Thermo SCIENTIFIC

Operating Manual DB-045-010514 E

FHT 6020

Version check

Rev.	Rev. version	Responsible Dept.	Name	Rev. Page	Cat. *)	Explanation
	14.08.2001	SM-GE	Schl			
A	19.09.2001	SM-GE	Schm	4-2	V	exchanged figure 1
B	18.06.2002	SM-GE	Schl	cpl.	V	**V 1.10**
C	11.10.02	SM-GE	Ka	cpl.	V	**V 1.21** (configuration of FHT 6025 added)
D	18.11.03	SM-GE	Schmitt	8-9	V	Operating temperature
E	24.08.05	RM&P-E	Froloff	0-6	K	WEEE Compliance
F	05.07.07	RM&P-E	Tr	cpl.	K	Bit I/O replaced by I/O 1 Analog I/O replaced by I/O 2
G	20.08.08	RM&SI	Eng	cpl.	K	
H	24.09.10	RM&SI-MP	Fr	4-6	S	Figure 8 and 9 replaced
I	27.04.12	RM&SI-SP	Schm	5-25,5-26	V	
J	22.02.13	RM&SI-E	Ff	4-3, 4-4	S	Figure 4 and 6 replaced

*) Category K: editorial correction
V: explanatory improvement
S: substantial change

An explanation is required at least for category S.

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WEEE Compliance:

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at **www.thermo.com/WEEERoHS**

FIGURES:

TABLES:

1. Preamble and useful remarks

1.1 The use of safety icons

The following safety icons are used in these Operating Instructions:

Non-observance of the information in the text marked with this sign may lead to possible injuries to persons.

Non-observance of information being marked with the ‚Caution' sign
may cause damages to the device or result in the display of distorted measured values.

1.2 General safety instructions

1. In industrial facilities, the regulations for the prevention of accidents issued by the federation of employer's liability insurance associations have to be strictly observed with respect to electrical installations and equipment.

2. When opening covers and / or removing parts (e.g. housing covers), alive components and connecting points/terminals may be freely accessible. For this reason, the measuring device has to be disconnected from the mains and any other connection before connecting it, performing any service or maintenance work or replacing / fitting any part or component.

3. Any service / maintenance work or the replacement / installation of single parts or component groups shall be only performed by competent service personnel duly instructed and familiar with the dangers related to the use of the instrument and the relevant regulations !

4. The measuring device left the manufacturer's production facility in perfect condition. Please check the unit for damages before initial setup. In the event of damages, never connect the measuring instrument to the mains ! Attention in this case, danger to life !

5. Please try to avoid the following unfavorable ambient conditions
   - Moisture and extreme atmospheric humidity
   - Inflammable gases, vapors or solvents
   - Strong vibrations
   - Strong magnetic fields (like in the vicinity of electrical machines)

6. When connecting / mounting the measuring instrument, please take appropriate protective measures against electrostatic building-up of charge.

7. Inside the unit, there are components with sharp edges or parts that stick out. Attention, risk of injuries !

8. Never switch on the unit immediately, if the instrument has been transferred from a cold to a warm location only shortly before. The condensation water resulting from this change in temperature may possibly cause damages to the device.

   Without voltage applied, allow the system to warm up to the room temperature at which the unit shall be operated.

9. If the situation gives reasons to believe that a reliable and safe operation is no longer possible, the system's operation must be stopped and the unit must be secured against repeated tries to unintentionally put the system into service again. These reasons will be given under the circumstance that:
   - The unit shows visible damages or
   - The unit no longer works.

10. Please check that all plugs have been properly fixed, when connecting the measuring instrument. Loose contacts may cause the unit to be damaged or result in distorted measured values to be displayed.

1.3 Purpose of this Operating Manual

This Operating Manual shall enable you to configure and use the FHT 6020 according to your requirements.
For additional information that go beyond the scope mentioned herein – such as remarks how to create your own programs for the communication with a FHT 6020 and its probes – please refer to the technical reference information of the FHT 6020, DT-020, as well as to the respective operating instructions and technical data sheets of the probes used.

2. Introduction

The display and communication unit FHT 6020 is the most recent product belonging to the well-know, tried and tested family of measuring gauges developed by Thermo Fisher Scientific Messtechnik GmbH. Compared to its predecessors FHZ 155 or FHT 6010, the FHT 6020 embodies many advantages. It may be operated in a network, it offers a wide variety of probes to be connected, features a reduced response time in the „transparent mode“ as well as a compact structural shape.

In stand-alone operation, the FHT 6020 can be used for the local display of measured values obtained from intelligent probes or from probes belonging to the FH 40 G - program. A „mixed operation“ with both intelligent probes and probes of the FH 40 G – family is possible as well.

When being used in a network, the FHT 6020 - together with the intelligent probes – may be remote-controlled and evaluated via a RS-485 bus. This configuration enables a central PC to access to the probes connected to the FHT 6020 right through the FHT 6020 unit itself.

The FHT 6020 incorporates a flash-EPROM for storage of the device program, thus enabling that both updates of the basic version as well as customer specific programs may be loaded on site.

Via its serial interfaces, the FHT 6020 may be easily configured by means of a PC, using the configuration program „FHT 6020.exe“. This 32-bit Windows program used in conjunction with the options incorporated in the FHT 6020 offers almost unlimited possibilities to customize the FHT 6020 such that the measurement requirements are exactly met and a “tailor-made” solution can be found.

3. Features of performance

3.1 Standard equipment

1x PC interface, RS-232, baud rate 9.600, 19.200, 38.400 bits
1x Display, resolution 128 x 64 Pixel, dimensions: W x H = 62 mm x 44 mm
1x battery-buffered real-time clock
1x operating key
4x LED (1x green, 2x yellow, 1x red)
1x sound generator, 85 dB(A) at 30 cm distance
1x digital bit output, 5 Bit, DC-decoupled
1x digital bit input, 4 Bit, DC-decoupled
80 Kbytes history memory only for measured data received from FH 40 G probes and analog inputs
Supply input for 10-30 VDC (from outside)

3.2 Accessory equipment

1x RS-485 interface for connection to a PC
1x RS-485 interface for connection of intelligent probes
1x or 2x interface(s) for FH 40 G probes
1x analog output: 0 or 4 to 20 mA, DC-coupled
1x DC isolation for analog output
1x additional analog output 0 or 4 up to 20 mA, without DC isolation [1)]
1x or 2x analog input(s), single-polar, 0 up to 4,5VDC [1)]
1x AC wide-range power supply 100-240VAC, 50/60Hz [1)]

[1)] requires housing type „high“ (for dimensions please see chapter 8.1.3, Dimensions and weights), Types HSx

3.3 Design types

Suited for table top operation or wall mounting, special mountings on request

3.4 Operating conditions

The unit has been designed for the indoor use (protection class IP 54) and can be operated at temperatures between 0 - 50°C .

3.5 Probes to be connected

Table 1: Probes to be connected

Name	Type	Connector at FHT 6020
FHZ 302	Probe FH40G, dose rate	Fischer DEE 103
FHZ 312	Probe FH40G, dose rate	Fischer DEE 103
FH 40 TG	Probe FH40G, dose rate	Fischer DEE 103
FHZ 612	Probe FH40G, dose rate	Fischer DEE 103
FHZ 632 L	Probe FH40G, dose rate	Fischer DEE 103
FHT 752	Probe FH40G, neutron dose rate	Fischer DEE 103
FHT 752 H	Probe FH40G, neutron dose rate	Fischer DEE 103
FHZ 672 E	Probe FH40G, detection	Fischer DEE 103
FHZ 512	Probe FH40G, detection	Fischer DEE 103
FHZ 502	Probe FH40G, detection	Fischer DEE 103
FHZ 502 P	Probe FH40G, detection	Fischer DEE 103
FHZ 503	Probe FH40G, detection	Fischer DEE 103
FHZ 732	Probe FH40G, contamination	Fischer DEE 103
FHZ 742	Probe FH40G, contamination	Fischer DEE 103
HCM-Detector	Probe FH40G	Fischer DEE 103
FHT 191 N	Intelligent ionization chamber	Probe
FHZ 621 G-L4	Intelligent probe, dose rate	Probe
FHT 641 D4	Intelligent amplifier for proportional counter tubes	Probe
FHT 671 S4	Intelligent amplifier for plastic scintillators	Probe
FHT 671 Y4	Intelligent amplifier for plastic scintillators	Probe

4. First steps – getting started

4.1 FHT 6020 equipment

The equipment delivered of the FHT 6020 depends on the components ordered. Please compare the single component parts coded with the order number with the identification plate located at one side of the FHT 6020 housing.

4.2 Installation / mounting

4.2.1 Table top operation

The unit shall be mounted onto a plain, dry base surface.

4.2.2 Wall mounting

Using the dimensioned drilling template attached at the end of this Operating Manual, you may mark out the position of the single fixing holes at the desired installation location.

4.3 Cabling

4.3.1 PC interface

4.3.1.1 PC Interface - RS-232

To connect the FHT 6020 via a RS-232 interface to a PC you may either use:

- a commonly used 9-pin 1:1 cable with D-Sub connectors
- or the 9-pin D-sub connection cable, SM 1685 35225, available from ESM

In case that power for the FHT 6020 shall be supplied by the PC, the connection set 42542 / 60 consisting of

- Probe supply for RS-232, 42542 / 6001,
- Connection cable, 5m long, 9-pin D-Sub, SM 1685 35225,
- and plug power supply 42510 / 4210-10 (230 VAC / 15 VDC, 540 mA)

may be employed.

The probe supply 42542 / 6001 for its part features already a connection cable, 0,3m long, 25-pin to 9-pin D-Sub, SM 1685 35149.

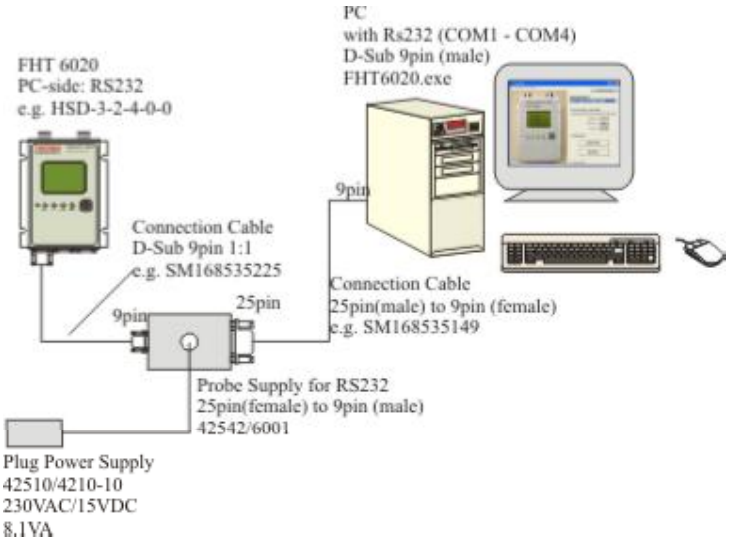


Figure 1: Connection to a PC via RS-232 interface

4.3.1.2 PC Interface - RS-485

To connect the FHT 6020 to a PC via RS-485 the following items are required:

- the interface converter 42509 / 2028 (RS-232 / RS-485),
- the plug power supply 42510 / 4210-10 (230 VAC / 15 VDC, 540 mA),
- a connection cable, 9-pin, D-Sub, 1:1 to connect the PC to the RS-232 side of the interface converter (e. g. SM 1685 35225)
- as well as a second connection cable, 9-pin, D-Sub, 1:1 to connect the RS-485 side of the interface converter with the FHT 6020.

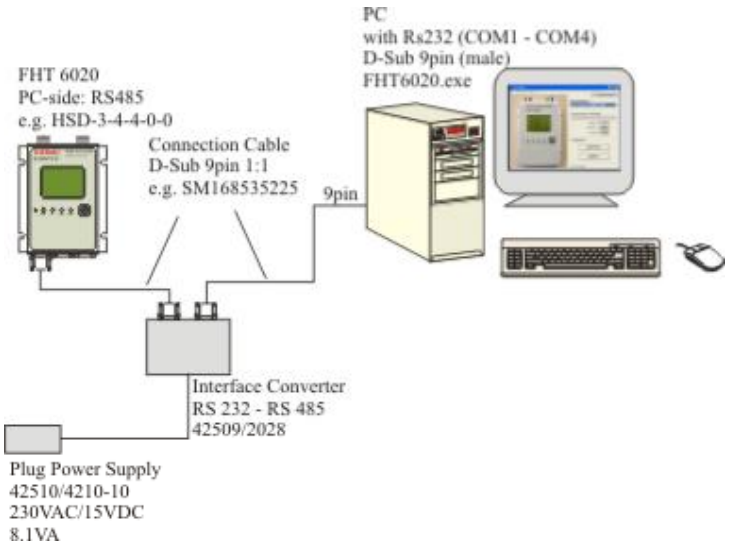


Figure 2: Connection to a PC via RS-485 interface

4.3.2 Probe interface

4.3.2.1 Intelligent probes without NEMP filter

With only few requirements made with respect to the protection class (IP 54) and with no protection against excess-voltage required for the cable between FHT 6020 and intelligent probe, the probe may be operated without NEMP filter.

To connect a single intelligent probe with RS-485 interface to the FHT 6020 a connection cable, 9-pin, D-Sub, 1:1 (e.g. SM 1685 35225) will completely suffice.

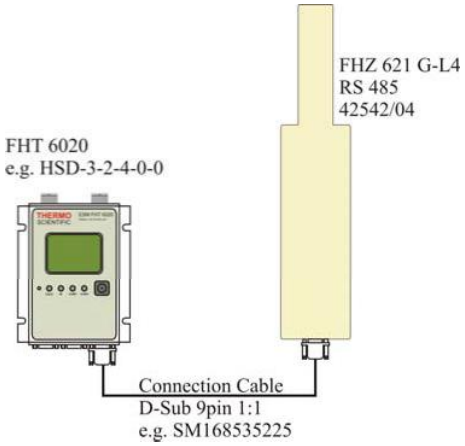


Figure 3: Connecting a single intelligent probe without NEMP filter

To connect several intelligent probes, an application specific probe cable needs to be prepared. Therefore, the following items will be necessary:

- Male probe connector, 9-pin, D-Sub 42509 / 2031,
- Bus distributor box 42509 / 1201 and
- Cable SM 1603 80056 (in the desired length).

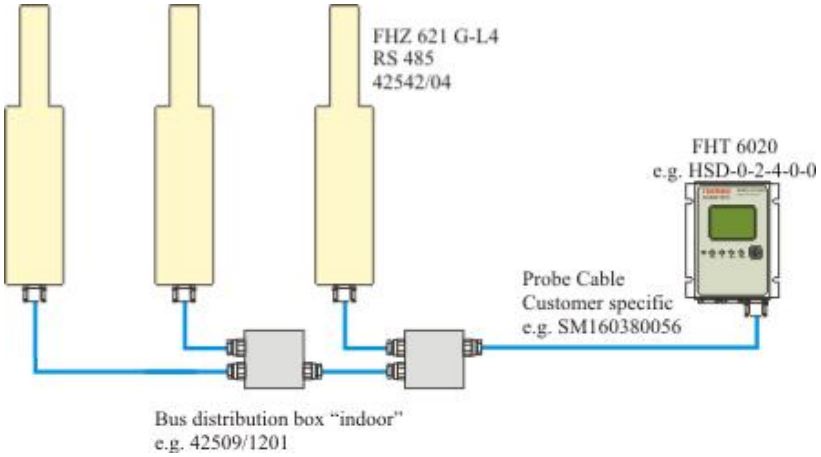


Figure 4: Connecting several intelligent probes without NEMP filter

4.3.2.2 Intelligent probes with NEMP filter

When the intelligent probes are used in outdoor operation and / or if a protection against over voltage is required for the line between the FHT 6020 and the intelligent probe, the latter mentioned device must be operated with a NEMP filter (Protection class IP 67).

If you wish to connect a single intelligent probe with RS-485 interface to the FHT 6020, you will require a connection cable, 6-pin MIL to 9-pin D-Sub, e.g. 42509/2036.

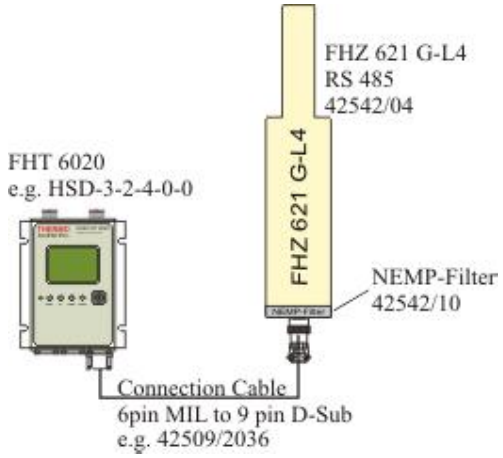


Figure 5: Connecting a single intelligent probe with NEMP filter

To connect several intelligent probes, an application specific probe cable has to be configured. To that end, you will need:

- Male probe connector, 6-pin MIL 42509 / 2030,
- Bus distributor box 42509 / 1201 and
- Cable SM 1603 80056 (in the desired length).

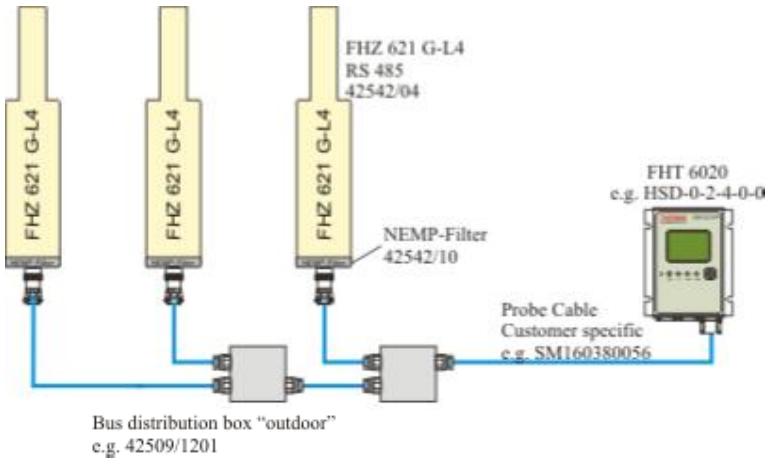


Figure 6: Connecting several intelligent probes with NEMP filter

4.3.3 FH 40 G –external probe interface

Provided that the mounting circumstances, the space available and the probe dimensions allow for it, each probe can be directly connected to the interfaces for the FH 40 G external probes. In some cases it may be useful to additionally support the probes by mechanical means.
In the event that the installation place of the FHT 6020 device and the FH 40 G external probe cannot or should not be identical, an external probe, type FH 40 G may be connected to the FHT 6020 using a cable, e.g. 42540/0040 .. 45. The length of the cable shall not exceed 50 m.

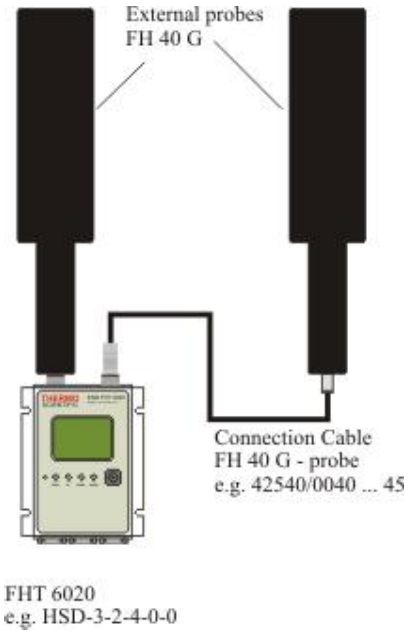


Figure 7: Direct and out-of-line/remote connection of FH 40 G external probes

4.3.4 In-/outputs

4.3.4.1 Digital in-/output

To connect digital in- and output devices as well as the analog current output 1 (connection I/O 1) the cable, type 42559 / 0130 can be used.
Connection to the FHT 6020 is ensured via the 15-pin D-Sub device socket in the center of the bottom plate.

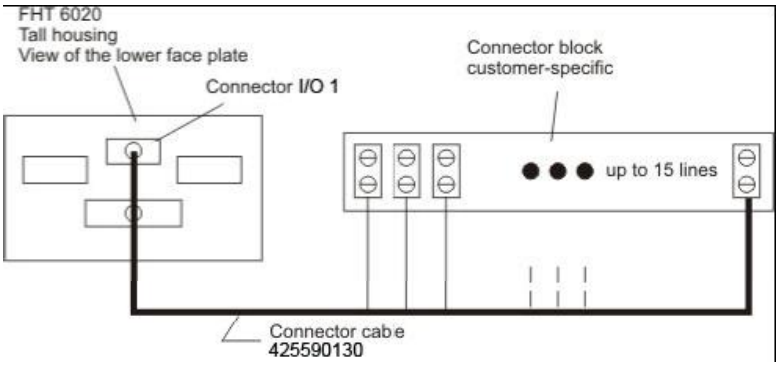


Figure 8: Digital in-/output via „I/O 1“ connection

4.3.4.2 Analog in-/outputs

If you wish to connect analog input devices as well as the analog current output 2, the use of the cable, type 42559 / 0230 will be recommended.

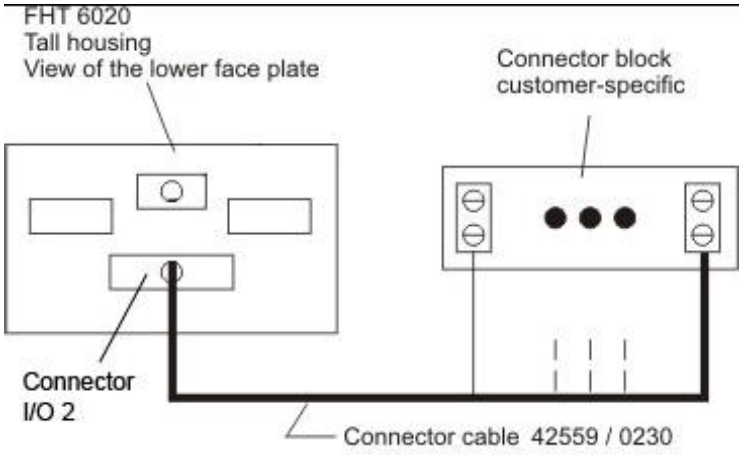


Figure 9: Analog in-/outputs via „I/O 2“ connection

Make sure to insert the plug of the desired probes as well as of the digital and analog periphery – if existing – into the corresponding connectors (as to position, designation and pin configuration/assignment, please see chapter 8, Technical data).

4.3.5 Power supply

The measuring instrument may be either operated with an external DC power supply unit or – with a built-in power supply unit – it may be directly connected to an AC power line.

4.3.5.1 DC power supply

There are different ways how to connect to the power supply :

- via interface converter and plug power supply,
- or via probe supply and plug power supply or
- via one of the 3 pin-and-socket connectors: ***PC*** or ***Digital I/O*** or ***Probe*** in an application specific installation without interface converter and probe supply from a supply source with a minimum power output of 8 VA (for details on the pin position for the external power supply please see chapter 8, data).

Warning:
A DC-supplied device may only be connected via one of the 3 aforementioned connectors (i.e. either … or) to a DC-power supply source !

Warning:
Please note restrictions made in the technical data with respect to the minimum admissible DC-supply voltage depending on the used probe type!

The plug power supply 42510 / 4210-10 enables – besides the FHT 6020 – up to 3 intelligent probes, type FHZ 621 G-L4 plus 2 FH 40 G – probes, model FHZ 612 / 632 to be supplied with power.

4.3.5.2 AC power supply with built-in supply unit

In case that the FHT 6020 has been ordered with built-in supply unit, power supply is simple ensured by connecting the mains plug to an AC power line (100 - 240VAC, 50/60 Hz).

Warning:
A measuring device with built-in supply unit under no circumstances must be supplied additionally by a DC –supply source via one of the 3 aforementioned connectors!

Warning danger to life:
Before opening the unit, please disconnect the measuring instrument completely from the mains (disconnect plug or branch off completely from the mains supply bar) !!!

Using a built-in supply unit, besides the FHT 6020 up to 2 intelligent probes, type FHZ 621 G-L4 plus 2 FH 40 G – probes, type FHZ 612 / 632 can be supplied.

4.4 Functional test

Once the supply voltage is applied, the unit will perform a self test.
During this test, the EPROM content is checked for integrity and the RAM cells, LEDs and the sound generator are tested with regard to their functions.

LEDs:	once the unit has been switched on, all LEDs should give light
ROM1:	in case of an error: the **ERROR** and **ALARM2** LEDs are on, the **STATUS** and **ALARM1** LEDs are off
RAM:	in case of an error: the **ERROR** and **ALARM1** LEDs are on, the **STATUS** and **ALARM2** LEDs are off
ROM2:	in case of an error: the LEDs **ERROR, ALARM1** and **ALARM2** are on, the **STATUS** LED is off
Sound Generator:	permanent tone for approx. 1-2 seconds after the unit has been switched on
Display:	3 test patterns for approx. 1 second each

After successful completion of the self test run, the device name and the firmware version will be displayed for approx. 1 second each.

Only after these steps have been performed correctly, all LEDs – except for the **STATUS** LED – will go off and the sound generator will become silent. Subsequently, the measured values of the 3 channels highest in priority will be displayed (channel activation and priorization will be carried out in the PC configuration program).

4.5 Operating concept

Figure 10 shows the normal display state of a FHT 6020 that has been configured for dose rate channels in display line 1, line 2 and line 3.

Figure 10: FHT 6020 – normal display state

The FHT 6020 will be configured via the serial interface, using the PC program FHT6020.exe.

The unit itself has a single button enabling the user to carry out important operating functions via key-stroke without a PC connected (e.g. alarm acknowledgment, display change-over). With every key-stroke the display backlight will be switched on for approx. 60 seconds, unless the display backlight has been switched to permanent illumination during configuration of the FHT 6020 (program FHT6020.exe, system settings „Display backlight always on“). With the display backlight in permanent mode, pressing the key does not have any effect on the display backlight of the FHT 6020.

4.5.1 Use of the key in measured value display mode

Depending on the operating mode of the measuring instrument, a keystroke can have different effects. Pressing the key for the first time, for example, may switch the display immediately to the screen where the next three measured values are shown, acknowledge the “sound generator” or different alarm states, or the backlight of the display may be switched on.

- When the sound generator is in active mode, it will be deactivated by the first keystroke (short or long stroke).

When the sound generator is not active or already deactivated, the following functions will be carried out depending on how long the key is pressed:

Long keystroke (> 1 second):

- If no alarm is active, i.e. neither the LED Alarm1 nor the LED Alarm2 gives light:
  Invoking the test menu „Testing...“, explained in the following chapter 4.5.2 .
- With an active alarm and with the sound generator in non-active mode (or if the latter has been already switched off), a long keystroke will reset all outputs and LEDs that can be acknowledged. The digital outputs 1-5 can be acknowledged, as well as the LEDs ALARM 1 and 2, if these LEDs – after an alarm or a malfunction has occurred - currently do no longer meet the requirements for an alarm- or error output (e.g. when a measured value that has caused the alarm falls again below the alarm threshold) and if the outputs are not reset automatically due to the configured latching mode.
  In case there are no outputs or LEDs that can be acknowledged, pressing the key does not have any effect at all. This will be also valid in the event that no latching mode has been programmed.

Short keystroke (< 1 second):

- Pressing the key for less than 1 second, the next three measured values will be displayed depending on the configuration set (Number and position of the measured values in the display!). Empty pages for which no display has been configured, will be simply skipped when switching from one display to another.

Table 2: Overview of the keystrokes in normal operating mode

State	Reaction of the FHT 6020 to the respective keystroke	
	1st Keystroke	2nd Keystroke and following ones
S0	***KEY3***, if short ***KEY4***, if long	***KEY3***, if short ***KEY4***, if long
S1	*KEY3*, if short Long keystroke: *KEY2*, with at least 1 alarm pending *KEY4*, with no alarm	*KEY3*, if short Long keystroke: *KEY2*, with at least 1 alarm pending *KEY4*, with no alarm pending
S2	*KEY1*	*KEY3*, if short Long keystroke: *KEY2*, with at least 1 alarm pending *KEY4*, with no alarm

Explanations for the information given in Table 2:

Operating state of the FHT 6020:

- **S0** := Normal operating mode FHT 6020, measuring mode without alarms, without malfunction and with the sound generator switched off
- **S1** := Operating state after an alarm or malfunction has occurred, the sound generator has not been switched on or it has been already switched off by pressing ***KEY1*** in the operating state S2
- **S2** := Operating state after an alarm or malfunction has occurred, the sound generator has been switched on

Pressing the key and its effects on the FHT 6020:

Basically, each keystroke results in the display backlight being switched on for about 60 seconds, unless the unit has been configured such that backlight is switched on permanently. Furthermore, pressing the key will have the following effect:

- ***KEY1*** := Switch-off sound generator.
- ***KEY2*** := Reset of all outputs and LEDs subject to an acknowledgment. Acknowledgment will be only possible for outputs and LEDs whose release conditions are no longer fulfilled. In the event that no latching function has been configured (= automatic acknowledgment), pressing the key will have no effect.
- ***KEY3*** := Display of the next three measured values, if more than three measured values have been configured for the display (more than one display page !) With only one page configured, a keystroke remains without any effect. Empty display pages will be always skipped.
- ***KEY4*** := Invoking the test menu

4.5.2 Use of the key in the test menu

Figure 11: The menu „Testing ...“ of the FHT 6020

In the ***Test menu.*** the following functions will be performed when pressing the key:

- Double keystroke: Execution of the function currently selected (a function is selected, when it is shown in inverted mode, i.e. bright characters on dark background, i.e. highlighted)
- Single, short keystroke: The next menu entry will be selected
- Single, long keystroke: You will quit the test menu and return to the measured value display

By selecting

- **Threshold**
  the alarm thresholds- and failure thresholds for the channels currently active will be shown. The thresholds for Alarm 1, Alarm 2 and failure for a channel will be displayed together, each one being represented by a number. After approximately 4 seconds, the thresholds of the next channel will be displayed. By pressing the key for a longer time, the user may cancel the thresholds to be displayed.
- **LCD**
  3 different test patterns will be displayed subsequently (all pixels on, chequerboard, inverted chequerboard), each one for approximately 4 seconds.
- **LED**
  the LEDs will be switched off and on twice, each state lasting one second.
- **Beeper**
  the sound generator will be switched on for about 4 seconds.

Table 3: Overview of the keystrokes in the test menu

Keystroke	Effect on the FHT 6020
Short	Selecting the next entry
Long	Canceling the threshold display, if active Returning to the measured value display, otherwise
double	Executing the selected entry

Please note:

- The measurements will continue during display of the test menu. The measured values will be recorded and checked. Occurring alarms will be indicated by a signal.
- Acknowledging alarms and switching the sound generator off by pressing the key will not be possible when being on the menu. To acknowledge e.g. an alarm, you first have to quit the menu.
- When there is no key pressed during approximately 15 seconds while being on the menu, the menu will be automatically quit and the unit returns to the measured value display.

5. PC program FHT6020.exe

Via the PC interface the measuring instrument can be connected to the serial interface of a PC by means of a 9-pin D-Sub cable (1:1). Depending on the hardware configuration of the FHT 6020, the use of an interface converter may be necessary (see chapter 4.3.1, PC interface).
Using a PC, the measuring instrument can be easily configured and the respective values can be transferred from the unit to the PC.

When describing the FHT6020 program, the following conventions will apply to make understanding easier:

Menus on the menu bar and in open menus are in bold print.
Example: **File / Close** means that you first have to click the **File** menu and then the menu point **Close**.

The keys on the keyboard will be represented in brackets, showing their designation.
Example: [Enter]

Buttons in the active windows are shown in a frame.
Example: [Cancel]

Entries in text boxes are shown in italics.
Example: *a:\setup*

The names of the windows and fields are shown in quotation marks.
Example: „Channel“ window

5.1 Installing the FHT6020.exe program

To install the program on a PC, you will need the program FHT6020. For installation, the operating systems WINDOWS 9x, WINDOWS NT or higher are required.

Start Windows. On the start menu bar, click on [Start], to open the start menu. Select **Run...** and enter in the command line „Open“ d:*setup* , if your CD-ROM disk drive is D:
(see Figure 12). Otherwise, replace the character „d“ by the character of the respective disk drive you use (e. g. „g:\setup.exe“). To cancel the setup and to close the window, press [Cancel].

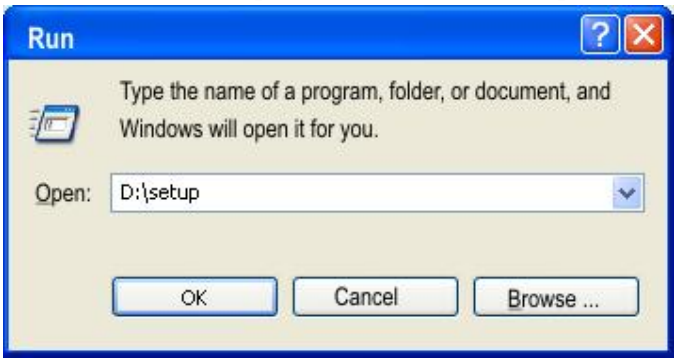


Figure 12: Installation, „Run“ window

After confirmation of your entry by pressing the [OK] button, the installation program will be executed and the „Select Language“ window appears on the screen (see Figure 13). Please select the respective language you wish to use during installation (English or German) and press [OK] to confirm the selected language.

Figure 13: Installation, „Select language“ window

After selecting the installation language the „Welcome“ window (see Figure 14) will appear on the screen, stating some useful general and legal information.

Figure 14: Installation, „Welcome“ window

By pressing the [Next] button, the „Choose installation folder“ window opens (see Figure 15). You may now either select an installation folder to your convenience by pressing the [Browse] button or you simply adopt the installation folder suggested by the program. To that end, press the [Next] button.

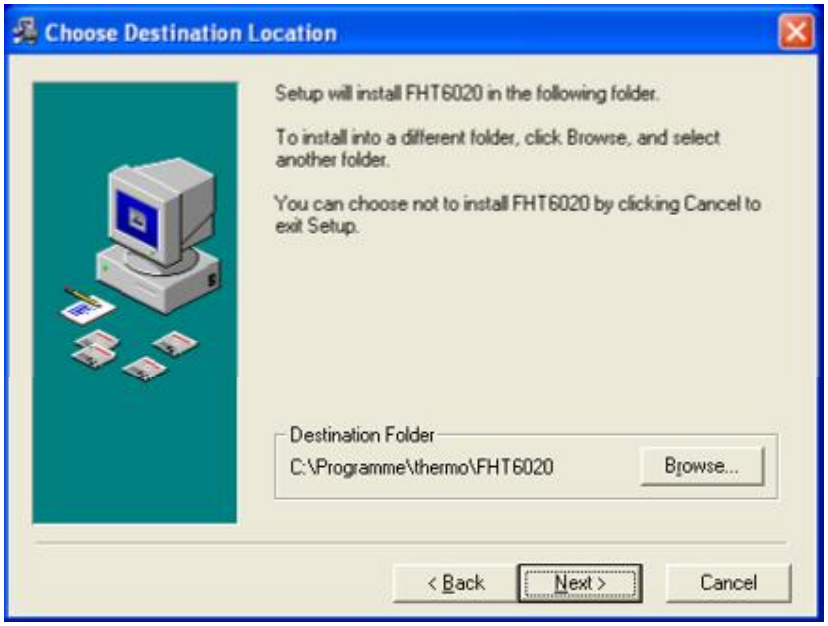


Figure 15: Installation, „Choose Destination Location“

Once you have chosen the installation folder, the „Select Program Manager Group“ window will appear on the screen (see Figure 16). You may now enter a name for the program group under which the FHT6020 program appears in the program manager. If you wish to adopt the name suggested by the program, press [Next]. In other cases, you can simply overwrite the suggested name by a program name you prefer.

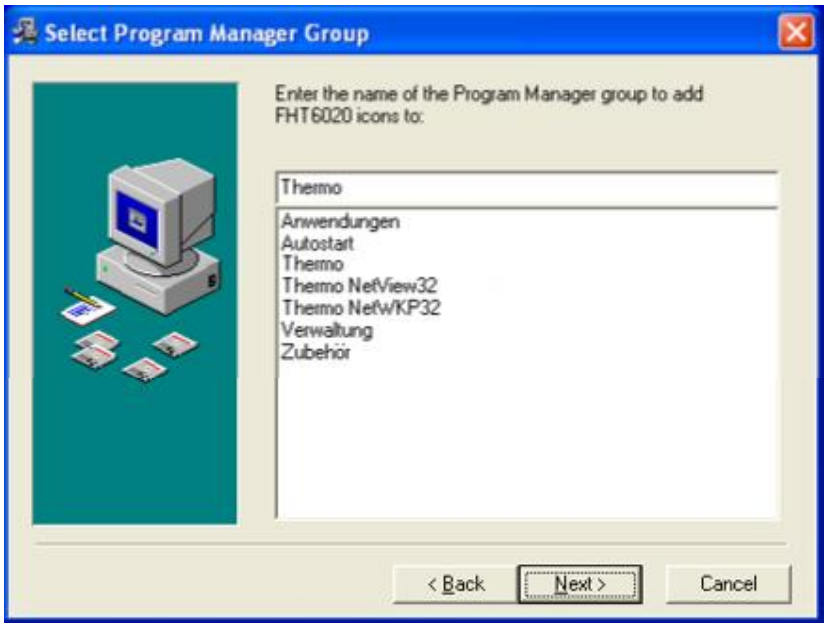


Figure 16: Installation, „Select Program Manager Group“ window

Once the name for the program group has been defined the „Start Installation“ window opens (see Figure 17). Here, you have the chance to change your settings, if not appropriate, by clicking the [Back] button or you may proceed with the installation by pressing the [Next] button.

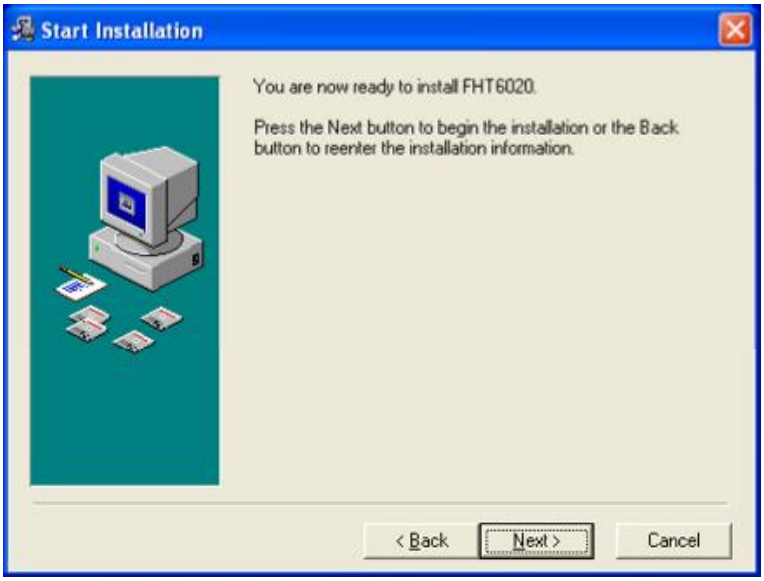


Figure 17: Installation, „Start Installation“ window

Once the installation has been started (by pressing the [Next] button), the „Installing“ window (see Figure 18) will keep you up to date about the installation process.

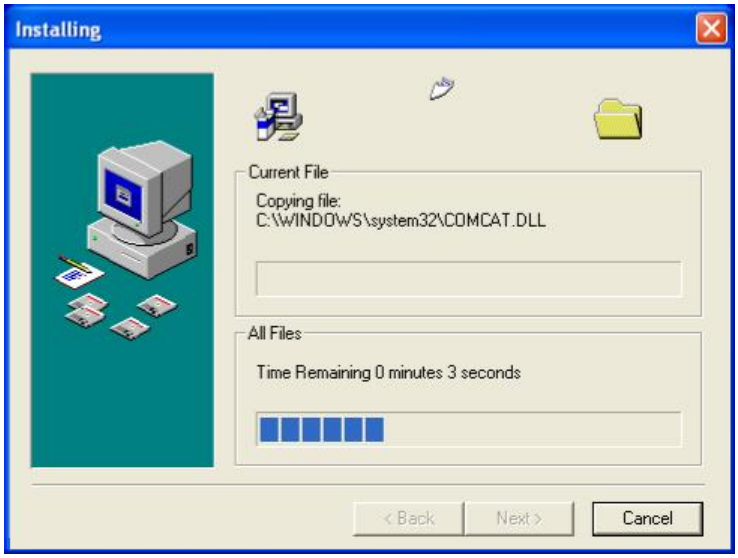


Figure 18: Installation, „Installing“ window

After successful installation of all files, the following message appears on your screen and remains for some time (depending on your processor type):

Updating System Configuration.

After the update has been completed, the final installation window „Installation Complete“ opens (see Figure 19). To complete the installation process, press the [Finish] button. The FHT6020.exe program is now ready for operation.

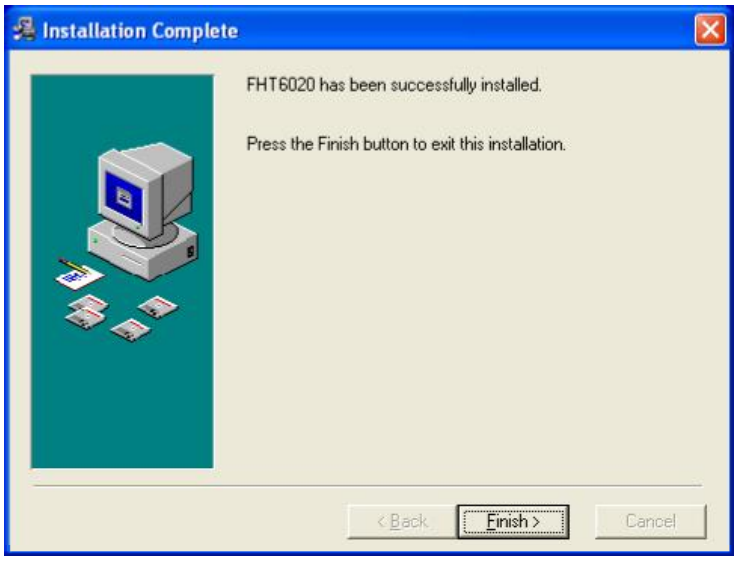


Figure 19: Installation, „Installation Complete“ window

5.2 Connection to a PC

According to the information given in chapter 4.3.1, PC interface, the measuring instrument has to be connected to a free, serial interface (COM1 ... COM4) of a PC.

5.3 Starting the program

Connect the measuring device to your PC and switch it on.
Now start the FHT6020.exe program by pressing the FHT6020 icon on the desktop or pressing the Windows [Start] button. Subsequently, select the menu point **Programs / FHT6020 / FHT 6020** (see Figure 20). The program FHT6020.exe is started automatically.

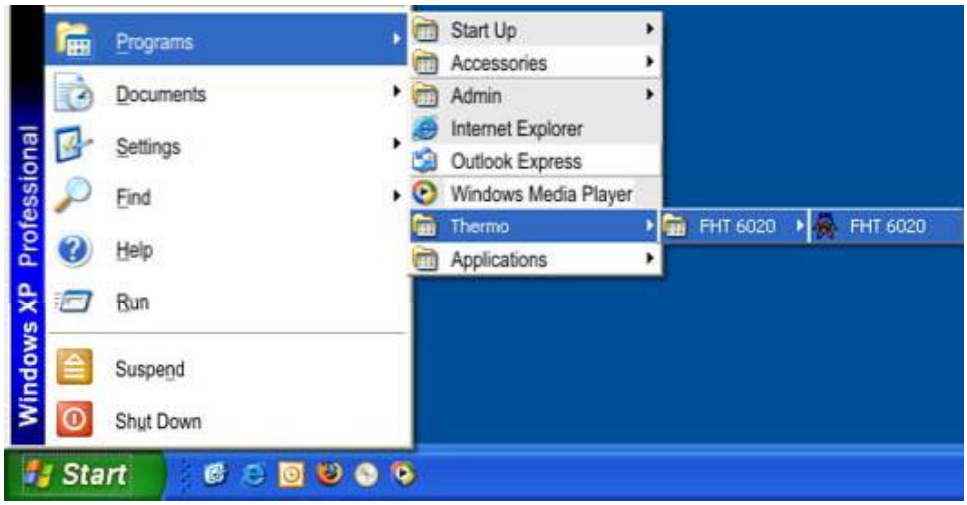


Figure 20: Start display

Now the main program window appears on the screen.

Figure 21: FHT6020, main program window

When starting the program for the first time, it is necessary to first update the network list (= List of the FHT 6020 units connected). To that end, on the „Options“ menu, select „Network list...“ (see chapter 5.7 Network list). During this search process, all FHT6020 units connected are recognized and added to the network list. Once the update of the network list has been completed, all the FHT 6020 units connected will figure in the drop-down menu list (Figure 23).
Probes connected to the FHT 6020 will only be recognized during the search process, if the FHT 6020 has been configured accordingly.

In case that the program has been already started before and the list of the connected FHT 6020 units already exists, it is checked after program start, if the FHT 6020 units figuring in the drop-down menu list are also at the program's disposal. In the event that one unit is not available, the program prompts, if this FHT 6020 shall remain in the drop-down selection menu (see Figure 22).
The program is now ready for operation and execution of the respective program functions.

Figure 22: Program start, FHT 6020 not found

5.4 The main program window

After program start, all available FHT 6020 units are listed in the drop-down selection menu (Figure 23).

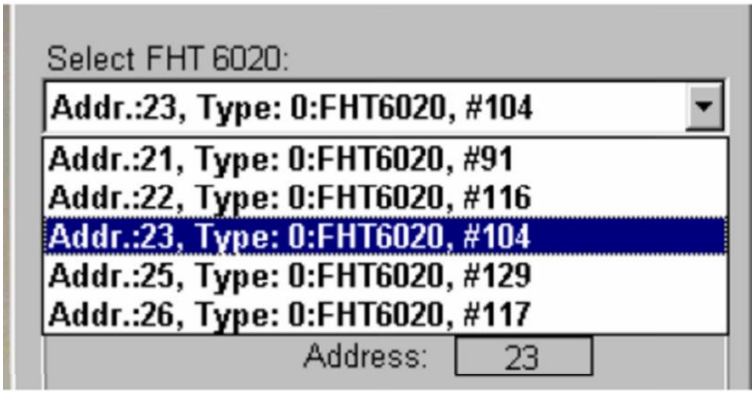


Figure 23: Drop-down menu: select FHT 6020

First select the desired FHT 6020 unit.
After selection, the „Characteristics of FHT 6020" frame shows the text assigned to the FHT 6020 and below the address, serial number as well as the firmware version. It is now possible to configure the FHT 6020 unit or to execute further functions such as recording measured values or reading history values.

To configure the FHT 6020 unit selected, please press the [Channels] and the [System] buttons.

5.4.1 Display of measured values in the main window

If you wish to display the measured values of the selected FHT 6020 unit, please click either the check box „Measured values" or on the picture. With no parameters read from the FHT 6020 so far, the program prompts first reading the parameters before the measured values are displayed. Subsequently, the measured values are displayed, each one for 1 second. With more than 3 measured values (channels) configured, you may switch to the subsequent display by pressing the key of the FHT 6020 device in the picture. If a failure or an alarm has been detected, the corresponding lamp in the picture will give light. The measured value display may be quit by pressing once more again the check box „Measured values".

Figure 24: Measured value display in the main window

5.4.2 The menu in the main window

On the **File** menu (see Figure 25) you can choose the following options:

- **Open parameter file** Selecting this option, you can load an already existing parameter file (.par) and modify it, if necessary, according to your needs. The selection of this menu point is identical in function to pressing the function key combination [Ctrl]+ [F5].
- **Save parameter file as.** This menu option enables the currently opened and modified parameter file to be saved using another file name and storing it in another folder. To obtain the same result, you may also press the function keys [Ctrl]+ [F6].
- **Close parameter file.** Use this menu option to close an open parameter file again. The same result may be achieved by pressing the function keys [Ctrl]+ [F7].
- **Read parameters from FHT 6020** Using this command, you load the current configuration of the FHT 6020 into the FHT6020.exe program. Instead of choosing this menu point it is also possible either to press the [F5] function key or click the [Read] button. To load the desired current configuration from the FHT6020.exe program to the FHT 6020 unit, please select the menu option **Write parameters to FHT 6020**. To obtain the same result, you can also press the function key [F6] or click the [Write] button.
- To quit the FHT 6020 program, select **Exit.**

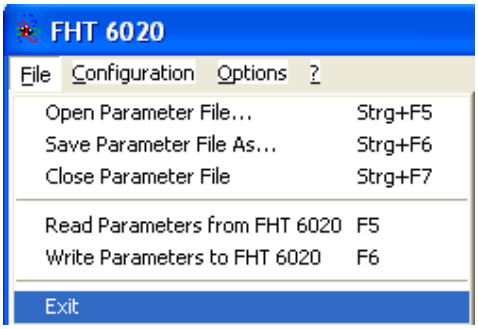


Figure 25: The „File“ menu

The menu **Configuration** (see Figure 26) offers you the following possibilities:

- To open the „Channel settings“ window, select the menu option **Channels** (chapter 5.10). Instead of using the menu function, you can also press either the [F3] function key or the [Channels] button
- On the „**Configuration**“ menu, choose **System** to open the „System settings“ window (chapter 5.9). Selecting this menu point is identical in function to pressing the [F4] function key or the [System] button
- To select the language, please choose the menu option **Language – German** or **English**
- Using the menu option **Serial interface**, enables you to configure the serial interface to the FHT 6020 (Attention: Modifications made in this menu only act on the PC program FHT6020.exe. To change the parameters of the FHT 6020 unit, please select the menu point “System” / frame „*FHT 6020- serial settings*“ / button [Settings] on the “Configuration” menu !). You may also press the function keys [Ctrl]+ [F4] to achieve the same result.

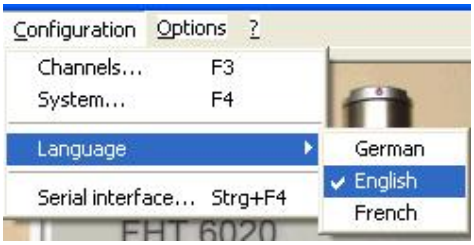


Figure 26: The „Configuration“ menu

On the **Options** menu (see Figure 27) you can choose the following functionalities:

- **Network list** offers you the possibility to find all FHT 6020 units and intelligent probes (e.g. FHZ 621 G-L) that are in the network and to update the device list in the main menu correspondingly.
- **Probe list** enables the user to find all intelligent probes connected to the FHT 6020. Intelligent probes are found as well which have not yet been configured in the FHT 6020. With this menu option, you can also configure probes that have not been configured yet.
- To display and save the current measured values of the active channels, select the **Measured values** option. Instead of choosing the menu option you may also press the function key [F7].
- Using the **History** option, you can display the recorded data of the active FH40G probes and analog input channels that have been selected for archiving, as well as the history of intelligent probes connected to the FHT 6020 in form of a X-T chart. You can also press the [F8] function key to obtain the same result.

- **Alarm store ...** recalls the alarm list of FHT 6020 for display and eventual storage. The selection of this menu point is identical in function to pressing the [F9] function key.
- To synchronize the FHT 6020 battery-buffered real-time clock with the clock of your PC, select the **Synchronize FHT 6020 with PC clock** menu option. The selection of this menu point is identical in function to pressing the [F12] function key.
- Using the command **Clear history** you can delete the history data of the FHT 6020 (only FH40G-probes and analog input channels).
- To initialize the FHT 6020 anew, select the **Reset FHT 6020** option. In doing so, the existing configuration is reset, the address is set to 1 and the baud rate to 9600. Please use this menu option only in case of problems with the FHT 6020.

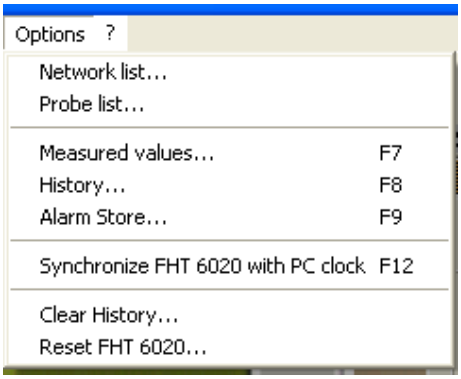


Figure 27: The „Options“ menu

On the **?** menu, you can choose the

- **About** menu option to obtain useful information on the FHT6020.exe program such as version, purpose and manufacturer of the program

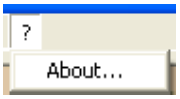


Figure 28: The “About” menu

5.5 Selecting the language of the FHT6020.exe program

On the menu „Configuration“- sub-menu „Language“ all available languages are listed. After selection of the desired language this selection needs to be confirmed. Subsequently, you are prompted to quit the program. The program is only displayed in the selected language after the program has been reset.

5.6 Configuring the serial interface

On the menu „Configuration“, select „Serial interface...“ to open the „Serial interface“ window. This window shows the frames „*Port Number*“, „*Baud rate*“ and „*Address FHT 6020*“ (see Figure 29). Here, you may configure the serial interface to the FHT 6020 unit.

- In the „*Port Number*“ frame, the current serial interface for the serial communication with the FHT 6020 is shown. To modify the selection in case of need, please click one of the 4 option boxes. Please note that only free and available serial interfaces can be selected by clicking on the respective option box.
- The „*Baud Rate*“ frame shows the current baud rate for the serial communication with the PC. The setting can be changed by clicking one of the 3 option boxes.
- The „*Address FHT 6020*“ frame displays the current device address for which the following rule applies: 2 ≤ valid address ≤ 99. In the text field beneath the frame title the device address can be modified accordingly.

To open the „Serial interface“ window you may also press the shortcut key combination [Ctrl]+ [F4] instead of selecting the window via the respective menu option.

Attention:
Modifications made to the interface parameters in this menu have only an effect on the FHT6020.exe program and/or the PC.
To configure the serial PC interface of the FHT 6020, please refer to chapter 5.9.6.

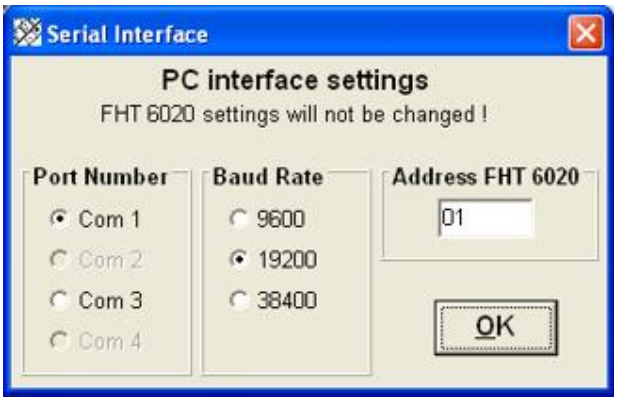


Figure 29: Configuration, the „Serial Interface“ window

Example:
In the example shown above, the serial interface 1 (COM-Port 1) has been selected. The current address of the FHT 6020 is „1“ and the communication between the FHT 6020 unit and the PC runs with a baud rate of 38400 Bit/s.

5.7 Network list - Searching FHT 6020 unit(s) and intelligent probes

The network list function is used to find out and to determine which intelligent probes and/or FHT 6020 units are currently connected to the PC. Furthermore, this functionality updates the drop-down selection menu figuring the FHT 6020 units connected.
To open the window „*Network list – Setting search*“, please select the menu option„Network list...“ in the “Options“ menu.

5.7.1 Network list – Setting search parameters

Here you may define and set the search parameters for the network list. Therefore, please use the options given in the „*Serial port*“, „*Baud rate*“, „*Address*“ and „*Device*“ frames.

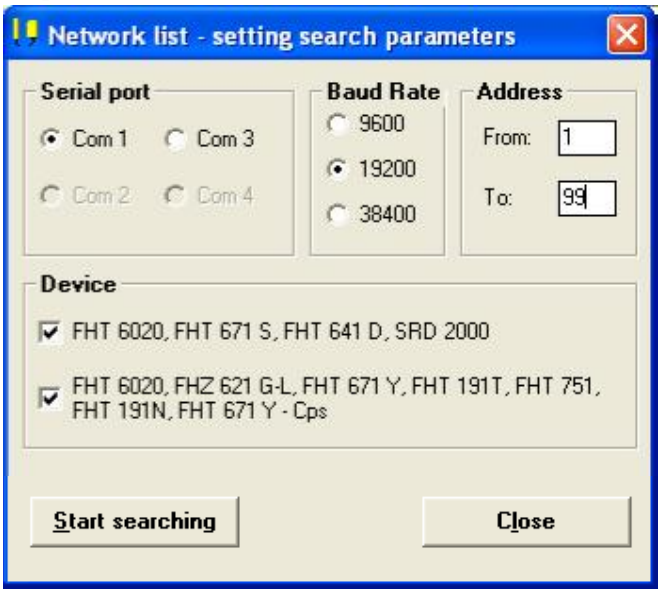


Figure 30: Setting the network's search parameters

- In the „*Serial port*“ frame, enter the serial interface that is used for the search process. To change the serial interface, simply click one of the 4 option boxes. Please note that only free and available serial interfaces can be selected.
- The „*Baud Rate*“ frame indicates the desired baud rate at which the search process shall proceed, i.e. at which the serial communication with the PC should run. In case you need to change the current setting, please click one of the 3 option boxes according to your needs.
- The „*Address*“ frame shows the address range subject to the search process. In the „From“ text field, enter the address where the search should start. In the „To“ text field, enter the address where the search should end. Address range: $1 \leq$ valid address ≤ 99
- In the *„Device“* frame, you will find the devices that are subject to the search process. Each device type is searched separately. In case that intelligent probes are connected to the FHT 6020 unit and provided that these probes are configured, these probes will be found irrespective of the selected device.

Once the parameters for the search process have been fixed, the search itself can be started by pressing the [Start searching] button.

5.7.2 Network list

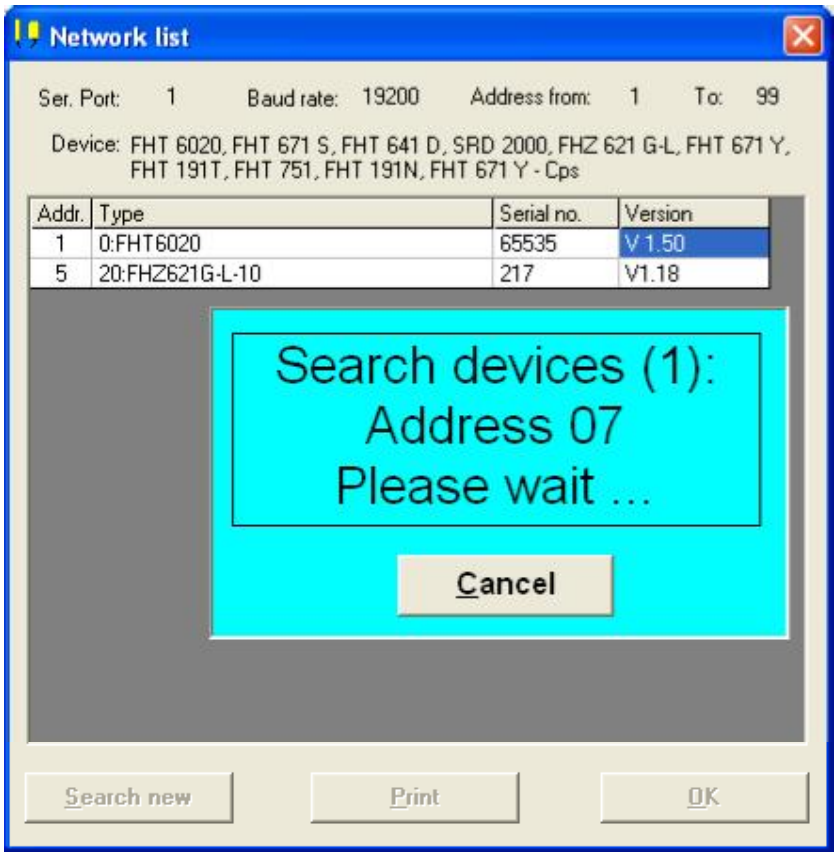


Figure 31: Searching devices in the network

The „Network list“ window indicates the parameters relevant to the search process. After the search process has been started, device type 1 (if selected) is searched first in the indicated address range. Then, search continues for device type 2 (if selected).

Once devices have been found, they are entered in the network list. Devices that exist in both device types are only entered once.

After completion of the search process, the update of the FHT 6020 list in the main menu is prompted by the program. (see Figure 32).
To enter all FHT 6020 units found in the network list, press the [Yes] button.

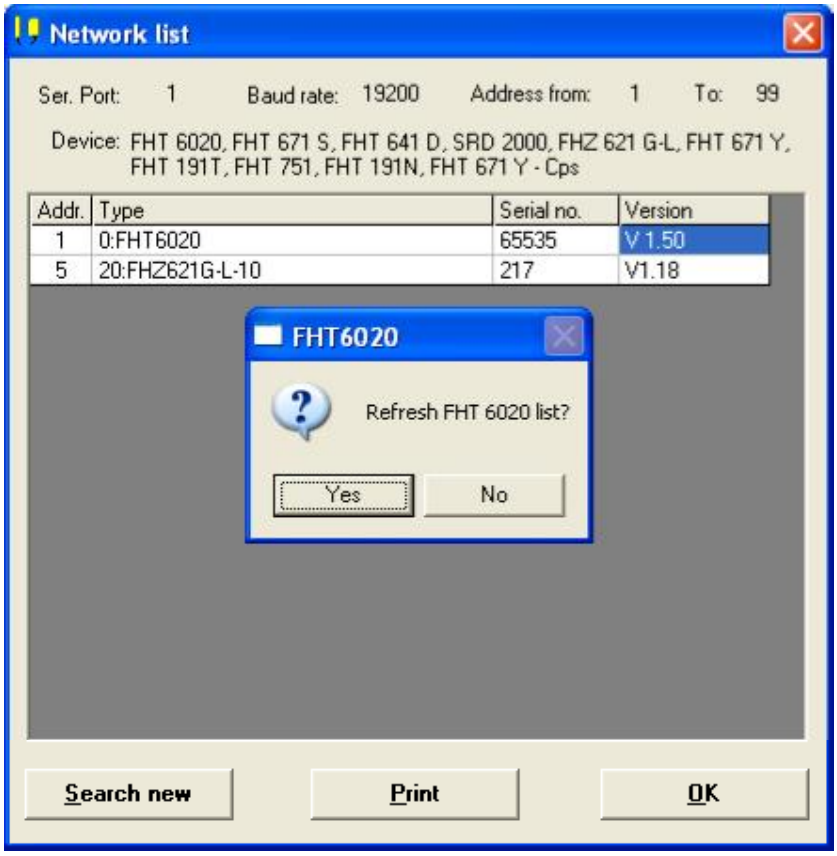


Figure 32: Network list

To print the network list with the current Windows printer, please press the [Print] button. Selecting the [Search new] button, the window „Network list-Setting search parameters“ is opened again. You may now change the current configuration settings and start a new search process. To quit the „*Network list*“ window, press the [OK] button.

5.8 Probe list – Searching intelligent probes connected to the FHT 6020

The menu function probe list serves the purpose to find and configure intelligent probes that have been connected only recently or that are not yet known to the system.

On the „Options“ menu, select the menu point „Probe list...“. You then enter the „*Probe list – Configure search*“ window.

5.8.1 Probe list – Configure search

This menu function is used to configure the process for searching the connected probes. The configuration is made in the „*Interface to FHT 6020*“ frame and in the „*Search probes at FHT 6020*“ frame. The „*Interface to FHT 6020*“ frame is subdivided into 3 sections, which are the „*Serial port*“, „*Baud rate*“ and „*Address*“ frames. The „*Search probes at FHT 6020“* frame contains the sections “*Baud rate*“, „*Address*“ and „*Device*“.

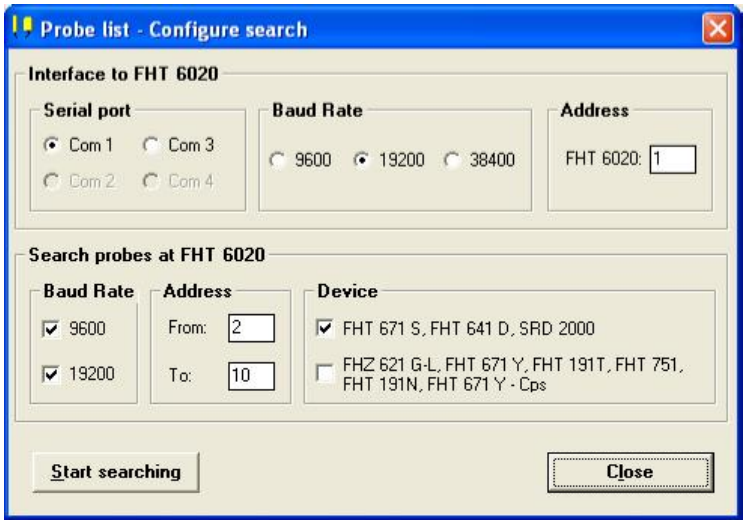


Figure 33: Probe list – Configure search

To configure the frame „*Interface to FHT 6020“* use the following procedure:

- In „*Serial port*“, select the serial interface that is used for communication. To select an interface or to modify an existing selection, click one of the 4 option boxes. Remember that only free and available serial interface can be selected by a click on the respective option box.
- The „*Baud rate*“ frame indicates the baud rate used for the serial communication with your PC during the search process. You have the choice between three baud rates available. To select one, simply click the respective option box.
- The „*Address*“ frame shows the device address of the FHT 6020 unit where the probes shall be searched. Address range:: 1≤ valid address ≤ 99

To configure the „*Search probes at FHT 6020“* section, please proceed as follows*:*

- The „*Baud rate*“ frame shows the desired baud rate for searching the probes. By clicking one of the two option boxes, you may select the baud rate used for searching the probes.
- The „*Address*“ frame indicates the address range where the probes shall be searched. To define the address range, enter the probe address to start with in the „From“ text field. The number entered in the “To“ text field will state the probe address where the search will be terminated. Address range: 1≤ valid address ≤ 99
- The „*Device“* section shows the devices which are subject to the search process.

Once the parameters have been defined for the search process, you may start the search by pressing the [Start searching] button.

5.8.2 Probe list

The parameters for the network search process are displayed in the „*Probes connected*“ window. After starting the probe search, first the parameters of the FHT 6020 are read to obtain information on probes that have been already configured. Subsequently, the search process first starts in the predefined address range at a baud rate of 9600 (if selected) and then proceeds with a baud rate of 19200 (if selected).
As soon as a probe has been found, it is entered in the probe list. If the probe is already activated or known to the FHT 6020, it will be added to the list in black writing. Otherwise, the entry will be made in red.

After completion of the search process, it is checked, whether

- the probe's baud rate corresponds to the baud rate of the FHT 6020's probe port and
- a new or unknown probe exists.

In the event that the baud rate differs from the baud rate of the probe port, the following message will be displayed:

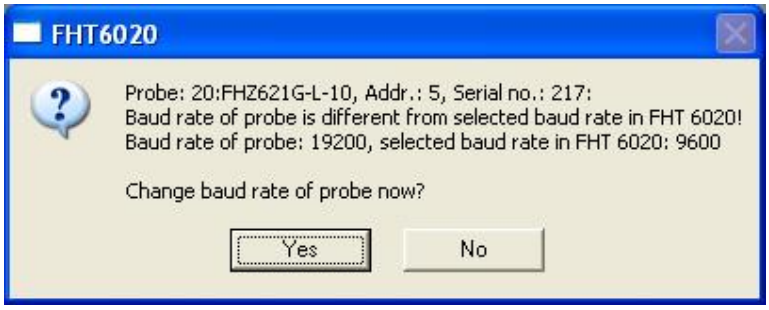


Figure 34: Changing the probe baud rate

When pressing the [Yes] button, the baud rate of the FHT 6020 probe port will be adopted.

If a new or unknown probe is found, a corresponding message will be displayed. The program then prompts whether this new probe shall be configured for the FHT 6020. (see Figure 35).

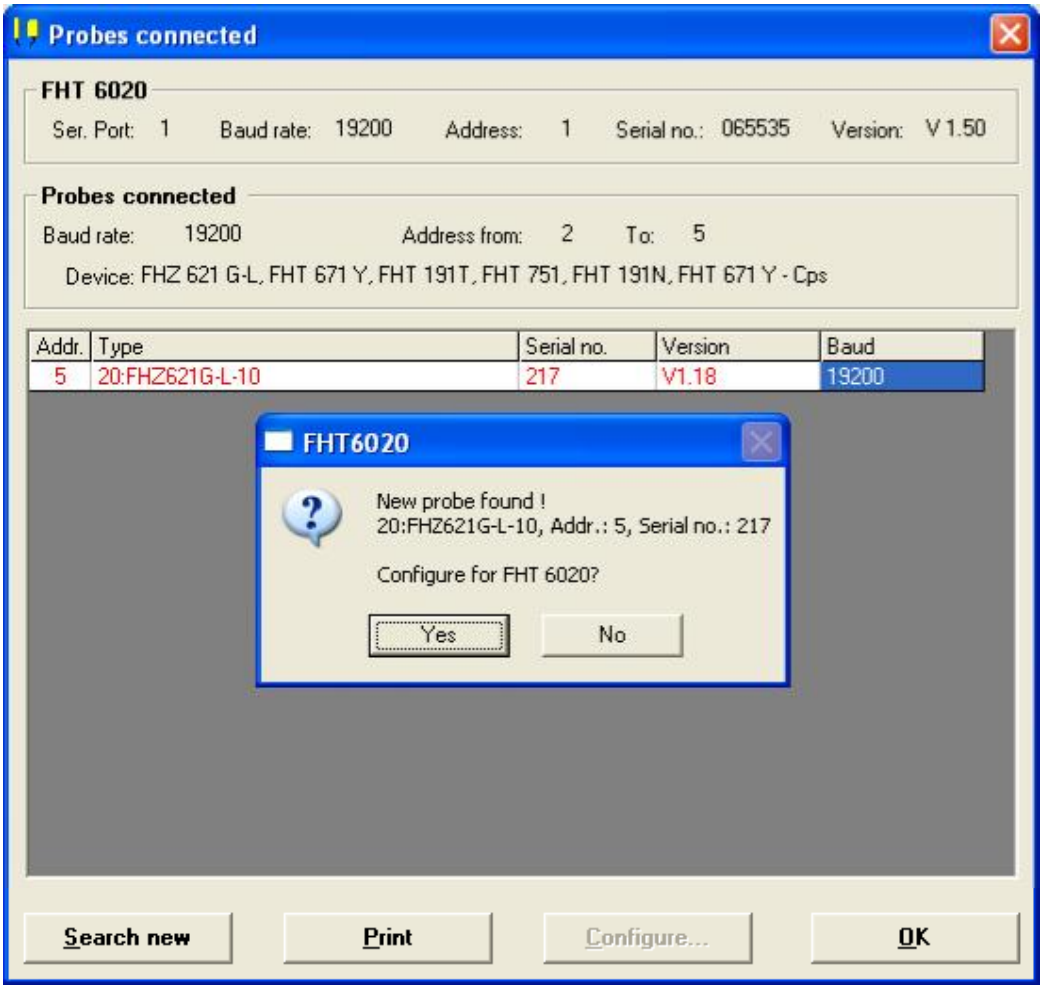


Figure 35: Probes connected

Pressing the [Yes] button, the „*Configure probe*“ window opens (see chapter 5.8.3).
When [No] is entered, the user may select a probe from the list by a simple mouse-click and subsequently configure it by pressing the [Configure...] button. Following this procedure, the „*Configure probe*“ window opens as well.
To print the probe list, press the [Print] button.
By pressing the [Search new] button, the program returns to the „Probe list – configure search“ window. Back in the „Probe list – configure search“ window, the search parameters may be changed, if necessary, and a new search process can be started.
To quit the „*Probes connected*“ window, press the [OK] button.

5.8.3 Configuring a probe

In the following window, the address of a probe and the baud rate for the operation with the FHT 6020 can be defined.

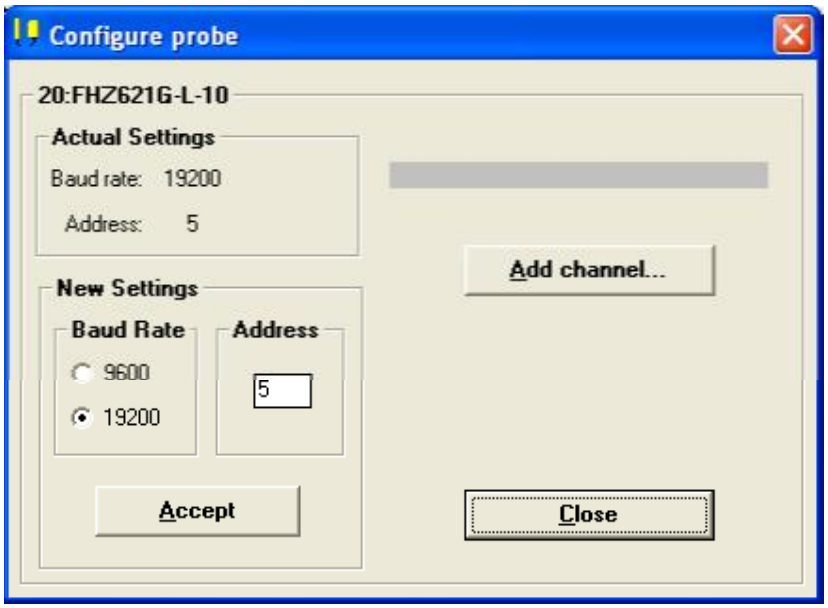


Figure 36: Probe configuration

The „*Current settings*“ section shows the current settings for the probe that needs to be configured.
The „*New settings*“ section states the baud rate required for the operation with the FHT 6020 .
If a probe with the address 1 is found, the program proposes in the *„Address”* frame the next free network address that could be used as new probe address.

Please note:
The address 1 is an address that is reserved for brand-new probes from the manufacturer ! This permits new probes to be integrated in an already existing network without any problem.
For this reason, please do not use the address „1“ for the normal network operation !

To transfer the new settings to the probe, press the [Update] button.

If one enters for the new probe an address via keyboard that has been already used previously, an error message appears on the screen and the transmission of the parameters to the probe is interrupted.

By pressing the Add channel... button, you add a new channel that has not been used so far for the probe.

5.8.4 Configuring a new channel for the intelligent probes

This window permits to configure a channel for the probe found. The parameters „Type“ and „Address“ (intelligent probes) in the „*Data Polling Parameter*“ section cannot be accessed and are set with the current probe parameters. The channel number and the probe type are displayed in the upper part of the window. The channel is already activated.

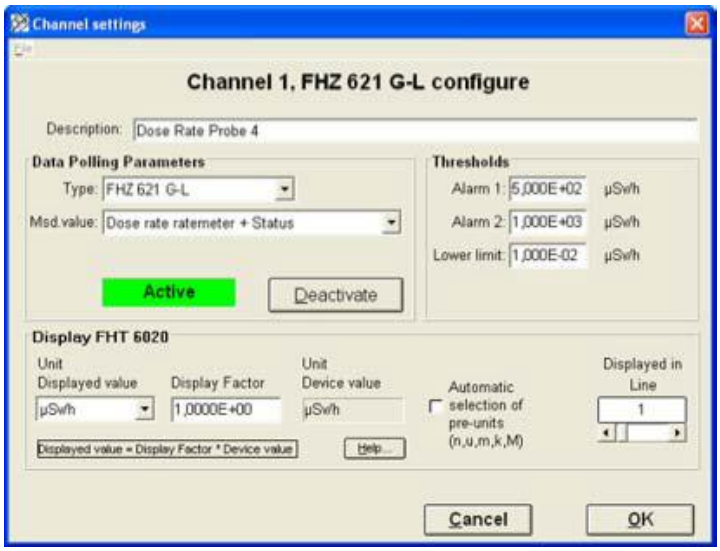


Figure 37: Channel settings

The following entries still have to be made:

- in the „*Data Pollong Parameters*“ frame: which measured value of the probe shall be used,
- in the „*Thresholds*“ frame: the failure and alarm limit values (if desired)
- in the „*Display FHT 6020*“ frame: the unit to be shown in the FHT 6020 display and in which line of the display the measured values of the probe shall be shown.

For detailed information on the four points last mentioned, please see chapter 5.10, „

Channel configuration“).

After the configuration of the probe the user has to confirm the configuration entries made by pressing the [OK] button. The user is now prompted to state whether another channel shall be configured.

Figure 38: Channel settings

If no further probe should be configured, the user is prompted whether the data should be send to the FHT 6020 or not.

Figure 39: The „Parameter transmission" prompt

To send the parameters to the FHT 6020 unit and to close the respective window, press the [Yes] button. Selecting the [No] button means that the window is closed without parameter transmission to the FHT 6020. To return to the „configure probe" window, press the [Cancel] button. Closing the "configure probe" window, you automatically return to the „Probes connected" window.

5.9 The basic device configuration (System settings)

To enter the "System settings" window, press the [System] button or the [F4] function key (see Figure 40): If no parameters from the FHT 6020 have been read so far (or loaded from a file), the software prompts to read the parameters before entering the „System settings" window.

5.9.1 The „Miscellaneous" tab

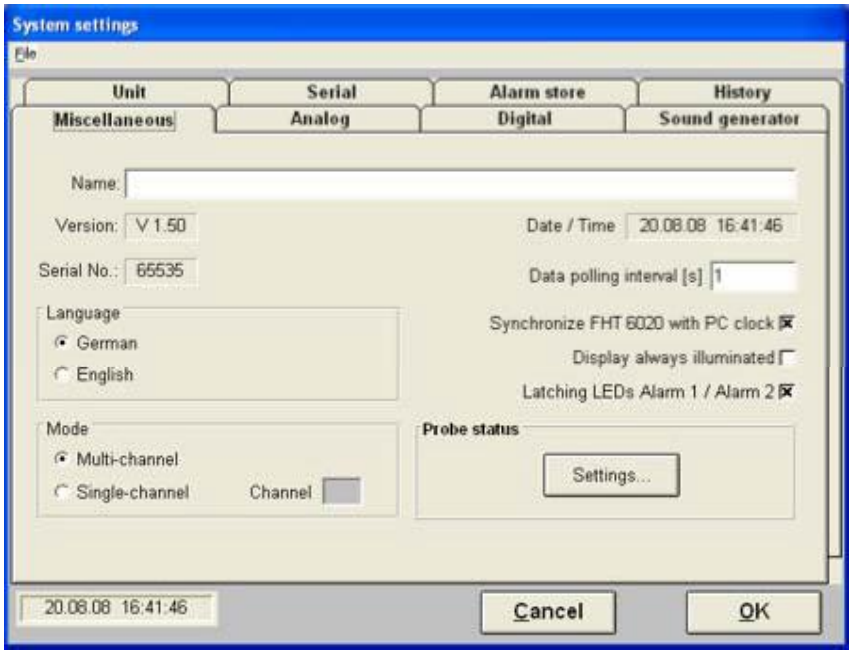


Figure 40: The „Miscellaneous" tab

The „Miscellaneous" tab figures some basic displays and setting possibilities for the device:

- In the text field *Name* you may enter the device name (alphanumeric characters) having a maximum length of 255 characters. This name is not transmitted to the FHT 6020 unit. It is solely available on the PC where the name has been entered. When saving parameters in a parameter file, this name is saved. When the parameter file is loaded again, the name appears on the screen.
- Serial number display
- Version display of the device firmware
- Date and time display, in the following format: TT.MM.JJ HH:MM:SS
- When you click the check box „Synchronize FHT 6020 with PC clock", the battery-buffered hardware clock of the FHT is synchronized to match the time indicated on the PC when the system settings are quit .
- Determine the time interval between two subsequent measurements in seconds $1s \leq \delta_{tM} \leq 60s$ by entering the respective number in the text field „Data polling",
- To set the display backlight of the LCD screen to permanent mode, click the check box „Display always illuminated"
- Selecting the check box „Latching LEDs Alarm1/Alarm2" one can define that – after an alarm 1 or alarm 2 occurring- the respective signal (LED, display symbol) "remains active" (= is locked/latched) until the alarm(s) is/are acknowledged manually by the operator. This is also valid when the current measured value again falls below the alarm threshold.
  This check box being not selected, the alarm signals (LEDs, display symbols) disappear automatically as soon as the measured value falls below the alarm threshold.
  For more details regarding alarms, please see chapter 6, „The FHT 6020 alarm and acknowledgment concept".

5.9.1.1 The „Language" frame

To select the language for the FHT 6020, click on the respective option boxes in the „language" frame.

5.9.1.2 The „Mode" frame (Single- / Multi-channel mode)

This frame is only available since firmware version V 1.25 of device FHT 6020.
Clicking the option button "Multi-channel", the device FHT 6020 is set to normal display mode. That means up to three measured values can be indicated in the display. Further values can be displayed by pressing the key at the FHT 6020.

Clicking the option button "Single-channel", the device is switched to single channel mode. That means that only one of the active channels is indicated in the display as digital value and an additional bar graph. The number of the channel to be displayed in the single-channel mode can be set in the text box "channel". The selected channel must be active. A message box is displayed when leaving the text box if the channel is not active.
The measured value display in the main window of the PC program is independent of these settings and always set to multi-channel mode.

5.9.1.3 The „Probe status“ frame

To enter the window „Probe status settings“, press the [Settings] button in the „System settings“ window / “FHT 6020“ tab. Below figure shows the „Probe status settings” window with the corresponding tabs: FHT 191N, FHT 191T, FHT 641 D, FHT 671 S, FHT 671 Y or FHZ 621 G-L, FH 40 G Ext. Input 1 and FH 40 G Ext. Input 2 (see Figure 41). Each tab comprises a list of probe specific status bits that are used to generated a failure- or alarm message, if the corresponding check box has been selected accordingly. The meaning of the single status bits for the respective probe type is explained in detail in the technical specification of the corresponding probe.

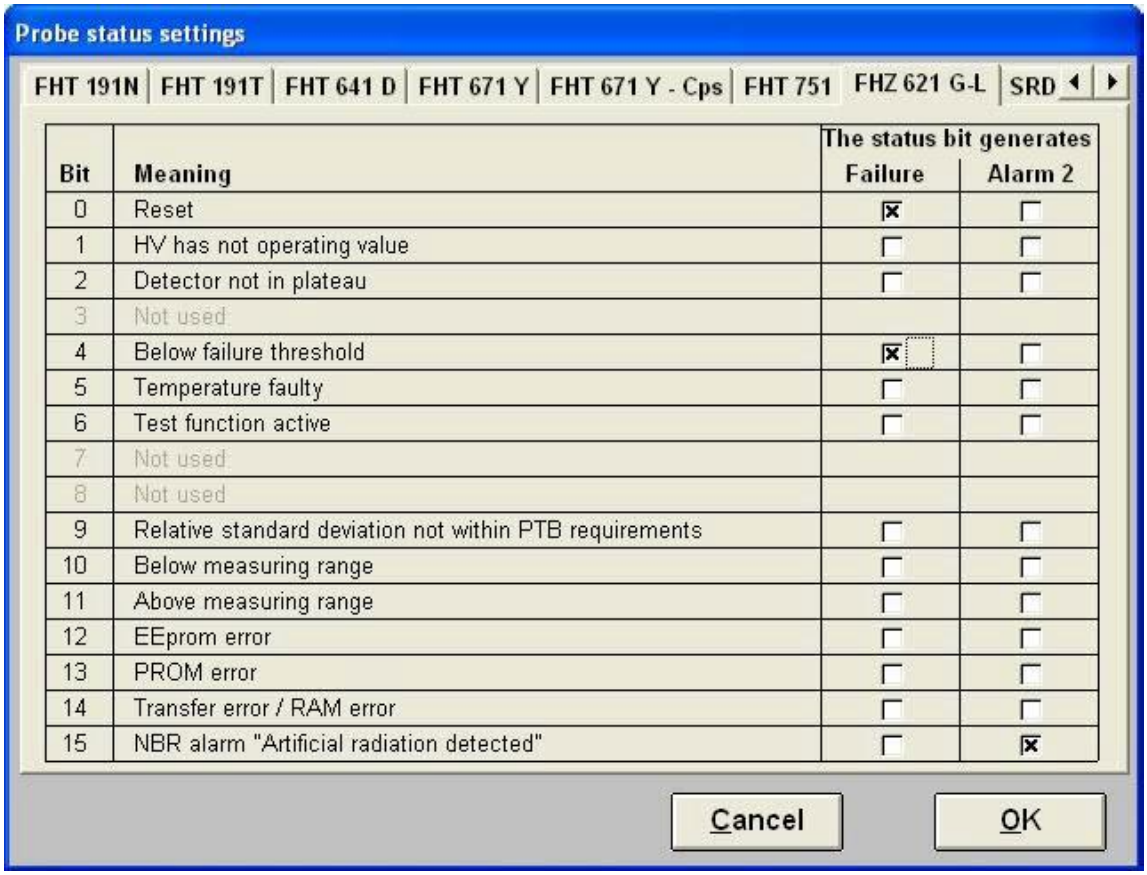


Figure 41: System settings, the „Probe status settings“ window

Example:
In the above example, the FHT 6020 is configured such that the status bits „Reset“ and „Below failure threshold“ are decoded / interpreted as failure and the status bit „NBR-Alarm“ as Alarm 2 when reading a measured value from the respective probe. In the FHT 6020 unit, „Failure“ or „Alarm 2“ are released subsequently.

5.9.2 The „*Analog*“ tab

The „Analog“ tab is grouped into the sections „*Analog outputs*“ and „*Analog inputs*“.

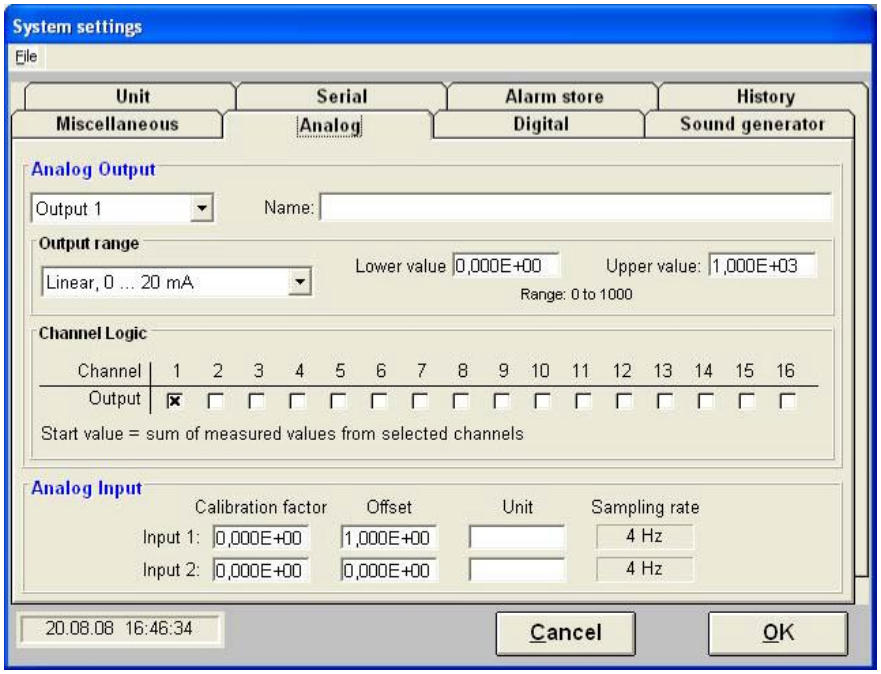


Figure 42: The „Analog“ tab

5.9.2.1 The „Analog output“ frame

The „*Analog output*“ frame, for its part, is split into „*Common Area*”, „*Output range*“ and „*Channel logic*“.

- In the „*Analog Output*“ section, you may define the number of the analog current output in a list box. In the text field *Name* you may enter the device name (alphanumeric characters) having a maximum length of 255 characters. This name is not transmitted to the FHT 6020 unit. It is solely available on the PC where the name has been entered. When saving parameters in a parameter file, this name is saved. When the parameter file is loaded again, the name appears on the screen.

- In the „*Output range*“ section, you may define the output range for the analog current output. In the list box you may define the axis scale and the current range. You can select one of the settings:
  – Linear, 0 ... 20 mA
  – Linear, 4 ... 20 mA
  – Logarithmic, 0 ... 20 mA (available from firmware version V 1.22)
  – Logarithmic, 4 ... 20 mA (available from firmware version V 1.22)

  In the text boxes „*Lower values*” and „*Upper value*“ you can set the lower and upper limit of the measured value range to be displayed in the selected analog current range in a linear or logarithmic form. The limits must be input as absolute values in case of linear output range; if logarithmic range is selected the limits must be input in exponential form. The output range resulting from the limits input is displayed below the text boxes.

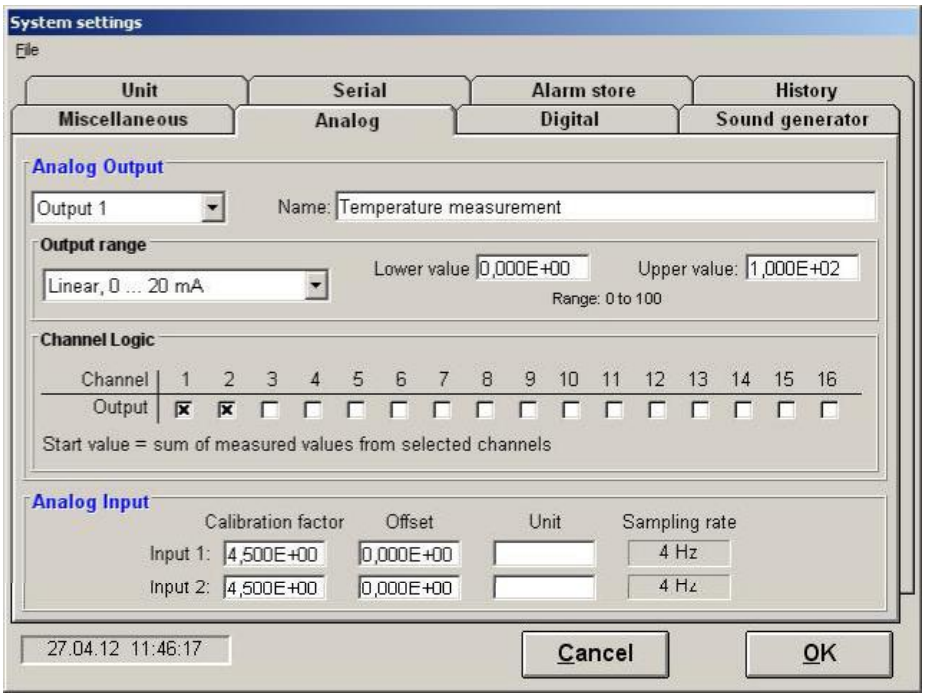
- In the „*Channel logic*“ section, you may define for the analog current output which measured values are to be summed up and output by the respective analog output. Therefore, please click the check boxes “Channel 1“ up to „Channel 16“.

Attention:
The measured values are summed up in probe units, i.e. in the physical unit used by the probe, and not in display units.

Neither the „FHT 6020.exe“ PC program nor the FHT 6020 firmware check, whether the summation of the measured values of the different channels “makes sense” or not.

Example:
Channel 1 is assigned to an analog input and measures a temperature proportional voltage. Channel 2 registers the dose rate values of a probe. The summation and analog output of both channels does not make sense, however, it is possible !

It is the sole responsibility of the operator, to make sure that only channel combinations are used that make any sense !



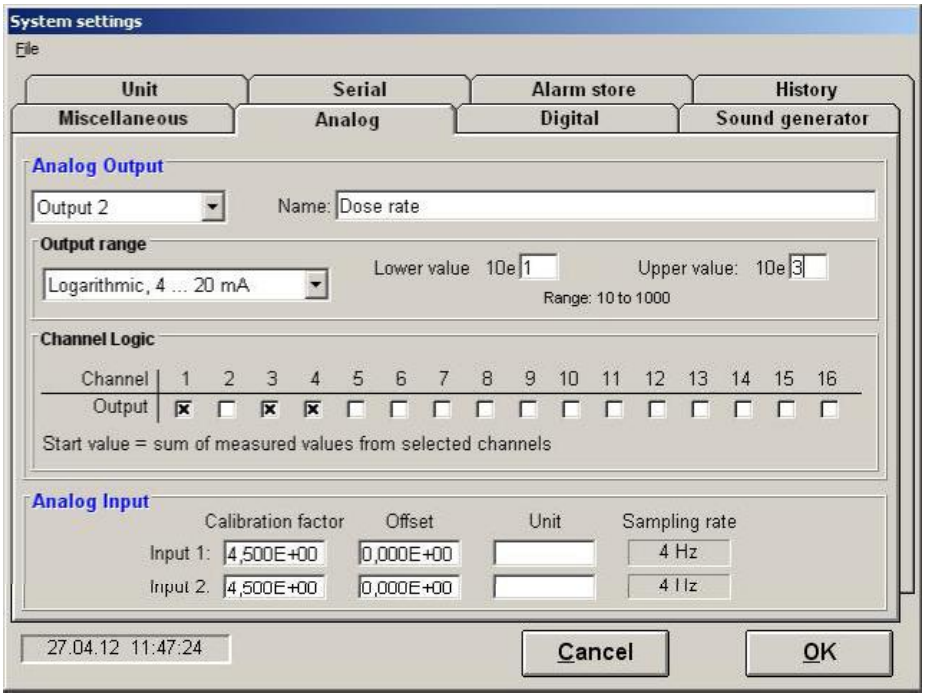


Figure 43: The „Analog output“ frame

Assumption: Channel 1 to 4 are assigned to probes of type FHZ 632 which deliver a dose rate measurement value in the base unit µSv/h.

Example 1:
For the analog current output #1 the measurement results of channel 1 and 2 are summed up.
The result in the range from 0 (lower value) up to 100 µS/h (upper value) is output linearly as a current from 0 to 20 mA.
As the name “Temperature measurement” was chosen.

Example 2:
For the analog output #2 the measurement results of channel 1, 3 and 4 are summed up.
The result in the range from 10 µSv/h up to 1000 µSv/h is output logarithmically as a current from 4 to 20 mA.
As the name “Dose rate” was chosen.

5.9.2.2 The „Analog input“ frame

The „*Analog input*“ frame enables the following settings to be made for analog input 1 and 2 (optional):

- In the text field „Calibration factor“, you define which value represents the maximum analog input voltage. **Warning: This value must be positive (> 0) !**
- In the text field „Offset“ you define which value represents the minimum analog input voltage.

- In the text field „Unit“ you assign a dimension to the measured value that has been calculated from the input voltage. This text may not exceed a maximum of 6 characters. This text field is available with Firmware Version V1.27 or higher
  Example:
  If the input voltage results in a temperature value (calculated by means of the values entered for the calibration factor and the offset value), °C has to be entered as unit.

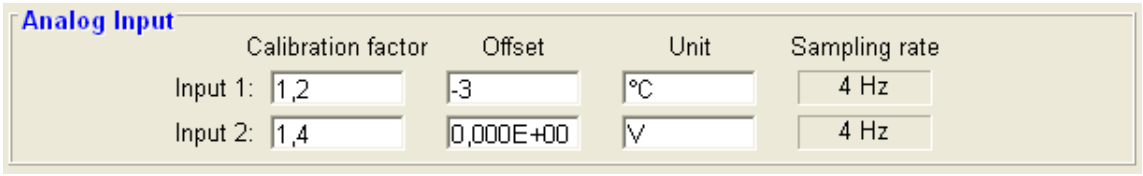


Figure 44: The „Analog Input“ frame

- In the fields „*Sampling rate”* you can read the number of samples per second. The value is evaluated as mean value of all values sampled in one second.

5.9.3 The „*Digital*“ tab

The „Digital“ tab is subdivided into the „*Digital Output*“ section and the „*Digital Input*“ section.

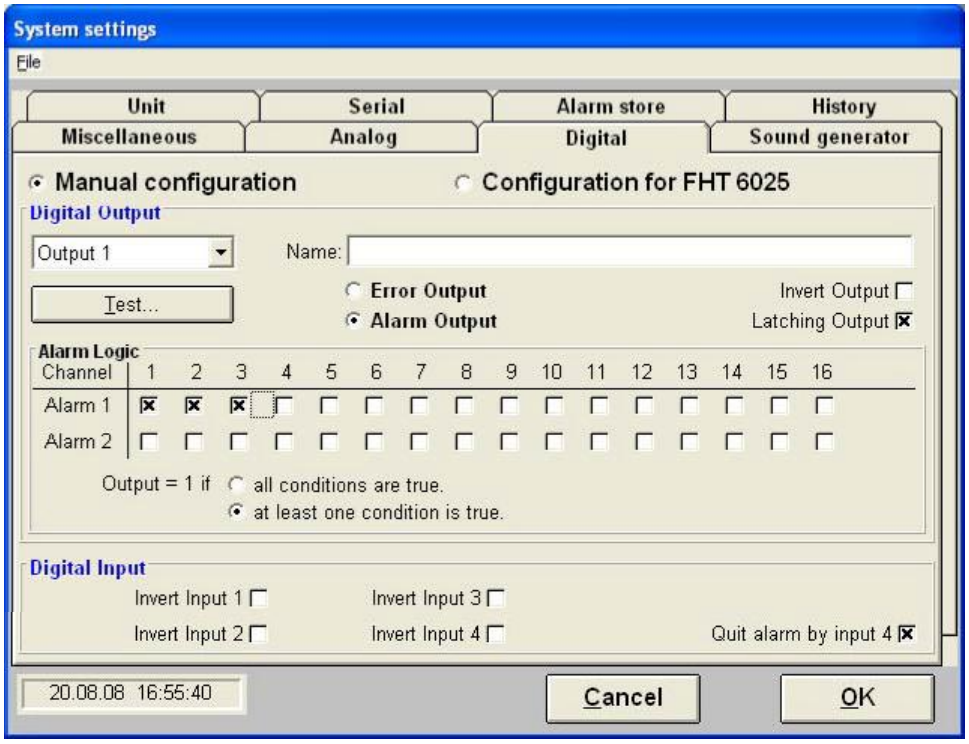


Figure 45: The „Digital“ tab

5.9.3.1 The „Digital Output“ frame

With the FHT 6020, a digital output is a potential-free, fuse protected switching output with a max. admissible current of 400 mA and a max. admissible voltage of 36VDC at a temperature of 25°C (for detailed information, please see chapter 8.6, Electrical parameters).
The „*Digital Output*“ section features a drop-down selection field for the desired output, the text field name, the option boxes „Error output“ and „Alarm output“, the check box „Lathing output“ (only with alarm output being selected), the check box “Invert output” as well as the „*Error logic* “ frame or the „*Alarm logic*“ frame (see Figure 45):

- In the selection scroll bar, you simply define for which of the 5 available digital outputs the subsequent settings shall apply.
- In the text field *Name* you may enter the device name (alphanumeric characters) having a maximum length of 255 characters. This name is not transmitted to the FHT 6020 unit. It is solely available on the PC where the name has been entered. When saving parameters in a parameter file, this name is saved. When the parameter file is loaded again, the name appears on the screen.
- Click one of the two option boxes „*Error output*“ or „*Alarm output*“ to define, whether the digital output select shall be operated as alarm- or error output.
  When operated as alarm output, the alarm thresholds 1 and 2 of the selected channels as well as the status bits of the measured value status (selected as alarm 2) influence the digital output.
  When operated as error output, the failure thresholds and the status bits selected as failure act on the digital output.
- Clicking the check box „Invert output“, the output state is inverted, i.e. if the condition for the output is set to „1“ („true“), the output is opened (highly resistive, current cannot flow).
  If this check box is not selected and the condition of the output is set to „1“ („true“), the output is switched through (of little resistance, current flows).
- Clicking the check box „Latching output“ (only available, if alarm output has been selected), the respective functionality is activated for the selected output. This means in case of an alarm that the output remains active, even if the alarm state no longer exists. The output is reset by manual acknowledgment (via key, digital input).
  Note: Only an alarm output can be configured to become a latching output, not an error output.
- In the „*Alarm Logic*“ frame, you may define which channels and which events shall have an effect on the output. To do so, please click the respective check box.

In the same frame, please click one of the both option boxes „all conditions are true..“ or „at least 1 condition is true...“ to define, if the events impacting the output stage of a channel are linked by an AND or an OR operation.

Example 1:

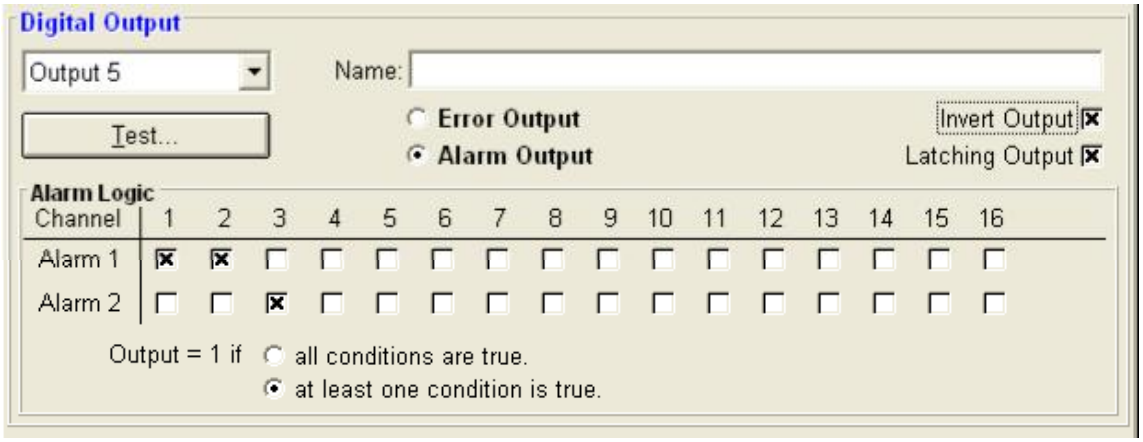


Figure 46: The window„Digital output settings, alarm output“

In the above example, the digital output no. 5 is configured such that an „Alarm 1“ in the channels 1, 2 or 6 or an „Alarm 2“ in channel 3 (or several of these conditions together, i.e. a logic OR operation) set the digital output no. 5 to “1” („true“). As the option „Invert output“ has been selected, the output is opened (highly resistant, current cannot flow).

Example 2:

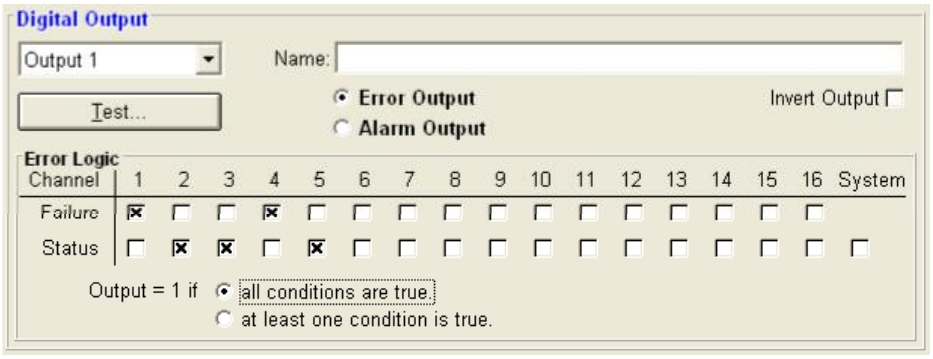


Figure 47: The window „Digital output settings, error output“

Above figure shows a second example. The digital output 1 is configured such that the output will be set only to „1“ („true“), if a failure in channel 1 and a failure in the channels 2 and 3 occur simultaneously (i.e. logic AND operation). Subsequently, the output is switched through (of little resistance, current flows).

5.9.3.2 The digital outputs

This function is available with firmware version FHT 6020 V 1.19 and higher.
Selecting the [TEST...] button in the frame *"Digital outputs"* a further window is displayed where you can manually set the digital outputs for testing.

Attention: The outputs are set when the window "Test digital outputs" is displayed. Alarms, door opening controls or other signals connected to the digital output can be activated while testing.

After pressing the [Test...] button the warning message is displayed:

„Attention! Digital outputs will be set when testing! Are you sure?"

After pressing the [YES] button the window "Test digital outputs" is displayed.

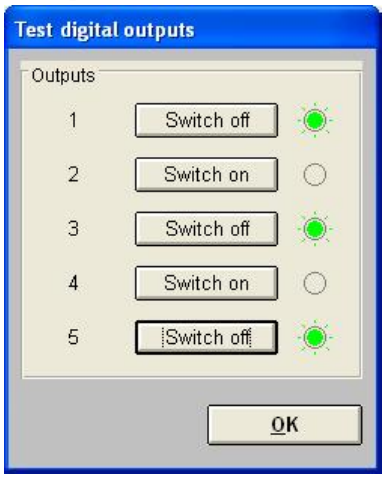


Figure 48: The window "Test digital outputs"

The outputs 1-5 can be switched on and off by pressing the belonging button. The actual state of the output is displayed right beside the buttons as lightening signal.

5.9.3.3 The „Digital Input“ frame

With the FHT 6020, a digital input is a potential-free input with a max. admissible current of 60 mA at a temperature of 25°C (for detailed information, please see chapter 8.6, Electrical parameters). By means of the check boxes „Invert input 1“ ... „Invert input 4“ you may define for each input bit, if digital inputs shall be interpreted as positive logic operation (current flows <==> switching state ON) or as negative logic operation (current flows <==> switching state OFF). If the check box „Quit alarm / error by input 4“ is selected, the input 4 can be used to acknowledge the sound generator and the latching mode of alarm- and/or failure outputs.

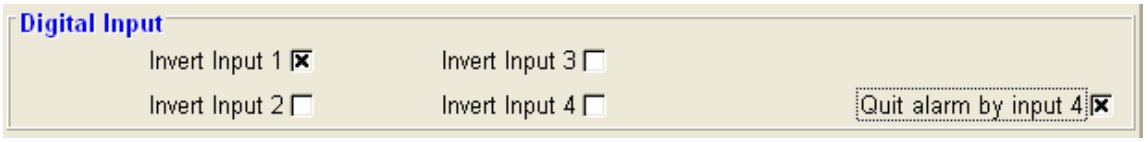


Figure 49: System settings, the window „Digital input“

5.9.3.4 The frame „Configuration for FHT 6025“

This frame is only visible if the option „Configuration for FHT 6025“ has been selected. In this case information for the operation of FHT 6020 with the alarm unit FHT 6025 are displayed.

If „Configuration for FHT 6025" is selected no additional configuration of the digital outputs is required -- it is automatically done inside FHT 6020. The alarm unit FHT 6025 duplicates the alarms of FHT 6020:

Alarm unit FHT 6025		**FHT 6020**
Red light	=	LED Alarm 2
Yellow light	=	LED Alarm 1
Green light	=	LED Status
Acoustic alarm	=	Internal beeper
Key Mute/Ack	=	Key

Each keystroke mutes the acoustical alarm, a long keypress (> 2 seconds) acknowledges the alarm.

5.9.4 The „Sound generator“ tab

The tab is subdivided in the „*Channel logic*“ and „*Sound generator*“ check:

- In the „*Channel logic*“ frame, you define the event (acting on one or several active channels) that activates the sound generator . To do so, please click the respective check box (Alarm 1, Alarm2, Failure and Error status).
- By clicking the „Latching“ check box, you ensure that the acoustic alarm message remains active even if the event that caused the alarm (e.g. Exceeding an alarm threshold) is no longer existing. Such type of acoustic alarm has to be acknowledged directly at the FHT 6020 unit by manual intervention of an operator !

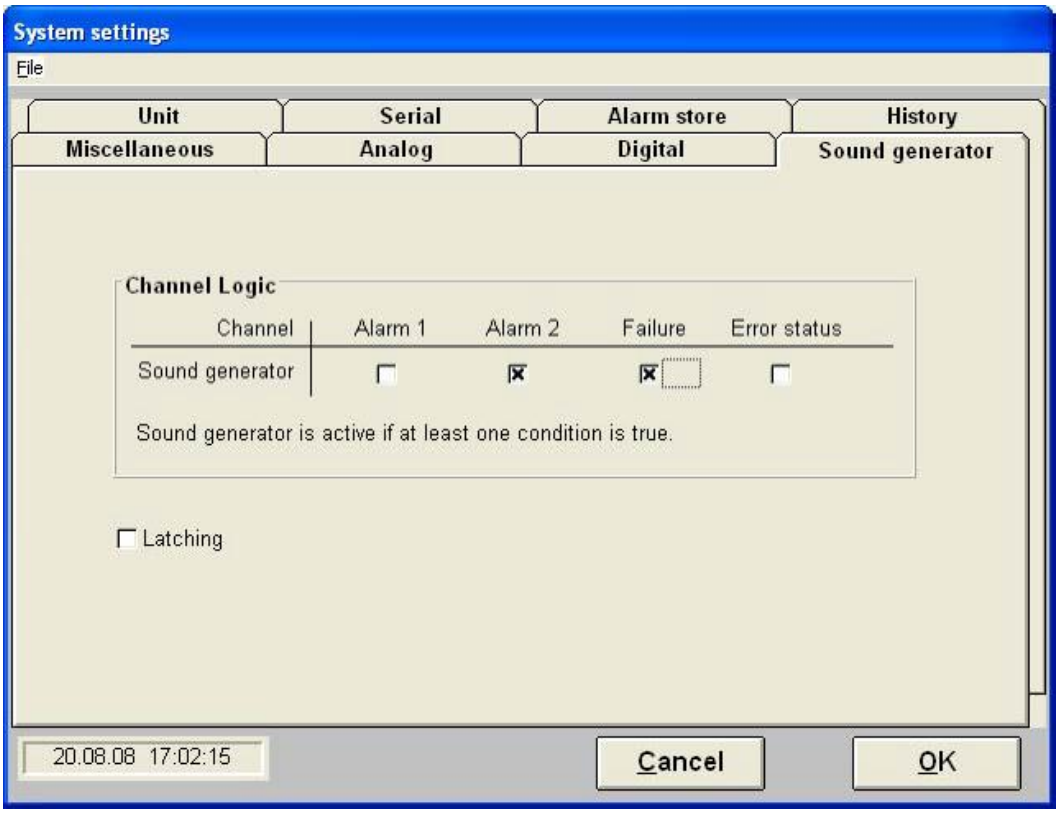


Figure 50: System settings - the „Sound generator settings“ window

Example:

In the example shown in the above figure, the alarm 2 and / or the failure of one of the active channels releases a latching acoustic alarm signal. The word latching means that the acoustic error message remains active, even if the event/problem that released the error message has been cleared or has simply disappeared. A latching acoustic error message requires a manual intervention. The error message must be acknowledged either by pressing the respective key or by an external input signal!

5.9.5 The „*Unit*“ tab

This tab shows the physical units available for the measured value display on the FHT 6020 LCD screen (see Figure 51):

Attention:
The measured values yielded by a probe have always a fixed unit, e.g. µSv/h or cps. All measured values are saved in the history of the FHT 6020 and are displayed on the PC screen with this fixed unit. Of course, this depends on the condition that appropriate channels for the history recording have been selected in the “History” tab.

However, any units can be displayed. Sometimes they can be even chosen by the operator and a user-defined factor can be added (see also chapter 5.10.5, The frame „Display *FHT 6020“*). It is the responsibility of the FHT 6020 operator to use display units that have been selected by the user.

- The „*Fixed Units*“ frame (left column) comprises a list of 10 predefined, fixed units set with the device. These units cannot be changed by the operator.
- The „*User Defined Units*“ frame (right column) contains 10 text fields. Here, the operator may enter 10 units (max. 6 characters) at will. These user defined units are additionally available for the measured value display.

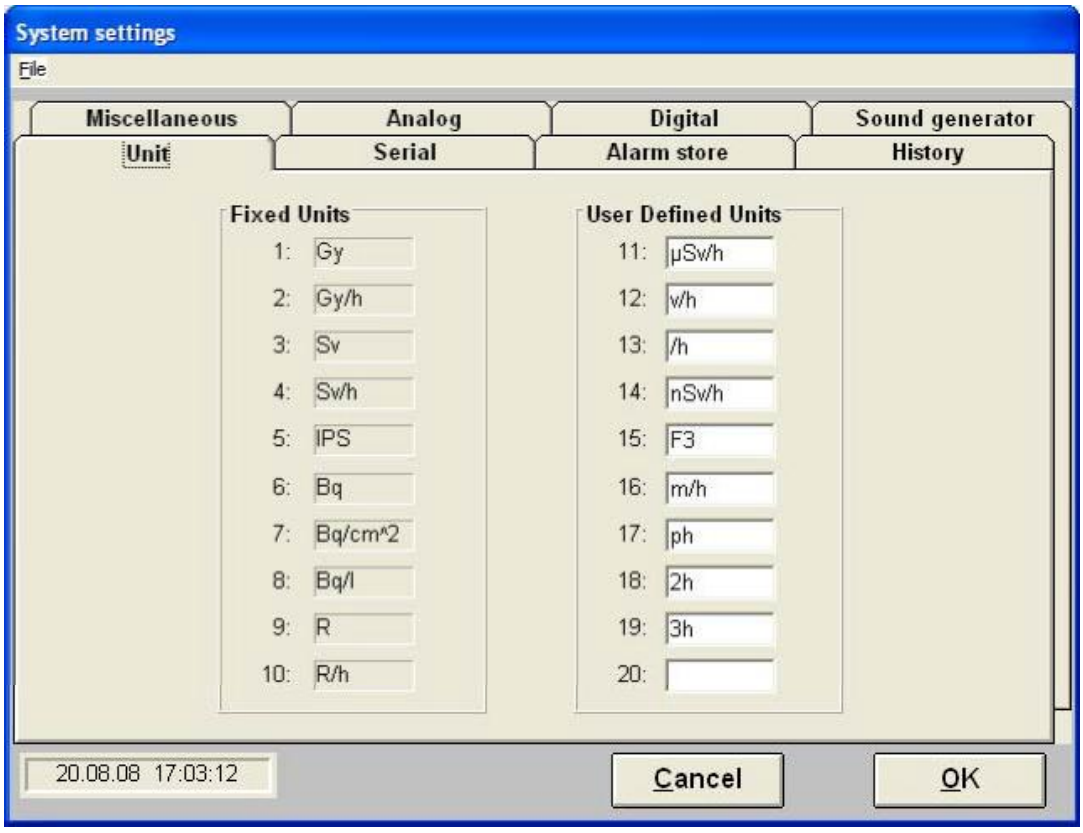


Figure 51: The „Unit“ tab

5.9.6 The „Serial“ tab

The „Serial“ tab is subdivided in the sections „*PC Interface*“ and „*Intelligent probes*“ (see Figure 52):

- The „*PC Interface/Address*“ section indicates the current device address, 1≤ valid address ≤ 99. The device address can be changed in the below text field.
- The „*PC Interface/Baud rate*“ section shows the current baud rate for the serial communication with the PC. The baud rate may be changed, if necessary, by clicking one of the boxes.
- The „*Intelligent probes/Baud rate*“ section displays the actual baud rate for the serial communication with intelligent probes. This value can be changed as well. To select one of the two values available, please click the respective option box.

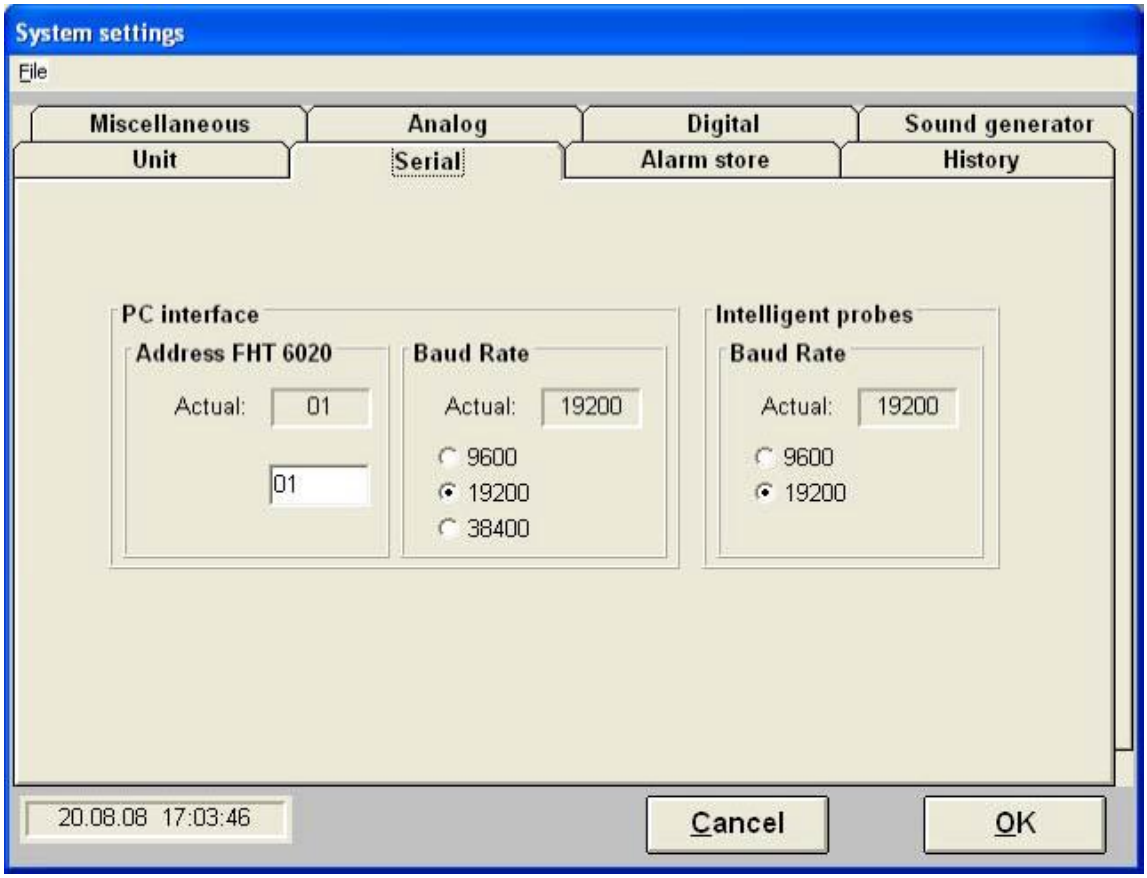


Figure 52: System settings – the „Serial settings“ window

Example:
In the above figure, the current address of the FHT 6020 has been set to „1“. The communication between FHT 6020 and the PC runs at a baud rate of 38400 Bit/s, the one between the FHT 6020 unit and the intelligent probes connected at a baud rate of 19200 Bit/s. You can get details information for serial transfer to Intelligent probes with double click on text „*Intelligent probes*“.

5.9.7 The „Alarm store“ tab

This tab is available with firmware FHT 6020 version 1.30 and higher.

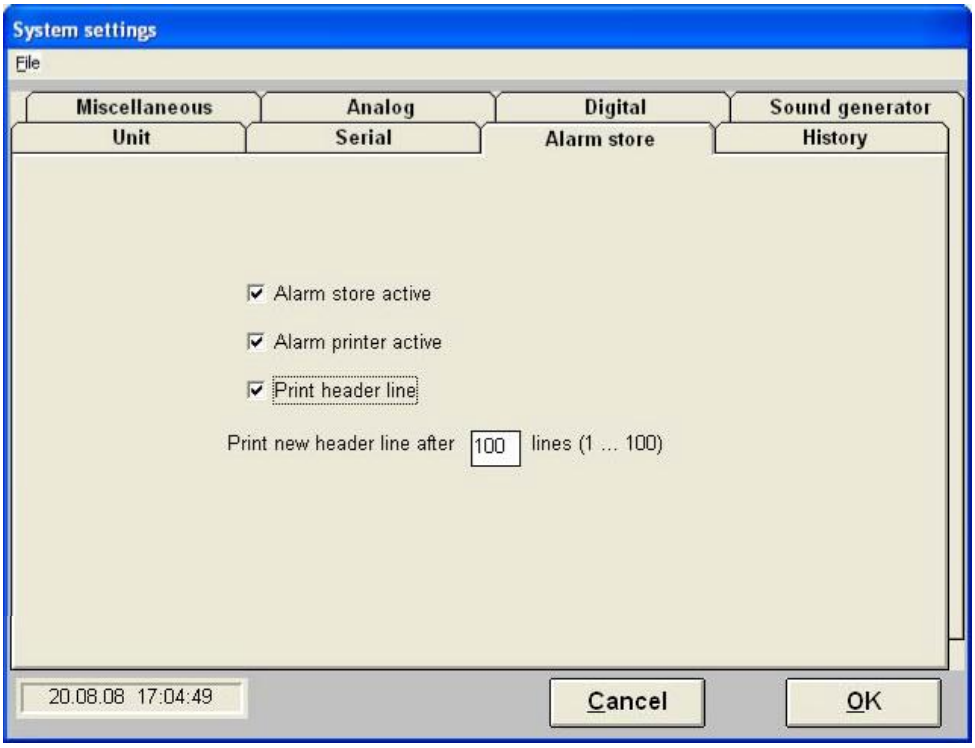


Figure 53: System settings – the „Alarm store“ window

5.9.7.1 Configuration of alarm store

The store and output of alarms described in chapter 5.9.7.2 and 5.9.7.3 can be configured in this tab.

- With activating the check box „Alarm store active“, the storage of alarm entries is switched on. If this check box is deactivated, the following settings are locked.
- With activating the check box „Alarm printer active“ Alarm entries are output to the PC-Port.
- If the check box „Alarm printer active“ is active, a header line can be selected for output by activating the check box „Print header line“. If a header line is selected, the number of lines (= number of alarm entries) must input after which a new header line is to be output..

5.9.7.2 Alarm storage / output

It is possible to store alarm events in an internal storage of the FHT 6020. Each time an alarm occurs and an alarm disappears following items are stored:

- number of channel
- date, time
- measured value with status
- unit of measured value
- alarm flag signing alarm has come or gone.

This alarm storage is called alarm entry in the following. 330 alarm entries can be stored at maximum. Then the oldest entry is replaced by the newest one.

Description of used names:

Channel:

Number of channel, which has triggered an alarm.

Date/Time:

The date and time of the alarm entry are stored as one text formatted as „YYMMDDHHNN“:

YY = Year e.g. 02
MM = Month e.g. 01
DD = Day e.g. 31
HH = Hour e.g. 09
NN = Minute e. g. 18
Example: 0201310918 is stored on 31.01.2002 09:18

Status:

Status means the measured status from the channel. It is built from the status of a connected Intelligent probe or from the measured value of a FH40G external probe or an analog input value referring to channel configuration.
Status contains bitwise coded information about the measured value. The meaning of each status bit is different between the devices and is listed in the “settings probe status” tab (chapter 5.9.1.3.).

In the table below you see the value of each bit. Combinations of bits are possible. Then, the value is the sum of all bit values.

Bit	Value (Hex)	Bit	Value (Hex)
0	1	8	100
1	2	9	200
2	4	10	400
3	8	11	800
4	10	12	1000
5	20	13	2000
6	40	14	4000
7	80	15	8000

Example 1:
In column „STAT“ the value 0801 is stored.
This value 0801 is built from value 1 and value 800. (Bit 0 and bit 11)

Example 2:
In column „STAT“ the value 0003 is stored.
The value 0003 is built from value 1 and value 2. (Bit 0 and bit 1)

Measured value:

Measured value of FHT 6020

Unit:

Unit of measured value

Alarm flag:

If the alarm flag is set to „A“ then the alarm entry stores the beginning of the alarm. The end of an alarm is signed by the alarm flag set to „-“.

5.9.7.3 Output of alarm store

The alarm entry can be automatically output to the PC-Port of the FHT 6020 when at beginning or end of an alarm. The output to the port is made immediately when the alarm begins or ends.
To this FHT 6020 “PC-Port” a serial online printer can be connected alternatively to a PC. Then, occurring alarms are printed out at the printer.
In order to format the printer protocol a new protocol header can be output after a user-selected number of lines. The protocol header contains 3 single lines.

- Empty line
- Title
- Separation line

As line terminator the characters <CR> + <LF> are output.

Example of an alarm printer output

```
CH DATE/TIME  STAT VALUE   UNIT    F
---------------------------------------
01 0201310918 0000 +5885.8  cps    -
02 0201310918 0000 +4539.6  cps    -
01 0201310930 0801 +4665.7  cps    A
02 0201310930 0000 +3462.6  cps    A
03 0201310930 0000 +5.6868         A
01 0201310930 0000 +5894.4  cps    -
02 0201310930 0000 +4299.0  cps    -
03 0201310930 0000 +7.1844         -
01 0201310937 0801 +3572.3  cps    A
02 0201310937 0000 +2536.2  cps    A
03 0201310937 0000 +5.8835         A
03 0201310937 0000 +6.0703         -
01 0201310937 0000 +5000.4  cps    -
02 0201310937 0000 +3788.7  cps    -
01 0201310939 0801 +3237.5  cps    A
02 0201310939 0000 +2037.8  cps    A
03 0201310939 0000 +7.1777         A
01 0201310940 0000 +5912.8  cps    -
02 0201310940 0000 +4447.3  cps    -
03 0201310940 0000 +7.1777         -
```

5.9.8 The „*History*“ tab

This tab permits to define for which inputs of the FHT 6020 (FH 40 G Input 1, FH 40 G Input 2, Analog 1, Analog 2) the measured values shall be saved in the measured value memory („History“) of the FHT 6020 and the time base for history.

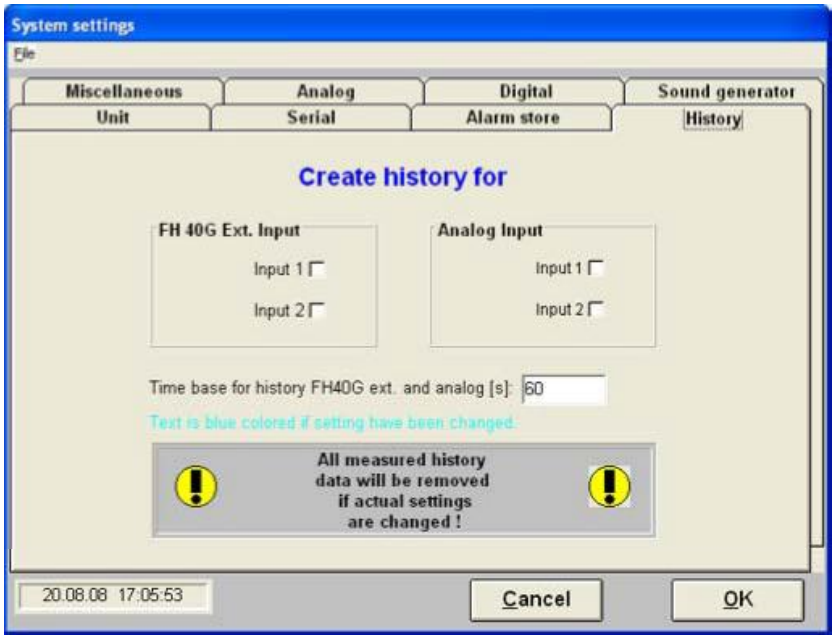


Figure 54: The „History“ tab

Intelligent probes feature their own history memories that may be polled by the PC through the FHT 6020 in transparent mode.
The time between two measured values, both to be saved in the memory, may amount between 60 and 3600 seconds. This time value is to be entered in the text *field „Time base for history FH40G ext. and analog [s]:*“. The default value set is 60 seconds. The values saved in the history memory are mean values for the set time period.
The history memory of the FHT 6020 is a ring-type memory. For each data record, date and time are saved (7 bytes). The length of a history record depends on the type of measuring instrument and the number of measurement data:

Parameter	**Record length in Byte**
Date and time	7 (max. once per record)
Measurement data from an analog input	9 (max. twice per record)
Measurement data from a FH 40 G - input	13 (max. twice per record)

Table 4: Storage capacity required in the history memory depending on the measuring instrument

The storage capacity thus depends on number and type of the configured measured values in the history. For more detailed information on this topic, please see the table figuring in the annex 11.2.

Example:
If only the measured value of an analog input is saved, a complete data record has 16 bytes. To save a measured value of a FH 40 G, 20 bytes storage capacity will be required. In case of two FH 40 G measured values, you will need 33 bytes.

The "FH 40G Ext. Input" section:

By means of the two check boxes „Input 1" and "Input 2" the operator defines, if the measured values of FH40G Ext. probes connected shall be archived and saved in the measured value memory of the FHT 6020.

The „Analog Input" section:

Here, the two check boxes „Input 1" and „Input 2" permit to define, if the measured values of the analog input voltage shall be saved in the history memory of the FHT 6020.

Attention:
With changes to the history settings, all existing history values are deleted.

5.9.9 The menu of the „System settings" window"

The **File** menu covers the following functionalities:

- To open an already existing parameter file (.par) and to modify it according to your requirements, select the **Open parameter file** option. Instead of selecting this menu point you may also press the function keys [Ctrl.]+ [F5].
- Using the menu option **Save parameter file as**, you can save the parameter file currently opened or modified under another file name or you can file it in another folder or directory. To open this function, you may also use the short key combination [Ctrl.]+ [F6].
- To again close an open parameter file, select the **Close parameter file** option via the menu. The same function can be entered via the function keys [Ctrl.]+ [F7].
- To load the current device configuration into the FHT6020.exe program, choose the **Read parameters from FHT 6020** menu point. You may also press the [F5] function key to obtain the same result.
- Using the menu option **Write parameters to FHT 6020**, the desired device configuration can be loaded from the FHT6020.exe program to the FHT 6020 measuring instrument. Selecting this menu point is identical in function to using the function key [F6].
- To close the „Systems settings" window and to return to the main display, choose the menu function **Close.**

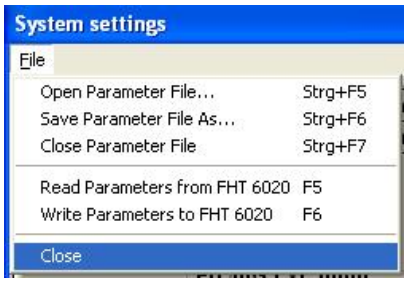


Figure 55: System settings – the "File" menu

5.10 Channel configuration

To enter the „Channel settings“ window, either press the [Channels] button or the function key [F3] (see Figure 56). This window feature the tabs for the single channels and the frames „*Data Polling Parameters*“, „*Thresholds*“, „*Unit*“ and „*Display FHT 6020*“ and finally one single menu point called **File**.

In the event that - before pressing the [Channels] button or the function key [F3] - no parameters have been loaded from the FHT 6020 or from a file, a window appears on the screen stating the question whether the parameters should be read now.

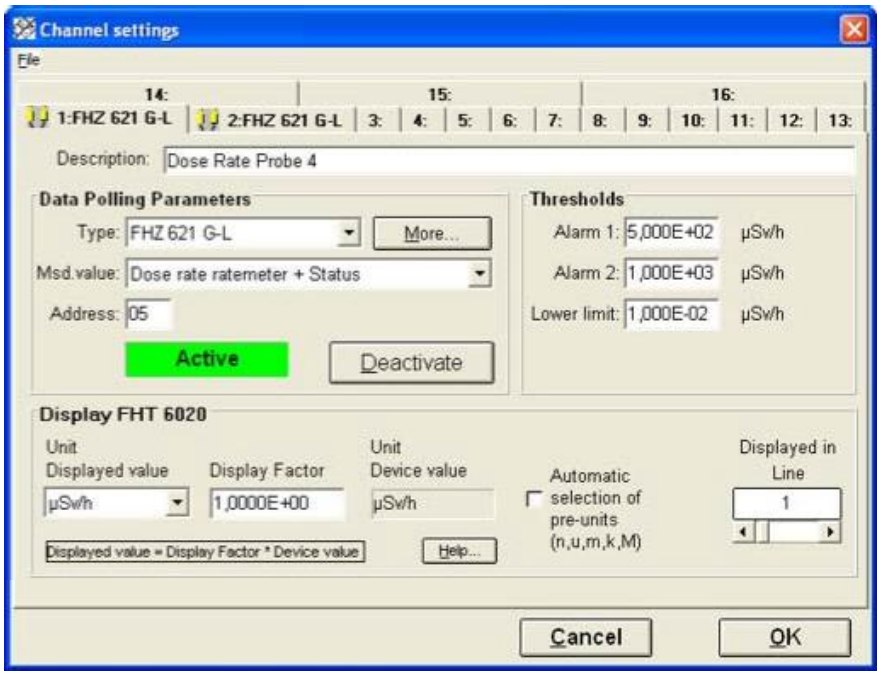


Figure 56: The „Channel settings“ window

The above shown window is displayed after selecting “Channel configuration”.

If single channel mode has been selected in the system settings, a text containing the number of the selected channel is displayed (see Figure 57).

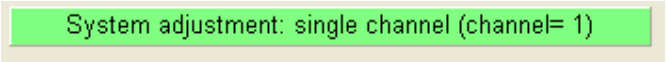


Figure 57: Message “single channel mode”

5.10.1 The channel tabs

To select the channel subject to configuration, select the corresponding channel tab. Activated channels are marked with the symbol and the name of the selected input. Channels that are not activated only figure the channel number.

By clicking the symbol or the name of the active channel(s) or simply by clicking the channel number (with not active channels), the desired channel is shown and can be configured correspondingly.

5.10.2 Description

In the text field „Description“, you may enter any text (max. 100 characters) for the selected channel. This text is not transmitted to the FHT 6020 unit. This text solely serves the purpose to describe the selected channel. This description is only available at the PC where the text has been entered. When saving the parameters, the text will be also saved and displayed again after loading.

5.10.3 The „Data Polling Parameters“ frame

Here, the operator can choose the type of device used. In this frame, only the button in the bottom right corner is accessible.
By pressing the button you define, whether a channel is active, i.e. whether the data of the selected probe are scanned.
If a channel has been activated, the field adjacent to the button is marked with the word „Active“ and highlighted in green. The button itself states the word „Deactivate“.
If a channel is deactivated, the field shows the description „Not active“ and is highlighted in gray. The button now is marked with the word „Activate“.

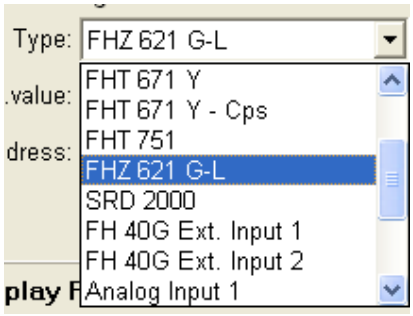


Figure 58: Partial view of the „Channel settings“ window, “selecting the device type”

5.10.3.1 Selecting FH 40 G probes

Selecting the type „FH 40 G Ext. Input 1“ or „FH 40 G Ext. Input 2“ from the drop-down menu, a second drop-down selection menu is activated (see Figure 59) representing all admissible FH 40 G probes. The operator has to define and select which of these probes are really connected. The selection made influences also the „Unit Device value“ display in the „Display FHT 6020“ frame. Please compare the type selected and the probe type carefully, as the FH 40 G probes are not automatically recognized by the FHT 6020.

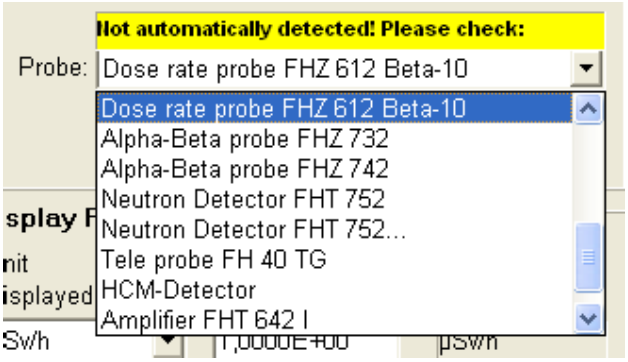


Figure 59: Partial view of the „Channel settings“ window, drop-down selection list for FH 40G external probes

5.10.3.2 Selecting intelligent probes and amplifiers

Selecting one of the seven (7) probe types FHT 191N, FHT 191T, FHT 641 D, FHT 671 S, FHT 671 Y or FHZ 621 G-L from the drop-down menu list, another drop-down selection menu named “Msd. Value”, a button [More...] and a text field titled „Address“ appears on the screen.

- The drop-down list „Msd. Value“ is used to define which data shall be scanned / inquired from the probe type previously selected. If an item of the list includes “...+status”, then the measured status is decoded as selected in the probe status configuration (see chapter 5.9.1.3) . If further data of the same probe shall be inquired from the „Msd. Value“ drop-down menu, hence, a new channel needs to be configured.

- In the „Address“ text field you may enter an address between 1 and 32 (or 99 with the probes FHZ 621 G-L and FHT 671 Y) for the selected probe. The chosen address must coincide with the probe address.
  Attention:
  The address 1 has a special position the network operation and therefore shall not be used in normal operating mode (for detailed information please see chapter 7).

- With the button [More...] the mask "Intelligent probes configuration" is called. There count time and ratemeter filter properties (only FHZ 752 and FHT 191) of intelligent probes can be determined. (see chapter 5.10.3.3).

Note:
The address selected has to coincide with the probe address. To query further probe data from the „Type“ drop-down selection list, please configure therefore a new channel.

(Note: The list of the available probe types is continuously updated and therefore may contain more than four probe types.)

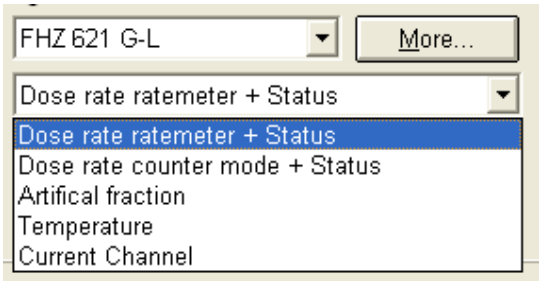


Figure 60: Partial view of the „Channel settings“ window, drop-down list “Type” for intelligent probes

5.10.3.3 Intelligent probe configuration

With the button [More...] in window "Channel configuration" the window "Intelligent probe configuration can be called (see chapter 5.10.3.2) Here the count time and the ratemeter filter properties of intelligent probes (only FHZ 751 and FHT 191) can be adjusted.

Note:
This can be done only for intelligent probes already connected to FHT 6020 with proper channel configuration.
If the channel configuration had been modified, it has to be transmitted to FHT 6020 in advance.
The configuration of the probe has to be the same as the configuration of FHT 6020.

If the program cannot communicate with the intelligent probe an error message will be displayed: "Failure in data transfer to detector -- please check the cable connection and channel configuration and send configuration to FHT 6020" . Accepting this message closes the window.
The following section describes the fields for input. The fields "Filter", "Tau" and "Sigma" are only visible for detectors of type FHZ 751 and FHT 191.

A more detailed explanation for these parameter and their meaning is given in the specific technical documentation of the probe

- **Count time**
  Here the integration time for the counter mode of intelligent detectors may be determined.

  Possible values are in the range of 1 to 16000 (seconds). At the end of each cycle the probe calculated a new 'counter value'.

– **Filter**
In the ratemeter mode of intelligent detectors the rate may be digitally filtered according to different definitions:

  – **PTB-Mode:** The filter forces a relative standard deviation stipulated by PTB (**P**hysikalisch-**T**echnische **B**undesanstalt).
  – **Sigma** The filter produces an adjustable relative standard deviation.
  – **Time1** The filter uses an adjustable time constant. An algorithm for detection of fast changes is activated.
  – **Time2** The filter uses an adjustable time constant. An algorithm for detection of fast changes is not activated.
  – **Tau** Field for input of the time constant 'Tau' for a filter of type Time1 oder Time2 n.
  – **Sigma** Field for input of the relative standard deviation for the filter of type Sigma.

5.10.4 The frame „*Thresholds*“

The frame „*Thresholds*“ enables values for the alarm- and failure thresholds to be preset for the selected probe. Behind the numerical values for the thresholds, the unit is displayed that has been set in the „Display FHT 6020“ frame (as to the alarm plan of the FHT 6020 taken as a basis, please see chapter 6).
With the „Automatic selection of pre-units“ function selected, this option eases the entry of the alarm thresholds via the drop-down selection menus and the unit with pre-unit (see Figure 61) can be selected, as with the “ Automatic selection of pre-units ” function the unit has to be always entered in its basic unit in the „Display FHT 6020“ frame (see also chapter 5.10.5, the „Display FHT 6020“ frame).

A modification of the pre-unit in the drop-down selection menu does not have an effect on the numerical value in the text field. The threshold is calculated then as follows: „Value in the text field“ * „Value of the pre-unit“.

Attention:
The thresholds set are applied to the measured values provided by the probes and not to the values displayed on the FHT 6020 screen !

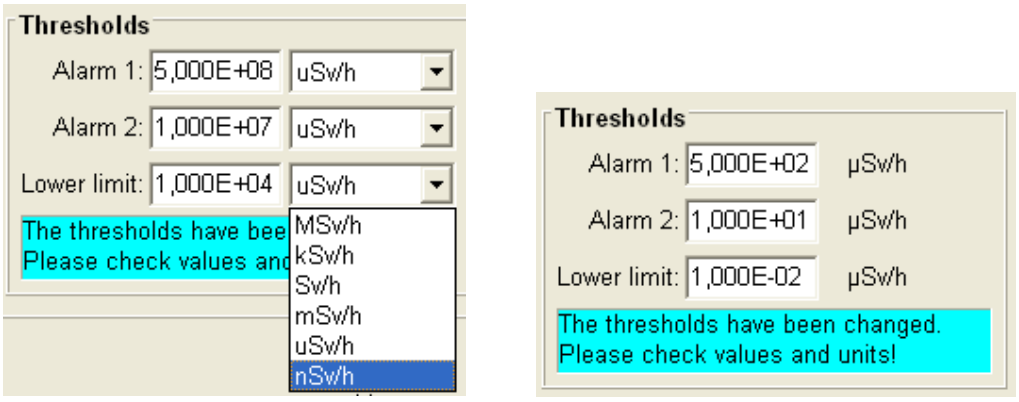


Figure 61: Partial view of the „Channel settings“ window, thresholds incl. their units

When a threshold is exceeded (threshold for Alarm 1 set to 50 nSv/h, for Alarm 2 to 1 µSv/h), the display of the FHT 6020 looks like in the following figure:

Figure 62: Display „Threshold exceeded“

5.10.5 The frame „*Display FHT 6020*“

The „**Display FHT 6020**“ frame contains the drop-down selection list „Unit Displayed Value“, text field „Factor“ , the „Unit Device value“ display, the „Automatic selection of pre-units“ check box, the button [Help...] and finally the scroll button „Displayed in Line“ (see Figure 63).

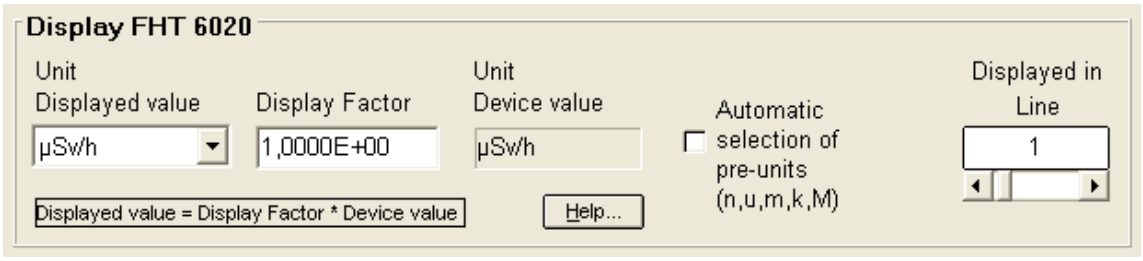


Figure 63: Partial view of the „Channel settings“ window, „unit” frame

- Using the drop-down menu list „Unit Displayed Value“ you can define, which of the units set in the „System“ window / frame „Display FHT 6020“ shall be used to indicate the measured value on the display screen. If the desired unit does not figure among the units listed, you can enter the desired unit via the system configuration (see chapter 5.9.5).
- The text field „Factor“ serves the purpose to enter the conversion factor between the measured value unit displayed at the FHT 6020 and the unit that is really delivered by the respective probe type.

Input of Display Factor:

Device Value:	The measured value of the connected device (e.g. pulse rate in 1/s).
Displayed value:	The value and unit displayed by FHT 6020 (e. g. dose rate in nSv/h)
Display factor:	Factor for conversion of measured value into displayed value (e.g. calibration factor (nSv/h)*s)

Note:
The output of measured value via serial interface or analog output as well as storage in 'history' is always done with the units of the device without a display factor.

- The „Unit Device value“ display shows the unit internally used by the probe.
- By clicking the check box „Automatic selection of pre-units “ you automatically switch on the automatic determination of the appropriate pre-unit nano (n), micro (u), milli (m), kilo (k) or mega (M) for the measured value currently displayed.

  Attention:
  If this option is activated via the respective check box, the basic unit always needs to be entered in the text field „Display FHT 6020“, which e.g. is not µSv/h, but Sv/h. When activating this option via this check box, a corresponding message / note will be displayed for the operator (see Figure 64).

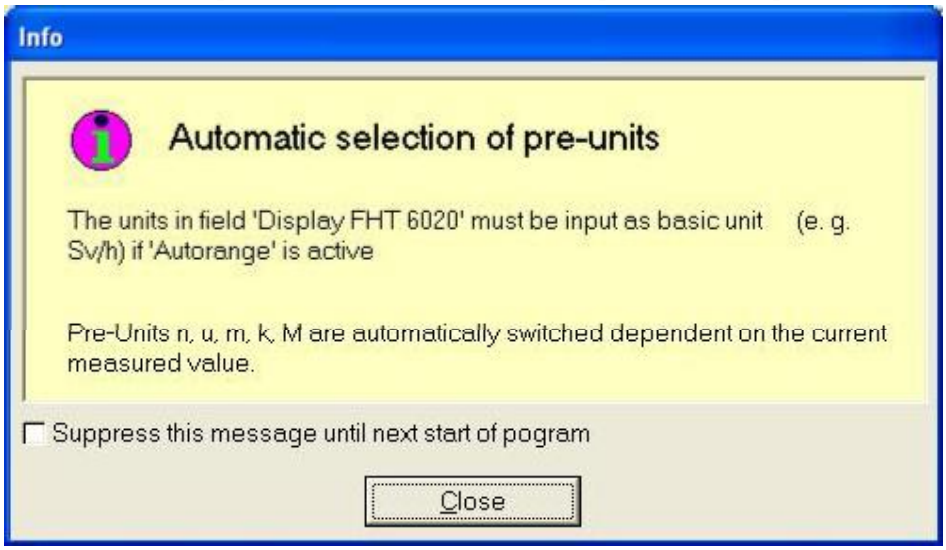


Figure 64: Message „Automatic selection of pre-unit“

- With selection scroll bar „Line number“ slider you may define the line of the FHT 6020 display in which the channel defined for the probe shall appear. 3 display lines for measured values (channels) form a display page. If a line number larger than 3 has been selected for an activated channel, you may move to the next display page by pressing the FHT 6020 key shortly.

If a line number has been already assigned to another channel, a respective message will be displayed immediately. The message is displayed directly above the drop-down selection menu (see Figure 65). In that case, increment the display line number by means of the slider until you reach a display line number that is not yet occupied or deactivate the display of another channel by setting its display line number to zero.

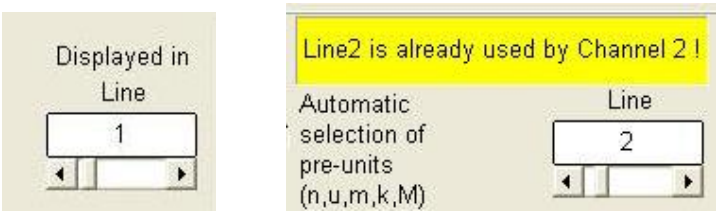


Figure 65: Partial view of the "Channel settings" window, message in case of an already assigned line number

Please note:
If zero is selected as line number, the corresponding measured value is not displayed on the screen. However, the value is calculated and is available for data polling via the serial interface of the PC.

- Pressing the [Help...] button opens following window (see Figure 66).

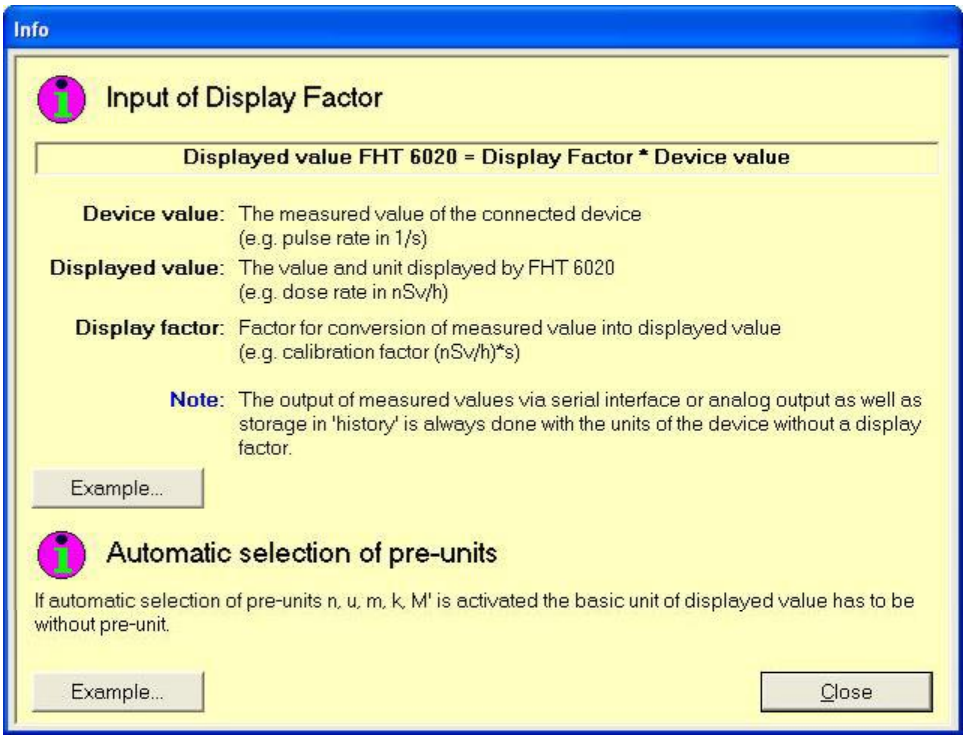


Figure 66: Help for setting display factor

With pressing the [Example...] button in the area „Input of display factor“ two examples for setting display factor are displayed (see Figure 67).

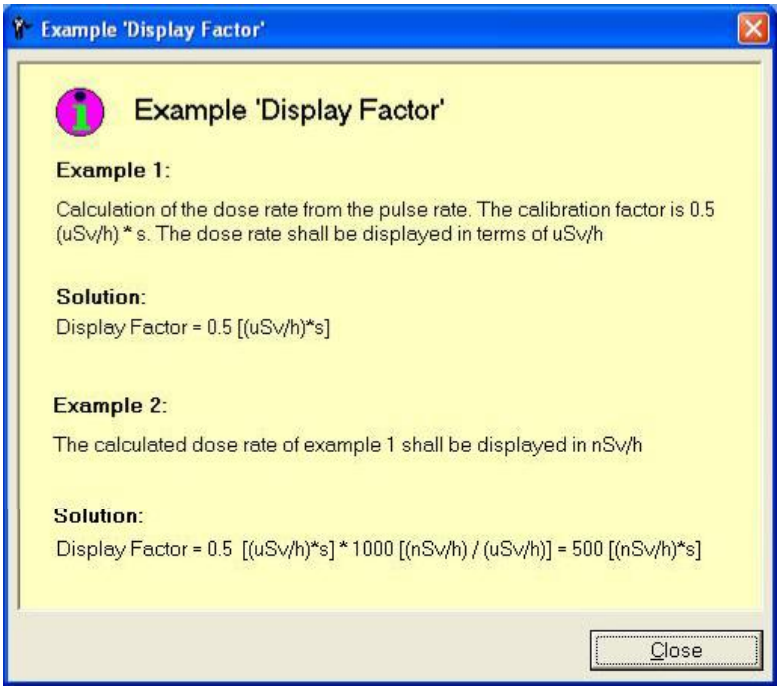


Figure 67: Window “Example Display Factor”

With pressing the [Example...] button in the area „Automatic selection of pre-units“ an example for „Automatic selection of pre-units“ is displayed (see Figure 68).

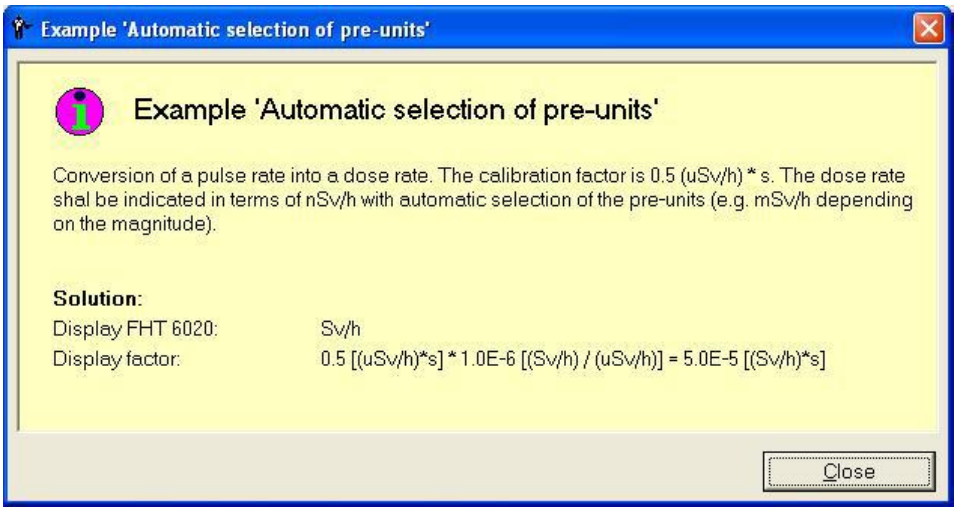


Figure 68: Example “Automatic selection of pre-units”

Examples of different settings in the „Unit“ frame and their effects

Example 1:

One and the same physical input is set in the channel logic to the channels 1 and 2 and displayed in the lines 1 and 2.

Settings for channel 1

- Display FHT 6020: Sv/h (fixed unit of the FHT 6020)
- Device: µSv/h
- Factor: $1x10^{-6}$
- Automatic selection of pre-units: ON

Settings for channel 2

- Display FHT 6020: nSv/h (user-defined unit)
- Device: µSv/h
- Factor: $1x10^{3}$
- Automatic selection of pre-units: OFF

This results in the subsequent representation / display of one and the same measured value (see Figure 69).

Figure 69: Representation of a measured value as a function of the settings made in the configuration program, example 1

The difference between the Settings of channel 1 and channel 2 is the activation of the “automatic selection of pre units”: The nominal measured value (from the device) is 0.23292 µSv/h. In the configuration the displayed value is set to Sv/h (2.3229E-7 Sv/h), that means at Display 0000 Sv/h. (without automatic selection units of pre-units, see also Figure 70). The activation of the selection of pre-units leads to the above shown display.

Example 2:
One and the same physical input is set in the channel logic to the channels 1 and 2 and displayed in the lines 1 and 2:

Settings for channel 1

- Display FHT 6020: Sv/h (fixed unit of the FHT 6020)
- Device: µSv/h
- Factor: $1x10^{-6}$
- Automatic selection of pre-units: ON

Settings for channel 2

- Display FHT 6020: Sv/h (fixed unit of the FHT 6020)
- Device: µSv/h
- Factor: $1x10^{-6}$
- Automatic selection of pre-units: OFF

This results in the subsequent representation / display of one and the same measured value (see Figure 70):

Figure 70: Representation of a measured value as a function of the settings made in the configuration program, example 2

Reason for the difference:
Due to the settings made for channel 2, the measured value provided by the measuring instrument is not within the range that can be represented. In this case, the measured value is below the smallest value that can be shown. A display value smaller than the smallest number that can be shown is represented as „0.0000“.
This difference, however, is of no importance for a possible memory function of the measured value and for the alarm management, as these two functions are ruled and run by the fixed unit of the probe used.

Attention:
By configuring the unit of a channel it is thus possible to get „0.0000“ displayed on the screen, although the dose rate measured at the measurement site is not zero !
This may be explicitly desired, in the event that only large dose rate values are of special interest while small dose rate values shall be neglected.
However, this could also be a possible configuration error !
We therefore recommend to proceed with utmost care when configuring the unit to be displayed and to contact the manufacturer in case of any doubts.

5.10.6 The menu of the window „Channel settings“

The menu point **File** offers you the following features to be chosen:

- The option **Open parameter file** is used to load an already existing parameter file (.par) and to modify it according to your requirements. Instead of choosing the menu option you may also use the short key combination [Ctrl]+ [F5].
- To save the parameter file currently open (and perhaps modified) under another file name and to another folder or directory, select the **Save parameter file as** menu point. You obtain the same result by pressing the function keys [Ctrl]+ [F6].
- To again close a parameter file, click the **Close parameter file** menu. Selecting this menu option is identical in function to pressing the function keys [Ctrl]+ [F7].
- Using the menu option **Read parameters from FHT 6020,** you can load the current device configuration into the FHT6020.exe program. You may also press the function key [F5] to enter this function.
- The **Write parameters to FHT 6020** menu point enables the desired configuration to be loaded from the FHT6020.exe program to the measuring unit. This function may be also entered via the [F6] function key.
- To exit the „Channel settings“ window and to return to the main menu window, select the **Close** option.

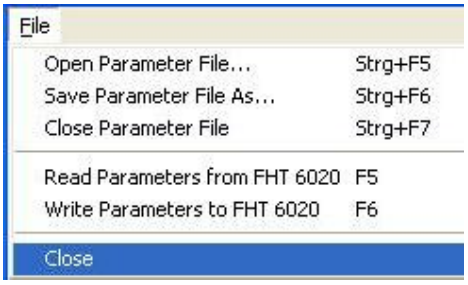


Figure 71: The “Channel settings” window, the “File” menu

5.11 The measured value display

The measured values, currently displayed can be queried permanently from a PC connected, displayed and saved with the FHT 6020 unit.

5.11.1 Display of the measured values

On the main menu, via the menu point „Options“, sub-menu point „Measured values...“ you enter the window „Measured values“ (see Figure 72). This window shows the following data in single columns:

- actual measured values of the active channels
- incl. the unit fixed in the channel configuration
- and the current probe state
- as well as the system status and the actual PC time

The „*Polling interval*“ frame features a drop-down selection menu to set the time interval between to polling procedures in seconds (range: $1s \leq \delta_{tM} \leq 3600s$) as well as a button that changes its labelling between [Stop] and [Start] according to the actual state of the polling process.

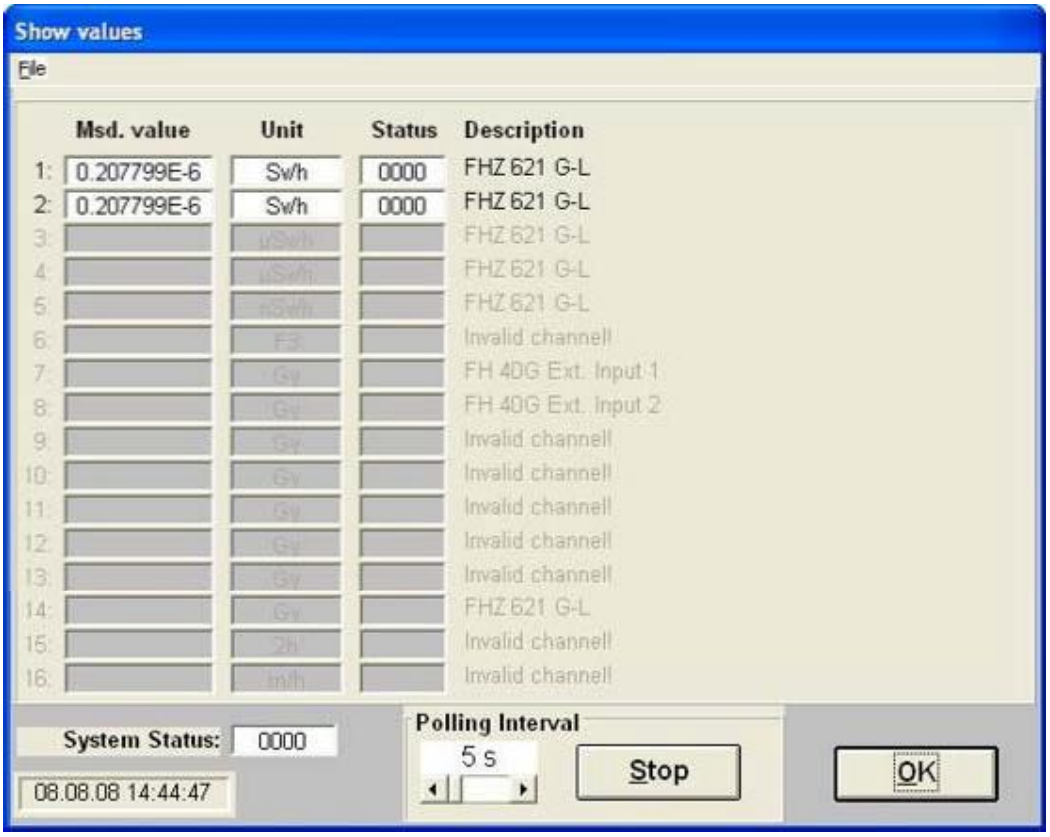


Figure 72: The „Measured values“ window

With the mouse pointer positioned directly above the status section, the current status is displayed as plain text.

5.11.2 The menu of the „Measured values“ window

The menu point **File** offers the following functionalities:

- Using the **Open data file,** you may create a file (.log) anew for measured value filing.
- To close a file opened for measured value filing, select the menu option **Close data file.**
- The functionality **Display data file** enables a created measured value file to be displayed in a text editor. This menu option is only available after stopping the measured value polling.
- To quit the „Measured values“ window, select **Close**.

Figure 73: „Measured values“ window, the “File” menu

5.12 History

Contrary to the measured value display, a history (file) (also a method to record and file measured values) can be only created for channels with FH 40 G probes and analog inputs. Recording of the measurement data from these channels is done in the FHT 6020 unit itself, i.e. for recording no PC is required. For storage, a non-volatile 80 kBytes ring memory is used. Unlike the measured value file in the FHT 6020.exe program, the data stored in the history file are no actual values, but the history values are the mean values of the second values within a time period that can be set. The storage depth depends on number and type of the configured measured values in the history. For more information, please see the table in the annex 11.2.

5.12.1 Display of the measured values

Selecting the menu point „History...“ on the „Options“ menu in the main window, you enter the “History” window (see Figure 74).

Attention: With older PC types that are relatively slow and/or have only little RAM memory, there may be a delay of up to 10 seconds after pressing the [History] button, until the “History” window is complete !

In the „History“ window you find a surface covered with a chart, one or several option boxes (depending on the number of measuring devices for which the history option has been selected in the “system settings” window). Furthermore, this window shows the frame „*Y-Scale*“ and the buttons [OK] and [Read history]:

- Clicking one of the option boxes ensures the history of the measuring device concerned to be selected for graphical representation in the chart (but: the history is not yet read).
- To change between an automatic scaling or a user-defined scaling of the y-axis, click one of the option boxes in the „*Y-Scale*“ frame.

- When clicking the [Read history] button, the history data of the FHT 6020 or of an intelligent dose rate probe FHZ 621 G-L4 connected to the FHT 6020 is read.
  Selection has to be made on the menu function “History”/”Select”, prior to the read process. Only the FHT 6020 itself can be selected and probes FHZ 621 F-L4 that are configured as measuring devices in the FHT 6020.
- To leave the „X-T chart“, press the [OK] button.

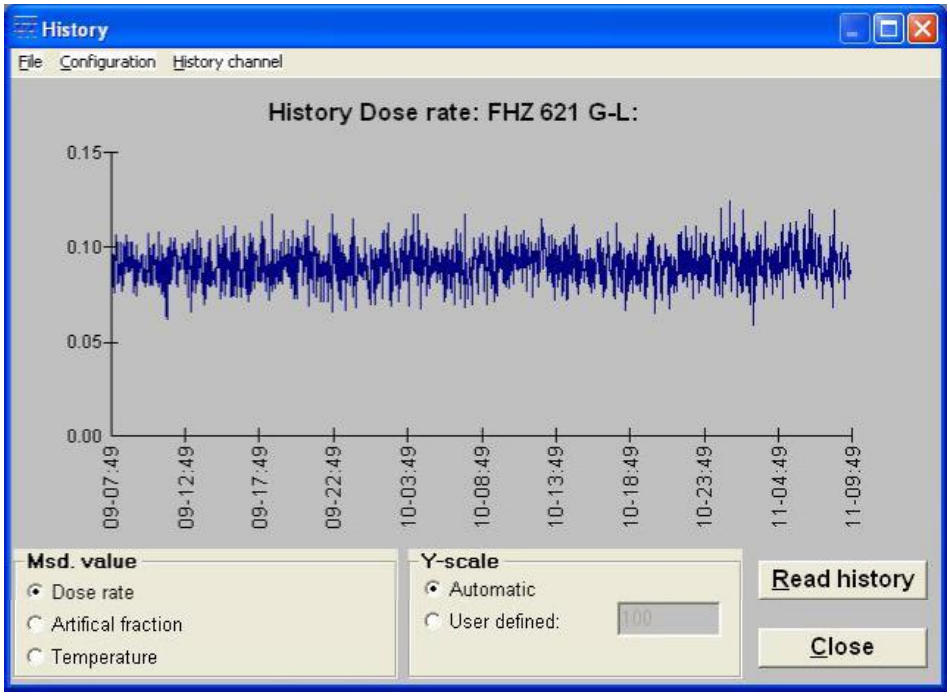


Figure 74: The “History” window

5.12.2 The menu of the „History“ window

On the **File** menu, you can choose the options

- **Open history file** to load a previously saved history file for graphical representation.
- **Save history file** to save a history file read from FHT 6020 to the PC.
- **Save history file as** to save a FHT 6020 history file using another file name, saving it in another folder / directory.
- **Close** to quit the „History“ window.

Figure 75: History, the „File” menu

On the **Configuration** menu, there are the following three entries for chart configuration:

- **Symbols in graphic**
- **Horizontal grid lines**
- **Vertical grid lines**

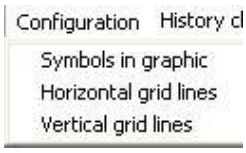


Figure 76: History, the "Configuration" menu

Once an entry has been selected via the menu, this entry shows a check mark. Selecting this entry once more again, the entry is deactivated and the check mark disappears.

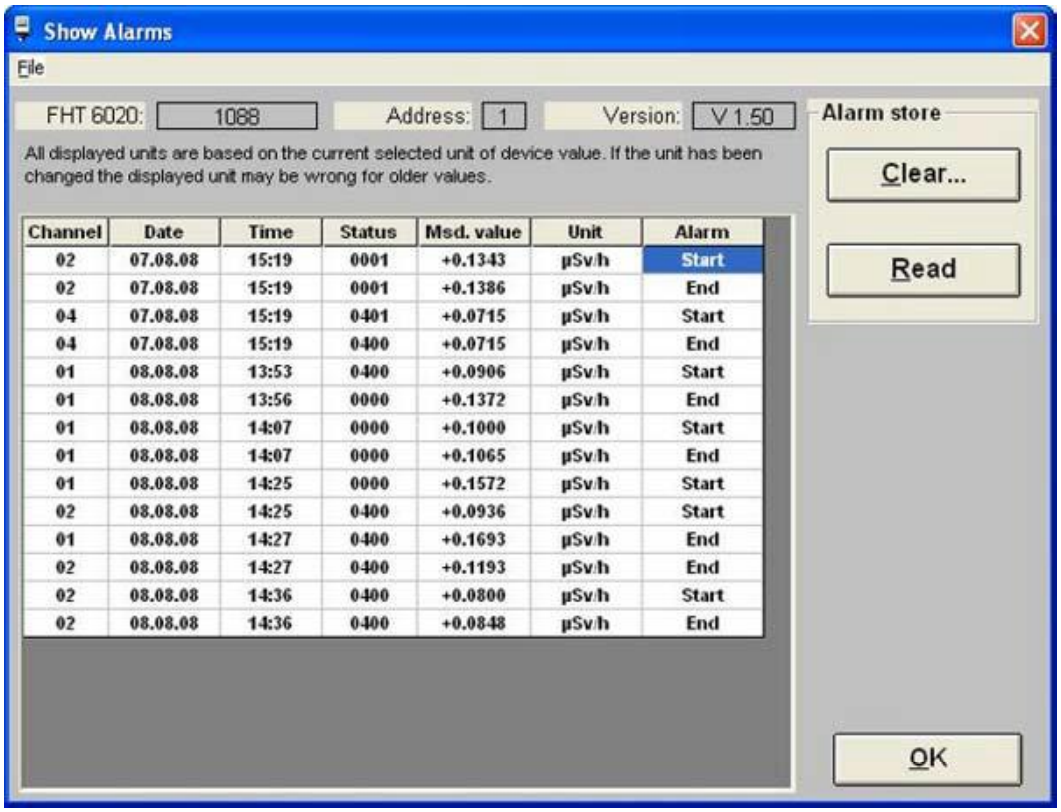
On the **History** menu, you can choose the options

- **Select** to choose a channel for history generation, e.g. FHZ 621 G-L or FHZ 621 G-L (if configured in the FHT 6020). Subsequently, the data from the selected channel can be read by pressing the [Read history] button.
  The FHT 6020 device is always available. Each FHZ 621 G-L probe, configured in the FHZ 6020, is displayed here. With a description entered in channel configuration for the corresponding probe, this description is displayed as well.
- **Read** to read a history file from the FHZ 621 G-L. Instead of using the menu, you may also press the [F12] function key or the [Read history] button.

Figure 77: History, the "History" menu

5.13 The Alarm store

Selecting the menu item „Alarm store...“ in „Options“ of the Main window the window „Show Alarms “ (see Figure 78).



Channel	Date	Time	Status	Msd. value	Unit	Alarm
02	07.08.08	15:19	0001	+0.1343	µSv/h	Start
02	07.08.08	15:19	0001	+0.1386	µSv/h	End
04	07.08.08	15:19	0401	+0.0715	µSv/h	Start
04	07.08.08	15:19	0400	+0.0715	µSv/h	End
01	08.08.08	13:53	0400	+0.0906	µSv/h	Start
01	08.08.08	13:56	0000	+0.1372	µSv/h	End
01	08.08.08	14:07	0000	+0.1000	µSv/h	Start
01	08.08.08	14:07	0000	+0.1065	µSv/h	End
01	08.08.08	14:25	0000	+0.1572	µSv/h	Start
02	08.08.08	14:25	0400	+0.0936	µSv/h	Start
01	08.08.08	14:27	0400	+0.1693	µSv/h	End
02	08.08.08	14:27	0400	+0.1193	µSv/h	End
02	08.08.08	14:36	0400	+0.0800	µSv/h	Start
02	08.08.08	14:36	0400	+0.0848	µSv/h	End

Figure 78: Show Alarms

First the firmware of FHT 6020 is tested. If the version is below V 1.30, the message: " For reading the alarm memory the firmware version V1.30 or above is required in FHT 6020“ is displayed and the window will be closed then. If parameter of FHT 6020 had not yet been read a reading will be requested now.

In the upper part of the window the serial number , the address and the version number is displayed. Below the alarm records with following columns are shown.

- Channel number
- Date and time of occurrence
- Status of measurement
- Measured value
- Unit of value (the current unit will be used! If the unit had been changed in the recorded period the displayed result may be wrong.)
- Alarm status (Start or End of Alarm)
  At the start of an alarm situation the actual value is recorded.
  At the end of an alarm period the maximum value within this period will be stored.

5.13.1 Alarm store read

With the button [Read] the alarm store of FHT 6020 is read and displayed as table. The maximum number of alarm records is 330.

Note:
Start and end of alarms will only be stored if this function is activated. This can be done by ticking the check box "Alarm store active" in window "System settings" tab "Alarm store" (see section 5.9.7).

5.13.2 Alarm store clear

With the button [Clear...] the alarm memory of FHT 6020 can be cleared. After confirming with [Yes] the safety request: " All alarm records will be cleared. Are you sure ...?" the alarm store will be cleared.

5.13.3 The menu in window "Show alarms"

The menu File contains items as follows:

- **Alarm store read** this function is identical to activating the button "Read".
- **Open** opens a previously saved alarm file for review.
- **Save as ...** the alarm data read from FHT 6020 may be stored to disk (HD or FD)
  A file name is suggested according to following template:
  Alarm123_yymmddhhmm.dat
  Legend:

123:	serial number
yy:	year
mm:	month
dd:	day
hh:	hour
mm:	minute

  Example:
  The alarm store of FHT 6020 with serial number 235 is read and stored on 11 July 2002 at 12:35
  The suggested file name would be:
  „Alarm235_0207111235.dat“
- **Close** close this window.

5.14 Setting the time in the FHT 6020

On the “Options“ menu in the main window, using the menu point “-„Synchronize FHT 6020 with PC clock“, the battery-buffered real-time clock of the FHT 6020 is synchronized with the time of your PC (i.e. the FHT 6020 adopts the time of your PC). This function can be also entered by pressing the [F12] function key.

5.15 Deleting the history

On the main window, select „Delete history“ from the „Options” menu point, to delete all measured values from the FHT 6020. Selecting this menu point, the program prompts you to answer the question „Do you really want to delete ?“. To proceed with the deletion, press the [Yes] button.

6. The FHT 6020 alarm and acknowledgment concept

For a better understanding, the following terms and definitions shall be used in this chapter:

Table 5: Definition of terms for the alarm plan

Term	Description
Latching mode	The reaction to a change of state (e.g. Alarm) is maintained until the state is manually acknowledged. This is in particular valid for the situation that the change of state has been already reset (e.g. alarm threshold is remained under again). The latching mode can be configured separately for the sound generator, the LEDs seen as an entity and for each digital output :
Failure	A measured value falls below the set failure threshold of a channel or a status bit has been set in the measured value status that has been configured as failure.
Alarm 1	Measured value exceeds the threshold set for Alarm 1.
Alarm 2	Measured value either exceeds the threshold set for Alarm 2 or a status bit has been set in the measured value status that has been configured as Alarm 2.

6.1 Signaling failures

When signaling failures (failure threshold or status bit), the latching mode is not applied to the LEDs. The „Error“ LED or a digital error output show always the current status. Therefore, a manual acknowledgment of failures or their signaling is not possible.
The digital outputs 1 –5 can be configured independently of each other as error- or alarm output with or without applying the latching mode. It is even possible to select which channels are assigned or linked to which output.

Table 6: Signaling failures

LED „Error“:	Gives light as soon as at least one channel has a failure, and goes out in case of no failure. Latching mode is not possible.
LED „Status“	Gives light, when the „ERROR“ LED is dark, i.e. when there is no failure. With an alarm occurring, the „Status“ LED will not become dark.
Out 1 – 5 (error output)	Opens as soon as at least one channel shows a failure that has been configured for this output. Alternatively, you can select the output to be opened not before all configured channels show a failure at the same time. It is possible to set the latching mode.
Sound generator	In the event of a failure, the sound generator is activated, if the failure has been configured as trigger for the sound generator. The latching mode can be set.

6.2 Signaling alarms

When signaling Alarm 1 or Alarm 2 (threshold exceeded or status bit set), the latching mode is applied depending on the configuration. The latching mode can be selected for the LEDs Alarm 1 and Alarm 2 together, and for the sound generator and for each digital output 1 – 5 separately.

- With the latching mode being switched off, The LEDs or the corresponding alarm output show the actual alarm status. If the alarm status no longer applies, the LEDs and the corresponding outputs are automatically reset.
- With active latching mode, after an alarm status has occurred, the LEDs or the corresponding alarm output remain set / active, until the alarm is acknowledged manually by the operator.

Irrespective of each other, the digital outputs 1 – 5 can be configured as error- or alarm output. It is also possible to define which channel is linked to which output.

Table 7: Signaling alarms

Signal	Latching	Non-latching
LED Alarm 1	Gives light, as soon as at least 1 channel is in Alarm 1 status. Light sign remains until the alarm is acknowledged manually, after no channel being in the Alarm 1 status any longer.	Gives light, if at least 1 channel is in Alarm 1 status. With no channel being in Alarm 1 status any longer, the LED is automatically switched off.
LED Alarm 2	Gives light, as soon as at least 1 channel is in Alarm 2 status. Light sign remains until the alarm is acknowledged manually, after no channel being in the Alarm 2 status any longer.	Gives light, if at least 1 channel is in Alarm 2 status. With no channel being in Alarm 2 status any longer, the LED is automatically switched off.
Out 1 - 5 (Alarm output)	Opens as soon as the configured release condition has been fulfilled for the respective output. The output remains set until it is acknowledged manually. Acknowledgment can only take place, if the release condition is no longer met.	Opens as soon as the configured release condition has been fulfilled for the respective output. With the release condition no longer met, the output is reset automatically.
Sound generator	In case of an Alarm 1 or 2, the sound generator is activated, if the status has been configured as release signal for the sound generator.	In case of an Alarm 1 or 2, the sound generator is activated, if the status has been configured as release signal for the sound generator.

6.3 Automatic display change-over in case of alarms

If the latching mode has been selected for the LEDs, the display of the FHT 6020 will change-over such – in case of an alarm – that the first display page will be shown containing a channel that released the alarm. As to priority, Alarm 2 is not higher than Alarm 1, i.e. both are equal.

Example
Display page 1: Channel 1, 2, 3
Display page 2: Channel 4, 5, 6
Display page 3: Channel 7, 8, 9
Page currently displayed: 1 Latching mode configured for LEDs.

First, Alarm 2 occurs with channel 8:	The display changes over to page 3
Then, Alarm 2 occurs with channel 4:	The display changes over to page 2
Additionally, there is an Alarm 1 in channel 3:	The display changes over to page 1

Pressing the key of the FHT 6020 shortly, you may change over from the displayed page to another at any time. Changing over to another display page does not take place before a new alarm occurs.

6.4 Acknowledging alarms

In case the latching mode has been chosen for the alarm signaling, the LEDs and the alarm outputs remain set until they are acknowledged manually by the operator. This can be done in two different ways:

- Acknowledgment via the FHT 6020 key
  In case of an alarm, all digital alarm outputs and the two alarm LEDs can be all acknowledged at the same time by pressing the key on the FHT 6020 unit (see also chapter 4). With the sound generator being active, the first key depression only acknowledges the sound generator. The second key depression then resets the outputs and the LEDs.
- External acknowledgment via the digital input no. 4
  Provided that the external acknowledgment has been admitted in the configuration, all alarm outputs and the two alarm LEDs are reset as soon as an edge of pulse has been detected with the digital input no. 4. At the same time, the sound generator will be switched off. This principle enables alarms to be acknowledged via remote control, even if the signaling unit is not in the same place.

Attention:

The manual acknowledgment via key or external input signal only resets the alarm status for the channels that are no longer in alarm status at the time of acknowledgment.

The LEDs Alarm 1 and Alarm 2 are only switched off after all channels have been reset. As long as there is still at least 1 channel in alarm status, the corresponding LED remains alight.
A digital alarm output is reset, if the release condition – configured for this output – is no longer met. As long as the condition is still given, the respective alarm output cannot be reset.

7. Rules for the network operation

7.1 Number of bus users

A maximum number of 16 intelligent probes / amplifiers can be connected to the RS-485 probe interface of a FHT 6020 measuring instrument.

If the PC interface of the FHT 6020 is a RS-485 interface as well, several FTH 6020 units can be connected to one and the same PC, forming a network.
However, if the PC interface of the FHT 6020 is a RS-232 interface, only one single FHT 6020 unit can be connected to the PC.

7.2 Interface parameters for the probe bus

7.2.1 Addresses

All bus users must obtain a unequivocal address. At first sight, this condition may look rather trivial, but it is extremely important for the „transparent mode“ of the FHT 6020. It means that the FHT 6020 behaves as if it would be completely transparent (non-existing) with respect to a command received from a PC connected, directed to the address of a probe being installed at the probe bus. The command is transmitted to the probe and the answer received is returned to the PC. For this reason, all devices have to feature a different address when operated in measuring networks consisting of several FHT 6020 units and intelligent probes, irrespective of the fact whether they are connected directly to a PC or to a FHT 6020 unit.

Attention:
Address 1 has a special position: This address is the ex works setting for intelligent probes and FHT 6020 units when leaving the factory. This address should not be used in normal network operation.

Reserving the address “1“ ensures that a new intelligent probe coming from the factory can be directly implemented in an existing network. Furthermore, this new probe is immediately recognized by the FHT6020.exe program without any problems.
Otherwise, this results normally in address conflicts when expanding and upgrading an existing network.

Table 8: Admissible address range depending on the probe type

Probe type	Admissible address
FHT 191 N	1 ≤ Probe address ≤ 99
FHZ 621 G-L4, G-L4-10	1 ≤ Probe address ≤ 99
FHT 641 D4	1 ≤ Probe address ≤ 31
FHT 671 S4 S4 HT	1 ≤ Probe address ≤ 31
FHT 671 Y4, Y4 HT	1 ≤ Probe address ≤ 99

Attention !

Address 0 is reserved for the function of sending messages to every probe across the network. This means that probes with any address react to a command having the address 0. As a result, all probes send back measurement data. This is, of course, not allowed in a network operation and therefore serves only for synchronization purposes.

7.2.2 Transmission speed (Baud rate)

The transmission speed for intelligent probes has to be set to the same value, i.e. either to 9600 or 19200 Bauds. A probe having a false baud rate is not detectable and cannot be accessed ! The admissible baud rates for the corresponding probes figure in the respective technical data.

7.2.3 Protocol

The protocols and data formats used by the FHT 6020 and the intelligent probes are described in detail in the technical reference data of the FHT 6020, DT-020-010518, as well as in the technical data sheets of the respective probe.

7.2.4 Definition of the power supply requirements

When dimensioning the power supply for a network, especially some points in time are very critical such as e.g. switching on in general or switching on the power supply after a power failure.
Due to the design of the intelligent probes, one should start out from a typical starting current of 120 mA for a FHZ 621 G-L4 and from a starting current of 140 mA for a FHT 6020 unit (featuring as standard equipment a RS-485 interface for both, PC and probe connection). The specific resistance of the supply line shall be laid out such that

- when starting-up a FHZ 621 G-L4, at least 5V apply to the probe connector

and

- when starting-up a FHT 6020, at least 8.5 V apply to the connector used for power supply.

Supposing that all consumers are connected to the supply-remote extremity of the supply line and that they are switched on simultaneously, the following formula expresses the worst case scenario for the expected voltage drop ΔU in Volt in the supply line due to starting currents:

$\Delta U = 2 * L * R` * (m * 0.14\ A + n * 0.12\ A)$

Whereas
L: = length of the supply line in m
R`: = Specific resistance of the supply line in Ω/m
m: = Number of FHT 6020 units
n: = Number of FHZ 621 G-L4 units

Based on the assumption that the consumers are placed at the same distance over the entire supply line length, the voltage drop calculated from the a.m. formula can be multiplied by the factor 0.6.

Aforementioned requirements can be met by:

1. Selecting a sufficient supply voltage at a given cable cross section
2. Increasing the cable cross section at a given supply voltage
3. switching on the single consumers one after another at fixed time intervals

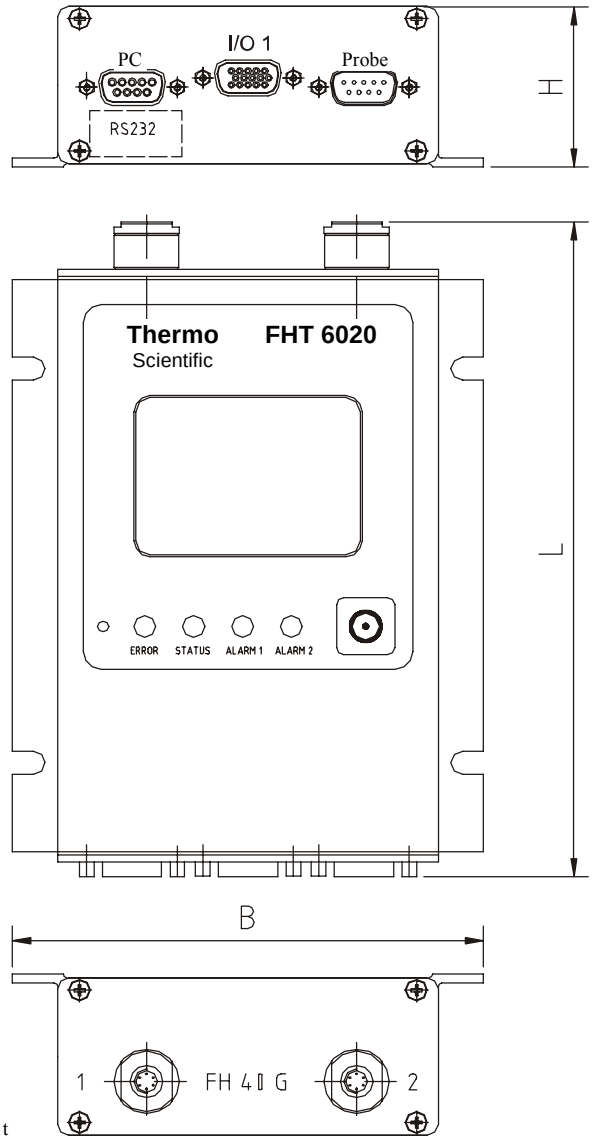
or by a combination of these measures.

8. Technical data

8.1 Views, dimensions and weights

8.1.1 Views – flat housing

Top view on the bottom front plate



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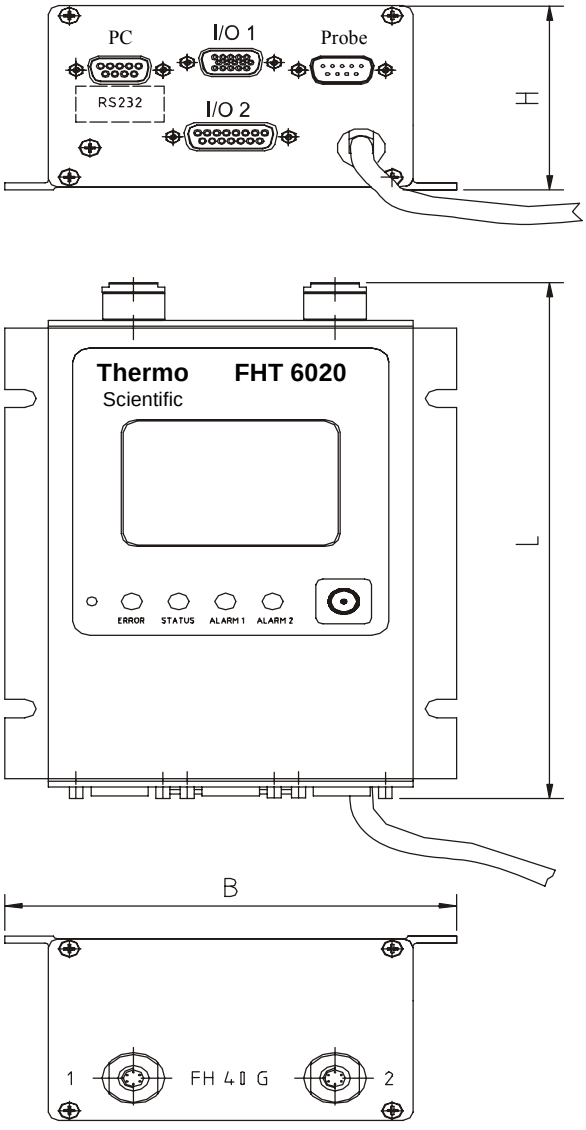
Top view on the top front plate

8.1.2 Views – high housing

Top view on the bottom front plate



Top view on the top front plate

8.1.3 Dimensions and weights

Table 9: Dimensions and weights

	W [mm]	L [mm]	H1 / H2 [mm] [1)]	M1 / M2 [kg] [2)]
Table	105	182	44.5 / 65	0.8 / 1.3
Wall	130	182	45.5 / 66	0.8 / 1.3

[1)] H1 : Housing type „flat“, H2 : Housing type „high“

[2)] M1: Housing type „flat“, M2 : Housing type „high“ with internal power supply unit

8.2 Connectors

Table 10: Connector types and their use

Designation/Application	Type
Detector 40G 1	6-pin female connector, Fischer DEE103
Detector 40G 2	6-pin female connector, Fischer DEE 103
PC	9-pin female connector., D-Sub
I/O 1	15-pin female connector., D-Sub, High Density
Probe	9-pin male connector, D-Sub
I/O 2	15-pin female connector, D-Sub (only HSx types)

8.3 Pin assignment

8.3.1 Detector 40G 1 and Detector 40G 2

Table 11: Pin assignment - female connector of the 40 G detector

Pin no.	Name	Function
1	AVDD	Supply ext. probe, +5V
2	AZMP	Pulse input
3	EEDO	dig. data output of the ext. probe
4	EEDI	dig. data input of the ext. probe
5	EESK	dig. cycle input of the ext. probe
6	GND	Supply ext. probe, ground (GND)

8.3.2 PC

Table 12: Pin assignment – female connector of the PC

Pin no.	Name	Function
1	PE	Shielding (connected to housing), With mains supply additionally connected to equipment grounding contactor (PE)
2	4: UBGND 2: TD	RS-485: FHT 6020 supply, decoupled ground RS-232: Send line
3	4: RXB 2: RD	RS-485: Data line B RS-232: Receive line
4		Reserved
5	4: SGND 2: GND	RS-485: PC interface supply, decoupled ground Signal ground for RS-485 interface (decoupled) RS-232: Supply- and signal ground
6		Reserved
7		Not occupied
8	4: RXA	RS-485: Data line A
9	+UB	FHT 6020 supply, decoupled +10 to +30 VDC When connecting intelligent ionization chambers: +15 to +30 VDC

8.3.3 I/O 1

Table 13: Pin assignment – female connector I/O 1

Pin no.	Name	Function
1	DOUT5	Digital output, potential-free (optically decoupled)
2	DOUT4	Digital output, potential-free
3	DOUT3	Digital output, potential-free
4	DOUT2	Digital output, potential-free
5	DOUT1	Digital output, potential-free
6	DIN3	Digital input, potential-free (optically decoupled)
7	DIN1	Digital input, potential-free
8	DIN2	Digital input, potential-free
9	DIN4	Digital input, potential-free
10	DIGND	Ground digital inputs
11	UBGND	FHT 6020 supply, decoupled ground
12	+UB	FHT 6020 supply, +10 to +30 VDC When connecting intelligent ionization chambers: +15 to +30 VDC
13	AGND	Ground analog current output 1, electrically-isolated, at option
14	IOUT	Analog current output 1, 0 or 4 to 20 mA, electrically-isolated, at option
15	DOGND	Ground digital outputs

8.3.4 Probe

Table 14: Pin assignment – male probe connector

Pin no.	Name	Function
1	PE	Shielding (connected to housing), With mains supply additionally connected to equipment grounding contactor (PE)
2	UBGND	FHT 6020 supply, decoupled ground Ground for voltage supply
3	B	Data line B
4		Reserved
5	SGND	Supply of probe interface, decoupled ground Signal ground for RS 485 interface (decoupled)
6		Reserved
7		Not occupied
8	A	Data line A
9	+UB	FHT 6020 supply, decoupled +10 to +30 VDC When connecting intelligent ionization chambers: +15 to +30 VDC

Voltage supply of the connected probes is ensured via the pins 9 and the associated ground pin 2. Data transmission (RS 485) is effected via the pins 8 and 3 with the associated ground pin 5.

8.3.5 I/O 2

Table 15: Pin assignment – female connector I/O 2

Pin no.	Name	Function
1	GND	FHT 6020 supply, internally, ground not decoupled
9	AIN2+	Analog input 2, $0 \leq U_{IN} \leq 4{,}5$ V, not electrically isolated
2	GND	FHT 6020 supply, internally, ground not decoupled
10	AIN1+	Analog input 1, $0 \leq U_{IN} \leq 4{,}5$ V, not electrically isolated
3	GND	FHT 6020 supply, internally, ground not decoupled
11	IOUT2	Analog current output 2, 0 or 4 to 20 mA, not electrically isolated

8.4 Equivalent block diagram

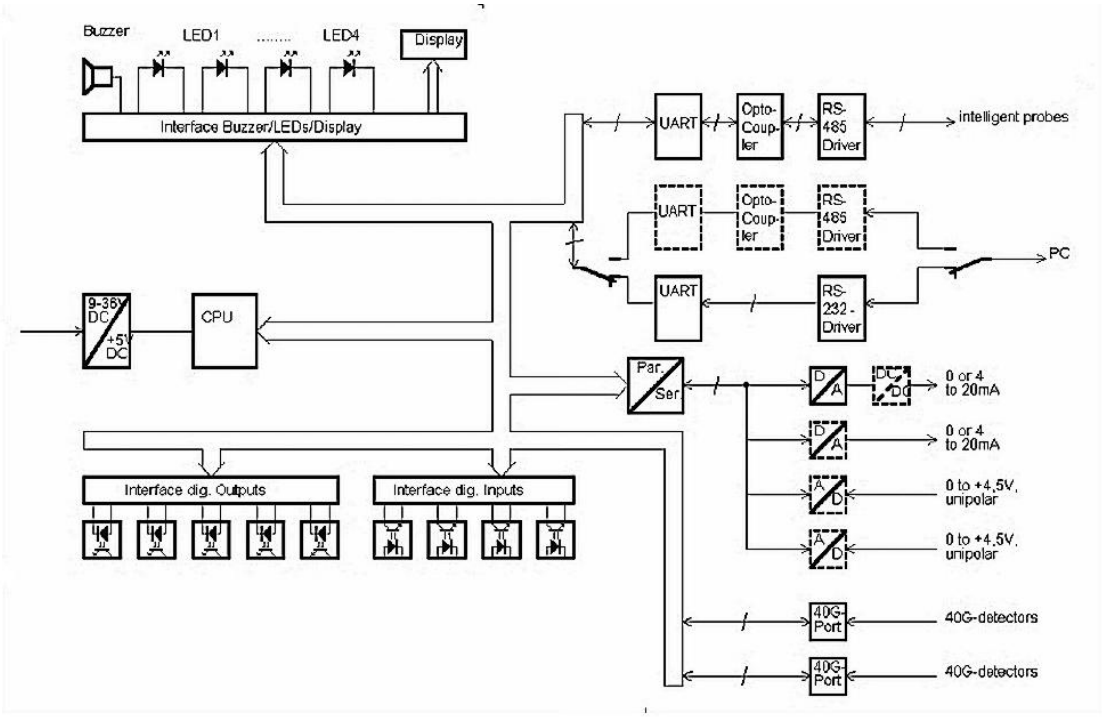


Figure 79: Equivalent block diagram FHT 6020

8.5 DC isolations

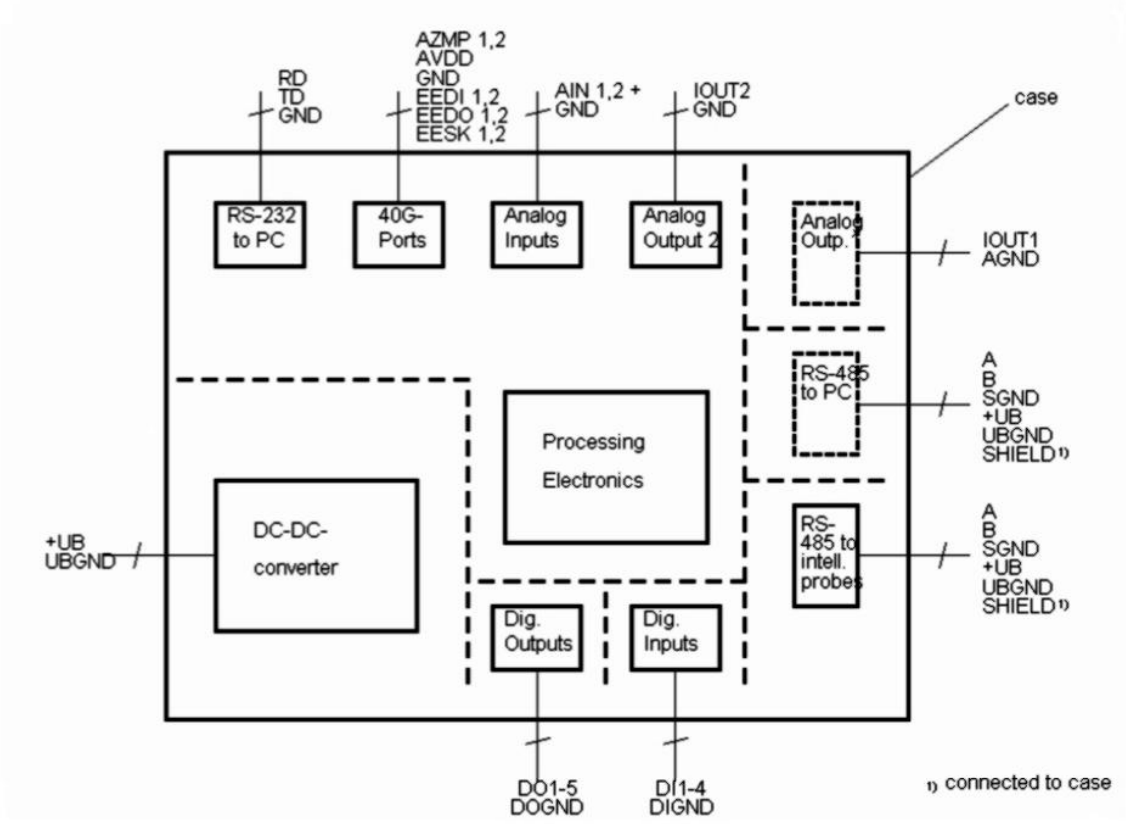


Figure 80: DC isolations FHT 6020

8.6 Electrical parameters

Table 16: Electrical parameters

Name	min.	Typ.	max.	Dim.	Condition
Supply voltage	9		36	VDC	
Primary current consumption		30 31 32 75 100 102 180		mA	UB = 15 VDC, at 25°C No probes connected Without RS-485 and I/O 2 with 1 FHZ 612 / 632 with 2 FHZ 612 / 632 with 1 FHZ 621 G-L4 with 2 FHZ 621 G-L4 with 2 FHZ 632 + 2 FHZ 621 G-L4 with 1 FHT 191
Voltage buffer battery		3.6		V	
Buffer battery life		10		a	
Accuracy	4.5			s/day	
Measured value display			4.5-digit 6.5-digit		Setting „with pre-unit“ Setting „without pre-unit“
Measured value that can be indicated			±99 M ±99 999		Setting „with pre-unit“ Setting „without pre-unit“

Digital outputs (electronic relay)

Voltage capacity	0 0		± 36 26.4	VDC VAC	Direct current (DC) Effective value at a sinusoidal alternating voltage (50/60 Hz AC)
Current capacity	0		± 400	mA	At an ambient temperature of 25°
Fuse protection per output			500	mA (T)	Self-resetting (PTC behavior)
„ON“ resistance		0.8	1.5	Ω	$I = I_{Max}$

Digital inputs

Current	± 3 ± 6		± 60 ± 30	mA	At an ambient temperature of 25°C At an ambient temperature of 25°C
Input resistance		1		kΩ	
Flow voltage LED		1.25	1.65	V	

Analog outputs

Load resistance (load)			250	Ω	Without module for DC isolation
Current	0		20	mA	
Resolution			4.9	µA	12 bit
Error		± 20		µA	

Analog inputs

Voltage	0		4.5	V	
Resolution			17.6	mV	8 bit
Error		± 45		mV	

Table 17: Ambient conditions

Housing	Aluminum, conductive coating
Protection class	IP 54
Operating temperature	-20 °C to +70°C
Storage temperature	-20°C to +70°C
Relative humidity	10% to 90 %, non-condensing
Electromagnetic susceptibility	EN 61000-4-3, 20 V/m, 80 kHz to 1 GHz
EMC-interference	EN 50081-1
EMC-resistance	EN 50082-2

8.6.1 Real-time clock

The FHT 6020 is internally equipped with a real-time clock used for managing date and time. Via the FHT6020.exe program, this real-time clock can be synchronized, if necessary, to the clock of the PC used for configuration (i.e. FHT 6020 adopts the PC time). In case of a power failure (ext. supply), supply for the clock is guaranteed by an internal Lithium battery.

An internal voltage monitoring device protects the clock against unintentional time regulation in case of voltage drops and during the switch-on/off processes.

8.6.2 Digital inputs

The FHT 6020 has 4 digital, optically decoupled inputs, each one being represented by the following equivalent block diagram:

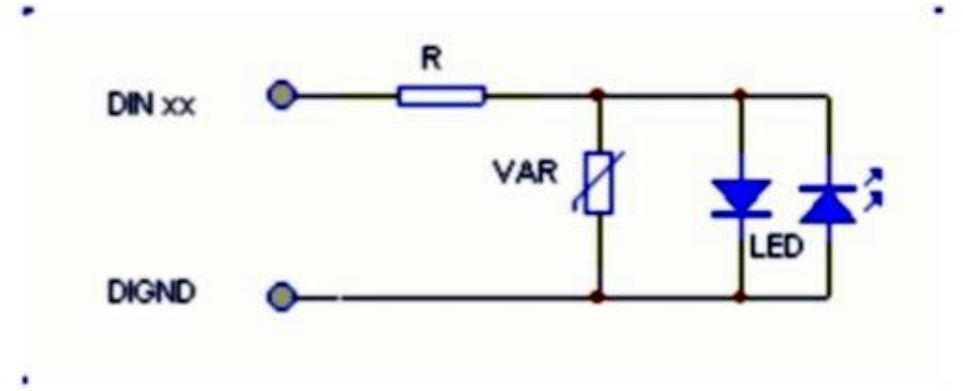


Figure 81: Equivalent block diagram – digital input

To calculate the min. admissible input voltage, the following formula applies:

$$U_{INMin} = R_V * I_{FMin} + U_{FMax}$$

Example: υ_A = 25°C, I_{FMin} = 3 mA (see technical data), R_V = 1 kΩ, U_{FMax} = 1.65 V

$$U_{INMin} = 1\ k\Omega * 3\ mA + 1.65\ V = 4.65\ V$$

The max. admissible input voltage is calculated as follows:

$$U_{INMax} = R_V * I_{FMax} + U_{FMin}$$

Example: υ_A = 60°C, I_{FMax} = 30 mA (see technical data), R_V = 1 kΩ, $U_{FMin} = U_{Ftyp.}$ = 1.25 V

$$U_{INMax} = 1\ k\Omega * 30\ mA + 1.25\ V = 31.25\ V$$

8.6.3 Digital outputs

The FHT 6020 is provided with 5 digital, optically decoupled outputs, each one being represented in the subsequent equivalent block diagram:

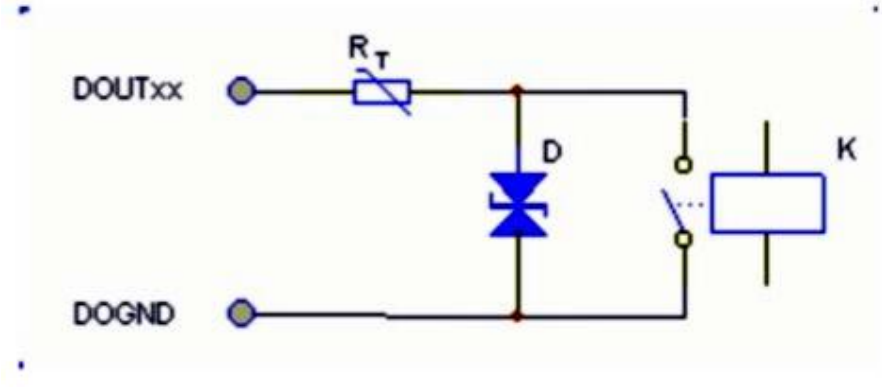


Figure 82: Equivalent block diagram – digital output

R_T is a self-resetting fuse with PTC characteristics, D is a bi-directional Transzorb-diode, protecting the electronic relay against transient voltage glitches.

8.6.4 Analog inputs

Optionally, the FHT 6020 is equipped with up to 2 analog inputs, each one characterized by the following equivalent block diagram:

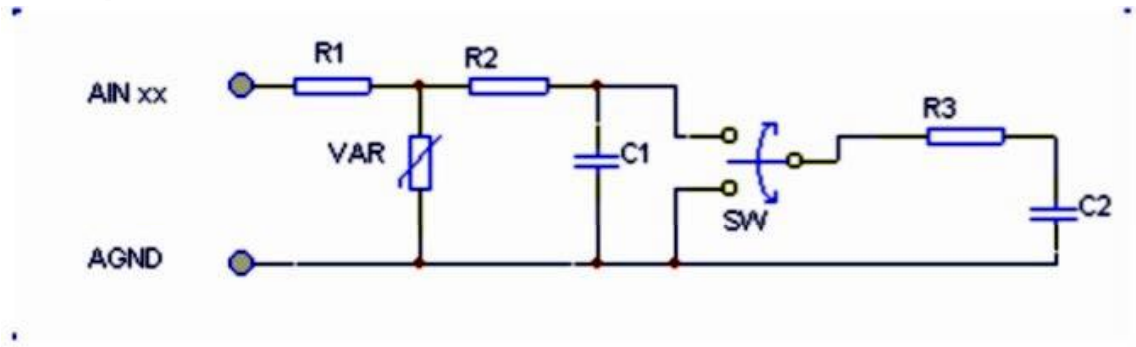


Figure 83: Equivalent block diagram - analog input

The combination R1-VAR protects the analog input against transient voltage glitches. The R2-C1 combination smoothes the input signal. SW, R3 and C2 graphically represent the input switching circuit of the A/D-converter.
On device level, the scanning interval is set to 1 second.

8.6.5 Internal power supply unit

The internal power supply unit of the FHT 6020 shows the following technical characteristics:

Table 18: Electrical characteristics – internal power supply unit

Name	min.	typ.	max.	Dim.	Condition
Input voltage	85		264	VAC	
Input frequency	50		400	Hz	
Output voltage	14.25	15	15.75	VDC	V_{IN} = 230 VAC, I_{OUT} = 330 mA, υ = 25°C
Output current			0.33	ADC	
Current limitation	105		130	% I_{Nenn}	
Efficiency	62			%	

9. The FH 40 G - probe program

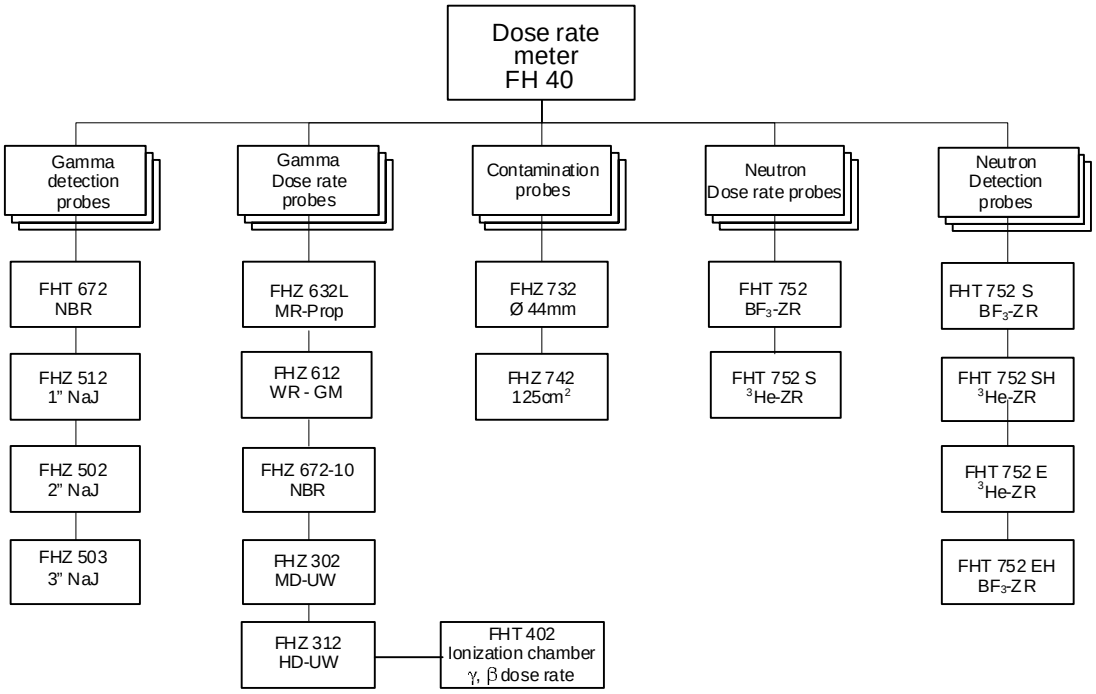


Figure 84: Product tree giving an overview of the FH 40 G - probes

Note:
The maximum length of the connection cable amounts to 50m.

Table 19: Gamma dose rate probes

Name	Unit	FHZ 302	FHZ 312	FHZ 612-10	FHZ 612	FHZ 632 L	FHZ 672-10
Order no.		42540/44	42540/40	42540/54	42540/52	42540/35	42540/66
Display range	µSv/h	1 - 1 x 10^6	10-100x10^6	0.01 - 10 x 10^6		0.01 - 100 x 10^3	0.001 - 200
Energy range	keV	82 – 3,000	82 – 3,000	60 – 1,300	82 – 1,300	36 – 1,300	60 – 3,000
Sensitivity for ^{137}Cs	cps/ (µSv/h)	0.3	0.001	ND: 1.7 HD: 0.017	ND: 1.7 HD: 0.03	2.2	2200
Detector type		GM counter tube	GM counter tube	GM counter tube ZP 1202 C 300	GM counter tube ZP 1201 ZP 1301	Proportional counter tube	Plastic scintillator
Radiation overload resistance	Sv/h	50	1000	100		50	0,02
Dimensions	mm	Ø 45	Ø 45	Ø 35		Ø 35	Ø 110
Length	mm	155	155	185		162	415
Weight	kg	1.35	1.35	0.25		0.185	4.1

Table 20: Neutron dose rate probes

Name	Unit	FHT 752	FHT 752 H
Order no.		42540/20	42540/21
Display range	µSv/h	0.0001 – 400,000	0.0001 – 110,000
Energy range	keV	0.025 x 10^{-3} – 10,000	0.025 x 10^{-3} – 10,000
Sensitivity for ^{252}Cf H_{made} accord. to ICRP 21 H*(10) accord. to ICRP 60	cps/(µSv/h)	 0.56 0.49	 2.0 1.79
Probe type		BF_3 neutron detector with moderator	^{3}He neutron detector with moderator
Radiation overload resistance		-	-
Dimensions	mm	Ø 208	Ø 208
Length	mm	435	435
Weight	kg	11.5	11.5

Table 21: Gamma detection probes

Name	Unit	FHZ 672E	FHZ 512
Order no.		42540/61	42540/32
Display range	cps µSv/h	0.01 - 100	0.01 – 100,000
Background	cps		≈ 20
Energy range	keV	> approx. 60	> approx. 30
Sensitivity for ^{137}Cs	cps/(µSv/h)	2,800	300
Probe type		750 cm^3 plastic scintillation probe	1“ × 1“-NaI Scintillation probe
Radiation overload resistance		up to 100-fold	up to 100-fold
Dimension	mm	∅ 110	∅ 48
Length	mm	410	332
Weight	kg	4.15	0.5

Table 22: Gamma detection probes (Continuation)

Name	Unit	FHZ 502	FHZ 502P -/E		FHZ 503
Order no.		42540/3301	42540/33 -/45		42540/63
Display range	cps	0.01 – 100,000	0.01 – 100,000		0.01 – 100,000
Background	cps	≈ 90	≈ 90		350
Energy range	keV	> approx. 30	> approx. 30		> approx. 30
Sensitivity for ^{137}Cs	cps((µSv/h)	1,400	1,400		7,000
NaI(Tl) Scintillation counter Crystal size		2“ × 2“	2“ × 2“		3“ × 3“
Radiation overload resistance		up to 10-fold	up to 10-fold		up to 10-fold
Dimensions	mm	∅ 66	∅ 90	∅ 80	∅ 110
Length	mm	345	380		410
Weight	kg	1.2	1.5		

Table 23: Contamination probes

Name	**Unit**	**FHZ 732**	**FHZ 742**
Order no.		42540/34	42540/37
Display range	cps	0.01 – 100,000	0.01 – 100,000
Sensitivity	cps / Bq	0.25 for ^{204}Tl	0.16 for ^{204}Tl
Probe type		Proportional counter tube LND 4313	ZnS / plastic scintillator
Radiation overload resistance		up to 50-fold	Up to 50-fold
Window size		Window Ø44 mm	100 cm^2
Dimensions	mm	Ø 68 ×30	
Length	mm	245	
Weight	kg	0.320	0.680

10. The intelligent probe program

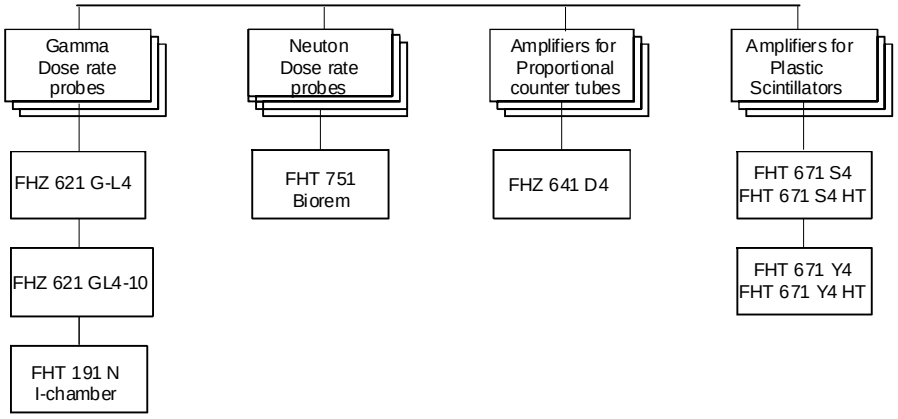


Figure 85: Product tree giving an overview of the intelligent probes

Table 24: Gamma dose rate probes with proportional counter tubes

Name	**Unit**	**FHZ 621 G-L4**	**FHZ 621 G-L4-10**
Order no.		42542/22	42542/18
Measuring unit		$\dot{H}_x$	$\dot{H}_x(10)$
Measuring range	µSv/h	0.01 - 1 x 10^5	0.01 - 1 x 10^5
Display range	µSv/h	0.001 - 1 x 10^7	0.001 - 1 x 10^7
Energy range	keV	30 – 1,300	26 – 1,300
Sensitivity for ^{137}Cs	cps/ (µSv/h)	10	10
Radiation overload resistance	Sv/h	5	5
Operating voltage	V	8 - 30	8 - 30
Diameter	mm	Ø 65	Ø 65
Length	mm	340 / 380	340 / 380
Weight	kg	0.933 / 1.090	0.933 / 1.090
PTB-approval		23.22 / 00.01	23.71 / 01.01

* PTB = Physikalisch-technische Bundesanstalt (=Federal Office for physical and technical affairs)
The values given for diameter, length and weight are indicated with and without NEMP filter. The NEMP filter (Nuclear Electro Magnetic Pulse) is required for outdoor applications (protection type IP67) and protects against over voltages.

For both probe types, FHZ 621 G-L4 and FHZ 621 G-L4-10, there is one PTB approved version each that can be only calibrated at the manufacturer's site. Further, it exists a version of each probe type that can be freely calibrated, having no PTB approval.

Version to be freely calibrated: FHZ 621 G-L4 Order no. 42542/22
FHZ 621 G-L4-10 Order no. 42542/24

Table 25: Gamma dose rate ionization chamber

Name	**Unit**	**FHT 191 N**
Order no.		42535/20
Measuring unit		Hx
Measuring range	µSv/h	0.001 - 1 x 10^7
Energy range	keV	35 – 7,000
Sensitivity for ^{137}Cs	fA / (µSv/h)	250
Radiation overload resistance	Sv/h	50
Operating voltage	V	12 - 30
Diameter	mm	Ø 208
Length	mm	518
Weight	kg	3.5
PTB approval		23.22 / 94.01

Table 26: Neutron dose rate probe

Name	**Unit**	**FHT 751**
Order no.		42294/10
Measuring unit		$\dot{H}_x(10)$ according to ICRP60
Detector type		BF_3 neutron detector with moderator
Measuring range	µSv/h	$10^{-4} – 4 * 10^{+5}$
Sensitivity for ^{252}Cf	cps / (µSv/h)	0.49 according to ICRP60
Operating voltage	V	10 - 30
Diameter	mm	208
Length	mm	395
Weight	kg	approx. 11

Table 27: Intelligent amplifiers for proportional counter tubes

Name	**Unit**	**FHT 641 D4**
Order no.		42542/06
Charge sensitivity of the counter tube entry	fCb	35
Amplifier sensitivity	V / pCb	5
Comparator threshold	mV	120
Fictive input capacitance	pF	400
High voltage	V	500 - 3000
Dead time	µs	1.6
Temperature measuring range	°C	0 - 400
Operating voltage	V	10 - 30
Diameter	mm	Ø 65
Length	mm	190
Weight	kg	0.42

A maximum number of two proportional counter tubes can be connected which are supplied by a common high voltage.
The counter tube pulses can be read out at one digital or analog test output.

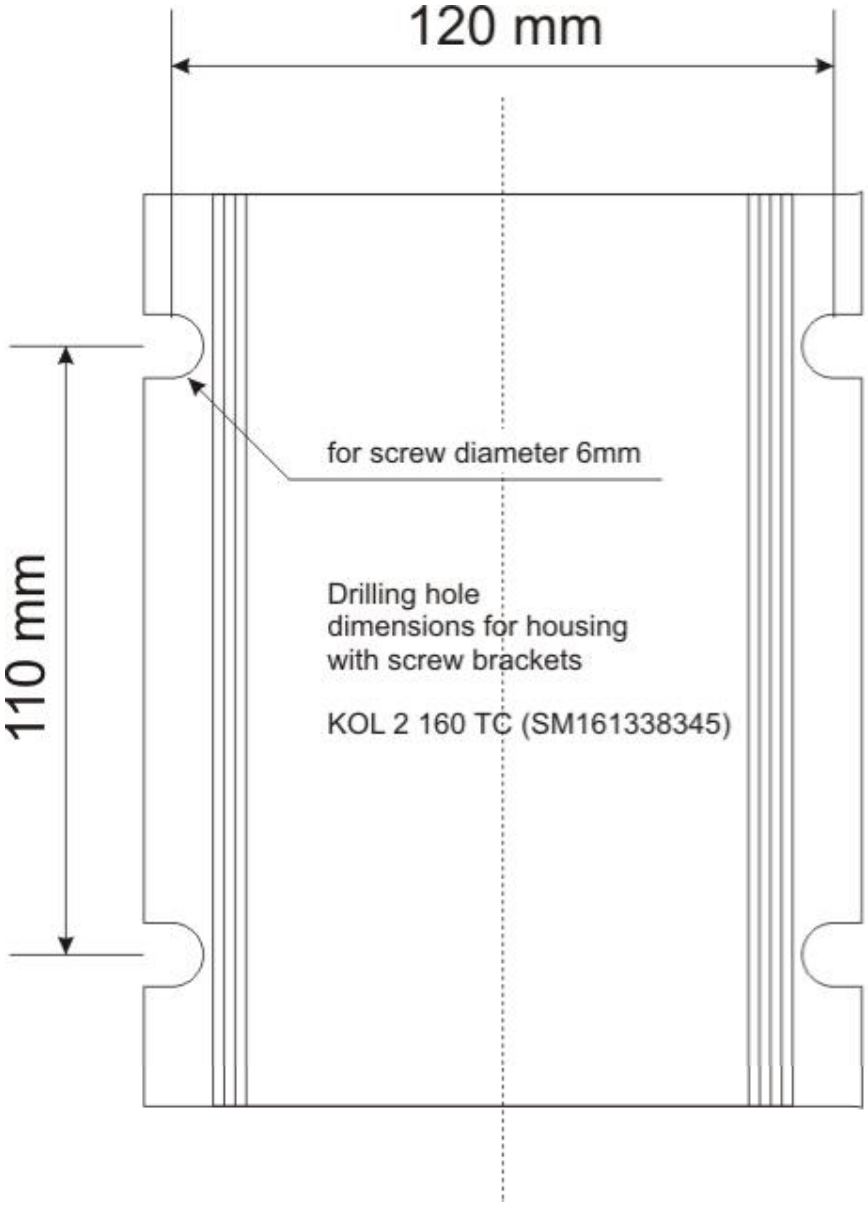
Table 28: Intelligent amplifiers for plastic scintillators

Name	**Unit**	**FHT 671 S4** **FHT 671 Y4**	**FHT 671 S4 HT** **FHT 671 Y4 HT**
Order no.		42542/08 42542/12	42542/16 42542/14
Detector connection		14-pin tube base	BNC-HT cable connection
Comparator threshold for integral counting rate	mV	60	60
High voltage	V	0 – 1400	0 - 1400
Dead time	µs	1.6	1.6
Operating voltage	V	10 – 30	10 – 30
Diameter	mm	65	65
Length	mm	160	160
Weight	kg	0.5	0.5

The amplifiers can be used with different plastic scintillator types. As to the HT versions, the connection to the photo multiplier is realized via a BNC-HT device socket and a corresponding cable. This flexible connection is strongly recommended, in case that the amplifier, due to its susceptibility to shocks, should not be rigidly connected with the detector.
With the versions FHT 671 S4 and FHT 671 Y4, the amplifier is directly plugged in via a 14-pin pin contact.

11. Annex

11.1 Drilling template



Drill hole dimensions as indicated in the template.

11.2 Storage capacity in the FHT 6020 History

The measured values of the measuring devices shown in the following table can be saved in the history.

Table 29: Memory required in the history for the measuring instruments

Measuring device	Memory required	
FH40G 1	13	Bytes
FH40G 2	13	Bytes
Analog 1	9	Bytes
Analog 2	9	Bytes
Date	7	Bytes

Depending on the measuring instrument selected, a different number of data records can be stored.

Table 30: Storage capacity in the history

Combinations	Analog 1	Analog 2	FH40G 2	FH40G 1	Bytes / record	Min. storage capacity	Max. storage capacity
1	0	0	0	0	0	0	0
2	0	0	0	1	20	3276	4095
3	0	0	1	0	20	3276	4095
4	0	0	1	1	33	1984	2480
5	0	1	0	0	16	4096	5120
6	0	1	0	1	29	2256	2820
7	0	1	1	0	29	2256	2820
8	0	1	1	1	42	1560	1950
9	1	0	0	0	16	4096	5120
10	1	0	0	1	29	2256	2820
11	1	0	1	0	29	2256	2820
12	1	0	1	1	42	1560	1950
13	1	1	0	0	25	2620	3275
14	1	1	0	1	38	1724	2155
15	1	1	1	0	38	1724	2155
16	1	1	1	1	51	1284	1605

Storage capacity per ROM-page 16384 bytes

Above table shows the min. and max. number of data records that can be saved in the history.
As the measured value memory is deleted side by side, the storage capacity varies between the indicated minimum and maximum value according to the point in time when the last deletion process has taken place.

INDEX OF TERMS:

Thermo Fisher Scientific Messtechnik GmbH
Frauenauracher Straße 96
D-91056 Erlangen, Germany

+49 9131 998-0
+49 9131 998 475 fax

Post address:
P.O. Box 16 60
D-91051 Erlangen, Germany

www.thermoscientific.com/rmp
info.rmp.erlangen@thermofisher.com