



Anton Paar

Measure
what is measurable
and make measurable
that which is not.

Galileo Galilei (1564-1642)

Instruction Manual and Safety Information

PMA 5

Pensky-Martens Flash Point Tester

(Original Instruction)

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Further information

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Address of the instrument producer: Anton Paar ProveTec GmbH
Ludwig-Erhard-Ring 13
D-15827 Blankenfelde-Mahlow / Germany – Europe

Tel: +49 (0) 33708 56-300
Fax: +49 (0) 33708 56-556
E-Mail: info.provetec@anton-paar.com
Web: www.anton-paar.com

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1 Safety Instructions

Read the manual at hand before using PMA 5:

- Follow all hints and instructions contained in this manual to ensure the correct use and safe function of the PMA 5.
- We make these recommendations under the assumption that a regular function and safety check is performed at least every two years. We also recommend keeping a device log book. In this book, all tests, calibrations, along with all significant procedures (modifications, repairs) can be documented.

1.1 General Safety Instructions

Liability

- The manual at hand does not claim to address all safety issues associated with the use of the instruments and samples. It is your responsibility to establish health and safety practices and determine the applicability of regulatory limitations.
- Samples which may be toxic or otherwise potentially harmful to operating personnel may only be used with PMA 5 if appropriate and sufficient protective measures have been taken.
- Anton Paar ProveTec GmbH only warrants the proper functioning of the PMA 5 if no modifications have been made to the mechanics, electronics and firmware.
- Follow the installation instructions provided with this manual. The installation has to be carried out by qualified personnel who are able to read, understand and apply these instructions.
- Make sure all operators are sufficiently trained in the correct and safe use of PMA 5. Operators must be able to judge dangerous situations and take the right measures to prevent accidents, injuries and damage.
- Only use the PMA 5 for the purpose described in this manual. Anton Paar GmbH is not liable for damage caused by incorrect use of PMA 5.
- Modifications to the instrument, and particularly the opening of it or the carrying out of modifications on electrical connections/electronic components must only be performed by trained service technicians and only after receiving proper permission by Anton Paar ProveTec. Unauthorized modifications shall render all

guarantee claims towards Anton Paar null and void.

- Do not use any sensors, accessories, consumables or wearing parts with PMA 5 other than those supplied by Anton Paar GmbH as this might result in serious damage to the instrument or injuries of users.
- All notices and danger symbols on the instrument are to be observed and to the extent that the notice is ambiguous / not compliant with standards or does not conform to existing directives, the service partner is to be contacted prior to commissioning!
- Do not use samples with the PMA 5 that
 - can decompose during the flash point test
 - contain corrosive, acidic, or alkaline components or that form corrosive vapors during the flash point test
 - are explosive or are instable compounds
- Prior to the flash point test it is your responsibility to ascertain whether the sample or components thereof may damage the PMA 5.
- The use of a standard may involve hazardous materials, operations and equipment. A standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to take appropriate measures for protection of the safety and health of the personnel prior to application of this standard, to check whether statutory requirements exist for this purpose and to fulfill these requirements.

Installation and use

- Prior to commissioning, as a general rule, the connections and supply lines must be checked for leak tightness.
- Before connecting the instrument to the mains, make sure that the voltage/frequency ranges indicated on the PMA 5 type plate correspond to the local specifications.
- Please ensure when connecting the plastic tubes, that there are placed away from hot surfaces and ignition sources.
- The instrument is only allowed to be put into operation if the back of the instrument is a minimum distance of 20 cm to the wall, in order to be able to activate a circuit cut-off device at any

1 Safety Instructions

time and to provide adequate ventilation.

- In order to prevent humidity damage upon delivery of the device (such as condensation on the electronic circuits as a result of fluctuating temperatures), you should store the device for 24 hours at room temperature prior to commissioning.
- If heating devices are used, you should undertake to ensure that no combustible material is located near the heat source.
- In case of fire, please keep a fire extinguisher or an extinguishing blanket at hand.
- For safety reasons, the sample filling is only allowed to be carried out under a properly certified hood and over a fireproof surface (e.g. collecting basin).
- When handling liquids (in particular, samples that are flammable or contain solvents), care should be taken to wear suitable work clothing, in particular rubber gloves.
- Please consult the relevant safety data sheets for handling dangerous materials. Observe and adhere to your national safety regulations for handling the chemicals (e.g. use of safety goggles, gloves, respiratory protection).
- A standards-compliant and safe testing configuration is to be observed. The test may only begin if the unit has been installed according to the intended use.
- Never carry out synthesis in PMA 5.
- Supervise PMA 5 at all times during operation.
- If you set up several PMA 5 side-by-side, you should adequately shield the devices from one another, as the devices can influence one another in terms of temperature increase due to ventilation.
- Any spills of chemicals, solvents etc. have to be removed immediately using appropriate equipment.
- Do not take out the cup in hot conditions, it contains hot liquids. Danger of injury!
- When passing PMA 5 to other users, also hand over documentation and manual materials.

Moving the instrument

- Before you move or lift PMA 5, make sure that the test container (cup) is empty and that the instrument is free of chemicals.
- Only transport PMA 5 horizontally.

- Carry the instrument gripping the base at the right and left side.

Service and repair

- In case of damage or malfunction, do not continue operating PMA 5. Do not operate the instrument under conditions which could result in damage to property and/or injuries and loss of life.
- Do not open the instrument casing, as this would uncover live parts.
- Installation, service and repair procedures may only be carried out by authorized personnel or by Anton Paar GmbH.
- Only replace the power cable by the same type!

Disposal

- Concerning the disposal of PMA 5 observe the legal requirements in your country.

1.2 Special Safety Instructions

- PMA 5 has been developed as a testing device for flash point testing. If PMA 5 is used for other test media, including the testing of new or modified additives, it is the responsibility of the user to determine in advance and prevent any risks that could result from high temperatures. This includes explosive reactions, which may occur due to high temperatures. The forming of potentially-toxic reactive products cannot be ruled out.
- The testing of highly explosive materials (such as pyrotechnic or blasting substances) is generally not allowed. Have in mind that flammable materials may generate explosive atmospheres. Make sure to operate the instrument in safe areas such as fume hoods with integrated exhaust systems.

**WARNING****Risk of fire**

When testing samples without known flash point special care must be taken to avoid the risk of a fire in case of accidentally overheating the sample. If the flash point of the sample is below the start temperature, a fire can occur.

- Always supervise flash point tests of samples with unknown flash point, do not leave the instrument unattended.
- Always select the lowest possible start temperature when testing unknown samples. Precool the sample.
- Avoid to set a too high maximum testing temperature. Instead, you can run consecutive tests raising the maximum testing temperature with each test.
- It is strongly recommended to run tests with unknown flash point only on instruments with fire extinguisher feature and connected inert gas.

Further information on safe testing of such samples can be found in chapter *Programming and Performing a Test Run*.

- Observe the stirrer movement. Wear a hair net for protection to avoid injuries.
 - Do not test strong acids due to the danger of hydrogenic out gassing in reaction with the cup material.
 - Manipulation of the pressure hose is strictly prohibited. Any resulting leaks can cause the discharge of flammable fumes inside and outside of the device – DANGER OF EXPLOSION!
 - A release of combustible liquid can only occur in case of non-standards-compliant use of the device. Please ensure the correct filling quantity according to standard and do not overfill the sample receptacle.
 - The maximum sample fill level is marked at the cup's inside. Do not overfill the cup. Make sure the fill volume corresponds to the expansion coefficient and the maximum test temperature. Reduce fill volume in order to prevent liquid overflow.
 - The parts of the instrument can become very hot during the test run. Therefore, do not touch any device components in the heating area, neither during nor after the test run, with your unprotected hand.
- The device is not suitable for warming up foods. This device is only to be deployed for its intended use.

Setup location

- PMA 5 is **not** an explosion-proof instrument and therefore must not be operated in areas with risk of explosion.
- Install PMA 5 only in a corrosion-free atmosphere.
- When the instrument is set up, care should be taken to choose an adequate distance from sources of heat or smoke and from electrical or *magnetic* disturbances, and that the device is not subjected to excessive electrostatic discharges (ESD). The surface of the workspace must be level. In order to prevent influence of the volume acquisition, the device is not allowed to be subjected to any vibrations.
- The device undergoes testing for compliance with threshold values of electromagnetic compatibility (EMC), as specified in the European Directive 2004/108/EU. The device does, however, generate radio frequency energy. If the device is not installed or used according to the operating instructions, it may cause disturbances in radio traffic.
- The instrument is only allowed to be connected to a power supply, as specified on the device and in the operating instructions.
- PMA 5 is an instrument with protective earth connection class I. Proper earthing of the device is to be ensured by on-site installation, according to the normal rules and should be regularly checked.
- Please ensure when laying the power cable that it cannot be damaged by persons or objects placed on it.
- **In the zone where liquids are poured (samples), there should be no power outlets.** Should it be necessary to have a power outlet in the area where liquids are poured, there must be a suitable local vent hood above the place where the pouring occurs.
- Please undertake to ensure that because of its radiating heat, PMA 5 stands alone and no flammable objects are in the immediate vicinity. Based on safety considerations, the placement of the device should proceed (e.g. through building measures) in such a manner that improper

1 Safety Instructions

operation, unknown sample material or defects cannot cause any hazard to personnel or objects. The following is to be observed in finding a location for the device:

- The basic area of 2 m² (1.4 m x 1.4 m) must be made out of a fireproof surface.
- Above PMA 5, no flammable materials are allowed within 2 m.
- Please ensure that no flammable materials are within a distance of 2 m above the PMA 5 (e.g. storage racks).
- Therefore, always ensure sufficient safety clearance to other flammable objects. In particular, the statutory regulations for storing combustible working materials or sample materials are to be observed. Do not store containers with flammable reagents or other ignitable materials (e.g. soaked cleaning paper) close to the instrument or on the instrument.
- For safety reasons, a laboratory fume hood is recommended.
- Relevant regulations and handling compressed gases must be observed. Maximum pressure limits (N₂ = 6 bar, propane gas = 50 mbar) are printed at the relevant inlet connectors at the backplate of the device.

Cleaning, Care and Maintenance

- Please clean the test cup regularly after each test with a soft cloth and a recommended or approved cleaning solvent.
- Please clean and dry the device surfaces and cavities in a regular manner.
- The time interval for the cleaning depends on the test frequency.
- Please keep a cleaning logbook, in order to ensure regular cleaning.
- With regard to detailed instructions for cleaning and maintenance please refer to *Upkeep and Error Handling* on page 31.

1.3 Warning Signs on the PMA 5



CAUTION

Risk of injury:

This warning concerns hot surface temperatures during testing.



CAUTION

This instrument conforms to European Safety Provisions Pursuant to ISO 9001



CAUTION

Risk of electrical shock:

Ensure that the connection is properly earthed in order to prevent electrical shocks.



WARNING

Risk of fire

The instrument may contain flammable material.



WARNING

Please read the instruction manual carefully.

2 An Overview

2.1 Intended Use

The automatic flash point analyzer PMA 5 is used for the empirical determination of the flash point of combustible liquids in accordance with the standardized test procedures and standards:

- ASTM D93 A, B and C, ISO 2719 A, B and C, JIS K2265 A, JIS K2265 B

These standards do not address all the safety concerns (if any) associated with their use. The operator of the PMA 5 should establish the appropriate safety and health practices before using the automatic flash point analyzer PMA 5.

The flash point determination is an empirical method. It is therefore important to comply with the standard specifications as accurately as possible, both in respect of the equipment and of the procedures. The flash point of a liquid is used in transport and safety provisions to define flammable and combustible substances.

The flash point is one of several material properties referred to in the determination of the overall fire risk of a material.

The flash point is defined as the lowest temperature of the liquid at which the vapor above the sample ignites as a result of the introduction of the flame or electric igniter.

The test procedures are standardized and laid down in the above mentioned standards.

The measurement period is from approx. 30 to 60 min. depending on the flash point of the sample. With manual flash point measurements, high requirements are set of the laboratory technician carrying out the measurement, both in respect of handling of the sample (avoidance of loss of volatile components, precise observation of the flash point) and in respect of the cleaning of the equipment.

In view of the complicated processes and handling involved in manual measurement, Anton Paar ProveTec has developed the automatic Pensky-Martens flash point analyzer PMA 5. When using the PMA 5 the operator's task is to fill the test cup with the sample, place it in the heating block and to remove the test cup again once the measurement is completed. It is necessary to pay attention to the standard while preparing the sample.

Summary of the Pensky-Martens Test Method

Approx. 75 mL sample is heated at a slow constant rate (5 to 6 °C/min) with continuous stirring in a closed brass test cup of dimensions specified by the standard method. The first test temperature is determined from the expected flash point entered by the operator. When the first test temperature is reached, the ignition source (the gas flame or the electrical igniter) is applied by opening the shutter of the test cup and dipping the igniter into the vapor space at the top of the test cup. The igniter is subsequently applied at the correct frequency until the vapor above the sample the sample ignites. Stirring is discontinued during application of the igniter.

You can also run a non-standard flash point test with the PMA 5.

The **Flash Point** of petroleum products is the lowest temperature, corrected to a barometric pressure of 101.3 kPa (760 mm Hg), at which the application of an ignition source causes the vapors of a specimen of the sample to ignite under specified test conditions.

2.2 Features

Benefits at a Glance

- Integrated fire-extinguishing system automatically controlled or manually released (requires N₂ or CO₂ gas)
- The One-Twist swivel-around multi-function head guarantees the safe and easy one-hand connection of all sensors and actuators such as the shutter release, stirrer, igniter and detector contacts
- A multi-detector combines the flash point detector and the temperature sensor in a solid housing with a perfectly adjusted immersion
- Memory for 1000 tests, 20 operators, 100 sample names
- Statistical analysis (Min, Max, Mean, Repeatability)
- Data handling via USB stick for import into MS Excel® or to LIMS

2.3 Functional Components

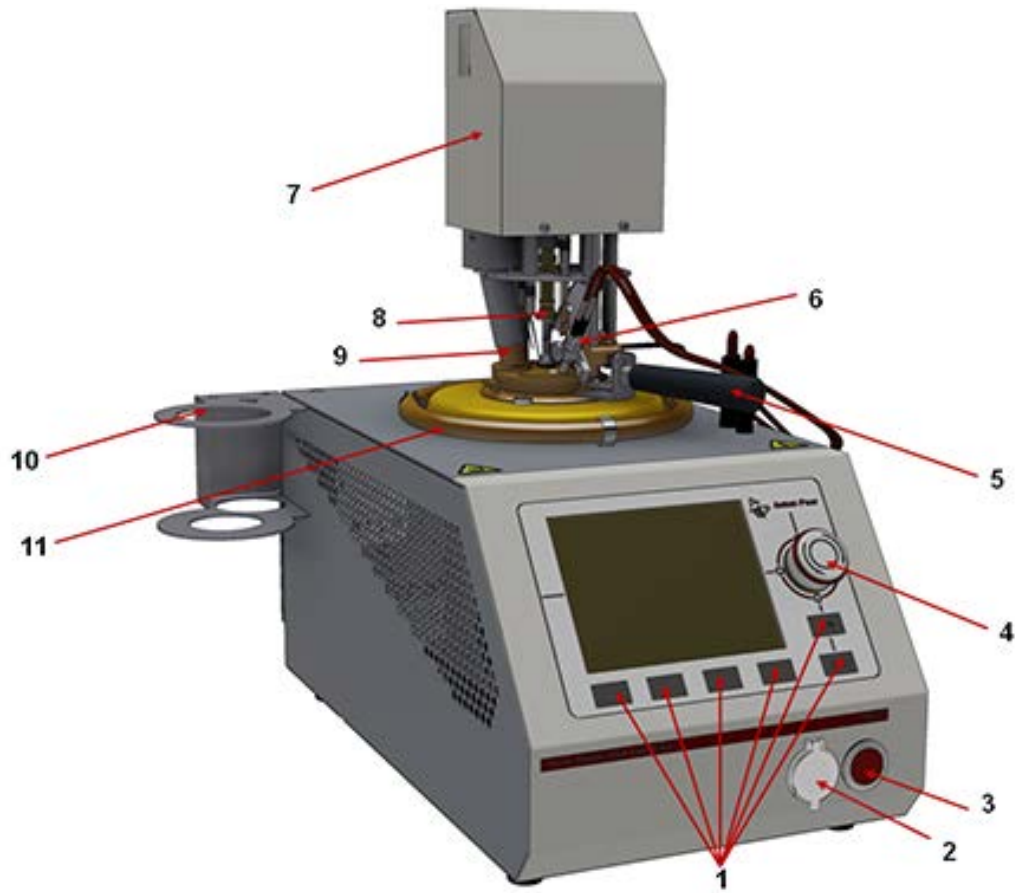


Fig. 2-1: Front view

Table 2-1: Elements at the front

No.	Description
1	Softkeys
2	USB port
3	Fire extinguisher button (for manual release)
4	Jog shuttle
5	Handle for hot test cup
6	Electric igniter
7	Multi-function head
8	Stirrer
9	Multi-detector
10	Test cup holder
11	Fire extinguisher

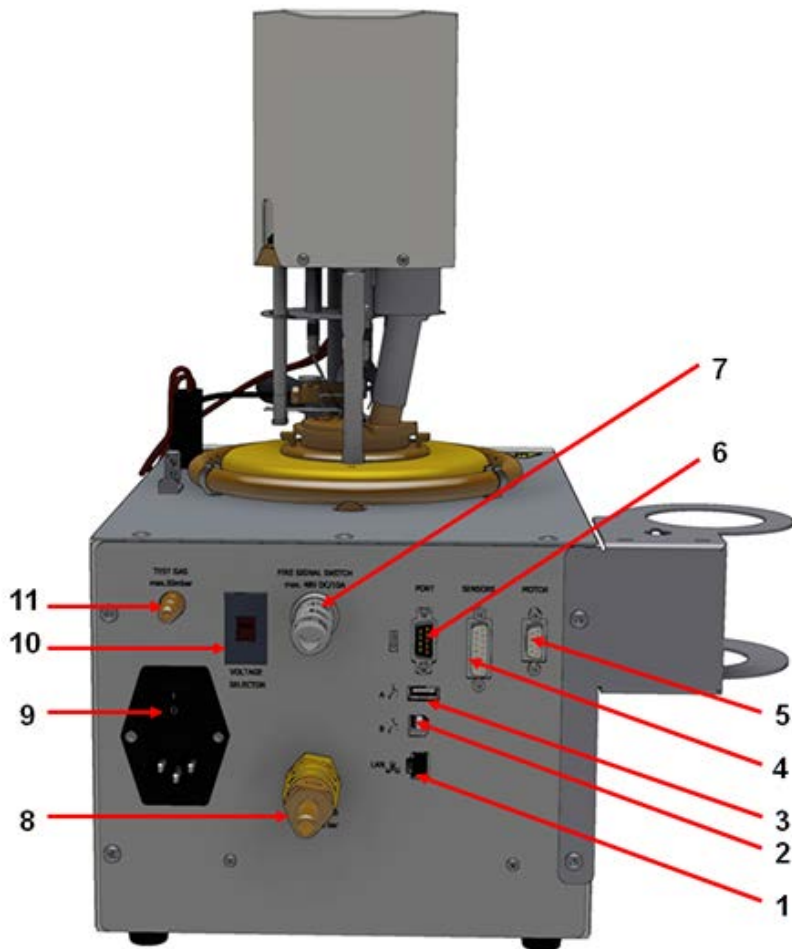


Fig. 2-2: Rear view

Table 2-2: Elements at the back

No.	Description
1	LAN port
2	USB-B port for external devices
3	USB port
4 + 5	Connections for sensor and motor
6	RS-232 port
7	Signal output
8	N ₂ or CO ₂ source connection for fire extinguisher
9	Main switch
10	Voltage selector
11	Connection for test gas (external gas supply)

2.3.1 USB Ports

Two USB ports can be used to connect different accessories:

- A USB storage device for immediate data export
- An alphanumeric keyboard for simplified data input
- A local printer for instant printing of reports

TIP: *Do not connect the USB storage device until the PMA 5 has completed the startup procedure*

2.3.2 RS-232 Port

In addition to the data transfer to printer and USB a data set is transferred via the RS-232 port automatically when a LIMS connection is required.

2.3.3 Ethernet Port

The Ethernet port allows in the menu "Network" the network settings of the device for data transfer via FTP. The following basic requirements are necessary to use the data transfer via FTP:

- At least PMA 5 firmware version 1.7
- At least Windows XP SP2
- Network connection PC/Device

For further options and accessories please visit www.anton-paar.com (product line: volatility) or contact your Anton Paar representative.

3 Installation

TIP: For more detailed information please refer to your Reference Guide.

3.1 Location

Please be aware that due to the heat emission (flash point measuring range up to 405 °C) the PMA 5 needs to be located freely.

The device should not be exposed to draft. Draft might falsify the measured flash point and affect the control of the gas flame's function.

NOTICE

Make sure to operate the instrument in safe areas only such as fume hoods with integrated exhaust systems

If you place several PMA 5 next to each other please separate the single devices by using an adequate shielding as otherwise through the ventilation the devices affect each other in temperature increase and flash point.

3.2 Putting into Operation

NOTICE

Danger of damage

Before putting into operation, the device must have been stored for at least 24 h at room temperature!

To ensure safe transportation, the PMA 5 is packed in two pieces: a bottom part (control device) and an upper part (multi-function head).

Insert the bolt of the multi-function head into the guide of the column on the bottom part of the PMA 5.

The pin of the bolt of the multi-function head now rests in the right recess of the guide column (shown on the right).

In this position of the multi-function head you can insert or take out the test cup.

To bring the multi-function head into test position, turn it to the left (clockwise) until the pin of the bolt slides into lower position (shown in the photo on the

right).

To swivel the multi-function head back again, lift the head slightly and turn it to the right (anti-clockwise) until the pin rests safely in the upper position.

Connect the plugs of the step motor control and the multi-detector at the rear of the instrument.

The plugs are different, so they can only be fitted into the correct socket.

Connecting the gas tubes

Make sure the tube connections for gas supply and fire extinguisher are gas-tight and secured in proper manner (using hose clamps). Use only suitable tubes and contact your local distributor in case of safety doubts.

Do not exceed the pressure limits indicated at the back plate and in this user manual (see *Technical Data* on page 35).

3.3 Switching On

Before connecting to the mains please make sure that the values on the device's rear side are set correctly for the existing mains voltage. If necessary please adjust to the correct values.

The applicable voltage value needs to be set at the change-over switch at the device's back side. Additionally, the device fuse has to be changed.

Connect the printer (option) to the printer interface at the instrument's side.

Before switching on the PMA 5 the printer has to be connected to the USB port to make sure the head row will be printed with the actual date after user login. However, the header with the measuring data will be printed out only after the first test was finished.

When using a gas ignition connect external gas supply to the back of the device with maximum inlet pressure of 50 mbar.

Insert the multi-detector into the test insert (cup and lid). Position test insert into the PMA 5 and turn the multi-function head towards you so that the connection between multi-detector and stirrer is made.

Now you can switch on the PMA 5.

First only the green LEDs on the jog shuttle light up.

3 Installation

The main menu appears after a boot process of approx. 1 minute.

When the device is ready you will hear a fourfold signal.

If PMA 5 is switched on without the test insert and the multi-sensor being assembled the following screen is displayed. You see that the temperature cannot be displayed.

3.4 Operating the Instrument

The PMA 5 can be operated with different controls.

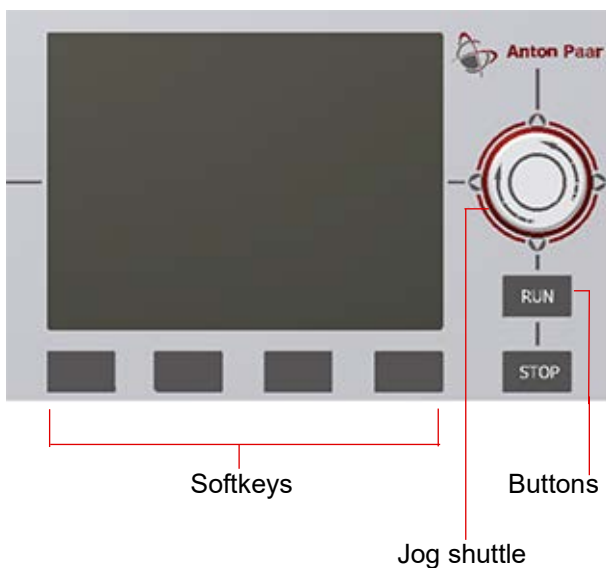


Fig. 3-1: Control elements

3.4.1 Using the Jog Shuttle

The jog shuttle and the 4 softkeys underneath the display are used to operate the PMA 5.

The jog shuttle has a scroll function (turn the jog shuttle), 4 cursor keys (press the jog shuttle up, down, left, or right) and an <Enter> function (press the center of the jog shuttle).

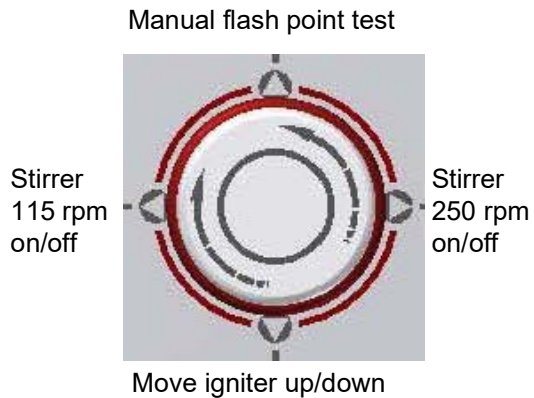


Fig. 3-2: Jog shuttle functions in the main menu

Jog shuttle functions

- When you are in the "Main menu", you can select manual functions by pressing the jog shuttle in the direction of the appropriate arrow:

Table 3-1: Manual functions in the "Main menu"

Jog shuttle cursor keys	Manual function
◀ (arrow left)	stirrer 115 rpm
▶ (arrow right)	stirrer 250 rpm
▼ (arrow down)	move igniter up/down
▲ (arrow up)	manual flash point test

These jog shuttle functions are only available when you are in the "Main menu".

- When you are **not** in the "Main menu", the jog shuttle can be used to control the cursor. The cursor keys are used to enter the sample name, the expected flash point, the time and date.

The cursor keys ◀ and ▶ move the cursor from one possible entry to the next, i.g. switches from day to month or from hour to minute.

The cursor keys ▲ and ▼ change between lines when entering the sample name.

- Pressing the center of the jog shuttle has the same function as the <Enter> key on a keyboard. In this manual, <Enter> means pressing the jog shuttle or the <Enter> key on your keyboard.

Pressing the jog shuttle opens a menu or sub-menu.

Press <Enter> to confirm each letter you select for the sample name. The cursor will then move forward to the next letter.

Please note that user input in the calibration menus must always be confirmed with the <OK> softkey (and not with <Enter>).

- Turn the jog shuttle clockwise to navigate down in a menu and anti-clockwise to navigate upwards.
- In a menu you can turn the jog shuttle to scroll through the available submenus. Press <Enter> to open a submenu.
- In a menu you can turn the jog shuttle to scroll through the available settings for an option, e.g. in the igniter selection screen turn the jog shuttle to toggle between the options "**Gas ignitor**" and "**Electric ignitor**". Confirm your selection with <Enter>.
- The illuminated arrow icons around the jog shuttle indicate the state of the PMA 5 device:

Table 3-2: Jog shuttle LED

LED color	Explanation
Green	Ready for operation
Green flashing	In operation (testing)
Red	Cooling down
Red flashing	An error occurred during the test

3.5 Choosing the Igniter System

The PMA 5 operates either with an electrical igniter or a gas igniter.

The preselected igniter system is shown in the test run menu in the footer. The factory setting is "**Electric igniter**".

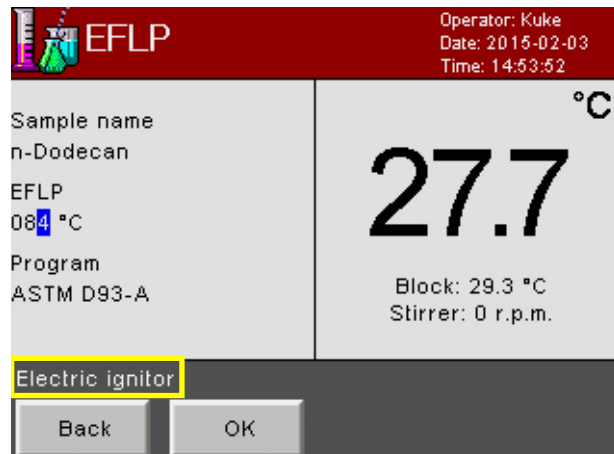


Fig. 3-3: Displaying the currently selected igniter system

1. To choose the igniter select "**Config & Service**" from the main menu.
2. Enter the access code 00000000 (eight zeros).
3. Confirm with <OK>. You return to the "**Config & Service**" menu.
4. Select "**Configurations**".
5. In the next screen select the <Extended> button.
6. In the "**Extended**" menu select "**Ignitor**" to select the igniter type:

3.5.1 Electric Igniter



CAUTION

Danger of damage

Before inserting the igniter into the holder make sure that the knurled screw at the holder is nearly loose. Otherwise the igniter coils can be damaged when inserting the igniter!

Insert the electric igniter as far as it will go into the igniter holder and fix it with the knurled screw. Connect both plugs of the igniter to the sockets at the top of the device.

NOTICE

When you need to exchange the electric igniter because it is damaged or aged, it must be initialized by the PMA 5 device. For this refer to *Changing the Electric Igniter* on page 28.

3.5.2 Gas Igniter

If you use the gas igniter, the electric igniter is used as an auxiliary igniter in a special position at the right side of the multi-function head.

The electric igniter now serves to ignite the gas flame.



Connect the hose of the gas igniter

Gas valve to control the size of the gas flame.

Fig. 3-4: Hose connection and gas valve

NOTICE

The gas valve on the PMA 5 to control the size of the flame must **never** be closed with any force. This would damage the valve in such a way that it would not safely close any more.

Only close the valve hand-tight.

3.5.3 Connecting the External Gas Supply

The gas line or gas bottle has to be connected to the rear side of the PMA 5 (we recommend the use of propane / butane). Only use tubes which are admitted for gas operation for the connection. The gas pressure at the connection of the PMA 5 must be 50 mbar. Ensure that a pressure reducer is installed as appropriate.



WARNING

Danger of fire

When connecting the plastic tubes, make sure that they are placed away from hot surfaces and ignition sources. Damage to the gas tubes could lead to fire or explosions.



Connection for external gas source

Fig. 3-5: Connection for external gas source

3.5.4 Adjusting the Gas Flame

After the external gas supply is connected to the instrument's rear side, the setting of the gas igniter can be checked. The size of the gas flame has already been set at delivery. Before conducting the first test we recommend to check this setting once again.

TIP: When first connecting the gas, it will naturally take a few minutes before the gas has passed through the hoses and displaced the existing air. To shorten this time it is possible to carefully open the gas valve at the device a bit wider for a short moment only.

The size of the flame can be adjusted with the help of the menu "**Manual functions > Gas flame adjustment**".

3 Installation

- Select the option "**Gas flame on**" to light the flame.
- Select the option "**Gas flame off**" to extinguish the flame.

Use the valve at the top right side of the device to regulate the size of the flame.

NOTICE

The gas valve on the PMA 5 to control the size of the flame must **never** be closed with any force. This would damage the valve in such a way that it would not safely close any more.

Only close the valve hand-tight.

The size of the gas flame has to be set between 3.2 mm and 4.8 mm in diameter according to the standard.

SAFETY FUNCTION:

After about 1 min the magnetic valve switches off automatically.



WARNING

Danger of injury

Please use only tubes which are admitted for gas-operation for the gas connection.

3.6 Filling in the Sample

NOTICE

Always complete all steps to prepare the flash point test **before** measuring and filling the sample into the cup.

If you are preparing the sample too early you might have significant losses of volatile material. This would lead to an erroneously high flash point.

For the same reason make sure to store the sample container air-tight, in dry conditions and not above room temperature.

According to the standard the sample is filled into the cup up to the mark inside the cup. The temperature of the cup and sample shall be at least 18 °C or

32 °F below the expected flash point.

If you have filled too much sample into the cup, remove the excess using a syringe or similar device.

Samples with an expected high flash point and a high heat expansion must be filled to a lower level.



WARNING

Danger of malfunction

The sample should not come in contact with the thermocouple for flash point detection at the multi-sensor during the test otherwise flash point indication can be affected.

Do not overfill the cup because of possible excessive expansion behavior of the sample at high temperatures. In case of unknown samples it is highly recommended to perform a pre-test to determine of a safe fill volume.

3.7 Fire Extinguisher System

The PMA 5 is equipped with an automatic fire extinguisher system which provides highest safety to the user. In the event of a fire the system automatically releases an inert gas over the lid shutter to extinguish the fire. For the correct function of the fire extinguisher system an inert gas (Nitrogen) source with an outlet pressure of 6 to 12 bar is required.



Fig. 3-6: Fire extinguisher system

Connect the fire extinguishing gas line to the connector at the back of the PMA 5 (we recommend the use of Nitrogen).

Use only tubes with an inner diameter of 9 mm and outer diameter of 15 mm which are admitted for gas operation. The tube must withstand a maximum pressure of 15 bar. Secure the tube with a hose clamp.

The gas pressure at the connection of the PMA 5 must be 6 bar. Ensure that a pressure reducer is installed as appropriate.

NOTICE

The fire extinguisher feature must be activated in the device's configuration! Without the activation of the feature the fire extinguisher will not work.

Refer to *Safety Configuration* on page 26 for details.

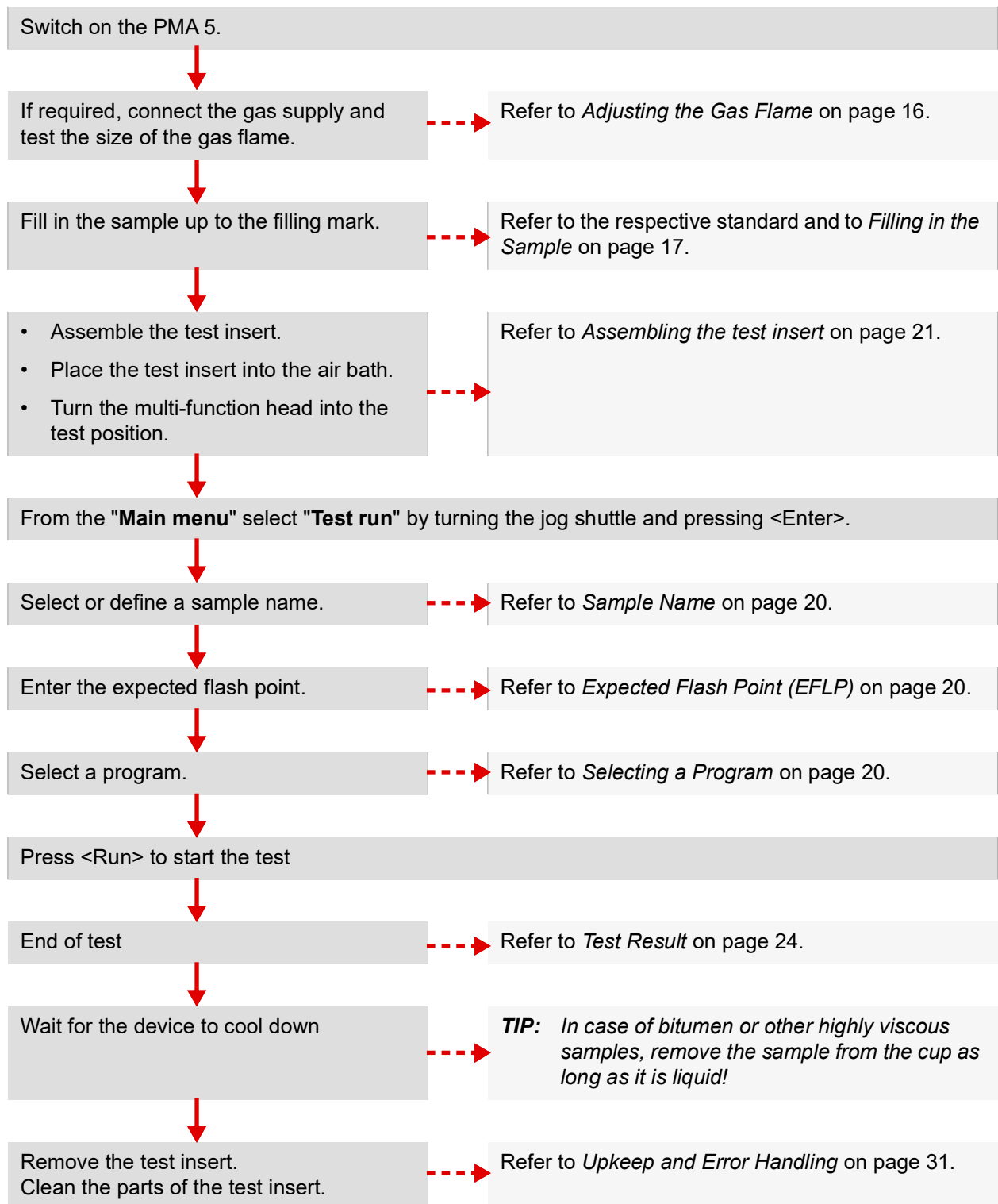
Please refer to *Fire Extinguisher Device and Fire Signal Switch* on page 37 for safety check and further information about the fire extinguisher.

4 Programming and Performing a Test Run

TIP: For more detailed information please refer to your Reference Guide. steps involved when performing a test. All steps are described in more detail in this chapter.

Typical flash point test procedure

The following diagram gives a brief overview of the



4.1 Programming a Test Run

Select the menu item "**Test run**" by turning the jog shuttle and confirm by pushing the jog shuttle

The display changes to the "**Test run**" menu.

You can now input or select the sample name, the expected flash point and the program name directly at the PMA 5 or with a connected USB keyboard.

4.1.1 Sample Name

The sample name can be selected from a list of previously defined sample names or press <New> to enter a new name.

NOTICE

Sample names must not contain any special characters!

Entering a new sample name

The sample name can be entered with the jog shuttle:

On the left-hand side of the screen, the cursor flashes at the character position of the sample name which is to be entered or changed. The right-hand side of the screen contains a list of all characters (letters, numbers and special characters) that can be used in the sample name.

- Use ◀ and ▶ (arrow left and right) to navigate through the character positions of the sample name.
- Turn the jog shuttle to scroll through the characters on the right-hand side.
- Use ▲ and ▼ (arrow up and down) to move from line to line.
- Accept a character with <Enter>. The cursor will move to the next position in the sample name. Alternatively accept a character by simply moving to the next position in the sample name with ▶ (right arrow key).

The sample name is inserted into the sample name list with the associated flash point and test program after starting/stopping a test.

4.1.2 Expected Flash Point (EFLP)

To enter the expected flash point:

1. Select "**EFLP**" and press <Enter>. The cursor

will flash on the first digit.

2. Use ◀ and ▶ (arrow keys left and right) to move from position to position. Change a digit by turning the jog shuttle. Confirm a digit with <Enter>.

TIP: The expected flash point can also be changed when the program is running. Just press <Enter> and change the EFLP as described above.

4.1.3 Selecting a Program

To select a program

1. Select "**Program**" which is appropriate for your sample and the standard to be used and press <Enter>. The cursor will flash on the program name.
2. Turn the jog shuttle to scroll through the list of the available programs.
3. Press <Enter> to select a program.

TIP: You can display the program parameters of a program if you highlight the program name and select the <Info> softkey. From here you can also print the parameters.

Please note that program parameters can only be modified for user programs. Parameters of standard programs cannot be changed

4.2 Performing a Test Run with Standard Programs

This chapter guides you through executing two typical test runs using the standard programs ASTM D93-A and BITUMEN.

4.2.1 Test with Standard Program ASTM D93-A

NOTICE

If you wish to print out the test results, the printer must be connected and switched on **before** your switch on the PMA 5. Otherwise the date in the header will not be updated to the current date.

1. Switch on the PMA 5.
2. Select the type of igniter to use. Please refer to *Choosing the Igniter System* on page 15.

4 Programming and Performing a Test Run

3. If required, adjust the gas size flame. For information refer to *Adjusting the Gas Flame* on page 16.

NOTICE

If the gas emerges with too much speed, the gas stream cools down the glowing electrical igniter too much. In this case, the gas might not be ignited.

4. Fill in the sample.

NOTICE

According to the standard method the sample is filled into the cup up to the filling mark inside the cup. If too much sample has been filled into the cup, remove the excess using a syringe or a pipette.

The temperature of the cup and sample shall be at least 18 °C or 32 °F below the expected flash point.

Deviating from the standard, samples with extreme thermal extension and high flash points should not be filled that high. Due to their expansion during the test, the flash point indicator could get wet which would influence the flash point indication (in worst case deactivate the flash point indication).

For further information please refer to *Filling in the Sample* on page 17.

Assembling the test insert

After you have filled the sample into the cup, put the lid with the stirrer onto the cup.

Make sure that the pin of the cup fits into the notch of the lid. Do not tilt or jam the parts. The lid should lie flat on the cup.

Note the little pin on the multi-detector. Insert the multi-detector as far as possible into the opening of the lid.

The pin on the multi-detector must slide into the notch of the lid.

Slide the shutter lid closed completely so that the hook which opens and closes the lid will snap into the groove on the lid when the multi-function head is turned into the test position.

Place the assembled test insert into the air bath of the PMA 5.

The three notches in the rim of the cup fit exactly around the two screws at the front and the column of the multi-function head.

Turn the multi-function head clockwise until it slides and locks into the test position.

Check that the shutter lid is closed and the hook which opens and closes the lid has engaged into the groove on the lid.

NOTICE

Consider the following points for safe test handling:

1. Check correct fill level.
2. Check correct position of the igniter.
3. Check program settings - are they appropriate for the test sample (program selection, expected flash point).
4. Check the size of the gas flame.
5. Wear protective glasses and gloves.



WARNING

Danger of injury

Before the gas igniter is taken into operation for the first time the gas hoses to the PMA 5 are still filled with air - instead of gas. Therefore it will take some time before the gas reaches the nozzle. You can temporarily raise the outflow speed. But take care because a larger flame might be emerging now!



WARNING

Danger of injury

The parts of the instrument can become very hot during the test run. Therefore, do not touch any device components in the heating area, neither during nor after the test run, with your unprotected hand.

6. Place the lid with the stirrer on the test cup and insert the multi-detector in the test lid. Slide the

4 Programming and Performing a Test Run

lid closed. Place the complete assembly into the PMA 5.

7. In the "**Main menu**" select "**Test run**".
8. Enter the sample name and the expected flash point. Refer to *Sample Name* on page 20 and *Expected Flash Point (EFLP)* on page 20.
9. Select the standard program "**ASTM D 93-A**". Confirm with <OK>
10. Press the <RUN> button.

The free disc space of the memory card is being checked.

The gradient is shown after approx. 3 minutes.

When the sample temperature is 22 °C below the expected flash point, the igniter is dipped into the test cup at regular intervals (every 1 °C or 2 °C raise in sample temperature, depending on the expected flash point).

The dip-in cycles are counted (displayed after *TESTING*):

NOTICE

Before the ignition source is first applied during a test (i.e. the specified temperature has not been reached, yet), you can press the <ManTest> softkey to trigger a flash point test manually.

After this point, the softkey is no longer available for the remainder of the test.

Just before (EFLP - 5 °C) the expected flash point the background color of the display changes to red.

When a flash point is found, the program stops automatically.

On the left-hand side the test status (**FPok**) is displayed and the reason why the device ended the test (stop flash point).

After the test the device will be cooled down automatically.

At the end of the cool-down phase you will hear an acoustic signal.

The fan is switched off automatically. The cool-down phase has ended once the cool-down temperature configured in the parameter set has been reached in the heating block and in the sample.

When the test insert with the multi-sensor is removed, the fan uses the temperature of the heating block as the basis.

This is the case at 35 °C in all programs (apart from bitumen).

Detailed test results can be displayed when you press <Result>.

4.2.2 Performing a Test without known EFLP



WARNING

Risk of fire

When testing samples without known flash point special care must be taken to avoid the risk of a fire in case of accidentally overheating the sample. If the flash point of the sample is below the start temperature, a fire can occur.

- Always supervise flash point tests of samples with unknown flash point, do not leave the instrument unattended.
- Always select the lowest possible start temperature when testing unknown samples. Precool the sample.
- Avoid to set a too high maximum testing temperature. Instead, you can run consecutive tests raising the maximum testing temperature with each test.
- It is strongly recommended to run tests with unknown flash point only on instruments with activated fire extinguisher feature and connected inert gas.

To search for a flash point you can use these programs

- SEARCH
- SEARCH-A
- SEARCH-B

Observe the safety warnings above and follow the test procedure as described under 6.2.1 *Test with Standard Program ASTM D93-A*. Detailed information on the Search programs and the preset parameters can be found under 6.1.5 *Standard Programs* and 6.10 *Program Parameters*.

4.2.3 Test with Standard Program Bitumen

NOTICE

This section contains specific information on the BITUMEN standard program. For all other details on performing a test, please refer to *Test with Standard Program ASTM D93-A* on page 20.

The test preparation and execution using highly viscous samples such as bitumen differs from the test execution with liquid samples.

1. Before filling the sample into the test cup, the bitumen sample must be heated in a suitable container in accordance with the standard. Refer to the standard for details.
2. Switch on the PMA 5.
3. Enter sample name and expected flash point.
4. Select the program "BITUMEN".
5. Fill the now liquefied sample into the test cup.
6. Assemble the test insert and insert it into the PMA 5.
7. Press the softkey <Heat on> to continue heating the sample. In this program the heater can be switched on or off with the softkeys <Heat on> or <Heat off>. By default, the stirrer is not started, yet.

NOTICE

With <Heat on> the sample is preheated to the preselected fan temperature. This preselected fan temperature is defined with the program parameter "Fan on/off".

If the program parameter "Preheating" is set to "On" or "Stirrer start" the preheating function is activated.

In the "BITUMEN" program the parameter "Fan on/off" is set to "200 °C". The fan will be switched to maintain this temperature at the air bath.

The combination of the parameters "Preheating", "Stirrer start" and "Stirrer" will trigger the correct start of the stirrer.

In the standard program "BITUMEN" the parameter "Preheating" is set to "Stirrer start", this setting activates the temperature-dependent stirrer start.

Additionally, the parameter "Stirrer start" is set to "10 °C" which will start the stirrer 10 °C below the temperature set with the parameter "Fan on/off"

TIP: As with all standard programs, the values cannot be changed. If you need to change the values to suit your sample, you can modify "#Userprogram13" which is preset with the values of the "BITUMEN" program. In a user program you can set the stirrer to start between 10 °C to 100 °C below the "Fan on/off" temperature.

Finally, the parameter "Stirrer" defines the stirrer speed.

After the test the sample is cooling down to the preselected fan temperature. If there is no cup in the device the heating block is held at this temperature.

The heater can be switched off and on with the respective soft keys.

4.3 Performing a Test with User Programs

The following user programs can be selected:

Initially, the user programs are preset with the parameters of the standard programs. These settings can be changed.

Table 4-1: Default settings of user programs

Userprogram	Preset with the program parameters of
#Userprogram1	ASTM D93-A
#Userprogram2	ASTM D93-B
#Userprogram3	ASTM D93-C
#Userprogram4	EN ISO 2719-A
#Userprogram5	EN ISO 2719-B
#Userprogram6	EN ISO 2719-C
#Userprogram7	JIS 2265-A
#Userprogram8	JIS 2265-B
#Userprogram9	RAPID
#Userprogram10	SEARCH
#Userprogram11	SEARCH-A
#Userprogram12	SEARCH-B

Table 4-1: Default settings of user programs

Userprogram	Preset with the program parameters of
#Userprogram13	BITUMEN
#Userprogram14	pPM
#Userprogram15	ASTM D93-A
#Userprogram16	ASTM D93-B

The name and the parameters of a user program can be changed. Press <Edit> and navigate by turning the jog shuttle to the parameters to be modified. Press <Enter> to change.

Parameter values can be changed simply by turning the jog shuttle for the complete value or for one character.

The name of the user program can be changed with <Rename> in the same way like operator name or sample name.

The hash key (also called pound sign) "#" remains in front of the name for user program identification.

4.3.1 Test Run with Userprogram 1

1. Perform step 1 to 8 as described under *Test with Standard Program ASTM D93-A* on page 20.
2. Select "**Userprogram1**".
3. Select <Edit>.
4. Press <Rename> to change the name of the user program.
5. By scrolling the jog shuttle you can change the displayed program parameter.
6. Confirm your changes with <OK>.
7. Press <RUN>.

The further proceeding is analogue to the *Test with Standard Program ASTM D93-A* on page 20.

4.4 End of the Test

After the test the instrument is cooling down automatically.

At the end of the cool-down phase you will hear an acoustic signal. The fan is switched off automatically. The cool-down phase has ended once the cool-down temperature configured in the parameters set has been reached in the heating block and in the sample. When the test insert with the multi sensor

is retracted, the fan uses the temperature of the heating block as the basis. This is the case at 35 °C in all programs (with the exception of the "**BITUMEN**" program).

1. When the apparatus has cooled down to a safe handling temperature, remove the test cover, the test cup and multi-detector.
2. Clean and dry all parts before starting the next test, use a suitable solvent capable of removing all of the specimen from the test cup, cover and multi-detector. Make sure to thoroughly remove the solvent afterwards. For a detailed description on cleaning the instrument and its accessories please refer to *Upkeep and Error Handling* on page 31.
3. Observe you local regulations when disposing solvents and waste material.

4.5 Test Result

A test can be stopped with a flash point and with all the status messages mentioned above.

The following message is displayed when a flash point is found: **FPok**

The barometric pressure-corrected, rounded flash point is shown on the main display.

The pressure sensor integrated into the device enables automatic barometer correction of the flash point measured.

The barometer correction is calculated according to the following formula:

$$korFP = FP + 0.25 (101.3 - p) \text{ for } ^\circ\text{C}$$

After a flash point test, the main display always shows the barometric pressure-corrected flash point with rounding to the nearest 0.5 °C (1 °F).

It is also possible to show the corrected and uncorrected flash point on the display. To do this, the detailed test result is either accessed in the device history (Details) or immediately after the test (Result).

5 "Configuration and Service" Menu

TIP: For more detailed information please refer to your Reference Guide.

The "**Configuration & Service**" menu is password-protected.

The "**Access code**" is set to "**00000000**" at delivery. When you open the "**Config & Service**" menu, this access code is automatically inserted and you just need to confirm it with <OK> to proceed.

5.1 Configurations

Select the option "**Configurations**" from the "**Config & Service**" menu to open the basic "**Configurations**" menu. If you press the <Extended> button, additional options are shown.

Options in the basic "Configurations" menu:

- Language
- Temperature unit
- User login

Options in the extended "Configurations" menu:

- Language
- Temperature unit
- User login
- Igniter
- Safety
- Flash point display
- Igniter parameters
- Data transfer
- Network

NOTICE

Changes to the "**Configurations**" options must **always** be confirmed with <OK> (and not with <Enter>).

5.1.1 Temperature Unit

You can set temperature unit of the PMA 5. Turn the jog shuttle to choose between

- "**Celsius [°C]**" or
- "**Fahrenheit [°F]**"

Select a temperature unit and confirm with <OK>.

NOTICE

This parameter is a user parameter. Any changes to this parameter are only active when the respective user is logged on.

User parameters allow you to customize the PMA 5 when several operators are sharing one device. User parameters are saved in your user profile.

5.1.2 User Login

Turn the jog shuttle to choose between

- "**enabled**" or
- "**disabled**"

If the user login is enabled, users select their user account to work with the PMA 5. If the user login is disabled, all users work under "**Operator: default**".

NOTICE

Changes to the "**Configurations**" options must **always** be confirmed with <OK> (and not with <Enter>).

For a description on creating user accounts refer to *Choosing the Igniter System* on page 15.

User-defined settings, such as the date format, are saved together with the user account.

5.1.3 Igniter

Here you can select igniter type. Turn the jog shuttle to choose between

- "**Gas igniter**" or
- "**Electric igniter**"

NOTICE

Changes to the "**Configurations**" options must **always** be confirmed with <OK> (and not with <Enter>).

5.1.4 Safety Configuration

The safety settings of the device can be enabled/disabled in this screen. Refer to

- *Maximum block temperature* on page 26
- *Maximum sample temperature* on page 26
- *Extinguisher* on page 26
- *External signal* on page 26

Maximum block temperature

This parameter defines the maximum allowed heater temperature, measured with the block Pt100. This temperature is set to 650 °C.

Do not change.

Maximum sample temperature

This parameter defines the maximum allowed temperature measured in the sample with the sample Pt100. This temperature is set to 405 °C.

Do not change.

When this temperature is exceeded, PMA 5 will automatically stop the test with the following message:

Extinguisher

With this option you can activate ("**On**") or deactivate ("**Off**") the fire extinguisher feature of the PMA 5. If a fire is detected, fire-extinguishing gas is released.



WARNING

Risk due to fire

If the option "**Extinguisher**" is set to "**Off**" the fire extinguishing feature will not work in case of fire even if the fire-extinguishing gas is connected.

The fire extinguisher works with external fire-extinguishing gas (we recommend N₂). For a description on the connection refer to *Fire Extinguisher System* on page 17.

In the case of a fire, the fire sensors in the multi-function head will trigger the fire alarm and automatically open the fire-extinguishing gas valves for 8 seconds. The released gas will extinguish the flames.

The heating of the PMA 5 will stop immediately.

After these 8 seconds the fire sensors check for fire again. If required, the fire-extinguishing gas valves are opened again for another 8 seconds.



WARNING

Risk due to fire

The magnetic valve for the supply of extinguishing gas can only be opened if mains supply is connected. Therefore, **NEVER** disconnect the PMA 5 from the mains supply or switch off the device in case of fire, otherwise the gas valve cannot be opened!

If a fire was detected the following screen is shown. The user interface will be blocked. In this case switch off the device after the fire has been extinguished and switch it on again to reset.

External signal

This option must be activated if you want to connect the PMA 5 to an external fire alarm system such as a signal lamp or fire bell. Refer to *Connecting the Fire Signal Switch* on page 37 for more information.

5.1.5 Flash Point Display

NOTICE

The parameters "**FP rounding**" and "**FP visualization**" are user parameters. Any changes to these parameters are only active when the respective user is logged on.

User parameters allow you to customize the PMA 5 when several operators are sharing one device. User parameters are saved in your user profile.

FP rounding

With this option you can determine which flash point value is displayed after a test. Use the jog shuttle to scroll through the following values and confirm your selection with <OK>.

Table 5-1: FP rounding

Option	Effect
corrected rounded	Displays the FP as barometric pressure corrected rounded value. This is the default setting and shows the result as specified by the standards.
uncorrected	Displays the FP as uncorrected and not rounded value.
corrected	Displays the FP as barometric pressure corrected, but not rounded value.

The other values (uncorrected, barometric pressure corrected) can be read out in the detailed result display.

FP visualization

It is possible to visualize the test phases of the flash point test with display colors to show the user in which phase the test run is at the moment.

Use the jog shuttle to scroll through the values "**dark**", "**light**" and "**off**" and confirm your selection with <OK>.

Default setting is "**off**", i.e. display colors are disabled.

When activated, the display colors are as follows

Table 5-2: Display colors

Color	Explanation
Green	Shown when the test is running until the test flame is lighted.
Yellow	Shown from the moment the test flame is lighted until 5 °C before the expected flash point.
Red	Shown from 5 °C before the expected flash point until test end.

The test result "**FPok**" is displayed in green color, when the result is according to standard. All other results that are not according to standard are displayed in red.

5.1.6 Igniter Parameters (for servicing purposes only)

The igniter parameters can be changed in this menu. Refer to

- *Current low and high* on page 27
- *Threshold Gas Indicator* on page 27
- *Reference Voltage Low/High* on page 28

Current low and high

This screen contains the settings for the electric current at the electric igniter.

Depending on whether the electric igniter is used as igniter for detecting the flash point or as secondary igniter to light the gas flame when necessary, different currents are predefined.

When the electric igniter is used as secondary igniter to light the gas igniter:

- "**lowest**" defines the current in standby
- "**high**" defines the current to light the gas flame at the beginning of the flash point test or when it is necessary to relight the gas flame after it has been blown out

When the electric igniter is used for the flash point test:

- "**low**" defines the current in standby
- "**high**" defines the current when the igniter dips in

By default "**lowest**" is set to 7 A, "**low**" is set to 9 A, "**high**" is set to 10.8 A.

NOTICE

Do **not** change the settings!

Threshold Gas Indicator

Threshold gas indicator means the temperature (in digits) at the thermocouple that controls the presence or absence of the gas flame.

The value set for this parameter depends on the safety detector used in your device:

NOTICE

Do **not** change the settings!

If there are any difficulties with the recognition of the gas flame, it is possible to show the value of the gas

flame indicator during the test (select it under "**Service > Diagnostics > Show measured data**") and to check, if the value is above 200 digits respectively 250 digits or not when the gas flame is on.

Reference Voltage Low/High

For service purposes only!

The allowed deviation of the electric igniter reference voltage is set in this menu.

5.1.7 Changing the Electric Igniter

The performance of the electric igniter is monitored during the flash point tests.

When the measured voltage increases or decreases by 300 mV, an error message will be displayed after a test and when a new test is started.

You can choose <Ignore> and continue. However, you should check and - if required - change the igniter as soon as possible.

Check the ignition for visible damage as shown below:

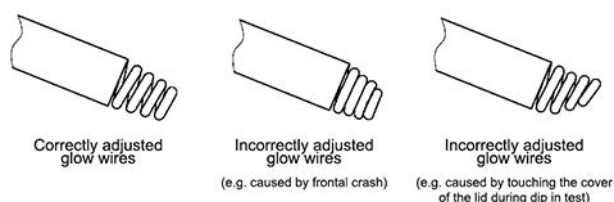


Fig. 5-1: Checking the electric igniter

NOTICE

When the electric igniter is not changed, it is most likely that the flash point values will be too high, because the thermal energy of the electric igniter will not be sufficient and no more comparable with the gas flame.

To change the electric igniter either press <Change> in this warning screen or select "**Change ignitor**" from the "**Service**" menu.

Follow the procedure below:

Press <Change> to confirm.

Remove the old igniter.

NOTICE

Make sure that you open the fixing screw of the igniter **completely** before inserting the new electric igniter. Otherwise you might easily damage the sensitive tip of the igniter.

Insert and connect the new igniter. Then press <Start>. The new igniter will be initialized.

When the device is ready, the next screen will be displayed. Confirm with <OK>.

NOTICE

When the electric igniter is exchanged, it must be initialized by the PMA 5 device. Therefore, it is mandatory that you select <Change> in the warning screen shown above or select "**Change ignitor**" from the "**Service**" menu and follow the change process as described above.

5.1.8 Test Components

When you select "**Test components**" from the "**Service**" you can test all of the device's individual components for correct functioning.

For all components the igniter value is displayed as well (thermocouple for the gas igniter).

Test components: Sample Pt100

Assemble the empty test insert (all parts at room temperature) and select this option to display the sample Pt100 temperature together with the offset.

Compare the value with the current room temperature. This allows you to check whether the measured value is plausible. This check does not substitute a proper calibration of the Pt100.

Test components: Block Pt100

Select this option when the device is at room temperature. Compare the value with the current room temperature. This allows you to check whether the measured value is plausible. This check does not substitute a proper calibration of the block Pt100.

Test components: Flash Point Indicator

This testing option is intended for Anton Paar service only.

Test components: Magnetic Valve

With this testing option you can switch the valve for the gas supply manually on and off. For safety reasons, turn off the gas supply before checking.

Select <On> and <Off> and you should hear a "click" when the valve switches.

Test components: Extinguisher

With this testing option you can test the fire extinguisher valve and signal.

Select <On> and <Off> and you should hear a "click" when the valve switches.

Select <Sign on> and <Sign off> to switch the external signal on and off.

Test components: Electric Igniter

With this option you can test and display the electric current settings for the electric igniter.

Select <I high> to display the setting for the igniter parameter "**Current high**". At the same time the current will be applied and the igniter will begin to glow (highest setting).

Select <I low> to display the setting for the igniter parameter "**Current low**". At the same time the current will be applied and the igniter will begin to glow (it should glow lower than with <I high>).

Test components: Gas Igniter

With this option you can switch the gas igniter manually on and off. When you select <On> the magnetic valve will open and the electric igniter will light the gas flame.

The display will show

- the temperature in digits at the thermocouple
- the threshold for the recognition of the gas flame (250 digits as default)
- the offset which had been set under "**Calibration**"

Test components: Stirrer Motor

With this option you can start the stirrer motor at 115 rpm and 250 rpm.

Press the softkey <115 r.p.m> or <250 r.p.m> to start the stirrer. <Off> turns the stirrer off again.

Check the functionality for visible plausibility, i.e. the stirrer should move faster at 250 rpm.

Test components: Igniter Motor

With this option you can test the function of the igniter motor which moves the igniter up and down.

Using the softkeys <Up> and <Down> moves the igniter up and down. Check whether the movement is correct and the igniter does not touch any parts of the test insert.

Furthermore the number steps executed by the motor is displayed and you see whether the end switch has been triggered or not.

Test components: Heater

With this option you can test the function of the heater.

The heater can be manually switched on and off. Press the softkey <On> to switch the heater on. The displayed block temperature should rise and the inside of the air bath should get warmer. Take care not to burn yourself!

Press the softkey <Off> to switch the heater off again. The temperature should decrease.

Test components: Fan

With this option you can check the function of the fan.

Press the softkey <On> to switch the fan on. You can hear the fan.

Press the softkey <Off> to switch the fan off again.

Test components: LED

With this option you can check the function of the LEDs around the jog shuttle.

Green and red LED can be switched on and off.

- <Green on> switches the green LEDs on
- <Green off> switches the green LEDs off
- <Red on> switches the red LEDs on
- <Red off> switches the red LEDs off

Test components: Buzzer Sound

With this menu you can test the buzzer sound.

When you press the softkey <On> you will hear the buzzer sound.

5.1.9 Diagnostics

The "**Diagnostics**" menu contains the following diagnostics functions.

Diagnostics: Show measured data

You can customize the displayed data of your PMA 5. You can select up to three value types to be displayed below the sample temperature.

The temperature of the block Pt100, board temperature (for Anton Paar service only), gas indicator, stirrer speed and fire extinguisher sensors can be displayed below the sample temperature during the test.

NOTICE

All changes must be confirmed with <OK> and not with <Enter>.

Diagnostics: Print cycle

With this option you can print out key test parameters at a defined interval.

The print interval can be set to 10 s, 30 s, 1 min, 2 min, 5 min, 10 min, or "no print".

Depending on the setting for "**Printer result**", either the "**short result**" or "**long result**" will be printed out after the test .

NOTICE

This parameter is a user parameter. Any changes to this parameter are only active when the respective user is logged on.

User parameters allow you to customize the PMA 5 when several operators are sharing one device. User parameters are saved in your user profile.

Diagnostics: Print device parameters

With this option you can display and print the device parameters.

Note that the settings for the parameter "**Gasflame ind. threshold**" shown in the printout above depends on the safety detector installed in your PMA 5.


Diagnostics: Print user parameters

With this option you can display and print the user parameters.

6 Upkeep and Error Handling

TIP: For more detailed information please refer to your Reference Guide.

To assure a constant and high accuracy of your measurements, employ a regular and effective cleaning routine and store the instrument under the recommended conditions.



WARNING

Risk of injury
Wearing gloves is highly recommended.

6.1 Service Inspection

After 1800 tests, a message is displayed (on powering up the device) about necessary servicing.

Confirm this message with <OK>. The **"Main menu"** will be displayed.

After the device has been serviced, the counter can be reset by Anton Paar service (password required).

6.2 Wetted Parts of PMA 5

Table 6-1: Wetted parts

Part	Material
Housing	Stainless steel, coated
Multi-detector	Stainless steel, Ni/Cr-Ni, glass
Test cup with lid	Brass/stainless steel

6.3 Maintenance Routines

The following parts should be checked at least at the intervals shown below:

Table 6-2: Maintenance routines

Component	Function	Test Activity	Test Interval	Tester
Electric igniter	Wear and tear test	Visual inspection	monthly	User
Electric igniter	Alignment	Visual inspection	monthly	User
Gas igniter	Uniform flame	Blockage test/blow-ing free	yearly	User/ Anton Paar service
Igniter arm	Alignment	Visual inspection	monthly	User

6.4 Error Handling

Display does not light up after power-on

Only the 4 green arrows around the jog shuttle light up immediately after device power-up for the first 10 s. The complete boot process (until the main menu is displayed) takes about 1 minute.

If the display still does not light up, check the fuse.

Gas igniter does not work

1. Gas connected?
2. Is air in the supply line instead of gas?
3. Are you using special gas hose material? Silicone is not gas-tight. Using this material, the gas igniter has a slowly increasing flame size, i.e. it cannot be started within 55 seconds on starting the next ignition period (safety function) because the gas is not flammable when escaping.
4. Can you hear the clicking of the magnetic valve when running a manual test?
5. Is the valve open?
6. No gas flame will ignite if the gas flow of the gas igniter is not opened wide enough or opened too wide.

Gas igniter flickers, cannot be adjusted

- The gas igniter must be cleaned at regular intervals (please contact your Anton Paar representative).
- Did you use silicone tubes? Silicone tubes are not gas-tight and must not be used.
- If you are using bottled gas, is the bottle almost empty?

Electric igniter does not work

- Igniter connectors inserted into device's sockets?
- Igniter coil defective / damaged?

No Display of Sample Temperature

- Is the sensor plug of the multi-function head properly inserted at the back of the device?
- Is the multi-sensor properly inserted and the multi-function head in the correct test position?

7 Maintenance and Repair

7.1 Maintenance Performed by an Authorized Anton Paar Service Engineer

The PMA 5 requires a periodical maintenance which shall be performed by an authorized Anton Paar Service Engineer.¹

A missing maintenance may mean that under certain conditions your warranty is no longer valid.²

Maintenance Interval:

- Once a year

Parts to be exchanged at every maintenance interval (wear and tear parts):

- Contact pins
- Stirrer coupling

Following parts are generally excluded from the warranty (wear and tear parts):

- Test cups
- Test cup lids
- Multi-detectors
- Electric igniters

NOTE

The average lifetime of the electric igniter strongly depends on the measured samples and mechanical stress applied. If handled carefully, the electric igniter will last between 200 and 300 measurements (typically observed values at customer sites) with respect to the sample type measured.

7.2 Repair Performed by an Authorized Anton Paar Representative

In case your instrument needs repair, contact your local Anton Paar representative, who will take care of the necessary steps. If your instrument needs to

be returned, request an RMA (Return Material Authorization Number). It must not be sent without the RMA and the filled "Safety Declaration for Instrument Repairs". Please make sure it is cleaned before return.

TIP: Find the contact data of your local Anton Paar representative on the Anton Paar website (<http://www.anton-paar.com>) under "Contact".

¹ Please contact your Anton Paar representative to get an offer.

² For detailed information please see the general terms of delivery (GTD) on the Anton Paar website (<http://www.anton-paar.com>).

Appendix A: Technical Data

Table A-1: Technical data

Item	Description
Power supply	AC 115 V \pm 10 %, 50/60 Hz AC 230 V \pm 10 %, 50/60 Hz
Apparent power	1000 VA
Heating power	800 W
Overvoltage category	II
Fuses	AC 115 V: T 10 A H, 250 V AC, 5 \times 20 mm AC 230 V: T 4 A H, 250 V AC, 5 \times 20 mm
Protection class	I, according to VDE 0106
Interfaces	2 \times USB for printer and USB memory device RS-232 for LIMS LAN for FTP
External fire signal output	max. 48 V DC / 10 A potential-free
Airborne noise emission	< 57 dB (A)
EMC radiated emission	Class A. This equipment can generate radiated disturbances in residential environment.
Fire extinguisher	CO ₂ or N ₂ , 6 bar - 12 bar 9 mm outer diameter
Thermal fuse	Cut out for interruption of the heater circuit Temperature threshold 700 °C (heater block)
Barometric pressure sensor	max error 0.6 % full scale
Flash point range	about 40 °C to 405 °C from about +20 °C (with external pre-cooling)
Igniter gas	Propane/butane or natural gas, max 0.05 bar 8 mm outer diameter
Temperature sensor	Pt100, Class 1/3 B
Stirrer speed	0 rpm to 250 rpm (\pm 1 rpm)

Table A-2: Dimensions and weight

Item	Description
Dimensions (W \times D \times H)	approx. 230 mm \times 460 mm \times 390 mm
Weight	approx. 14 kg

Table A-3: Environmental conditions

Item	Description
Ambient temperature	10 °C - 30 °C
Air humidity	Min. relative humidity: 10 % Max. relative humidity: 80 % (non-condensing)
Altitude	0 m - 2000 m
Pollution degree	2
Indoor use only!	
Laboratory bench / laboratory environment	

NOTICE

Danger of damage

Before putting into operation, the device must have been stored for 24 h at room temperature!

Appendix B: Fire Extinguisher Device and Fire Signal Switch

Appendix B.1: Checking the Fire Extinguishing Device

Do this:

- Monthly
- With a lighter

The fire extinguishing device can be triggered in two ways (manually and automatically). Carefully check the functioning of both trigger mechanisms.

1. Remove the external gas supply.
2. Test the manual trigger device:
Press the red pushbutton on the front of the PMA 5.
3. Deactivate the fire alarm:
Switch the unit off and on again.
4. Test the automatic trigger device:
Hold a lighter flame near the fire sensor.
5. Deactivate the fire alarm:
Switch the unit off and on again.

NOTICE

If the fire alarm has been triggered, the message FIRE will appear on the display and a long drawn-out signal tone will sound. Afterwards, the unit must be switched off and on again because all the functions are deactivated by the alarm and the alarm can only be reset in this way.

Appendix B.2: Connecting the Fire Signal Switch

You can connect the PMA 5 to an external fire alarm system such as a signal lamp or a fire bell using the included LEMO plug.



Fig. B-1: LEMO plug (side and top view)

Depending on your requirements and the distance to the next fire alarm system connector in your laboratory, choose and connect the appropriate cable to the LEMO plug.



Fig. B-2: LEMO plug dismantled to connect cable



WARNING

Danger of injury

All electrical installations must be executed by qualified personnel in accordance with your respective local legal requirements.

Connect the LEMO plug to the Fire Signal Switch at the rear of the PMA 5 device.

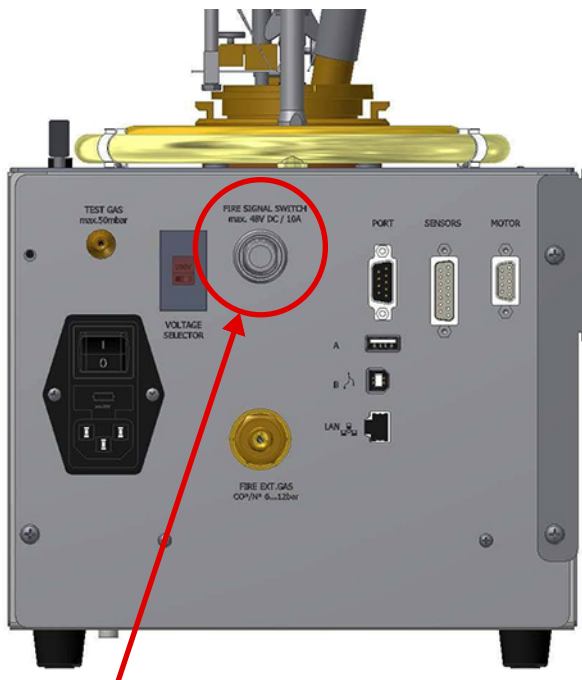


Fig. B-3: Location of fire signal switch



Fig. B-4: Pin configuration

Default position is closed (no signal) and connector 1 and 2 are connected.

When the switch is on (fire signal) connector 1 and 3 are connected.



WARNING

Use only the LEMO plug (mat. no. 138814) which is included in the standard delivery of the PMA 5. Do **not** use any other plug to connect the PMA 5 to the alarm system!

After connecting the instrument to the alarm system, the feature must be activated in the configuration of the PMA 5. Please refer to *Safety Configuration* on page 26 for a description on activating the external signal.

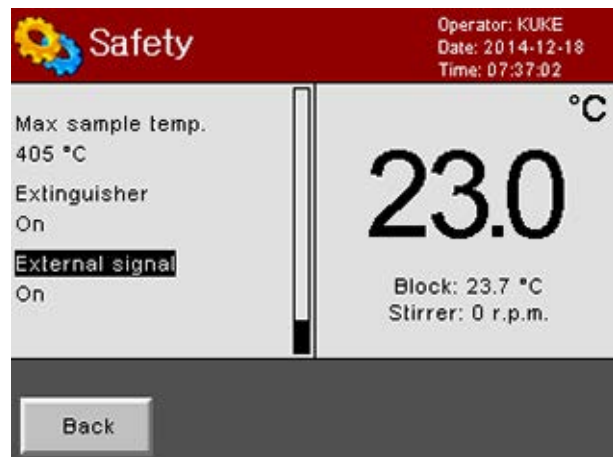


Fig. B-5: Activating the external fire signal

Appendix C: Declarations of Conformity

EC Declaration of Conformity
(original)



The manufacturer **Anton Paar ProveTec GmbH**, Ludwig-Erhard-Ring 13, D-15827 Blankenfelde-Mahlow, Germany, hereby declares that the product described below:

Description: **Pensky-Martens flash point tester**
Model: **PMA 5**
Material number: **135404**
Serial number:

complies with all the relevant provisions of the

- **Low Voltage Directive (2014/35/EU, OJ L 96/357 of 29.3.2014)**
- **Electromagnetic Compatibility Directive (2014/30/EU, OJ L 96/79 of 29.3.2014)**
- **RoHS Directive (2011/65/EU, OJ L 174/88 of 1.7.2011)**


and complies with the provisions of the following harmonized standards:

- EN 61010-1:2010 + A1:2019 +A1:2019/AC:2019 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements
- EN 61010-2-010:2014 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-010: Particular requirements for laboratory equipment for the heating of materials
- EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

The product is classified as a class A equipment and is intended for the use in industrial area.

This declaration relates exclusively to the product in the state in which it was placed on the market, and excludes components which are added and/or operations carried out subsequently by the final user.

Done at Blankenfelde/Mahlow, 2022-07-22


Dr. Soeren Gehne
Product Lines Manager
Anton Paar ProveTec GmbH


Marcel Berk
Production & Purchasing Manager
Anton Paar ProveTec GmbH


Dr. Carolin Edinger
Product Manager
Anton Paar ProveTec GmbH

Fig. C-1: CE declaration of conformity

UK Declaration of Conformity
(original)



The manufacturer **Anton Paar ProveTec GmbH**, Ludwig-Erhard-Ring 13, D-15827 Blankenfelde-Mahlow, Germany, hereby declares that the product described below:

Description: **Pensky-Martens flash point tester**
Model: **PMA 5**
Material number: **135404**
Serial number:

is in conformity with all the relevant UK legislation

Electrical Equipment (Safety) Regulations 2016, 2016 No. 1101

Electromagnetic Compatibility Regulations 2016, 2016 No. 1091

Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012, 2012 No. 3032

complies with the designated standards:

- EN 61010-1:2010 + A1:2019 +A1:2019/AC:2019
- EN 61010-2-010:2014
- EN 61326-1:2013

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Importer: Anton Paar Ltd, Unit F, The Courtyard, Hatfield Rd, St Albans AL4 0LA, United Kingdom;

Responsible for technical documents: Managing Director, Anton Paar Ltd.

Done at Blankenfelde/Mahlow, 2022-07-22

Dr. Soeren Gehne
Product Lines Manager
Anton Paar ProveTec GmbH

Marcel Berk
Production & Purchasing Manager
Anton Paar ProveTec GmbH

Dr. Carolin Edinger
Product Manager
Anton Paar ProveTec GmbH

Fig. C-1: UK declaration of conformity