



FRANKONIA

FHT-25

PC-aided Measuring and Testing System for Testing Harmonics and Flicker According to EN 61000-3-2/3



Inclusive

- 16A reference impedance for flicker measurements
- waveform generator
- control software, evaluation software

General

The system FHT-25 permits to perform measurements of constant and variable harmonic currents, conforming to the Standard EN 61000-3-2 (IEC 61000-3-2), as well as of voltage fluctuations and flicker, conforming to EN 61000-3-3 (IEC 61000-3-3). The measurement of harmonic currents may be carried out without using an additional external AC voltage source, provided that the inherent low-voltage mains fulfills the requirements defined in the Standard. Whether this is the case or not, can be determined in a simple and precise manner by means of the function mains analysis which can be recalled in the software.

As regards the measurement of voltage fluctuations and flicker conforming to standards, an external zero-sequence field impedance AC voltage source is imperative since measuring faults may result from measurements on the mains supply system. To be still able to perform reliable pre-compliance testing without AC voltage source, the FHT-25 is equipped with a 16A flicker impedance (approx. 0.4Ω) which can be connected, and by which any measuring faults can be largely avoided. For tests which are in absolute conformity with the standards, we offer a broad variety of adequate AC voltage sources.

Construction:

The FHT-25 is a PC-aided testing equipment which can be operated with every commercial IBM compatible PC using the operating system Windows 95/98/NT. For the linkage between test equipment and PC a data logging card (ISA-DAQ Card or PCI-DAQ Card) is included in the delivery, which establishes the connection between analog and digital world. Beside the basic functions of harmonics and flicker testing, there exists a variety of further applications, e.g. mains or performance analysis. The waveform generator, which is integrated in the equipment, generates in its standard version a clean 50Hz sine wave for driving a power amplifier (AC voltage source). By means of further, optional software modules, the analysis and generation of wanted and unwanted low-frequency signals up to 2.5kHz or 12.5kHz, are possible, depending on the capacity of the DAQ Card. The equipment may thus be easily completed to be suitable for performing further EMC tests. Some of these are, for example:

- IEC 61000-3-9 Emission of intermediate harmonics
- IEC 61000-3-10 Emissions in the frequency range 2kHz to 9kHz
- IEC 61000-4-13 Immunity to harmonics and intermediate harmonics
- IEC 61000-4-14 Immunity to voltage fluctuations



Picture1

Functioning:

Immediately after installation of the DAQ Card as well as of the control software, the equipment is ready for operation. The connection of the EUT is realized via an earthed socket („Schuko“) integrated in the front panel of the equipment, or via laboratory sockets. Feeding of the mains voltage to the EUT is realized via separate laboratory sockets at the rear side of the equipment. The supply can be made optionally via the inherent low-voltage mains or via the external AC voltage source.

After starting the software, a selection menu is offered with the following functions: **<Constant Harmonics>** **<Fluctuating Harmonics>** **<Current Class D?>** **<Flicker>** **<Mains Analysis>**.

<Current Class D?> :

The limit values for admissible harmonic currents are classified according to the equipment classes A, B, C, and D. The classification is as follows:

- A: Symmetric three-phase appliances and all other appliances, except those mentioned in one of the following classes.
- B: Portable electric tools
- C: Lighting equipment including dimming regulators
- D: Appliances which – under given test conditions – have an input current of a „special“ curve shape, and an input power of $P \leq 600W$.

With the menu item **<Current Class D?>** it is possible to verify automatically if the EUT fulfills the criteria of a Class D equipment. The respective display on the screen can be seen in Picture 1.

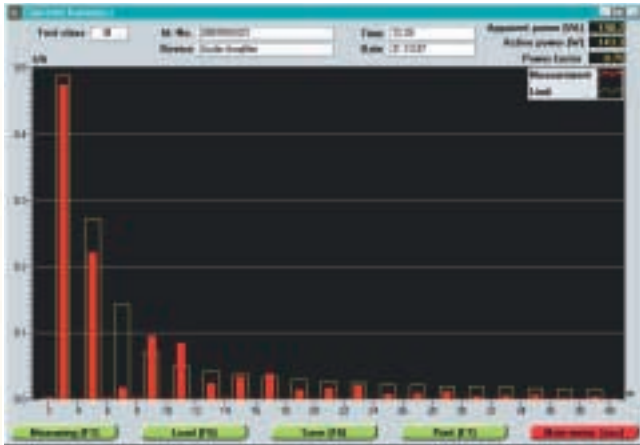
<Constant Harmonics>

This menu option permits the measurement of even and uneven harmonics up to the 40th order, conforming to standards. Before starting the measurement, the class (A,B,C or D), in which the EUT is to be classified, has to be entered. By selecting the class, the limit values admissible for the respective class are automatically loaded so that it appears at once whether the EUT fulfills the requirements defined by the Standard. The respective screen display can be seen in Picture 2.

<Fluctuating Harmonics>

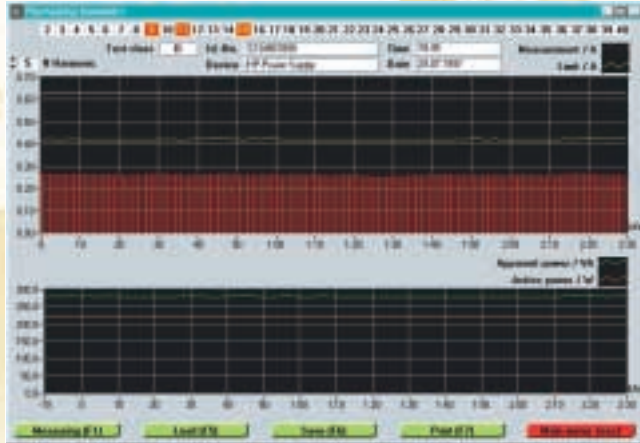
This menu option allows the measurement and analysis of fluctuating harmonic currents resulting from variations of load of the EUT. In this case an upper deviation by up to 1.5 as against the limit values for harmonic currents of the orders 2 to 10 and 3 to 19 is admissible, if its duration is not exceeding 10% during an observation period of 2.5 minutes. Harmonic currents which continue, at the most, 10 seconds after switching „On“ or „Off“ of the EUT, may be neglected when evaluating the EUT.

After starting the measurement, the apparent output and the actual output of the EUT are first of all measured during the observation period of 2.5 minutes, and their time domain is



Picture 2

shown on the screen. After expiration of the measuring period all harmonics of the complete measuring duration are calculated, and their variation (selectable per ordinal) is represented graphically on the upper half of the screen. In addition, the respective admissible limit value as well as the limit value for the admissible upper deviation by 1.5 are presented. To avoid having to examine each individual harmonic (2nd to 40th order), intermittent digits in the upper line of the window will indicate for which harmonics the limit value was exceeded. The presentation on the screen can be seen from Picture 3.



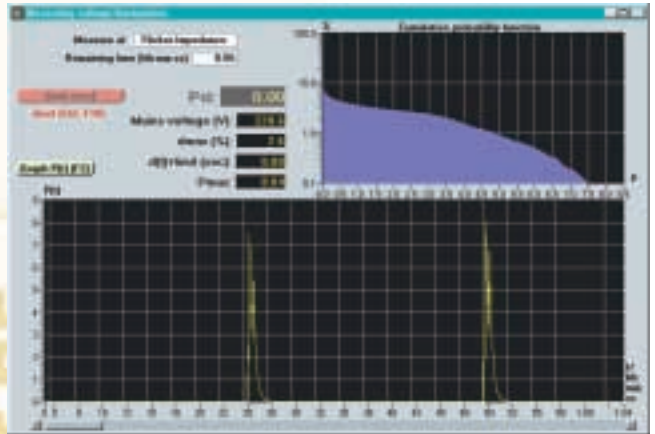
Picture 3

<Flicker>:

When starting the flicker measurement, a selection can be made first of all between the „measurement via integrated flicker impedance“ or the „measurement at the EUT connection“. If pre-compliance tests – without external AC voltage source – are realized, it is always recommended to measure via the integrated flicker impedance. The control software now offers the possibility of measuring either short-time flicker (Pst) with a measuring period of 10 minutes, or long-time flicker (Plt) with a measuring period of up to 2 hours. For quick synoptic measurements, it is also possible to select measuring periods of 1 or 5 minute(s).

After starting the measurement, the actual measuring values of a measuring period of 1 minute (optionally flicker or voltage fluctuations) are shown in the lower part of the screen. At the end of the first minute the scaling changes, depending on the measuring period; the previous measuring values, however, are stored for a measuring period of 10 minutes and may be

viewed by shifting the scroll bar. Besides, at the end of the first minute, the cumulative frequency function is presented in the right upper half of the screen. This figure represents – simplified – the percentage of the flicker values measured. Besides, the actual supply voltage, the short-time flicker value determined (Pst), the max. voltage fluctuation (dmax) in percent, as well as the max. measured flicker value (Pmax) are shown on the screen (see Picture 4).



Picture 4

Depending on the measuring period selected, between 1 to 12 short-time flicker values are determined which, together with the maximum values, are transferred into the table as shown in Picture 5, after conclusion of the measurement. The calculation of the long-time flicker value is made on the basis of the short-time flicker values previously determined.

In the FHT-25, the complicated calculation methods for voltage fluctuations and flicker, and thus the evaluation of the EUT with respect to its compliance with the limit values prescribed by the Standard, have been transferred completely to the software/PC and are accomplished fully automatically. They are set forth in the corresponding Standards (IEC 61000-3-3 / EN 60868).



Picture 5

<Mains Analysis>.

This additional function allows, in a simple way, to obtain a precise information on the quality of the inherent low voltage mains. Thus it can be verified quickly, for instance, whether the inherent mains fulfills the quality requirements regarding measurements of harmonic currents. Via a selectable measuring period, the mains voltage as well as the k-factor are shown numerically and graphically as minimum, maximum and average values.

Storage and Printing of Measuring Results:

Each menu option offers the possibility of storing the measuring data, recalling data already stored and/or printing measuring records. Besides it is possible to export the measuring data to other programs for further processing.

Technical Data:**Connecting possibilities:**

Monitor outputs (BNC):	EUT voltage ($U_p/100$) EUT current ($I/10$) Voltage via flicker impedance ($U_f/5$)
Generator output (BNC):	0 to 10 V AC, 10 to 2.5kHz (FHT-25) 0 to 10 V AC, 10 to 12.5kHz (FHT-125) 0 to 10 V DC
D/A converter output	1 piece
Digital trigger input (TTL)	1 piece
Digital input/output	4 pieces
Input for external current clamp	1 piece

Max. measuring faults:

EUT current / voltage	< 0.1% (25°C) < 0.2% (0°C - 40°C)
Nominal supply voltage (recovery time $\tau = 27$ s) for flicker measurement	< 0.5 %
Voltage fluctuations	< 5%

Flicker impedance

Max. peak voltage**500 V****Max. peak current****68 A**

(with internal current transformer)

Attenuation:

Antialiasing filter	> 70dB
Harmonics filter	$f(-3\text{dB}) = 3\text{Hz}$ $f_n + 15\text{Hz}, f_n - 15\text{Hz} > 40\text{dB}$ $f(n-1), f(n+1) > 57\text{dB}$ mains frequency > 68dB

General Data:

Temperature range:	0° to 40°C
Air humidity, max.	< 90%
Housing:	19" – 3HU
Weight:	10 kg

Volume of delivery:

FHT-25 basic equipment
16 bit data acquisition card
system software WIN9x/NT
68-pole SCSI-II cable
mains cable for operating voltage and
for supplying of the EUT

Optionally:

PCI-DAQ Card for signal generation and
measurement up to 12.5kHz (FHT-125)