



Thermo Scientific

Iodine Monitor FHT 1702 S-125

Technical Specification ZT-228E

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Chapter 1

System overview

The Iodine Monitor 1702 S - 125 can be used for various applications in the field of air contamination monitoring as well as for immission and emission measurements. With these applications the gaseous iodine activity accumulated since the first measurement and the present activity concentration can be measured and monitored.

Depending on the measuring application, the iodine isotope ^{125}I and its total activity can be detected. Additionally, a second energy window with thresholds above and below the iodine window is set to measure the background count rate (trapezoid method). The measurement is done in parallel to the sampling. The results are displayed as accumulated activity and derived concentration in units of Bq and Bq/m³, respectively.

The device can be operated by a touch panel.

The mechanical design of the device allows an easy transport, especially over stairs and obstacles. As the required floor space is very small, the Iodine Monitor 1702 S - 125 can be used e.g. for inspection work almost everywhere in the nuclear power plant.

Chapter 2

Functional Description

Measuring Principle

The sample air is passed through a 2¼” standard filter cartridge filled with iodine adsorbent. Elementary as well as organically bound iodine are precipitated. The filter cartridge is manually exchanged.

A NaI scintillation detector located in the axis of the filter cartridge continuously measures the low-energy gamma quanta emitted by the accumulated I-125 activity. The pulse height is discriminated by an appropriately set iodine window.

Measured Values

^{125}I activity in units of Bq (= time integral of the activity concentration), moving ratemeter calculation every second with a selectable time constant t_1

^{125}I activity concentration in units of Bq/m^3 , moving ratemeter calculation every second with selectable time constant t_2

Measuring Range

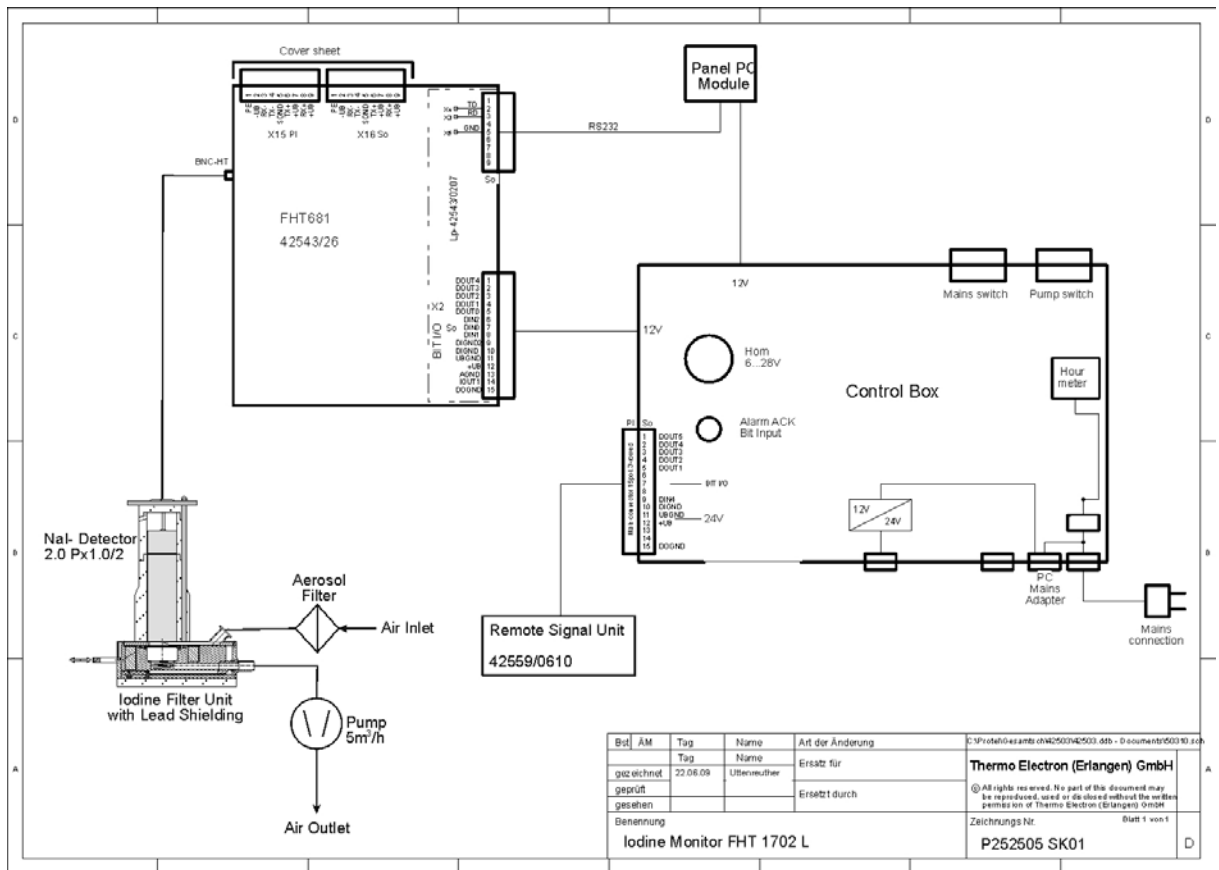
$10^0 \dots 10^5 \text{ Bq}/\text{m}^3$ related to 60 minutes sampling time

Minimum Detectable Activity Concentration (MDAC)

The minimum detectable activity concentration is provided according to ISO 11929

$< 0.6 \text{ Bq}/\text{m}^3$ related to ^{125}I with $t_1 = 5 \text{ min}$, $t_2 = 30 \text{ min}$ at a constant dose rate level of $100 \text{ nSv}/\text{h}$

Block Diagram



Chapter 3

Hardware Key Components

19" rack A 19" rack, 32 HE is used for the installation of the components mentioned in the subsequent paragraphs.

The cabinet fitted with:

- | a terminal block with potential-free relay contacts (change-over-relays, max. load of relays: 230 V/6 A)

alarm activity	X
alarm concentration	X
air flow min.	X
air flow max.	X
status ok	X
detector fail rate	X
analog output concentration	0,4 - 20 mA

- | Operation Hours Meter
The monitor is fitted with a non-resettable operating hours meter for the pump allowing to keep track of maintenance intervals.
- | Mains switch with fuse
- | Pump switch with fuse
- | Mains cord, 6m

Pump

- | Rotary vane vacuum pump,
optional: low noise gas ring vacuum pump with micromaster (variable frequency converter for 3 phase AC drives),
- | oil-free,
- | air-cooled

Aerosol Filter

- | Glass fibre GF10, grade H12 for prevention of contamination and pollution of the iodine cartridge by aerosols.

Heating Hose The heating of sample air intake reduce the relative moisture of the medium and thereby to enhance the degree of precipitation of iodine by the filter granules. The temperature of the complete detector

system is kept constant at $40\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. The temperature controller of the flexible heating hose is located at the front panel of the 19" rack.

Filter Drawer with Iodine Filter Cartridge

Filter drawer for standard charcoal filter cartridge. Lead bricks are inserted into the front and the side parts of the filter drawer to reduce the influence of external radiation fields.

The sample air passes through an in-let flange at the rear of the filter drawer. Its dead volume above the adsorber cartridge is minimized to eliminate cross sensitivity against noble gas. Then, the sample air flows through the iodine filter whereby the iodine is accumulated by the adsorber material. Having left the iodine filter, the sample air is let out again.

Detector

- | NaI scintillation detector with integrated photomultiplier

Shielding

Omni directional lead shielding made of ring elements above the filter drawer with top lid. The complete shielding is fixed by means of two threaded rods and a clamp (2 hexagon cap nuts).

Additional a lutetium adapter for peak stabilization is integrated in the lead shield.

Pre-amp

6 counters in total

4 counters are used for the three energy windows

- | background energy window left,
- | Iodine energy window and
- | background energy window right

Evaluation and Display Unit

Windows based Panel PC with

- | Touchscreen support
- | USB port
- | Ethernet port
- | USB stick
- | Data evaluation software, pre-installed

Air Flow Rate Meter

With automatic shut down of the pump upon exceeding the adjusted range of the pressure drop across the filter.

**Differential
Pressure Sensor
(Option 1)**

Pressure gauge to control the maximum allowed underpressure against the detector window due to, e.g. a blocked air inlet. Upon exceeding the maximum underpressure, the pump is shut down in order to prevent a damage of the detector window. The signalisation is triggered via the air flow measurement. Reset button in the front panel to restart the pump after trouble shooting.

**Alarm Signal Unit
(option 2)**

A remote signal unit consisting of 3 optical and 1 acoustical elements.

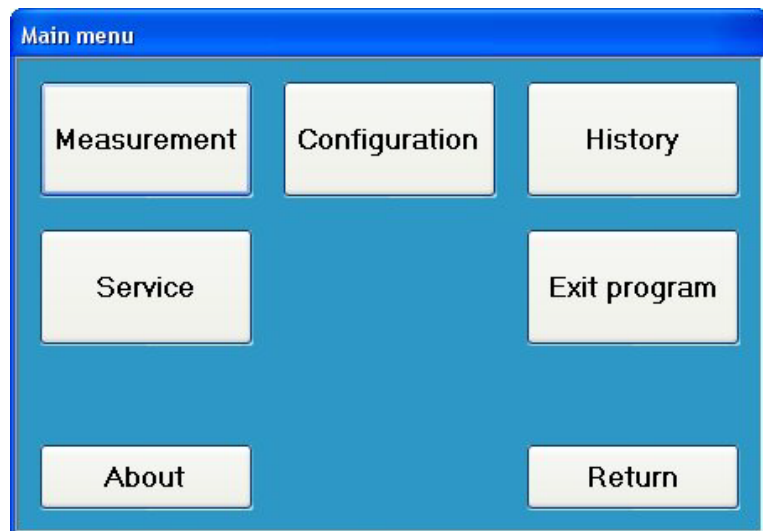
Chapter 4

Software

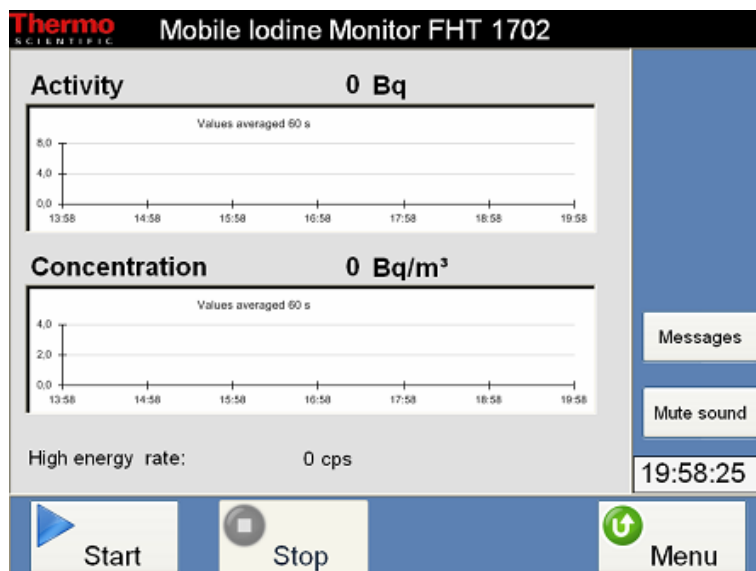
Windows-based touch screen operated GUI for the sampling of measurement values from the pre-amp display and storage of measurement values for activity, concentration and high energetic nuisance radiation configuration of the monitor administration of data history execution of service tasks

A windows based touch screen operated GUI for

- sampling of measurement values from the preamplifier
- display and storage of measurement values for
 - activity
 - concentration
 - high energetic nuisance radiation
- configuration of the monitor
- administration of data history
- execution of service tasks



Main Screen of the Iodine Software FHT 1702



Measurement Window of the Iodine Software FHT 1702

Chapter 5

Technical Data

Radiological

Parameter	Min.	Typ.	Max.	Unit	Condition/Note
Measuring Range	10 ⁰		10 ⁵	Bq/m ³	
Minimum Detectable Activity Concentration (acc. to ISO 11929)		0.6		Bq/m ³	t ₁ = 5min., t ₂ = 30min., amb. DR level approx. 100nSv/h
Efficiency		0,093		cps/Bq	¹²⁵ I
Background		0.2		cps	in compensation window amb. dose rate level: approx. 100nSv/h
		0.07		cps	In iodine window

Environmental Conditions

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Amb. Temperature				°C	
• operating	+ 15		+ 45		
• storage					
Permitted Temp. Gradient			15	K/h	
Sampled Air Intake Temperature	-10		+ 45	°C	with optional heating on
Barometric pressure	500		1050	hPa	
Rel. Humidity of Sampled Air at Intake	20		80	% R.H.	non-condensing

Electrical Connection

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Mains Voltage		230		V	AC, single phase
Mains Frequency		50	60	Hz	
Power consumption		300		VA	
Mains fuse		4		A	slow
Pump fuse		4		A	slow
Mains chord		6		m	

Dimensions and Weight

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Height		1600		mm	without packing
Width		600		mm	without packing
Depth		800		mm	32HU, without packing
Weight		170		kg	net, without packing

Detector

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Nal crystal					High transmission Be-window.
• Diameter		40		mm	
• Height		2		mm	
Efficiency		0.093		cps / Bq	
Resolution			10	%	for ¹³⁷ Cs
Cross-sensitivity		10		cps / Bq	¹³⁷ Cs, without compensation in the ¹³¹ I energy window
Operating Voltage		900		V	
Shielding		25		mm	lead, all directions
Detector Assembly				mm	incl. shielding
• Diameter		100	120		
• Height		240			

Digital Outputs

Function	Output
Signal horn	OUT0
Malfunction	OUT1
Alarm 1 (pre-alarm)	OUT2
Alarm 2 (main alarm)	OUT3
Measurement in progress1	OUT4

Digital Inputs

Function	Input
Push button "Ack alarm"	IN0
Signal "Air flow ok"	IN1
Signal "Heating ok"	IN2
(reserved)	IN3

Filter Drawer and Filter Cartridge

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Air Intake Flange		DN 16 KF			
Air Intake Filter • Diameter		50		mm	Sgrade
Filter Cartridge • Diameter • Height		58 27		mm	Charcoal
Cartridge Service Life		several weeks			depending on the iodine conc. of the ambient air
Cartridge Activity Load			1	MBq	

Pump

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Air Flow Rate		4	5	m ³ / h	
Supply Voltage		230		V	AC, single phase
Supply Frequency		50		Hz	
Power Consumption		250		VA	
Protection Class			IP54		
Noise Level			68	dB	at 1m distance
Maintenance Interval			6	month	

Heating

Parameter	Min.	Typ.	Max.	Unit	Condition / Note
Heating hose		H300			Hillesheim
Temp. controller		JRK100			
Supply voltage		230		V	
Frequency		50		Hz	
Power consumption		150		W	

Chapter 6 Consumables

Item	Reference number
Iodine Cartridge (10 ea)	SM149248269
Aerosol Filter (200 ea)	SM149248357
Carbon Vanes (1 set)	KT169001049

Chapter 7 Reference Sources

Reference Source Ba-133	To check the position of the ^{131}I peak;
Ref. no. SM149470556	geometry identical to the Iodine cartridge, homogeneously activated. Activity: 1.85 kBq

Chapter 8 Documentation included

- | 1 ea. Combined Hardware-Software Manual
- | 1 ea. bootable USB-Stick with Program, Configuration Utility and System Backup