MFplus

USER MANUAL



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Operation Manual –

Please carefully read and follow all instructions before operating the analyzer.

Inspect Shipment for Damage

Carefully inspect the entire shipment for damage in the presence of the shipper's agent, removing packaging material if necessary. Note any damage to packaging and/or goods on Packing List and have it signed by the shipper's agent prior to accepting the shipment. Submit damage claim to MRU immediately.

NOTE: Damage claims not received by MRU within 3 days of receipt of shipment will not be accepted.

Important notice!

This high quality electronic analyzer utilizes batteries that discharge even when the analyzer is not in use. Therefore it is very important to charge the batteries every 4 - 6 weeks, *even if the analyzer is not in use.* When it is fully charged, the analyzer should be switched on and allowed to zero itself before being switched off again.



Failing to properly charge the batteries will void your warranty!

Save the original box and the packing material for use if the analyzer must be shipped in the future.

The products described in this manual are subject to continuous development and improvement and it is therefore acknowledged that this manual may contain errors or omissions. MRU encourages customer feedback and welcomes any comments or suggestions relating to the product or documentation.

Please forward all comments or suggestions to the Customer Feedback Department at the following address:

> MRU GmbH Fuchshalde 8 + 12 74172 Neckarsulm / Obereisesheim GERMANY

Fon (+49) 71 32 99 62 0 (Reception) Fon (+49) 71 32 99 62 61 (Service) Fax (+49) 71 32 99 62 20 Email: <u>info@mru.de</u> Homepage: <u>www.mru.eu</u>

This manual is intended solely as a guide to the use of the product.

MRU shall not be liable for any loss or damage whatsoever arising from content errors or misinterpretation of information's from this manual or any mis-use resulting from the use of this manual.

2 Introduction

2.1 The Multi-purpose instrument MFplus

The Multi-purpose instrument is used for:

- Pipe tests
- Mobile gas leakage detection (option HC-sniffer)
- 2-channel differential pressure measurement
- Temperature measurement
- Differential temperature measurement
- Humidity measurement (incl. temperature and barometric pressure)
- Barometric pressure measurement
- Flow speed measurement using vane probe or Pitot tube with flow rate calculation
- 4-Pa-test

2.2 The company MRU GmbH

Your instrument is produced by the MRU GmbH in Neckarsulm Germany (founded in 1984), a medium sized company that specializes in developing, producing and marketing high quality emission monitoring analyzers. MRU GmbH produces a wide range of instruments, from standard analyzers up to tailor made industrial analyzers. MRU GmbH contact details are listed on the previous page.

2.3 Important general information (EN 50379) and VDI 4206

This analyzer is not designed to be used for continuous measurements.

Before using the instrument verify the condition of the various parts of the instrument, such as the probes, the ambient air conditions and the connectors for damage and/or blockages.

The use of the instrument for regulatory purposes is subject to special regulations (for example a periodical examination of the instrument). Please obtain the appropriate regulations from your local responsible authority.

2.4 Important information about the users/operation manual

The users/operation manual is an important part of this delivery. It will explain how to use this instrument properly and sets forth safety and environmentally friendly procedues.

It is the responsibility of all users to read and familiarize themselves with this manual, paying particular attention to the safety instructions.

The most important safety details are listed in chapter 3 (Safety Information). Additional safety details in other chapters are clearly marked with an *attention* sign.Safety information

The following safety procedures must to be followed at all times. They are a significant and essential part of this manual. Failure to follow safety procedures can result in the loss of your warranty claims.

2.5 Safety regulations

- 1. The MFplus may only be used as indicated in this manual.
- 2. Our instruments are checked according to the following regulations: **VDE 0411 (EN61010)** and **DIN VDE 0701** before they leave the MRU GmbH factory.
- 3. MRU technical products are designed and manufactured according to **DIN 31000/ VDE 1000** and **UVV** = **VBG 4** of the professional guilds for fine mechanics and electrical engineering.
- 4. MRU GmbH assures that the instrument complies to the essential requirements of the legal regulations of the member states of the electro-magnetic compatibility (2014/30/E) and to the low-voltage regulations (3/23/EWG).

2.6 Specific safety regulations

- 1. Use only the battery charger supplied with the analyzer for this instrument
- 2. No part of the instrument, including the metal probe tube and all other metal parts & accessories are to be used as electric conductors.
- 3. The instrument is not to be used in or under water.
- 4. The instrument is not to be placed near or directly exposed to open fire or heat.
- 5. The specified probe temperature range is not to be exceeded, as the probe, temperature sensory mechanism and sensor could be damaged or destroyed.
- 6. The instrument shall void dropping.



2.7 Guideline for Li-Ion Batteries

- The battery pack is not accessibly for end users
- Li-Ion rechargeable battery pack for OPTIMA 7 Combustion Analyzer
- Do not heat or throw the battery pack of in fire. Do not charge and leave the battery pack at the high temperature.
- Do not deform, short-circuit, disassemble or modify the battery pack
- Do not allow the battery to be immersed in or wetted with water or sea water
- Do not subject the battery pack to a strong impact or throw it
- Do not cut, squeeze, tear at the cables of the battery pack
- Do not carry or store the battery pack together with material which have sharp edges or is electrical conductive in the same custody
- Not letting (+) terminal come in contact with (-) terminal or metal
- The above items may cause heat, fire and explosion

Your quality management MRU GmbH

3 Returned goods

Packing regulation of 12.07.1991

If your local waste facility does not except MRU packing materials for disposal, you may return it to MRU or our local sales representative. Packing materials returned to MRU must be returned prepaid.

3.1 Return of hazardous waste

Waste Disposal/Returns/Warranty -

MRU GmbH is required to accept the return of hazardous waste such as electro-chemical sensors that cannot be disposed of locally. Hazardous waste must be returned to MRU prepaid.

Die Rücklieferung muss für uns kostenfrei erfolgen.

Schadstoffhaltige Teile sind: z.B. elektrochemische Sensoren, Batterien und Akkus.

3.2 Return of analyzer according to ElektroG

MRU GmbH is required to accept the return, for proper disposal, of all analyzers delivered after 13th of August 2005. Analyzers must be returned to MRU prepaid.

4 (not used)

5 Instrument description

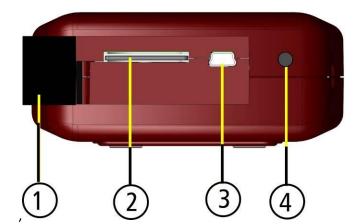
5.1 Instrument front



1	Display

2 Key pad

5.2 Connectors - top



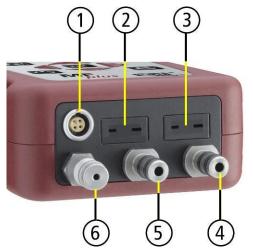
1	Cover
2	SD-card reader (only by using a MRU-SD-CARD we can assure the compatibil- ity of all analyzer functions)
3	USB-interface
4	IR-interface

5.3 Instrument Connectors - bottom side (Model pressure / temperature)

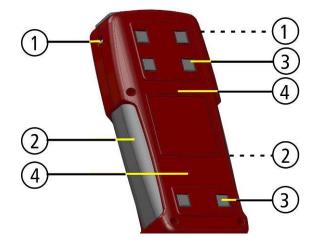


1	AUX connector			
2	Temperature connector T2			
3	Temperature connector T1			
4	Pressure connector P1			
5	Pressure connector P2			
6	Pressure connector P3			
7	Pressure connector P4			

5.4 Instrument Connectors - bottom side (Model TRGI)



5.5 Instrument back



1	AUX connector
2	Temperature connector T2
3	Temperature connector T1
4	Pressure connector P1
5	Pressure connector P2
6	Pressure connector P3 (TRGI)

1	Eyelets for carrying strap
2	Handle strip
3	Analyzer feet
4	Fixing magnets

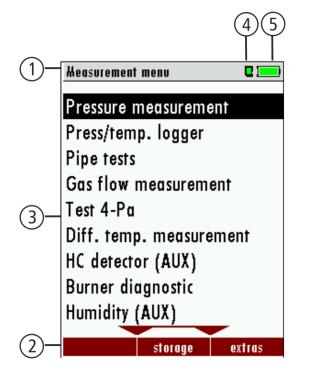
6 Accessoiries

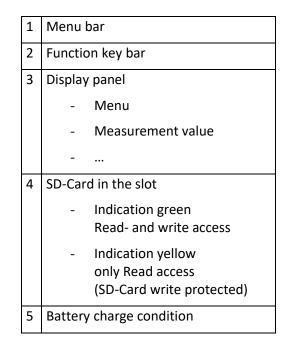
A complete list of available accesoires can be found in the current price list of this instrument.

7 Operating

7.1 The Display

All information required to operate the instrument is displayed as shown below.





7.2 The Keypad

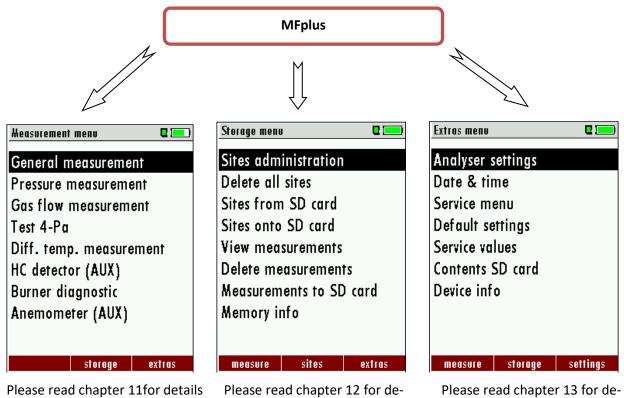
Description and function of the keys:

ON / OFF	Press to switch ON/OFF the instrument without delay.
Function Keys	Activates the functions seen on the display (2 function key bar)
Menu Key	Will show all available functions in the window that is currently in use – also those which have an individual key on the key pad like the printer and the three function keys.
ESC	Abort or return to the menu above
Arrow Keys	Jump in between lines, change values
ОК	Confirmation key, select a marked menu point
Printer	Activates the printer function in the measurement and service window.

7.3 Menu configuration

The MFplus organizes all available actions in three main menus:

- Menu Measurement \rightarrow all tasks for the measurement programs of the instrument. Here you can select all installed and available measurement programs.
- Menu Memory \rightarrow all tasks for the management of the data memory available.
- Menu Extras → all the other available tasks for management and customizing your instrument



tails.

tails.

You can jump in between the 3 main menus with the 3 function keys (according to the displayed name on the screen).

8 First use of the instrument

After the instrument has been inspected and is ready for start up it can be switched on and personalized settings can be entered. These settings can be changed at any time.

8.1 Analyzer ready for operation

- Unpack the analyzer, read the complete manual
- The instrument was shipped completely assembled, in working condition and ready for operation. It is recommended that the instrument is thoroughly inspected for completeness and damage.
- Recommendation: charge the batteries for 8 hours prior to use.
- Check/Change date and time

8.2 Instrument settings

The "Settings" menu allows configuring some instrument specific paramteres.

In the main menu "EXTRAS" = "F3 key" - scroll down to "Settings" then press the "OK" key, By selecting a line the parameter value can be changed by the arrow keys.

Extras menu 🛛 🗖 💻	Analyser settings	C 💻	Analyser settings	0 📼	Analyser settings 🛛 🗖 💻
Analyser settings	LCD brightne	ess (%) 50	LCD brightness (%	%) 50	
Date & time	Country	England/intern.	Country Eng	land/intern.	ATTENTION !
Service menu	Language	English	Language	English	Changing the country
Default settings	Helping hints	s ON	Helping hints	ON	Changing the country causes the loss of some
Service values	Keyboard be	ep ON	Keyboard beep	ON	
Contents SD card					individual settings!
Device info					abort
					continue
					commue
measure storage settings	OK print-out	measurem.	print-out	measurem.	print-out measurem.

LCD brightness	5 – 100 %	Display-brightness, depending on temperature and also on the personal judgement of the user, at 20°C a value of ca. 50% is normal
Language	DE/GB/FR/ITCZ/RO/TR/ ES/	Select device languages
Country	DE/USA/GB/IT/AT/RO/ ES/ plus others	Enables some country specific parameters
Helping hints	ON / OFF	Helpful hints activated or deactivated (explanation below)
Keyboard beeper	ON / OFF	Keyboard beeper activated or deactivated

Explanation for "Helping hints":

Some helpful hints which are very useful for an inexperienced user but are not needed by experienced users, can be activated or deactivated. The following hints will be affected:

"Reminder! Charge batteries at regular intervals!"

"Measurement stopped/started."

8.2.1 Setting printer type and print-out

In the main menu "EXTRAS" item analyzer settings: print-out settings.

Analyser settings	۵ 📼	Print-out settings	C 📰
LCD brightness (%) 50	Print logo	OFF
Country Eng	gland/intern.	Print site lines	3
Language	English		
Helping hints	ON		
Keyboard beep	ON		
print-out	measurem.	E1	

Print logo ON/OFF:

Print logo see chap. 13.1

Print site lines 0 ... 9:

Line 1 (Site no.) is necessary, further lines (freetext) printable if necessary see chap. 13.2

8.2.2 Measurement settings

Standard condition

The standard conditions for temperature and pressure are standard sets of conditions for experimental measurements to be established to allow comparisons to be made between different sets of data.

In the menu "measurement settings" you can choose the different std. conditions or you can also define the standard condition.

Heasurement settings	0 💻		Measurement settings	0 📼
Temperature unit	°C		Temperature unit	°C
Std. conditions	Users		Std. conditions	STP/IUPAC
Std. Temp [°C]	0		Pressure (left)	
Std. press [hPa]	1000.00		Pressure unit	Pa
Pressure (left)			T90 time [s]	6
Pressure unit	Pa		Pressure (right)	
T90 time [s]	6		Pressure unit	hPa/Pa
Pressure (right)			T90 time [s]	10
Pressure unit	hPa/Pa			
return		→	return	

Analyser settings	Q 🧰	Measurement settings	
LCD brightness (%)	50	Temperature unit	°C
Country Engla	nd/intern.	Pressure unit	hPa/Pa
Language	English		
Helping hints	ON		
Keyboard beep	ON		
print-out	measurem. 📑		

Temperature heating	°C or °F	Change the unit for temperature in all screens
Pressure unit	hPa/PA, hPa, kPa/Pa, kPa, mbar, mmH2O, cmH2O, inchH2O,mmHG, inchHG, PSI, Pa	Change the unit for pressure in all screens. The meaning of hPa/Pa and kPa/Pa is that the instru- ment performs a dynamic change of unit depend- ing on the absolute value of pressure.

8.3 Setting time and date

Extras menu 🛛 🖬 📰	Do	nte & time	0 💻		
Analyser settings				F2	Edit
Date & time				FZ	Euit
Service menu	D)ate	TUE 16.04.2013		Change the marked num-
Default settings				,	ber
Service values	Т	ime	07:46:01		
Contents SD card					Move the cursor to the
Device info					next position
				ESC	Back to Extras menu
measure storage settings	ок 📕		modify		

9 Maintenance and Cleaning

9.1 Cleaning

The MFplus needs to the long value preservation only one very low maintenance need:

• after longer disuse load battery first and afterwards approx. all 4 weeks

9.2 Service and Maintenance

- An annual service check and if necessary adjustment of the sensors at an MRU service department (<u>www.mru.eu</u>) are recommended for the preservation of value.
- With optional gas detector: In the case of a use to the pure leakage detection (maximum value search) a fubction check of the equipment is enough e.g. over an impact from a search gas bottle. A long-term continuous detector accuracy is guaranteed however only by an annually repeated calibration of the equipment.

10 Preparation for each measurement

If you switch on the analyzer with an instrument temperature below 0°, the message appears:

"Due to low device temperature the measuring accuracy is reduced"

If necessary, increase the instrument temperature to avoid measurement inaccuracies.

Switch off the analyzer.

Place the analyzer in a heated room, for example.

Wait until the device temperature exceeds 0°C (32° F).

Switch on the analyzer.

If no message appears, the measurement accuracy is restored.

10.1 Power supply

the instrument can be used with:

- 1. with the internal MRU battery (provided)
- 2. with the MRU battery charger (provided)

External equipment may only be connected while the analyzer is switched off!

10.2 Auto Off

The instrument is automatically switched off after 60 minutes.



During a measurement or a battery charging cycle the auto off is deactivated.

10.3 Measurement with battery charger/battery charging

When ever you connect the instrument with external power supply (100..240 V / 50/ 60Hz) the battery of the instrument will be charged.



At the moment, if the battery is fully charged and the trickle charge mode begins an acoustic feedback will be played.

10.4 Measurement with battery (Battery monitoring)

The battery symbol in the top right corner displays the current battery charge condition.

Approximately 15 minutes (depending on the instrument configuration) before the battery is drained, the battery symbol will start to blink red (about once per second).

If the battery is almost drained and the analyzer is not connected to the battery charger within one minute, then the instrument will switch off automatically to prevent deep discharge of the battery.



11 How to take a measurement

11.1 General measurement

The general measurement allows the simultaneous measurement of all existing sensors. The measurement can be stored individually and printed. Further, a long-term measurement can be recorded.

Heasurement menu 🛛 🖬 💷] [General measure	ement	
General measurement		Temperature T1 [°C]	2:	5.4
Pressure measurement Gas flow measurement		Temperature T2 [°C]	2:	5.1
Test 4-Pa Diff. temp. measurement		Pressure (right) [Pa] fine	().2
HC detector (AUX) Burner diagnostic		Pressure (left) [Pa] fine	-().3
Anemometer (AUX)		AUX [bar]	1.8	59
storage extras	ок	auto-log	store z	ero point

Only the connected sensors will be displayed.

If the measuring window is full and the AUX sensor will be additional connected (menu key AUX on/AUX off) the last line can be chosen between differential temperature and AUX with the arrow keys un/down

11.1.1 Settings

The temperature and pressure sensors can be setted individually via the menu button / settings.

General measurement 🛛 🗖 💻	General measurement 🛛 🗖 💻	Heasurement settings	C 💻
Temperature 11 25.4	Temperature T1 24.4	Temperature unit	°C
Temperature T2 25.1	T settings [1 AUX off	Pressure (left)	
Pressure (right)	Auto log function (F1)	Pressure unit	hPa/Pa
Pressure (right) 0.2	Store measurement (F2)	T90 time [s]	6
	p zero point (F3)		
Pressure (left) [Pa] fine -0.3	r print-out (Pr)	Pressure (right)	
	A return (Esc)	Pressure unit	hPa/Pa
AUX 1.859		T90 time [s]	10
auto-log store zero point	auto-log store zero point	return	

11.1.2 Pressure / Temperature logger

Using the DATA logging function the MFplus can protocoll pressure and temperature.

The user can widely adjust the properties of the measurering automatic to his current needs. The DATA will be saved onto the internal memory and can later be transferred onto the SD Card.

General measurement	0	Auto log function	C 💷)	General measurement 🛛 🗳 💻
Temperature T1 25 [°C]	.4			Temperature 11 24.4
Temperature T2 25 [°C]	.1	Duration	30:00	Temperature T2 27.3
Pressure (right) [Pa] fine	.2	Interval	5:00	Pressure (right) [Pa] fine -2.2
Pressure (left) [Pa] fine -O	.3	Required memory Available memory	6 15962	Pressure (left) [Pa] fine -0.3
AUX [bar] 1.8	59			AUX [bar] 1.860
auto-log store zei	ro point F1	start	export CSV	F1 stop 29:51

To activate the DATA logging function press the F1 button "Log".

11.1.3 DATA logging internal memory

The internal memory has a limited capacity, therefore the relationship between total measuring time and measuring interval also has ceratin limits, when the the measurering automatic saves values internally. The MFplus will display the expected needed memory space. In case the needed memory space is bigger than the available memory space you can either reduce the measuring time or increase the measuring intervals.

You can also delete saved measurements to have more available space for storage.

Auto log function		Auto log function	
Duration	30:00	Duration	30:00
Interval	5:00	Interval	5:00
Required memory	6	Required memory	6
Available memory	15962	Available memory	15962
start	export CSV	start	export CSV

11.1.4 Loggen DATA logging internal memory with automatic export to SD Card

This function allows a continious measurement over a period of 10 days. The SD card must be in the SD card slot. The MFplus will start saving the data in the internal memory and once the memory is full the data will automatically be transferred onto the SD Card. Each export will create a file (Format LOG000XX.csv).

11.1.5 Settings

- Measurement time in minutes(1 Minute 24 hours or 10 days with SD Card) Total measung time of the measurering automatic.
- Intervall in seconds (1 second 2 hours)
 Start the measurering automatic with the F1 button.
- With the F3 button the complete memory will be exported onto the SD Card. (if measurements are saved in the internal memory)

Start recording using the F1 button "Start".

During recording the remaining time will be displayed.

Stop 179:57

Once recording is completed the data can be exported onto the SD Card using the F3 button. (In case you have selected "10 days SD-Card"

the data will be exported automatically.

Log Export CSV

11.1.6 Site selection

The saved measuremet data will be saved to the selected site.

Select the site where you want the data to be saved to before starting the measurering automatic. The site can be selected in the STORAGE MENU. With the buttons left and right you can select either the previous or

measure sites extras

 Storage menu
 Sites administration

 Sites administration
 2010080

 Delete all sites
 CUSTOMER

 Sites onto SD card
 View measurements

 Delete measurements
 Measurements to SD card

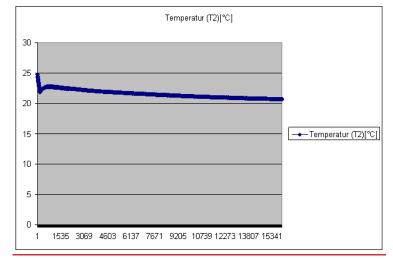
 Memory info
 Memory info

OK new modify delete

11.1.7 Evaluating data using Excel

× 1	Microsoft Excel - LOG00051.csv								
: 🗐	<u>D</u> atei <u>B</u> earb	eiten <u>A</u> nsicht	Einfügen For	rma <u>t</u> E <u>x</u> tras	Date <u>n E</u> enste	rr <u>?</u>			
:	📂 🖬 💪 (🎔 🛍 🐰 🗉	a 🛍 • 🛷	9 - C - 1	Ξ 😣 Σ - 👌	↓ X↓ 🛄 🕝	Arial	•
_						:			- 8 # 8
	A1 🗸	r <i>f</i> ∡ Ar	nlagen-Nr.						,
	A	В	С	D	E	F	G	Н	
1	Anlagen-Nr.	Datum	Uhrzeit	Temperatur (1	Temperatur (1	Druck 2[hPa]	Druck 1[hPa]	Aux[bar]	Reserv.
2	Anlage #3#	25.02.2013	17:14:17	24,8	25	0	0	0	0
3	Anlage #3#	25.02.2013	17:14:18	24,7	25	0	0	0	0
4	Anlage #3#	25.02.2013	17:14:19	24,7	25	0	0	0	0
5	Anlage #3#	25.02.2013	17:14:20	24,8	25	0	0	0	0
6	Anlage #3#	25.02.2013	17:18:38	24,4	24,5	0	0	0	0
7	Anlage #3#	25.02.2013	17:18:39	24,4	24,5	0	0	0	0
8	Anlage #3#	25.02.2013	17:18:40	24,4	24,5	0	0	0	0
9	Anlage #3#	25.02.2013	17:18:41	24,4	24,4	0	0	0	0
10	Anlage #3#	25.02.2013	17:18:42	24,4	24,5	0	0	0	0
11	Anlage #3#	25.02.2013	17:18:43	24,4	24,5	0	0	0	0
12	Anlage #3#	25.02.2013	17:18:45	24,4	24,5	0	0	0	0
13	Anlage #3#	25.02.2013	17:18:46	24,4	24,4	0	0	0	0
14	Anlage #3#	25.02.2013	17:18:47	24,4	24,5	0	0	0	0
15	Anlage #3#	25.02.2013	17:18:49	24,4	24,5	0	0	0	0
16	Anlage #3#	25.02.2013	17:18:50	24,4	24,4	0	0	0	0
17	Anlage #3#	25.02.2013	17:18:51	24,4	24,5	0	0	0	0
18	Anlono #3#	25.02.2013	17-18-52		24.4	Π	Π	Π	Π

The saved Excel data can be modified.



Additional information about the file format can be found in chap. 13.4.3 Exporting data, in the user manual

IMPORTANT: please use the AC/DC adaptor for long term measurements..

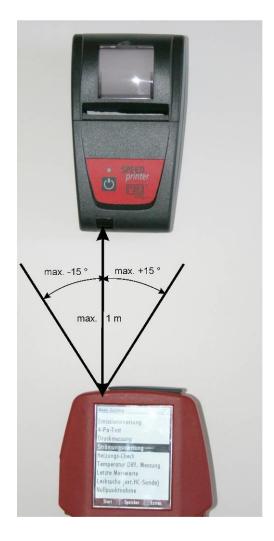
11.2 Storage the measuring results

If in the function key bar "store" is indicated, you can store with the accompanying function key F2 or F3 the measurement in the data memory. The function of the data memory is explained in chapter 12.

11.3 Printing the measurement results

While in the measurement window pressing the printer key will send the information to the IR printer.

The speed printer (IR desktop printer) Art. No. 62693 must be aligned in addition as follows:



All values that can be seen in the measurement window on all three pages will be printed, double measurement values will only be printed once.

Further technical specifications as well as battery and paper rolls changes please see separate printer manual.

11.4 Pressure measurement

Pressure (4 values) is measured and saved to the selected measurement name. The actual measured value is displayed in the middle of the display. The 4 measurement names can be changed as desired.

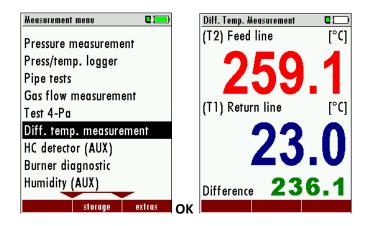
The hose on the draft + connector must be connected for draft measurements.

The second hose on the Delta P- connector must be connected for differential measurement.

	General measurement		hPa		
	Pressure measurement	Differ.pressure	-0.00		
	Gas flow measurement	Gas flow pressu	0.00		
	Test 4-Pa	Pressure 3	0.00		
	Diff. temp. measurement	Pressure 4	0.00		
	HC detector (AUX)				
	Burner diagnostic		4.0		
	Anemometer (AUX)	[Pa]	1.3		
	storage extras	OK accept zero point	store		
— , •	Select the measurement	name 1-4			
F1	Save the measured value	e to one of the measu	urement		
	name				
F2	Zeroing the pressure sensor				
F3	Change the name of the measurement category				
ESC	Detune to the measure	Return to the measurement menu			
F2					

11.5 Differential temperature measurement

The MFplus can display two temperature values in the menu Differential Temperature if two temperature sensors are connected to T1 and T2. The instrument will also calculate and display the differential temperature.



Note:

The accuracy of the difference temperature measurement is guaranteed only on use of the MRU temperature sensors.

12 Data Storage

12.1 Organisation of the data memory

Basis of the data memory of the MFplus is a set of sites stored in the device. Every site exists of an unique site number and 8 freely usable text lines which can have, e.g., the address, customer name etc.

The device can store up to 4000 different sites.

Sites can be created in the device and be changed, or could be imported from a PC program. Attention: sites created in the device and site data changed in the device will not be updated towards the PC. The device does only transmit to the PC the measurement values, but no information about site data.

Measurements are stored by assigning them to a site. Measurements can be, on this occasion, singles flue gas measurements or other measuring programmes available in the device.

12.2 Information about the data memory

In the menu item "storage" you select "memory info" to get information about the actual memory volume. The part of free memory, the total number of the stored sites and the number of the measurements stored all together, split in the kind of the measurement is listed.

Storage menu 🛛 🗖 💻	Hemory info		Memory info	
Sites administration	Available memory (%)	99.5	Test 4-Pa	5
Delete all sites	Sites	3	Pressure measurement	5
Sites from SD card	Test 4-Pa	5	Flow measurement	0
Sites onto SD card	Pressure measurement	5	Temperaturverlauf	11
View measurements	Flow measurement	0	Belastungsprüfung	3
Delete measurements	Temperaturverlauf	11	Dichtheitsprüfung	3
Measurements to SD card	Belastungsprüfung	3	Gebrauchsfähigkeitpr.	4
Memory info	Dichtheitsprüfung	3	Pipe tests	1
	Gebrauchsfähigkeitpr.	4	Flüssiggasleitungen	0
measure sites extras	ок			
industro sites cittus			▼	

12.3 Site administration

In the menu item "Sites administration" you are able

- view all data of the stored sites
- create new sites
- change date of existing sites
- delete sites

Storage menu	I	•
Sites adm	inistration	
Delete all	sites	
Sites from	n SD card	
Sites onto	SD card	
View mea	surements	
Delete me	asuremen	ts
Measurem	ents to SD) card
Memory in	nfo	
· ·		
measure	sites	extras

Attention:

In the device new created sites and changes in the data of a site will not transmit to the PC back

12.3.1 View and search sites

If the menu item "Site administration" will be selected for every stored site will be displayed with:

- of the unequivocal site number in the first line which is set down because of this meaning colorfully,
- the other 8 free text lines.

With the arrow keys on the left / on the right you scroll by all sites.

In this menu item, as well as in the menus for viewing the measurements, you can filter straight after sites by using a search mask.

• Select with the menu key "Search a site"

Sites adminis	tration	0 💻	Sites admin	nistration	0 💻
2010080			2010080)	
CUSTOME	R		Search	a site	
			Storag	e menu (Es	c)
			New sit		
			Modify	site (F2)	
			Delete	site (F3)	
			return	(«)	
			forwar	d (»)	
new	modify	delete	new	modify	delete

• Now you can enter the text to be searched for the first line, i.e. the site number, or for the second line, or for the rest of the text lines.

Search a site	Q 💻
Search a site	
Search a sile	
search in:	
Site no.:	
Line 2:	
Other:	
abort	modify

• Select the line for searching (site no. No., line 2, or rests) and select F3 "modify"

• Now in the indicated text input field you can enter a combination of letter, character and figures for whose occurence is searched in the selected text field. Press then "OK".



• Select after input of the search text F2 = "start"

Search a site		•
Search a s	ite	
search in:		
Site no.: Line 2:		
Other:		A
abort	start	modify

• If only one site is found as a result of the search, this is displayed. If became several sites the total number is found in the header viewed and you can scroll by this found standing with the arrow keys.

	Page through the sites							
	Menu key: Search site							
	igta, $igtarbox$: Selection of the input field							
	F3: Input mask, see chap. 15.1							
	F2: Start search							
	• According to the search criteria found sites page through. If							
	no saved site with the search criteria agrees occurred the Me-							
	dung: "Search unsuccessfully"							
ESC	Back to storage menu							

12.3.2 New entry and change of sites

In the menu item "Sites administration" you can new entry sites and change data of existing sites.

Select F1 = "new" for a new site. Besides, it is displayed:

- The first line which must contain an unequivocal site number to the identification of the site. With the function F2 = "auto no." can assign the device automatically a free site number.
- All further free text lines which can contain, e.g., name and address.

Storage menu 🛛 🖬 💻	Sites	s administration			Hodify site 🛛 🗖 💻
Sites administration	201	10080			Site no. (required)
Delete all sites	CUS	STOMER			Free text (e.g. name)
Sites from SD card					Free text (e.g. name suppl.)
Sites onto SD card					Free text (e.g. street & no.)
View measurements					Free text (e.g. ZIP & town)
Delete measurements					Free text
Measurements to SD card					Free text
Memory info					Free text
					Free text
measure sites extras	ок	new modify	delete	F1	modify auto no.

In the new site or an existing site you can change the data while you select the too change line, F1 = "modify" select and use the text input field for editing of the text. Conclude the text input field with "OK" and store the

updates with F3 = "store".

Modify site 🛛 🗖 💻	Modify site 🛛 🗖	Sites administration
A	A Free text (e.g. name) Free text (e.g. name suppl.)	A
ABCDEFGHIJKLM NOPQRSTUVWXYZ abcdefghijklm	Free text (e.g. street & no.) Free text (e.g. ZIP & town)	
n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9 ! # &	Free text Free text Free text	
☐ () * + , / : ; = ? ÄÖÜäöüß@€áàéè delete insert set char.	or F2 modify store	F3

12.3.3 Delete sites

You are able to

- delete the displayed sites only by selecting the menu entry "F3" = "delete
- or delete all sites at the same time

Storage menu 🛛 🗖 💻	Storage menu 🛛 🗖 💻
Sites administration Delete all sites Sites from SD card Sites onto SD card View measurements Delete measurements Measurements to SD card Memory info	ATTENTION !!! All stored sites and all measurements will be deleted ! continue abort
measure sites extras	OK measure sites extras

This user's decision must be confirmed. (see chap. 15.2)

12.4 Data transfer via SD Card (Option)

The data exchange format is CSV. A character-separated values (CSV) file is a simple text format for a database table. Each record in the table is one line of the text file. Each field value of a record is separated from the next by a character. MFplus uses a semi-colon ';' as value separator (other implementations use sometimes a comma). Implementations of CSV can often handle field values with embedded line breaks or separator characters by using quotation marks or escape sequences. CSV is a simple file format that is widely supported, so it is often used to move tabular data between different computer programs, for example Microsoft Excel[™] or Access[™], that support the format. Also other computer programs offer this type of interface because it is widely spread and easy to use.

The following functions are available from Software Version 1.11 and higher:

- Import of Sites
- Export of Sites
- Measurements

12.4.1 Import of Sites

Storage menu 🛛 🗖 💻		Sites from SD card	
Sites administration		Sites from SD card	
Delete all sites			
Sites from SD card		No sites file found	
Sites onto SD card			
View measurements		Found sites	0
Delete measurements		Imported sites	0
Measurements to SD card		Max. importable	3998
Memory info			
measure sites extras	01		
industro sinos carras			

With this function you can Import Sites which have been created on a computer or another instrument.

The File name must have the name "anlagen.csv" (anlagen = german for sites). The file has no column heading that means that the first line already has user data. Each line has a minimum of 9 columns (with 8 semi-colons) and the first field in the line will be the site number. All data will be imported as long a site number is available. Per field a maximum of 24 characters will be imported, too long words will be cut off.

Example file with 8 valid sites (4 with 9 lines and 4 with less lines):

A1-Z1;A1-Z2;A1-Z3;A1-Z4;A1-Z5;A1-Z6;A1-Z7;A1-Z8;A1-Z9 A2-Z1;A2-Z2;A2-Z3;A2-Z4;A2-Z5;A2-Z6;A2-Z7;A2-Z8;A2-Z9

A3-Z1;A3-Z2;A3-Z3;A3-Z4;A3-Z5;A3-Z6;A3-Z7;A3-Z8;A3-Z9

A4-Z1;A4-Z2;A4-Z3;A4-Z4;A4-Z5;A4-Z6;A4-Z7;A4-Z8;A4-Z9

A5-Z1;A5-Z2;A5-Z3;A5-Z4;;;;;

A6-Z1;A6-Z2;;A6-Z4;;;;;

A7-Z1;;;A7-Z4;;;;;

A8-Z1;;;;;;;;

Example file with 2 invalid sites (1 with not enough fields and 1 with missing site number):

A1-Z1;A1-Z2

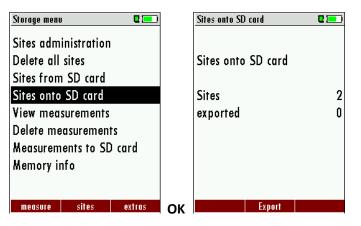
;A1-Z2;A1-Z3;A1-Z4;A1-Z5;A1-Z6;A1-Z7;A1-Z8;A1-Z9

Important:

Whilst importing data from the SD Card to the instrument there is no check for double site numbers (Line 1), neither inside of the file that is imported nor between the file and the sites already inside the instrument. The instrument can easily handle double site numbers but you could face problems with double site numbers when exporting them again to a computer program (see also Export of Measurements).

However the instrument marks the files that have been imported successfully. If you try to import a file with the same instrument that is already in the instrument you will get a red information screen.

12.4.2 Export of Sites



This function can be used for an instrument back up or if you wish to supply the instrument information to a computer program or another instrument. This is very handy if you have made some modifications inside the instrument (site) for example if you have modified the phone number of a customer and this modification needs to be updated in the computer software, or if a second analyzer needs to have the same site information.

The File format ist the same as described above, Import of Sites".

Only the file name is different, the file name will be ,ANLxxxxx.csv', in which the xxxxx are continuing 5 digit numbers with leading zeros. If the file must be imported into another instrument, the file must first be renamed into "anlagen.csv".

12.4.3 Export of Measurements

This function is used to export the measurements from the instrument to a computer program.

Attention! This function is not suitable for back up or for the transfer to another instrument because the exported file can not be imported again!

The created file has the name ,EMIxxxxx.csv', in which the xxxxx are continuing 5 digit numbers with leading zeros.

12.4.4 Export of Differential Pressure Measurements

The same function as under 12.4.3(Export of Measurements) only the file name is different.

The created file has the file name "DDMxxxxx.csv", in which the xxxxx are continuing 5 digit numbers with leading zeros.

The created file has a column header with the following information: Site number, Date/Time, as well as 4 saved pressure measurements.

12.5 Measurements in the data memory

12.5.1 View measurements

In the menu item "View measurements" you can inspect the stored measurements. After selection of this item you receive first an overview of the number of the stored measurements according to measuring type.

Storage menu	1	C 💷)	View measur	ements	
Sites administration			View mea	surements	
Delete all	sites				
Sites from	n SD card		Test 4-Pa		5
Sites onto	SD card		Pressure i	neasurem.	5
View measurements			Pipe tests		11
Delete me	asuremen	ts	Flow mea	surement	0
Measurem	ients to SD) card			
Memory info					
measure	sites	extras		view	

- Select a measuring type.
- Then you receive first a page with context information to the stored measurement. Scroll with the arrow keys by the context information of the stored measurements.

Pressure measure	nent	C ()
TUE 16.04.2 Anlage #3#	013 (07:59:49
		hPa
Differ.pressur	e	0.00
Gas flow pres	SU	0.00
Pressure 3		0.00
Pressure 4		0.00
new th	s site	delete

- With F2 = "measured value" are displayed the measured data of the stored measurement in detail, available in 3 measuring value pages, as they are defined in the measuring value window.
- With ESC you return to the context information of the measurement.

You have the possibility to display only those data that are assigned to a single site:.

- either F1 = "this site", while a measurement of the desired site is displayed.
 With F1 = "all sites" you cancel this filter again.
- or while you select with the menu key the function "search a site" and execute, as described in the chapter site administration.

12.5.2 Delete measurements

You are able to

- delete single measurements, while they are displayed press the key F3 = "delete".
- or delete all measurements of a measuring type.

Storage menu 🛛 🗖 💻		Delete measurements		Delete measurements 🛛 🗖 💻
Sites administration Delete all sites		Delete measurements		ATTENTION !!!
Sites from SD card			51	All selected
Sites onto SD card		5	36	measurements
View measurements		Pressure measurem.	1	will be deleted !
Delete measurements Measurements to SD card				
Memory info				continue
				abort
measure sites extras	ОК	delete	F2	delete

12.5.3 Export measurements to a SD card (optional)

The MFplus offers the possibility to export all stored measurements to a SD card.

Storage menu 🛛 🗖 💻		Measurements to SD card 🛛 🗖 💻	
Sites administration		Measurements to SD card	
Delete all sites			
Sites from SD card		Flue gas measurem. 36	
Sites onto SD card		Pressure measurem. 1	
View measurements			
Delete measurements			
Measurements to SD card			
Memory info			
measure sites extras	ок	Export	F2

By confirming with the F2 key the data transmission / export on the SD card is started.

During the data export the display reads "please wait". A write error to SD card is reported by the instrument. Make sure that the SD card is not write protected.

The data are stored as a csv-file (e.g., EMI01032.csv) on the SD card. The filename exists of a sequential number which fixes the device.

This file is editable on your Notebook/PC with a program like e.g. Microsoft[®] EXCEL or OpenOffice[®] Calc. With possible problems with the using of your computer programs please read your software documentations or ask your software dealer.

13 EXTRAS / Settings

The MFplus is delivered in a standard software configuration which should cover most needs. However, there are many ways to tailor the settings to your individual needs if required. The possibilities are highly flexible and individual adaptable.

Use the variable possibilities to adapt your instrument to your own needs and customize the measurement menu, the measurement window, the printer out put and many other features. Usually this is something you will do once you receive the instrument, once you have adapted your instrument you will most probably don't make much changes in future, but you can when ever you need and want to do so.

After you have made any changes in the configuration, you should switch off the instrument to save all the changes that have been made. Next time that you start up the instrument, all changes will have been made.

13.1 User definable Logo print out

Overview:

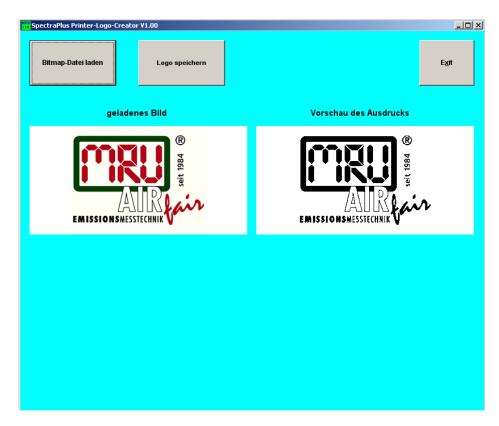
The Logo file can be created out of a Bitmap using the program "MFpluslusPrnLogoCreator.exe" which comes with the analyzer CD. The generated file will be transferred from your computer to the analyzer using the SD card (only once). Once transferred the Logo can either be printed above or below the customer address or you can choose not to print the logo at all.

Converting a Bitmap into a Logo file:

Use the enclosed Windows-Program "MFplusPrnLogoCreator.exe" (MRU Product CD / Software / MFplusPrnLogoCreator).

The Bitmap can have any color depth bit ideal is a color depth of 1-bit black-white. The horizontal resolution must have 384 pixels. If necessary the Bitmap can be adjusted using a picture editing program (not included on the CD).

The vertical resolution of the Bitmap must be a multiple of 24, where 24 is the minimum and the maximum is 480 pixels. If necessary the Bitmap can be adjusted using a picture editing program (not included on the CD).



Die erzeugte Logo-Datei muss "lg_print.mru" genannt werden (wird vom Programm vorgeschlagen). Die Größe der erzeugten Logo-Datei darf 16896 Bytes nicht übersteigen (wird vom Programm geprüft). Transferring the Logo file per SD card to the analyzer:

Copy the created file "lg_print.mru" onto the SD card (root).

Extras menu 🛛 🗖	Device info	0 💻	D Options list 🛛 🗖 🗖
Analyser settings	MRU MFplus		Temp. meas. T1
Date & time	Firmware versio	n 1.02.05	5 Temp. meas. T2
Service menu	Bootloader versi	on 1.00	Pressure sensor (type 2)
Default settings	Serial number	999999	1 bar (type 2)
Service values	Manuf. date	07.12.2011	4-Pa-Test
Contents SD card			Li-lon battery
Device info	Operating hours	48.1	AUX connector
			Humidity (AUX)
			Anemometer (AUX)
measure storage settings	OK optio	ns	F2

Switch on the analyzer then navigate to – Extras (F3) Analyzer info options. Now insert the SD card into the SD card slot, the unit will conform the upload with a short beep and on the screen you will see a short message – Logo installed.

Extras menu	C 📼)	Analyser settings	•
Analyser settings		LCD brightness	(%) 50
Date & time		Country England/intern	
Service menu		Language	English
Default settings		Helping hints	ON
Service values		Keyboard beep	ON
Contents SD card			
Device info			
measure storage	settings	print-out	measurem.

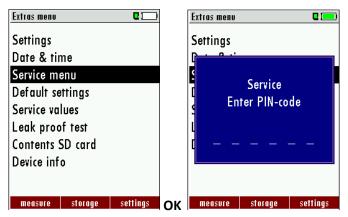
Printer Logo setting:

As soon as the Logo has been installed and the printer type is set on MRU, the Logo print will be available in the menu "extras / settings (print Logo).

Print-out settings	•	Print-out settings	•	Print-out settings	0 💻
Print logo	OFF	Print logo	over address	Print logo	under address
Print site lines	3	Print site lines	3	Print site lines	3

13.2 Maintenance adjustment menu

The Maintenance adjustment menu is secured with a Pin Code to protect it against unauthorized users.

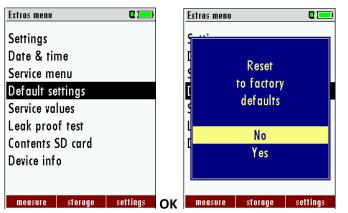


If you enter a wrong pin code you will be exited into the "Extra Menu" again.

Please contact MRU GmbH if you need the Pin Code for your instrument.

Press the Enter key if you should have landed in this menu by accident and you will be exited into the "Extra Menu" again.

13.3 Manufacturer default settings



The analyzer will be reset to original delivery settings.

Be aware that your configurations will be deleted, such as:

Settings	
LCD brightness(%)	50
Helping hints	ON
Printer type	MRU

13.4 Service values

Should your instrument display an error message after zeroing, then you can use the Service value menu to get detailed information about possible defects. In this menu you will see all service values of the sensors and also other parameters.

In case of a defect contact the MRU service department. The MRU service technician will ask you about these values or he will ask you to send them by fax or email.

	Extras m	enu	Q (1)		Service values		Service values		
	Setting	12			Press. 1 [m¥]	0.010	TC-2 [mV]	-0.064	
	Date 8	time			Press. 2 [mV]	0.020	TC-1 [mV]	-0.080	
	Service	e menu			PT-REF-I [kR]	1.099	U-Batt [V]	3.941	
	Defaul	t settings			PT-REF-L [kR]	1803.643	I-Batt [A]	-0.193	
	Service	values			TC-LEMO [mV]	585.000	T-Batt [V]	1.544	
	Leak p	roof test			TC-2 [mV]	-0.068	VDD [V]	3.239	
	Conten	its SD card			TC-1 [mV]	-0.079	T-ADC [°C]	25.006	
	Device	info			U-Batt [V]	3.943	AD-U-VBUS [V]	0.000	
					I-Batt [A]	-0.188	U-WL-Charge [V]	0.000	
	measu	re storage s	ettings (ЭК		Events> SD		Events>SD	
▲ ,		Jump betwee	en the l	ine	S				
F2		Export of the service values to the SD card							
ESC	return								

13.5 Contents SD card

Extras menu	•	1	Contents SD	card		
Settings			4-PASCA0	I.LCD		
Date & time			4-PASC~1.BMP			
Service menu			ANALYSE	D.LCD		
Default settings			ANALYSE	I.LCD		
Service values			ANALYSE2.LCD			
Leak proof test			ANALYSE:	3.LCD		
Contents SD card			ANALYS~	1.BMP		
Device info			ANALYS~	2.BMP		
			ANALYS~	3.BMP		
measure storage	settings	ок	delete	refresh	ореп	

The contents of the SD card will be displayed. With F3 the selected file can be opened.

13.6 Instrument information

Here you will find information about the analyzer and the installed options.

Extras menu 🛛 🗖 💻		Device info	C 💻		Options list 🛛 🗖 💻
Settings		MRU MFplus			Temp. meas. T1
Date & time		Firmware version	1.02.05		Temp. meas. T2
Service menu		Bootloader version	n 1.00		Pressure sensor (type 2)
Default settings		Serial number	999999		1 bar (type 2)
Service values		Manuf.date (07.12.2011		4-Pa-Test
Leak proof test					Li-lon battery
Contents SD card		Operating hours	48.5		AUX connector
Device info					Humidity (AUX)
					Anemometer (AUX)
measure storage settings	OK	options		F2	

Use the F2 button to see the installed options.

14 Technical specifications

14.1 General Specifications

Deutsch		English
Betriebstemperatur	-10°C +45 °C / 14 °F 113 °F	Operating temperature
Rel. Luftfeuchtigkeit bei Betrieb, nicht- kondensierend	95%	Rel. Humidity, non-condensing
Lagertemperatur	-20°C +50°C / -4°F 122°F	Storage Temperature
Akku intern, Betriebszeit	NiMH: 15h	Internal Battery Pack, operating
	Li-Ion: 30h	hours
Stromversorgung ext. USB Netzteil	USB 5V 1A	Power Supply USB power supply externally
Gewicht	470 g	Weight
Maße (BxHxT)	90 x 205 x 38 mm ³	Size (WxHxD)
Gehäusematerial	PA6 GF 30	Housing Material
Schutzart mit Schutzkappe	IP40	Protection Class with protection cap
Bluetooth Frequenzbereich und Ausgangs- leistung	EDR Power @ 2.402 GHz:5.5* dBm	Bluetooth frequency range and output power
	EDR Power @2.441 GHz: 7.5*dBm	
	EDR Power @2.480 GHz: 8.5* dBm	
	BLE Power@2.402 GHz: 5.5* dBm	
	BLE power @2.440GHz: 7.5* dBm	
	BLE power @2.480 GHz: 8.5*dBm Typische Werte/ Typical values	

14.2 Measured Values

Temperatur	Т	Temperature
Anzahl und Typ der Thermoelementanschlüsse Messbereich, abhängig vom verwendeten Füh- ler	2x Typ K Mini -200 °C - 1300 °C	Qty and type of thermocouple inputs Measuring Range, depending on actual probe type
Genauigkeit abs. / vom Messwert	±1°C / 1%	Accuracy abs. / reading
unterstützte Einheiten Differenztempeaturberechnung	°C, °F •	supported units calculation of differential tempera-

MRU GmbH

USER MANUAL MFplus

		ture
Druck	Р	Pressure
Anzahl gleichzeitiger Druckmessungen (jeweils einer der u.a. Messbereiche)	2	Qty of simultaneous pressure meas- urements (each with one of the measuring ranges below)
5		
Anschluss über Metallstutzen unterstützte EInheiten	• Pa, mbar, PSI, inH2O	Metal connectors supported units
Messbereich	100 mbar	Measuring Range
Genauigkeit (abs./ vom Messwert)	\pm 0,02 mbar / 1%	Accuracy (abs. /reading)
Differenzdruck		Differential Pressure
Messbereich		Measuring Range
Genauigkeit (vom Endwert)	250 mbar	Accuracy (Full Scale)
Differenzdruck	$\pm 2\%$	Differential Pressure
Messbereich		Measuring Range
Genauigkeit (vom Endwert)	1 bar	Accuracy (Full Scale)
Differenzdruck	$\pm 2\%$	Differential Pressure
Messbereich		Measuring Range
Genauigkeit	300 1200 hPa ± 3 hPa	Accuracy
Barometrischer Druck		Barometric Pressure

14.3 Calculated values

Strömungsgeschwindigkeit (optional)	v	Velocity (optional)
<i>basierend auf Differenzdruckmessung</i> mit Prandtlrohr		based on differential pressure measure- ment with Pitot tube
Messbereich typisch	1 m/s 40 m/s	typical measuring range
Absolutdruckmessung(setzt den Absolutdrucksensor von oben voraus)	•	absolute pressure measurement (requires abs. pressure sensor above)
basierend auf Flügelradmessung		based on vane anemometer
Messbereich (abhängig von Flügelrad-Typ)	0,25 - 35 m/s	measuring range (depending on actual vane type)
Feuchte- & Temperatursonde	RH	Humidity & Temperature Probe
Messbereich Feuchte	3 - 98 %	Measuring Range Humidty
Genauigkeit Feuchtemessung abs.	$\pm 3\%$ RH	Accuracy Humidity Measurement
Messbereich Umgebungstemperatur	-20 °C +80°C	Measuring Range Ambient Temperature
Genauigkeit Umgebungstemperaturmessung	±1°C	Accuracy Ambient Temperature Measure- ment

		1
Gasleitungsprüfung - Belastungsprüfung		
Messbereich	0 - 1500mbar	Measuring Range
Genauigkeit (abs. / vom Messwert)	±4 mbar / 2%	Accuracy (abs. /reading)
setzt 1bar - Sensor von oben voraus		
Gasleitungsprüfung - Dichtheitsprüfung		
Messbereich	0 - 200 mbar	Measuring Range
Genauigkeit (abs. / vom Messwert)	±0,5 mbar / 3%	Accuracy (abs. /reading)
setzt 1bar - Sensor von oben voraus		
Gasleitungsprüfung - Gasleckmenge		
Messbereich	0 - 8 l/h	Measuring Range
Genauigkeit (abs. / vom Messwert)	±0,2 l/h / 5%	Accuracy (abs. /reading)
mit 1bar - Sensor oder 100 mbar - Sensor		
Gaslecksuche		Gas Sniffer
Messbereich CH4	5 - 20000 ppm	Measuring Range CH ₄
Überlast	100000 ppm	Overload
Auflösung	1 ppm	Resolution
Ansprechzeit	T ₉₀ < 5s	Response Time

14.4 Data Communication

Deutsch	Anga- be	English
USB Anschluss	•	USB interface
SD Karte		SD card
für SW update, Datenaustausch, erweiterterter Datenspeicher	>= 2GB	for SW update, data exchange or extended data memory

15 Appendix

15.1 Text input

A numbers of texts and names can be changed to your own needs.

(for example: the names of the user defined fuel types, site names, the names of the measurement programs)

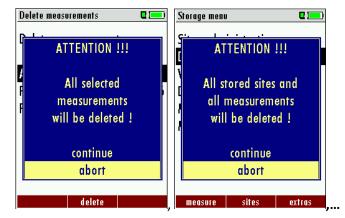
When you select the text input, the following window will pop up:

	Hodify site 🛛 🗖		
	A		
Insert cursor	A		
Selection cursor	ABCDEFGHIJKLM		
	N O P Q R S T U V W X Y Z a b c d e f g h i j k l m		
	nopqrstuvwxyz		
	0123456789!#&		
	() * + , / : ; = ? ÄÖÜ ä ö ü ß@€ á à é è		
	delete insert set char.		

▲, ▼,◀, ►	Select a letter, number or sign
F1 – delete	The letter left of the cursor will be deleted
F2 – insert	Selected letter or number will be inserted
F3 – over write	Selected letter or number will over write the current letter or number
ESC	Abort the window, changes will NOT be saved

15.2 Asking the user for a decision (pop up window)

The MFplus will ask you now and then to confirm the action that will be taken.



▲, ▼	Select a line
ОК	Confirm the action
ESC	Abort the window, changes will NOT be saved

15.3 Using the USB-Port

This port is used for data transfer from your analyzer to your PC / Laptop using the MRU Online View (Version 2.XX). The first time you want to use your analyzer for data transfer to your PC or laptop, you have to "mate" the MFplus and your PC / Laptop. (Requires operating system Windows XP or Windows 7).

🔃 Neue Hardware gefunden 🗙	🔅 Neue Hardware gefunden 🗙	Veue Hardware gefunden
USB-HID (Human Interface Device)	MFplus 5N300128	Die neue Hardware wurde installiert und kann jetzt verwendet werden.
AW 📴 Systemsteu 🛛 📴 <	emst 🔁 62001DE 🛛 📴 « 💐	🏹 CorelDR 📴 Systems 🔁 62001DE 🗍 📴 <

Your PC / Laptop will recognize the MFplus USB- HID (Human Interface Device).

Check list:

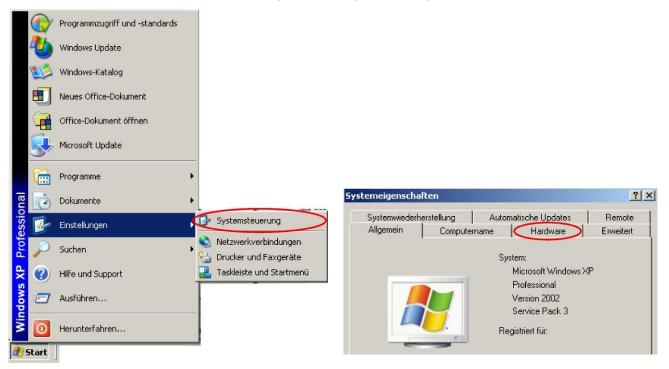
- 1. Switch on the MFplus
- 2. Connect the USB cable to the MFplus
- 3. Connect the USB cable into a free USB port at your PC/Laptop
- 4. The PC/Laptop must be powered on
- 5. The above seen information "New hardware found" will be displayed above the USB-Icon of your PC/Laptop

If this is not the case, then you have a problem with your USB-Connection of your PC/Laptop.

Check in your Device Manager if the analyzer is ready for operation. The MFplus is as HID-conform unit registrated.

Windows XP: Press the START button – then select the CONTROL PANEL – select SYSTEM – selct HARDWARE – select DEVICE MANAGER

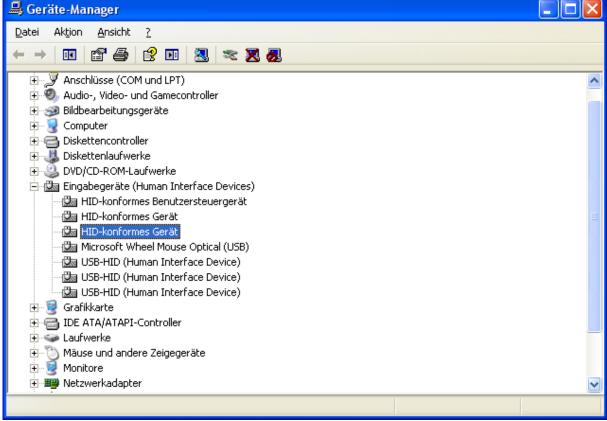
Windows 7: for Windows 7 there are several possibilities, please read your Windows 7 manual for details.



(The grafics may look different on your PC/Laptop as shown in this manual!)

(

Systemv	iederherstellung 📔 Automatische Updates	Remote
Allgeme	n Computername Hardware	Erweitert
ieräte-N	lanager Der Geräte-Manager listet alle auf dem Computer in:	stallierten
Z	Hardwaregeräte auf. Verwenden Sie den Geräte-M. die Eigenschaften eines Geräts zu ändern.	
	Geräte-Mana	ager
4		
	Durch die Treibersignierung kann sichergestellt wer installierte Treiber mit Windows kompatibel sind. Üb Update können Sie festlegen, wie Treiber über dies aktualisiert werden sollen.	er Windows
	Treibersignierung Windows Up	date
>	Über Hardwareprofile können Sie verschiedene Ha konfigurationen einrichten und speichern. Hardwarepro	
	OK Abbrechen	Übernehmen
	-Manager	
eräte		
	jon <u>A</u> nsicht <u>?</u>	



The MFplus is registrated as HID-conform unit.

In the Generel folder you can see if the unit is ready for operation.

In the detail folder the instrument is registered with the VID 152A.

Eigenschaften von HID-konformes Gerät 🛛 🛛 🔀
Allgemein Treiber Details
HID-konformes Gerät
Gerätetyp: Eingabegeräte (Human Interface Devices)
Hersteller: (Standardsystemgeräte)
Ort: Pfad 0
Gerätestatus
Das Gerät ist betriebsbereit.
Problembehandlung
Geräteverwendung:
Gerät verwenden (aktivieren)
OK Abbrechen
Eigenschaften von HID-konformes Gerät
Eigenschaften von HID-konformes Gerät
Allgemein Treiber Details
Allgemein Treiber Details HID-konformes Gerät
Allgemein Treiber Details HID-konformes Gerät Geräteinstanzkennung

In case the instrument is not ready for operation, choose a different USB instrument to check the USB port on your computer, and/or connect the MFplus to a different computer to locate the error.

15.4 Errors

1. Effect	2. Error indication	3. Cause	4. Solution
Device cannot be switched off by press-	LED behind the conden- sate separator is on and	Device does not react on any key.	Press ESC and ON simulta- neously!
ing the OFF key.	the LCD display is dark		EMERGENCY OFF
			After this, the date and time have to set new.
Inside of the device is	Display indication:	e.g. device was stored in a cold	Put the device to a warm
too cold, device not ready for operation.	"Device too cold" or	place during winter.	room and wait
	audible sound every 5 sec		
Measurement	Display indication:	Device temperature below 0°C	Warm up the analyzer
accuracy reduced	Due to low device tem- perature the measuring accuracy is reduced!	(32° F)	
No measurement pos- sible		Device cannot be switched on or does not react after being switched on.	Connect the device to the line power in order to charge the battery.
		Battery discharge	
Measurement without	Temperature indication:	Thermo element defective,	Call our after-sales service.
exact temperature values.	,-°C	balancing network interrupted or not connected.	Remove probe from the gas duct and condensate from the probe tube.

15.5 Options

15.5.1 Standard condition

The standard conditions for temperature and pressure are standard sets of conditions for experimental measurements to be established to allow comparisons to be made between different sets of data.

In the menu "measurement settings" you can choose the different std. conditions or you can also define the standard condition.

Heasurement settings	C 💻	Heasurement settings 🛛 🗖 💻
Temperature unit	°C	Temperature unit °C
Std. conditions	Users	Std. conditions STP/IUPAC
Std. Temp [°C]	0	Pressure (left)
Std. press [hPa]	1000.00	Pressure unit Pa
Pressure (left)		T90 time [s] 6
Pressure unit	Pa	Pressure (right)
T90 time [s]	6	Pressure unit hPa/Pa
Pressure (right)		T90 time [s] 10
Pressure unit	hPa/Pa	
return		

15.5.2 Library of pitot tube (option)

Storage menu	I	
Sites administration		
delete all saves		
Sites from SD card		
Sites onto	SD card	
Pitot tube		
View measurements		
Delete measurements		
Measurements to SD card		
Memory info		
moncuro	sites	extras
measure	Siles	eATTUS

The MFplus give you the possibility to manage 5 coefficients and calculate the correct K according to the actual velocity.

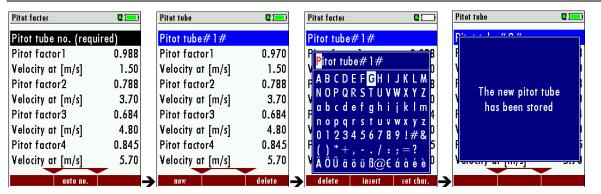
You can store until 100 pitot tubes.

Insert a new pitot tube:

It is possible to insert a new pitot tube from the Storage menu or from the settings of gas flow measurement. With the key F1 you can create a new pitot tube.

settings	2 💻		Pitot tube
Measuring method			
Line numbers	5		No Pitot tube
Traverse points nr.	5		
Set averaging time	e		
Averaging time	Manual		
Define factors			
Pitot factor			
Wall factor	0.860		
Test SWIRL	ON		
return I	^D itot factor	→[KEY-ENTER]→	Пew

Before start the gas flow measurement, you should load the saved parameter of the pitot tube. If there is no saved pitot tube the measurement will be done with a default parameter.



With the key F3 you can delete the tube. Before delete the pitot tube make sure that the pitot tube was never be used in a measurement otherwise you can't export the information about the parameter of the used pitot tube in CSV.

15.5.3 Library of chimney (option)

MRU GmbH

The Library of chimney gives you the possibility to recall the chimney details in the setting menu, instead of insert them manually before starting every measure.

Storage menu 🛛 🖬 💻	Chimney administration 🛛 🗖 💻	modify chimney 🛛 🗖 🥅
Sites administration		Chimney #1#
delete all saves	No chimney	Free text (e.g. name)
Sites from SD card		Free text (e.g. name suppl.)
Sites onto SD card		Free text (e.g. street & no.)
Chimney administration		Cross-sct. area Circle
View measurements		Diameter [m] 10.00
Delete measurements		Line numbers 10
Measurements to SD card		Traverse points nr. 10
Memory info		
measure sites extras	new land	→ modify store

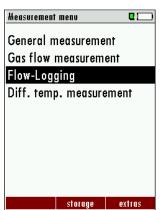
After get the details of the chimney, with the key F3 you can save the parameter of the chimney.

You can load the parameter of chimney before start the measurement in the menu setting of flow gas measurement.

settings	0 📼	
Set measuring units		
P-abs.	hPa	
Cross-sct. area	m²	
v-flow	m/s	
Q-flow rate	NI/s	
Set cross-sect.	area	
Cross-sct. area	Rectangle	
Width [m]	0.50	
Depth [m]	0.50	
Chimney return		
cummey Terorn		

NB: If you delete the chimney, the all assigned measurements will be deleted.

15.5.4 Data logger of flow (option)



In the menu "measurement menu" you find the Flow-Logging.

The flow velocity and the volume flow will be presented in the form of graphic, this helps to check the stability of the flow. With the Key "right/left ,, you can switch to the other measurement and with the key F1 you can chose the flow velocity or the volume flow.

Flow-Lo	gging		2 📼
	v-live	25.00 m	/s
40.0		λ.	and and
20.0 -	v vvv	W	<u>v v~yw</u> r
0.0 -			<u> </u>
-20.0 -			
-40.0 -			
	0.01		00.0
T-gas	ſĽ		20.0
	l°Cj ty[Kg/i	m³]	1.155
	ry[Kg/i	m³]	

Flow-Logging]	
Q-flow	rate <mark>-28.29 l</mark>	/s
3+03 -	_	~~~
2+03-		
o - J		— <u> </u>
-2+03 -		
-3+03 -		
T-gas[°C]		20.0
Density[K	g/m³]	1.155
v-live [m/	s]	-0.1
v-live	settings	auto-log

With the key F3 "auto-log" another window appears (see the picture below).

Auto log function	Q 💻
Duration	1:00
Interval	0:02
mean value	ON
Required memory	30
Available memory	15999
start	export CSV

After the setting, the logging of flow will be started and the measurement will be saved. At the end of the measurement you will hear a beep. This means that the logging of data is finished.

Flow-Logging 🛛 🗖 📼
Q-flow rate 5194.5 1/s
9+03 -
5-03-MM MM M
0 mm. 1 m
-5+03 -
-9+03 -
Q-flow rate[l/s] 5194.5
Q-flow rate wet[NI/s] 0.00
Q-flow rate dry[Nl/s] 0.00
v-live settings 0:35

In the menu "storage" → "View measurement" you can see the saved measurement.

View measurements	0	View	Q 💻
View measurements		MON 28.11.2016 Chimney #1#	10:56:15
General measurements (Number measuring points	30
Flow measurement (1	Heasure time [s]	1:00
Flow-Logging		Q-flow rate [l/s]	2888
		Q-flow rate wet [NI/s]	0.0
		Q-flow rate dry [NI/s]	0.0
		v-mean stack [m/s]	11.55
		T-air [°C]	20.0
view	[KEY ENTER]	this site detail	delete

You can also export the measurement as CSV file, if the option SD card is activated.

15.5.5 Calculation of the sampling (option)

First you should go to the menu "View measurments" and choose the "Flow measurements" or "Flow-Logging".

Sites administration delete all saves Sites from SD card Sites onto SD card				
delete all saves Sites from SD card				
Sites onto SD card				
View measurements				
Delete measurements				
Measurements to SD card				
Memory info				
measure sites extras				

Select the measurement witch you want to calculate the nozzle. With the context menu select "the Nozzle calculation".

Verificare	C 💶	Verificare 🛛 🗖 🗖	כ
Numero punti di mis.	1	N Ricerca cliente	1
Tempo di misura [s]	0:20	τ questo cl. (F1)	0
Portata [I/s]	1789.0	p dettagli (F2)	0
Portata umida [NI/s]	1667.0	P cancella (F3)	0
Portata secca [NI/s]	1483.6	P Stampa (Stamp)	ó
v-camino media [m/s]	2.65	v indietro («)	5
T-amb. [°C]	20.0	T avanti (»)	0
T-gas [°C]	20.0	T Nozzle calculation	0
P-amb. [hPa]	1013.0	P Menù memoria (Esc)	0
questo cl. dettagli	cancella	questo cl. dettagli cancella	

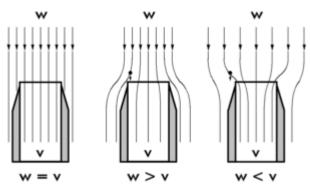
A new window appears with the name "Nozzle calculation" and gives you information about the diameter of

Nozzle calculation	•		Nozzle calculation	
v-mean stack [m/s]	11.55		v-mean stack [m/s]	11.55
v-local min. [m/s]	-1.07		v-local min. [m/s]	-1.07
v-local max. [m/s]	42.02		v-local max. [m/s]	42.02
T-Pumpe [°C]	25.0		T-Pumpe [°C]	25.0
V-Flow [l/min]			nozzle diameter	
	10.0			5.0
Diameter avg. [mm]	0.14		Spl.Flow avg[l/min]	13.8
Diameter min. [mm]	0.45		Spl.Flow min[l/min]	-1.3
Diameter max. [mm]	0.07		Spl.Flow max[l/min]	50.3
Q-flow rate		[KEY-F1]	Diameter	

the nozzle or the flow rate. Q-flo

15.5.6 Isokinetic sampling (option)

The measurement of dust must be done in isokinetic sampling that means that the velocity inside the sampling nozzle is the same velocity of the stack.



Source: www.photometer.com

With the option Isokinetic sampling you can have the information about the flow velocity inside the chimney and the pump flow.

Isokinetic sampling	C (1997)
nozzle diamete	er 5.0
T-Pumpe [°C]	25.0
T-Gas [°C]	20.0
P-abs. [hPa]	1013.0
Pressure [Pa]	1190.23
v-chimney [m/s]	45.2
Pump flow [l/min]	54.1
stop setti	ings zero point



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Technical data change w/o notice!

General Manager: Erwin Hintz HRB 102913, Amtsgericht Stuttgart USt.-IdNr. DE 145778975

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MFplus

USER MANUAL OPTION FLOW MEASUREMENT



64668GB



Content

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Die leeren Seiten der Bedienungsanleitung sind kein Fehler sondern herstellungsbedingt erforderlich!

The blank pages of the operating instructions are not a mistake but due to manufacturing required!

Пустые страницы в инструкции по эксплуатации не ошибка, а требуется производством!

Les pages vides sont pas fauses, mais dûs à la production requise!



Heasurement menu

General measurement Pressure measurement Gas flow measurement Diff. temp. measurement The connection of the pressure hoses is explained in the main manual of the MF-Plus!

1. Flow measurement with the MF-plus

The option flow measurement enables you to measure flow velocity.

	storage	extras
Gas flow me	asurement	
Line 1	Trav	erse pt. 1
Distance		1.271
[inch]		
v-live		68.62
[feet/s]		00.01
v-mean fr	av nt	
[feet/s]	u. p.	•
v-mean st	ack	
[feet/s]	ULK	
[reers]		
Q-flow r	ate	7588.9
[cfm]		
	zoro point	cottings
start	zero point	settings

In addition to the flow velocity, information such as measuring line and measuring spot, where the PITOT tube is places, is displayed.

(V-current) is the currently determined flow velocity. This is determined by Eq. [4]. The local average value of the flow velocity (v-local average) is the total of the current flow velocities divided by the current flow velocity (see Eq. [5]).

This is only displayed during measurement.

The average value of the duct flow velocity (v-duct average) is the total of the determined local average values (v-local average) divided by the current number of measuring spots (see Eq. [6]).

The flow rate (vol.-flow) is calculated by Eq. [7]. During the measurement the local average flow rate is displayed (see Eq. [8]). At the end of the measurement the average flow rate of the stack is displayed, calculated by Eq. [9].

ent 🛛 🛄
Traverse pt. 1
1013.00
0.00
233.71
ret 6759.9
point settings
point serrings
ent C
ent 🛛 🗋
ent C
ent C
ent C
ent C
Traverse pt. 1 20.0
ent C.196
Traverse pt. 1 20.0

By pressing the arrow buttons left or right, additional information such as temperature, dynamic pressure, the gas density as well as the duct cross-sectional area will be displayed.

A default value of 20°C will be set if sensor (T2) is not connected.

MANUAL Option Flow measurement MFplus

1.1. Zeroing

During zeroing the ambient temperature, the ambient pressure and the dynamic pressure are determined. The zeroing can be started using the "F2" button.

Zeroing should be performed before EVERY measurement!

1.2. Adjustment menu

The adjust menu can be opened using either the "F3" button or the "Menu key" button.

In this menu, parameters for the flow measurement are determined. These adjustments have to be done prior to the measurement.

1.1.1 Units

P-abs. describes the unit of the absolute pressure. (hPa/inchHG)

Cross-sectional describes the unit of the cross-sectional area e.g. m², feet², inch², cm². V-flow describes the unit of the flow velocity in either m/s or feet/s.

Flow-vol. describes the unit of the volume flow rate. The flowing units are available: l/s, Nl/s, m^3/h , Nm³/h, cfm, Ncfm.

Nl/s, Nm³/h, Ncfm mark the standardized volume flow rates.

1.1.2 Cross section

Here the geometry of a stack such as length or diameter can be entered. One can choose between "circle", "rectangle", "square" or "oval".

After selection of the geometry the stack measurements can be entered. The min. and max. values are related to the selected units (see chart 1).

Units	r	n	feet Inch cm		Inch		m	
	min	max	min	max	Min	max	min	max
Length	0,01	10	0,01	35	0,1	400	2	1000
Diameter	0,01	10	0,01		0,1	400	2	1000

Chart 1: Threshold values length in relation to units

1.1.3 Gas parameters

O2, CO2, H2O, CH4, N2 identify the gas ratio in percent. An error message will be displayed if the total of the gas ratio is above 100%.

Error: The total is above 100%

1.1.4 Measurement method

Here the number of measuring lines and measuring spots per line can be entered. The total number of lines and spots are limited to 10, in total 100 measurement can be performed.



settings	
Set measuring unit	s
P-abs.	hPa
Cross-sct. area	m²
v-flow	m/s cfm
Q-flow rate	cfm

return

Set cross-sect. area	
Cross-sct. area	Circle
Diameter [m]	0.50
Cross-sct. area [m ²]	0.196

Define gas paran	neters
H20	0.0 %
02-dry	0.0 %
CO2-dry	0.0 %
CH4-dry	0.0 %
N2-dry	100.0 %
Mol. mass [kg/mol]	0.0280

Define gas	parameters
H20	0.0 %
02-dry	0.0 %
CO2-dry	100.0 %
CH4-dry	29.9 %
Error: sum >	100%!

5
5



Set averaging time Averaging time	
Averaging time	0:10

1.1.5 Averaging time

Two modes can be viewed here, the automatic and the manual measurement. The automatic measurement is timer dependent. The timer can be set between 10 seconds and 10 minutes. The manual measurement must be stopped by the user.

Define factors	
Pitot factor	0.990
Wall factor	0.860

1.1.6 Factors

Two factors have to be entered: Pitot factor (see Pitot tube) and v-flow correction (between 0.1 and 10).

The v-flow correction factor is only used for spot measurement.

1.3. Performing a measurement

Prior to a measurement the parameters (e.g. geometry and length of the stack, gas ratio and number of measuring spots, etc.) must be entered in the adjustment menu.

1.1.7 Manual measurement

To activate the manual measurement, the average time must be set to manual (adjustment menu).



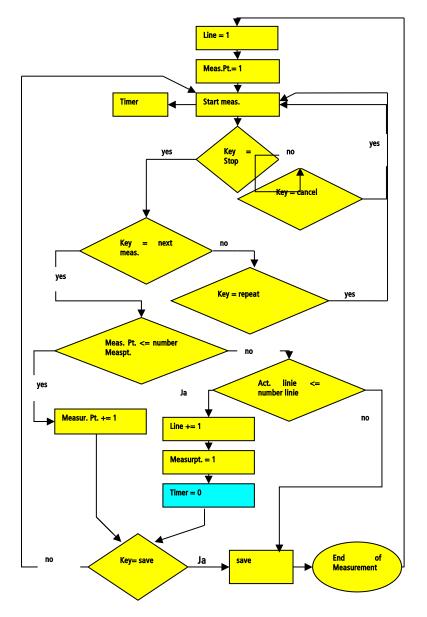


Image 14 shows the measurement sequence in the manual mode. The button "F1" (Start) starts the measurement. During measurement the measurement can be stopped or aborted. The screen will turn from white to gray if the measurement is stopped, which means that the measurement for the current measurement point is completed. You can now press "F3" to repeat this measurement or press "F1" to make the next measurement. After pressing "F1" you can either save "F2" the measurement or perform the next measurement "F3".

Gas flow measuremen	ıt 🛛 🗖	Gas flow measureme	nt 🛛 🗖	Gas flow measureme	ent 🛛 🛄
Line 1 1	raverse pt. 2	Line 1	Traverse pt. 2	Line 1	Traverse pt. 2
Distance [m]	0.116	Distance [m]	0.116	Distance [m]	0.468
v-live [m/s]	18.17	v-live [m/s]		v-live [m/s]	-0.51
v-mean trav. pt. [m/s]	14.89	v-mean trav. pt [m/s]	. 14.43	v-mean trav. pt [m/s]	
v-mean stack [m/s]	-0.41	v-mean stack [m/s]	7.01	v-mean stack [m/s]	2.71
Q-flow rate [1/s]	2510.3	Q-flow rate [I/s]	1181.6	Q-flow rate [l/s]	456.8
stop 0:0.	<mark>5 abort</mark>	next	repeat	sto	re next

"Starting measurement" "Stopping measurement" "End the measurement"



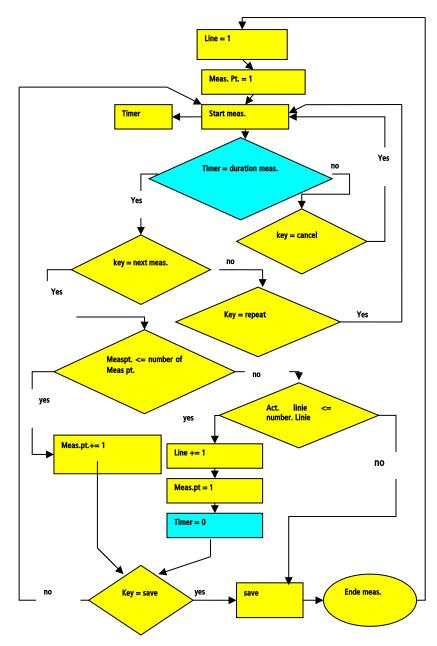
Gas flow measureme	ent 🗳 🛄
Line 1	Traverse pt. 1
Distance	0.032
[m]	
v-live	-0.17
[m/s]	
v-mean trav. pt [m/s]	. -0.15
v-mean stack	
[m/s]	
Q-flow rate	-25.4
[l/s]	
0:05	abort

1.4. Automatic measurement

The automatic measurement is timer dependent.

The measurement stops when the defined times has elapsed.

To activate this mode select the adjustment menu and select the measuring time. The measurement is started with the "F1" button, when the time has elapsed the next measurement for the next measurement point can be started. (The rest of the measurement procedure is identical with the manual measurement.





1.5. SWIRL

To make a correct measurement of the flow in a chimney, it should be verified if there is swirl or cyclonic flow inside the duct. This test should be done in every point of the grid before starting the measurement.

The user should insert the pitot in the correct measuring point of the grid and then rotate it at 90° to check if in this point the differential pressure is 0 Pa. If it is 0 Pa all is ok, there is no swirl.

The MFplus give you the possibility to insert the angle of SWIRL in every measuring point before pressing start. With the keys "right/left" you can activate the SWIRL option and with the Key "ESC" you return to the window "gas flow measurement".

With the Key F1, you ca show the window with Angle (see picture below) and with the key up and down you can change the value of the Angle

→[KEY-F1]→

settings	C 💻
Measuring metho	4
Line numbers	5
	5
Traverse points nr.	
Set averaging tin	
Averaging time	Manual
Define factors	
Pitot factor	
Wall factor	0.860
Test SWIRL	ON
return	Pitot factor

Gas flow measurem	ient 🛛 🗖 💻
Line 1	Traverse pt. 1
Distance	0.032
[m]	
v-live	-0.13
[m/s]	
v-mean trav. p)t
[m/s]	
v-mean stack	
[m/s]	
Q-flow rate	-46.3
[cfm]	
Test SWIRL zero	point settings

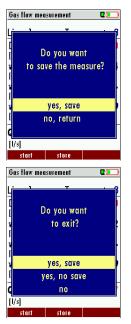
Gas flow mea	isurement	C 💻)
Line 1	Trav	erse pt. 1
SWIRL an [deg]	gle	0
P-sta. [hPa]		0.00
P-dyn. [Pa]		-0.02
Q-flow ro [Notm]	ate wet	0.0
start	zero point	settings



extres Constraints Change position Line 5 Traverse pt. 4 Change density ON Density [Kg/m³] 1.155

1.6. Change the density and the position of measurement During the measurement and in the menu Extras of the gas flow measurement you can change the density of the gas or jump to another line or point.





0
0
0
3

1.7. Storing a measurement

A measurement can be stored after each measurement cycle. When pressing the "F2" button, you will be asked if you want to store the measurement or return to the measurement. You will also be asked if you want to store the results when exiting the measuring screen.

When storing a measurement it must be assigned to a site.

Stored measurements can be view in the storage menu (view measurements). Once a measurement has been stored the next measurement can be performed.

1.8. Exporting a measurement to the SD-card In the storage menu the stored measurements can be exported in CSV format to the SD card.

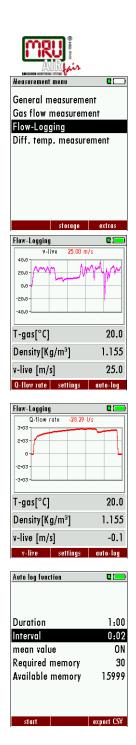
6	Strömungsm	essuna																											
7		Speicherdatum	Zaitetar	Linia	Maccou	hincore	it Macone	D and	P. she	P.ct.	Druck	Druck Mds	Druck Mir	TGN	TiGardia	T.G. Min	LIDE	002	02.0	W M	2 Molmacc	Diokto	u Loka	u Lok	- u Loka	Vol Sz	Vol Strör	Vol Ström	Trooke
	consigerera.	opercheroacom	Lensten	Line	inesspu	[\$]	[cm]	fl-Dal	(LD-1	ThD.	(Dal)	(Dat)	[Pa]	11013	CC1	['C]	1120	10/1	02 0	1 17 19	[Kg/mol]	E Dionie	1 fendel	fendal.	(mia)	for the 1	Mar.Mb1	Min Mil	HOUNE
3	A	06.08.2015, 09.02.	00.00.00			[2]	8,333	[nr-a]	[n=a]	[n=a	10.07	11,04	10,69	['C] 20	20	101	0 1	2	21	1 12	38 0,024	1,001	[[mrs]	4,7	lines	[mm]	28,267	2798	
	Anlage #1#	06.08.2015, 03:02:					0,333	336,7	336,6	-0,1	10,07		10,63	20	20		0 1	0,1	21	40	38 0,024								
2			06.08.20			00:1	25	996,7	996,6	-0,1	10,7	10,96	10,44	20			0 1	0,1	21	40	38 0,024	1,001	4,6	4,6	4,6	2815	28,146	2786	
			06.08.20					996,7	996,6	-0,1	10,52	10,65					0 1	0,1	21	40	38 0,024					2808		2780	
2			06.08.20	2	2 3	00:1	8,333	996,7	996,6	-0,1	10,45	10,76	10,2	20	20	21	0 1	0,1	21	40	38 0,024	1,001	4,6	4,6	4,5	11191	111,914	11079	
	Normale Kor	ditionen																											
	Tnorm	[k]	273,15																										
	Pnorm	[KPa]	101,3																										
5	Faktoren																			_									
	Pitotfaktor	[#]	1																										
)	V-Strömkorr	(#)	0,86														-			-	_	-							
	+-sconson	[*]	0,06		-		-		-								-	-		-		-	-	-	-				
	Kamineigens																			_									
2		chalt																		_									
3	Querschnitt		Rechteck																										
4	Seitenlänge /	[cm]	50																										
5	Seitenlänge E	[cm]	44																										
6	Querschnitt		2200																										
7	H20	[%]	1																										
8	C02	[%]	0,1																										
9	02	[%]	21																										
0	CH4	[%]	40																										
1	N2	[%]	37.9																										
2	Molmasse	[Kalmol]	0.024																										
3	11101110225	frightined	0,061																			-							
4	Ergebnisse																			_	_								
5	Anzahl Mess	(#)	2															-		-				-					
			4																	_									
6	Anzahl Mess	[*]																		_									
7	Messdauer	s	00:40																	_									
8	Temp, Amb.	[°C]	20																										
9	T-gas Mittel		20																										
0	Dichte	[Kg/m³]	1,001																										
1		[hPa]	996,7																										
2	P-abs. Mittel		996																										
3	v-Lokal Mitte	[m/s]	4,7																										
4	v-Lokal Mitte		4.5																										
5		• •																											
6							-																						
7		Vs	m²ñ	ofm			-	-							-		-	-		-		-	-	-	-	-			
8	Vol.Ström	3108.7					-										-			-	-	-	-		-				
9	Vol.Ström Fe			237													-			-		-	-		-				
																				_			-						
0	Vol.Ström Tr	3077,6	11080	***																_									

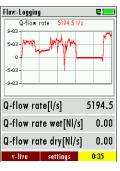
MANUAL Option Flow measurement MFplus

1.9. Data logger of flow (option)

In the menu "measurement menu" you find the Flow-Logging.

The flow velocity and the volume flow will be presented in the form of graphic, this helps to check the stability of the flow. With the Key "right/left ", you can switch to the other measurement and with the key F1 you can chose the flow velocity or the volume flow.





With the key F3 "auto-log" another window appears

After the setting, the logging of flow will be started and the measurement will be saved. At the end of the measurement you will hear a beep. This means that the logging of data is finished.



View measurements	C 💻
View measurements	
General measureme	nts O
Flow measurement	0
Flow-Logging	1
view	
View	C 💳
MON 28.11.2016 Chimney #1#	10:56:15
Number measuring points	30
Number measuring points Heasure time [s]	30 1:00

MUN 28.11.2016 Chimney #1#	10:20:12
Number measuring points	30
Heasure time [s]	1:00
Q-flow rate [1/s]	2888
Q-flow rate wet [NI/s]	0.0
Q-flow rate dry [NI/s]	0.0
v-mean stack [m/s]	11.55
T-nir (°C)	20.0

this site detail delete

MANUAL Option Flow measurement MFplus

In the menu "storage" \rightarrow "View measurement" you can see the saved measurement.

[KEY ENTER]

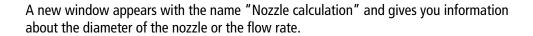
You can also export the measurement as CSV file, if the option SD card is activated.

MANUAL Option Flow measurement MFplus

1.10. Calculation of the sampling (option)

First you should go to the menu "View measurements" and choose the "Flow measurements" or "Flow-Logging".

Select the measurement witch you want to calculate the nozzle. With the context menu select "the Nozzle calculation".





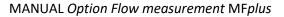




Nozzle calculation	2 💻
v-mean stack [m/s]	11.55
v-local min. [m/s]	-1.07
v-local max. [m/s]	42.02
T-Pumpe [°C]	25.0
V-Flow [l/min]	
	10.0
Diameter avg. [mm]	0.14
Diameter min. [mm]	0.45
Diameter max. [mm]	0.07
Q-flow rate	

Nozzle calculation	C 💻
v-mean stack [m/s]	11.55
v-local min. [m/s]	-1.07
v-local max. [m/s]	42.02
T-Pumpe [°C]	25.0
nozzle diameter	
	5.0
Spl.Flow avg[l/min]	13.8
Spl.Flow min[l/min]	-1.3
Spl.Flow max[l/min]	50.3
Diameter	

[KEY-F1]

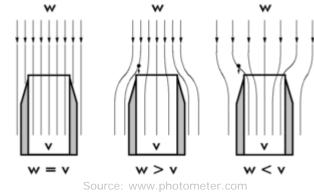




Isokinetic sampling	C 💻
nozzle diameter	5.0
T-Pumpe [°C]	25.0
T-Gas [°C]	20.0
P-abs. [hPa]	1013.0
Pressure [Pa]	1190.23
v-chimney [m/s]	45.2
Pump flow [l/min]	54.1
stop setting	js zero point

1.11. Isokinetic sampling (option)

The measurement of dust must be done in isokinetic sampling that means that the velocity inside the sampling nozzle is the same velocity of the stack.



With the option Isokinetic sampling you can have the information about the flow velocity inside the chimney and the pump flow.



1.12. Appendix

1.1.8 Calculation of the molecular weight

The molecular weight of a gas is depending on the gas ratio, these are calculated by Eq. [1]:

$$M = 0.00001 * (32 * [O_2] + 44 * [CO_2] + 18 * H_2O + 16 * [CH_4] + 28 * [N_2])$$

Equation 1: Molecular weight

Unit of the molecular weight is $M = \left[\frac{Kg}{mol}\right]$

1.1.9 Calculation of the gas density

The gas density is calculated by Eq. 2]:

$$\rho = \frac{P_{abs} * M}{RT_{gaz}}$$

Equation 2: Gas density

Whereat

 ρ : Gas density in $[\frac{Kg}{m^3}]$

 ${\cal P}_{abs}\,$ Identifies the absolute pressure in [Pa]

M : Molecular weight in $\left[\frac{Kg}{mol}\right]$

$$R$$
 : Gas constant and to be 8.314 $\left[\frac{J}{mol * K}\right]$

 T_{gaz} : Gas temperature in Kelvin

1.1.10 Calculating the current flow velocity

The flow velocity is determined using the Pitot tube, measuring the pressure in combination with the gas density see Eq. [3]).

$$\tilde{v} = \sqrt{\frac{2*\overline{\Delta P}}{\rho}}$$

Equation 3: Flow velocity

 \tilde{v} : flow velocity in [m/s]

 $\overline{\Delta P} = \frac{\sum_{i}^{m} \Delta P}{m}$: average value of the pressure difference in [Pa]

 ρ : Gas density in $[\frac{Kg}{m^3}]$

The geometry of the Pitot tube is considered using the Pitot factor.

$$v_{mom} = K_{wall} * K_{pitot} \sqrt{\frac{2 * \overline{\Delta P}}{\rho}}$$

Equation 4: Flow velocity with Pitot factor



 K_{pitot} : Pitot factor K_{pitot} : Wall factor

1.1.11 Calculating the local average value of the flow velocity

The local average value of the flow velocity is the amount of the flow velocities divided by the number of current flow velocities.

$$v_{lok,mittel} = \frac{\sum_{k}^{n} v_{mom}}{n}$$

Equation 5: local average flow velocity

Whereas v_{mom} is the current flow velocity and n is the amount of measurements.

1.1.12 Calculating the average value of the stack flow velocity

The average value of the stack flow velocity is the amount of the local average values divided by the amount of measuring points.

$$v_{ka\min,mittel} = \frac{v_{lok,mittel}}{n_p}$$

Equation 6: local average value of the stack flow velocity

Whereas $v_{lok,mittel}$ der local average value of the flow velocity and n_p amount of measuring points.

1.1.13 Calculating the actual volume flow

The actual volume flow is the current flow velocity multiplied by the cross-sectional area

 $q_{v,mom} = v_{mom} * A$

Equation 7: volume flow

 $q_{v.mom}$: current volume flow in [m³/s]

 v_{mom} : current flow velocity in [m/s]

A : Cross-sectional area in [m²]

1.1.14 Calculating the local average flow velocity

The local average flow velocity is calculated by Eq. [8]

$$q_{lok,mittel} = v_{lok,mittel} * A$$

Equation 8: local average flow velocity

 $q_{lok,mittel}$: local average volume flow in [m³/s]

 $v_{lok.mittel}$: local average flow velocity in [m/s]

A : Cross-sectional area in [m²]



1.1.15 Calculating the average value volume flow of a stack

The average value of the volume flow of a stack is calculated by Eq. [9]

$$q_{ka\min,mittel} = v_{ka\min,mittel} * A$$

Equation 9: average value volume flow of a stack

 $q_{ka\min,mittel}$: average value volume flow of a stack in [m³/s]

 $v_{ka\min,mittel}$: average value of the stack flow velocity in [m/s]

A : Cross-sectional area in [m²]

1.1.16 Calculating the standardized volume flow (wet and dry)

The standardized volume flow (wet) is calculated by Eq. [10]:

 $q_{Feucht} = V * \frac{P_c}{1013.1} * \frac{273.15}{T_{aac}} * \frac{\varphi_{H2o}}{100}$

Equation 10: standardized volume flow (wet)

The standardized volume flow (dry) is calculated by Eq. [11]:

$$q_{Trocken} = V * \frac{P_c}{1013.1} * \frac{273,15}{T_{gas}} * \frac{100 - \varphi_{H2o}}{100}$$

Equation 11: standardized volume flow (dry)

1.1.17 Calculating the swirl

 $v_c = \cos \theta_{meas} v_{meas}$ Where $\cos \theta_{meas}$ is the cosine of the angle measured. v_{meas} ist he velocity measured.



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