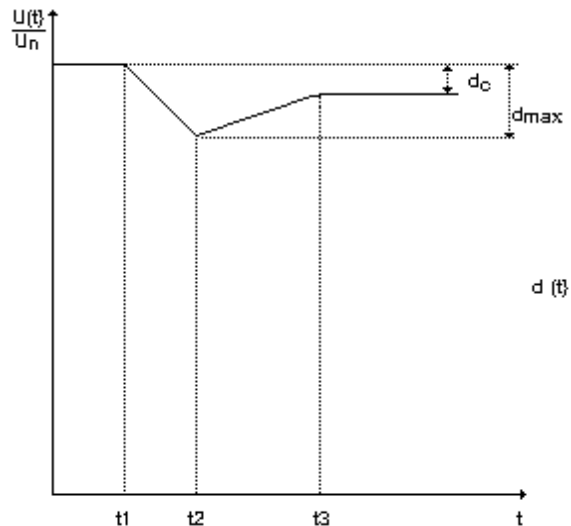
Within the short-term interval: the maximum difference which occurred between two constant²⁾ voltage levels, within them at least one voltage variation occurred.

Unit of measure: %

- dt>3% – Maximum duration of relative voltage change >3%

Within the short-term interval: the longest duration within a voltage variation course during which the relative voltage change was >3%.

Unit of measure: s (seconds)



Relative voltage variation course $d(t)$

- 1) Relative voltage variation course $d(t)$: variation course of the voltage (half-cycle) rms value between two constant voltage levels relative to its nominal value.
- 2) A voltage is designated as „constant“ when its effective value (r.m.s.) does not change for at least 1 second.

2.3 Compatibility Levels

The compatibility levels for voltage fluctuations given below are taken from the norm EN 61000-3-3 (Limitations of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current $\leq 16A$).

The informations written in parantheses specify the limit conditions for measurements with MAVO-FSA option in order to meet the required measurement accuracy of the respective measured quantity. Exceeding voltage fluctuations are considered as voltage dips or over voltage having different evaluation criterias to flicker severity.

- The value of Pst must not exceed 1.00, determined with an uncertainty less than $\pm 5\%$.
(measurements up to Pst = 3 are feasible).
- The value of Plt must not exceed 0.65 .
- The maximum relative voltage variation dmax must not exceed 4% .
(magnitude range of voltage variation: max. 5%).
- The relative constant voltage deviation dc must not exceed 3% .
- The relative voltage variation course d(t) during a voltage fluctuation must not exceed 3% for a duration of more than 200ms .

3 Flicker Measurements

Knowledge of the parameter setting procedure as described in the operating instruction for the basic instrument is assumed for settings described below.

3.1 Activating the Flicker Function

Measurements with optional functions PDA, TCM and FSA are performed with the function selector switch in position PDA.

The function to be used must be selected in MENU *general* if several of these options are installed:

```

menu general
> contrast 60
  language english
  time 11:34:37
  date 05.10.1997
  mains 2/4-Wire
  TCM off
  flicker on
>general

```

TCM off, Flicker off ⇒ measurements with PDA function

TCM on, Flicker off ⇒ measurements with TCM function

TCM off, Flicker on ⇒ measurements with FSA function

Simultaneous use of two or more optional functions is not possible.

Note: The setting parameter for flicker option is only displayed after it has been unlocked (→ chapter 1ff).

3.2 Setting of Operating Parameters

Setting of operating parameters for flicker function is accomplished in *Setup* with the function switch in the PDA position.

```
flickersetup 5 17:53:40
> rangeU      600U-Uratio
  fli, int,   0600
  printer     off
>num,        >setup
```

range U is a fixed voltage measuring range. Selection between 600V, 100V and 12V is possible.

Due to the necessarily short reaction time the measuring range selection cannot be performed by autoranging.

The measuring range values are referred to effective (r.m.s.) values. For measuring ranges of voltage inputs see also Technical Data in Operating Instructions of basic instrument.

fli.int. (flicker interval) is the observation time interval for evaluation of the short term flicker Pst.

Selection of 60 or 600 seconds flicker interval is possible. For flicker measurements referred to the standards the 600s interval is required.

The long term flicker Plt is calculated from 12 successive Pst values.

Notes

- Avoid from changing the flicker interval during a measuring cycle. This may cause misinterpretation of measuring results of Pst and Plt values!
- In addition to the above mentioned measuring and recording parameters, settings for the operating parameters which are relevant to all of the measuring functions included with the MAVOWATT 45 must also be observed. These include:
 - the weighting factors *Uratio* for the analog measuring inputs, available in the *setup* menu under L1/L2/L3.
 - all parameters in MENU > *general*.
- The parameters *cycle time* and *interval* are not relevant for measurements with the option FSA.

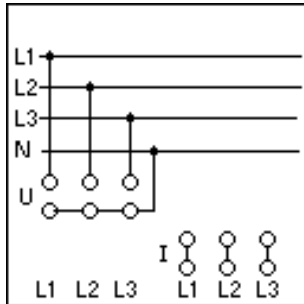
3.3 Performing Flicker Measurements

3.3.1 Measuring Connection for Flicker Measurements

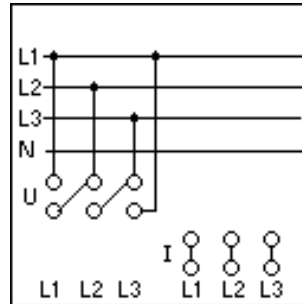
The voltage measuring inputs can be connected to either phase-to-neutral voltage (L to N) or phase-to-phase voltage. (L1 to L2, etc.).

Phase-to-neutral voltages of a three-phase system can be measured either with real or virtual neutral point (by interconnecting the three LOW terminals).

Flicker measurements are only referred to voltage inputs of single-phase or multi-phase systems. Therefore the current inputs can be short circuited.



Measurement of phase-to-neutral voltages with real neutral point



Measurement of phase-to-phase voltages with virtual neutral point

3.3.2 Display of Measurements on the LCD

The measurement results are displayed as numerical values simultaneously for the three phases.

Indicated values refer to the last fully terminated interval. This means that the values for Pst, dmax, dc and dt>3% will always be refreshed at the end of a flicker interval. Refresh of the Plt values takes place after 12 flicker intervals each.

Following additional information is available on the display:

Remaining number of seconds till end of currently running flicker interval →

Number of flicker intervals elapsed since begin of measurement →

Flicker Num,	S	13:17:27
396	L1	L2 L3
Pst	0,639	0,613 0,327
dmax / %	3,32	2,6 3,37
dc / %	1,65	2,13 1,69
dt>3% / s	3,47	4,32 4,63
12		
Plt	0,429	0,326 0,566
>Num,	>S/H	

Other display modes as well as further flicker analysis and documentation can be realized by means PC-software METRAWin 45.

4 Printing via the PSI Module

This function is only available if optional printer module SECUTEST PSI is installed.

4.1 Manually Activated Print-Out

A copy of the current LCD display can be printed out onto a papertape by pressing the PRINT key on the SECUTEST PSI module.

The display is temporarily stored in a reserved memory participation so that the instrument is available for continued measurements during printing.

4.2 Automatically Activated Print-Out

When the printer is enabled (*printer on* in flicker setup), a copy of the LC display will be printed after termination of each *flicker interval* (60 s or 600 s resp.).

5 PC Card – Recording and Read-Out of Flicker Measurements

The procedures for use of the PC Card are described in detail in the Operating Instructions for the basic instrument. Thus only the special characteristics involved with the recording and read-out of flicker measurements are included here.

5.1 Storage to PC-Card

- ☞ Activate the FSA option (→ chap. 3.1).
- ☞ Set the function selector switch to PDA position.
- ☞ Set the desired operating parameters (→ chap. 3.2).
- ☞ Select the display mode *flicker num.*
- ☞ Open the PC-Card menu via the menu bar.
- ☞ If the start of the recording is to be delayed, enter the desired *start time* and *start date*.
- ☞ Start recording by confirming *store yes*.
- ☞ Return to the num. display mode via the menu bar.

After recording has been started, the analyzed values are stored to the PC Card just after termination of each *flicker interval* (1 minute oder 10 Minutes).

Interrupting a recording

If supply voltage to the MAVOWATT 45 fails during recording, current recording is interrupted, and is resumed automatically after power has been restored, but a new record file (run) will be created on the PC Card.

Ending Recording

- ☞ In order to end current recording, open the PC Card menu, select *save no* and confirm with <Enter>.

5.2 Reading Out a Record

- ☞ Open the PC-Card menu via the menu bar.
- ☞ Enter the number of the desired record file (run) at *read ##* and confirm with <Enter>.
- ☞ The results of the first stored flicker interval from the selected record appears at the LC display. Backward and forward scrolling within the record is possible with the scroll keys ▼▲.
- ☞ The display is returned to the PC Card menu by pressing the M key.

5.3 Uploading Measurement Data to a PC

METRAwin[®] 45 PC software for Windows[®] is available for uploading measurement data stored at the PC card. It also allows for detailed analysis, as well as documentation, archiving and export of measurement data to other programs.

For the uploading of measurement data the RS232-interface at the MAVOWATT 45 must be connected to one of the COM ports at the PC with the signal cable included with the basic unit.

Communication via interconnected modems is also possible.

METRAwin[®] 45 version 4.26 or higher is required for the analysis of flicker measurements. Further information for operation can be called up via the help menu included with the PC software.

Product Support

If required, please contact:

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