

Operating Manual Hand-held Measuring Device

MH 3330

for Atmospheric Humidity, Temperature,
Dew Point, Dew Point Distance, Enthalpy
and
Flow Speed



How to Operate and Maintain Device:

a.) When to replace battery:

If Δ and 'bAt' are shown in the lower display the battery has been used up and needs to be replaced. The device will, however, operate correctly for a certain time.

If 'bAt' is shown in the upper display the voltage is too low to operate the device; the battery has been completely used up.

Please note: We recommend to take out battery if device is not used for a longer period of time.

b) Treat device and sensor carefully. Use only in accordance with above specification. (do not throw, hit against etc.).

Protect plug and socket from soiling.

Only use the specified sensors (p.r.t. 'connections'). Connecting the instrument to others, may damaged the instrument and the probe.

c) Switch off instrument to change sensors.

d) When connecting the TFS or STS - probe the connector may not lock correctly. In such case take the plug not at the casing but at the buckling protection at the end of the plug. If plug is entered correctly, it will slide in smoothly.

e) To disconnect sensor/probe, the interface or the power supply device do not pull at the cable but at the plug.

f) Mains operation:

When using a power supply device please note that operating voltage has to be 10.5 to 12 V DC.

Do not apply overvoltage!! Cheap 12V-power supply devices often have excessive no-load voltage. We, therefore, recommend using regulated voltage power supply devices. Trouble-free operation is guaranteed by our power supply GNG10/3000.

Prior to connecting the plug power supply device with the mains supply make sure that the operating voltage stated at the power supply device is identical to the mains voltage.



Safety Requirements:

This device has been designed and tested in accordance with the safety regulations for electronic devices.

However, its trouble-free operation and reliability cannot be guaranteed unless the standard safety measures and special safety advises given in this manual will be adhered to when using the device.

1. Trouble-free operation and reliability of the device can only be guaranteed if the device is not subjected to any other climatic conditions than those stated under "Specification".
2. If the device is transported from a cold to a warm environment condensation may cause in a failure of the function. In such a case make sure the device temperature has adjusted to the ambient temperature before trying a new start-up.
3. If device is to be connected to other devices (e.g. via serial interface) the circuitry has to be designed most carefully. Internal connection in third party devices (e.g. connection GND and earth) may result in not-permissible voltages impairing or destroying the device or another device connected.

Warning: If device is operated with a defective mains power supply (short circuit from mains voltage to output voltage) this may result in hazardous voltages at the device (e.g. sensor socket at interface).

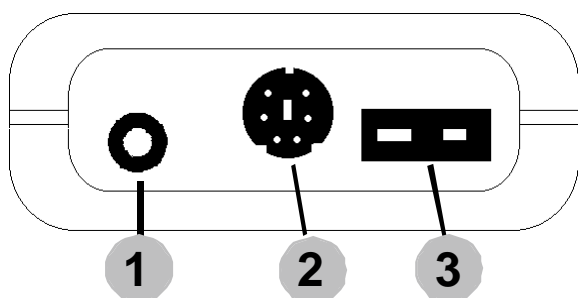
4. If there is a risk whatsoever involved in running it, the device has to be switched off immediately and to be marked accordingly to avoid re-starting.

Operator safety may be a risk if:

- there is visible damage to the device
- the device is not working as specified
- the device has been stored under unsuitable conditions for a longer time.

In case of doubt, please return device to manufacturer for repair and/or maintenance.

Connections



1

Interface: Connection for electr. isolated interface adapter (accessories: GRS 3100)

2

Connection for meas. probes: the following sensor types can be connected:

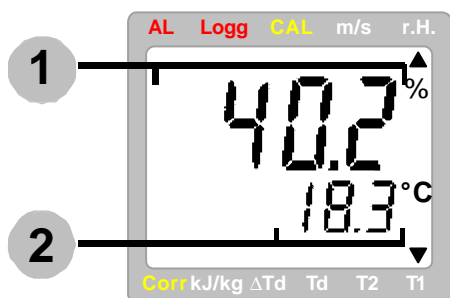
- TFS 0100 (atmospheric humidity and temperature T1)
- STS 020 (flow speed air, 0..20.00m/s)
- STS 005 (flow speed water, 0..5.00m/s)

3

Temperature input T2: Connection for NiCr-Ni-temperature probe (type K) for surface temperature measurements etc.

The **mains socket** is located at the left side of the measuring instrument.

Displays



1 Main display

2 Secondary display

Depending on the measuring probes/sensors connected the following measuring results can be displayed:

-TFS 0100:

- Main display **r.H.:** relative atmospheric humidity in %
- Secondary display **T1:** temperature of the TFS 0100
- Td:** dew point temperature of air
- kJ/kg:** enthalpy with surface temperature probe at T2:
- T2:** surface temperature
- DTd:** dew point ratio = T2 - Td

Use the "Set"-key (key 4) to change over between the measuring results in the secondary display.

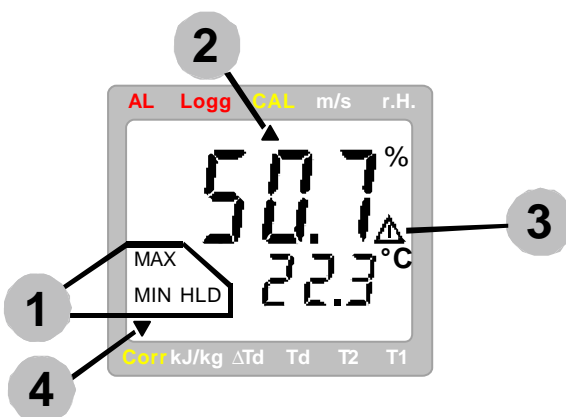
-STS 005 and/or STS 020:

- Main display **m/s.:** flow speed
- Secondary display **t.AVG:** time left till average flow value in seconds will be displayed

with temperature probe at T2 as soon as the average time has been reached:

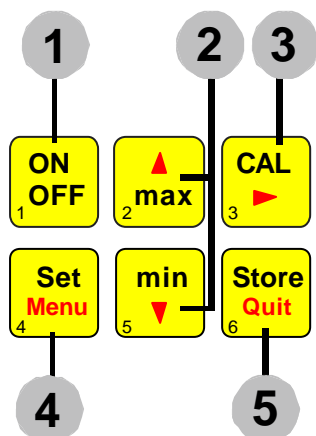
- Secondary display **T2:** temperature

Special display - elements:



- 1 Min/Max/Hold:** shows if a min., max. or hold value is displayed in either the main or the secondary display.
- 2 CAL-arrow:** indicates that a humidity calibration is carried out at the moment.
- 3 Warning triangle:** indicates a low battery
- 4 Corr-arrow:** indicates active status of correction factor (Corr) or zero displacement (Offset) of the temperature channel displayed.

Pushbuttons



- 1 On/off key**
- 2 min/max when taking measurements:**
 - press shortly: min. or max. measuring value will be displayed
 - press for 1 sec.: the value shown will be deleted
- up/down for configuration:** to enter values, and/or change settings
- 3 CAL:** (for TFS 0100-measuring probe only)
 - press for 2 sec.: humidity calibration will be started
 - press for more than 10 sec.: reset of humidity calibration to factory calibration
- 4 Set/Menu:**
 - press (Set) shortly: display changes between: T1, T2, Td, ΔTd, kJ/kg (if existing)
 - press (Menu) for 2 sec.: configuration will be activated
- 5 Store/Quit:**
 - Measurement: Hold current measuring value ('HLD' in display) for flow measurements in the 'AVGHold' mode: start new measurement
 - Set/Menu: Acknowledge setting, return to measuring.

Device Configuration

For configuration of the device press "Set"-key (key 4) for 2 seconds.

Choose between the individual values that can be set by pressing the "Set"-key (key 4) again.

The individual values are changed by pressing the keys "▲" (key 2) or "▼" (key 5).

Use key "Store" (key 6) to leave configuration and to store settings.

Any items referring either to measurements using flow or humidity sensor will only be displayed if the relevant measuring sensor has been connected.

'AVG': Selection of Averaging Proceedings for Flow Measurement (only STS005/020)



Cont: continuous averaging - the average value calculated from the measurements conducted during the averaging period will be displayed.

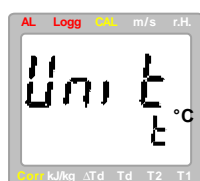
Hold: press key for averaging - flow measurements will be taken during the averaging period, then the average value will be calculated and displayed till the next flow measurement is started.

't.AVG': Setting of Averaging Period (only STS005/020)



1 .. 30: Time for averaging (in seconds) during flow measuring

'Unit t': Selection of Temperature Unit °C /°F



°C: All temperature values in degrees Celsius

°F: All temperature values in degrees Fahrenheit

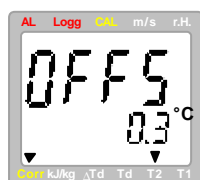
'Offset T1': Zero Displacement of Sensor Temperature T1 (only TFS0100)



-10.0°C...10.0°C and/or
-18.0°F...18.0°F: The zero point of the measurement achieved at T1 will be displaced by this value set.

off: Zero displacement for T1 has been deactivated. (=0.0°)

'Offset T2': Zero Displacement of Temperature T2



-10.0°C...10.0°C and/or
-18.0°F...18.0°F: The zero point of the measurement achieved at T2 will be displaced by this value set.

off: Zero displacement for T2 has been deactivated. (=0.0°)

A zero displacement can be carried out for each of the two temperature channels T1 (TFS0100 only) and T2:

Temperature displayed = temperature measured - Offset

Standard setting: 'off' = 0.0°, i.e. no zero displacement will be carried out. The zero displacement is mainly used to compensate for sensor deviations. Unless 'off' has been set, this value will be shown shortly after the device has been switched on. During operation it will be identified by the Corr-arrow in the display.

Corr T2': Selection of Display Correction Factor for Temperature T2



1.001 .. 1.200: The temperature value (referring to 0°C or 32°F) will be multiplied by this factor.



off: Factor deactivated (=1.000)

This factor is used to compensate for losses of transfer in case of surface measurements, occurring if the object to be measured is extremely hot but will be cooled by lower ambient temperatures. The same can be true for sensors with a large mass. Unless 'off' is set, this value will be displayed shortly after the device is switched on; during operation it will be identified by means of the Corr-arrow in the display

$$\text{temperature displayed[°C]} = \text{temperature measured[°C]} * \text{Corr}$$

$$\text{or } \text{temperature displayed[°F]} = (\text{temperature measured[°F]} - 32°F) * \text{Corr} + 32°F$$

Standard setting: 'off' =1.000

'Power.off': Selection of Power-Off Delay



1...120: Power-off delay in minutes. Device will be automatically switched off as soon as this time has elapsed if no key is pressed/no interface communication takes place.



off: automatic power-off function deactivated (continuous operation, e.g. in case of mains operation)

'Address': Selection of Base Address



01, 11, 21, ..., 91: Base address for interface communication.

Channel 1 will be addressed by the base address set, channels 2 and 3 will have the following addresses.

(Example: base address 21 - channel 1 = 21, channel 2 = 22, channel 3 = 23)



Using the interface converter GRS3105 it is possible to connect several instruments to a single interface. As a precondition the base addresses of all devices must not be identical. In case several devices will be connected via one interface make sure to configure the base addresses accordingly.

Measurements Using the Combination Measuring Sensor TFS0100

The TFS0100 has been especially designed to carry out measurements of ambient temperature. All TFS0100-probes are interchangeable without recalibration being required. The scope of supply includes one sensor to measure relative atmospheric humidity and another one to measure the ambient temperature T1.

rel. humidity r.H. [%]

relative humidity measured in the tip of the probe. Resolution 0,1%.

Ambient temperature T1

temperature measured in the tip of the probe. Resolution 0,1°C or 0,1°F.

Other values on display will be calculated by the measuring device (acc. to Mollier diagram).

Dew point temperature Td

Cold air cannot absorb as much steam as warm air. This means that the **relative** humidity increases as the temperature decreases. If 100% have been reached, the air is saturated with steam; another decrease in temperature results in part of the steam condensing to water, becoming visible as fog or precipitation (dew).

The dew point temperature indicates at which temperature a 100% saturation would be reached and as of when "dew" can be expected.

Enthalpy h [kJ/kg]

Enthalpy refers to the energy content of air. This value always refers to dry air at 0° C. I.e. the energy content of air with a relative humidity of 0% and 0°C is 0kJ/kg. The warmer the air the higher the relative humidity, the higher the energy content. Therefore, more energy is required to heat up humid air than dry air.



All humidity and temperature values calculated from the measuring values refer to a standard atmospheric pressure of 1013 mbar. For measuring atmospheric air, the deviations do not have to be taken into account. When taking measurements in pressure vessels or under similar conditions, the values have to be corrected in accordance with a suitable correction table.

Additional Measurements with NiCr-Ni-Surface Probe at T2:

Surface temperature T2

The second temperature channel can amongst other things be used to take measurements of surface temperatures

Dew point distance DTd

This measurement refers to measurements of T1, T2 and relative atmospheric humidity.

The combination sensor is used to measure the ambient air, whose condition is used to calculate the dew point Td. The surface sensor is used to measure surfaces within this ambient air, with ΔT_d stating the temperature difference between those measurements and the dew point.

Example: measuring the ambient temperature results in a Td of 5°C. As long as the surface-temperature (T2) of a window exceeds 5°C ($\Delta T_d > 0^\circ\text{C}$) the surface won't sweat! When T2 falls below 5°C, ($\Delta T_d < 0^\circ\text{C}$) it will sweat.

Other examples for application: detection of 'humid corners', monitoring of heat exchangers, weather forecast etc..

Measurements Using the Flow Measuring Probes STS005 a STS020

Two types of measuring probes are available for flow speed measurements:

Please note: -use **STS 005** to measure **water** flow
 -use **STS 020** to measure **air** flow

Incorrect use will result in incorrect measurements!

Please observe max. measuring ranges for flow measurements!

-STS 005: 0.05 ... 5.00 m/s (water)
-STS 020: 0.55 ... 20.00 m/s (air)

Higher speeds may destroy the measuring head or may, at least, permanently influence measuring accuracy.

An arrow on the measuring head indicates the required flow direction.

Flow measuring probes are 'free-jet calibrated', i.e. the diameter of the flow channel has to be 5 times bigger than the diameter of the flow measuring head (= approx. 5 cm, otherwise measuring errors up to 40%).

When evaluating the measuring results please also note that in a channel the flow speed is usually higher in the middle of the channel than at its edges. Therefore, use appropriate tables to calculate air flow by means of flow speed.

Averaging for Flow Measurements:

When taking flow measurements fluctuations tend to be quite high. To be able to display a stable measuring value two averaging functions have been integrated in the instrument.

Continuous Averaging

The average value displayed has been calculated from the past few measurements conducted during the averaging time set. After the instrument has been switched on the time remaining till expiration of the averaging time will be displayed at the bottom line of the display. The min. and max. values memorized refer to the minimum and/or maximum average value displayed.

Average Hold

As soon as the MH3330 instrument has been switched on the device starts calculating the average flow value during the averaging time. During measuring the **current measuring value** will be shown in the top line of the display while the bottom line shows the remaining measuring time. As soon as measurements have been completed the **averagevalue** will be displayed and the device will switch to the HOLD mode. The min. and max. values memorized refer to the minimum and/or maximum measuring value established during averaging.

To start a new measuring series press the key "Store" (key 6).

Additional Measurements with any NiCr-Ni-Temperature Probe at T2:

Use temperature channel T2 to take measurements of medium temperature, for example. The value shown is not an average value.

The Serial Interface

All measuring and setting data of the device can be read and/or changed by means of the serial interface and a suitable electrically isolated interface adapter (GRS3100 or GRS3105). In order to avoid transmission errors, there are several security checks implemented.

The following **standard software packages** are available for data transfer:

- EBS9M** 9-channel software to display the humidity (channel 1), the temperature. (channel 2, 3), ...
- EASYCONTROL**: Universal multi-channel software (EASYBUS-, RS485-, or MH3000- operation possible) for real-time recording and presentation of measuring data in the ACCESS@-data base format.

In case you want to develop your own software we offer a **MH3000-development package** including

- a universally applicable 32 bit Windows functions library ('MH3000.DLL') with documentation that can be used by the most programming languages.
- Programming examples Visual Basic 4.0, Testpoint (Keithley Windows measuring software)

The following interface functions will be supported:

Channel						DLL-Code	Name/function
1	2	3	4	5	6		
x	x	x	x	x	x	0	Read nominal value
x	x	x	x	x	x	3	Read system status
x						12	Read ID number
x	x	x	x	x	x	199	Read meas. type in display
x	x	x	x	x	x	200	Read min. display range
x	x	x	x	x	x	201	Read max. display range
x	x	x	x	x	x	202	Read unit of display
x	x	x	x	x	x	204	Read decimal point of display
x						208	Read channel count
	x	x				216	Read offset correction
		x				218	Read corr. factor (1000..1200)
x						240	Reset unit
x						254	Read programm identification

For TFS 0100:

- Channel 1: rel atmospheric humidity
- Channel 2: temperature T1
- Channel 3: temperature T2
- Channel 4: dew point temperature Td
- Channel 5: dew point distance ΔT_d
- Channel 6: enthalpy h

For STS 005 / STS 020

- Channel 1: flow speed
- Channel 3: temperature T2
- Channel 2, 4, 5, 6: not supported.

For NiCr-Ni (without TFS../STS..)

- Channel 3: temperature T2
- Channel 1, 2, 4, 5, 6: not supported.

functions as "Read ID number", "Read channel count" still works with channel 1.

How to Calibrate Meas. of Rel. Humidity Using TFS 0100

Due to the natural aging process of the polymer humidity sensor we recommend to calibrate the sensor at least once a year to ensure optimum measuring accuracy. For optimum recalibration and linearity check, please return device to manufacturer. Use integrated calibration function for 2-point on-site calibration.

How to calibrate sensor with the calibration device GFN xx

The following humidity variables are acceptable for the automatic buffer detection.

Name	RH at 20°C	Calibrationdevice
KNO3	93%	---
NaCl	76%	GFN 76
MgCl2	33%	GFN 33
Silica-Gel	0%	---

The calibration device GFN XX have been optimized for application with TFS 0100. To ensure highly accurate calibration, we recommend to use these humidity variables only. For more detailed information please refer to the relevant operating manual.

Please note: Automatic temperature compensation during calibration

The rel. humidity to be found in the calibration equipment is quite often highly dependent on temperature. This dependence is automatically compensated for when calibrating with the integrated calibration equipment and automatic detection. In case you want to enter calibration values manually, make sure to enter the respective temperature with the values.

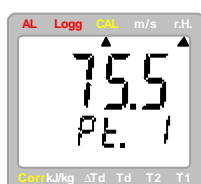
How to carry out calibration

Start calibration: press "CAL" (key 3) for 2 sec. (after more than 10 sec. the factory calibration will be set)

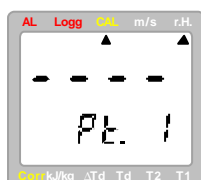
The display prompts you to measure the first humidity value. Use "Set"-key (key 4) to stop calibration whenever you want to. In such a case the last calibration before this one will be used.

1) Selection automatic detection / manual input

Press "CAL"-key (key 3) for a short time to switch over between the various possibilities existing:



automatic detection (acceptable humidity variables see above)
Display will switch over between the acceptable variables.



manuel input

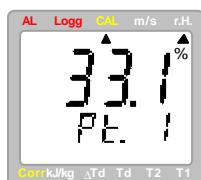


If you want to use other humidity values than those provided in the automatic detection, please enter them here.



0 ... 100.0 %: input range for rel. atmospheric humidity.
(please note Watch out for 'Automatic temperature compensation during calibration')

2) Calibration point 1

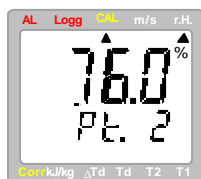


Put sensor in suitable calibration equipment.

- As long as the individual values in the display for the automatic detection keep changing, a valid value could not be detected (humidity value measured may deviate from value set by manufacturer by approx. 10%).
- In case of manual input, enter value here.

As soon as the display stops blinking and changing between values, a stable value has been detected and can be taken over by means of the "Store"-key (key 6). Then the next calibration step will be displayed.

3) Calibration point 2






Put sensor into suitable calibration equipment prepared for the second humidity value.

Precondition: If the first value was below 50%, this value has to be over 50% or vice versa. Otherwise proceed as above. As soon as the display stops blinking and changing between values, the measuring value can be taken over by means of the "Store"-key (key 6) and the calibration has been completed.

If error messages are displayed when calibrating the instrument, the old calibration keeps valid, the new calibration data are lost. Please refer to "Error and System Messages During TFS0100 Calibration"

Error and System Messages

Display	Description	Remedy
	No probe/sensor connected probe/sensor damaged	connect probe/sensor probe/sensor defective -> return to manufacturer for repair
	Low battery voltage, device will only continue operation for a short time	replace battery
	Low battery voltage If mains operation: wrong voltage	replace battery replace power supply, if fault continues to exist: device damaged
No display or characters confused	Battery voltage too low If mains op.: power supply defective or wrong voltage/polarity System error device defective	replace battery check/replace power supply disconnect battery or power supply, wait for a short time, re-connect return to manufacturer for repair
Err.1	Values exceeding measuring range Sensor/cable defective	Check: are there any values exceeding the measuring range specified? -> meas. value too high -> replace
Err.2	Values below measuring range Sensor/cable defective	check: are there any values below the measuring range specified? -> meas. value too low -> replace
Err.3	Values exceeding display range	
Err.4	Values below display range	
Err.7 return	System fault	switch on again: if fault continues to exist, device is damaged -> to manufacturer for repair
Err.9	No probe/sensor existing or probe/sensor defective	connect probe/sensor probe/sensor damaged -> return to manufacturer for repair
Err.11	Value cannot be calculated	One measuring variable required for calculation is missing (no sensor) or incorrect (overflow/underflow)

Error and System Messages During TFS0100 Calibration

Display	Description	Remedy
Cal Err.1	Deviation too high (zero point)	correct humidity variable ? no -> probe no longer within permissible tolerances, return to manufacturer for recalibration
Cal Err.2	Difference point1-point2 too small	difference has to be at least 40% if values are entered manually select suitable values
Cal Err.3	Incorrect temperature	calibration is only permissible in the temp. range from 5 ... 40°C

Specification

Measuring ranges

with TFS 0100 probe:

Humidity	0,0 ... 100,0 % relative atmospheric humidity	(resolution 0.1 %RH)
Ambient temperature	-40.0 ... +120.0 °C (0.0 ... 60.0°C with TFS0100)	(resolution 0.1 °C / 0.1 °F)
Surface temperature	-80.0 ... +250.0 °C	(resolution 0.1 °C / 0.1 °F)
Units calculated		
- Dew point temperature	-40.0 ... +70.0 °C	(resolution 0.1 °C / 0.1 °F)
- Dew point distance	-200.0 ... +290 °C	(resolution 0.1 °C / 0.1 °F)
- Enthalpy	0 ... 250 kJ/kg	(resolution 0.1 kJ/kg)

with STS 005 and/or STS 020 probes

Flow speed depending on probe		(resolution 0.01 m/s)
Temperature	-80.0 ... +250.0 °C	(resolution 0.1 °C / 0.1 °F)

Accuracy device (+/- 1 digit)

rel. atmospheric humidity:	± 0.1%
Ambient temperature T1	± 0.2%
Surface temperature T2	± 0.5% of m.v. ± 0.5°C
Flow speed	± 0.1%

Surface temperature input T2:

Comparison point	± 0,5°C
Temperature drift	0,01%/K

Nominal temperature 25°C

Working temperature 0 to +50°C


Relative humidity 0 to +95%r.h. (non-condensing)

Storage temperature -20 to +70°C

Housing dimensions 142 x 71 x 26 mm (L x W x D)
impact-resistant ABS plastic housing, membrane keyboard, transparent panel. Front side IP65, integrated pop-up clip for table top or suspended use.

Weight approx. 155 g

Interface serial interface (3.5mm jack), serial interface can be connected to RS232 interface of a PC via electrically isolated interface adapter GRS3100 or GRS3105 (see accessories).

Power supply 9V-battery, type IEC6F22 (included) as well as additional d.c.connector (dia of internal pin 1.9 mm) for external 10.5-12V direct voltage supply.  (suitable power supply: GNG10/3000)

Power consumption approx. 2.5 mA (incl. TFS0100)

Display 2 four digit LCDs (12.4mm high and/or 7 mm high) for measuring values, and/or for min./ max values, hold function, etc. as well as additional pointing arrows.

Pushbuttons 6 membrane keys altogether for on/off switch, selection of thermoelements, min. and max. value memory, hold-function etc.

Min-/max-value memory Both the max. and the min. value will be memorized for each measurement taken

Hold-function Press button to store current measuring values

Automatic-off-function Device will be automatically switched off if no key is pressed/no interface communication takes place for the time of the power-off delay. The power-off delay can be set to values between 1 and 120 min.; it can be completely deactivated.

EMC: The MH3330 corresponds to the essential protection ratings established in the Regulations of the Council for the Approximation of Legislation for the member countries regarding electromagnetic compatibility (89/336/EWG). Additional fault: <1%