DM
9600
CHP

USER MANUAL

Precision - Manometer

DM
9600

MRU®
AIRfair
EMISSION MONITORING SYSTEMS

9122EN-CHP

Content

1   Introduction

- This manual enables you to understand and safely operate this MRU precision digital manometer **DM**9600 CHP.
- Please read this manual with great vigilant and get familiar with the product before using it.
- This analyzer may only be operated by competent personnel and for its intended use.
- Please pay special attention to all safety directions and warnings to prevent personal injuries and damaging of the product.
- We can't be held responsible for any injuries and/or damages that occur by not following the instructions in this manual.
- Always keep the manual near you when working with the analyzer, to be able to read instructions as needed.
  Please ensure to hand over all documents to when handing the analyzer over to others.

1.1   Intended use

The **DM**9600 CHP is designed for pressure measurements as well as temperature measurement of NON-explosive gases.

The instrument was manufactured according relevant normatives and regulations. It has to used within it's intended use.

The Instrument must not be modified from the design or safety engineering.
Modifications of any kind by the user will render the declaration of conformity.

This instrument meets the requirements of the valid European and national regulations.
You can ind the declaration of conformity in the appendix.

1.2   About us

The Analyzer 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

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2   Information for product and safety

2.1   Safety manual

All general information and safety precautions of MRU products are listed in the supplied separate safety manual.
Therefore this manual must be read and observed before the first use of the instrument.

Instrument-specific safety and warning requirements in this manual are prefixed before dangerous actions.

2.2   Safety precautions

The used category's of safety precautions are here explained once more.

⚠ DANGER

Identifies an immediate, impending hazard that, if ignored, will result in severe bodily injuries or death.

⚠ WARNING

Identifies an immediate, impending hazard that, if ignored, may result in severe bodily injuries, material damage or death.

⚠ CAUTION

Identifies a possibly dangerous situation that, if ignored, may result in minor injuries.

ATTENTION

Identifies a possibly harmful situation that, if ignored, may result in damages to the device or its surroundings.

NOTE

Identifies user tips and other especially important information.

3   Description

3.1   Task

The main task of the precision digital manometer **DM***9600* CHP is measuring pressure and temperature on CHP engines.
Optional with AUX port:

• HC-probe for gas leak detection
• External pressure sensor to measure higher pressures

For an overview on all available options please refer to the company's home page www.mru.eu or sales representatives.

3.2   The measuring instrument

The measuring instrument has a compact and robust fiber-reinforced plastic enclosure.
It is entirely operated using the color touch screen.
Strong magnets on the backside are fixing the device on metallic parts.

1	Touch screen	2	Pressure port **P2**
3	Pressure port **P1**	4	Mini-USB interface
5	Temperature port **Temp 1**	6	Temperature port **Temp 2**
7	**AUX** port	8	IR interface for ext. printer
9	**Reset** button	10	Micro-SD card slot

The Measuring instrument is supplied with hose set with quick coupling on device side and male thread on motor side.

Display

All functions of the unit are selected and activated by it's touch screen. In several menus detailled sub-menus are available..
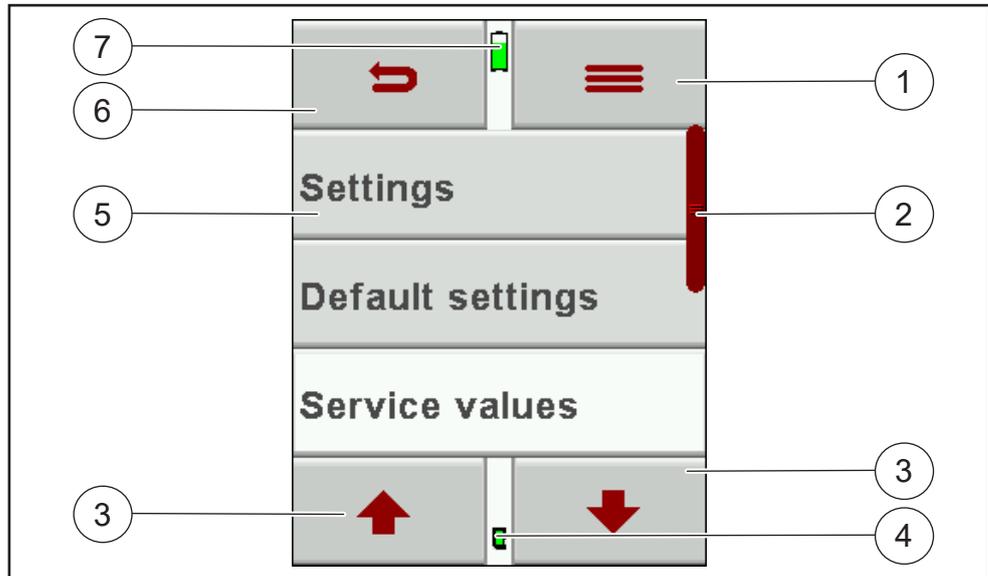
1	Context menu
2	Scroll bar indicator for the main menu
3	Function keys, such as. scroll / edit / store
4	State of SD-card: Green symbol - read and write is possible Yellow symbol - only read (SD-card locked) No symbol - no card in reader
5	Main menu bars
6	Function key, such as return
7	Battery charging condition (Lithium-Ion Battery)

3.3   Menu structure

The measuring instrument has 3 available main menus::
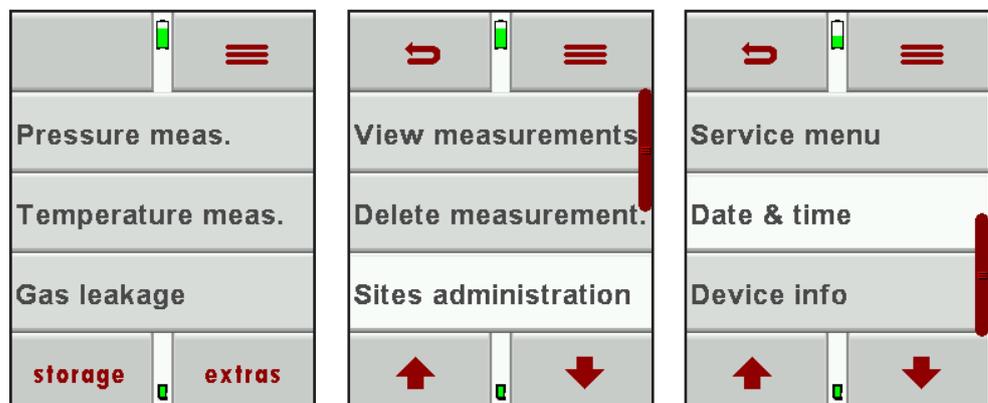
Measurement   **Storage**   **Extras**

The context menu key lets you select the available main menus.

Menu **Measure-ment**:	All available measurement options will be displayed and can be selected here. This screen will only display installed and available options.
Menu **Storage**:	All available storage options will be displayed here.
Menu **Extras**:	All other options are displayed here, for example setting to adapt your device.

4   Operation

4.1   Commissioning

The measuring instrument is delivered fully assembled and ready to use.
- ▶ Nevertheless, check if the delivery is complete and that nothing is damaged
- ▶ Charge the battery for 8 hours. ☞ see also 6.1.

4.2   Switch on

- ▶ Touch the display
- ⇨ Power up? appears.

- ▶ Push the ⏻ Button.
- ⇨ The MRU start screen appears.
- ⇨ The start menu appears.
- ⇨ The device is ready for use.

4.3   Switch off

4.3.1 Switch off
- ▶ Touch the „Context menu" on the display.

- ▶ Push the ⏻ Button.
- ⇨ „Switch-off the device now? ?"
- ▶ Push „Yes, switch-off".
- ⇨ The device will switched off

4.3.2 Automatic switch off - Auto-off function
The Auto-off function powers down the device in the main menus **Measurement**, **Storage** und **Extras** if no key has been touched for 60 minutes. During measurement and/or battery charging the Auto-off function is deactivated.

The device will give an acoustic signal and will display that it wants to shut down, the shutdown can be prevented by touching the screen.
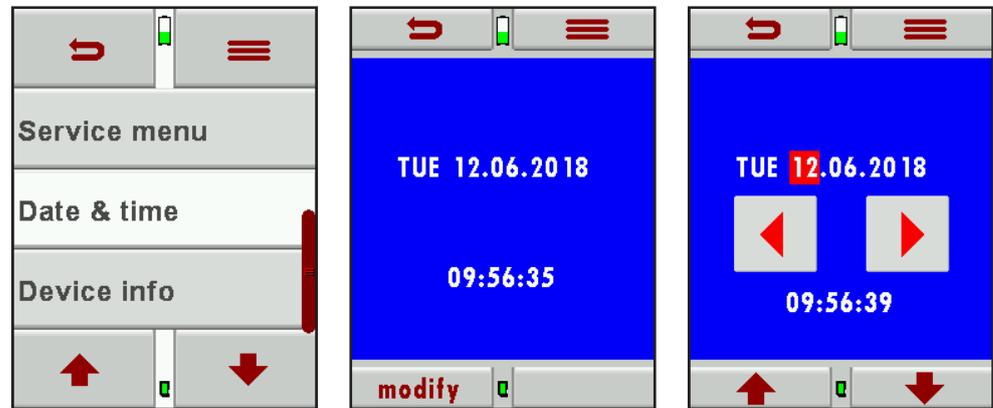
5   Settings

The measuring instrument can be customized during the first start-up.
Of course, all modifications can also be done at a later stage.
The following adjustments can be made in the **Extras** menu:

Country		When changing the country, country specific pre-settings and measurement procedures will be activated. Please pay special attention if the country specific settings and procedures are working according to their regulations.
Language		Select the operating language
LCD brightness [%]	5 – 100	The LCD brightness is depending on temperature and personal perspective of each user. 50% brightness are normal at 68°F (20°C
Keyboard beep	ON / OFF	Turn the Keyboard beep ON or OFF
Helping hints	ON / OFF	Turn the feature Helping hints ON or OFF
Temperature unit	°C / °F	Select the units for pressure and temperature
Pressure unit	Pa...mbar... mmHg...ect.	Select the units for pressure
P-abs	hPa / inHg	Select the units for temperature
Pressure P1	Positive / Negative	
Logo	ON / OFF	
Druckertyp	MRU / HP	
Bluetooth	Android / IOS	
Ext. Sensor		Configuration of extern. sensor

5.1   Date and time

Date and time can be viewed and adjusted in the **Date & time** menu. This device automatically changes from winter to daylight savings time and back.
The date and time should be adjusted in the internal battery was completely drained..

▶ Use the arrow buttons (up/down and left/right) to adjust the date and time.
▶ In case the battery is discharged it might be necessary to correct the date and time settings

5.2   Bluetooth

The Bluetooth mode can be viewed and selected in the **Bluetooth** menu. Please use BT-CL for connections to Android and BT-LE for connections to IOS..
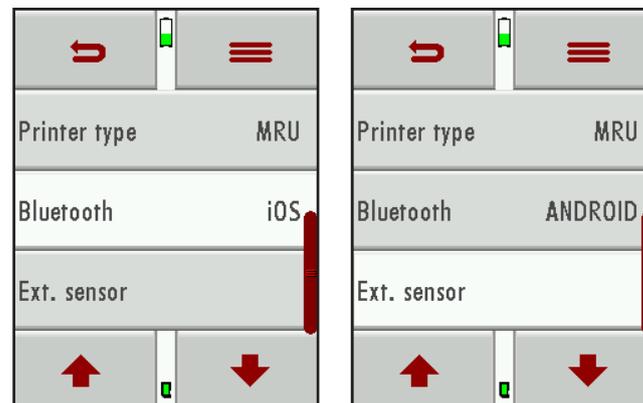
The full version of the MRU Bluebottle-Software **MRU4u** for free use is available in the Apple App. Store and Google Play Store.

6 Measurement operation

6.1 Preparation for each measurement

6.1.1 Power supply
The measuring instrument can be operated optionally:
* with the built in Lithium-Ion battery
* with the included battery charger connected to the USB port
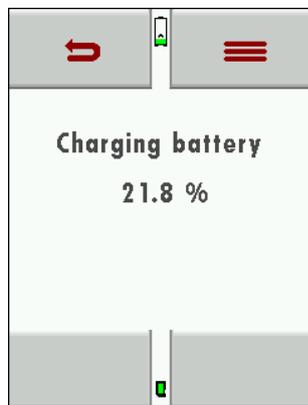* with USB cable on PC

6.1.2 Measuring with grid power supply / Battery charging
* The device can be charged by connecting the supplied charger 90...260 V / 50/ 60Hz to the USB port.
* The device can be operated while it is charged.
* The device will switch to trickle charge mode once the battery is fully charged.

6.1.3 Battery charge condition

The battery symbol indicates the battery capacity. The battery symbol will start to flash every second in red once the battery reaches a remaining operation time of +/- 60 minutes (depending on device configuration). The device will shut down if the batteries are not charged in time to prevent a total battery discharge..

6.1.4 Operating temperature
The device will display should you try and operate it whilst outside of the defined temperature ranges..

| NOTE |
| --- |
| In case the device was stored at a very cold location you will have to give the device time to adapt to the warmer environment before powering it up, this will avoid condensation!
The device is not operable when not within the temperature parameters. After powering up the device will give acoustic signals during warm up. |

6.2   Performing a measurement

The base version of the measurement instrument has the complete functionality for you to make pressure and temperature measurements.
For additional measurements additional accessories must be purchased and used.

6.2.1 Auto-Log

The **Auto-Log** function allows you to define the **measuring time** and the measuring **interval**.
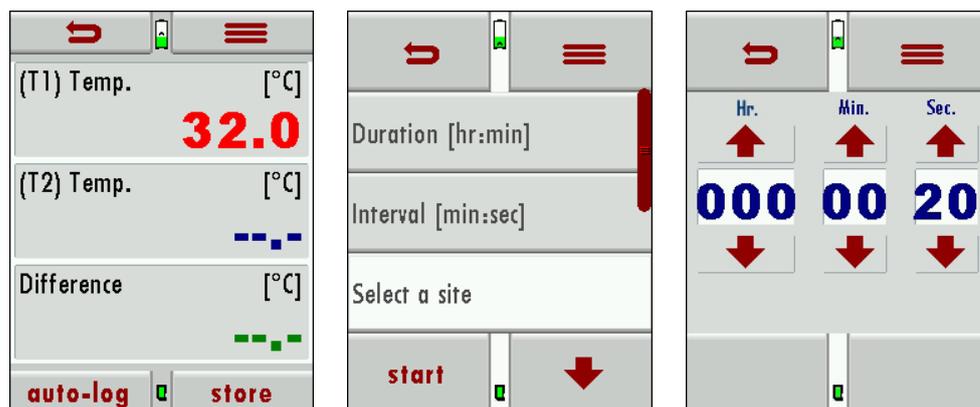
Auto-Log settings:

Measuring time is the complete time for one measurement cycle.
▶ Press the button measuring time to be able to set the measurement time (using the arrows up and down to change the time).
Interval means, after each interval duration a measurement is made.
▶ Press the button interval to select how frequently you want to save the results.
⇨ Upon the measuring time the measurements were stored.

1	Measurement time	2	Interval
3	Measurements	4	Storage point
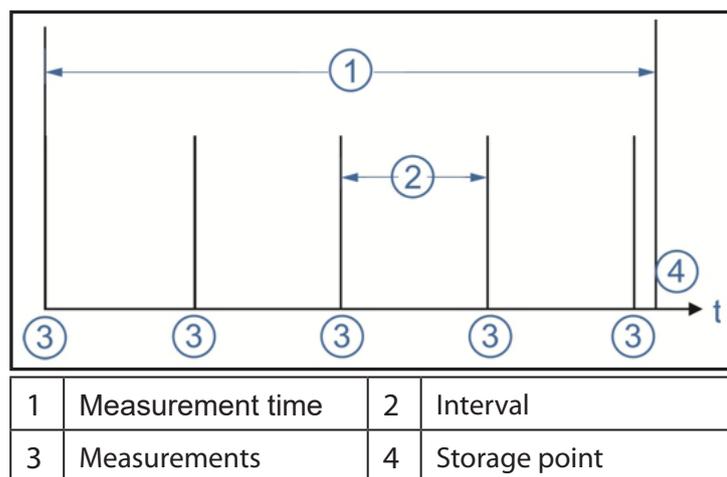
Storage of auto-logg files

The auto log function saves data records at the end of each interval by assigning those data to a site selected from the data storage menu.
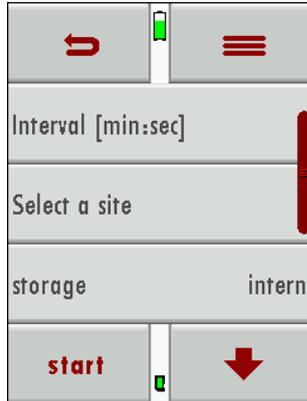
▶ First select a site.

The Auto-Log can save results either on the internal memory or onto the SD Card..
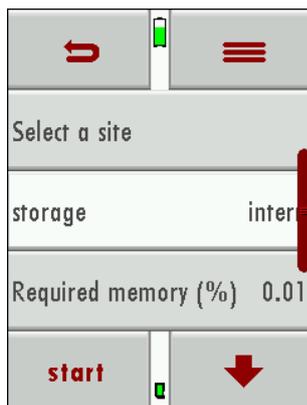
▶ Press the Store button and then select where the results should be stored.
▶ Please make sure that there is enough storage space available.
▶ Press the start button to start the Auto-Log, it will end automatically after the defined measurement time has elapsed.

6.3   Pressure measurement

In this menu following measurements are possible.
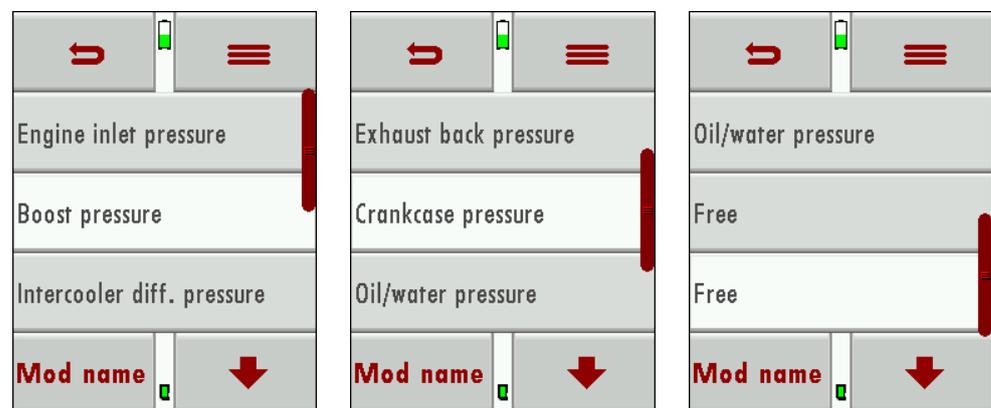
You can place measuring programs ao the empty fields.
▶ Select „Mod name" and the empty field.
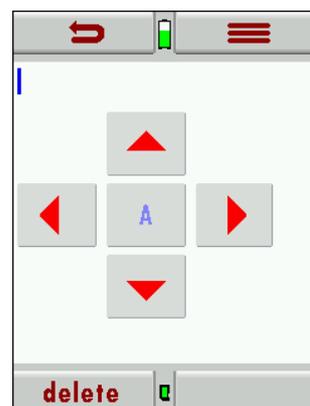
▶ Edit the text with the arrow keys.
▶ And this way procedure with the name of the existing programs.

6.3.1 Performing a measurement

▶ Connect the pressure hose on pressure port P1.
  Connect the second pressure hose on pressure port P2 for differential pressure measurements.
Select the wanted measurement.
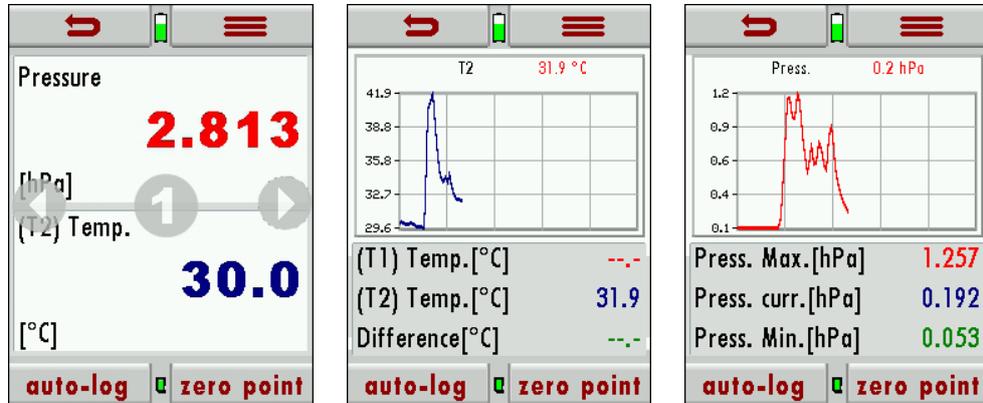
▶ Scroll with the arrow keys between the displays.
  ⇨ On the following displays the pressure gradient will be presented graphically.
The pressure can be auto-logged (see auto-Log function). When saving results, the max and min values are saved as well as the pressure average.

6.3.2 Zeroing

You can zeroing the pressure sensor at every measuring.

6.3.3 Context menu

You can configure the settings for each measuring.
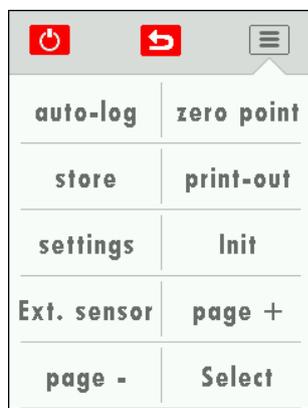
auto-Log	Measurements are being logged (only in graphic mode)
zero point	The pressure value is set to zero
store	Single measurements are being stored
print out	Measurements are beeing printed
settings	Pressure unit Bar...PSI...mbar... hPa...etc.
init	Graphically display starts again
Ext. Sensor	Configuration of external sensor
page +	Turn to next page
page -	Turn to previous page
select	Physical dimension for Measuring (Pressure / Temperature)

6.4   Temperature measurement

In the menu **temperature measurement**, 2 temperatures can be measured. The K-Type temperature sensors are connected at port T1 and T2 – the temperatures T1 and T2 will be displayed as well the temperature difference..

NOTE

The measurement accuracy can only be granted with original MRU temperature sensors.

6.4.1 Performing a measurement
▶ Connect the temperature sensor on temperature port T1.
  Connect the second temperature sensor on temperature port P2 for differential temperature measurements.
▶ Select **Temperature meas.**.
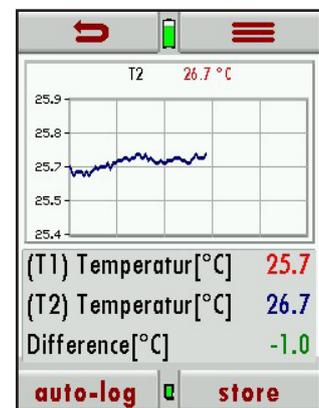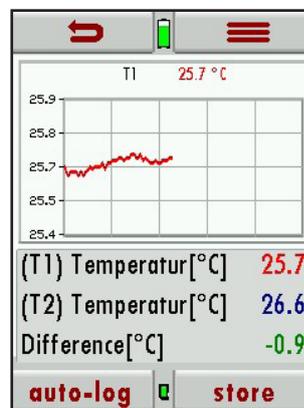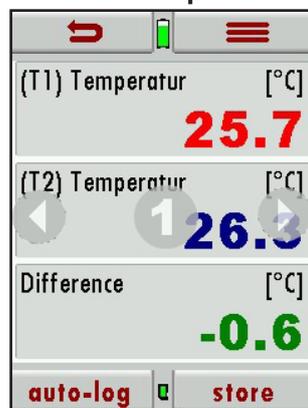
▶ Scroll with the arrow keys between the displays.
  ⇨ On the following displays the temperature gradient will be presented graphically.

The temperature can be auto-logged (see auto-Log function). When saving results, the max and min values are saved as well as the temperature average.

6.4.2 Kontextmenü
You can configure the settings for each measuring.

auto-Log	Measurements are beeing logged (only in graphic mode)
store	Single measurements are beeing stored
Init	Graphically display starts againt
print-out	Measurements are beeing printed
page -	Turn to previous page
page +	Turn to next page
settings	Temperature unit °C oder °F

7   Maintenance and care

7.1   Maintenance

An annual service check and if necessary adjustment of the sensors at an MRU service department www.mru.eu are recommended for the preservation of value.

7.2   Care

The Analyzer needs only low maintenance effort for long value preservation
If the analyzer is not being used over a period it is recommended to charge the battery before storing it and then recharge the battery every 4 weeks.

8   Data storage

8.1   Data storage structure

The main component of data storage is the site. Each site has a distinct site number and 7 user definable text components which can be used for the address, customer name and so on.

- The Device can save several thousand measurements up to 500 different sites.
- New sites can be generated. Modifications and additions can be transferred using the PC program MRU Win.
- Attention: Sites that have been created in the DM9600 will NOT be transferred back to the PC. Only measurement results will be transferred from the DM9600 to the PC which will be identified by the site number.
- Measurement results are stored and must be assigned to a site.

8.2   Measurements in the data storage menu

8.2.1 View measurements

Measured results can be viewed in the menu „view measurements".
Once selected you will see an overview of the different measurement modes with the number of saved results for each mode.
In case of a logged data sequence, the total duration, interval and number of saved measurements are displayed.Der Leseprozess der Note that the process of reading data may take some time when a lot of data records are stored.

- ▶ Select **Pressure meas.** or **Temperature. meas.**
  - ⇨ You will first see context information about the stored measurement. Use the arrow buttons to jump in between different stored measurements.
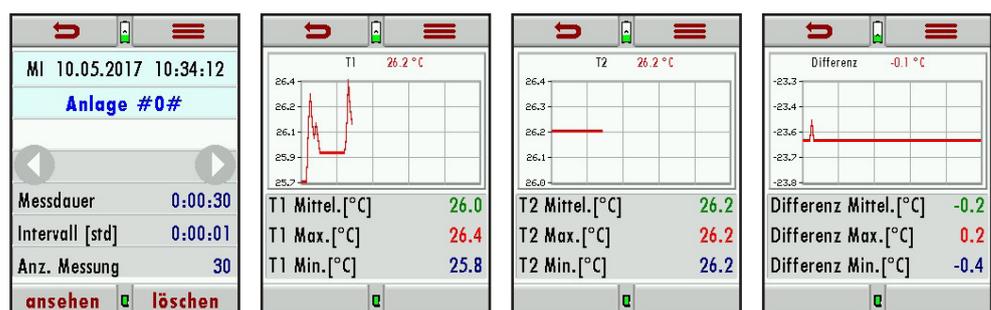
- ▶ Press „**view**"to see the details of the selected measurement. Results will be displayed as they are defined in the measurement screen.
- ▶ With „**back**" you will return to the context information screen..

8.2.2 Delete measurements

- ▶ Delete single measurements when pressing the delete button while the measurement is being displayed.
- ▶ Or delete all measurements of a measurement mode. You will be asked to confirm your intention to delete all measurements.

8.3   Sites
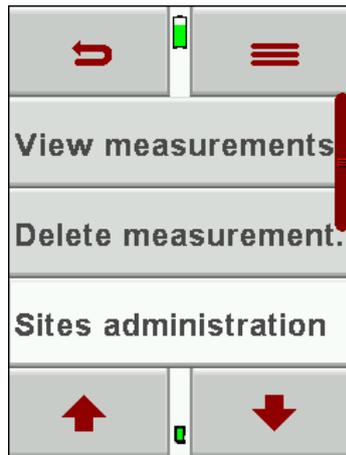
In the menu **Sites** you can view all data of the stored site, delete sites and add new sites Any modifications to the sites will not be transferred to the PC .

The modifications must be transferred via SD-card. ☞ see also 6.1

8.3.1 Add new sites or modify sites
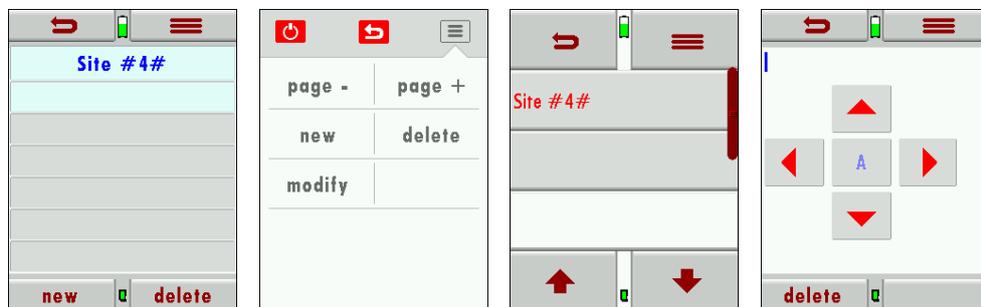
- ▶ Select "new" to add a new site.
  - ⇨ The first line which must have a distinct site number for identification. The device can also create a new site number (the next available site number will be selected).
- All other lines are user definable lines for address, customer name and so on.
- ▶ Select „modify" in the context menu.
  - ⇨ The site will be displayed in red and is now editable.
- ▶ Select the site and edit the text with the arrow keys.
- ▶ And this way procedure with the other lines

CSV-import ☞ see also 6.1
Once an SD card is inserted containing a file with site data in csv format, the unit will propose the import of this file automatically.
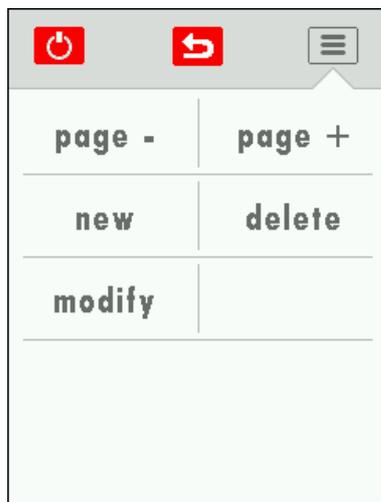
8.3.2 View sites

In the menu „Sites administration"each site will be displayed with the distinct site number, and 6 user definable fields.

You can page through the sites using the arrow buttons left and right.

8.3.3 Delete sites

You can delete single sites in the menu „Sites administration" by selecting delete in the context menu, or you can delete all sites at once

You will be asked to confirm your intention to delete all sites.

8.4 Data transfer using the SD-card (CSV)

For data transfer, we use the CSV format
CSV is a simple file format used to store tabular data, such as a spreadsheet or database. Files in the CSV format can be imported to and exported from programs that store data in tables, such as Microsoft Excel or OpenOffice Calc. CSV stands for "comma-separated values"

Possibilities:
- Import CSV
- Export CSV

Import CSV
This function can be used to transfer a CSV file that has been created on a PC.
IMPORTANT: The file name must be "anlagen.csv" (anlagen = German for sites)!
The file may not contain any header information, meaning, the first line will contain actual data.
Each line that is not empty and which doesn't start with a comma (both would result in an empty site number which is not permitted) will be transferred.
Each line and/or data set a maximum of 7 lines will be transferred. A maximum of 24 numbers and letters are allowed for each line, everything longer than 24 letters/numbers will be cut off.

Examples for sites

Site	Spelling
7 Lines	A1-F1,A1-F2,A1-F3,A1-F4,A1-F5,A1-F6,A1-F7,A1-F8,A1-F9
2 Lines (1 and 4)	A4-F1,,,A4-F4
1 Line	A5-F1

Error reasons for invalid sites:
- Comma at the beginning
- Blank line

Important: No check is performed inside the file or the devicefor duplicate site numbers (line1).
The device can handle duplicate numbers, however that can be difficulties later to assign measurements to site numbers when exporting these back to the PC.
(see also 3. + 4. Export of measurements)

The DM9600 will mark duplicate site numbers after import. If the same file is imported to the same DM9600 an indication will be displayed in red letters.

8.4.1 Export CSV

This function can either be used as backup of the sites to a PC or to transfer them to a different DM9600. This is very useful especially when modifications (like modified telephone number, etc.) have been made manually in the Sites Administration of the DM9600 and these modifications need to be updated in the PC program. Or, if the same sites must be installed in a second DM9600.
The format of this file is identical as the one described in "Import of sites".

Only the file name is different, in this case "ANLxxxxx.csv". The xxxxx in the file name are consecutive numbers containing zeros. The exported file can be used to import the sites into another DM9600, however the name must be changed to "anlagen.CSV" before it can be used for import.

8.4.2 Exporting measurements

This function is used to export measurements to a PC.

<div align="center">NOTE</div>

This is not a backup function and the results can't be transferred to another device
It can take up to 2 minutes to export measurements, depending on the number of measurements that are being exported.

The created file has the file name "TMPxxxxx.csv" the xxxxx in the file name are consecutive numbers containing zeros
The created file has a header with information like, Site number, Date/time, measuring values and units, all the information that is also stored inside the unit.

Here is an example:

	A	B	C	D	E	F	G	H	I
1	Site-No.	Date	Time	Intervall	Program name	Pressure	Ext.Pressure sensor	Temperatur (T1)	Temperatur (T2)
2						[hPa]	[Bar]	[°C]	[°C]
3	Site 12345	12.06.2018	11:29:57	00:00:01		-0.015	-3.862	---.-	28.6
4						-0.015	-3.862	---.-	28.6
5						-0.015	-3.862	---.-	28.6
6						-0.015	-3.862	---.-	28.6
7						-0.015	-3.862	---.-	28.6
8						-0.014	-3.862	---.-	28.6
9						-0.015	-3.862	---.-	28.6
10						-0.015	-3.862	---.-	28.6
11						-0.015	-3.862	---.-	28.6

8.4.3 Information about the data storage

In the „menu storage „you select „Memory info" to get information about the available storage capacity of the unit. You will see the number of stored sites (max 500) and the number of stored measurements (max 10.000).

9   Extras

The Device leaves our factory with standard firmware settings, and in most cases, this will cover your daily needs. However, these settings are adjustable and customizable to make work even easier. .
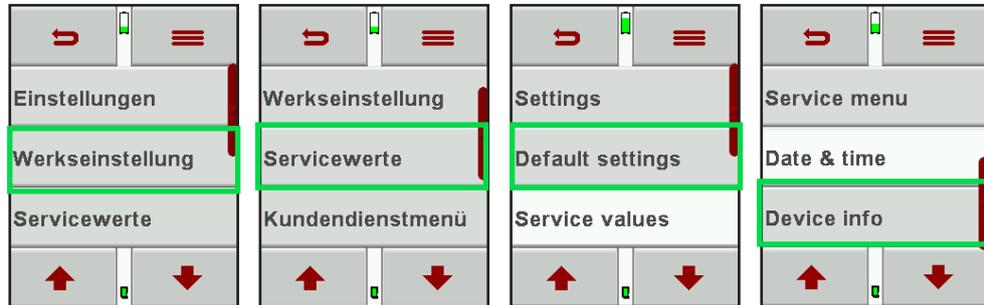
The menu items **Settings** and **Date & time** has already been explored in **chapter 4 Settings**.

9.1   Factory settings

The Device will be reset to factory settings:

Settings:
LCD brightness (%)   50
Helping hints   ON
Key beep   ON

9.2   Service values

Device errors can often be determined by using the values in the "service vales" menu.
The service values of all installed sensors are displayed here.
Please contact your local MRU service partner in case you have a malfunction of your device.
It's always handy to have the device next to you when make a service call, most likely the technician will ask you for these values and the serial number of the device.

9.3   Service menu

The service adjustment menu is PIN code protected. Only authorized and trained personnel may enter this menu.

You will be prompted back to the "settings menu" once you have entered a wrong PIN code.
Please contact a MRU service partner www.mru.eu to get the correct PIN code.

9.4   Device info

Here you get all informations of the device.

10 Appendix

10.1 Specifications

10.1.1   Accuracy of measurement

pressure sensor ±7.000 hPa (mbar)	
Maximal pressure	10.000 hPa
Range 1	-99,8 - +500 hPa
Resolution	0,1 hPa
Accuracy abs./reading	±0,5 hPa / 1 %
Range 2	-7.000 - +7.000 hPa
Resolution	0,1 hPa
Accuracy abs./reading	±1,0 hPa / 1 %
Temp. variation (typical)	(0 - 50 °C) ±0,5 %

Temperature Measurement T1, T2	
Number of thermocouple type	2
Range	-40 °C - +1.200 °C
Accuracy	±1°C / 0,5%

Velocity (optional #10711) (Only in combination with DM9600 - 75 hPa #912200 based on differential pressure measurement with Pitot tube"	v
Measuring range differential pressure	75 hPa
Accuracy differential pressure	±0.5 Pa / 1% with <5°C temp. change <30min meas. time
Measuring range	1 m/s - 100 m/s
Accuracy without error of Pitot tube	±1 m/s (0<v<2m/s) ±0.2 m/s (2<v<10m/s) ±0.5% (v>10m/s)
absolute pressure measurement (requires abs. pressure sensor above	•

Gas sniffer	
Measuring range CH_4	5 - 20.000 ppm
Overload	100.000 ppm
Resolution	1 ppm
Response time T90	< 5s

10.1.2   Data communication

Mini USB interface master only (for connection to USB stick or accessories)

microSD card reader

Infrared-interface for printer

Bluetooth

RS485 (AUX socket, for connection of external sensor modules)

10.1.3   Technical data

Suitable for	Non-aggressive Gas
Connector	8 mm
Size silicone hose	Ø 6 x 2 mm
Operating temperature	+ 5 - + 40 ℃
Storage temperature	- 20 - + 50 ℃
Quantity and size of batteries	Li-Ion
Operating time (50% brightness)	20h
Display	2,8" touch TFT
Housing material	PA6GF30
IP degree of protection	IP30
Weight	340 g
Size	83 x 38 x 180 mm
Memory sites	500
Memory Measures	1 000

10.1.4   Device trouble shooting

Fault indication	Possible causes	Repair
Device shows no reaction.	Device doesn't react to any touch screen commands.	▶ Press reset button
Display notice: "Device too cold" or A beep every 5 seconds	e.g. Device was stored in the trunk of a car during winter time.	▶ Take the device into a warm room and give it time to adapt to the room temperature!
Device can't be turned on or doesn't react once powered up.	Battery discharged.	▶ Connect the device to the battery charger and charge the battery.

Wrong temperature measurement results	K-Type plug not connected properly	▶ Check the connection
Gas temperature too high or jumping	Broken wire or broken thermo-couple.	▶ Check the wire for damages
		▶ Remove condensate drops from thermo-couple tip.

10.2 Firmware update

10.2.1   How to install a new firmware to the device
▶ Turn on the device

▶ Select **context menu / extra / device-Info**
  ⇨ In the 3rd line you will see the current installed firmware version for example 0.90.48

We will need the following information from you in case something has gone wrong with the update.
▶ Please note the version and the current firmware of your device.

10.2.2   Performing and verification of an update

Preparing a SD card
Typically, you will receive an update by email. You will have to unzip the file in case you have received the file in a zip format (you would do this on your PC). Now you will copy the unzipped file „1128.fwb" onto the root directory of the SD card.

10.2.3   Performing the Updates
▶ Copy the 1128.fwb file onto the root directory of the SC card
▶ Insert the SD card into the card reader of the device. The SD card contact pins must face towards you when you insert them into the device

and must snap into place once inserted.
Slightly push the SD card into the device and let go again to release the SD card.
▶ Start the device.
▶ Please wait, until you see the message „New firmware…found".
▶ Select and confirm „install firmware".
 ⇨ The update procedure will start...
▶ This will take about 45 seconds, don't press any keys during the update.
▶ Start the device again after the update.
▶ Confirm the information „Firmware update was performed…" with OK.

How can I verify that the update was successfully?
▶ Turn on the device. Select the context menu / extras / device info
 ⇨ In the 3rd line you will see the current installed firmware version for example 0.90.48.

What can I do if the old firmware version number is still displayed?
 ⇨ Repeat the update procedure.

Who can help me if I can't perform an update?
On the MRU-Homepage www.mru.eu you can find the Contact of your local sales office.

11   Declaration of conformity

EU-Konformitätserklärung

Declaration of conformity

CE
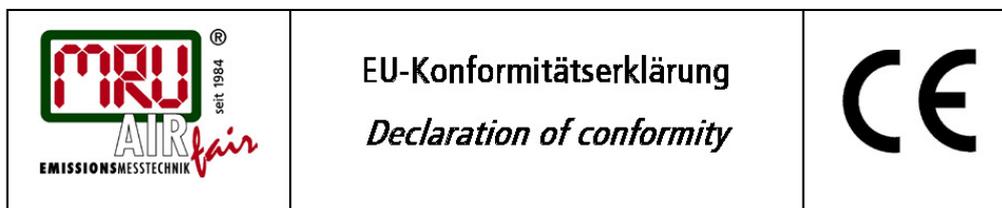
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Bevollmächtigte Person, für die Zusammenstellung der technischen Unterlagen

Person authorized to compile the technical documents

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Ort / *city:*	74172 Neckarsulm
Land / *country:*	Deutschland / *Germany*

Produkt/Product

Bezeichnung / *designation:*	Präzisions Digitalmamometer
	Digital Precision Manometer
Produktname / *name:*	**DM** *9600*
Funktion / *function:*	Druckmessung / Pressure measurement

Hiermit erklären wir, dass das oben beschriebene Produkt allen einschlägigen Bestimmungen entspricht, es erfüllt die Anforderungen der nachfolgend genannten Richtlinien und Normen:

We declare the conformity of the product with the applicable regulations listed below:

- EMV-Richtlinie / *EMV-directive* 2014/30/EU

- Niederspannungsrichtlinie / *low voltage directive* 2014/35/EU

- RoHS-Richtlinie / *RoHS directive* 2011/65/EU (RoHS II)

Neckarsulm, 06.04.2017

Erwin Hintz, Geschäftsführer / *Managing Director*