Operating Instructions
Precision Pressure Controller/Calibrator DPC 3800

1. Important Information

Dear Customer,

You have purchased an instrument that was manufactured in our company, which is certified according to DIN ISO 9001.

The pressure controllers are manufactured according to the valid norms. Their designs, dimensions and materials represent the state of engineering at the time of printing.

We reserve the right to change and replace components without further notice.

The integrated pressure sensors are, unless otherwise agreed, calibrated in compliance with test certificate 3.1 according to EN 10204, and thus traceable to a national standard.

Please read these operating instructions carefully before taking the precision pressure controller / calibrator DPC 3800 (see fig. 1) into operation.

The following operating instruction was composed with due care. The following chapters provide you with all information necessary for a safe handling.

Please ensure that all persons, who operate the device, have read and understood these operating instructions.

It is, however, not possible to take into account all versions and possible fields of application in this manual.

If you have any questions regarding a special application, regarding the devices, storage, mounting or operation, please contact us as manufacturer or the distributor.

Should a reason for complaint however arise, please return your device with a detailed description of faults to our factory.

For special versions please note the specifications indicated on the delivery note.

Please support us in improving this operating instruction. We will gladly accept your advice.

Fig. 1

All applications according to regulations are explicitly stated, any other application is considered improper use!

Both ARMATURENBAU GmbH and MANOTHERM Beierfeld GmbH do not assume liability for damages that arise from incorrect use of the device or from disregard of the information contained in this manual.

Please keep the operating instructions in a safe place to draw on it as and when required.

Do not tamper with the device on your own. Otherwise, all warranty claims will be void.

No reproduction of this operating instruction (in whole or in part) is allowed.

Not all functions that are depicted and described in this manual are available for every instrument version.

Firmware - Manual - Version Key	
Manual	**Firmware**
V 1.0	

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2. Contents

3. General Information

The following chapters provide you with all information necessary for a safe handling of the precision pressure controller / calibrator DPC 3800. If you require further information or if any problems arise, which are not reflected in detail in this operating instruction, please contact:

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3.1 Pictographs Used in This Manual

In this manual pictographs are used as hazard warnings.

Particular information, instructions and restrictions designed for the prevention of personal or substantial property damages

Warning! Is used to warn you against an imminent danger that may result in personal injury or death.

Important! Is used to warn you against a possibly hazardous situation that may result in personal, property or environmental damages.

Caution! Is used to draw your attention to important recommendations to be observed. Disregarding them may result in property damages.

Danger! This symbol is used for hazards generated by electric current. Disregarding these safety instructions may result in serious or fatal injuries.

Passages in the text containing explanations, information or advices are highlighted with this pictograph.

The following symbol highlights
- actions you have to conduct
  or
- instructions that have to be strictly observed.

4. Safety Instructions

Please read this operating instruction thoroughly before operating the pressure controller DPC 3800. Disregarding the containing warnings, especially the safety instructions, results in a risk of fatal injury. Severe personal injuries as well as property damages may arise.

Any use of the pressure controller DPC 3800 diverting from or exceeding the set applications according to the regulations is not allowed.

It is required to comply with all technical specifications of the pressure controller according to this manual.

The precision pressure controller is to be handled with care. The permissible ambient conditions according to data sheet 10461 are to be kept.

The device is supplied with hazardous voltages via mains cable. Even after the disconnection from the power supply, dangerous voltages may be temporarily present due to capacities.

Warning!
Before the mounting, commissioning and operating it is necessary to ensure that the device is suitable concerning pressure range, version and specific measuring conditions.

Do not open the device.

The device may only be opened by trained and qualified personnel. There is a risk of an electric shock.

Transporting the device from a cold to a warm environment, condensation may result in a failure of the function. In such a case, make sure the device temperature has adjusted to the ambient temperature before putting it into operation again.

If faults cannot be corrected with the help of this operating instruction, the device has to be decommissioned instantly and secured against unintentional startups.

The manufacturer shall not be held liable for any damage due to misuse of the device. Repairs shall only be performed by the manufacturer. Any modifications or changes to the device are not permissible.

4.1 Operator's Obligation to Exercise Diligence

The pressure controller DPC 3800 was designed and manufactured following a careful selection of standards to be complied with as well as further technical specifications. It therefore complies with the state of the art and guarantees maximum safety.
This safety is achieved in industrial practice only if all necessary measures are taken.
The necessary measures are subject to the due diligence of the user of the pressure controller DPC 3800.

In particular, the user shall ensure that
- the pressure controller DPC 3800 is only used according to the regulations (please refer to the chapter “Product Description”).
- there exist proved safety mechanisms, which avoid any risks for personnel or devices, especially test items (UUT) in case of undue pressurisation or leakage of the applied pressure media.
- the device and all components involved are only operated when in a flawless and fully functional condition, when the installation and commissioning was carried out correctly and when regular maintenance is conducted.
- the persons who operate the pressure controller have access to this manual at all times and that they have read and understood this manual.
- the pressure controller shall only be mounted, commissioned, maintained and put out of operation by authorized trained and instructed personnel who are able to independently recognize potential hazards.
- the pressure controller must always be handled with the care necessary for an electronic precision measuring device.

4.1.1 Personnel Qualification

Warning!
Risk of injury in case of insufficient qualification!

Personnel, responsible for mounting, commissioning, operating and decommissioning has to be adequately qualified for these tasks.

Qualified personnel are those persons who are familiar with setting up, mounting, commissioning and operating this pressure controller DPC 3800 and those who have an appropriate qualification corresponding to their function.

Attention should be paid to directions concerning occupational safety and regulations of the employer's liability insurance association.

4.2 Basic Safety Instructions

Sound and safe operation of the pressure controller requires proper transport, professional storage, setup, mounting and intended use. A careful operation and scheduled interval maintenance is required for an electronic precision measuring device.

In the case of an error, a high medium pressure or vacuum may be on the input and output connections.
An unregulated release of gas pressure poses a serious danger for humans and the environment.

If the display is damaged, please pay attention to glass fragments since you might cut or injure yourself.

Further important safety instructions can be found in the various sections of this operating instruction.

4.3 Personal Protective Equipment

Warning!
High sound pressure due to outpouring pressure medium.

Wear ear protection!

When working on and with the device, wear safety glasses!

4.4 Safety Instructions Concerning the Operation

Before pressurisation of the pressure controller, all involved components shall be in a flawless and fully functional condition. The attached components shall be suitable for the applied maximum pressure.
Check the screw fittings for leaks and that they are firmly seated.

The used pressure medium shall meet the requirements according to the operating instructions.

Maintenance, cleaning and service works on the pressure controller shall always be carried out under voltage free and pressure free conditions of the system.

Ensure that a safe pressure release is possible on the rear side of the pressure controller.

The limit values for voltages and current must not be exceeded.

4.5 Safety Markings on the Pressure Controller

4.5.1 Explanation of Symbols

This operating instruction is to be read prior to mounting and commissioning by all means!

With the CE marking the pressure controller DPC 3800 complies with the current European Directives.

For disposal return the product to the manufacturer or bring it to a designated collection facility. See EU-Directives 2002/96/EC.

4.6 Information on the Electromagnetic Compatibility (EMC)

4.6.1 EN 55011 (or CISPR 11)

Warning!
This is a device of Class A for interference emission and is designed for use in an industrial environment.
In other environments, e.g. living and business areas, it might possibly interfere with other devices. In this case, the user may be required to take appropriate corrective action.

5. Device Description

Fig. 5

Features / Specialties

The pressure controller DPC 3800 (see fig. 5) features a wide range of industrial capabilities.

- Pressure controller with precision pressure sensor
- Up to 3 precision sensors can be actuated automatically (plus barometric reference)
- Customised configurations of the pressure controller possible
- Very high measuring rate
- Colour touchscreen, LED backlight
- Easily calibrated
- Modular construction
- Fully digital measuring instrument
- Automatic creation of test certificates via optional calibration software DynaCal

Instrument Versions

Please refer to the delivery note of your device for detailed information on the range of function and on the scope of delivery.

5.1 Software License

This product contains intellectual property, i.e. software programmes, that are licensed for use by the end user / customer (hereinafter “end user”).

This is not a sale of such intellectual property.

The end user shall not copy, disassemble or reverse compile the software programme.

The software programmes are provided to the end user “as is” without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability and fitness for a particular purpose. The entire risk of the quality and performance of the software programme is with the end user.

ARMATURENBAU GmbH and MANOTHERM Beierfeld GmbH shall not be held liable for any damages suffered or incurred (including, but not limited to, general, special, consequential or incidental damages including damages for loss of business profits, business interruption, loss of business information and the like), arising from or in connection with the delivery, use or performance of the software programme.

6. Product Description

6.1 Intended Use

The modular controller DPC 3800 is equipped with up to three precision sensors and an optional barometric reference. The pressure connections of the controller DPC 3800 are located on the rear side. Due to a measurement uncertainty of 0.01 % FS of the entire measuring chain and its control stability of 0.003 % FS this controller DPC 3800 is suited for the automatic calibration of pressure measuring instruments.

Warning!
The controller shall only be used with clean dry air or nitrogen. Workshop air shall be avoided and according to Article 2 Section 2 of the Directive 67/548/EWG it is essential to avoid using hazardous media as pressure medium.

The pressure medium, which was used as pressure transmission medium during calibration, shall be used preferably (see calibration certificate included in the delivery).

Strictly adhere to the indicated limit values of the individual pressure sensors as well as all other technical specifications listed in this manual.

Extremely fast pressure change rates pose a danger for the sensor technology. Especially, if they result in an internal pressure (even for a short time) which exceeds the upper range value of the controller, since they mean a high mechanical stress for the sensors. A protection by means of the integrated overload device cannot be guaranteed in such a case, since there is a certain response time required for actuation.

All integrated pressure sensors are equipped with a calibration certificate for the entire measuring chain (see enclosure). Improper handling or exceeding the maximum pressure range might possibly require recalibration and adjustment. In this case, please return the device immediately to the manufacturer.

The device is not suitable for the operation in potentially explosive areas. The DPC 3800 is no safety component according to the pressure equipment directive and must not be used as such. If not used according to this operating instruction, no safe operation of the DPC 3800 is ensured.

The operator of the device, not the manufacturer, is liable for any personal and material damages that arise from unintended use!

6.2 Design

The precision pressure controller DPC 3800 is available as stackable desktop case or optional as 19" rack mounting with side panels including mounting kit. Furthermore, an optional barometric reference sensor is available. The main components of the precision pressure controller DPC 3800 are the measuring and control electronics, three or five magnetic valves, evaluation unit and the interfaces RS-232, Ethernet and touchscreen.

6.3 General Description of Function

1. Up to three temperature compensated high-precision pressure sensors.
2. An optional internal, highly precise barometric reference sensor indicates the pressure change from differential pressure to absolute pressure.
3. The DPC 3800 controls (positive or negative) pressure changes of 10 % FS at a test volume of 50 ml within ≤ 10 seconds.
4. Pressure ranges > 100 kPa measuring uncertainty (K=2) 0.01 % FS or
   Pressure ranges < 100 kPa difference measuring uncertainty (K=2) 0.03 % of the measuring span.
   Recommended calibration interval: 1 year.
5. Compact case or 19" rack mounting.
6. Remote operation via RS-232 or Ethernet.
7. Emulation of other standard controllers.

6.4 General Instructions on the Interface Communication

For integration in existing systems a RS-232, Ethernet or optionally IEEE-488.2 interface or an analogue output is available.

6.4.1 Ethernet Interface

The Ethernet communication port enables the DPC 3800 to communicate with computers via 10/100 Base-T-Specifications.

Please consult your network administrator before connecting the device with your network to avoid conflicts with existing IP addresses.

Ethernet communications are transmitted via RJ-45 standard cable. Prior to the first use of Ethernet communication, the four parameters "IP", "Net mask", "Gateway" and "Port" must be set. These are configured in the communication SETUP menu.

6.4.2 RS-232 Interface

When using the RS-232 interface, a cable must be connected directly from the instrument to a suitable port on the computer in a 'point to point' link. Table 2-1 shows the PIN connections for the 9-pin D-type, RS-232 connector, the RS-232 control signals, and the relationship between the computer and pressure connection. The device is configurated as data terminal equipment (DTE).

6.4.3 IEEE-488.2 Optional Interface

The connection of the IEEE-488.2 interface is designed as a 24-pin IEEE-488 socket. The manufacturer of the IEEE-488 interface board provides software to allow communication between the DPC 3800 and various programming languages.

6.4.4 DPC-Interface Configuration

Connector pin assignment DPC 3800 (option push button)

PIN	Configuration	Description
1	Vent 1 CNT	valve 1 control output cut off control unit
2	Vent 1 GND	valve 1 ground
3	Vent 2 CNT	valve 2 control output exhaust UUT (Unit Under Test)
4	Vent 2 GND	valve 2 ground
5		
6		
7		
8		
9	Control + 24 V	supply control gate input
10	Control Input	control gate input (pedal button)

USB Interface
The USB 2.0 FS-connection on the rear side of the device is a socket type USB-B. It is needed for service purposes only.

DPC Commands

Command	Usage	Description
?	?<CR><LF>	provides actual and reference values and stable state, separated by ,;' (ISTWERT; SOLLWERT; STABLE)
P=[WERT]	P=5.05<CR><LF>	sets the actual control value to 5.05
E0	E0<CR><LF>	test item exhaust off
E1	E1<CR><LF>	test item exhaust on
V1	V1<CR><LF>	system quick exhaust on
C0	C0<CR><LF>	locks controller unit
C1	C1<CR><LF>	unlocks the controller, the controller sets to reference value
#T16	#T16<CR><LF>	provides actual values
U …	U1 … U 16<CR><LF>	change pressure units according to chapter 15
TONIN=	TONIN=10<CR><LF> !Intervention in the controller!	change the valve coefficient of the inlet side
TONOUT=	TONOUT=10<CR><LF> !Intervention in the controller!	change the valve coefficient of the outlet side
PIDIN=	PIDIN=P;I;D;C !Achtung!	change the PID parameters "inlet"
PIDOUT=	PIDOUT=P;I;D;C !Achtung!	change the PID parameters "outlet"
U?	U?<CR><LF>	show the pressure unit
DIG=	DIG=1<CR><LF>	setting the decimal places
DB=	DB=0.005<CR><LF>	"DeadBand" in bar (always)
R0 R1 R2	R0<CR><LF> !Use only in VENT mode!	switching of the measuring range R0 activates auto range function
T1	T1<CR><LF> !Only VENT mode!	the active sensor will be tared possible R1 and R2 as MB
ID?	ID?<CR><LF>	information on DPC, e.g. serial number
F0 F1	F1<CR><LF>	filter depending on DB=

RS-232 Socket 9 PIN Sub-D

PIN	Configuration	Description
1		
2	RX	transmission (wire colour yellow)
3	TX	receive path (wire colour green)
4		
5	signal-ground	(wire colour brown)
6	DSR	dataset ready (wire colour white)
7		
8		
9		

6.5 Operating Principle of the Multiple Range Version

Besides the main sensor, the pressure controller version multiple range includes a second or third precision sensor in order to increase the accuracy of the lower part of the pressure range.
Depending on the required working pressure, the multiple range controller chooses the pressure range which is most suitable automatically and smart.
This is carried out regardless of whether the reference value was entered via touchscreen or sent via interface.
The combination of the precision pressure sensors is provided flexible according to customer requirements. Sensors with a pressure range ratio of up to 1:10 may be combined to ensure a wide calibration range.

7. Technical Data

Pressure Ranges
Gauge pressure (bar) -1 – 1; 0 – 2; -1 – 3; 0 – 5; -1 – 10; 0 – 20; -1 – 30; 0 – 60; -1 – 100

Absolute pressure (bar abs.)
0 – 1; 0 – 3; 0 – 10; 0 – 30; 0 – 100

Differential pressure (mbar) ± 30; ± 100; ± 300

Optional Barometric Reference

Function:	Barometric reference is required for the change of absolute pressure <=> gauge pressure. A pressure controller with relative reference sensors requires compound ranges for full functionality.
Pressure range:	800 mbar to 1,200 mbar abs.
Accuracy:	0.008 % FS

Pressure Units 23 and 1 freely programmable (15 of these via touchscreen)

Instrument Version Desktop case
optional: 19"-rack mounting with side panels incl. mounting kit

Weight approx. 7.0 kg (15.43 lb)

Display

Screen division:	actual value, reference value, steps
Resolution:	6 digits
Keyboard:	colour touchscreen
Warm-up time:	< 10 minutes
Response time:	approx. 10 ms

Pressure Ranges max. 3 pressure ranges and 1 barometric reference

Pressure Connections G ⅛" female
optional: 6 mm Swagelok®-tube fitting or connection adapter

Media
Clean, dry, non-corrosive, non-combustible and non-oxidising gases

Overrange Protection
150 % of the largest pressure range
optional: external pressure relief valves

Power Supply
Auxiliary energy 88 – 264 V AC, 47 – 63 Hz

Permissible Ambient Conditions

Operating temperature:	+10 to +40 °C (+50 to +104 °F)
Storage temperature:	0 to +70 °C (+32 to +158 °F)
Relative humidity:	0 to 95 % r. h. (non-condensing)
Compensated temperature range:	+15 to +35 °C (+59 to +95 °F)

Communication

Interfaces:	RS-232, Ethernet
optional	
Interface:	IEEE-488.2
Switching outputs:	24 V DC PWM or TTL level

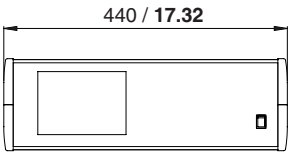
Instruction Sets
DPC 3800, alternative instruction sets possible, alignment to existing HOST software upon request

Approvals and Certificates
EMC-Directive 2004/108/EC, EN 61 326-1 emission (group 1, class A) and stability (industrial sector)

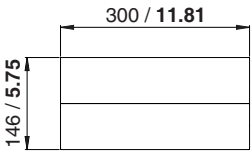
Calibration certificate 3.1 according to DIN EN 10204, optionally internationally traceable calibration certificate

Dimensional Data in mm / inch

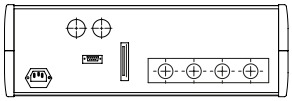
Front view



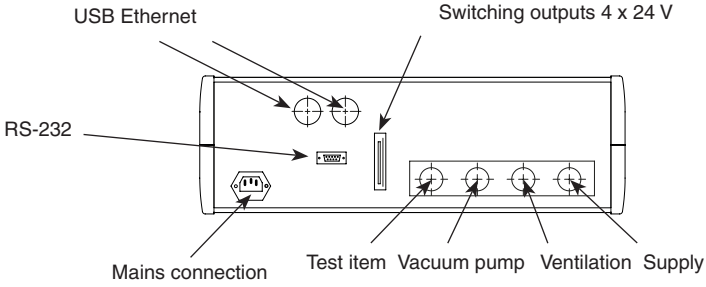
Lateral view



Back view



Electrical connections and pressure connections – back



8. Transport, Packing and Storage

The system shall be clean and free of dirt before shipping. This is especially important if the medium is health-damaging, e.g. toxic, corrosive, carcinogenic or radioactive.

The pressure controller DPC 3800 shall only be sent within transport boxes that are especially designed for this. Please request such a transport box if necessary.

1. Please wrap the device in an antistatic plastic foil.
2. Put the device into the box and make sure that it is tightly packed with the protective material.
3. If possible, place a bag containing desiccant inside the box.
4. Please make sure that the shipment is labelled as carriage of a highly sensitive measuring instrument.

8.1 Packing Materials Handling

The packing shall only be removed immediately before mounting the DPC 3800.

Please keep all packing materials, since it offers ideal protection for transporting in case of changing operation sites or repair return consignments.

8.2 Storage

The system shall be clean and free of dirt before storage. This is especially important if the medium is health-damaging, e.g. toxic, corrosive, carcinogenic or radioactive.

The storage location shall comply with the following conditions:

- Ambient temperature: 0 to 70 °C (32 to 158 °F)
- Humidity: 35 to 85 % relative humidity (non-condensing)

Avoid the following influences:

- Direct sunlight or vicinity to hot objects
- Mechanical vibration / mechanical shock (by putting it down hard)
- Soot, vapour, dust and corrosive gases
- Potentially explosive environments, flammable atmospheres

The device should be stored in its original transport box, in a place that meets the conditions listed above.

Follow the instructions below to avoid damages:

1. Wrap the device in an antistatic plastic foil.
2. Place the device in the box using the protective material.
3. If stored for a prolonged period of time (more than 30 days), add a bag with desiccant to the box.

9. Installation – Configuration and Function

9.1 Introduction

The following chapter contains recommendations concerning the initial installation of the DPC 3800. The installation is carried out as follows: unpack the device, set it up at an appropriate place, connect it, switch it on and configure the system if necessary.

9.2 Scope of Delivery

Apart from additional parts you may have ordered, the delivery consists of:

1. Basic device precision pressure controller / calibrator
2. Mains connection cable 1.5 m
3. Operating instructions with calibration certificate of the sensor technology
4. Optional: recommended interface cables

9.3 Unpacking

Please unpack all components of the device carefully and check the individual parts for damages. Immediately report any damage to the shipping company.

9.4 Setting Up

The installation site shall comply with the following conditions:

- Ambient temperature: 15 to 35 °C (59 to 95 °F)
- Humidity: 0 to 95 % relative humidity, without condensation
- Flat, horizontal position; secure and fixed working surface (desktop version) or proper installation in a solid 19" mounting frame / 4HE (19"- rack mounting)
- During operation, pressure escapes at the rear side of the device. Therefore, make sure that personnel has no access to the rear side during operation as well as to the vent opening in case of piped VENT / LOW SUPPLY port.

Avoid the following influences:

- Direct sunlight or vicinity to hot objects;
- Unstable installation position or highly inclined installation position;
- Mechanical vibrations;
- Proximity to disturbing sources with strong electromagnetic fields, such as high voltage appliances, mobile phones or power lines;
- Soot, vapour, dust and corrosive gases;
- Potentially explosive environments.

Pressure supply requirements:

- Stable supply pressure: slightly above the full scale value of the controller
- Permissible media: dry, clean air or nitrogen
- Vacuum: at least 50 litres/min (if required)

9.5 Pressure Connections

All pressure connections (see fig. 9.5), except for the Ref. port, have G ⅛" female connections at the rear side of the instrument. The cross-section of the piping shall be selected according to length and pressure.

Fig. 9.5

TEST
Below the label “TEST” is the pressure connection where the pressure, which is precisely regulated by the controller, is applied or an applied pressure is precisely measured by the device.

SUPPLY
Below the label “SUPPLY” is the pressure connection for the supply pressure, which shall be slightly higher than the full scale value of the controller (see labelling strip on the upper right front side of the device).

VAC
Below the label “VAC” is the pressure connection for the vacuum supply (only for supply pressure < 40 bar). In case of an overpressure version, atmospheric pressure may be optionally applied here.

VENT
Below the label “Vent” is the pressure connection, with which the system is abruptly vented to atmosphere in certain situations.

REF.
If there is no blind plug available, the port (connection) labelled Ref. is the connection to the optional barometric reference as well as to the reference port of the pressure sensors with overpressure measuring ranges < 4 bar. This connection must be left open to atmosphere and external pressure must not be applied.

9.6 Instructions on the Pressure Connections

The user has to ensure that any medium that might escape from the VENT or SUPPLY port is released in a suitable manner without danger for humans or the environment. Furthermore, suitable sound dampers shall be used.

The higher the supply pressure at SUPPLY (inlet port of the control unit), the higher the possible pressure, which can leave the system through VENT (outlet port of the control unit).
If a vacuum pump is connected to VAC, appropriate protective measures have to be taken by the user, so that the vacuum pump will not be damaged.

Furthermore, the maximum supply pressure shall not endanger the vacuum pump. (Therefore, the technical data of the vacuum pump have to be checked beforehand.)

If a vacuum is applied to the SUPPLY port of the controller, negative pressure peaks of several -100 mbar might occur at the TEST port for a short time when changing from the measuring mode to the control mode.

Prior to the connection of the device, there must be ensured that there exist appropriate protective measures, which prevent an overload of the test item or the device. The supply pressure at the SUPPLY port must not exceed the overload capability of the test item.

The pressure pipes, couplings and other components used for piping must be suitable for the occurring pressures.

9.7 Recommendation Concerning the Pressure Piping

The user must ensure that the used pressure media are available in clean and dry form. If necessary, the sensors have to be protected by using sediment bowls, particle filters or humidity filters.

9.8 Electrical Connections on the Rear Side

The electrical installation has to be carried out according to the following instructions while observing all relevant regulations. It is to be carried out by personnel, who are familiar with the safety regulations for working on electrical plants and who can work according to them.

9.8.1 Connection of the Mains Input Socket

Before connecting the mains input socket, make sure that the mains voltage corresponds to the specification of the power supply unit. Switch off the device before connecting it with the mains. Only the provided mains cable should be used. The provided 3-pin mains cable is equipped with a protective conductor. Hence, operate the device only from a three-pin socket and always make sure that the earth conductor is properly connected.

The mains input socket is to be connected, according to the regulations, to a power supply with the provided country-specific connection cable, which is within the stipulated specification (see chapter 7 “Technical Data”).

9.8.2 Connection of the Interfaces

The interface cables must not be longer than 3 m and must be laid separate from cables with voltages > 60 V. Devices which are connected to the interfaces have to comply with the standard IEC 60 950.

RS-232 Interface:

The RS-232 interface is designed as a 9-pin SUB-D-socket and is to be connected as required according to the regulations with the cable mentioned below or a 9-pin 1:1 cable of similar quality:
- 3 m Data Extension Cable; DB9 Male/DB9 Female.

IEEE-488 Interface:

The connection of the IEEE-488 interface is designed as a 24-pin IEEE-socket and is to be connected as required according to the regulations with the cable mentioned below or a cable of similar quality:
- 2 m IEEE-488-2 MPB CABLE.

9.8.3 Connection of the Relay Outputs

When connecting the relay outputs, the national installation regulations (e.g. Germany: VDE standard) and the Appliance Safety Law are to be observed and followed. The limit values of the relays for current and voltage must not be exceeded. The relays must not have any direct or indirect influence on critical processes.

10. Commissioning and Operating

Prior to switching on the device, it must be ensured that the device was installed according to the instructions of the previous chapter and that all connections installed are fitted or carried out according to the regulations.
It is necessary to ensure that all specifications, such as supply voltage, supply pressure, operating temperature, humidity, specified pressure media and pressure ranges are met. Rapid temperature changes might cause condensation within the device. In such a case, allow the device to acclimatize. Before pressurising, appropriate protective measures must be taken to ensure that the device or a test item will not be overloaded. When working with or on the device, safety glasses must be worn. When the supply pressure exceeds 40 bar, ear protection must be worn.
When working with inert gases, these might leak. This is why premises, in which the DPC 3800 is operated, need sufficient air ventilation systems.

Pressure can accelerate loose components in a hazardous manner.

The device is configurated ex-works in such a way that the individual measured value display (1 window/MEASURING-Mode) appears on the screen.
After thermal balancing with the installation place, the controller is immediately ready for operation. However, in order to achieve the ideal precision of the system, the device should be switched on about 15 minutes prior to its use.

11. Operation

11.1 Preparations

Instrument displays may differ from the figures in this manual, depending on the selected instrument configuration.

Please ensure that electrical cables and pressure pipes comply with the installation requirements in chapters 9 and 10.

A proper connection of the required components will be accomplished by following the directions below:

1. Make sure that the power switch on the front side is turned off (push the lower part of the **red flip switch**).

2. Connect the supplied mains cable to the power supply.

3. Check the pressure hoses of your pressure supply for damages as well as infiltrating dirt and moisture.

4. Connect a device for pressure supply to the **"SUPPLY"** port on the rear side of the device. As measured by the stationary pressure sensors, a pressure supply about 10 % above the highest installed pressure level shall be connected, in order to guarantee complete control. A compressor is available separately.

5. Connect a filter to the **"VENT"** port. If no filter is used, this connection must be left open to atmosphere and external pressure must not be applied.

6. Connect a calibration object or a device for pressure testing to the **"TEST"** port. A test item (UUT) is available separately.

Caution!
The test item might be damaged due to overpressure. Therefore, please bear in mind the permissible maximum pressure of the test item during control and make necessary adjustments on your pressure controller (see chapter 11.4.2).

7. If required, connect a vacuum pump to the **"VAC"** port. Such a vacuum pump is also available separately.

8. Please test the device prior to use.

Get an overview and acquaint yourself with the complete procedure before starting a process on a component or system.

For further connection options for external operation please refer to chapter 11.6.

11.2 Switching On and Off

After completing all preparations, turn on the device by pressing the **red flip switch** on the front side of the device. Wait a few seconds for the display menu to appear on the screen (see chapter 11.4.1). The device is now ready for operation.

Before switching off the device, we recommend to release the pressure, which might be within the device, by venting it. To do so, press the **"VENT"** button in the display menu via touchscreen (see chapter 11.4.1). When the device is vented successfully, turn it off by pressing the **red flip switch** on the front side of the device.

Caution!
Protect your device from a too high permanent load. If you are not going to use the device for a considerable time, please turn off the pressure supply as well as the device itself.

11.3 Basic Settings

To remove the factory settings, please make the following adjustments:

Pressure Unit
Select the desired pressure unit by pressing the button **"Unit"** in the display menu via touchscreen (see chapter 11.4.1).

Operating Language
In the service menu (see chapter 11.7), menu point **"Setup",** the required operating language can be selected.

11.4 Menu Navigation and Buttons

11.4.1 Display Menu

Fig. 11.4.1-1

The display menu (see fig. 11.4.1-1) is the main menu of the device and appears right when the device is turned on. Here, you can **read the actual pressure and the reference (desired) pressure** and you can make the main settings by using the buttons. **Active buttons** are always highlighted **green**. The activation is done via touchscreen. The following buttons and values can be operated or displayed in the display menu:

Tare
The displayed actual value can be saved as tare. By pressing this button, the actual pressure value is defined as “zero pressure”.

Caution!
The device might be damaged due to overpressure. Please bear in mind that the actual pressure is not released when set to zero, but is still within the device. Hence, during control this value is further increased by the set reference value.

Vent
By pressing this button, you vent the device.

Control
By pressing this button, you start the control process. Here, the actual pressure is equalised to the specified reference pressure.

Unit
By pressing this button, you access another menu that will enable you to select the required pressure unit via the according button (see fig. 11.4.1-2):

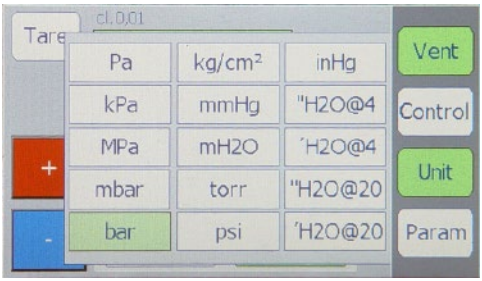


Fig. 11.4.1-2

Via touchscreen, you can choose between 15 different units.

Param
By pressing this button, you access another menu, the parameter menu. There you can adjust the parameters for the control process more precisely. For further information, please refer to chapter 11.4.2.

Pressure Range (Single Range Device)
The button with the pressure range (e.g. 0-1 bar) represents a sensor with a defined pressure interval. The controlled actual pressure is within this range if this button, and therefore this pressure sensor, was selected.

Pressure Ranges (Multiple Range Device)
Additional buttons with different pressure ranges represent further sensors with their respective pressure intervals. The actual pressure is within this range if a button, and therefore its associated pressure sensor, was selected manually.

AUTO
If this button is activated (green highlighting), the device automatically chooses the ideal pressure range.

Actual Pressure
This value shows the controlled actual value in the selected pressure unit (e.g. bar) and cannot be modified manually. As soon as the actual value is equal (within a specified tolerance, see chapter 11.4.2) to the reference value, this value is highlighted green.

dP
After appropriate setting in the service menu (see chapter 11.7), the deviation of the actual pressure from the reference pressure is displayed above the display of the actual value.

Desired
This section displays the desired pressure. This reference pressure can also be modified here by pressing the displayed value. Then a new display appears (see fig. 11.4.1-3):

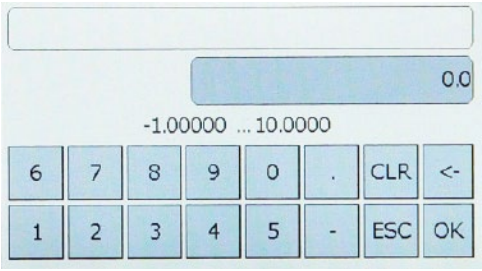


Fig. 11.4.1-3

Enter the desired reference pressure via the **numerical keypad**. Previous entries can be deleted with **"CLR"** or the **cursor key**. Confirm with **"OK"**. Press **"ESC"** if you choose not to save the changes. If the entered value flashes red and is not accepted, the permissible reference value range might be exceeded.

Step
This section displays the interval resp. the value, by which the reference pressure can be gradually increased or decreased. This value can be changed by pressing the step display (see fig. 11.4.1-4):

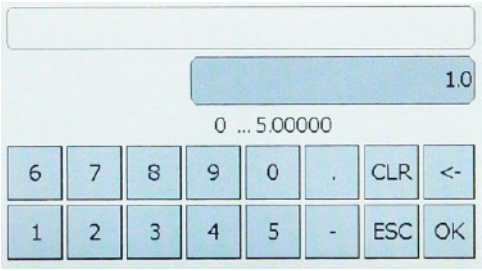


Fig. 11.4.1-4

Now enter the required step value via the numerical keypad.

+ / -
With these buttons you can gradually increase (+) or decrease (-) the reference pressure. Here, the step value is defined via the section **"Step"**.

11.4.2 Parameter Menu

In the parameter menu, you can adjust the decimal places of the pressure readings, the control tolerance and the vacuum valve for a vacuum pump (optional) as well as further settings for an external operation. You may enter the parameter menu by pressing the button **"Param"** on the touchscreen both in the display menu and in the submenus of the parameter menu. The following display appears (see fig. 11.4.2-1):

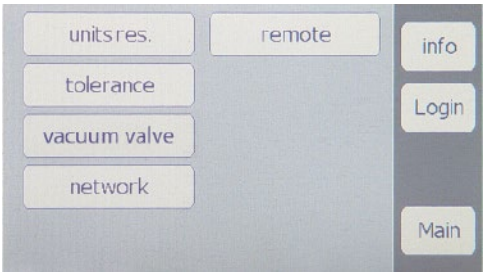


Fig. 11.4.2-1

Now you can choose between several buttons:

Info
By pressing this button, the serial number and the BIOS version of this device is displayed.

Login
By pressing this button, you can log on to the service menu (see chapter 11.7).

Main
By pressing this button, you return to the display menu.

Units Res.
By pressing this button, you can define the number of decimal places for the respective pressure units (see fig. 11.4.2-2):

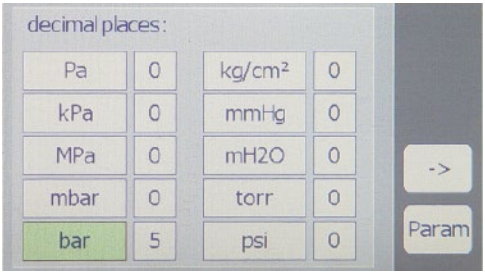


Fig. 11.4.2-2

With the cursor key, you gain access to more units (see fig. 11.4.2-3):

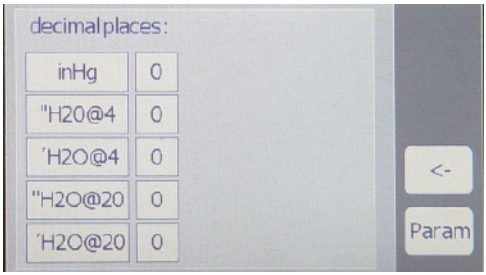


Fig. 11.4.2-3

Via touchscreen, you can now choose the required unit for which you would like to change the decimal places. A **numerical keypad** appears where you can enter the required number of decimal places. By pressing the button **"Param"** you can return to the parameter menu.

Tolerance
By pressing this button, you can enter another display (see fig. 11.4.2-4):

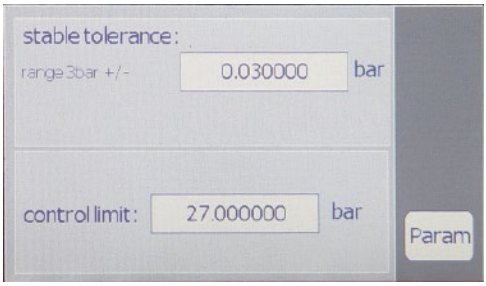


Fig. 11.4.2-4

In the upper boxes **"Stable Tolerance +/-"** you can set the deviation tolerances for the controlling. After pressing the box, a numerical keypad appears with which the control tolerance can be entered.
In the lower box, the **"Control Limit"** can be determined, i.e from which maximum pressure onwards the safety ventilation shall be activated. This safety ventilation aims to **protect the test item**. This value can similarly be set by touching the box and entering the required value via numerical keypad. If the full potential of a pressure sensor shall be tapped here, we recommend entering a value slightly above the limit of the pressure sensor.

Vacuum Valve
By pressing this button, the control can be optionally switched on or off with an external vacuum pump. This button is highlighted green when activated.

Network
By pressing this button, you access the display for the installation of an external computer. There you have the option to enter **IP Address, Subnet** and **Gateway** by touching the respective boxes (see fig. 11.4.2-5):

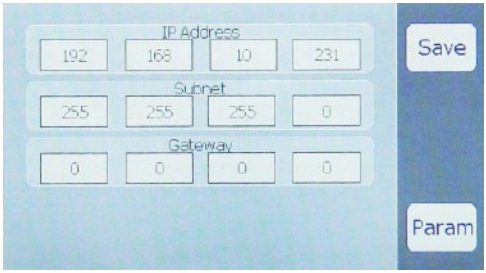


Fig. 11.4.2-5

Please confirm your entries with **"Save"**. For detailed information on the external operation, please refer to chapter 11.6.

Remote
If an external computer is connected, a command is displayed after pressing this button, which was issued by the external computer prior to this (see fig. 11.4.2-6):

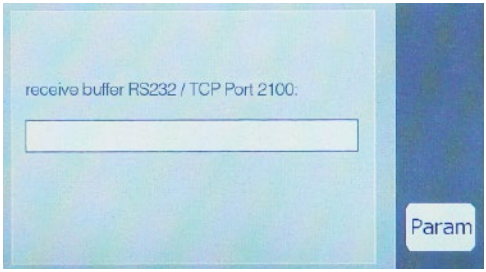


Fig. 11.4.2-6

11.5 Control

The core function of this device is the pressure regulation and calibration of pressure measuring instruments. Please note the following directions for successful control:

1 Connect a sufficient pressure supply to the connection **"Supply"**.

2. Connect a test item if necessary.

3. Switch on the device. The display menu (see fig. 11.5) appears:

Fig. 11.5

4. Enter the required pressure unit via **display menu -> unit.**

5. If necessary, enter the decimal places (**units**) via **parameter menu**, the **control tolerance** as well as the **control limit.**

6. Enter the **desired value** in the **display menu**.

7. Enter the step interval via the box **"Step"**.

8. Afterwards, press the button **"Control"**. The actual pressure will now be adjusted to the specified reference pressure.

9. If applicable, please pay attention whether the test item indicates the settled actual or reference pressure correctly.

10. Press the **"+"** or the **"-"** button to increase or decrease the **reference value** gradually..

11. When you finished the control process, you can manually exhaust the pressure from the device by pressing the button **"Vent"** in the **display menu**.

If the actual pressure exceeds the previously set control limit, the safety ventilation will be initiated automatically to protect the test item.

Caution!
The device may be damaged by overpressurization. Therefore, please follow the direction on the button **"Tare"** in chapter 11.4.1.

11.6 External Operation

You have the following options if you want to control the device externally:

Ethernet Interface
The Ethernet communication port enables the device to communicate with computers via 10/100 Base-T-Specifications. Ethernet communications are transmitted via RJ-45 standard cable.

Prior to the first use of Ethernet communication, the parameters **IP-Address, Subnet** and **Gateway** must be set. Access the **parameter menu** via the **display menu** and press the button **network**.

Please consult your network administrator before connecting the device with your network to avoid conflicts with existing IP addresses.

RS-232 Interface
When using the RS-232 interface, a cable must be connected directly from the instrument to a suitable port on the computer in a 'point to point' link. The device is configurated as data terminal equipment (DTE).

IEEE-488.2 Interface (Optional)
The connection of the IEEE-488.2 interface is designed as a 24-pin IEEE-488 socket. The manufacturer of the IEEE-488 interface board provides software to allow communication between the DPC 3800 and various programming languages. Usually also an interactive troubleshooting programme is provided.

For further details on this, please read the documentation of the board manufacturer.

Software (Optional)
Besides the optionally available calibration software DynaCal, which allows for comfortable calibration of pressure measuring instruments, including automatic creation of test certificates, the user is able to create own software programmes, (e.g. via LabVIEW).

Please press the button "Remote" via the parameter menu to read the external commands from your connected computer on the device (see chapter 11.4.2).

11.7 Service Menus

In the p**arameter menu** (see chapter 11.4.2) under **"Login"**, you can log on to the protected service section of the device. There, basic settings, maintenances and fine adjustments are done.

Caution!
Unauthorised modifications in the service menu may result in considerable functional limitations of the device. Therefore, all settings in this section shall be made by trained and qualified personnel only.

If you enter the service number 48485 in the login section, you access the following service menu (see fig. 11.7-1):

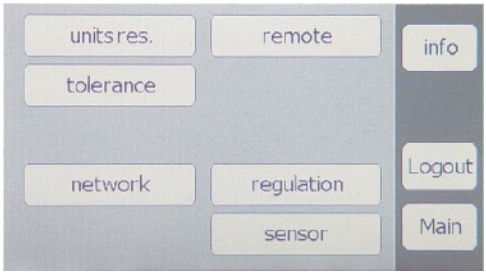


Fig. 11.7-1

Additionally to the public parameter settings, you can make protected settings there as well.

F3 Valve
By pressing this button, you can change the pulse width of the valves.

Regulation
By pressing this button, you access another menu (see fig. 11.7-2):

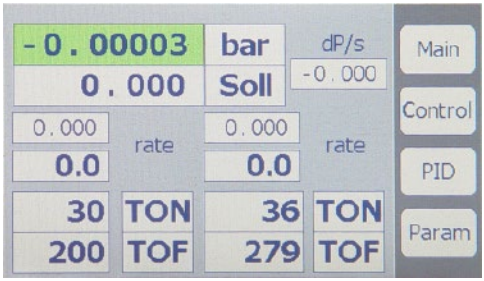


Fig. 11.7-2

In the lower part of the display, you can read the respective pulse widths. The left side represents the pressure generation and the right side represents the pressure reduction.

Please enter this menu and contact our sales team if you have problems with your device. In case of uncertainties, do not make any arbitrary adjustments.

By pressing the buttons **"Main"** and **"Param"**, you return to the display or the parameter menu.

The button **"Control"** starts the control process.
By pressing the button **"PID"**, you access the following submenu (see fig. 11.7-3):

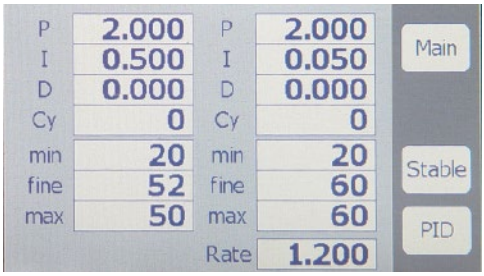


Fig. 11.7-3

By pressing the button **"Stable"**, you can define whether the deviation (dP) of the actual pressure is displayed **above the actual value box ("Stable" switched on)** or **within the actual value box ("Stable" switched off)** in the **display menu**.

Sensor
By pressing the button "**Sensor**", the following menu appears (see fig. 11.7-4):

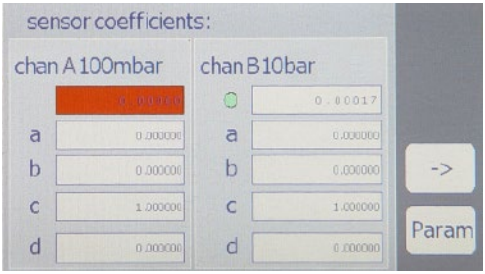


Fig. 11.7-4

This signal display shall only be accessed for checking the sensors. The boxes concerning the recalibration may not be modified arbitrarily by the operator.

Setup
Via the setup menu you can make various basic settings.

12. Troubleshooting Measures

If faults cannot be cleared with the help of the operating instructions, the device must be decommissioned instantly, it must be ensured that no pressure is applied anymore, and it must be secured against unintentional startups. Following this, the information has to be given to a superior and to authorised service personnel. Repairs shall only be carried out by the manufacturer. Any modifications or changes to the device are not permissible. Work on electrical or pneumatic / hydraulic equipment must be carried out by qualified and authorised technical staff only, observing the corresponding safety regulations.

In case of faults caused by defects of the electrical or pneumatic / hydraulic equipment, the operators must inform their superiors immediately and consult qualified and authorised technical staff for maintenance.

12.1 Description of Faults and Measures

I. When switching on the device, no measuring value(s) appear(s) after 10 seconds, but the entire screen remains white or dark.

- Turn off the device, wait about 5 seconds, and turn it on again.

II. The screen is dark and the measures for faults of type I are without effect.

- Check, whether the mains cable is connected properly. Have also authorised technical staff check whether the supply voltage is correct.

III. The screen is dark and the measures for faults of type II are without effect.

- First, pull out the mains cable from the power socket and then from the mains input socket of the device. After that, pull out the fuse holder and check the fuses.

IV. Malfunction during operation.

- Turn off the device, wait 5 seconds, and turn it on again.

V. Instable control.

- Check the piping for leakages.

VI. Intensified release of pressure medium at the SUPPLY port during pressure controlling.

- Turn off the device, wait about 5 seconds, and turn it on again. (Controller will be reinitialised.)

VII. The reference value is not reached.

- Check, whether the supply pressure at the SUPPLY port is at the required level (see chapter 7 “Technical Data”) and check the piping for leakages. Check also, whether the setting of "control limit" in the control tolerance menu: controlled system recognition is correct.

If the fuses of the mains input socket have to be replaced, only suitable 2 Ampere fuses type T2L250V may be used.

13. Dismounting

Work on electrical or pneumatic / hydraulic equipment must be carried out by qualified and authorised technical staff only, observing the corresponding safety regulations and according to the operating instruction.

When dismounting the device, please proceed as follows:

1. Make sure that there is no positive or negative overpressure on the device and that all components are at room temperature.
2. Switch off the device by pressing the main switch on the front right side of the device.
3. First, pull out the mains cable from the power socket and then from the mains input socket of the device.
4. Remove the pressure connections.

When removing the outer pressure connection, make sure that the connections on and in the device are not overtightened or loosened

5. Remove the device if necessary.
6. Make sure that the device is free of any pressure medium.
7. Protect the connections with the supplied protective caps.

14. Decommissioning

Prior to disposal of the device, all adhering medium residues shall be removed. This is especially important if the medium is health-damaging, e.g. corrosive, toxic, carcinogenic or radioactive.

When decommissioning the device, please dismount it according to the instructions of this manual, chapter 13 “Dismounting”. Please observe the legal and local regulations when disposing disused appliances. For the final disposal, a qualified specialist company is to be commissioned.

15. Units and Conversion Factors of the SETUP Menu Point: Units

ID	Name	Abbreviation	p [bar] / p [Unit]	p [Unit] / p [bar]
0	Bar	bar	1.000000E+00	1.000000E+00
1	Millibar	mbar	1.000000E+03	1.000000E+03
2	Pascal	Pa	1.000000E-05	1.000000E+05
3	Pound-force / inch²	psi	6.894757E-02	1.450377E+01
4	Standard atmosphere (760 Torr)	atm	1.013250E+00	9.869233E-01
5	Technical atmosphere	kp/cm²	9.806650E-01	1.019716E+00
6	Pound-force / foot²	lbf/ft²	4.788026E-04	2.088543E+03
7	Kilopond / cm²	kp/cm²	9.806650E-01	1.019716E+00
8	Centimetre of water 4 °C	cmWS (4 °C)	9.806380E-04	1.019744E+03
9	Inch of water 4 °C	inH_2O (4 °C)	2.490820E-03	4.014742E+02
10	Inch of water 60 °F	in H_2O (60 °F)	2.488400E-03	4.018647E+02
11	Foot of water 4 °C	ft H_2O (4 °C)	2.988980E-02	3.345623E+01
12	Micrometre of mercury 0 °C (Micron)	µmHg (0 °C)	1.333224E-06	7.500615E+05
13	Millimetre of mercury 0 °C (Torr)	mmHg (0 °C)	1.333224E-03	7.500615E+02
14	Centimetre of mercury 0 °C	cmHg (0 °C)	1.333224E-02	7.500615E+01
15	Inch of mercury 0 °C	inHg (0 °C)	3.386380E-02	2.953006E+01
16	Inch of mercury 60 °F	inHg (60 °F)	3.376850E-02	2.961340E+01

16. Maintenance

Have your device maintained regularly to ensure proper function of the instrument. For this purpose, please contact authorized service partners or contact ARMATURENBAU GmbH resp. MANOTHERM Beierfeld GmbH directly. Manufacturers and service partners offer you the expertise and the qualifications necessary for proper maintenance of your instrument with appropriate special tools.

In order to avoid a loss of functionality, we recommend the following intervals:

- Recalibration of the measuring equipment at an interval of 1 year.

- Maintenance of the mechanical components incl. cleaning and the replacement of the backup battery at an interval of 2 years.