

OPERATING MANUAL

Aalborg DPM Mass Flow Meters

Installation, wiring, configuration, alarms, totalisers, serial commands and maintenance of Aalborg DPM multi-gas mass flow meters.

AMTC-MN-0010

About this manual

This manual is for everyone who installs, configures or maintains an Aalborg DPM mass flow meter. It covers the standard models DPM07, DPM17, DPM37, DPM47, DPM57, DPM67 and DPM77, the low-pressure-drop models DPM04, DPM14, DPM24, DPM34, DPM44 and DPM54 and the corrosion-resistant models DPM08, DPM18, DPM38, DPM48, DPM58, DPM68 and DPM78.

If the meter is new to you, read Safety (p. 6) first, then follow Installation (p. 10) with its electrical connections (p. 11), Commissioning (p. 15) and Operation (p. 16) in order. If you read the meter from a computer or programmable logic controller (PLC), Communication (p. 25) has the complete command set.

The display and joystick, the Modbus interface and the type of serial interface are options. Your meter's configuration, gas and flow range are on its front label and on the screens shown at power-up. Sections that apply only to an option say so.

Keep this manual for the lifetime of the product. The current revision is on the product page at analyt-mtc.com.

Conventions in this manual:

- Keys, buttons and menu entries are printed like this: **ENT**.
- A menu path such as **General Settings** › **Communication Port** means that you open each entry in turn.
- Commands you send and replies the device returns are set in monospace type, for example `!12`, `G`.

Abbreviations

Abbreviation	Meaning
ASCII	American Standard Code for Information Interchange
CRC	Cyclic redundancy check
EEPROM	Electrically erasable programmable read-only memory
EMC	Electromagnetic compatibility
FKM	Fluoroelastomer
NPT	National Pipe Taper, the US tapered pipe thread
OLED	Organic light-emitting diode
PTFE	Polytetrafluoroethylene
RTS	Request to send, a serial handshake line
RTU	Remote terminal unit (Modbus transmission mode)
RX	Receive
SPST	Single-pole, single-throw (one make contact)
TD	Transmit data, a serial line
TX	Transmit
UART	Universal asynchronous receiver-transmitter, the serial interface chip
UNC	Unified National Coarse, the US coarse screw thread

Safety notices in this manual

⚠ WARNING

A hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

Practices not related to personal injury — damage to the product, the process or the sample.

Note

Information that helps understanding; never a hazard.

Conventions

- **FS** is full scale, the top of the range your meter is calibrated for. Accuracies given as “% FS” are a percentage of that value; “RD” means reading.
- Joystick directions are **`UP`**, **`DN`**, **`LEFT`** and **`RIGHT`**; pressing the joystick in is **`ENT`**.
- Pressures are gauge pressures in bar unless marked absolute; the value in psi follows where the meter itself works in psi.

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2	October 2026	Quality programme: new document type, number and identity pages.
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CHAPTER 1

Safety

Read this chapter before you connect gas or power, and follow the procedures in this manual as written. Each point below is repeated, with its context, in the section where it applies.

Intended use

The DPM measures the mass flow, volumetric flow, absolute pressure and temperature of clean, dry, non-corrosive gases (the corrosion-resistant models also of the corrosive gases in Appendix B (p. 45)) within the limits given in Specifications (p. 35). It cannot measure liquids. Selecting a gas in the meter only changes how the flow is calculated; check yourself that the wetted materials (see p. 36) suit your gas — the manufacturer gives no guarantee of corrosion resistance.

⚠ WARNING

The DPM is not designed for life-support applications, where a malfunction could injure a person. Do not use it in such applications. Do not use the meter on oxygen unless it has been specially cleaned and prepared for oxygen service. Ask Analyt-MTC before you order a meter for oxygen.

Rules that protect the meter

NOTICE

Pressure. Pressure above the line pressure or the differential pressure rating of your model damages the differential pressure sensor permanently — also through short pressure steps from quick-acting solenoid valves. Install the meter only in lines whose pressure and temperature stay within its ratings, with a margin for spikes and surges. Never exceed these limits (see Pressure limits, p. 10). In high-pressure systems, fit relief valves or burst discs.

NOTICE

Sealants. Pipe grease and sealant contaminate the narrow channels of the laminar flow element and damage the meter permanently. Do not use them on the process connections.

NOTICE

Power. More than 26 V DC, or power through the DC jack and the Mini-DIN connector at the same time, can damage the meter. Never apply more than 26 V DC. Power the meter through the DC jack *or* the Mini-DIN connector, never through both at the same time. Switch the power off before you connect or disconnect any cable.

NOTICE

Outputs and interface. An external voltage on the self-powered 4–20 mA output can damage the output circuit. The internal RS-485 termination resistor enabled on RS-232 damages the meter or disturbs communication. Never connect the 4–20 mA output to an external voltage source or a loop-powered input. Never enable the internal RS-485 termination resistor while the interface is set to RS-232.

NOTICE

Electrostatic discharge. Some components are sensitive to static electricity, which can destroy them. Wear a grounded wrist strap whenever you work on the opened meter.

Situations that give wrong readings

Flow above 133 % of full scale	The meter is swamped; the flashing reading is neither accurate nor linear (see Swamping (p. 16)).
Auto zero or pressure tare with gas flowing	The zero is wrong and every later reading is offset (see Chapter 7 (p. 30)).
Analogue output test active	The output shows the test value, not the flow (see Output test (p. 20)).
Standard or normal conditions changed	All mass flow readings refer to the new conditions (see Reference conditions (p. 18)).

CHAPTER 2

Product description

How the meter measures

The gas passes through a restriction flow element whose channels keep the flow laminar over the whole measuring range. In laminar flow, the volumetric flow is proportional to the pressure drop across the element, which a differential pressure sensor measures. An absolute pressure sensor and a temperature sensor give the gas density, so the meter calculates the mass flow from the ideal gas law. It therefore shows mass flow, volumetric flow, absolute pressure and temperature at the same time.

The gas properties are stored in the meter: you select your gas from its built-in list (Appendix B (p. 45)) or define a mixture, without recalibrating. The meter also offers two totalisers, flow, pressure and temperature alarms, a solid-state relay, a pulse output, automatic zeroing and self-diagnostics.

Display and controls

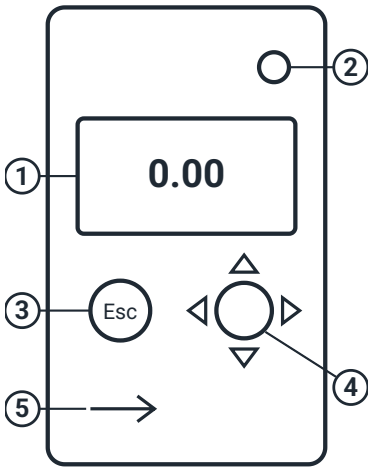


Figure 2-1. Front of a meter with the display option.

#	Element
1	OLED display, 128 × 64 pixels (option)
2	Status LED: green, red or amber (see Status LED (p. 21))
3	**Esc**: switches between the readings and the menus; returns one menu level
4	Joystick: **UP**, **DN**, **LEFT**, **RIGHT**; press it in for **ENT** (Enter)
5	Flow direction arrow

Circuit board

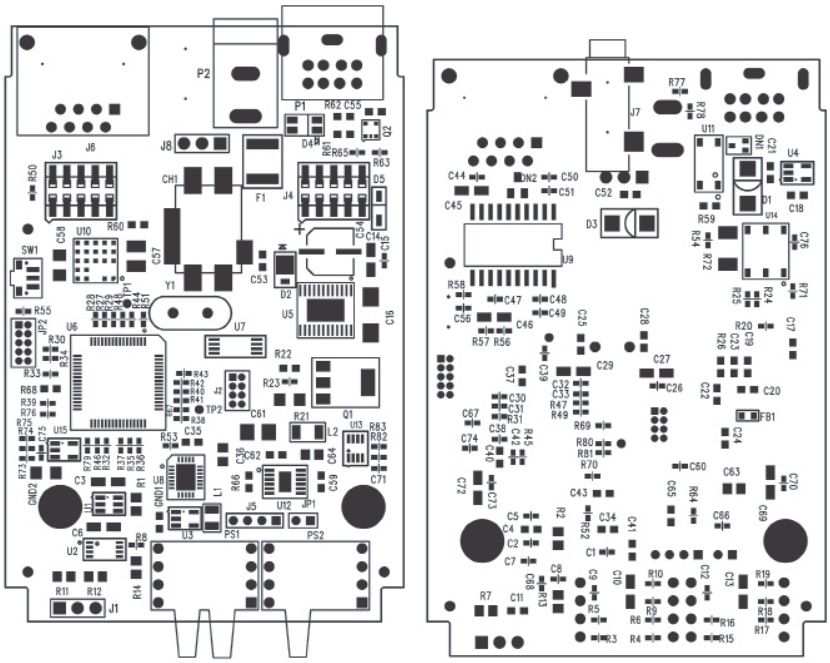


Figure 2-2. Circuit board, top component side (left) and bottom component side (right).

Supplied items and accessories

An RS-232 meter is supplied with the CBL-A232 communication cable. Cables, converters, power supplies and fittings are listed in Ordering information under Accessories, p. 39; checking the delivery is described under Unpacking, p. 10.

CHAPTER 3

Installation

Unpack and check the meter, make sure your line pressures suit its model, then plumb it into a clean gas line. Wiring follows in Electrical connections (p. 11).

Unpacking

1. Before you open the carton, look for transport damage. If the carton is damaged, report it to the carrier straight away.
2. Open the carton from the top and check the meter for hidden damage. Report any damage to the carrier and to Analyt-MTC.
3. Check the contents against the packing list and tell Analyt-MTC promptly if anything is missing.

Suitable gases

The DPM measures gases only, never liquids. The standard and low-pressure-drop models measure clean, non-corrosive gases only; the corrosion-resistant DPM08, DPM18, DPM38, DPM48, DPM58, DPM68 and DPM78 are also compatible with the corrosive gases in Appendix B (p. 45). For more information, ask Analyt-MTC. A gas that may carry particles must be filtered before it reaches the meter. For oxygen service the meter must have been specially cleaned and prepared; ask Analyt-MTC before you use one on oxygen.

Pressure limits

Two limits protect the differential pressure sensor: the *line pressure* (the static pressure inside the meter, also called common-mode pressure) and the *differential pressure* between inlet and outlet. Check both against your process before you install the meter.

Table 3-1 Pressure ratings

Models	Max. line pressure	Max. differential pressure	Proof pressure
Standard: DPM07, 17, 37, 47, 57, 67, 77	8.3 bar g (120 psig)	0.83 bar (12 psid)	145 psig
Low pressure drop: DPM04, 14, 24, 34, 44, 54	3.44 bar g (50 psig)	0.67 bar (9.75 psid)	3.44 bar g (50 psig)
Corrosion-resistant: DPM08, 18, 38, 48, 58, 68, 78	10.3 bar g (150 psig)	10 psid	175 psia

If your supply pressure is higher than the line pressure limit, fit a pressure regulator upstream of the meter and set it to the limit or below.

NOTICE

Pressure above the limits damages the differential pressure sensor permanently. A steady line pressure within the limit is harmless, but short pressure steps on either port are not: a quick-acting solenoid valve that opens upstream or downstream of the meter can destroy the sensor. On low-pressure-drop models, any line pressure above 3.44 bar g (50 psig) causes permanent damage, and on corrosion-resistant models any line pressure above 10.3 bar g (150 psig). Keep the line pressure within the limits, and avoid pressure steps at the ports.

NOTICE

Pressure spikes and surges beyond the ratings of the meter damage the differential pressure sensor permanently. Install the meter only in lines that stay within its pressure and temperature ratings, and leave a safety margin if the process has spikes or surges. In high-pressure applications, protect the line with suitable relief valves and burst discs.

Mounting

The meter works in any position and needs no straight pipe runs upstream or downstream. Choose a stable environment: no frequent or sudden temperature changes, no high humidity and no draughts. Keep it away from vibration, hot corrosive atmospheres and strong radio-frequency or magnetic fields. Threaded holes in the base take mounting screws; their positions are in Dimensions and weights (p. 37).

Filters

The laminar flow element consists of narrow stainless-steel channels that particles block easily. Install an in-line particle filter upstream of the meter in every application: 20 µm or finer, and 5 µm for the DPM07 and DPM08. Ask Analyt-MTC which filter suits your port size and model.

NOTICE

Particles and deposits in the flow channels shift the calibration and eventually block the flow. Use the meter only on clean gas, filtered upstream.

Connecting the gas line

The process ports are female threads; their size depends on the model (see Table 10-2 (p. 35)). Fit compression fittings suitable for your tubing.

1. Inspect all parts of the piping — tubing, ferrules and fittings — for dust and other contamination, and clean them if needed.
2. Note the flow arrow on the front of the meter. Install the meter so that the gas flows in the direction of the arrow; a reversed meter reads negative.

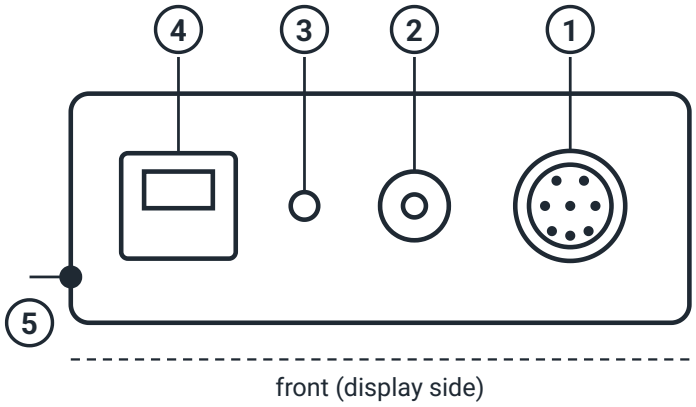
   NOTICE

   Pipe grease or sealant on the process connections contaminates the laminar flow element and damages the meter permanently. Do not use pipe grease or sealant on the process connections.
3. Push the tubing into each compression fitting until its end sits against the shoulder of the fitting.
4. Tighten each compression fitting by 1¼ turns, or as the fitting manufacturer specifies. Do not overtighten: it can damage the fitting.
5. Leak-test the connections before you apply process pressure.

Electrical connections

All connectors are on the top of the meter. One 8-pin Mini-DIN socket carries power, the analogue output, the relay and the serial interface; the other sockets duplicate power and the serial interface in more convenient forms, or add Modbus.

Connectors



#	Connector
1	8-pin Mini-DIN: power, analogue output, relay, serial interface
2	DC power jack, 9–26 V DC
3	3.5 mm stereo jack: RS-232 or RS-485
4	RJ-45: Modbus RTU (option)
5	Multi-function push-button (Push-button (p. 24))

Figure 3-1. Top of the meter, seen from above with the display facing you. Callout 5 is the push-button hole on the left side.

8-pin Mini-DIN connector

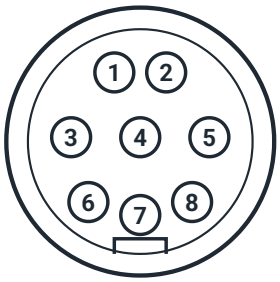


Figure 3-2. Mini-DIN socket on the meter, pin numbers.

Table 3-2 Mini-DIN pinout

Pin	Function
1	Relay (solid-state, normally open), contact 1
2	Relay (solid-state, normally open), contact 2
3	Serial input: RS-232 RX / RS-485 (–)
4	Analogue output, return (–)
5	Serial output: RS-232 TX / RS-485 (+)
6	Analogue output (+): 0–5 V DC, 0–10 V DC or 4–20 mA
7	Power supply (+), 9–26 V DC
8	Power supply common (–) and RS-232 signal ground

NOTICE

Most Mini-DIN plugs follow the standard numbering, but some do not. A cable wired by those numbers connects signals to the wrong pins, and the meter does not work correctly. Wire your cable by the function of each pin in Table 3-2, not by the numbers printed on the mating plug. Shielded cables with stripped ends are listed with the accessories (see p. 39).

Power supply

The meter needs 9 to 26 V DC from a single-polarity supply that delivers at least 100 mA, with a ripple below 150 mV peak-to-peak. If you use the 4–20 mA output, the supply must be at least 12 V DC. Connect the supply either to the DC jack or to the Mini-DIN connector — pin 7 (+) and pin 8 (–). When several meters share one supply, size it for their combined current.

Both power inputs are protected against reversed polarity and by a 300 mA resettable fuse. If a short circuit or reversed polarity trips the fuse, switch off the supply, correct the fault and switch on again; the fuse resets itself.

NOTICE

More than 26 V DC, or power through the DC jack and the Mini-DIN connector at the same time, can damage the meter. Never apply more than 26 V DC, and never power the meter through both at the same time.

NOTICE

A wiring error can damage the meter or make it work incorrectly. Switch off the power before you connect or disconnect any cable. Before you switch on, check the wiring and the polarity of the supply.

Analogue output

The meter has one calibrated, linear analogue output that represents 0 to 100 % of the full-scale flow. You choose 0–5 V DC, 0–10 V DC or 4–20 mA at the display or over the serial interface (see Analogue output settings (p. 20)). Connect the load between pin 6 (+) and pin 4 (–).

Output	Load
0–5 V DC	5 kΩ or more
0–10 V DC	5000 Ω or more
4–20 mA (sourcing, not isolated)	500 Ω or less loop resistance; supply at least 12 V DC

To keep noise out of the signals, run the power, serial and analogue lines in separate cables.

NOTICE

The 4–20 mA output supplies its own loop current, and an external voltage source on it can damage the circuit. Never connect an external voltage source to it, for example a loop-powered input.

NOTICE

A low-impedance load (below 5 kΩ) on a voltage output can damage the circuit or make it work incorrectly. A load above 500 Ω on the 4–20 mA output makes the current non-linear or wrong. Check which output type is set before you connect a load. Keep the load at 5 kΩ or more on a voltage output and at 500 Ω or less on the 4–20 mA output.

Relay output

Pins 1 and 2 are the contacts of a solid-state relay (SPST, normally open) for switching your own equipment. Do not exceed 48 V (AC peak or DC) or 400 mA. When the relay is energised, the contact closes. What switches it — an alarm, a totaliser limit, the pulse output or a manual command — is set under Relay assignment (p. 20).

Serial interface

The serial interface works either as RS-232 or as RS-485; the meter leaves the factory set to the interface you ordered. The signals are on the 3.5 mm stereo jack and, in parallel, on Mini-DIN pins 3 and 5. Default settings: 9600 baud, 8 data bits, no parity, 1 stop bit, no flow control.

NOTICE

Connecting the meter to a computer or PLC that uses another interface type can damage it or disturb communication. Check the interface type before you connect the meter. On a meter with a display it is shown for about 2 seconds on the start-up screen (see p. 15). Without a display, press the push-button briefly and count the amber flashes (see p. 24).

RS-232

An RS-232 meter comes with a 1.5 ft crossover cable from the stereo plug to a 9-pin D-sub socket for the PC. To make your own cable, wire it as follows:

Computer, 9-pin D-sub	Meter, 3.5 mm stereo plug
Pin 2 (RX)	Ring (meter TX)
Pin 3 (TX)	Tip (meter RX)
Pin 5 (signal ground)	Sleeve (ground)

RS-485

An RS-485 meter comes with a 3 ft cable from the stereo plug to stripped wires. Set your RS-485 converter to multidrop, two-wire, half-duplex operation. Its transmitter must be enabled by TD or RTS, whichever the converter offers, and its receiver must follow the transmitter setting so that you do not receive your own echo.

RS-485 line	Stereo plug	Wire colour
A, T(–) / R(–)	Tip (meter RX–)	White
B, T(+) / R(+)	Ring (meter TX+)	Red
Ground (if available)	Sleeve	Shield

Every meter on a bus needs its own address (see Communication port (p. 19)). The last device at each end of a long bus needs a 120 Ω termination resistor between (+) and (–), within 6 ft of the device. The DPM has this resistor built in; enable it under **`General Settings`** › **`Communication Port`** › **`RS-485 Termination`** when the meter is the last device on a line longer than 100 m. It is disabled when the meter leaves the factory.

NOTICE

Enabling the termination resistor while the interface is set to RS-232 damages the meter or disturbs communication. Never enable the termination resistor while the interface is set to RS-232.

Modbus (option)

Meters with the Modbus option have an RJ-45 socket on top, connected to a separate, isolated RS-485 transceiver for Modbus RTU. Its settings are described under Modbus settings (p. 19).

CHAPTER 4

Commissioning

Switching on

With the meter installed and leak-tested, make sure no gas is flowing, then switch on the supply. A meter with a display shows, in this order:

1. A start screen, for 2 seconds.
2. An information screen, for another 2 seconds: firmware and gas-table version (`Fw`, `Tbl`); serial interface type and its hexadecimal RS-485 address (`COM`, `Add`); baud rate; Modbus option present (`Y` or `N`) and its decimal address.
3. The first process information screen with pressure, temperature, mass flow and totaliser 1, in the units selected.

About 5 seconds after switch-on the status LED lights steady green: the meter is measuring. Before you zero the meter, let it warm up for at least 15 minutes (see Chapter 7 (p. 30)).

CHAPTER 5

Operation

How you move through the screens and menus with the joystick and the Esc button, how you configure the meter, how alarms, totalisers and events work, and what the push-button does. Meters without the display option are set up over the serial interface (Chapter 6 (p. 25)) and the push-button (The push-button (p. 24)).

Process information screens

The readings are spread over six process information (PI) screens. Move the joystick **UP** to page forward and **DN** to page back; after the last screen the first appears again. The meter can also page through them by itself (see Display settings (p. 18)), and screens you do not need can be hidden — except screen 1.

Screen	Content
1	Absolute pressure, temperature, mass flow, totaliser 1
2	Absolute pressure, temperature, mass flow, totaliser 2
3	Absolute pressure, temperature, mass flow, volumetric flow
4	Selected gas and full-scale range; serial interface type and address; analogue output type; Modbus option present
5	Events: hours since power-up; status of the flow, pressure and temperature alarms; relay assignment; totaliser and pulse output status; alarm events (`AE`) and diagnostic events (`DE`) registers
6	Diagnostics: raw sensor counts, differential pressure in mbar and psid, gas temperature — for troubleshooting with Analyt-MTC support

When an alarm is active, the unit next to the reading alternates every second with an alert: `Lo!` or `Hi!` for flow, `LOW!` or `HIGH!` for pressure, `L` or `H` for temperature (see Alarms, totalisers and events (p. 21)). The exact screen layout depends on the model and configuration.

Swamping

The meter measures up to 133 % of its full scale. Above that it is *swamped*: the mass flow reading flashes. Any reading that flashes — flow, pressure or temperature — is outside the range of its sensor.

> **Note**
> Above 133 % of full scale the meter is swamped. While a reading flashes, neither it nor the mass flow can be trusted: they are not accurate and not linear. Bring the flow back below 133 % of full scale. Normal measurement then resumes by itself.

Using the menus

Press **Esc** on a PI screen to open the main menu. Move the joystick **UP** and **DN** to highlight an item — the list wraps around at both ends — and press **ENT** to open it. **Esc** returns one level, and from the main menu back to the readings.

Settings are entered in one of two ways:

- **From a list:** select the option with **UP** and **DN**, then press **ENT**.
- **As a number:** **UP** and **DN** change the digit under the cursor (0–9), **LEFT** and **RIGHT** move the cursor, **ENT** saves the value in the meter's non-volatile memory.

The meter checks every value you enter; a value outside the permitted range is rejected with a message.

Program protection

All settings that change the measurement are protected. Protection switches on at every power-up. To change settings, open **`Program Protection`** in the main menu:

- If the password is 0 — as delivered — no password is asked. Select **`DISABLED`** and press **`ENT`**.
- Otherwise the meter asks for the password, up to three digits. Once it is accepted, protection stays off until the next power-up.

To set or change the password, disable protection first, then open **`Change PP Password`**, enter the old password and then the new one; the meter confirms the change. If the password is lost, contact Analyt-MTC.

Menu overview

Main menu	Contains	See
Program Protection	Enable or disable protection	p. 17
Change PP Password	Old and new password	p. 17
Device Information	Device ID and full-scale flow; analogue and serial interface; firmware and table version (read only, no password)	p. 15
Units of Measure	Mass flow, volumetric flow, pressure, temperature; user-defined unit	p. 17
Select Gas	Gas groups, recent gases, user-defined mixtures	p. 18
Alarm Settings	Flow, pressure and temperature alarms	p. 21
`Totalizers Settings`	Totaliser 1, totaliser 2, pulse output	p. 22
General Settings	Standard and normal conditions; display and PI screens; communication port; Modbus; relay; analogue output; status LED; signal conditioner	from p. 17
Sensor Zero Calibr.	Start auto zero, start pressure tare, view zero parameters	p. 30
Alarm & Diagnostic	Alarm and diagnostic event registers; diagnostic screens	p. 23

Configuring the meter

Set the units first, because other settings — alarm limits, totaliser volumes, pulse values — are entered in them. Then select your gas, check the reference conditions and set up the outputs. Disable program protection before you start (p. 17). Every setting can also be made over the serial interface (Command reference (p. 25)).

Units of measure

`Units of Measure` sets separate units for mass flow, volumetric flow, pressure and temperature. The units apply everywhere: on all PI screens, in serial responses and to the totalisers, which follow the mass flow unit automatically. The meter offers 43 mass flow units — standard (S), normal (N) and true mass — plus one user-defined unit, 15 volumetric flow units, 15 absolute pressure units and 4 temperature units; they are listed in Appendix A (p. 43).

A **user-defined unit** is set under **`Units of Measure › User Defined Unit`** with three values: the K-factor (the volume of one unit in litres, default 1.00), the time base (second, minute, hour or day) and whether the unit is density-based (a mass) or not. Then select **`USER`** as the mass flow unit.

Selecting the gas

The gases are arranged in groups under **Select Gas**: Standard, Bioreactor, Breathing, Chromatography, Fuel, Laser, O2 Concentrator, Stack and Welding gases. **Recent Gases** keeps the last 16 gases you selected. To select nitrogen, for example, open **Select Gas** › **Standard Gases**, highlight **Nitrogen** and press **ENT**. All gases, with the numbers used over the serial interface, are listed in Appendix B (p. 45).

User-defined mixtures

You can store up to 20 mixtures of two to five gases from the gas list. As delivered, no mixture is stored.

1. Open **Select Gas** › **User Defined Mixture**. The first line, **Add Mixture**, shows how many places are free. Press **ENT**.
2. Enter a name. A flashing A appears: **UP** and **DN** change the character, **RIGHT** moves to the next position, **LEFT** switches between upper and lower case. Press **ENT** to save the name.
3. The mixture screen lists the components G1 to G5. Highlight G1 and press **ENT**; select its gas from the list and press **ENT**.
4. Press **RIGHT** to move to the percentage, press **ENT**, enter the value and press **ENT** again. **UP** and **DN** move between components; **LEFT** and **RIGHT** switch between gas and percentage.
5. Repeat for the other components. The header shows the running total, which must reach exactly 100 %; a mixture with another total is refused with an error message.
6. Press **LEFT** to save. The meter confirms with NEW MIXTURE HAS BEEN SAVED; press any key. The mixture now appears in the **User Defined Mixture** list, where you select it like any other gas.

To edit a mixture, highlight it in the list, press **LEFT**, select **YES** and press **ENT**. You can then change its name, its components and their percentages.

Reference conditions

Standard (S) flow units refer to the standard temperature and pressure, normal (N) units to the normal temperature and pressure. Both pairs can be changed under **General Settings** › **STP/NTP Units Cond**: select **Standard Temperature**, **Standard Pressure**, **Normal Temperature** or **Normal Pressure**, choose the unit of the value, then enter the value and press **ENT**.

	Temperature	Pressure
Standard conditions (factory setting)	21.11 °C	1013.25 mbar
Normal conditions (factory setting)	0 °C	1013.25 mbar

> **Note**
> Changing a reference condition changes every mass flow reading — on the display, on the analogue output and over the serial interface. When you compare the DPM with another meter, make sure both use the same reference conditions.

Display settings

Under **General Settings** › **Display & PI Screens**:

Setting	Effect
Display Oper. Mode	**Static** (default): you page through the PI screens with the joystick. **Dynamic**: the meter shows them in turn.
Screen Cycle Time	Time each screen is shown in dynamic mode, 1–3600 s.

Setting	Effect
PI Screens Config.	Shows or hides each of the six PI screens. Select a screen and press **RIGHT** to set or clear its [*] (shown); press **ENT** to save. All screens are shown as delivered; screen 1 cannot be hidden.
OLED Brightness	Brightness in normal operation, 256 levels.
Screen Saver Mode	Disabled, Low Brightness, Vertical Scrolling (default) or OLED Off.
OLED SS Time Out	Time without a key press before the screen saver starts; default 900 s (15 min). Any key press restores normal brightness and restarts the timer.
OLED SS Brightness	Brightness in Low Brightness mode, 127 levels; default 127, the best level at room temperature.
Flow Rate Precision	**Normal** (default) or **Elevated**, one more decimal place. If the last digit becomes unstable, return to Normal.

NOTICE

An OLED screen can retain an image that stays unchanged for a long time, temporarily or permanently; the screen saver prevents this. If nobody reads the display — for example in a closed cabinet — set the screen saver to **OLED Off**. A changed screen-saver setting takes effect from the next screen-saver cycle.

Communication port

Under **General Settings › Communication Port**:

Setting	Effect
UART Transceiv Mode	Disabled, RS-232 or RS-485. Set at the factory to the interface you ordered.
Baud Rate Settings	1200, 2400, 4800, 9600 (default), 19200, 38400, 57600 or 115200 baud. Must match the computer or PLC.
RS-485 Bus Address	Two hexadecimal characters, 01–FF; default 11. Not used with RS-232.
RS-485 Termination	Built-in 120 Ω termination; default Disabled (see p. 14).

NOTICE

Connecting the meter to a computer or PLC that uses another interface type can damage it or disturb communication. Before you change the interface type, make sure the computer or PLC uses the same type.

NOTICE

Two devices with the same address on an RS-485 bus cause collisions and communication errors. Give every device its own address. Address 00 is the global address: every device executes a command sent to 00, but none replies. Never assign 00 to a device.

Modbus settings (option)

The DPM supports Modbus RTU. A computer or PLC then reads and writes the meter's parameters directly in its registers; ask Analyt-MTC for the register map. Under **General Settings › ModBus Interface**:

Setting	Effect
Dev. ModBus Address	Device address, 1–247 (decimal); default 11. Unique on each Modbus segment.
Baud Rate Settings	1200–115200 baud, as for the communication port; default 9600. All meters on one master use the master's baud rate.
ModBus Com. Parity	None (default), Odd or Even — as set in the Modbus master.
ModBus Com. StopBit	1 or 2 (default) — as set in the Modbus master.

Relay assignment

`General Settings` › **`Relay Assignment`** decides what energises the solid-state relay (wiring: p. 13). As delivered, the relay is disabled.

Assignment	Relay energised when
Disabled	Never (default)
Low / High F. Alarm	The flow is at or below the low limit / at or above the high limit
F. Range H - L	The flow is between the low and the high limit
Low / High P. Alarm, P. Range H - L	The same for pressure
Low / High T. Alarm, T. Range H - L	The same for temperature
`Totalizer #1 / #2 Event`	The totaliser has reached its action volume
Pulse Output	The relay carries the pulse output (p. 22)
Alarm Events	One or more alarm events are active
Diagnostic Events	One or more diagnostic events are active
Manual On	Always, regardless of any condition

Analogue output settings

Under **`General Settings`** › **`Analog Output`**:

Setting	Effect
`Analog Output Mode`	0–5 V DC (load 5 kΩ or more), 0–10 V DC (5000 Ω or more) or 4–20 mA (sourcing, loop 500 Ω or less).
`Analog Output Cal.`	Recalibrates the output at 0 and 100 % of full scale.
`Analog Output Test`	Forces the output to a value you enter.

NOTICE

A load outside the limits of the new output mode can damage the output circuit or give wrong values. Before you change the output mode, check that the connected load is within the limits of the new mode. Never connect an external voltage source to the 4–20 mA output.

Calibrating the analogue output

The output is calibrated at the factory. Recalibrate it only after a repair of the output circuit or when Analyt-MTC support asks you to; the factory calibration is then no longer guaranteed.

1. Power the meter for at least 30 minutes. Check which output mode is set.
2. Connect a voltmeter (voltage modes) or an ammeter (4–20 mA) to pin 6 (+) and pin 4 (–) of the Mini-DIN connector.
3. Start **`Analog Output Cal.`** and follow the prompts: at each of the two calibration points, adjust the value with the joystick until it matches your instrument.
4. The meter shows the new offset and span. Press **`ENT`** to save them, or **`Esc`** to leave without changes. **`Esc`** also aborts the calibration at any point.

Output test

`Analog Output Test` is for troubleshooting with Analyt-MTC support. Enter a flow value from 0.0 to 110.0 % of full scale and press **`ENT`**: the output shows that value. Press **`Esc`** to end the test; the output

follows the actual flow again. During the test the output does not represent the flow: make sure nothing downstream acts on it.

Status LED

`General Settings` › `Status LED Settings` selects which events the LED signals in green, red or amber. In every mode, a steady red light means an auto zero failure or a fatal error.

Mode	Indication
Default Events	Steady red: auto zero failure or fatal error (power cycle needed). Steady amber for 1–3 s at power-up: sensor warm-up. Patterns of up to 35 s: push-button operation.
F. Alarm & Tot Events (default)	Flashing once per second: red = high flow alarm, green = low flow alarm, amber = totaliser 1 or 2 event. Combinations alternate: red/amber or green/amber (every second with totaliser 1, every 2 s with totaliser 2); amber 3 s and off 1 s for both totalisers; amber 3 s and red or green 1 s for both totalisers with a flow alarm.
Alarm Events	Green flashing once per second: at least one alarm event active
Diagnostic Events	Red flashing once per second: at least one diagnostic event active
Main Com. Interface	Short red flash on each received message, short green flash on each transmitted message (about 200 ms)
Modbus Interface	The same for the Modbus interface

Signal conditioner

The meter answers flow changes within milliseconds (10 ms response time as delivered). It therefore follows fast flow pulsations, for example from a diaphragm pump or an unstable pressure regulator. The averaging (damping) parameters under **`General Settings` › `Signal Conditioner`** slow the reading down for such applications; they also hold the filter settings for pressure and temperature. The factory setting gives the best performance: change it only together with Analyt-MTC technical support.

Alarms, totalisers and events

The meter watches flow, pressure and temperature against limits you set, adds up the flow in two totalisers, sends pulses proportional to the flow and records every alarm and diagnostic event. Alarms and totaliser events can switch the relay; pulses always use it.

Flow, pressure and temperature alarms

The three alarms work the same way and are set under **`Alarm Settings`**. An alarm condition exists while the reading is at or above the high limit, or at or below the low limit. It is shown on the PI screens, by the status LED, and — if you assign it — by the relay (Relay assignment (p. 20)). Set the limits in the current units; the high limit must be greater than the low limit.

Setting	Flow alarm	Pressure alarm	Temperature alarm
Mode	Enabled or Disabled (default)		
Low limit	0–109.9 % FS	0.0–99.9 % of pressure sensor range	−20.0 to 69.9 °C
High limit	0–110 % FS	0.1–100 % of pressure sensor range	−19.9 to 70.0 °C
Step	0.1 % FS	0.1 % of range	0.1 °
Action delay	0–3600 s, default 0: how long the condition must last before the alarm becomes active		
Power-up delay	0–3600 s, default 0: the alarm is ignored for this time after switch-on		
Latch	Disabled (default): the alarm clears when the condition ends. Enabled: the relay stays on until reset.		
Display alert	`Lo!` / `Hi!`	`LOW!` / `HIGH!`	`L` / `H`

Note
A short action delay, typically 2 to 10 seconds, confirms that the flow has really settled at a level and that the alarm is not triggered by a brief spike.

Totalisers

Two independent totalisers integrate the mass flow over time, in the mass unit currently selected. They count up only. Their readings are saved in non-volatile memory every second, so they survive a power failure, and a backup copy is kept every 6 minutes. Settings for each totaliser are under **`Totalizers Settings`** › **`Totalizer #1`** or **`#2`**.

Setting	Effect
`Totalizer Mode`	Enabled or Disabled (default).
Flow Start	The totaliser counts only while the flow is at or above this value, 0–100 % FS in 0.1 % steps.
Action Vol.	Volume, in the current unit, at which the totaliser event occurs — for example to switch the relay. 0 (default) means no event.
PowerOn Delay	The totaliser starts this long after switch-on, 0–3600 s (default 0), so that the warm-up does not count.
Auto Reset	Enabled: the totaliser returns to zero when it reaches the action volume — useful for dispensing repeated batches. Default Disabled.
AutoReset Delay	Pause before the next batch starts after an automatic reset, 0–3600 s (default 0).
`Reset Totalizer`	Sets the reading to zero after a confirmation (**`YES`**, **`ENT`**).
DP Precision	Removes 0–5 decimal places from the totaliser reading. The reading has 10 digits, so fewer decimals leave room for a larger total. Example: with a flow shown to 3 decimals, −2 shows the total to 1 decimal.

Set all parameters before you enable a totaliser. On meters without a display, the totalisers are reset with the push-button (p. 24). If a total must be kept for the life of the meter, the reset can be locked over the serial interface (command T1L / T2L, Table 6-5, p. 27); a locked totaliser cannot be reset by any means until it is unlocked. The reset is unlocked as delivered.

Pulse output

The pulse output sends one pulse each time a set quantity of gas has passed, independent of the totalisers. The pulses appear on the relay contacts, Mini-DIN pins 1 and 2, so assign the relay to **`Pulse Output`** first (p. 20). Settings are under **`Totalizers Settings`** › **`Pulse Output`**:

Setting	Effect
PulseOutput Mode	Enabled or Disabled (default).
Pulse Flow Start	Pulses are sent only while the flow is at or above this value, 0.0–100.0 % FS.
[Unit]/Pulse	Quantity per pulse, in the current unit.
Pulse Active Time	How long the relay stays closed for each pulse, 50–6553 ms.

The output cannot send more than one pulse every 100 ms. Pulses that come faster are held in a queue and sent later when the flow drops; an overflowing queue is recorded as an alarm event. Rather than relying on the queue, set the quantity per pulse to the maximum flow per second: the output then pulses at most once per second. Example: at a maximum flow of 120 g/min (2 g/s), 2 g per pulse gives one pulse per second, 120 g per pulse one pulse per minute.

Alarm and diagnostic events

The meter records alarm events and diagnostic events in two registers, viewed under **`Alarm & Diagnostic`**. Each has three parts:

- **Status** (read only): the events currently recorded, with their number on the first line. If more than seven are listed, scroll with **`UP`** and **`DN`**.
- **Mask**: which events are monitored at all. An event that is masked out is neither processed nor shown.
- **Latch**: which events stay recorded after their cause has ended, until you reset the status register. Unlatched events are shown only while they last.

To change the mask or latch, select an event and press **`RIGHT`** to set or clear its `[*]` (enabled), then press **`ENT`** to save. **`Reset Alarm Events Reg.`** and **`Reset DiagEvents Reg.`** clear the status after a confirmation. The status registers are also cleared when the power is switched off. The code in the first column is the one shown on the display; the bit value is the one used in serial commands.

Table 5-1 Alarm events

Code	Event	Bit
0	High flow alarm	0x0001
1	Low flow alarm	0x0002
2	Flow between limits	0x0004
3	Totaliser 1 at action volume	0x0008
4	Totaliser 2 at action volume	0x0010
5	High pressure alarm	0x0020
6	Low pressure alarm	0x0040
7	Pressure between limits	0x0080
8	High temperature alarm	0x0100
9	Low temperature alarm	0x0200
A	Temperature between limits	0x0400
B	Pulse output queue overflow	0x0800
C	Password event (attempt to change it)	0x1000
D	Power-on event (power-up delay set)	0x2000

As delivered, only event D is monitored and no event is latched.

Table 5-2 Diagnostic events

Code	Event	Bit
0	CPU temperature too high	0x0001
1	Differential pressure sensor initialisation error	0x0002
2	Absolute pressure sensor initialisation error	0x0004
3	2.5 V DC reference out of range	0x0008
4	Flow out of permissible range	0x0010
5	Absolute pressure out of range	0x0020
6	Gas temperature out of range	0x0040
7	Analogue output alarm	0x0080
8	Serial communication error	0x0100
9	Modbus communication error	0x0200
A	Memory (EEPROM) read/write error	0x0400
B	Auto zero failure	0x0800
C	Pressure tare failure	0x1000
D	Differential pressure reading invalid	0x2000
E	Absolute pressure reading invalid	0x4000
F	Fatal error	0x8000

As delivered, only event 0 is monitored and no event is latched.

The other entries under **`Alarm & Diagnostic`** — sensor readings, temperature sensors, analogue output and pulse queue, reference voltage and calculation values — are read-only screens for troubleshooting together with Analyt-MTC support.

The push-button

A small push-button behind a hole on the left side of the housing (p. 12) gives access to the most important functions on every DPM, with or without display. What it does depends on how long you hold it; the status LED shows which function you will get when you release it.

Hold for	Status LED	On release
Less than 6 s	Amber, 1, 2 or 3 flashes	Nothing changes; the flashes show the serial interface: 1 = disabled, 2 = RS-232, 3 = RS-485.
6–12 s	Amber flashing (every 2 s)	The meter restarts: warnings and error messages are cleared and it runs its self-test.
12–18 s	Green flashing (every 2 s)	Auto zero starts (see p. 30). Only with no flow and after at least 15 minutes of warm-up.
18–24 s	Steady red	Opens a 14-second window to reset a totaliser or change the serial interface (see below).

Within the 14-second window, press the button the number of times below. Hold it each time until the green LED goes out (about 2 seconds); when you release it, the red LED lights again, ready for the next press.

Presses	Action
1	Reset totaliser 1
2	Reset totaliser 2
3	Reset totalisers 1 and 2
4	Change the serial interface one step: disabled → RS-232 → RS-485 → disabled

Note
If you do not press the button in time, or release it before the green LED goes out, nothing happens: the push-button returns to its normal state and the LED turns green.

CHAPTER 6

Communication

Over RS-232 or RS-485 a computer or PLC reads every measurement and changes every setting of the meter with plain ASCII commands. Any serial terminal program will do; wiring and port settings are in Serial interface (p. 13).

Command format

A command is a line of printable ASCII characters ending with a carriage return (**<CR>**); line feeds are ignored. Arguments follow the command, separated by commas. On RS-485, every command starts with `!` and the two-character hexadecimal address of the meter. On RS-232 there is only one meter on the line, so the start character and address are left out — never send them.

RS-485	`!Addr,Cmd,Arg1,Arg2,Arg3,Arg4<CR>`	Example: `!11,F<CR>`
RS-232	`Cmd,Arg1,Arg2,Arg3,Arg4<CR>`	Example: `F<CR>`

`Addr` is 01 to FF (default 11, see p. 19); 00 addresses all meters at once, and none of them replies. `Cmd` is one or two characters; arguments not needed are left out. The examples below address a meter at hexadecimal address 12:

Task	Send	Reply
Read the selected gas	`!12,G`	`!12,G:0,AIR` — gas 0, air
Read the flow alarm status	`!12,FA,R`	`!12,FAR:N` — no alarm
Read mass and volumetric flow	`!12,F`	`!12,50.0,50.3`
Set the flow alarm limits to 90 % and 10 % FS	`!12,FA,C,90.0,10.0`	`!12,90.00,10.00,`

Finding a meter with an unknown address

A meter without a display whose RS-485 address you do not know can be given a new one with the global address:

1. Connect only this meter to the RS-485 bus.
2. Send `!00,MW,118,XX,<CR>`, where `XX` is the new hexadecimal address, 01 to FF.

From then on the meter answers to the new address.

Command reference

The tables give the command and argument as they follow the address; on RS-232 send them as shown. * marks the setting as delivered. Responses show the command letters, a colon and the value, for example `FAA:5`.

Table 6-1 Readings and device information

Send	Function	Response
`F`	Mass and volumetric flow in the current units	`50.0,50.3`
`FM` / `FV`	Mass flow only / volumetric flow only	`value`

Send	Function	Response
GT / GP	Gas temperature / absolute gas pressure, current units	24.51 / 14.66
PI	All process values: mass flow, volumetric flow, totaliser 1, totaliser 2, temperature, pressure; flow, temperature and pressure alarm status (D disabled, N none, H high, L low); alarm events and diagnostic events registers	25.4,23.2,354.2,0.0,24.8,14.95,D,N,D,0x0,0x0
DI	Device information: gas number and name, full scale in L/min, mass and volumetric unit, totaliser 1 and 2 (E/D), analogue output (0 = 0–5 V DC, 1 = 0–10 V DC, 2 = 4–20 mA), Modbus (0 installed, 1 not installed)	DI:5,Helium,0.200,Sml/min,ml/min,E,D,0,1
G	Read the selected gas	G:0,AIR
G,n	Select gas number n, 0–128; 0–162 on the corrosion-resistant models (Appendix B (p. 45))	G:5,He

Table 6-2 Units and reference conditions

Send	Function	Response
U	Read the mass flow unit	U:SmL/min
U,unit	Set the mass flow unit (and totaliser unit), written as in Appendix A (p. 43), e.g. U,SL/min; %FS*	U:SL/min
U,USER,k,t,d	Define the user unit: K-factor k > 0; time base t 0 s, 1 min, 2 h, 3 day; d 1 = density-based, 0 = not. U,USER alone selects it.	U:USER,1.5,1,0
VU, VU,unit	Read / set the volumetric flow unit, e.g. VU,mL/min; %FS*	VU:mL/min
PU, PU,unit	Read / set the pressure unit, e.g. PU,barA	PU:PSIA
TU, TU,u	Read / set the temperature unit: F, C, K or R	TU:C
C,S,C,S,T,P	Read / set standard conditions, T in °F, P in psia (70.0, 14.696*)	CS:70.0,14.696
C,N,C,N,T,P	Read / set normal conditions, °F and psia (32.0, 14.696*)	CN:32.0,14.696
C,T / C,T,Z	Read / reset the hours since the last calibration (reset it after each calibration)	CT:1024.2
C,P	Hours since the last power-up or reset	CP:148.7

Table 6-3 Alarms

The flow (FA), pressure (PA) and temperature (TA) alarms take the same arguments. Replace FA by PA or TA; the responses change accordingly.

Send	Function	Response
FA,E / FA,D*	Enable / disable the alarm	FA:E
FA,C,high,low	Set the limits. Flow in % FS: high 0.1–110.0, low 0.0–109.9. Pressure in psia: high 0.1–100.00, low 0.0–90.99. Temperature in kelvin: high 253.16–343.15, low 253.15–343.14. High must be greater than low.	FAC:40.10,20.50
FA,A,s	Action delay, 0–3600 s	FAA:5
FA,P,s	Power-up delay, 0–3600 s	FAP:60
FA,L,n	Latch: 0 = off*, 1 = on	FAL:0
FA,R	Alarm status: N none, H high, L low	FAR:N
FA,S	All settings: mode, high, low, action delay, latch, power-up delay	FAS:E,40.00,20.00,2,0,8

Table 6-4 Events registers

Send	Function	Response
AE / DE	Read the alarm / diagnostic events status (bit values: Tables 5-1 and 5-2, p. 23)	AE:0x0
AE,R / DE,R	Reset the status register to 0x0000	AER:0x0
AE,M, AE,M,0xhhhh	Read / set the mask register (also DE,M). Write all six characters, e.g. 0x0011.	AEM:0x11
AE,L, AE,L,0xhhhh	Read / set the latch register (also DE,L), six characters	AEL:0x11

Table 6-5 Totalisers and pulse output

Totaliser commands start with T1 or T2; the examples use totaliser 1. The pulse quantity command P,U answers with PU:, the same prefix as the pressure unit command PU in Table 6-2; match the response to the command you sent.

Send	Function	Response
T1,E / T1,D*	Enable / disable the totaliser	T1:E
T1,R	Read the total in the current unit	T1R:value
T1,Z	Reset to zero (not while locked)	T1Z
T1,C,start,volume	Flow start in % FS (0.0–100.0) and action volume in the current unit (0 = no event)	T1C:2.5,0.0
T1,P,s	Power-up delay, 0–3600 s	T1P:10
T1,A,n	Automatic reset at the action volume: 0 off, 1 on	T1A:0
T1,I,s	Delay after an automatic reset, 0–3600 s	T1I:2
T1,L, T1,L,n	Read / set the reset lock: 0 unlocked*, 1 locked	T1L:0
T1,B	Restore the total from the backup copy	T1B
T1,S	Settings: mode, flow start, action volume, power-up delay, auto reset, auto reset delay	T1S:E,0.5,2045.2,10,0,5
P,E / P,D*	Enable / disable the pulse output	P:E
P,U,value	Quantity per pulse in the current unit (not a time-based unit)	PU:10
P,T,ms	Pulse active time in ms, 50–6553; at most half the pulse period (see p. 22)	PT:100
P,F,value	Flow start, 0.0–100.0 % FS	PF:1.0
P,Q	Number of pulses waiting in the queue	PQ:n
P,S	Settings: mode, flow start, quantity per pulse, active time	PS:E,1.0,1.666,100

Table 6-6 Outputs, display and interfaces

Send	Function	Response
R,R,S	Read the relay assignment	R:D
R,code	Assign the relay: D disabled*, FL / FH / FR low, high, range flow alarm, PL / PH / PR pressure, TL / TH / TR temperature, T1 / T2 totaliser event, PO pulse output, AE alarm events, DE diagnostic events, M manual on	R:FH
AO,M, AO,M,n	Read / set the analogue output: 0 = 0–5 V DC, 1 = 0–10 V DC, 2 = 4–20 mA	AOM:0
AO,S	Analogue output alarm: N normal, Y fault detected	AOS:N
S,S,n	Read / set the status LED mode: 0 normal, 1 flow alarm and totalisers, 2 alarm events, 3 diagnostic events, 4 serial interface, 5 Modbus	S:1

Send	Function	Response
L	Display installed: Y or N	L:Y
L,M,x	PI screens: S static, D dynamic	LM:S
L,T,s	Screen time in dynamic mode, 1–3600 s	LT:5
L,S,0xhhhh	Shown PI screens, one bit per screen: 0x0001 screen 1 … 0x0020 screen 6 (0x003F all); screen 1 always shown	LS:0x3F
L,B,n	Display brightness, 1–255	LB:127
L,P,n	Screen saver: 0 off, 1 low brightness, 2 vertical scrolling, 3 display off	LP:2
L,O,s	Screen saver delay, 1–36000 s	LO:900
L,C,n	Screen saver brightness, 1–128	LC:6
L,D,n	Flow decimals: 0 normal, 1 elevated	LD:1
L,A,n	Averaging of the displayed flow, 0–25 samples	LA:1
L,E,value	Dead band of the displayed flow, 0.0–0.99 % FS	LE:0.01
MB,A,n	Modbus address, 1–247 (11*)	MBA:11
MB,B,baud	Modbus baud rate, 1200–115200 (9600*)	MBB:9600
MB,P,n	Modbus parity: 0 none*, 1 odd, 2 even	MBP:0
MB,S,n	Modbus stop bits: 1 or 2*	MBS:2
MB,D	Modbus counters: messages, CRC errors, slave messages, overrun errors	MBD:1,0,0,0
MB,R	Restart the Modbus port	MBR:Done

Each L and MB command without its value returns the current setting. Commands for the display and Modbus work only on meters with those options.

Table 6-7 Zero, tare and service

Send	Function	Response
Z,N	Start auto zero — no flow, at least 15 minutes after power-up	ZN
Z,S	Auto zero status: tare value, sensor counts, N not started, I in progress, F failed, D done	ZS:7492,70581,N
Z,V	Current zero value	ZV:589
Z,A,Z,A,p	Pressure tare status; tare with ambient pressure p from a reference, 13.1–15.99 psia — no flow, ports open	APZ:-0.0266,-640002,839,N
SC,…	Signal conditioner parameters (averaging and filters for flow, pressure and temperature). Factory set; change only with Analyt-MTC support.	
MR,i	Read memory location i, 0–413	value
MW,i,value	Write memory location i, 115–413; 0–114 are read-only	

NOTICE

The memory holds the factory settings of the meter, and a wrong value written with MW can make it malfunction. Write to memory only on instruction from Analyt-MTC technical support. The one exception is the address change described above.

Error codes

When the meter cannot carry out a command, it replies with an error code:

Code	Meaning
1	Command not supported, or not enabled
2	Wrong number of arguments
3	Memory address out of range (`MR`, `MW`)
4	Wrong number of characters in an argument
5	Attempt to write to a protected memory area
6	Command or argument not found
7	Argument value out of range
8	Access key for manufacturer data wrong or disabled

CHAPTER 7

Calibration and verification

The meter was zeroed at the factory. Zero it again only if it shows a flow when no gas is flowing, or if its absolute pressure reading has drifted. Both procedures need a warm meter and absolutely no flow. The yearly recalibration is described under Recalibration (p. 31).

Auto zero of the flow reading

Auto zero adjusts the differential pressure sensor so that the meter reads zero at zero flow. You can start it from the display, with the push-button (p. 24) or over the serial interface (command `Z, N`).

1. Power the meter for at least 15 minutes — 30 minutes give a better result.
2. Shut off the gas flow. To be sure that no gas seeps through the meter, disconnect the gas source.

   Note
   Any flow through the meter during auto zero is stored as zero and offsets every later reading. Make sure no gas flows through the meter during auto zero.

3. Open **`Sensor Zero Calibr.`** › **`Start Auto Zero Now`**, select **YES** and press **ENT**. The display shows `AUTO ZERO IS ON!` and the status LED flashes red and green, changing every 2 seconds.
4. Wait 5 to 15 seconds. When the sensor reading is within 0 ±7 counts, the zero has succeeded: the LED returns to steady green and the display shows `AUTO ZERO IS DONE!`. Press any key.

If the meter cannot bring the reading within 0 ±7 counts, the LED stays steady red and the display shows `Auto Zero ERROR!`. Check that there is really no flow and try again. If the error persists, the sensor is probably defective; contact Analyt-MTC to arrange a repair.

Tare of the absolute pressure sensor

The absolute pressure sensor is calibrated at the factory and needs no calibration. Depending on the installation, a tare from time to time can improve its accuracy. You need a reference barometer with an accuracy of 0.2 % of reading or better: the tare is only as accurate as your reference.

1. Power the meter for at least 15 minutes, preferably 30 minutes.
2. Stop the flow and open both the inlet and the outlet port to the atmosphere.

   Note
   A tare taken with flow, or with a port closed, offsets the pressure reading. Tare the pressure sensor only with absolutely no flow and with both ports open to the atmosphere.

3. Open **`Sensor Zero Calibr.`** › **`Start AP Auto Tare`**, select **YES** and press **ENT**.
4. Enter the ambient pressure read from your reference and confirm. Over the serial interface, the value is sent in psia, 13.1 to 15.99 psia (about 903 to 1102 mbar), with command `Z, A`.

Recalibration

Have the meter recalibrated once a year. Calibration must be carried out by the manufacturer's calibration laboratory or by a calibration facility it has authorised and trained. Contact Analyt-MTC to arrange recalibration, and give the serial number of the meter (see Service, warranty and contacts (p. 41)). The meter counts the hours since its last calibration; you can read the counter with command `C,T` (p. 25).

CHAPTER 8

Maintenance

A DPM that measures clean, dry, filtered gas needs no routine maintenance apart from its yearly calibration. This chapter covers what to do when the flow path is blocked; how to trace the most common faults is described in Troubleshooting (p. 33).

Blocked flow path

The narrow stainless-steel channels of the laminar flow element block easily — with particles, or with deposits from a gas that crystallises. If the meter reads low or does not respond to flow, look into the inlet and outlet ports for debris and remove what you can reach. If the blockage remains, send the meter to Analyt-MTC for cleaning (see Service, warranty and contacts (p. 41)).

NOTICE

Dismantling the meter can upset its calibration, and the electronics contain components that static electricity can destroy. After the flow element and flow paths have been cleaned, the meter must be recalibrated. Do not take the meter apart.

CHAPTER 9

Troubleshooting

Many faults have simple causes. Check these first:

- Are all cables connected correctly, and does your cable follow the pin functions of the meter (p. 12)? Cables made for other manufacturers' equipment are often wired differently.
- Is the installation free of leaks?
- Does the power supply meet the requirements (p. 12), including the current for all meters connected to it?
- Is there enough pressure difference across the meter for the flow you expect?

Then look up your symptom below. If the problem remains, contact Analyt-MTC with the information listed under Before you call (p. 41).

Power, display and outputs

Symptom	Cause and remedy
Status LED and display stay dark at power-up; the analogue output does not respond to flow	Measure the voltage between pins 7 (+) and 8 (–) of the Mini-DIN connector. If it is outside 9–26 V DC, replace the power supply. If it is negative, the polarity is reversed: correct the wiring. If the supply is correct, the electronics are defective: send the meter in for repair.
The display and the 0–5 V DC output fluctuate widely during measurement	The analogue output is short-circuited to ground or overloaded. Check the wiring on pins 6 (+) and 4 (–) and make sure the load is at least 5 kΩ.
The display is correct, but the 0–5 V DC output does not change (stays at one value or near zero)	The output scaling may be corrupted: recalibrate the analogue output (p. 20). If that does not help, the output circuit is damaged: send the meter in for repair.
The display and voltage output are correct, but the 4–20 mA output does not change (stays near 4 mA)	The loop is open or its resistance is too high. Check the wiring on pins 6 (+) and 4 (–) and keep the loop resistance at 500 Ω or below. Otherwise the output circuit is damaged: send the meter in for repair.
Diagnostic event 0 is active (CPU temperature too high)	Switch off the power. Make sure the ambient temperature is below 60 °C and let the meter cool down for at least 15 minutes. Switch on and check the event again; if it returns, send the meter in for repair.
The status LED is steady red	Fatal error (memory or auto zero). Switch the power off and on. If the LED is still red, wait one minute and start an auto zero (p. 30). If the error comes back after the zero, send the meter in for repair.

Flow readings

Symptom	Cause and remedy
The meter does not read zero when no gas flows	The zero is wrong. Run an auto zero (p. 30).
The readings are off by more than ±0.5 % FS	The zero has shifted. Shut off the flow, disconnect the gas source so that nothing leaks through either port, wait one minute and run an auto zero.
A reading on the display flashes	The value is beyond the range of its sensor — for example a flow above 133 % FS. Bring it back within the limits; until then, neither this value nor the mass flow is accurate. If the values are within the limits, a sensor or the electronics are defective: send the meter in for repair.
Gas flows, but the display and the output do not respond	The flow may be too small for this model: check the full-scale range on the front label. Otherwise the differential pressure sensor or the electronics are defective: send the meter in for repair.

Symptom	Cause and remedy
The display shows a negative flow and the 0–5 V DC output stays near 1 mV while gas flows	The gas flows against the arrow on the front: reverse the connections. Or the meter is under back pressure and there is a leak in the system: find and repair it. If the leak is inside the meter, send it in for repair.
The flow reading is unstable or jumps	The meter reacts within 20 ms and so shows flow pulsations, for example from a diaphragm pump or a faulty pressure regulator; the averaging of the signal conditioner (p. 21) can be increased. Also check the upstream connection for debris such as shreds of PTFE tape.
The DPM disagrees with another meter in the same line by more than their combined accuracy	Check that both are set to the same gas and to the same standard conditions (p. 18), and that the line between them has no leak.

Serial communication

Symptom	Cause and remedy
The meter does not answer the computer	• Check the interface type: press the push-button briefly and count the amber flashes (p. 24). • Check that the baud rate of the meter and the computer match (p. 19). • RS-485: check the address and the ! start character; RS-232: send neither. • Check the cable: RS-232 needs a crossover connection (p. 14).
The meter answers with a number from 1 to 8	The command was not accepted; see Error codes (p. 29).

CHAPTER 10

Specifications

Data for standard Aalborg DPM meters. The gas, the full-scale range and the calibration conditions of your meter are on its label and calibration documents, which take precedence.

Performance

Table 10-1 Measurement

Accuracy, including linearity	±0.5 % of reading + 0.2 % of full scale at calibration temperature and pressure
Repeatability	±0.15 % FS
Measuring range, turndown	0.5–100 % FS, 200:1
Maximum measurable flow	133 % FS
Temperature coefficient	0.05 % FS per °C or less
Pressure coefficient	0.01 % FS per psi (6.895 kPa) or less
Response time	10 ms as delivered, adjustable
Warm-up time	< 5 s
Calibration conditions	14.7 psia (101.4 kPa) and 21.1 °C (70 °F), unless otherwise ordered
Reference conditions (STP)	21.11 °C, 1013.25 mbar; for others, ask Analyt-MTC; adjustable (p. 18)
Gases	Built-in gas list (Appendix B (p. 45)) and up to 20 user mixtures of 2–5 gases

Models and flow ranges

Table 10-2 Flow ranges, process connections and pressure drop (air, 21.11 °C, 1013.25 mbar)

Model	Full-scale range	Process connection	Pressure drop at full scale
STANDARD PRESSURE DROP			
DPM07	0.5–50 smL/min	10-32 female thread	68.9 mbar (1.0 psid)
DPM17	51 smL/min – 20 sL/min	1/8" NPT female	68.9 mbar (1.0 psid)
DPM37	21–50 sL/min	1/4" NPT female[1]	137.9 mbar (2.0 psid)
DPM47	51–100 sL/min	1/4" NPT female	172.4 mbar (2.5 psid)
DPM57	101–250 sL/min	1/2" NPT female	379.2 mbar (5.5 psid)
DPM67	251–500 sL/min	3/4" NPT female	379.2 mbar (5.5 psid)
DPM77	501–1000 sL/min	3/4" NPT female	482.6 mbar (7.0 psid)
CORROSION-RESISTANT			
DPM08	0.5–50 smL/min	10-32 female thread	68.9 mbar (1.0 psid)
DPM18	51 smL/min – 20 sL/min	1/8" NPT female	68.9 mbar (1.0 psid)
DPM38	21–50 sL/min	1/4" NPT female[1]	137.9 mbar (2.0 psid)
DPM48	51–100 sL/min	1/4" NPT female	172.4 mbar (2.5 psid)
DPM58	101–250 sL/min	1/2" NPT female	379.2 mbar (5.5 psid)
DPM68	251–500 sL/min	3/4" NPT female	379.2 mbar (5.5 psid)
DPM78	501–1000 sL/min	3/4" NPT female	482.6 mbar (7.0 psid)

Model	Full-scale range	Process connection	Pressure drop at full scale
LOW PRESSURE DROP			
DPM04	0.5–20 smL/min	10-32 female thread	4.1 mbar (0.06 psid)
DPM14	21 smL/min – 2 sL/min	1/8" NPT female	4.8 mbar (0.07 psid)
DPM24	2.1–10 sL/min	1/4" NPT female	5.9 mbar (0.085 psid)
DPM34	10.1–20 sL/min	1/4" NPT female	20.7 mbar (0.3 psid)
DPM44	20.1–40 sL/min	1/2" NPT female[1]	10.3 mbar (0.15 psid)
DPM54	40.1–100 sL/min	3/4" NPT female	17.2 mbar (0.25 psid)

Pressure drop at the top of each range; for the DPM07 and DPM17, at flows up to 20 sL/min. Pressure limits: Table 3-1, p. 10. [1] Thread size differs between the manufacturer's documents: check the ports of your meter or ask Analyt-MTC before ordering fittings.

Table 10-3 Maximum pressure drop (air)

Model	Flow (sL/min)	Max. pressure drop (mm H_2O)	(psid)	(kPa)
STANDARD AND CORROSION-RESISTANT				
DPM07, DPM08, DPM17, DPM18	up to 20	703	1.0	6.894
DPM37, DPM38	30	1406	2.0	13.789
	40	1406	2.0	13.789
	50	1406	2.0	13.789
DPM47, DPM48	60	1757	2.5	17.236
	100	1757	2.5	17.236
DPM57, DPM58	200	3867	5.5	37.92
DPM67, DPM68	500	3867	5.5	37.92
DPM77, DPM78	1000	4921	7.0	48.26
LOW PRESSURE DROP				
DPM04	0.02	42.2	0.06	0.413
DPM14	2	49.2	0.07	0.483
DPM24	10	59.8	0.085	0.586
DPM34	20	210.9	0.3	2.068
DPM44	40	105.5	0.15	1.034
DPM54	100	175.8	0.25	1.724

Operating conditions

Operating temperature	−10 to +60 °C (14–140 °F)
Gas humidity	0–100 % relative, non-condensing
Mounting position	Any; no sensitivity to position
Ingress protection	IP40
Environment (IEC 664)	Installation category II, pollution degree 2
Line pressure, differential pressure	See Table 3-1 (p. 10)

Materials

Wetted parts: stainless steel, FKM O-rings, high-temperature polyamide, alumina ceramic, epoxy, silicone, glass and gold. The manufacturer gives no guarantee that these materials resist a particular

gas; choosing a model whose materials suit your gas is the user's responsibility. Ask Analyt-MTC if you are unsure.

Electrical data

Supply voltage	9–26 V DC, ripple < 150 mV peak-to-peak; at least 12 V DC with 4–20 mA output
Current consumption	100 mA maximum
Protection	Reverse polarity protection; 300 mA resettable fuse
Analogue output	0–5 V DC (load ≥ 5 kΩ), 0–10 V DC (load ≥ 5000 Ω) or 4–20 mA (loop ≤ 500 Ω), selectable; noise ≤ 10 mV peak-to-peak on voltage outputs
Relay	Solid-state, SPST normally open; 48 V AC peak or DC, 400 mA
Digital interface	RS-232 or RS-485, selectable; Modbus RTU over a separate isolated RS-485 port (option)
Display	128 × 64 pixel yellow OLED with joystick and Esc button (option)
Connectors	8-pin Mini-DIN, DC power jack, 3.5 mm stereo jack, RJ-45 (Modbus option)
EMC	Directive 2014/30/EU; CISPR 11; emission EN 61000-6-3, group 1, class A; immunity EN 61000-6-1, EN 61000-4-2, EN 61000-4-3

Dimensions and weights

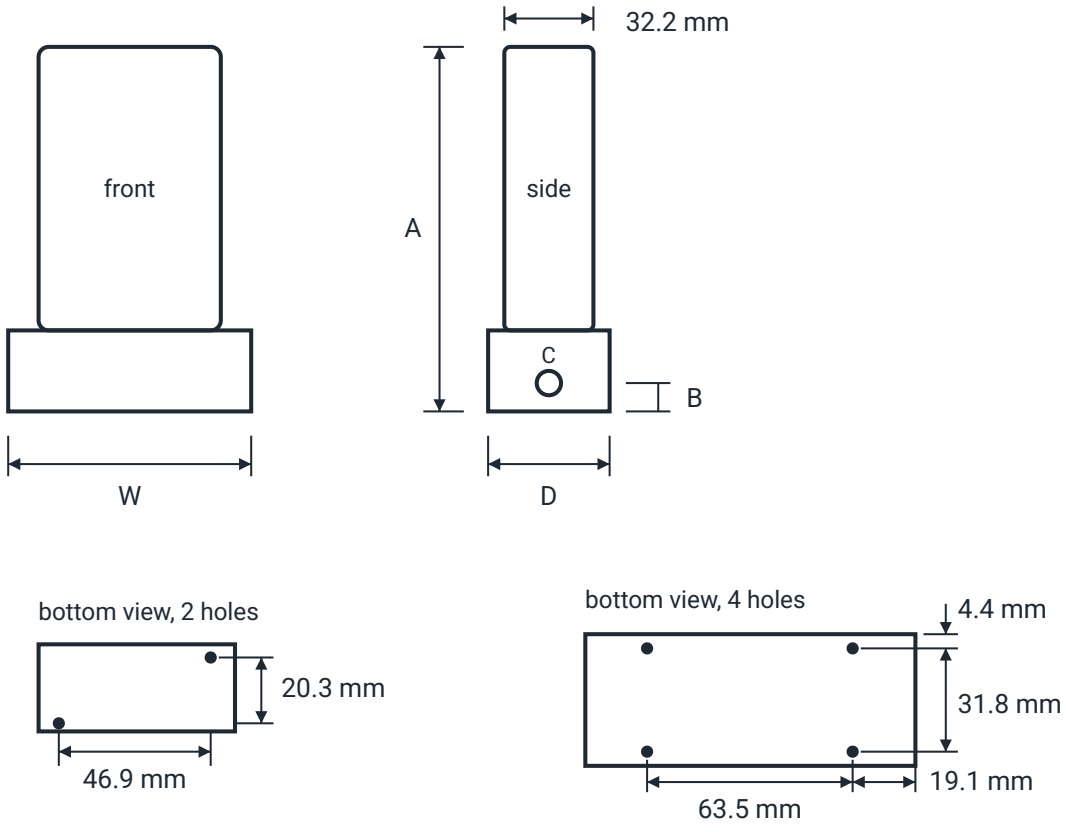


Figure 10-1. Dimensions (mounting holes: Table 10-4): A height, B height of the port centre above the base, C process port (Table 10-2), W width of the base, D depth of the base. The housing above the base is 32.2 mm deep on all models. The bottom views give the position of the mounting holes.

Table 10-4 Dimensions in mm

Models	A	A, corrosion-resistant	B	W	D	Mounting holes in the base
DPM04, DPM07, DPM08	111.8	126.5	8.5	60.4	26.7	2 × 6-32 UNC, 0.170" deep, 46.9 mm apart
DPM14, DPM17, DPM18	116.2	130.4	8.9			
DPM24	127.0	–	8.9			
DPM34, DPM37, DPM38	123.2	143.5	12.3	101.6	40.6	4 × 8-32 UNC, 0.300" deep, 63.5 × 31.8 mm pattern
DPM44, DPM47, DPM48	132.2	143.5	12.3			
DPM54, DPM57, DPM58, DPM67, DPM68	139.1	159.5	20.3			
DPM77, DPM78	139.1	159.5	20.3			

Table 10-5 Weights

Models	Meter	Shipping weight
DPM04, DPM07, DPM14, DPM17	0.40 kg (0.85 lb)	1.20 kg (2.55 lb)
DPM34, DPM37, DPM44, DPM47	0.52 kg (1.15 lb)	1.36 kg (3.0 lb)
DPM24		Ask Analyt-MTC
DPM54, DPM57	1.60 kg (3.5 lb)	2.32 kg (5.1 lb)
DPM67	2.04 kg (4.5 lb)	3.04 kg (6.7 lb)
DPM77	2.35 kg (5.2 lb)	3.97 kg (8.75 lb)
DPM08, DPM18, DPM38, DPM48, DPM58, DPM68, DPM78		Ask Analyt-MTC

CHAPTER 11

Ordering information

Order from Analyt-MTC with the order codes. The meters below are the standard versions; for any other version, contact Analyt-MTC. Ranges are for air at standard conditions (21.11 °C, 1013.25 mbar).

Accessories

Order code	Description
CBL-A232	RS-232 cable, 3.5 mm stereo plug to 9-pin D-sub socket, 1.5 ft (supplied with RS-232 meters)
CBL-A485	RS-485 cable, 3.5 mm stereo plug to stripped wires, 3 ft
CBL-8MINIDIN-3	Shielded 8-pin Mini-DIN cable with stripped ends, 3 ft
CBL-8MMINIDIN-12	Shielded 8-pin Mini-DIN cable with stripped ends, 12 ft
USB-RS232	USB to RS-232 converter
USB-RS485	USB to RS-485 converter
PS-GFM-240UK-2	Power supply 240 V AC / 12 V DC, UK plug
PS-USA	Power supply 110 V AC / 12 V DC, North America
PS-GFM-110NA-4	Power supply 110 V AC / 24 V DC, North America
PS-GFM-230EU-2	Power supply 220 V AC / 12 V DC, European plug
PS-GFM-230EU-4	Power supply 220 V AC / 24 V DC, European plug
ECS803-1	RJ45 shielded Y adapter (passive tap), for the Modbus option
TDG1026-8C	RJ45 modular coupler, for the Modbus option
MOD27T	RJ45 line terminator, 100 Ω, 0.25 W, for the Modbus option
JMOD4S-1	RJ45 splitter, fully shielded, 1 input and 4 outputs, for the Modbus option
TRD815BL-2	Category 5e patch cable, RJ45 to RJ45, blue, 2 ft
TRD815BL-10	Category 5e patch cable, RJ45 to RJ45, blue, 10 ft
TRD815BL-25	Category 5e patch cable, RJ45 to RJ45, blue, 25 ft
F1C5	Compression fitting, 10-32 thread, 1/8 in tube, 316 stainless steel (DPM04, DPM07, DPM08)
F2C5	Compression fitting, 10-32 thread, 1/8 in tube, nickel-plated brass (DPM04, DPM07)
F2C2	Compression fitting, 1/8 in NPT thread, 1/8 in tube, 316 stainless steel (DPM14, DPM17, DPM18)
F2C4	Compression fitting, 1/8 in NPT thread, 1/4 in tube, 316 stainless steel (DPM14, DPM17, DPM18)
F4C4	Compression fitting, 1/4 in NPT thread, 1/4 in tube, 316 stainless steel (DPM34, DPM37, DPM38)
F4C6	Compression fitting, 1/4 in NPT thread, 3/8 in tube, 316 stainless steel (DPM24, DPM34, DPM47, DPM48)
F8C6	Compression fitting, 1/2 in NPT thread, 3/8 in tube, 316 stainless steel (DPM44, DPM57, DPM58)
1210-1-12-316	Compression fitting, 3/4 in NPT thread, 3/4 in tube, 300 series stainless steel (DPM54, DPM67, DPM68, DPM77, DPM78)

Filters: ask Analyt-MTC.

Meters

		Without display, order code		With display, order code	
Model	Range	without Modbus	with Modbus	without Modbus	with Modbus
DPM04	0.5–20 smL/min	DPM04-N0	DPM04-NM	DPM04-L0	DPM04-LM
DPM07	0.5–50 smL/min	DPM07-N0	DPM07-NM	DPM07-L0	DPM07-LM
DPM14	21 smL/min – 2 sL/min	DPM14-N0	DPM14-NM	DPM14-L0	DPM14-LM
DPM17	51 smL/min – 20 sL/min	DPM17-N0	DPM17-NM	DPM17-L0	DPM17-LM
DPM24	2.1–10 sL/min	DPM24-N0	DPM24-NM	DPM24-L0	DPM24-LM
DPM34	10.1–20 sL/min	DPM34-N0	DPM34-NM	DPM34-L0	DPM34-LM
DPM37	21–50 sL/min	DPM37-N0	DPM37-NM	DPM37-L0	DPM37-LM
DPM44	20.1–40 sL/min	DPM44-N0	DPM44-NM	DPM44-L0	DPM44-LM
DPM47	51–100 sL/min	DPM47-N0	DPM47-NM	DPM47-L0	DPM47-LM
DPM54	40.1–100 sL/min	DPM54-N0	DPM54-NM	DPM54-L0	DPM54-LM
DPM57	101–250 sL/min	DPM57-N0	DPM57-NM	DPM57-L0	DPM57-LM
DPM67	251–500 sL/min	DPM67-N0	DPM67-NM	DPM67-L0	DPM67-LM
DPM77	501–1000 sL/min	DPM77-N0	DPM77-NM	DPM77-L0	DPM77-LM

CHAPTER 12

Service, warranty and contacts

Calibration, repair, cleaning and technical support for your DPM go through Analyt-MTC. Talk to Analyt-MTC before you send anything: many problems turn out to be settings that can be corrected on the phone.

Contact and support

ANALYT-MTC Messtechnik GmbH

German Headquarters

Klosterrunsstraße 18, 79379 Müllheim
Germany

+49 7631 5545

info@analyt-mtc.de

French Subsidiary

175 Avenue d'Alsace, 68000 Colmar
France

+33 3 89 41 47 78

info@analyt-mtc.fr

www.analyt-mtc.com

Before you call

Have the following at hand so that Analyt-MTC can help you quickly:

- the model and serial number from the labels on the meter;
- the firmware version shown at power-up (Fw line, see p. 15);
- your gas, flow and line pressure, and any active alarm or diagnostic event codes.

Technical support

Analyt-MTC application engineers help with installation, configuration, alarms, totalisers and serial communication. Have the model, the serial number and the firmware version at hand, together with a description of your process: gas, flow, line pressure, and any active alarm or diagnostic event codes (p. 23).

The contact details are given above and on the back cover.

Open and follow every service request in the Analyt-MTC customer portal at portal.analyt-mtc.com: where your meter is in the process, and, once the work is done, its certificates, digitally signed.

Sending in a meter

1. **Open a service request.** Open it online in the Analyt-MTC customer portal, portal.analyt-mtc.com, with the model, the serial number and the reason for service: calibration, repair or cleaning. Do not put paper forms in the box: the service request carries everything Analyt-MTC needs.

> **⚠ WARNING**
>
> A meter that has carried hazardous media holds residues. Residues endanger the people who unpack and service it. Never send in such a meter without purging and neutralising it.

2. **Decontaminate.** Flush out every residue of toxic, corrosive, infectious or radioactive media and tell Analyt-MTC which gases the meter has carried. In the service request, state the substances the meter has been in contact with and their hazards, and confirm the safety declaration online. If you are not sure, do not send it.
3. **Pack the meter alone.** Send the meter without power supply, cables, fittings or case unless they are part of the problem; Analyt-MTC is not responsible for accessories sent. Close the process ports so that nothing enters the flow path, protect the connectors against electrostatic discharge, and pack each meter individually for transport.
4. **Ship it to Müllheim.** Send the parcel to the Analyt-MTC service centre in Müllheim, Germany, never to the Colmar address.

When the meter arrives, it is registered and assessed, and you receive a quote before any work begins: no work is done without your agreement. If you decline the quote, a bench fee and return transport are charged. Every instrument passes a final check before it is returned with its documentation. A standard service typically takes one to two weeks from arrival to dispatch; this lead time is indicative. Express service can be requested in the service request.

Warranty

The warranty terms for your meter are those agreed in your order confirmation. Warranty claims are handled by Analyt-MTC: give it the serial number and a description of the fault before returning the meter.

Disposal

Do not dispose of the meter with household waste. Dispose of it as electrical and electronic equipment under local regulations (WEEE). Remove batteries first where fitted and dispose of them separately.

APPENDIX A

Units of measure

These are the units you can select under Units of measure (p. 17) or send with the unit commands (p. 25). Write them over the serial interface as shown in the first column. Standard units (S) refer to the standard conditions, normal units (N) to the normal conditions (see Reference conditions, p. 18); true mass units do not depend on them. The totalisers use the volume or mass unit that belongs to the selected flow unit.

A-1 Mass flow units

Flow unit	Total	Unit
PERCENT		
%FS	%s	Percent of full scale
STANDARD		
SuL/min	SuL	Microlitres per minute
SmL/sec	SmL	Millilitres per second
SmL/min	SmL	Millilitres per minute
SmL/hr	SmL	Millilitres per hour
SL/sec	SL	Litres per second
SL/min	SL	Litres per minute
SL/hr	SL	Litres per hour
SL/day	SL	Litres per day
Sm3/min	Sm3	Cubic metres per minute
Sm3/hr	Sm3	Cubic metres per hour
Sm3/day	Sm3	Cubic metres per day
Sf3/sec	Sf3	Cubic feet per second
Sf3/min	Sf3	Cubic feet per minute
Sf3/hr	Sf3	Cubic feet per hour
Sf3/day	Sf3	Cubic feet per day
TRUE MASS		
gr/sec	gr	Grams per second
gr/min	gr	Grams per minute
gr/hr	gr	Grams per hour
gr/day	gr	Grams per day
kg/min	kg	Kilograms per minute
kg/hr	kg	Kilograms per hour
kg/day	kg	Kilograms per day
lb/min	lb	Pounds per minute
lb/hr	lb	Pounds per hour
lb/day	lb	Pounds per day
oz/sec	oz	Ounces per second
oz/min	oz	Ounces per minute
NORMAL		
NuL/min	NuL	Microlitres per minute
NmL/sec	NmL	Millilitres per second
NmL/min	NmL	Millilitres per minute
NmL/hr	NmL	Millilitres per hour
NL/sec	NL	Litres per second
NL/min	NL	Litres per minute
NL/hr	NL	Litres per hour
NL/day	NL	Litres per day
Nm3/min	Nm3	Cubic metres per minute
Nm3/hr	Nm3	Cubic metres per hour
Nm3/day	Nm3	Cubic metres per day
Nf3/sec	Nf3	Cubic feet per second
Nf3/min	Nf3	Cubic feet per minute
Nf3/hr	Nf3	Cubic feet per hour
Nf3/day	Nf3	Cubic feet per day
USER-DEFINED		
USER	U	User-defined unit (p. 17)

A-2 Volumetric flow units

Flow unit	Total	Unit
%FS	%s	Percent of full scale
uL/min	uL	Microlitres per minute
mL/sec	mL	Millilitres per second
mL/min	mL	Millilitres per minute
mL/hr	mL	Millilitres per hour
L/sec	L	Litres per second
L/min	L	Litres per minute
L/hr	L	Litres per hour
L/day	L	Litres per day
m3/min	m3	Cubic metres per minute
m3/hr	m3	Cubic metres per hour
m3/day	m3	Cubic metres per day
f3/sec	f3	Cubic feet per second
f3/min	f3	Cubic feet per minute
f3/hr	f3	Cubic feet per hour
f3/day	f3	Cubic feet per day

A-3 Pressure units (absolute)

Unit	Description
PSIA	Pound-force per square inch
barA	Bar
mbarA	Millibar
hPaA	Hectopascal
kPaA	Kilopascal
MPaA	Megapascal
atm	Standard atmosphere
g/cm2A	Gram-force per square centimetre
kg/cm2A	Kilogram-force per square centimetre
inHgA	Inch of mercury at 0 °C
mmHgA	Millimetre of mercury at 0 °C
cmH2OA	Centimetre of water at 4 °C
inH2OA	Inch of water at 4 °C
TorrA	Torr
%FS	Percent of the pressure sensor's full scale

A-4 Temperature units

Unit	Command	Description
°F	F	Degree Fahrenheit
°C	C	Degree Celsius
K	K	Kelvin
°R	R	Degree Rankine

APPENDIX B

Gas list

These gases can be selected under Selecting the gas (p. 18) or with the command `G,n` (p. 25), where n is the number in the first column. On the display they appear in the groups shown here; the short name is the one the meter displays and returns over the serial interface. Any of these gases can also be a component of a user-defined mixture (p. 18). If your gas is not listed, ask Analyt-MTC whether the meter is suitable. The groups Pure corrosives and Refrigerants (gases 129 to 162) are supported only by the corrosion-resistant models DPM08, DPM18, DPM38, DPM48, DPM58, DPM68 and DPM78.

#	Short name	Composition
STANDARD GASES		
0	Air	Air
1	Ar	Argon
2	CO_2	Carbon Dioxide
3	N_2	Nitrogen
4	O_2	Oxygen
5	He	Helium
6	CO	Carbon Monoxide
7	C_2H_4	Ethylene
8	C_2H_6	Ethane
9	n-C_4H_{10}	n-Butane
10	i-C_4H_{10}	i-Butane
11	C_3H_8	Propane
12	D_2	Deuterium
13	H_2	Hydrogen
14	N_2O	Nitrous Oxide
15	CH_4	Methane
16	Ne	Neon
17	Kr	Krypton
18	SF_6	Sulfur Hexafluoride
19	Xe	Xenon
20	C_2H_2	Acetylene
21	C25	25 % CO_2 / 75 % Ar
22	C10	10 % CO_2 / 90 % Ar
23	C8	8 % CO_2 / 92 % Ar
24	C2	2 % CO_2 / 98 % Ar
25	C75	75 % CO_2 / 25 % Ar
26	He75	75 % He / 25 % Ar
27	He25	25 % He / 75 % Ar
28	A1025	90 % He / 7.5 % Ar / 2.5 % CO_2
29	Star29	Stargon CS 90 % Ar / 8 % CO_2 / 2 % O_2
30	P5	95 % Ar / 5 % CH_4

#	Short name	Composition
BIOREACTOR GASES		
36	Bio-5M	5 % CH_4 / 95 % CO_2
37	Bio-10M	10 % CH_4 / 90 % CO_2
38	Bio-15M	15 % CH_4 / 85 % CO_2
39	Bio-20M	20 % CH_4 / 80 % CO_2
40	Bio-25M	25 % CH_4 / 75 % CO_2
41	Bio-30M	30 % CH_4 / 70 % CO_2
42	Bio-35M	35 % CH_4 / 65 % CO_2
43	Bio-40M	40 % CH_4 / 60 % CO_2
44	Bio-45M	45 % CH_4 / 55 % CO_2
45	Bio-50M	50 % CH_4 / 50 % CO_2
46	Bio-55M	55 % CH_4 / 45 % CO_2
47	Bio-60M	60 % CH_4 / 40 % CO_2
48	Bio-65M	65 % CH_4 / 35 % CO_2
49	Bio-70M	70 % CH_4 / 30 % CO_2
50	Bio-75M	75 % CH_4 / 25 % CO_2
51	Bio-80M	80 % CH_4 / 20 % CO_2
52	Bio-85M	85 % CH_4 / 15 % CO_2
53	Bio-90M	90 % CH_4 / 10 % CO_2
54	Bio-95M	95 % CH_4 / 5 % CO_2
BREATHING GASES		
56	EAN-32	32 % O_2 / 68 % N_2
57	EAN-36	36 % O_2 / 64 % N_2
58	EAN-40	40 % O_2 / 60 % N_2
59	HeOx-20	20 % O_2 / 80 % He
60	HeOx-21	21 % O_2 / 79 % He
61	HeOx-30	30 % O_2 / 70 % He
62	HeOx-40	40 % O_2 / 60 % He
63	HeOx-50	50 % O_2 / 50 % He
64	HeOx-60	60 % O_2 / 40 % He
65	HeOx-80	80 % O_2 / 20 % He
66	HeOx-99	99 % O_2 / 1 % He
67	EA-40	Enriched air, 40 % O_2
68	EA-60	Enriched air, 60 % O_2
69	EA-80	Enriched air, 80 % O_2

#	Short name	Composition
70	Metabol	Metabolic Exhalant (16 % O_2 / 78.04 % N_2 / 5 % CO_2 / 0.96 % Ar)
CHROMATOGRAPHY GASES		
71	P-5	5 % CH_4 / 95 % Ar
72	P-10	10 % CH_4 / 90 % Ar
FUEL GASES		
74	SynG-1	40 % H_2 / 29 % CO / 20 % CO_2 / 11 % CH_4
75	SynG-2	64 % H_2 / 28 % CO / 1 % CO_2 / 7 % CH_4
76	SynG-3	70 % H_2 / 4 % CO / 25 % CO_2 / 1 % CH_4
77	SynG-4	83 % H_2 / 14 % CO / 3 % CH_4
78	NatG-1	93 % CH_4 / 3 % C_2H_6 / 1 % C_3H_8 / 2 % N_2 / 1 % CO_2
79	NatG-2	95 % CH_4 / 3 % C_2H_6 / 1 % N_2 / 1 % CO_2
80	NatG-3	95.2 % CH_4 / 2.5 % C_2H_6 / 0.2 % C_3H_8 / 0.1 % n-C_4H_{10} / 1.3 % N_2 / 0.7 % CO_2
81	Coal Gas	50 % H_2 / 35 % CH_4 / 10 % CO / 5 % C_2H_4
82	Endo	75 % H_2 / 25 % N_2
83	HHO	66.67 % H_2 / 33.33 % O_2
84	HD-5	LPG 96.2 % C_3H_8 / 1.5 % C_2H_6 / 0.4 % C_3H_6 / 1.9 % n-C_4H_{10}
85	HD-10	LPG 85 % C_3H_8 / 10 % C_3H_6 / 5 % n-C_4H_{10}
LASER GASES		
89	LG-4.5	4.5 % CO_2 / 13.5 % N_2 / 82 % He
90	LG-6	6 % CO_2 / 14 % N_2 / 80 % He
91	LG-7	7 % CO_2 / 14 % N_2 / 79 % He

#	Short name	Composition
92	LG-9	9 % CO_2 / 15 % N_2 / 76 % He
93	HeNe-9	9 % Ne / 91 % He
94	LG-9.4	9.4 % CO_2 / 19.25 % N_2 / 71.35 % He
O_2 CONCENTRATOR GASES		
99	OCG-89	89 % O_2 / 7 % N_2 / 4 % Ar
100	OCG-93	93 % O_2 / 3 % N_2 / 4 % Ar
101	OCG-95	95 % O_2 / 1 % N_2 / 4 % Ar
STACK GASES		
104	FG-1	2.5 % O_2 / 10.8 % CO_2 / 85 % N_2 / 1 % Ar
105	FG-2	2.9 % O_2 / 14 % CO_2 / 82.1 % N_2 / 1 % Ar
106	FG-3	3.7 % O_2 / 15 % CO_2 / 80.3 % N_2 / 1 % Ar
107	FG-4	7 % O_2 / 12 % CO_2 / 80 % N_2 / 1 % Ar
108	FG-5	10 % O_2 / 9.5 % CO_2 / 79.5 % N_2 / 1 % Ar
109	FG-6	13 % O_2 / 7 % CO_2 / 79 % N_2 / 1 % Ar
WELDING GASES		
114	C-2	2 % CO_2 / 98 % Ar
115	C-8	8 % CO_2 / 92 % Ar
116	C-10	10 % CO_2 / 90 % Ar
117	C-15	15 % CO_2 / 85 % Ar

#	Short name	Composition
118	C-20	20 % CO_2 / 80 % Ar
119	C-25	25 % CO_2 / 75 % Ar
120	C-50	50 % CO_2 / 50 % Ar
121	C-75	75 % CO_2 / 25 % Ar
122	He-25	25 % He / 75 % Ar
123	He-50	50 % He / 50 % Ar
124	He-75	75 % He / 25 % Ar
125	He-90	90 % He / 10 % Ar
126	A1025	90 % He / 7.5 % Ar / 2.5 % CO_2
127	Star29	Stargon CS 90 % Ar / 8 % CO_2 / 2 % O_2
PURE CORROSIVES (CORROSION-RESISTANT MODELS ONLY)		
129	NH_3	Ammonia
130	1Butene	Butylene (1-Butene)
131	cButene	Cis-Butene (cis-2-butene)
132	iButene	Iso-Butene
133	tButene	Trans-Butene
134	COS	Carbonyl Sulfide
135	Cl_2	Chlorine
136	CH_3OCH_3	Dimethylether
137	H_2S	Hydrogen Sulfide
138	NF_3	Nitrogen Trifluoride
139	NO	Nitric Oxide
140	C_3H_6	Propylene
141	SiH_4	Silane

#	Short name	Composition
142	SO_2	Sulfur Dioxide
REFRIGERANTS (CORROSION-RESISTANT MODELS ONLY)		
145	R-11	Trichlorofluoromethane
146	R-115	Chloropentafluoroethane
147	R-116	Hexafluoroethane
148	R-124	1-Chloro-1,2,2,2-tetrafluoroethane
149	R-125	Pentafluoroethane
150	R-134A	1,1,1,2-Tetrafluoroethane
151	R-14	Tetrafluoromethane
152	R-142b	1-Chloro-1,1-difluoroethane
153	R-143a	1,1,1-Trifluoroethane
154	R-152a	1,1-Difluoroethane
155	R-22	Chlorodifluoromethane
156	R-23	Trifluoromethane
157	R-32	Difluoromethane
158	RC-318	Octafluorocyclobutane
159	R-404A	44 % R-125 / 4 % R-134a / 52 % R-143a
160	R-407C	23 % R-32 / 25 % R-125 / 52 % R-134a
161	R-410A	50 % R-32 / 50 % R-125
162	R-507A	50 % R-125 / 50 % R-143a

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