Cambustion

Aerosol Diluter

AD60

User Manual

(Original Instructions)

Version 1.0

User Interface Software v1.0

Firmware v1.0

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The system described herein is a standard system. If any non-standard components, configurations, or alterations have been made or requested, please refer to special instructions for these items and/or contact Cambustion for advice.

Please read this manual in its entirety before attempting to use or maintain the product.

CONTENTS

Contents

Endpiece: Information on Cambustion and our products

AD60 Manual Changelog:

Version	Date	Changes	Reviewed
1.0	20.08.2025	Initial release	FK

1 Introduction

1.1 Scope of this manual

This manual contains instructions for a skilled operator to operate the AD60 under normal conditions in a laboratory environment.

1.2 Explanation of Symbols Used

Symbol	Meaning
	Caution, an error has occurred – risk of danger or system malfunction. **You must consult this manual.** On user interface.
	Used in this manual to warn of other hazards, and on the product to inform the user that they should read this manual before use to be informed of relevant hazards.

1.3 Safety Instructions

1.3.1 Intended Use

The AD60 is intended to dilute the concentration of particles in a gas stream (i.e. of an aerosol).

It is intended for use by a trained operator in a laboratory environment.

Only use the mains power cable provided with the AD60.

1.3.2 Power Rating

Connector	Voltage	Max Current	Max Power
C13 AC connector	100-240 VAC (50 or 60 Hz)	3.15A for 230V 5A for 115V	350 W

AC power must be supplied via an RCD (residual current device) / GFI (ground fault interrupter) protected circuit.

1.3.3 Power Disconnection

Power disconnection is achieved by disconnecting the mains power cable from the back of the AD60.

1.3.4 Installation, Environment & Handling

The AD60 should be situated on a flat surface, in a dry indoor environment at an altitude no higher than 2000 meters (6000 feet). The equipment is designed to operate within the following limits:

	Ambient Temperature °C	Ambient Humidity (%RH)
Minimum	10	0
Maximum	40	95% non-condensing

Do not install in a location such that the power switch is inaccessible.

1.3.5 Gas connections

AD60 gas connections are designed for operation around local atmospheric pressure. Do not connect high pressure gases (>100 mb gauge) to any inlet or outlet.

Connecting high pressure gases to any of them is likely to result in permanent damage to the diluter.

Do not obstruct the pump exhaust port while the inlet flow is activated.

1.3.6 Liquid spills

The AD60 is not rated for protection against liquid ingress. If liquid is spilt into the AD60 disconnect the AC power and seek support from Cambustion. Ensuring Safe Operation

⚠ The diluter is not rated to prevent escape of biological materials.

⚠ The diluter is not suitable for diluting aerosols containing hazardous or flammable gases. Carrier gases should be limited to air, nitrogen, carbon dioxide or argon.

⚠ Diluter assembly may become hot under prolonged operation and become a hazard. Allow time for it to cool down before cleaning or handling

⚠ Diluter is not designed to contain toxic gases, even in trace amounts. If the aerosol contains toxic gases, normal laboratory procedures including gas detection should be followed.

2 System Description

2.1 Components

- AD60 aerosol diluter
- Mains power cable
- This user manual
- USB flash drive containing documents
- Calibration certificate
- (optional) Rigid shipping case

2.2 Controls and Ports

Most user interaction is via the touchscreen interface located on the front panel, allowing access to all functions.

The touchscreen can be operated with a finger or stylus

The physical controls and indicators are listed in the sections below.

2.2.1 Front Panel

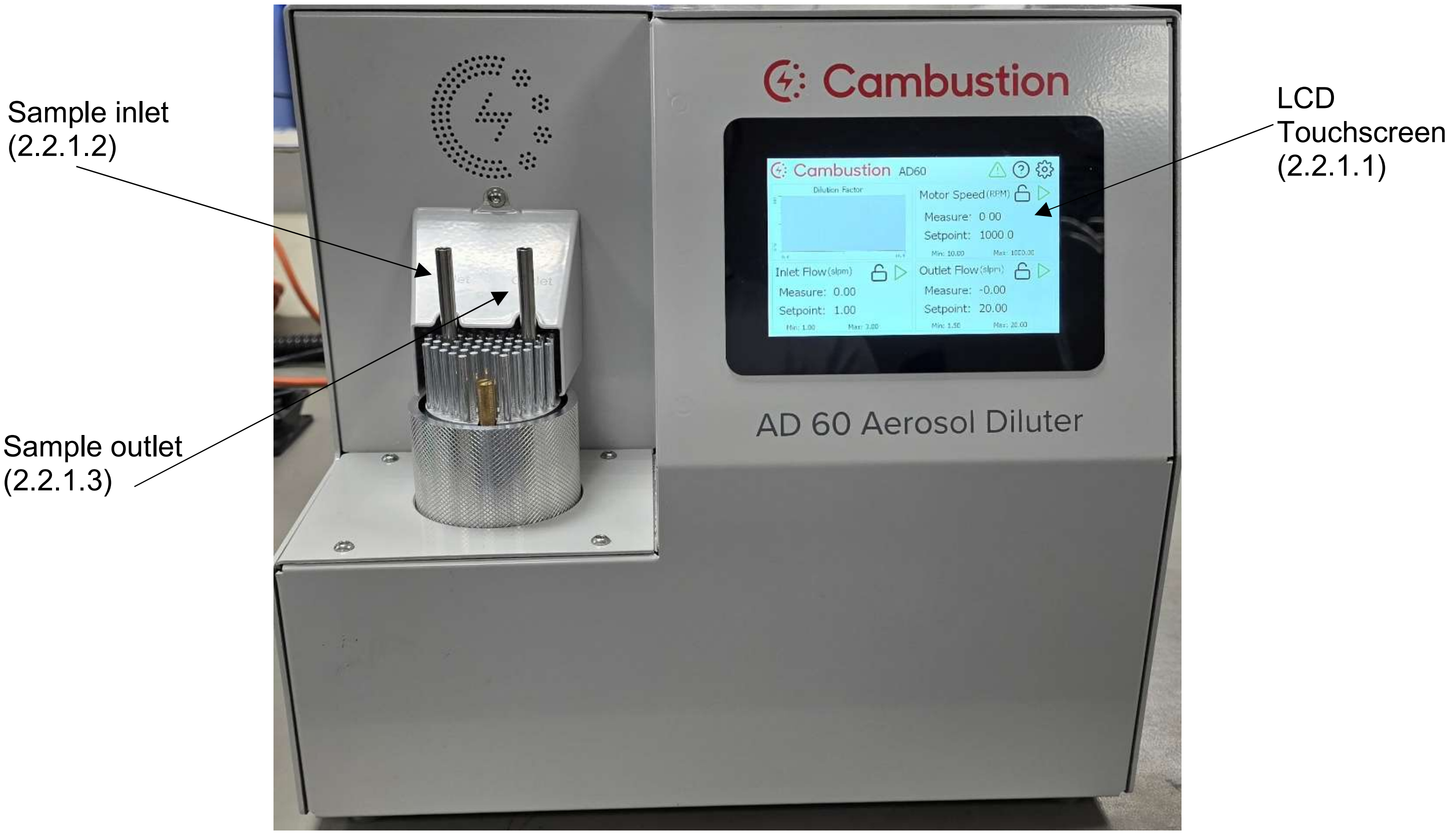


Figure 1 Front Panel

See subsequent sections (indicated in parentheses) for descriptions.

2.2.1.1 Touchscreen

All functions of the diluter are controlled and indicated via this, as well as the display of data. See Section 4.

2.2.1.2 Sample inlet

This is where the undiluted aerosol sample enters the diluter at a user adjustable flow rate of 1 to 3 lpm. See Section 3.1.3

2.2.1.3 Sample outlet

This is where the diluted aerosol sample exits the diluter at a user adjustable flow rate of 3 to 15 lpm. See Section 3.1.4

2.2.2 Rear Panel

Figure 2 Rear Panel

See subsequent sections (indicated in parenthesis) for descriptions.

2.2.2.1 AC Power Connector

The AC power connector is used to connect the mains power. Allowable voltage is 90-240 VAC at current 3.15 A to 5 A (fused) with maximum power of 350 W.

2.2.2.2 Power Switch

This is the main on/off switch for the diluter. Beneath it is a fuse holder, fitted with two 5A fuses.

2.2.2.3 USB B

The USB B port is used for firmware upgrades (see section 5.1)

2.2.2.4 Serial (RS232) comms

The serial port is used for communications to a PC / laptop (see section 6.1.2).

2.2.2.5 Ethernet Port

This is used to connect the diluter to a PC / laptop – using a “cross-over” cable – or to a local area network. This allows remote control of the diluter via remote commands – see sections 6.1.1.

2.2.2.6 Analogue Output

The analogue output is via a BNC connector. The output voltage range is 0–5 VDC. The impedance of the output is 50 Ω. The output voltage is a linear function of one of the user selected variables: dilution factor, outlet flow, and inlet flow – see Section 4.5.4.

2.2.2.7 Pump Exhaust port

The pump exhaust contains the gas of the sample inlet, but no particles. If the sample inlet contains hazardous gases, it must be extracted.

2.2.2.8 Dilution air intake port

The dilution air intake port is used to connect the dilution gas at ambient pressure to the diluter. If nothing is connected, ambient air is used for the dilution gas after being passed through an internal HEPA filter.

2.2.2.9 HEPA and coalescing filters

These are user replaceable filters used to eliminate particles in the sample before being exhausted via the pump exhaust port. Depending on aerosol type selected sample flows through the left HEPA filter – for solid particles – or through the coalescing filter and the right HEPA filter – for liquid particles.

2.2.2.10 Liquid Trap

The liquid trap collects liquid that gets deposited in the coalescing filter when sampling a liquid-based aerosol. For maintenance instructions see Section 7.2

3 Basic Operation

3.1 Fluid Connections

Fluid ports on the front and the rear of the AD60 are the end points of 2 internal flow paths shown in Figure 3.

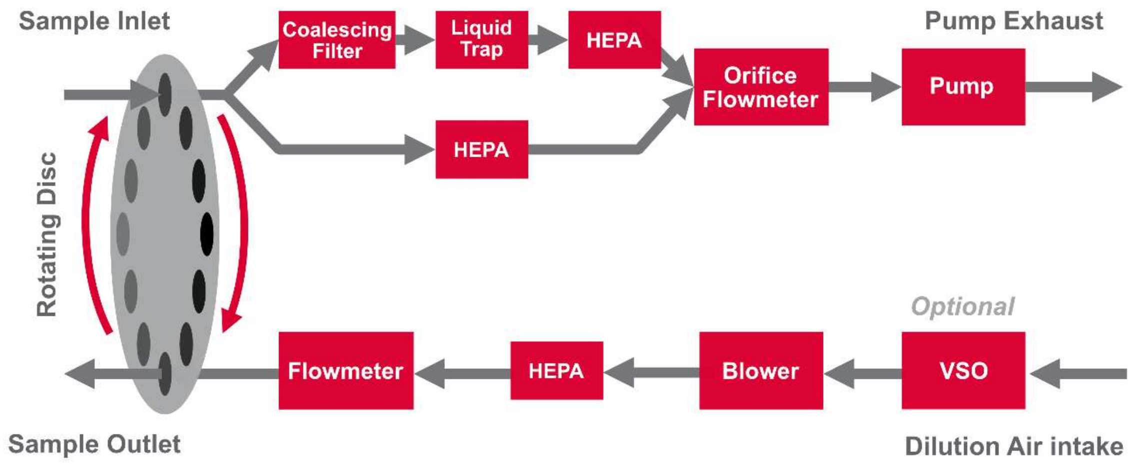


Figure 3 AD60 Fluid Schematic

3.1.1 Pump Exhaust port

The exhaust of the AD60 contains the carrier gas of the sample being diluted. If the aerosol contains potentially hazardous gases, it must be connected to an extract by pushing a well fitting tube over the barb on the rear panel. Tubes with internal diameter between 10 and 12 mm are recommended. The exhaust must not be connected to a vacuum.

3.1.2 Dilution air intake port

AD60 operates by transporting a portion of the sample inlet flow into a particle free gas flow, which becomes the sample outlet flow. This particle free gas flow consists of the gas supplied at the dilution air intake port, which passes through an internal HEPA filter. If nothing is connected to the dilution air intake port, carrier gas of the sample outlet flow is the ambient air.

To use a different carrier gas for the diluted aerosol, it must be supplied to the dilution intake port at near **ambient pressure, 0 – 50 mb gauge,** by pushing a well fitting tube over the barb on the rear panel. Tubes with internal diameter between 10 and 12 mm are recommended.

3.1.3 Sample Inlet

The sample inlet (high concentration) connection is the left tube on the front of the diluter. Electrically conductive sample tubing is recommended to avoid electrophoretic particle losses. Suitable electrically conductive silicone tubing is available from Cambustion. Push the tube over the sample inlet tube, which has outer diameter of 6.35 mm (1/4 inch).

AD60 can either passively measure the sample inlet flow that is being blown into it by an external aerosol source or actively control it via the integrated pump. In controlled mode inlet flow rate is user adjustable between 1 and 3 slpm (as measured by AD60), see section 4.1.1.2 for definition of slpm.

While the sample inlet flow is actively controlled and the sample inlet flow is blocked, restricted (for example, by a tube or device upstream of the diluter) or too overpressurised, the error “Setpoints not achievable” appears. To allow the diluter to achieve the user input setpoint, reduce the restriction or stop the excessive overpressure.

3.1.4 Sample Outlet

The sample outlet connection is the right tube on the front of the diluter. Electrically conductive sample tubing is recommended to avoid electrophoretic particle losses. Suitable electrically conductive silicone tubing is available from Cambustion. Push the tube over the sample inlet tube, which has outer diameter of 6.35 mm (1/4 inch).

AD60 can either passively measure the outlet flow that is being sucked through it or actively control it via the integrated blower. The outlet flow rate is user adjustable between 1 and 15 slpm (as measured by the diluter).

While the out flow is actively controlled and the sample outlet flow is blocked, restricted (for example, by a tube or device downstream of the diluter), or too underpressurised, the error “Setpoint not achievable” appears. To allow the diluter to achieve the user input setpoint, reduce the restriction or stop the excessive underpressure.

3.2 Turning On

Connect the supplied mains cable to the AC power inlet on the rear panel of the diluter and to the mains supply. After this change the power switch on the rear panel to the *on* position. This will cause the diluter to turn on and you will be presented with the main screen, as shown below:

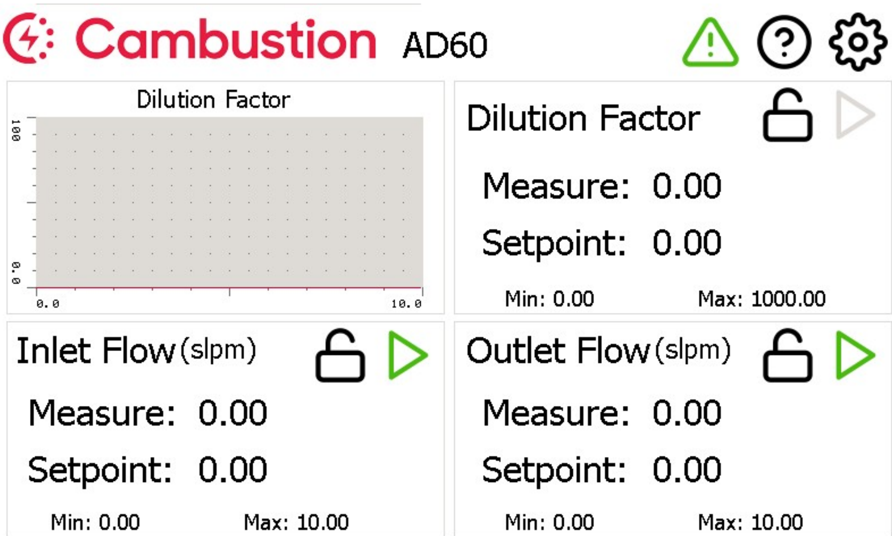


Figure 4 Main Screen

Input the desired inlet flow, outlet flow and dilution factor by tapping on the associated setpoint value. This will bring up an input screen. Confirm your selection by pressing ✓, which will return to the main screen and cause the variable to become locked, indicated by 🔒. A variable can also be toggled between locked and unlocked by pressing 🔓 and 🔒, respectively. For more information regarding locked variables see section 4.3.3

To turn on the respective variable tap the *on* button ▷. Dilution factor can only be turned on if at least two of three variables are locked. To turn off a variable tap the *off* button ☐.

When turned on inlet and outlet flows are actively controlled to the user setpoints, but if they are turned off AD60 measures the flows and uses that information to achieve the desired dilution factor. This means inlet flow can be blown into and outlet flow sucked through the AD60 without being controlled by it.

The order of operations can matter. This is because the allowed dilution factors are based on the measured values of the inlet and outlet flows. Consequently, the flows should be turned on, or blown into/sucked through, before adjusting the dilution factor setpoint.

3.3 Achievable Dilution Factors

The range of possible dilution factors depends on the flowrates, rotational speed, geometry of the disc and the ambient conditions, for more details see Appendix A.1.

Figure 5 shows an approximate operating map for air at ambient conditions, which can be used to estimate the operating range. AD60 displays the exact limits in the variable fields as the minimum and maximum values achievable at current conditions. For a larger format graph see Appendix G.

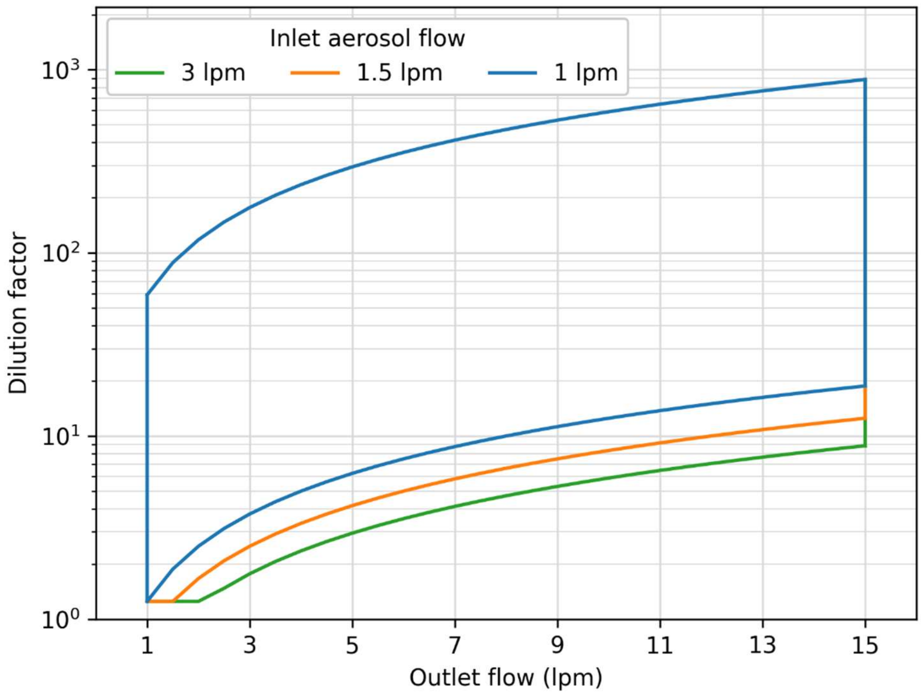


Figure 5 Achievable dilution factors

3.4 Exporting a log

The diluter records an ongoing 'black box' log at ~1Hz, this frequency can be changed with a command (see Appendix D), but returns to ~1Hz on startup.

This log can be exported via remote control commands either through ethernet telnet or RS232 serial communications.

3.5 Shutting Down

Change the power switch on the rear panel to the *off* position to shut down the instrument. All settings will be saved, except for on/off statuses, which will be set to off on startup. However, please wait 2 seconds after changing any setting before turning AD60 off to allow them to be saved.

If settings are changed or data inputted at the moment of shut down, they might not get saved. Similarly, log entry might not get saved at the moment of shut down. Please take that into account when operating the AD60.

4 User Interface

4.1 Conventions

4.1.1 Units

4.1.1.1 Temperature and Pressure

Quantity	Temperature	Pressure
Unit	Degrees Celsius / °C	Pascals / Pa

Standard conditions are user adjustable – see section 4.5.2.

4.1.1.2 Standard flow (slpm)

Either inlet or outlet sample flow at the selected reference standard conditions (temperature, pressure). In standard litres per minute.

By default reference standard conditions are 20 °C at 101325 Pa.

4.1.1.3 Dilution Factor

The dilution factor achieved by the diluter. Defined as the ratio of standard concentration in the sample inlet flow to the standard concentration in the sample outlet flow assuming zero losses of particles within the diluter. Since particle losses are size dependent, the effective dilution factor will have a dependency on particle size.

4.1.1.4 Motor Speed (RPM)

The rotational speed of the motor and hence the diluting disc. Expressed in revolutions per minute.

4.2 The User Interface

4.2.1 User Interface Conventions

✓ Accept changes and return to previous screen

✕ Cancel changes and return to previous screen

↵ Return to previous screen

4.2.2 Control buttons

▷ or □ Respectively: Turns on the respective variable and turns off the respective variable.

🔓 or 🔒 Respectively: Locks the respective variable and unlocks the respective variable.

or Respectively: Toggle signifying off and toggle signifying on.

4.2.3 Item selection

When presented with multiple choices, the current choice has a chevron > next to it.

When there are multiple pages of text or items to scroll through:

^ Scroll to the top, or first item

v Scroll to the bottom, or last item

4.2.4 Keypad data entry

In some screens a numeric keypad will appear to allow quantities to be entered. The available keys will change depending on which type of data entry is allowed, for example:

- A decimal point (.) for non-integers and IP addresses
- A minus sign (-) if negative values are allowed
- ← deletes the right most number

If more than one quantity is shown on the screen (e.g. date & time, temperature and pressure), touch the required quantity to select it for data entry. A black border is present around the currently selected quantity.

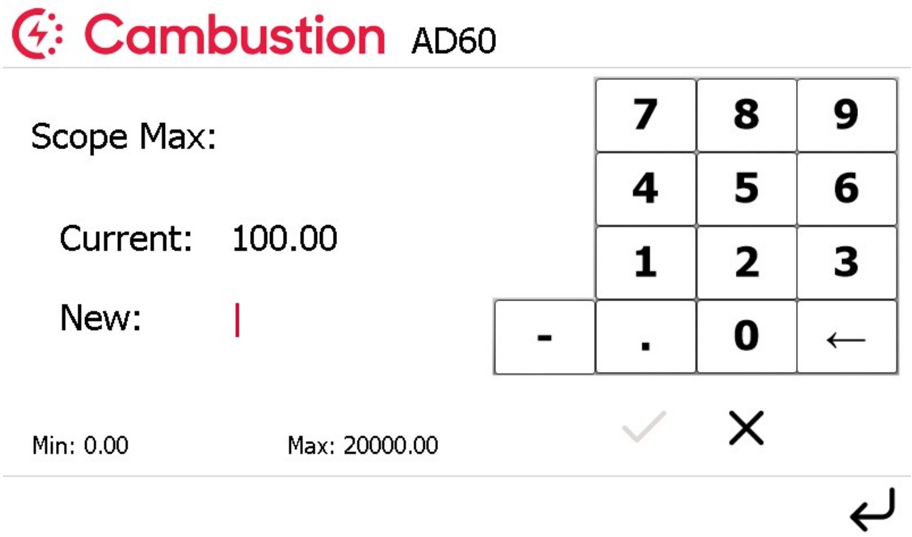


Figure 6 Example Numeric keypad

4.3 Main Screen

Upon powering on the diluter, after a short delay you are presented with the main screen.

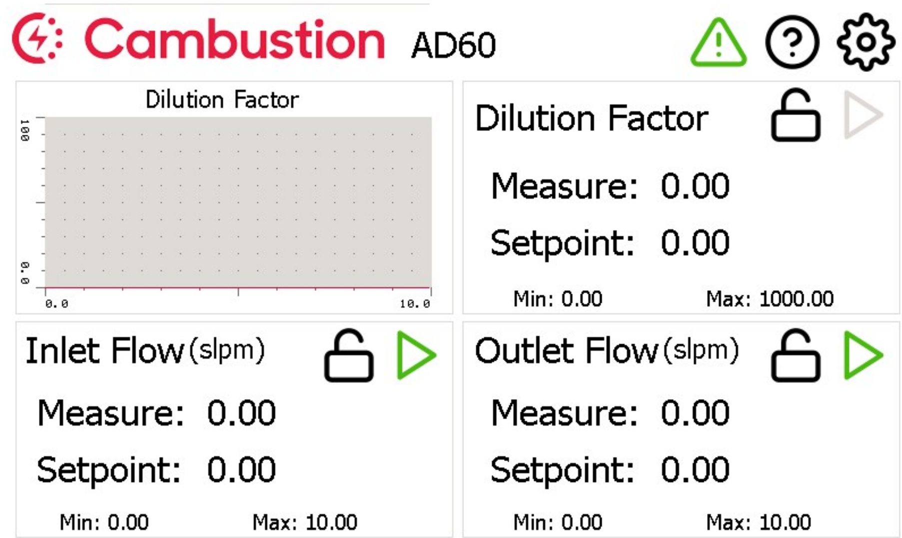


Figure 7 Main screen

The AD60 saves most settings between sessions with the exception of *on/off* statuses, such that all variables are off after startup.

4.3.1 Scope

Scope is located on the upper left quadrant of the main screen. It shows a graph of one of the variables over time. Tapping the graph opens up scope settings, where the user can select which variable is being shown and adjust the timescale and range of the plot.

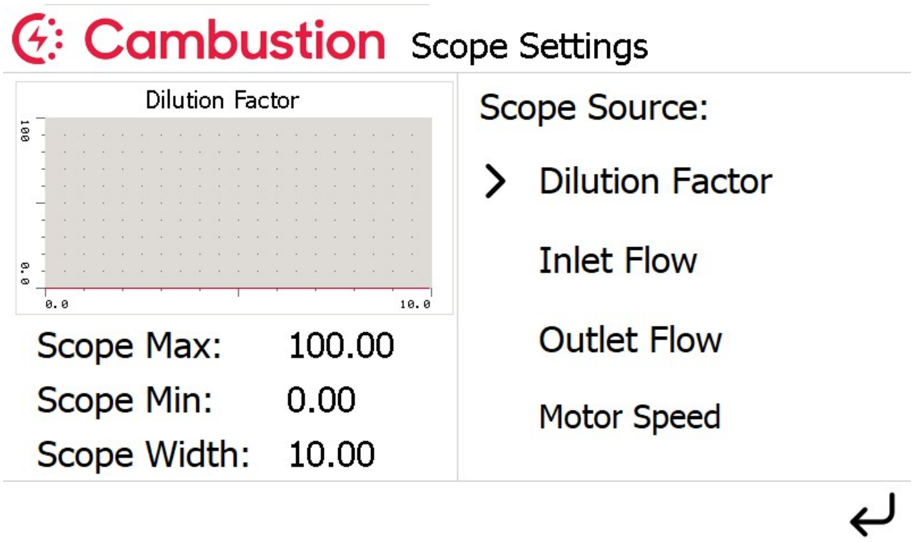


Figure 8 Scope settings selection

4.3.2 Variable fields

On the main screen there are variable fields, which display information regarding respective variables and are used to adjust them. In open loop mode there are 3 for inlet flow, outlet flow and dilution factor, or motor speed in direct speed mode. Outlet flow field is shown below:

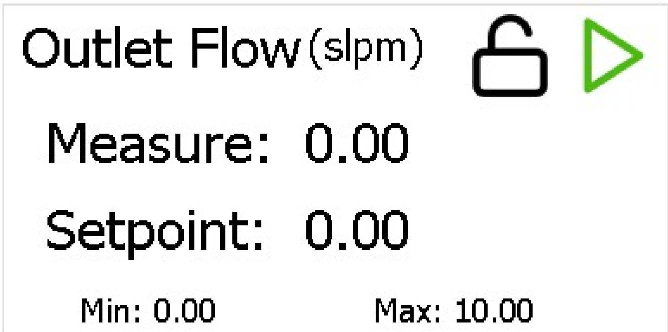


Figure 9 Outlet flow field

Each variable field shows the measured value, setpoint value, locked status, for unlocked and for locked, *on*/*off* status, for off and for on, and allowed limits of the respective variable. The , , and icons are both status indicators, showing the current state, and toggles used to switch between the states.

On startup all variable fields are off, showing . To turn a variable on tap the icon, which will change to signifying the variable is currently running. Similarly, to lock a variable tap , which will change to indicating the variable is locked.

To adjust the setpoint tap the displayed setpoint value, this will bring up a selection screen with limits still present at the bottom. Notably the setpoints can be adjusted while a variable is active, but the respective variable needs to be unlocked.

Variable fields also show the minimum and maximum value possible for the respective variable. They can either be the absolute limits or dynamic limits, described in the following section, depending on the number of locked variables. Furthermore, while in the main screen clicking on the limits will display a message box describing what they are caused by and potentially how to extend them, like shown in Figure 10.

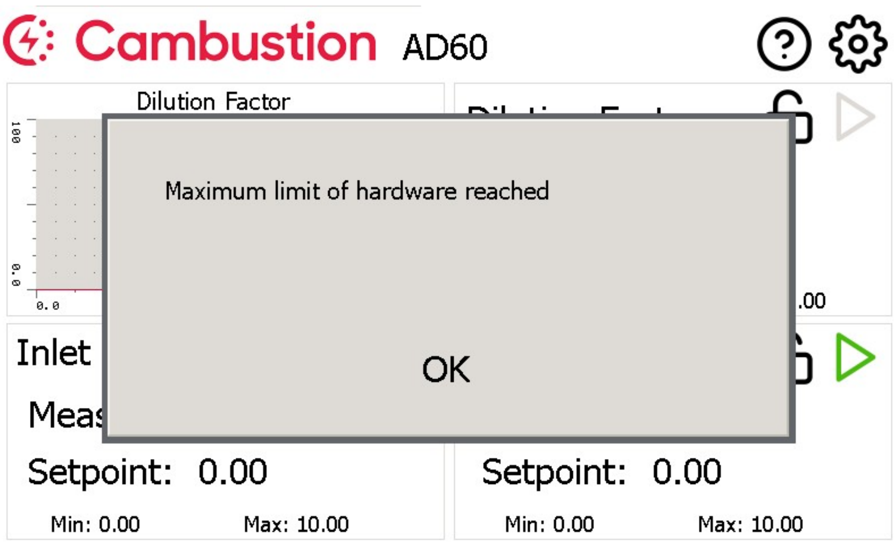


Figure 10 Limit Message

A variable must be unlocked to adjust it. After inputting a setpoint it locks automatically if less than 2 variables are locked.

Uniquely, dilution factor can only be turned on if at least 2 variables are locked, if that is not the case dilution factor's on/off status is greyed out . This is not the case for other variables and crucially a variable can be turned on while left unlocked.

4.3.3 Dynamic limits and locking

AD60 dilutes an aerosol by transferring a certain volume flowrate through the disc from the inlet sample into the outlet sample, which starts as a particle free flow. This results in a 3 degree of freedom nonlinear system, which presents a challenge to intuitively explain to the user. To learn more, see Appendix A.

To help remedy that AD60 uses dynamic limits for the 3 variables of interest that become active when at least 2 variables are locked. Any combination of any 2 out of the 3 variables restricts the operating range for the remaining one to a subset of the full range, referred to in the operating map, Figure 5, and the specification, Appendix F.

This means, for example, when starting with all 3 variables unlocked and entering the desired setpoints one by one the allowable range for the 3rd one will be restricted (if less than 2 variables are locked, entering a setpoint will lock the respective variable). This feature allows the user to easily gauge the operating range at any given conditions, whenever 2 variables are locked.

Crucially, the dynamic limits do depend on the inlet and outlet conditions, which means they can change if, for example, the inlet temperature or pressure changes. Because of that the dynamic limits can shift invaliding a previously entered setpoint. What AD60 does in such a situation depends on how many variables are locked.

When all 3 variables are locked, AD60 **will temporarily adjust** the last locked variable setpoint to keep it within the operating range and return to its initial value if it becomes possible. This is most likely to happen when the last locked variable setpoint is near its limits. In practice the least 'important' variable should be locked last. If AD60 adjusts a locked setpoint, a "**Setpoints not achievable**" warning will appear.

When 2 variables are locked, AD60 will adjust the setpoint of the unlocked variable to keep it within the operating range. It **will not** return to its initial value even if it becomes possible.

When only 1 variable is locked, AD60 will not adjust any setpoints, as the dynamic limits only apply when at least 2 variables are locked. This, however, is not very useful, because dilution can only be turned on when at least 2 variables are locked.

Importantly, AD60 only adjusts a setpoint if the respective variable is turned on.

4.3.4 Errors and Warnings Icon

This icon is located in the upper right of the main screen. When no errors or warnings are present it is green and if any appear it turns red. Tapping it brings up the Errors and Warnings screen, as shown in Figure 11 below:

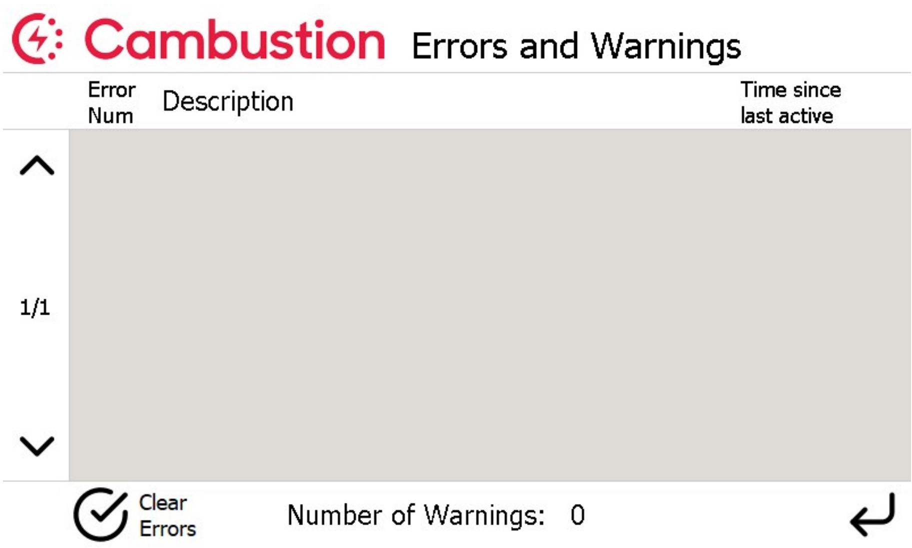


Figure 11 Errors and Warnings screen

This screen shows any active or past errors, which have not been cleared. It displays the error identification number, its description, time since it was last active and overall number of errors. To clear errors, tap the clear errors button .

4.4 Help Screen

Pressing the help button in the upper right corner brings up a screen with two QR codes, one pointing to a Quick-Start guide and other to the full manual. These can be scanned with a smartphone to obtain the most up-to-date manual for a given unit. Copies of the manuals when the AD60 was originally supplied are included on the USB flash drive.

4.5 Settings

Tapping the button in the upper right corner of the main screen brings up the settings menu, as shown below. All the settings are described in the following sections.

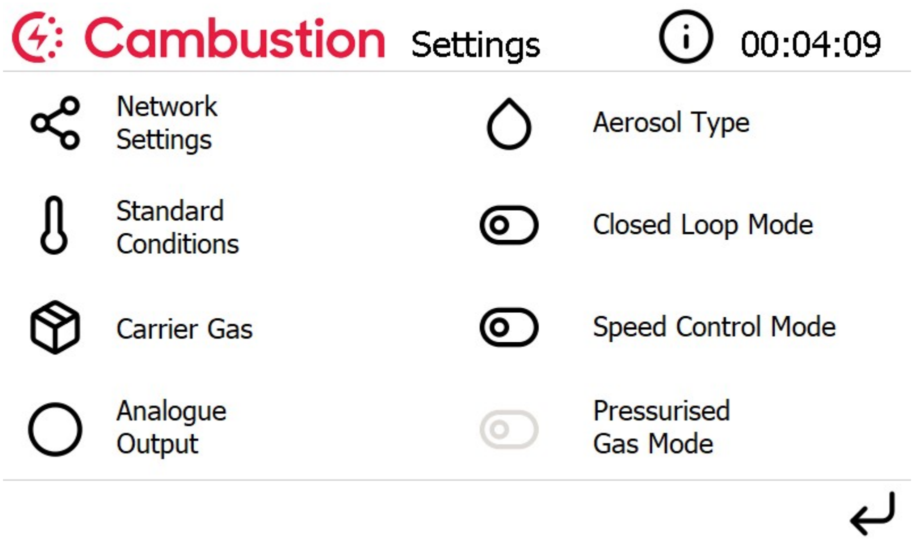


Figure 12 Settings screen

4.5.1 Network Settings

This menu can be used to view the MAC address and adjust the IP, by default it's set to 192.168.1.12. To change it, touch IP Address field and type the address, using period (.) as a separator.

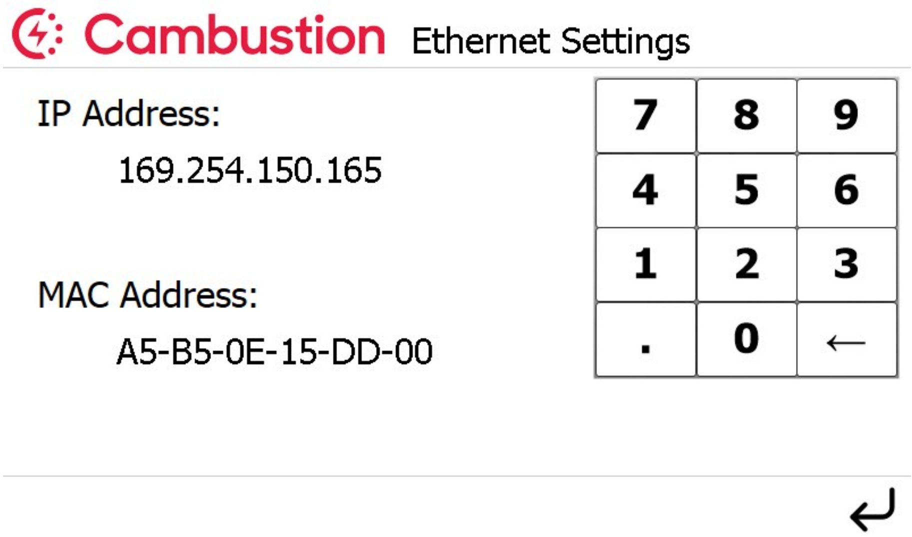


Figure 13 Ethernet Configuration

4.5.2 Reference Standard Conditions

Reference standard conditions can be changed by tapping on temperature and pressure, which will bring up a numerical input pad, where the desired conditions can be entered.

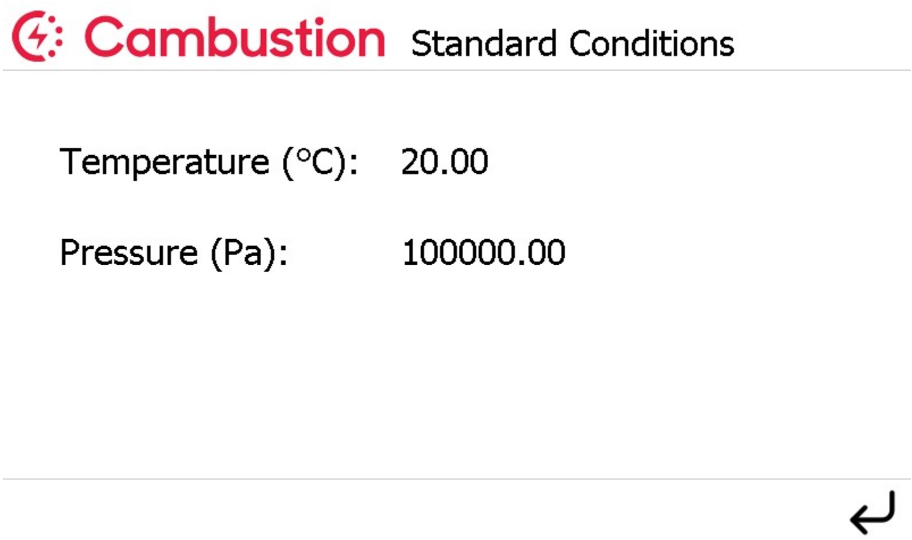


Figure 14 Conditions screen

These conditions are used for the slpm as reference for the inlet and outlet flows.

4.5.3 Select carrier gas

Opens a submenu allowing you to choose the carrier gas from air, carbon dioxide (CO_2), nitrogen (N_2) or argon (Ar). Flows will adjust accordingly. The diluter is factory calibrated for air – other gases use a physics-based conversion.

Notably, AD60 assumes the same carrier gas is present in the inlet and outlet flow paths. This can be assured by using closed loop mode, which recirculates the inlet sample bulk flow as the outlet sample bulk flow. Alternatively, the inlet sample bulk flow gas should be supplied at the dilution air in port.

4.5.4 Analogue output

Opens a submenu allowing the user to select which variable is sent to the analogue output.

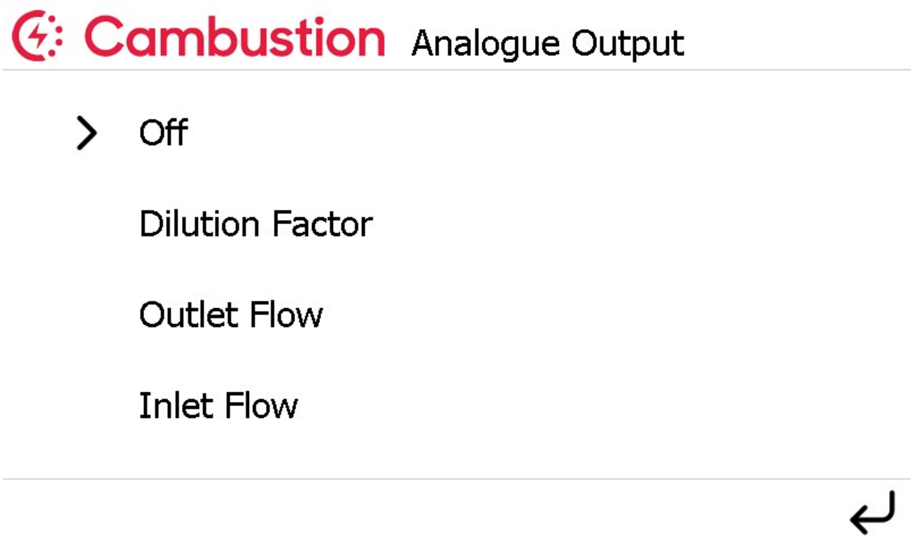


Figure 15 Analogue Output selection screen

The range of the analogue output is 0 – 5V and its value is proportional to the selected variable. Full scale output depends on the variable selected and is summarised in Table 1 below:

Analogue Output	Dilution Factor	Outlet Flow	Inlet Flow
0 V	0	0 slpm	0 slpm
5 V	900	15 slpm	3 slpm

Table 1 Analogue Output full scale summary

4.5.5 Info

Tapping this button bring up an information screen. It lists all the sensor readings, including temperatures and pressures, and information about the AD60: Firmware version, screen software version and serial number.

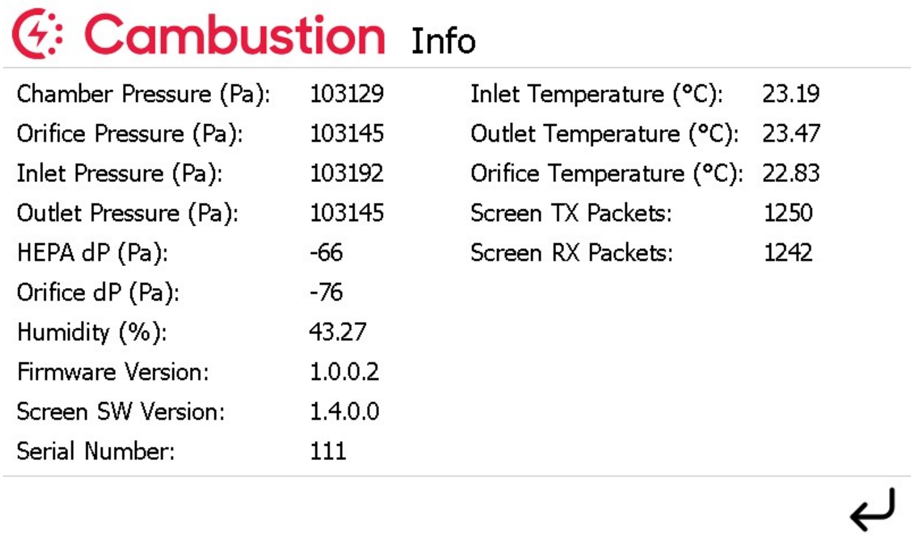


Figure 16 Information screen

4.5.6 Aerosol Type

Tapping this button toggles which path the sample inlet flow takes inside the diluter. There are 2: one for liquid based aerosol indicated by  and one for solid based aerosol indicated by .

When  is displayed the currently selected path is the liquid based aerosol one and similarly, when  is displayed solid based aerosol path is selected.

Use of the incorrect setting may lead to premature clogging of filters.

4.5.7 Closed Loop Mode

In closed loop mode the sample inlet carrier gas is reused for the sample outlet flow. This is achieved by connecting the **pump exhaust port** to the **dilution air intake**, then the overall flow is controlled by the vacuum pump and the flowrate is limited to the inlet flow limits. As a result, the main screen changes and only displays one field for flow, as shown in Figure 17 below:

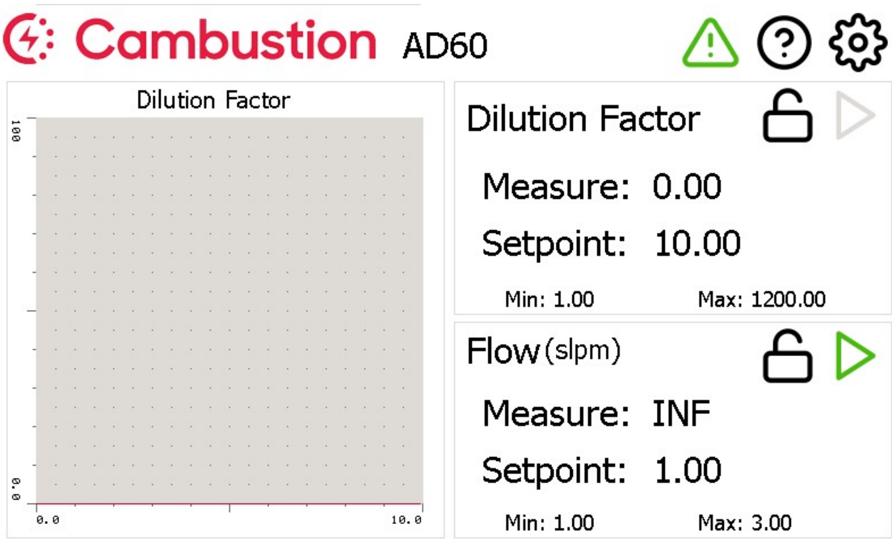


Figure 17 Closed Loop Mode Main Screen

While in closed loop mode the outlet flow variable is inherently locked, such that only one displayed variable needs to be locked to turn the dilution factor on.

4.5.8 Speed Control Mode

In Speed Control Mode the dilution factor field changes to the motor speed field, like shown in Figure 18, and the user can directly control the disc speed in RPM. Notably dynamic limits still apply when 2 or more variables are locked, adjusting the minimum and maximum motor speed.

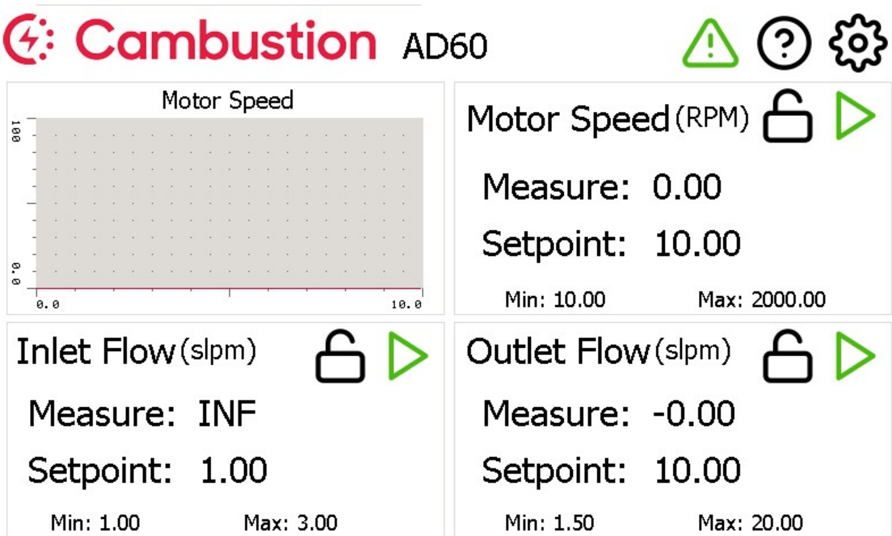


Figure 18 Speed Control Mode Main Screen

For information about how to calculate the disc speed required for a given dilution factor see Appendix A.1.

4.5.9 Pressurised Gas Mode

In some cases, it might be desirable to use compressed gas as the dilution air in. AD60 **cannot** take compressed gas directly by default, but it is possible with an optional add-on.

Pressurised Gas Mode is only available when an add-on has been fitted to the AD60, which consists of internal and external parts. In case of its absence this setting is greyed out. Pressurised Gas add-on can be fitted to existing AD60s by Cambustion, for further information please contact us.

In Pressurised Gas Mode the integrated blower is disabled, and the outlet flow is controlled by an internal valve. To function a compressed gas supply must be connected to the dilution air in port via the external pressure regulator provided with the add-on. The regulator must be set to a pressure **less than 200 mb** gauge.

Exceeding 200 mb gauge at the dilution air in port is likely to cause damage to the internal components.

5 Advanced Software Operations

5.1 Updating firmware

Please contact Cambustion at support@cambustion.com to obtain software necessary for updating system controller firmware and screen software.

6 Remote control

6.1 Command line interface

The AD60 provides a command line interface over which any function can be controlled. This is accessible over Ethernet (Telnet) and RS232. You can use these to control the diluter over a terminal, or from your own programmes or scripts.

6.1.1 Ethernet Telnet connection

To use connect to IP Port 23 (Telnet) at the diluter's IP address, for example using PuTTy:

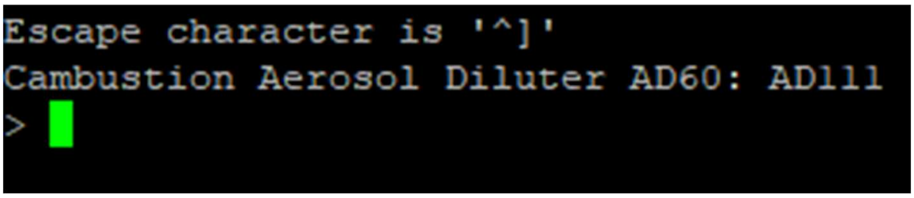


Figure 19 Example Telnet session

6.1.2 RS232

Connect to a COM port on your PC (or via a USB to RS232 adapter). Use 115200 baud, 8 data bits, 1 stop bit & no parity.

6.1.3 Basic command usage

Upon entering the command line via Telnet you are presented with a welcome message:

```
Cambustion Aerosol Diluter AD60: ADXXX

>
```

where ADXXX is the serial number of the diluter. To get the prompt when connected over USB or RS232 firstly send a 0x04 character (or press ctrl-D) to reset the serial interpreter.

The > prompt appears on each new line.

Commands are in the form of up to 3 characters. The first indicates the type of command:

A – Action. Do something now (e.g., turn on the inlet flow, **AOP**)

G – Get. Return a measured value (e.g., the measured dilution factor, **GMD**)

T – Target get. Return a target setpoint (e.g. the outlet flow setpoint, **TOF**)

S – Set. Set a value (e.g., standard temperature, **SST**)

The second and optional third characters determine the specific action or value required. **S**et commands then take a floating point, integer number or an IP address.

The value must be separated from the command by a space. **G**et and **T**arget-get commands will return a floating-point number to 2 decimal places or an integer. All other commands return *OK* if the command has been interpreted correctly. If a command cannot be interpreted (e.g., if it is not a valid command, or a parameter is missing or out of range) *Unknown command: XXX* or a more specific error is returned.

Commands are case insensitive.

For a full list of commands, see Appendix 8.1D.

For example, the command to get the current measured dilution factor is **GMD**. The command to set the standard pressure is **SST**:

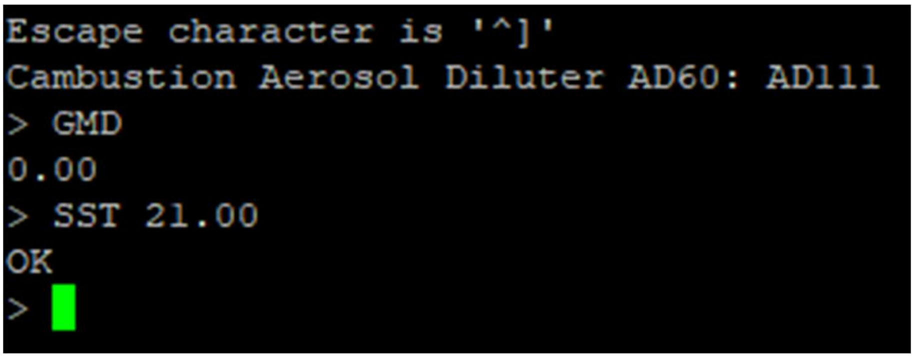


Figure 20 Example Telnet Session

7 Maintenance

There are no user maintainable or serviceable parts inside the AD60 enclosure. All user maintenance can be completed from the outside with minimal tools.

User maintenance comprises replacing external filters and cleaning the diluter assembly, described in the following sections. We further recommend annual service & calibration at Cambustion, which includes maintenance of the internal components, – see Appendix E

7.1 Filters replacement

AD60 monitors the pressure drop across the sample line filters and alerts the user when they need to be replaced by an error "HEPA Full". Not replacing the filters may lead to a reduced maximum inlet flow.

Sample line filters are located on the back of the AD60 and can be replaced by removing 2 10mm hex nuts, see Figure 21 below.

Figure 21 Filter Replacement Step 1

After removing these 2 hex nuts, disconnect the elbow fittings from the tubes connecting to the top of the filters, see Figure 22.

Figure 22 Filter Replacement Step 2

Next remove the top bracket holding the filters in place, as shown in Figure 23.

Figure 23 Filter Replacement Step 3

Now you can remove the filters by unplugging them from the remaining tubes.

When fitting new filters make sure their orientation matches the arrows on the top of the rear panel and reuse the original tubing, then follow the above instructions in reverse.

The HEPA filters, on the left and right, are Whatman HEPA-CAP 75 with ½ inch stepped barb inlet and outlet. The coalescing filter, in the middle, is a Headline DIF-LN60C. They are commercially available, but Cambustion can also provide them if needed.

7.2 Liquid trap drainage

AD60 has 2 liquid bowl on the back into which liquid can drain from the coalescing filter. They can be emptied by unscrewing them from the liquid bowl holder, shown in Figure 24 below.

Figure 24 Liquid Trap

The liquid bowls have drain ports, shown in Figure 24, but we don't recommend using them to drain liquids. They must be kept closed to prevent a leak in the inlet flow path.

7.3 Diluter assembly cleaning

Over time aerosol particles deposit within the diluter assembly and may become resuspended introducing particles into the sample outlet flow independent of the dilution factor selected. In addition to that the rotating disk inside the diluter assembly produces very small number of particles by abrasion, which can also appear in the sample outlet flow.

Overall, this manifests as a non-zero 'background' concentration when no aerosol is present in the sample inlet flow. In a clean state the AD60 has a 'background' concentration of around 0-1 particles per cc. If it is higher the diluter assembly needs to be cleaned.

⚠ Before starting disassembly make sure AD60 is turned off. Opening the diluter assembly exposes the rotating disc, which may present a mechanical hazard.

Using a M2.5 ball/hex driver remove the screw securing the heat sink fan shroud and take it off. Besides the screw it is also held in place by 4 locating magnets.

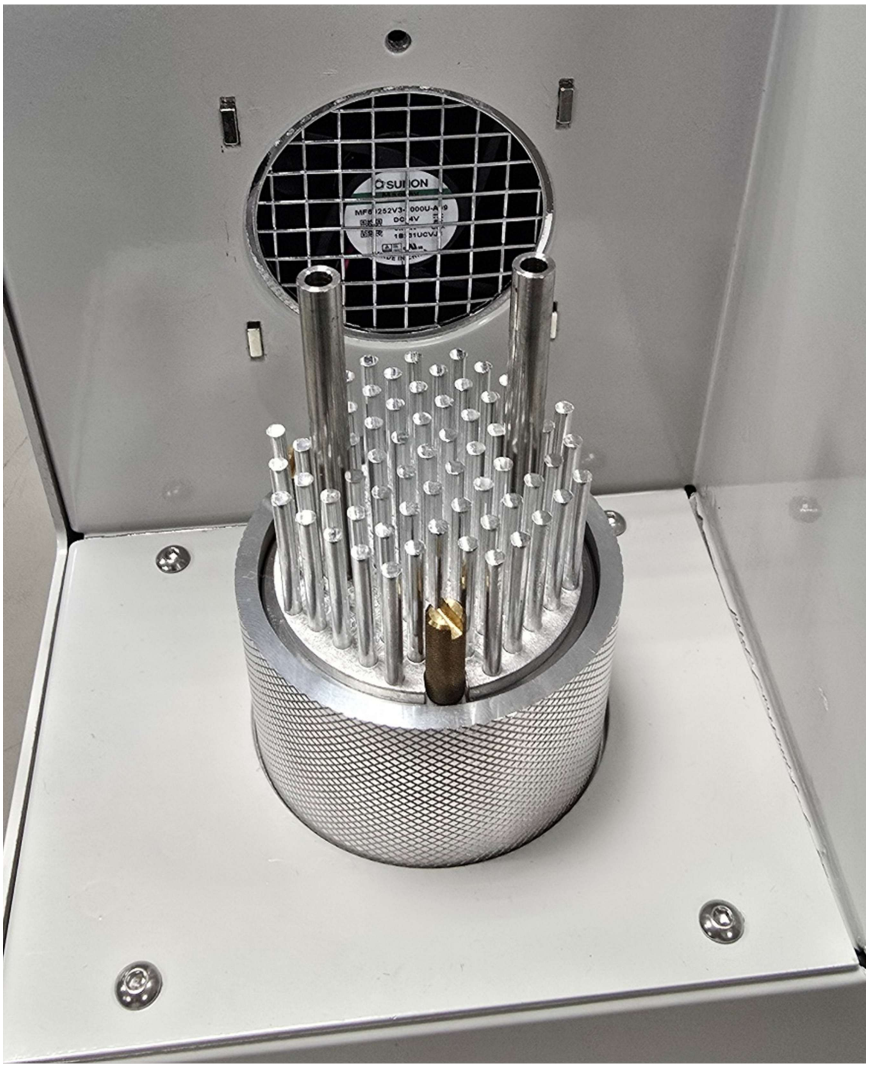


Figure 25 Diluter Assembly Cleaning Step 1

Remove the diluter sleeve by pulling it upwards, rotating it can make it easier to remove.

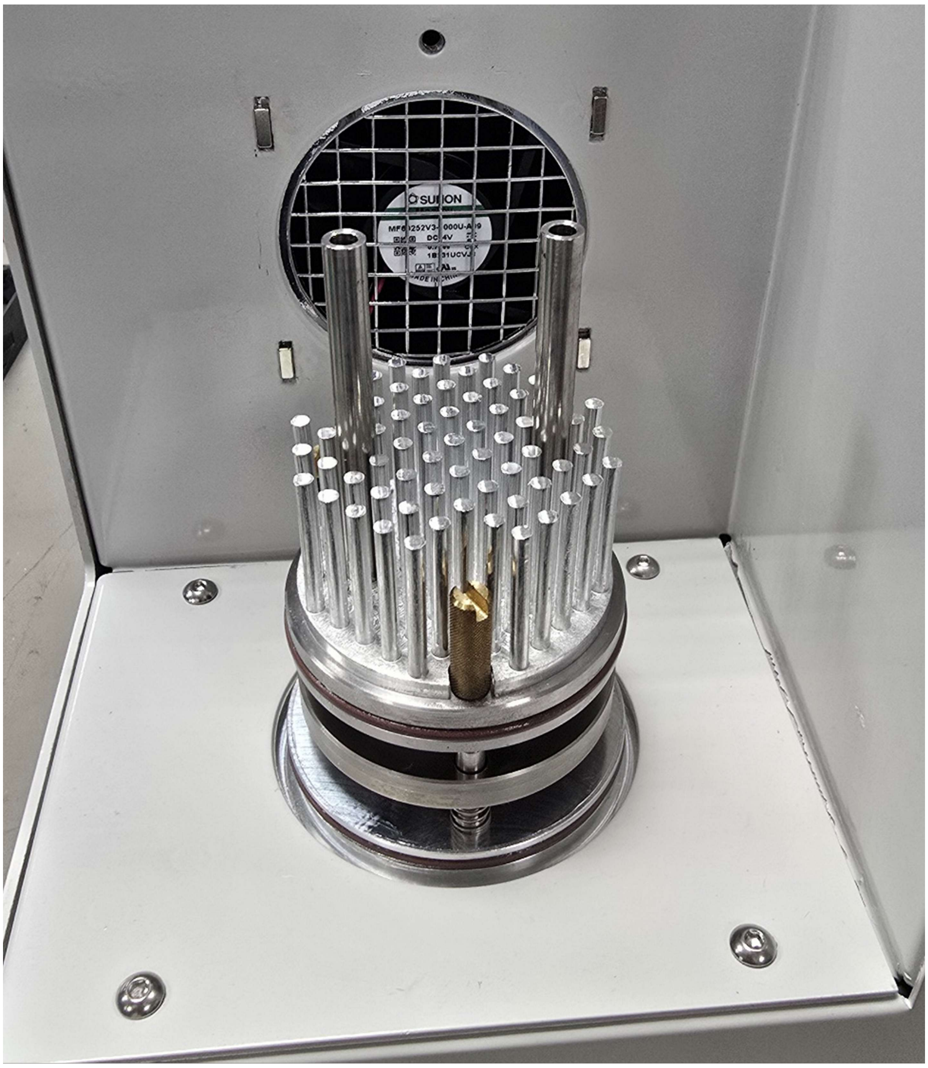


Figure 26 Diluter Assembly Cleaning Step 2

Unscrew the 3 flat head nuts on top of assembly. This will allow you to lift up the top stator.

Figure 27 Diluter Assembly Cleaning Step 3

Now you can remove the disc, bottom stator and bottom connecting stems for cleaning. Make sure to note the top side of the disc, as it needs to be reassembled in the same orientation. The disc has a ‘T’ marking on its top side.

Figure 28 Diluter Assembly Cleaning Step 4

We recommend using isopropyl alcohol for cleaning the disc, stators and other parts of the diluter assembly. Avoid excessive cleaning of the o-rings on the top stator and diluter base. O-rings are greased with silicone grease to provide better sealing of the diluter assembly.

If you cannot fit the diluter sleeve back on lubricate the o-rings with some silicone grease.

To reassemble the diluter assembly after cleaning follow the above instructions in reverse.

8 Troubleshooting

8.1 Error Messages

Error messages may be displayed on the diluter screen – see Appendix C for a full list of errors. Under remote control, a generic "*Unknown command*" message can be returned to the terminal if the command cannot be interpreted (see section 6.1.3 and Appendix D).

Appendices

A. Principle of Operation

A.1 Description

The diluter operates by transferring particles from the sample inlet flow into a bulk flow of particle free gas, which becomes the sample outlet flow. It achieves that by creating a steady volume transfer via the rotating disc.

The disc has a set of slots, which on the sample inlet side become filled with particle laden gas and empty on the sample outlet side. By limiting disc speed depending on the flowrates in each leg we can ensure that all the holes' volume gets replaced on each side. This allows us to write a simple equation relating the resulting dilution factor with the motor speed:

$$DF = \frac{\dot{m}_{out}}{N_{rpm} V_{disk} \rho_{inlet}}$$

The limit for the disc speed can be formulated as:

$$N = \frac{SF \times min(\dot{V}_{out}, \dot{V}_{in})}{V_{disk}}$$

Where SF is the safety factor. This equation comes from requiring that both inlet and outlet volume flows are big enough to allow the hole volume to be replaced

These 2 equations together with an overall motor speed minimum limit of 10 RPM, to avoid intermittent concentration spikes, and maximum limit of 1000 RPM, to avoid stall, are used to calculate the dynamic limits for all the variables, by rearranging for the unlocked variable.

A.2 Fluids Schematic

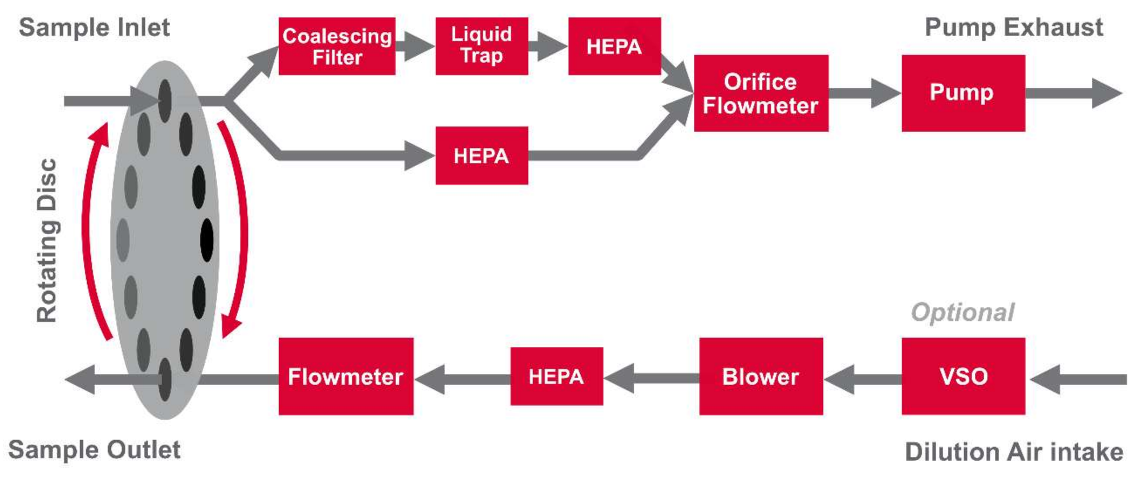


Figure 29 AD60 Fluid Schematic

B. Log Format

When **G**et **L**ogs command is sent, the logs are returned in the following format. Floats are returned with 2 decimal digits.

The regular data file is comma delimited. The first line is a header containing the string "Cambustion Aerosol Diluter AD60:", followed by the serial number, followed by title-value pairs:

Calibration date (yyyy-mm-dd*), firmware version, Screen software version*

Then there is a header row for the columns of data, which follow and are:

A: Log entry record number

B: Time since startup (in seconds)

C: Dilution Factor

D: Motor Speed (RPM)

E: Standard Sample in Flow (slpm)

F: Standard Sample out Flow (slpm)

G: Inlet Temperature (°C)

H: Inlet Pressure (Pa)

I: Outlet Temperature (°C)

J: Outlet Pressure (Pa)

K: Standard Temperature (°C)

L: Standard Pressure (Pa)

M: Log interval (s)

N: Aerosol Type (1 – Liquid, 0 – Solid)

O: Bulk Gas (0 – Air, 1 – CO2, 2 – N2, 3 – Ar)

P: Numeric error codes – see Appendix C for further explanation

Diagnostics files have considerably more information on all sensor values, you can enable them by remote command – see Appendix D

C. Errors

Here is a list of errors which may be seen on the Errors and Warnings screen accessed via 

Each error also has a code number associated with it (given in hexadecimal in the first column). These are the numbers which are returned by the **G**et **E**rrors remote command, and if more than one error occurs, they are logically ORed together.

Errors which are likely to occur in normal use are **shown in bold.**

Hex error #	Name	Cause/Consequence	User action
1	HEPA full	Pressure drops across the sample line HEPA filters is too high. This decreases the maximum inlet flow achievable	Replace the sample line HEPA filters, see section 7.1
2	Humidity Alert	Sample inlet humidity is outside specification	Decrease humidity of the sample inlet
4	Setpoints not achievable	Likely restriction in the sample inlet or outlet line Or change in external conditions	Remove the restriction Or restore initial external conditions
8	Chamber Pressure	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
10	Orifice Pressure	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
20	Inlet Pressure	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
40	Outlet Pressure	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
80	dP HEPA	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
100	dP Orifice	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
200	Humidity	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
400	Inlet Temperature	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
800	Outlet Temperature	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
1000	Orifice Temperature	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
2000	Outlet Flow	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion
4000	Motor Speed	Reading outside of expected range. Possibly sensor error	Hardware fault, contact Cambustion

D. Remote commands

Action Commands:

These cause the AD60 to take action, toggling a setting in most cases.

ASC – Action direct Speed Control
ADC – Action Dilution factor Control
ACL – Action Closed Loop
AOL – Action Open Loop
ASP – Action Solid aerosol Particles
ALP – Action Liquid aerosol Particles

APO – Action Pressurised gas On
APF – Action Pressurised gas oFf

ALI – Action Lock Inlet flow
AUI – Action Unlock Inlet flow
ALO – Action Lock Outlet flow
AUO – Action Unlock Outlet flow
ALM – Action Lock Motor speed
AUM – Action Unlock Motor speed
ALD – Action Lock Dilution factor
AUD – Action Unlock Dilution factor

AIO – Action Inlet flow On
AIF – Action Inlet flow oFf
AOO – Action Outlet flow On
AOF – Action Outlet flow oFf
AMO – Action Motor On
AMF – Action Motor oFf
ADO – Action Dilution On
ADF – Action Dilution oFf
AAF – Action All systems oFf

Get Commands:

These get current *measured* values, statuses or settings. One can take an argument.

GAT – Get Analogue output Type (0 = off, 1 = Dilution Factor, 2 = Outlet Flow, 3 = Inlet Flow)
GDC – Get Calibration Date (yy/mm/dd)
GE – Get Errors, see Appendix C
GG – Get carrier Gas (0 = air, 1 = CO_2, 2 = N_2, 3 = Ar)
GTS – Get Time since Startup in seconds
GLD – Get Logging Diagnostics state (0 = user log format, 1 = diagnostic log format)

GL n – Get Logs. Returns last 600 log entries. If integer n is provided, returns last n log entries
GLI – Get Logging Interval. Minimal time between log entries in seconds
GU – Get Unit's serial number
GVF – Get Version of the Firmware
GVU – Get Version of the UI
GIP – Get IP address
GMA – Get Mac Address

GA – Get Aerosol type (0 = Solid aerosol particles, 1 = Liquid aerosol particles)
GC – Get Control type (0 = Dilution factor control, 1 = Speed control)
GLO – Get loop setting (0 = open loop, 1 = closed loop)
GPG – Get Pressurised Gas status (0 = VSO control off, 1 = VSO control on)

GSS – Get Speed Status. Returns 2 characters separated by a space "L O", where for L, 0 = unlocked and 1 = locked, and for O, 0 = Off and 1 = On.

GOS – Get Outlet flow Status. Returns 2 characters separated by a space "L O", where for L, 0 = unlocked and 1 = locked, and for O, 0 = Off and 1 = On.

GIS – Get Inlet flow Status. Returns 2 characters separated by a space "L O", where for L, 0 = unlocked and 1 = locked, and for O, 0 = Off and 1 = On.

GDS – Get Dilution factor Status. Returns 2 characters separated by a space "L O", where for L, 0 = unlocked and 1 = locked, and for O, 0 = Off and 1 = On.

GSP – Get reference Standard Pressure in Pa
GST – Get reference Standard Temperature in °C

GSL – Get Speed Limits. Returns "min-max", where min is the lower limit and max is the upper limit.

GOL – Get Outlet flow Limits. Returns "min-max", where min is the lower limit and max is the upper limit.

GIL – Get Inlet flow Limits. Returns "min-max", where min is the lower limit and max is the upper limit.

GDL – Get Dilution factor Limits. Returns "min-max", where min is the lower limit and max is the upper limit.

GMS – Get Measured Speed in RPM
GMO – Get Measured Outlet flow in slpm
GMI – Get Measured Inlet flow in slpm
GMD – Get Measured Dilution factor

GDO – Get PID Drive for Outlet flow control
GDI – Get PID Drive for Inlet flow control
GDP – Get PID Drive for Pressurised gas VSO control

GIT – Get Inlet Temperature in °C
GOT – Get Outlet Temperature in °C
GRT – Get oRifice Temperature in °C

GH – Get relative Humidity in %

GIP – Get Inlet Pressure in Pa
GOP – Get Outlet Pressure in Pa
GRP – Get oRifice Pressure in Pa
GCP – Get Chamber Pressure in Pa
GOD – Get Orifice Delta Pressure in Pa
GHD – Get Hepa Delta Pressure in Pa

Target Get Commands

These get the target (setpoint) for controllers. They take no argument.

TS – get Target Speed in RPM
TO – get Target Outlet flow in slpm
TI – get Target Inlet flow in slpm
TD – get Target Dilution factor

Set Commands:

These all take a floating point or integer argument. Floating point arguments must be provided with 2 decimal places or the command won't be recognised.

SAT n – Set Analogue output Type (0= off, 1= Dilution Factor, 2= Outlet Flow, 3 = Inlet Flow)
SG n – Set carrier Gas (0 = air, 1 = CO2, 2 = N2, 3 = Ar)

SD n – Set Dilution factor setpoint
SS n – Set Speed setpoint
SI n – Set Inlet flow setpoint
SO n – Set Outlet flow setpoint

SIP n – Set IP address

SLD n – Set Logging Diagnostics state (0 = off, 1 =on)
SLI n – Set Logging Interval in seconds

SSP n – Set reference Standard Pressure in Pa
SST n – Set reference Standard Temperature in °C

E. Service and Calibration

The AD60 contains calibrated sensors and rotating components. The diluter interface will warn when the 12 months calibration interval has expired[1]. At this point return to Cambustion for service, preventative maintenance and calibration is recommended.

This includes:

- Strip down and cleaning. Replacement of seals.
- Replacement of filters
- Replacement of pinch valve tubing, and pump if necessary
- Software & firmware upgrade to latest version.
- Calibration of sensors against traceable standards.
- Checking dilution performance against a traceable standard
- Issuing a calibration certificate

For details and pricing for the above services, please contact support@cambustion.com

Service must be agreed and booked in advance.

You **must** inform Cambustion if any hazardous contamination may be present in the diluter and inform us of any precautions we must take. Equipment contaminated with any biological hazards, radioactive materials, organic metals or mercury cannot be accepted.

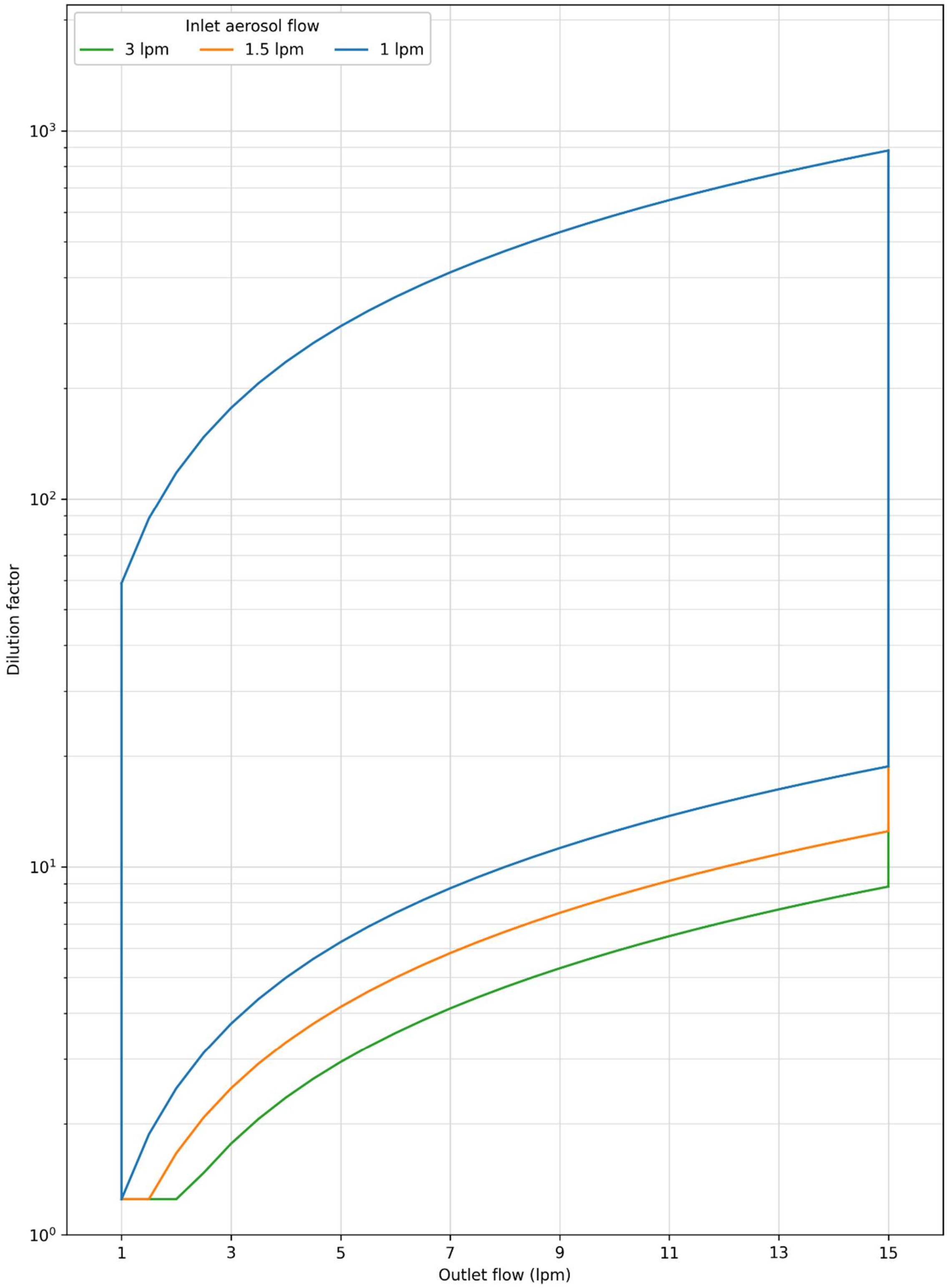
The diluter should be shipped in the original packaging, taking precautions to avoid damage to the screen.

[1] If you do not wish to take advantage of this service or have made alternative arrangements, please contact Cambustion if you wish to disable this warning message.

F. Technical Specifications

Supported aerosols	Non-corrosive solid and/or liquid aerosols in air, CO_2, N_2 and Ar
Dilution method	Rotating disc
Achievable dilution ratio	2 – 900 (see Section 3.3)
Inlet flow	1 – 3 slpm
Outlet flow	1 – 15 slpm
Default Reference Conditions for slpm	20 °C at 101325 Pa
Flow modes	Open loop or recirculating
Ambient conditions	+10 - +40 °C (0 – 95% RH)
Operating Altitude	Up to 2000 meters (6000 feet)
Power requirements	100 – 240 VAC 50/60 Hz
Power consumption	130 W Typical operation, 350 W Maximum
Inlet pressure	100 mb below ambient
Data recording	Internal 'black box' log
Weight	15 kg
User Interface	4.3 inch touchscreen. Data updated at 10 Hz
Dimensions	35 × 38 × 33cm
Environmental conditions	10–40 C, 0–95% RH non-condensing
Digital Communications	RS232, Ethernet.
Analogue output	0–5 V

G. Achievable Dilution Factors – Large Format



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I. Final disposal of this product

If you are within the UK or the European Union, special conditions apply to the final disposal of this equipment when it reaches the end of its useful life.

Please do not scrap via usual domestic or industrial refuse systems. Contact Cambustion for collection and disposal in accordance with the Waste Electrical and Electronic Equipment (WEEE) Regulations 2013 (as amended) (UK) or Directive 2012/19/EU (EU).

J. UKCA Declaration of Conformity

Cambustion

J6 The Paddocks, 347 Cherry Hinton Road
Cambridge CB1 8DH, United Kingdom
cambustion@cambustion.com
Tel. +44 1223 210250
cambustion.com

UK CA

UKCA Declaration of Conformity

We, Cambustion, declare that the product here named meets the essential requirements of the relevant UK regulations by design and construction. In the case that this product is modified without our approval, this declaration will be void.

Product / Model:	AD60 – Aerosol Diluter
Purpose:	Laboratory instrument to reduce particle concentration for measurement or otherwise.
Manufacturer:	Cambustion Ltd, J6 The Paddocks, 347 Cherry Hinton Road, Cambridge, CB18DH, United Kingdom.

The product meets the requirements of the following UK regulations:

- Electrical Equipment (Safety) Regulations 2016
- Electromagnetic Compatibility Regulations 2016

by means of the following designated standards:

- BS EN 61010-1:2010+A1:2019 *Safety requirements for electrical equipment for measurement, control, and laboratory use*
- BS EN IEC 61326-1:2021 *Electrical equipment for measurement, control and laboratory use – EMC requirements*

Chris Nickolaus
Director (Products Division)

Cambridge, United Kingdom, 20th August 2025

This product was designed, manufactured and tested under a quality management system registered to ISO9001:2015, and under an Environmental Management System registered to ISO14001:2015

Regd. Office: The Paddocks, Cherry Hinton Road, Cambridge   Regd. Cardiff 1987 No. 2127427   VAT Reg. No. GB 864 4520 18

K. EC Declaration of Conformity

J6 The Paddocks, 347 Cherry Hinton Road
Cambridge CB1 8DH, United Kingdom
cambustion@cambustion.com
Tel. +44 1223 210250
cambustion.com

EC Declaration of Conformity

We, Cambustion, declare that the product here named meets the essential requirements of the relevant EC directives by design and construction. In the case that this product is modified without our approval, this declaration will be void.

Product / Model:	AD60 – Aerosol Diluter
Purpose:	Laboratory instrument to reduce particle concentration for measurement or otherwise.
Manufacturer:	Cambustion Ltd, J6 The Paddocks, 347 Cherry Hinton Road, Cambridge, CB18DH, United Kingdom.

The product meets the requirements of the following directives:

- EC Directive on Low Voltage Equipment (2014/35/EU)
- EC Directive on Electromagnetic Compatibility (2014/30/EU)

by means of the following harmonised standards:

- BS EN 61010-1:2010+A1:2019 *Safety requirements for electrical equipment for measurement, control, and laboratory use*
- BS EN IEC 61326-1:2021 *Electrical equipment for measurement, control and laboratory use – EMC requirements*

Chris Nickolaus
Director (Products Division)

Cambridge, United Kingdom, 20th August 2025

This product was designed, manufactured and tested under a quality management system registered to ISO9001:2015, and under an Environmental Management System registered to ISO14001:2015

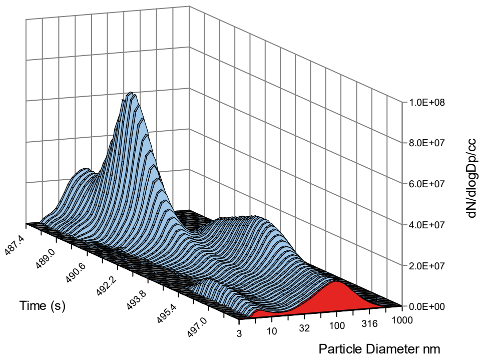
Regd. Office: The Paddocks, Cherry Hinton Road, Cambridge Regd. Cardiff 1987 No. 2127427 VAT Reg. No. GB 864 4520 18

Cambustion
Company History

In 1987 a group of researchers at Cambridge University Engineering Department devised techniques which reduced the response time of a Flame Ionisation Detector (FID) for HC measurement from ~1 second to ~1 millisecond. This allowed unprecedented insight into combustion behaviour, and Cambustion was formed to commercialise fast-response measurement technology.

Further development expanded the range to include further fast-response gas analyzers, including NO_X and CO&CO_2, and a division was set up for engineering services and engine testing.

In 2002 Cambustion offered their first aerosol measurement product - the DMS500. Offering mobility size / number spectra at 10 Hz, with a time response of ~200 ms, the DMS500 was adopted by aerosol researchers who appreciated its advantages over older scanning equipment.



The Centrifugal Particle Mass Analyzer (CPMA) launched in 2012 and allows aerosol researchers to classify particles directly according to mass:charge ratio.

The Unipolar Diffusion Aerosol Charger (UDAC) and the Aerodynamic Aerosol Classifier (AAC) further expanded Cambustion's aerosol instrumentation range. Cambustion continue to sponsor aerosol research and the annual Cambridge Particle Meeting, while our large R&D team undertakes collaborative projects with researchers from around the world.

Connect to the experts

Cambustion's unique instrumentation is used by industry, academic and government customers in over 35 countries worldwide.

Our engineers and scientists work closely with customers, offering both instrument and broader application support, enabling users to expand their measurement horizons.

Select

Measure

1 nm 0.001 µm | 10 nm 0.01 µm | 100 nm 0.1 µm | 1,000 nm 1 µm | 10,000 nm 10 µm | 100,000 nm 100 µm

25 nm — 5 µm

AAC — Aerodynamic Aerosol Classifier

- Size select aerosol particles from 25 nm to >5 µm
- Measure size distributions & output monodisperse particles

0.2 ag — 6.6 pg (~7 nm — 3 µm)

CPMA — Centrifugal Particle Mass Analyser

- Measure shape, density and morphology of particles
- Component of aerosol mass calibration standard

5 nm — 2.5 µm

DMS500 — Fast Particle Sizer

- Real-time aerosol particle size distributions at 10 Hz
- Available with sample handling options for high concentrations

5 nm — 10 µm

5210 CPC — Condensation Particle Counter

- Fast time response for rapidly changing number concentration (50 Hz data rate)
- Wide size range $d_{50,min}$ 5 nm; $d_{50,max}$ >10 µm

50 nm — 5 µm

M²AS — Mass & Mobility Aerosol Spectrometer

- Online characterisation of aerosols and powders
- Understand size, surface, structure, effective density, coatings, and more...

Dilute

Monitor

Charge

0.1 lpm | 1 lpm | 10 lpm

1 — 3 lpm (in), 3 — 15 lpm (out)

AD60 — Aerosol Diluter

- Flexible general purpose diluter for aerosols
- Active control with touchscreen & data logging

0.1 — 10 lpm

AF10 — Aerosol Flowmeter

- Maintains constant resolution of instruments with real-time flow measurement of aerosol laden gases
- Self cleaning for long term operation

1.5 — 8 lpm

UDAC — Unipolar Diffusion Aerosol Charger

- Computer control to accurately and repeatably charge aerosols
- Applications including filtration, mass calibration standard, and more...

Measure Particle Distributions

M²AS —Mass & Mobility Aerosol Spectrometer

- Measure mass, size and number distributions in one single scan
- Ideal for characterising non-spherical particles and revealing detailed particle morphology and structure
- Resolve components of different density, e.g. multimodal or coatings

DMS500 —Fast Particle Sizer

- Measure size distributions
- Size range of 5 nm to 2.5 μm
- Ideal for time varying measurements with a fast time response of $T_{10\text{-}90\%}$ <200 ms and 10Hz data
- High sensitivity for ambient measurements
- Dilution options available for high concentration sources

Particle Selection

AAC — Aerodynamic Aerosol Classifier

- Select particles by aerodynamic diameter from 25 nm to >5 µm
- Measure size distributions (with a detector)
- Output size selected aerosol for collection, exposure studies, filtration measurements and more

CPMA — Centrifugal Particle Mass Analyser

- Selects particles by mass:charge ratio
- Combine with other instruments to study particle morphology, effective density and more

Particle Counting

5210 CPC — Condensation Particle Counter

- Fast response time and high data rate (50 Hz) make the 5210 ideal for time varying applications such as aerosol flux studies.
- A uniquely wide size range, 5nm — 10 µm, allows the 5210 to be applied to a myriad of applications, including vehicle brakes & tyres to ambient, bioaerosols, healthcare and more.
- **Connect to the experts for tailored advice on your application!**

Sample Handling

AF10 — Aerosol Flowmeter

- Non-invasive measurement of aerosol gas flows for accurate and traceable measurements
- Ideal for general lab use, and compatible with many Cambustion aerosol instruments

AD60 — Aerosol Diluter

- General purpose, wide range aerosol diluter
- Flexible input and output flows allow matching of aerosol source and measurement requirements
- Active control and monitoring for stability and accuracy

Find out more

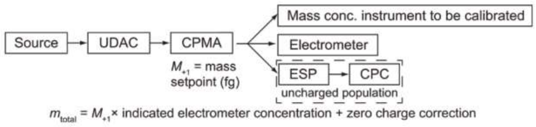
Combined Systems

Scanning Aerodynamic Size Spectrometer (SASS)

- Combination of AAC + 5210 CPC
- Single measurement technique for aerosol size distributions between 25nm and >7µm
- Flexible software for push button operation by user or via API

CPMA Electrometer Reference Mass Standard (CERMS)

- Combination of AD60 + UDAC + CPMA + 5210 CPC + Electrostatic Precipitator
- A calibration bench for aerosol mass concentration
- Provides a reference for calibration of aerosol mass measurement instruments
- Highly integrated system for metrology class accuracy, traceability and ease of use



AD60 + AAC + 5210 CPC

- Calibration bench for Optical Particle Counters (OPCs)
- With a suitable aerosol generator, outputs size selected aerosol of user selected concentration
- CPC measures reference concentration

Other Accessories

Diffusion Dryer

- Effective drying of aerosols (including droplets) with low particle losses
- Uses silica gel or activated carbon as absorbing agents

Electrostatic Precipitator

- Remove charged particles from aerosol flow
- Variable cut point supports experimental measurements

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Application Examples

Sample handling and conditioning

- Control your sample flow with the AD60 by easily varying the dilution factor or fixing the desired sample flow
- Monitor flows in real time with the AF10 and improve repeatability between experiments
- UDAC places high level of selected polarity while minimising particle losses inside the system

Aerosol calibration bench

- The AAC and CPMA form the cores of calibration benches for particle size/number and mass respectively
- The 5210 CPC offers a reference number concentration measurement
- The AD60 allows varying of the output concentration while leaving the aerosol generator unadjusted, for maximum stability and repeatability

Material characterisation

- The AAC and CPMA determine particle aerodynamic diameter and mass respectively
  - Together with a CPC, they function as a CPMA—SASS measuring effective density
- The M²AS characterises particle's full morphology through mass, mobility and density distributions

Brake & tyre emissions

- 5210 CPC's detection range fully covers the size range of brake and tyre emission particles
- Paired with the DMS500, these instruments provide a comprehensive size distribution of these particles

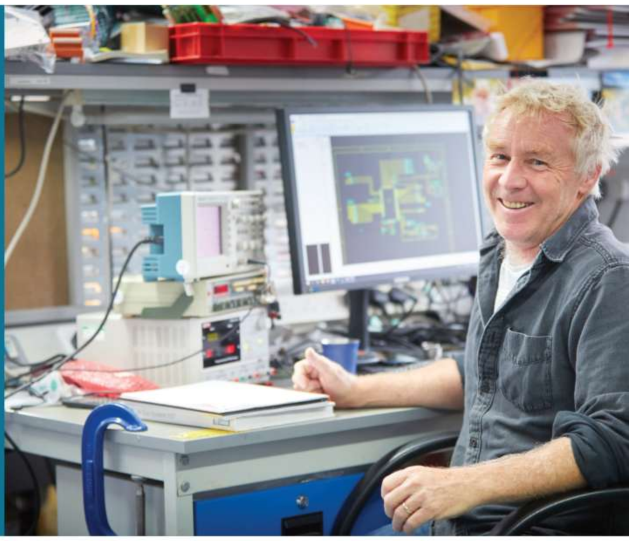
Atmospheric aerosols

- The SASS combines the AAC and 5210 CPC to measure ambient size distributions over the widest range
- The 5210 CPC combines 50 Hz data with an unprecedentedly wide size range, for number concentration measurements, including rapidly changing aerosol fluxes

Your application

- Don't see your application here?
- Have a measurement challenge?

Contact one of our experts for a technical discussion to explore!



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