ANALYT MESSTECHNIK



COMMUNICATION GUIDE

358 Series serial interface (RS-232/RS-485)

RS-232 / RS-485 command reference for 358 Series mass flow meters and controllers, pressure gauges and controllers, and liquid flow devices.

AMTC-CG-0002

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About this guide

This guide explains how to operate 358 Series mass flow meters, mass flow controllers, pressure gauges, pressure controllers and liquid flow devices through their RS-232 or RS-485 serial interface. It covers the commands you need for day-to-day work — reading data, changing the gas, sending set points, taring — and the less common commands for configuring control loops, totalisers, units and the device itself.

If you are new to serial communication with 358 Series devices, read Interface and wiring (p. 6) and Protocol conventions (p. 7) first. If you already know the command set, go straight to the Quick command reference (p. 10).

The guide describes the most common features and settings. If your application needs a function that is not covered here, the Analyt-MTC application engineers will be glad to help.

Conventions in this guide:

- Keys, buttons and menu entries are printed like this: **Enter**.
- Commands you send and replies the device returns are set in monospace type, for example `AG 8`.

Abbreviations

Abbreviation	Meaning
ASCII	American Standard Code for Information Interchange
CR	Carriage return
ID	Identifier
NTP	Normal temperature and pressure
STP	Standard temperature and pressure

Safety notices in this guide

NOTICE

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

Note
Information that helps understanding; never a hazard.

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Before you call

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

- the model and serial number of the device (label, or the manufacturing info (p. 27) command);

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- the firmware version (firmware version (p. 27) command);
- the exact command you sent and the response you received.

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

Devices covered

All 358 Series instruments share one serial command set. Which commands a device accepts depends on what it measures and whether it controls:

- **Mass flow meters and controllers** (gas) — every flow, gas and totaliser command, and every command for standard conditions (STP) and normal conditions (NTP).
- **Liquid flow meters and controllers** — flow and totaliser commands; gas commands do not apply.
- **Pressure gauges and controllers** — pressure, tare and control commands; flow and gas commands do not apply.

A device ignores, or answers with a question mark (?), any command that does not apply to it: a meter does not accept a set point, a pressure gauge does not tare flow. Each command in this guide states the devices it applies to.

Firmware versions

The firmware of 358 Series devices has evolved over the years. Each generation stores more information and adds commands; older commands keep working. Firmware versions are written as a major number, the letter **v** and a minor number — `10v05` is generation 10, release 05.

To find the firmware of your device, open the device information on the display, or send the firmware version (p. 27) command.

Firmware	What to know
`GP`	The oldest circuit board. GP devices cannot be upgraded to any later firmware. Every command needs two extra characters, `$$`, directly after the unit ID — for example `A$$V` instead of `AV`.
`1v–7v`	A newer circuit board than GP. Devices with a serial number below 135000 have an older processor and can be upgraded up to 6v firmware only; devices above 135000 can be upgraded up to 7v.
`8v–9v`	Comparable circuit boards to each other. Devices on 7v or older cannot be upgraded to 8v or later. Existing commands are unchanged; new commands and functions were added.
`10v`	The newest circuit board and the current firmware generation. Existing commands are unchanged; new commands and functions were added. Devices on 9v or older cannot be upgraded to 10v.

Each command in this guide shows the firmware that introduced it, for example `10v05`. The command works on that version and every later one. Commands without a firmware tag work on all versions. If a command fails, first check that your device's firmware is at least the version shown.

How commands are written

Commands are shown in a monospace font. The fixed part of a command — the characters you type exactly as shown — is **`bold`**. Variables that you replace with your own values are `blue` and lower case:

```
unit_idG gas#
```

To select nitrogen (gas number 8) on the device with unit ID A, you type `AG 8` and press **`Enter`**. The command must be terminated by a carriage return (**`<CR>`**, ASCII 13), which is what the Enter key sends in a terminal program. Spaces separate the variables from the command and from each other.

Unless stated otherwise, commands are not case-sensitive — capitals are used here only to set the command apart from its variables. Where a command must be typed in capitals, its description says so.

Many commands both query and change a setting. Send the command without its variables (or with only the first ones, as described) to read the current setting; add the values to change it. When a command is not accepted, the device answers with a question mark (?).

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CHAPTER 1

Interface and wiring

Communication settings

Connect the device to a serial (COM) port of your computer, either directly over RS-232, over an RS-485 network, or through a USB adapter that creates a virtual COM port. The serial pins of the 8-pin Mini-DIN and the locking industrial connector are listed in Appendix D (p. 44).

Open the port in any terminal program, or from your own software, with these settings:

Baud rate	**19 200** (factory default; can be changed with the baud rate (p. 26) command)
Data bits	8
Parity	None
Stop bits	1
Flow control	None
Command terminator	Carriage return (**<CR>**, ASCII 13)

To find which COM port the device is on, open the *Ports (COM & LPT)* section of the Windows Device Manager, then plug the device or its adapter in and out: the port that appears and disappears is the one to use.

Unit ID

Up to 26 devices can share one COM port or virtual COM port. Each device on the port needs its own unit ID: a single letter from `A` to `Z`. The factory default is `A`, and every command starts with the unit ID of the device it is meant for.

When you connect several devices to the same port, give each one a different unit ID first. The easiest way is through the device display — see the operating manual of your device. Without a display, use the change unit ID (p. 27) command: connect one device, change its ID, then connect the next one. If two devices end up with the same ID, disconnect one of them and change the ID of the one still connected.

If you need more than 26 devices, use additional COM ports.

CHAPTER 2

Protocol conventions

Most commands are answered with a data frame: one line holding the unit ID followed by the device's current readings. Which values appear, in which order and in which units depends on the device model and its configuration. You can change the layout of the frame with serial commands — see configure data frame (p. 23).

The examples below show typical default frames.

Example 1 — a mass flow controller with totaliser, unit ID A, gas air, valve drive on hold (HLD).

A	+087.59	+025.00	+164.7	+981.6	985.0	022741.4	Air	HLD
Unit ID	Absolute pressure	Temperature	Volumetric flow	Mass flow	Set point	Totalized flow	Gas	Status code

Example 2 — a mass flow meter with unit ID B, measuring helium. A meter has no set point column.

B	+010.02	+025.00	+128.0	+87.2	He
Unit ID	Absolute pressure	Temperature	Volumetric flow	Mass flow	Gas

Example 3 — a liquid flow meter, unit ID C. It reports gauge pressure and has no mass flow or gas column.

C	+042.45	+018.66	+56.7
Unit ID	Gauge pressure	Temperature	Volumetric flow

Example 4 — a differential pressure gauge, unit ID D. A negative value means the pressure is higher on the downstream port; a positive value means it is higher upstream.

D	-05.62
Unit ID	Differential pressure

> **Note**
> Engineering units are not sent with the data frame, to save bandwidth. If you cannot see the device display, check the units with the query data frame (p. 25) command.

Polling mode

A device whose unit ID is a letter is in polling mode; this is the default. In polling mode the device sends nothing until it is asked. The most common request is a poll for the current readings: send the unit ID alone and the device answers with a data frame (p. 7).

Typing `A` **<CR>** `B` **<CR>** `C` **<CR>** polls devices A, B and C in turn; each answer begins with the unit ID of the device that sent it.

> **Note**
> Wait for each response before sending the next command. Software can send commands far faster than a person can type, and responses to commands sent in quick succession can run together into an unreadable string.

Streaming mode

The one unit ID that is not a letter is the at sign, `@`. A device with unit ID `@` is in streaming mode: it sends data frames continuously, without being asked. Streaming is useful when you want every reading the device produces, for example to log a fast process.

A streaming device still receives and understands commands, even though the incoming data may hide what you type. See start streaming (p. 14) and stop streaming (p. 14).

Note
The default streaming interval is 50 ms. Change it with the streaming rate (p. 29) command.

Note
A streaming device fills the line with data and disrupts communication with the other devices on a shared COM port. When several devices share a COM port, all of them must be in polling mode. As with letter IDs, only one device with ID `@` may be connected to a port at a time.

Sending a command to all devices

Note
A command sent with the asterisk changes the configuration of every connected device at the same time. Use the asterisk only when the change is meant for every device; to change one device, address it by its unit ID.

To send the same command to every device on a port at once, use an asterisk (*) in place of the unit ID — for example `*V` tares flow on all connected devices.

CHAPTER 3

Command and register reference

The complete command set: an overview of the advanced commands, the quick command reference, then the essential commands and the advanced commands in full.

Advanced commands configure control, readings, the device itself, gas mixtures, totalisers and valves. The overview below shows what each one does; the full descriptions follow the essential commands.

Control setup	Controllers	p. 16
Batch	Flow a set quantity, then stop.	
Deadband limit	How far the process may drift from the set point before the controller acts.	
Deadband mode	What the valves do while the process is inside the deadband.	
Control algorithm	Choose between the PD/PDF (proportional–derivative / pseudo-derivative feedback) and PD²I control algorithms.	
Control variable	Choose which reading the set point controls.	
Set point range	Read the control range; limit the allowed set points.	
Maximum ramp rate	How fast the controller moves to a new set point.	
PD/PDF gains	Tune the PD/PDF algorithm.	
PD²I gains	Tune the PD²I algorithm.	
Power-up set point	A set point applied as soon as the controller is switched on.	
Overpressure limit	A pressure that stops the flow when exceeded.	
Ramping options	When the ramp rate applies.	
Set point source	Where the set point comes from: analogue input, or display and serial.	
Valve offset	The valve drive at opening, and the drive below which a valve counts as closed.	
Zero pressure control	What a pressure controller does with a set point of zero.	
Data readings		p. 22
Auto-tare	Tare automatically at a zero set point (controllers).	
Configure data frame	Change the number format of the data frame.	
Engineering units	Read or change the units of a reading.	
Flow/pressure averaging	How long readings are averaged.	
Full-scale values	Read the measuring range.	
Power-up tare	Tare automatically at power-up.	
Query data frame	Show what each field of the data frame contains, and its units.	
STP/NTP pressure	Reference pressure for standard and normal flow (mass flow devices).	
STP/NTP temperature	Reference temperature for standard and normal flow (mass flow devices).	
Zero band	Readings below this level are reported as zero.	
Device setup		p. 26
Analogue output source	Choose what the analogue output represents.	
Baud rate	Read or change the serial speed.	
Blink display	Flash the backlight to identify a device.	
Change unit ID	Give the device a new unit ID.	
Firmware version	Read the firmware version.	
Lock / unlock display	Disable or enable the display buttons.	
Manufacturing info	Read model, serial number, calibration and manufacturing data.	
Remote tare actions	What happens when the remote tare pin is grounded.	

Restore factory settings Return all settings to their defaults.
User data Store or read your own text on the device.
Streaming rate Interval between streamed data frames.

Gas mixtures Mass flow devices p. 29
Create gas mixture Define a custom mixture of installed gases.
Delete gas mixture Remove a custom mixture.
Query gas mixture Read the composition of a custom mixture.

Totalisers Flow devices p. 31
Configure totaliser Enable, disable and set up either totaliser.
Reset totaliser Set the total back to zero.
Reset totaliser peak Clear the highest flow recorded since the last reset.
Save totaliser Keep the totals across a power cycle.

Valve control Controllers p. 32
Cancel valve hold Release all valve holds and resume control.
Exhaust Close the inlet valve and fully open the outlet valve (multi-valve controllers).
Hold valve(s) Hold the valves in their current position.
Hold valve(s) closed Close the valves and hold them closed.
Query valve drive Read how hard each valve is being driven.

Quick command reference

All commands at a glance, for readers who already know the command set. The last column gives the page with the full description.

Action	Devices	Firmware	Command	Page
DATA READINGS				
Poll device data	All		`unit_id`	13
Request averaged data	All	6v00	`unit_idDV time statistic1 … statistic13`	13
Start streaming	All		`unit_id@ @`	14
Stop streaming	All		`@@ new_unit_id`	14
Auto-tare	Controllers	10v05	`unit_idZCA enable delay`	22
Configure data frame	All	6v00	`unit_idFDF format`	23
Query data frame	All	6v00	`unit_id??D*`	25
Engineering units: query or change	All	10v05	`unit_idDCU statistic group unit override`	23
Flow/pressure averaging	All	10v05	`unit_idDCA statistic averaging_time`	24
Full-scale values	All	6v00	`unit_idFPF statistic unit`	24
Power-up tare	All	10v05	`unit_idZCP enable`	24
STP/NTP pressure	Mass flow	10v05	`unit_idDCFRP s_or_n unit pressure`	25
STP/NTP temperature	Mass flow	10v05	`unit_idDCFRT s_or_n unit temperature`	25
Zero band	All	10v05	`unit_idDCZ 0 zero_band`	25

Action	Devices	Firmware	Command	Page
GAS				
Active gas	Mass flow	10v05	`unit_idGS gas# save`	14
List available gases	Mass flow		`unit_id??G*`	14
Set gas	Mass flow		`unit_idG gas#`	15
Create gas mixture	Mass flow	5v00	`unit_idGM name mix# gas1% gas1# … gas5% gas5#`	29
Delete gas mixture	Mass flow	5v00	`unit_idGD gas#`	29
Query gas mixture	Mass flow	9v00	`unit_idGC gas#`	30
SET POINT				
Change set point	Controllers	4v33	`unit_idS setpoint`	15
Query or change set point	Controllers	9v00	`unit_idLS setpoint unit`	15
Power-up set point	Controllers	8v04	`unit_idSPUE setpoint`	20
Set point source	Controllers	10v05	`unit_idLSS mode`	21
TARES				
Tare absolute pressure	With barometer	6v00	`unit_idPC`	16
Tare flow	Flow		`unit_idV`	16
Tare gauge/differential pressure	All		`unit_idP`	16
TOTALISER				
Configure totaliser	Flow	10v00	`unit_idTC totalizer statistic mode limit_mode digits decimals`	31
Reset totaliser	Flow	8v00	`unit_idT totalizer`	31
Reset totaliser peak	Flow	8v00	`unit_idTP totalizer`	32
Save totaliser	Flow	10v05	`unit_idTCR enable`	32
VALVE CONTROL				
Cancel valve hold	Controllers		`unit_idC`	32
Exhaust (open downstream valve)	Multi-valve controllers	4v37	`unit_idE`	32
Hold valve(s) at current position	Controllers	5v07	`unit_idHP`	32
Hold valve(s) closed	Controllers	5v07	`unit_idHC`	33
Query valve drive	Controllers	8v18	`unit_idVD`	33
CONTROL SETUP				
Batch	Flow controllers	10v00	`unit_idTB totalizer batch_size unit`	16
Deadband limit	Controllers	10v05	`unit_idLCDB save limit`	17
Deadband mode	Controllers	10v05	`unit_idLCDM mode`	17
Control algorithm	Controllers	10v05	`unit_idLCA algorithm`	17
Control variable	Controllers	9v00	`unit_idLV variable`	18

Action	Devices	Firmware	Command	Page
Set point range	Controllers	9v00	`unit_idLR variable unit min max`	18
Maximum ramp rate	Controllers	7v11	`unit_idSR max_ramp time_unit`	19
PD/PDF gains	Controllers	10v05	`unit_idLCGD 0 save p_gain d_gain`	19
PD²I gains	Controllers	10v05	`unit_idLCG 0 save p_gain i_gain d_gain`	19
Overpressure limit	Controllers	5v09	`unit_idOPL pressure_limit`	20
Ramping options	Controllers	10v05	`unit_idLSRC up down zero power_up`	20
Valve offset	Controllers	10v05	`unit_idLCVO 0 save initial closed`	21
Zero pressure control	Controllers	10v05	`unit_idLCZA enable`	22
DEVICE SETUP				
Analogue output source	All	10v05	`unit_idASOCV output value unit`	26
Baud rate	All	10v05	`unit_idNCB baud_rate`	26
Blink display	With display	8v28	`unit_idFFP duration`	26
Change unit ID	All		`unit_id@ new_unit_id`	27
Firmware version	All		`unit_idVE`	27
Lock display	With display		`unit_idL`	27
Unlock display	With display		`unit_idU`	27
Manufacturing info	All	8v28	`unit_id??M*`	27
Remote tare actions	With remote tare pin	10v05	`unit_idASRCA action`	28
Restore factory settings*	All	7v00	`unit_idFACTORY RESTORE ALL`	28
Streaming rate	All	10v05	`unit_idNCS interval`	29
User data	All	8v24	`unit_idUD slot value`	28

* This command must be typed in capitals.

Essential commands

The commands most users need every day. Less common commands are described after them, from Control setup (p. 16) onwards.

How a command is described

Every command in this chapter is laid out the same way. On the left: the command name, the firmware version that introduced it and the devices it applies to. On the right: the syntax, what the command does, what each variable means, and the response you get when the command succeeds.

Command name

`firmware` Devices

```
unit_idCOMMAND variable
```

What the command does.

`variable` What to enter for this variable, and where to find the possible values.

Response: What the device sends back when the command succeeds.

Data readings

These commands read the measurements of the device. Most of them are answered with a data frame — see Chapter 2 (p. 7).

Poll device data

All devices

```
unit_id
```

Asks the device for its current readings. The command is simply the unit ID of the device.

Response: a data frame. Its content depends on the device; the most common layouts are shown in Chapter 2 (p. 7). You can change the layout with configure data frame (p. 23).

Request averaged data

`6v00` All devices

```
unit_idDV time statistic1 statistic2 … statistic13
```

Returns the average of up to 13 statistics over a period you choose. Use it to read values that are not in the data frame.

`time` Averaging period in milliseconds. The device samples once per millisecond and returns the mean of those samples.

`statisticN` The statistics to average, in any order. At least one is required, up to 13 are allowed. Use the values below.

Value	Returns
0–699	The statistic with that number — see Appendix A (p. 35).
700	The unit ID of the device.
701	Any active errors.
702	The current status of the device. Use either 701 or 702, not both, and place it last in the request.
703	The selected gas, always 6 characters long (mass flow devices only).

Response: the averaged values, in the order they were requested.

Start streaming

All devices

```
unit_id@ @
```

Switches the device from polling to streaming mode (p. 8): its unit ID becomes `@` and it sends data frames at regular intervals.

The stream does not block the command line: the terminal still accepts commands, even if fast-moving data hides what you type. If you lose track of what you have typed, press Backspace a few times, then Enter, and start again.

Response: the device immediately starts sending data frames.

Stop streaming

All devices

```
@@ new_unit_id
```

Switches a streaming device back to polling mode (p. 7) and gives it a letter ID.

`new_unit_id` A letter from A to Z that no other device on the COM port uses.

Response: the stream stops; the device now answers to its new unit ID.

Gas Mass flow devices

These commands select the gas a mass flow device measures. Liquid and pressure devices ignore them.

Active gas

`10v05` Mass flow

```
unit_idGS gas# save
```

Reads or changes the active gas, and the gas the device selects at power-up. To read the active gas, send `unit_idGS`.

`gas#` The number of the gas — see Appendix C (p. 42). Not every gas is available on every device: corrosive gases and refrigerants are available only on corrosion-resistant devices. The list available gases (p. 14) command shows the gases installed on your device.

`save` `1` also makes this gas the power-up gas; `0` leaves the power-up gas unchanged. If omitted, the gas is saved as the power-up gas.

Response: the unit ID, the gas number, the short name and the long name of the gas.

List available gases

Mass flow

```
unit_id??G*
```

Lists every gas installed on the device with its gas number. A gas that is not on this list cannot be measured correctly by the device. Custom mixtures created with create gas mixture (p. 29) appear in the list with their numbers.

Appendix C (p. 42) lists all gas numbers, but does not tell you which gases are installed on a particular device.

Response: the full list of installed gases with their numbers, one per line.

Set gas

Mass flow

```
unit_idG gas#
```

Changes the active gas. On firmware 10v05 and later, use active gas (p. 14) instead.

`gas#` The number of the gas — see Appendix C (p. 42). Corrosive gases and refrigerants are available only on corrosion-resistant devices.

Response: a data frame showing the newly selected gas.

Set point Controllers

The set point is the flow or pressure a controller works to reach. Meters and gauges ignore these commands.

Change set point

4v33 Controllers

```
unit_idS set point
```

Gives the controller a new set point. On firmware 9v00 and later, query or change set point (p. 15) offers more.

`set point` The new set point, within the range of the controller, in the current engineering units (see engineering units (p. 23)). Bidirectional controllers also accept negative set points.

On a mass flow controller, a set point of 0 stops the flow and closes all valves. On a pressure controller, a set point of 0 makes it control to zero pressure; zero pressure control (p. 22) changes this behaviour.

Response: a data frame with the new set point.

Query or change set point

9v00 Controllers

```
unit_idLS set point unit
```

Reads the set point, or sets a new one — optionally in different units from those currently shown. To read the set point, send `unit_id`**LS**.

`set point` The new set point, within the range of the controller. A flow set point of 0 closes all valves; a pressure set point of 0 controls to zero pressure (see zero pressure control (p. 22)). Bidirectional controllers accept negative set points.

`unit` Optional. The number of the engineering unit the set point is given in — see Appendix B (p. 39). If omitted, the current engineering units apply.

Response: the unit ID, the current set point, the requested set point, the unit number and the unit label. If the requested set point is outside the range of the controller, it is limited to that range, so the current set point may differ from the requested one.

Tares

A tare sets the zero reference of a reading: no flow, zero gauge pressure or zero absolute pressure. Tare before starting a new process, and whenever the device has been moved or knocked.

Tare absolute pressure

`6v00` With barometer

```
unit_idPC
```

Tares the absolute pressure reading against the internal barometer. Available only on devices built with a barometer. Use it only when there is no flow and the line is not pressurised.

Response: a data frame with the absolute pressure reading tared. A device without a barometer ignores the command and answers with a question mark (?).

Tare flow

Flow devices

```
unit_idV
```

Sets the zero-flow reference for more accurate flow readings. Before you tare, bring the line to its normal operating pressure and make sure nothing is flowing through the device.

Response: a data frame with the flow reading at zero.

Tare gauge or differential pressure

All devices

```
unit_idP
```

Sets the zero reference for gauge or differential pressure.

- **Gauge pressure:** there must be no flow, and the device must be open to atmosphere.
- **Differential pressure:** the pressure difference between the ports must be zero — open both ports to atmosphere, or connect them to the same pressure source.

Response: a data frame with the gauge (or differential) pressure reading at zero.

Control setup Controllers

Batch

`10v00` Flow controllers

```
unit_idTB totaliser batch_size unit
```

Makes the controller deliver a set quantity and then stop: once the batch has flowed, the valves close. The batch is counted by one of the totalisers. To read the batch size of a totaliser, send `unit_idTB totalizer`.

`totaliser`	1 or 2 — the totaliser that counts the batch. Required.
`batch_size`	The quantity to deliver. `0` disables batching.
`unit`	Optional. The number of the volume unit — see tables B-3 and B-5 in Appendix B (p. 39). If omitted, the current engineering units apply.

Response: the unit ID, the totaliser, the batch size (0 if disabled), the unit number and the unit label.

> **Note**
> To run another batch of the same size, reset the totaliser: `unit_idT totalizer` (see reset totaliser (p. 31)).

Deadband limit

10v05 Controllers

```
unit_idLCDB save limit
```

Sets how far the process may drift above or below the set point before the controller acts. A deadband is mostly used on dual-valve pressure controllers. When the process leaves the deadband, the controller brings it back to the set point, then lets it drift again. To read the deadband, send `unit_idLCDB`.

`save` 1 keeps the limit after a power cycle; `0` applies it until the next power cycle only. Save only values you are sure of, to spare the controller's memory.

`limit` The allowed drift, in the units of the controlled variable. Example: with a limit of 0.5 and a set point of 20 psia, the controller acts only when the pressure rises to 20.51 psia or falls to 19.49 psia; it then returns to 20 psia before letting the process drift again.

Response: the unit ID, the current deadband, the unit number (see Appendix B (p. 39)) and the unit label.

Deadband mode

10v05 Controllers

```
unit_idLCDM mode
```

Sets what the controller does while the controlled variable is inside the deadband (p. 17). To read the mode, send `unit_idLCDM`.

`mode` 1 — hold the valves in their current position until the process leaves the deadband.
2 — close the valves until the process leaves the deadband.

Response: the unit ID and the mode (1 or 2).

Control algorithm

10v05 Controllers

```
unit_idLCA algorithm
```

Reads or selects the closed-loop control algorithm. To read it, send `unit_idLCA`.

`algorithm` 1 — PD/PDF (tune with PD/PDF gains (p. 19)).
2 — PD²I (tune with PD²I gains (p. 19)).

Response: the unit ID and the active algorithm (1 = PD/PDF, 2 = PD²I).

Control variable

9v00 Controllers

```
unit_idLV variable
```

Selects which reading the set point controls — for example mass flow or absolute pressure.

`variable` The statistic number of the reading to control:

Controlled reading	Value	Note
Mass flow	37	Mass flow controllers only
Volumetric flow	36	Mass flow and liquid controllers only
Absolute pressure	34	
Gauge pressure	38	
Differential pressure	39	
Second absolute pressure	345	Devices with a second pressure sensor
Second gauge pressure	353	Devices with a second pressure sensor
Second differential pressure	361	Devices with a second pressure sensor

Response: the unit ID and the new control variable.

Set point range

9v00 Controllers

```
unit_idLR variable unit                          9v00
```

```
unit_idLR variable unit min max                  10v05
```

Reads the valid set point range of a control variable. From firmware 10v05 it can also limit the set points the controller accepts. Send `unit_id`**LR** to read the current control variable — on 10v05 and later, together with its minimum and maximum set points.

`variable` The statistic number of the control variable — see the table under control variable (p. 18).

`unit` Optional. The number of the engineering unit to report in — see Appendix B (p. 39). `0` or `1` uses the default units of the control variable.

`min` 10v05 and later. The lowest set point the controller accepts. If larger than `max`, both limits are reset to the full range.

`max` 10v05 and later. The highest set point the controller accepts. If smaller than `min`, both limits are reset to the full range. On firmware 10v04 and older, leave out `min` and `max`.

Response: the unit ID, the control variable, the unit number and the unit label; on 10v05 and later followed by the minimum and maximum set points.

Maximum ramp rate

7v11 Controllers

```
unit_idSR max_ramp time_unit
```

Limits how quickly the controller moves to a new set point: it steps towards the set point by at most `max_ramp` per `time_unit`. To read the ramp rate, send `unit_id`**`SR`**. Ramping options (p. 20) sets when ramping applies.

`max_ramp` The largest step per time unit, in the current engineering units (see engineering units (p. 23)). `0` disables ramping: the controller jumps straight to each new set point. The `time_unit` is still required.

`time_unit`

Value	Label	Time unit
3	`ms`	Millisecond
4	`s`	Second
5	`m`	Minute
6	`Hour`	Hour
7	`Day`	Day

Response: the maximum ramp rate, the number of the set point unit (see Appendix B (p. 39)), the time unit and the units-per-time label.

PD/PDF gains

10v05 Controllers

```
unit_idLCGD 0 save p_gain d_gain
```

Reads or changes the gains of the PD/PDF algorithm (selected with control algorithm (p. 17)). To read the gains, send `unit_id`**`LCGD`**.

`save` 1 keeps the gains after a power cycle; `0` applies them until the next power cycle only. Save only values you are sure of, to spare the controller's memory.

`p_gain` Proportional gain, 0 to 65535.

`d_gain` Derivative gain, 0 to 65535.

Response: the unit ID, the P and D gains, and the number 0. The 0 is reserved for future use.

PD²I gains

10v05 Controllers

```
unit_idLCG 0 save p_gain i_gain d_gain
```

Reads or changes the gains of the PD²I algorithm (selected with control algorithm (p. 17)). To read the gains, send `unit_id`**`LCG`**.

`save` 1 keeps the gains after a power cycle; `0` applies them until the next power cycle only. Save only values you are sure of, to spare the controller's memory.

`p_gain` Proportional gain, 0 to 65535.

`i_gain` Integral gain, 0 to 65535.

`d_gain` Optional. Derivative gain, 0 to 65535.

Response: the unit ID, the P, I and D gains, and the number 0. The 0 is reserved for future use.

Power-up set point

`8v04` Controllers

```
unit_idSPUE set point
```

Gives the controller a set point that it applies as soon as it is switched on.

`set point` The power-up set point, in the current engineering units. `0` disables the power-up set point.

Response: a data frame showing the current set point — not the power-up set point you just sent.

Overpressure limit

`5v09` Controllers

```
unit_idOPL pressure_limit
```

Sets a pressure above which the controller stops the flow: as soon as the pressure exceeds the limit for 1 millisecond, all valves close, and a purge valve opens if the controller has one. To resume operation, send a new set point.

`pressure_limit` The highest pressure allowed in the process. A value of 0 or less, or above the pressure full scale, disables the limit.

Response: a data frame.

Ramping options

`10v05` Controllers

```
unit_idLSRC up down zero power_up
```

Sets in which situations the maximum ramp rate (p. 19) applies. For each option, `1` means "follow the ramp rate" and `0` means "jump straight to the new set point". To read the options, send `unit_idLSRC`.

`up` When the new set point is higher than the current one.

`down` When the new set point is lower than the current one, including set points below zero on bidirectional devices.

`zero` When the new set point is zero.

`power_up` When the controller starts up with a power-up set point (p. 20).

Response: the unit ID followed by the four options, each 0 (off) or 1 (on), in the order up, down, zero, power-up.

Set point source

10v05 Controllers

```
unit_idLSS mode
```

Selects where the controller takes its set point from: the analogue input, or the display and serial interface. To read the mode, send `unit_idLSS`.

Mode	Set point source
A	Analogue input. The set point cannot be changed from the display or over the serial interface. Not all controllers have an analogue input — check the pin-out in the operating manual of your device.
S	Display or serial interface; set point changes are saved and restored at power-up. Avoid this mode if the set point changes often, to spare the controller's memory.
U	Display or serial interface; set point changes are not saved, and the set point is 0 at power-up. Recommended when the set point changes often.

Response: the unit ID and the current set point source.

Valve offset

10v05 Controllers

```
unit_idLCVO 0 save initial closed
```

Sets the valve drive used when a closed valve first opens, and the drive below which the valve counts as closed. Both are percentages of the maximum drive voltage — not of how far the valve is open. To read the offsets, send `unit_idLCVO`.

`save` 1 keeps the offsets after a power cycle; `0` applies them until the next power cycle only. Save only values you are sure of.

`initial` 0–100 %. When opening a closed valve, the controller starts at this drive. Default: 0.

`closed` Optional. 0–100 %. Below this drive, the control algorithm treats the valve as closed. If higher than `initial`, the `initial` value is used instead.

Response: the unit ID, the initial offset and the closed offset, in percent.

Zero pressure control

10v05 Controllers

```
unit_idLCZA enable
```

Sets what a pressure controller does with a set point of zero: either actively control to zero pressure, or simply open or close its valves. To read the setting, send `unit_id`**`LCZA`**.

`enable` 1 — active control: the controller uses normal closed-loop control to reach zero.
`0` — no active control: the valves open or close fully, as shown below.

Dual valve?	Inverse pressure control?	Negative pressure?	Valves at zero set point, control off
No	No	No	Valve closed
No	No	Yes	Valve open
No	Yes	No	Valve open
No	Yes	Yes	Valve closed
Yes	No	—	Downstream valve open, upstream valve closed
Yes	Yes	—	Upstream valve open, downstream valve closed

Note
When a controller controls flow, a zero set point always closes the valves, whatever this setting.

Response: the unit ID and the setting: 0 (active control off) or 1 (active control on).

Data readings

Auto-tare

10v05 Controllers

```
unit_idZCA enable delay
```

When enabled, the controller tares automatically each time it receives a zero set point, after a delay you choose. To read the setting, send `unit_id`**`ZCA`**.

`enable` 1 enables auto-tare; `0` disables it.

`delay` Seconds to wait after the zero set point before taring, from 0.1 to 25.5. For flow, less than 1 second may not let the process settle to a true no-flow condition. For pressure, a delay matters even more, since the pressure must stabilise at zero.

Response: the unit ID, 1 (enabled) or 0 (disabled), and the delay in seconds (0 when disabled).

Configure data frame

`6v00` All devices

```
unit_idFDF format
```

Changes the number format of the data frame.

Format	Description
`0`	Default. Values have 5 digits (the totaliser 7); set point and totaliser are shown without sign.
1	As 0, but set point and totaliser carry a + or − sign.
2	From 8v00. Signed like format 1; the number of digits follows the range and resolution of the device's calibration. Exponential notation is supported.

Response: a data frame in the new format.

Engineering units

`10v05` All devices

```
unit_idDCU statistic group unit override
```

Reads or changes the engineering units of a reading, or of a whole group of readings. To read the units of a statistic, send `unit_idDCU statistic`.

`statistic` The statistic number — see Appendix A (p. 35).

`group` `0` changes only this statistic; `1` changes its whole group. Example: 0 changes only the primary gauge pressure units, 1 changes the units of all pressures.

`unit` The number of the new unit — see Appendix B (p. 39).

`override` Optional. Some readings keep their own units when their group changes. `0` (or omitted) respects these exceptions; `1` applies the new unit everywhere and removes them.

Response: the unit ID, the unit number and the unit label.

Flow/pressure averaging

10v05 All devices

```
unit_idDCA statistic averaging_time
```

Sets how long a reading is averaged. The device measures every millisecond; the display and data frame show the average over the time set here. To read the averaging time of a reading, send `unit_idDCA statistic`.

`statistic` The reading to average:

Value	Reading
1	All pressures and pressure sensors
2	Absolute pressure
4	Volumetric flow
5	Mass flow
6	Gauge pressure
7	Differential pressure
17	External volumetric flow (volumetric flow referenced to external conditions)
344	Absolute pressure, second sensor
352	Gauge pressure, second sensor
360	Differential pressure, second sensor

`averaging_time` 0 to 9999 milliseconds. With 0 the reading updates every millisecond.

Devices without a second pressure sensor ignore values 344, 352 and 360.

Response: the unit ID, the reading and its averaging time.

Full-scale values

6v00 All devices

```
unit_idFPF statistic unit
```

Reads the measuring range (full scale) of a reading.

`statistic` The statistic number — see Appendix A (p. 35).

`unit` Optional. The unit to report in — see Appendix B (p. 39). If omitted, the units set with engineering units (p. 23) apply.

Response: the full-scale value of the reading, the unit number and the unit label.

Power-up tare

10v05 All devices

```
unit_idZCP enable
```

When enabled, the device performs a 0.25-second tare at power-up, once its sensors are stable. On a controller, closed-loop control waits and the valves stay closed until the tare is complete. To read the setting, send `unit_idZCP`.

`enable` 1 enables power-up tare; `0` disables it.

Response: the unit ID and 1 (enabled) or 0 (disabled).

Query data frame

6v00 All devices

```
unit_id??D*
```

Describes the fields of the data frame, including their engineering units.

Response: a table with one row per field. The first row describes the leftmost field of the data frame, each following row the next field to the right. A name preceded by an asterisk (*) belongs to a field that appears only under certain conditions — usually status and error codes, which appear only when active.

STP/NTP pressure

10v05 Mass flow

```
unit_idDCFRP s_or_n unit pressure
```

Reads or changes the reference pressure used to calculate standard or normal flow. Together with the reference temperature it defines the gas density from which the flow at actual conditions is calculated. Standard conditions are used for standard units such as SLPM or SCFM; normal conditions for normal units such as NLPM. The factory default is 1013.25 mbar. To read a reference pressure, send `unit_idDCFRP s_or_n`.

`s_or_n` S for standard pressure, N for normal pressure.

`unit` The number of the pressure unit — see Appendix B (p. 39). 0 keeps the current unit.

`pressure` The new reference pressure.

Response: the unit ID, the reference pressure, the unit number and the unit label.

STP/NTP temperature

10v05 Mass flow

```
unit_idDCFRT s_or_n unit temperature
```

Reads or changes the reference temperature used to calculate standard or normal flow (see STP/NTP pressure (p. 25)). The factory default is 21.11 °C for standard and 0 °C for normal conditions. To read a reference temperature, send `unit_idDCFRT s_or_n`.

`s_or_n` S for standard temperature, N for normal temperature.

`unit` The number of the temperature unit — see Appendix B (p. 39). 0 keeps the current unit.

`temperature` The new reference temperature.

Response: the unit ID, the reference temperature, the unit number and the unit label.

Zero band

10v05 All devices

```
unit_idDCZ 0 zero_band
```

Sets the level below which flow or pressure is reported as zero. To read the zero band, send `unit_idDCZ`.

`zero_band` A percentage of full scale, from 0 to 6.38. 0 disables the zero band.

Response: the unit ID, the number 0 and the zero band in percent of full scale. Because of internal rounding the reported value can differ slightly from the one you sent; the device still applies the value you requested.

Device setup

Analogue output source

10v05 All devices

```
unit_idASOCV output value unit
```

Reads or changes what an analogue output represents. To read it, send `unit_idASOCV output`.

`output` `0` for the primary analogue output, `1` for the secondary output (if fitted).

`value` What the output carries:

Value	Output
`0`	Fixed at the minimum of the output — a constant 4 mA on a 4–20 mA output.
`1`	Fixed at the maximum of the output — a constant 20 mA on a 4–20 mA output.
other	The statistic number of the reading to follow — see Appendix A (p. 35). Not every reading can be sent to an analogue output.

`unit` Optional. The engineering unit of the output — see Appendix B (p. 39). If omitted, the unit is unchanged.

Response: the unit ID, the value (0, 1 or the statistic number), the unit number and the unit label. For a fixed minimum or maximum, the unit number is 1 and the label is `---`.

Baud rate

10v05 All devices

```
unit_idNCB baud_rate
```

Reads or changes the serial speed of the device. Make sure the COM port you connect to supports the new rate. To read the baud rate, send `unit_idNCB`.

`baud_rate` One of: 2400, 9600, 19 200, 38 400, 57 600, 115 200.

Response: the unit ID and the baud rate. When you change the rate, the device confirms the new rate before switching to it. The connection is then lost: reconnect at the new rate.

> **Note**
> If you cannot reconnect, the operating manual explains how to reset the baud rate from the device display. If the device has no display, contact Analyt-MTC support.

Blink display

8v28 With display

```
unit_idFFP duration
```

Flashes the display backlight — handy for finding a particular device among several. To check whether the display is flashing, send `unit_idFFP`.

`duration` Seconds to flash. `0` stops the flashing; `-1` flashes until stopped.

Response: the backlight starts flashing at once, and the device returns its unit ID followed by 1 (flashing) or 0 (not flashing).

Change unit ID

All devices

```
unit_id@ new_unit_id
```

Gives the device a new unit ID (p. 6).

`new_unit_id` A letter from A to Z.

Response: none. The device answers to its new unit ID from now on.

Firmware version

All devices

```
unit_idVE
```

Reads the firmware version installed on the device. See Firmware versions (p. 3) for what the version means.

Response: the unit ID, the firmware version and the firmware date.

Lock display

With display

```
unit_idL
```

Disables the buttons on the front of the device. While locked, the device can be changed only over the serial interface or its other connections. Use unlock display (p. 27) to enable the buttons again.

Response: a data frame with the `LCK` status.

Unlock display

With display

```
unit_idU
```

Enables the display buttons again and clears the `LCK` status.

If you have lost communication with a locked device, press and hold the four corner buttons together for 5 seconds. The `LCK` status disappears from the display when the device is unlocked.

Response: a data frame without the `LCK` status.

Manufacturing info

8v28 All devices

```
unit_id??M*
```

Reads manufacturing and configuration data stored in the device.

Response: 10 lines containing:

- Analyt-MTC contact details (email, website and phone number);
- the device model and serial number;
- the manufacturing date;
- the date of the last calibration and the initials of the calibration technician;
- the software version.

Remote tare actions

`10v05`

With remote tare pin

`unit_id`**ASRCA** `action`

Sets what the device does while its remote tare pin is grounded. The pin is mostly found on meters and gauges, rarely on controllers; check the pin-out in the operating manual of your device. To read the setting, send `unit_id`**ASRCA**.

`action` The sum of the actions you want:

Value	Action while the pin is active
1	Tare the primary pressure sensor. An absolute-pressure sensor needs a barometer; without one the request is ignored.
2	Tare the secondary pressure sensor. An absolute-pressure sensor needs a barometer; without one the request is ignored.
4	Tare flow. Ignored by devices that do not measure flow.
8	Hold totaliser 1 at zero. Ignored if totaliser 1 is not enabled.
16	Hold totaliser 2 at zero. Ignored if totaliser 2 is not enabled.

Add values together to combine actions. For example, `unit_id`**ASRCA 5** tares both the primary pressure (1) and flow (4). `0` disables all actions.

Response: the unit ID and the sum of the active actions (0 if none).

Restore factory settings

`7v00` All devices

NOTICE

Restoring factory settings removes any calibration made by third parties. Contact Analyt-MTC support before you use this command.

`unit_id`**FACTORY RESTORE ALL**

Returns all settings to their factory defaults. The command must be typed in capitals. Switch the device off and on again afterwards.

Response: `unit_id factory values have been restored.`

User data

`8v24` All devices

`unit_id`**UD** `slot value`

Stores up to 32 characters of your own text on the device — a tag number or a location, for example — or reads it back. To read a slot, send `unit_id`**UD** `slot`.

`slot` 0 to 3. Each of the four slots holds 32 characters.

`value` Up to 32 ASCII characters. Binary data must be encoded first — numbers in decimal or hexadecimal notation, arbitrary data in base64.

Response: the unit ID and the value now stored in the slot.

Streaming rate

10v05 All devices

```
unit_idNCS interval
```

Reads or changes the interval between data frames in streaming mode (p. 8). To read it, send `unit_idNCS`.

`interval` Milliseconds between data frames (default 50). If the interval is shorter than the time needed to send one frame, the next frame starts as soon as the previous one is complete.

Response: the unit ID and the interval in milliseconds.

Start streaming and stop streaming are described with the essential commands: see start streaming (p. 14) and stop streaming (p. 14).

Gas mixtures Mass flow devices

A mass flow device can store up to 20 custom gas mixtures, each made of up to five installed gases. Selecting and listing gases is covered with the essential commands: active gas (p. 14), list available gases (p. 14) and set gas (p. 15).

Create gas mixture

5v00 Mass flow

```
unit_idGM name mix# gas1% gas1# gas2% gas2# … gas5% gas5#
```

Defines a custom gas mixture so the device can measure it correctly.

> **Note**
> The device does not mix gases. The gases must be mixed before they reach the device.

`name` A short name for the mixture, up to six letters — the equivalent of the short gas names in Appendix C (p. 42).

`mix#` The gas number to store the mixture under, 236 to 255. An existing mixture with that number is overwritten. `0` picks the next free number, counting down from 255 to 236; if none is free, the command fails.

`gasN%` The molar percentage of the gas that follows, with up to two decimals. The percentages must add up to exactly 100.00, or the command fails.

`gasN#` The number of the gas — see Appendix C (p. 42) or list available gases (p. 14).

Example: `AGM MYMIX 0 70 8 30 4` creates a mixture of 70 % nitrogen (8) and 30 % carbon dioxide (4) on device A.

Response: the unit ID and the gas number of the mixture, followed by the percentage and short name of each component.

Delete gas mixture

5v00 Mass flow

```
unit_idGD gas#
```

Deletes a custom gas mixture.

`gas#` The number of the mixture, 236 to 255.

Response: the unit ID and the number of the deleted mixture.

Query gas mixture

9v00 Mass flow

```
unit_idGC gas#
```

Reads the composition of a custom gas mixture.

`gas#` The number of the mixture, 236 to 255. If no mixture is stored under this number, the device answers with a question mark (?).

Response: the unit ID followed by the gas number and percentage of each component. Appendix C (p. 42) gives the gas for each number.

Configure totaliser

10v00 Flow devices

```
unit_idTC totaliser statistic mode limit_mode digits decimals
```

Enables or disables a totaliser and sets how it counts and displays the measured flow. To read the configuration, send `unit_idTC totalizer`.

`totaliser` 1 or 2.

`statistic` The flow statistic to totalize — see Appendix A (p. 35). This enables a disabled totaliser. `-1` keeps the current statistic. To disable the totaliser, send 1 and leave out the remaining variables.

`mode` How flow is accumulated. Positive flow moves forward through the device (usually left to right), negative flow backwards.

mode	Accumulation
−1	Keep the current mode.
0	Add positive flow; ignore negative flow.
1	Add negative flow; ignore positive flow.
2	Add positive flow and subtract negative flow.
3	Add positive flow until the flow stops; when positive flow resumes, restart from 0.

`limit_mode` What happens when the totaliser reaches its maximum value. Some modes set the OVR status (see Error handling (p. 34)).

limit_mode	At the maximum value
−1	Keep the current limit mode.
0	Stop counting and stay at the maximum. No status.
1	Restart from zero and keep counting. No status.
2	Stop counting and stay at the maximum. Sets the OVR status.
3	Restart from zero and keep counting. Sets the OVR status.

`digits` Total number of digits of the totaliser value, 7 to 10. Default: 7.

`decimals` Number of digits after the decimal point, 0 to 9. If the device's resolution does not allow as many, it uses the maximum available.

Response: the unit ID followed by the configuration, as numbers in the same order as the command: statistic, mode, limit mode, digits, decimals. A statistic of 1 means the totaliser is disabled.

Reset totaliser

8v00 Flow devices

```
unit_idT totaliser
```

Sets the total back to zero and restarts the totaliser timer. Flow passing at that moment is counted from zero at once. The command also resets the totaliser peak and restarts a batch (p. 16).

`totaliser` 1 or 2. If omitted, totaliser 1 is reset.

Response: a data frame with the totaliser at zero.

Reset totaliser peak

`8v00` Flow devices

```
unit_idTP totaliser
```

Clears only the highest flow rate recorded since the last reset. The total and the timer are not affected.

`totaliser` 1 or 2. If omitted, the peak of totaliser 1 is reset.

Response: a data frame.

Save totaliser

`10v05` Flow devices

```
unit_idTCR enable
```

When enabled, the device saves the totaliser values at regular intervals and restores the last saved values at power-up. When disabled, the totalisers start from zero at every power-up. The setting applies to every enabled totaliser. To read it, send `unit_idTCR`.

`enable` 1 enables saving; `0` disables it.

Response: the unit ID and 1 (enabled) or 0 (disabled).

Valve control Controllers

Cancel valve hold

Controllers

```
unit_idC
```

Releases all valve holds; the controller resumes closed-loop control.

Response: a data frame without the `HLD` status — also when no hold was active.

Exhaust

`4v37`

Multi-valve controllers

```
unit_idE
```

Closes the upstream valve and opens the downstream valve(s) fully. No new gas enters, and the process can empty. Single-valve controllers ignore the command.

Response: a data frame with the `HLD` status. Send cancel valve hold (p. 32) (`unit_idC`) to resume control.

Hold valve(s)

`5v07` Controllers

```
unit_idHP
```

Holds the valves in their current position and pauses closed-loop control until the hold is cancelled.

Response: a data frame with the `HLD` status. Send cancel valve hold (p. 32) to resume control.

Hold valve(s) closed

5v07 Controllers

```
unit_idHC
```

Closes all valves and pauses closed-loop control until the hold is cancelled.

Response: a data frame with the HLD status. Send cancel valve hold (p. 32) to resume control.

Query valve drive

8v18 Controllers

```
unit_idVD
```

Reads how hard each valve is being driven, as a percentage of the maximum drive voltage. This is not the valve opening, but the two go together: the higher the drive, the further open the valve. If the drive slowly rises over time at the same set point, the controller needs more power for the same result — a sign of a problem in the process, such as debris or a blockage.

Response: the unit ID and the drive percentage of each valve. On dual-valve controllers the first value is the upstream valve and the second the downstream valve. On three-valve controllers the third value is usually the exhaust valve.

CHAPTER 4

Error handling

When a special condition is active, a status code appears in the last column(s) of the data frame, as in example 1 under Protocol conventions (p. 7). Status codes signal a special state, a warning or a fault. Several codes can appear at once.

ADC Internal communication error. Not common — please contact Analyt-MTC support.

EXH Manual exhaust valve override is enabled: the downstream valve is driven fully open.

HLD Valve drive is on hold; closed-loop control is bypassed (see valve control (p. 32)).

LCK The display buttons are locked (see lock display (p. 27)).

MOV Mass flow over range: the flow is outside the measurable range, including the uncalibrated range.

OPL The overpressure limit (p. 20) is enabled.

OVR The totaliser has rolled over at least once, or is frozen at its maximum value.

POV Pressure over range: the pressure is outside the measurable range, including the uncalibrated range.

TMF The totaliser has missed some flow data because of a `MOV` or `VOV` condition.

TOV Temperature over range: the temperature is outside the measurable range.

VOV Volumetric flow over range: the flow is outside the measurable range, including the uncalibrated range.

APPENDIX A

Statistics

Statistics are the readings and values a device can provide. Several commands take a statistic number — for example request averaged data (p. 13), engineering units (p. 23) and configure totaliser (p. 31). The tables below list those numbers.

Not every statistic is available on every device or configuration. If you are unsure whether a statistic works with your device, contact Analyt-MTC support. A firmware tag such as `8v32` marks statistics introduced with that version.

A-1 Flow statistics

Statistic	Value	Notes
Batch mass remaining	**12**	The remaining mass in the totaliser batch.
Batch volume remaining	**11**	Remaining volume, referenced to flow conditions, in the totaliser batch.
Batch volume, external remaining	**19**	Remaining volume, referenced to external conditions, in the totaliser batch.
Mass flow	**5**	
Mass flow, average	**69**	Average mass flow over the time of totalizing.
Mass flow, maximum `8v32`	**175**	Highest mass flow since reset.
Mass flow, minimum `8v32`	**174**	Lowest mass flow since reset.
Mass flow, peak	**101**	Peak mass flow during the time of totalizing.
Mass flow set point	**37**	
Mass flow set point error `8v00`	**173**	Mass flow minus the ramp-limited set point.
Time, totalizing	**10**	Amount of time that the totaliser has been running.
Total mass	**9**	Totalized mass.
Total volume	**8**	Totalized volume, referenced to flow conditions.
Total volume, external	**18**	Totalized volume, referenced to external conditions.
Volumetric flow	**4**	Volumetric flow referenced to flow conditions.
Volumetric flow, average	**68**	Average volumetric flow, referenced to flow conditions, over the time of totalizing.
Volumetric flow, maximum `8v32`	**167**	Highest volumetric flow since reset.
Volumetric flow, minimum `8v32`	**166**	Lowest volumetric flow since reset.
Volumetric flow, peak	**100**	Peak volumetric flow, referenced to flow conditions, during the time of totalizing.
Volumetric flow set point	**36**	The set point for volumetric flow referenced to flow conditions.
Volumetric flow set point error `8v00`	**165**	Volumetric flow minus the ramp-limited set point.
Volumetric flow, external	**17**	Volumetric flow referenced to external conditions.
Volumetric flow, external average	**81**	Average volumetric flow, referenced to external conditions, over the time of totalizing.
Volumetric flow, external maximum `8v32`	**271**	Highest volumetric flow since reset.
Volumetric flow, external minimum `8v32`	**270**	Lowest volumetric flow since reset.

Statistic	Value	Notes
Volumetric flow, external peak	**113**	Peak volumetric flow referenced to external conditions during the time of totalizing.
Volumetric flow, external set point	**49**	The set point for volumetric flow referenced to external conditions.
Volumetric flow, external set point error `8v00`	**268**	Volumetric flow, referenced to external conditions, minus the ramp-limited set point.

A-2 Pressure statistics

Statistic	Value	Notes
Pressure, absolute	**2**	
Pressure, absolute average	**66**	Average absolute pressure over the time of totalizing.
Pressure, absolute maximum `8v32`	**151**	Highest absolute pressure since reset.
Pressure, absolute minimum `8v32`	**150**	Lowest absolute pressure since reset.
Pressure, absolute peak	**98**	Peak absolute pressure over the time of totalizing.
Pressure, absolute set point	**34**	
Pressure, absolute set point error `8v00`	**149**	Absolute pressure minus the ramp-limited set point.
Pressure, barometric	**15**	Barometer reading.
Pressure, barometric average	**79**	Average barometer reading over the time of totalizing.
Pressure, barometric maximum `8v32`	**255**	Highest barometric pressure since reset.
Pressure, barometric minimum `8v32`	**254**	Lowest barometric pressure since reset.
Pressure, barometric peak	**111**	Peak barometer reading over the time of totalizing.
Pressure, differential	**7**	
Pressure, differential maximum `8v32`	**191**	Highest differential pressure since reset.
Pressure, differential minimum `8v32`	**190**	Lowest differential pressure since reset.
Pressure, differential set point	**39**	
Pressure, differential set point error `8v00`	**189**	Differential pressure minus the ramp-limited set point.
Pressure, gauge	**6**	
Pressure, gauge average	**70**	Average gauge pressure over the time of totalizing.
Pressure, gauge maximum `8v32`	**183**	Highest gauge pressure since reset.
Pressure, gauge minimum `8v32`	**182**	Lowest gauge pressure since reset.
Pressure, gauge peak	**102**	Peak gauge pressure over the time of totalizing.
Pressure, gauge set point	**38**	
Pressure, gauge set point error `8v00`	**181**	Gauge pressure minus the ramp-limited set point.
Pressure, second absolute `7v01`	**344**	For devices with a pressure sensor in a second location, the absolute pressure of the second sensor.
Pressure, second absolute maximum `8v32`	**351**	Highest second absolute pressure since reset.
Pressure, second absolute minimum `8v32`	**350**	Lowest second absolute pressure since reset.
Pressure, second absolute set point `7v01`	**345**	The set point for the second absolute pressure.
Pressure, second absolute set point error `8v00`	**349**	Second absolute pressure minus the ramp-limited set point.

Statistic	Value	Notes
Pressure, second differential 7v01	**360**	For devices with a pressure sensor in a second location, the differential pressure of the second sensor.
Pressure, second differential maximum 8v32	**367**	Highest second differential pressure since reset.
Pressure, second differential minimum 8v32	**366**	Lowest second differential pressure since reset.
Pressure, second differential set point 7v01	**361**	The set point for the second differential pressure.
Pressure, second differential set point error 8v00	**365**	Second differential pressure minus the ramp-limited set point.
Pressure, second gauge 7v01	**352**	For devices with a pressure sensor in a second location, the gauge pressure of the second sensor. On devices with an orifice, this is the pressure upstream of the orifice.
Pressure, second gauge maximum 8v32	**359**	Highest second gauge pressure since reset.
Pressure, second gauge minimum 8v32	**358**	Lowest second gauge pressure since reset.
Pressure, second gauge set point 7v01	**353**	The set point for the second gauge pressure.
Pressure, second gauge set point error 8v00	**357**	Second gauge pressure minus the ramp-limited set point.

A-3 Other statistics

Statistic	Value	Notes
None	**1**	No statistic; generally implies an empty location.
Date, user 7v01	**400**	The current date of the device or the start date of the measurement.
Fluid name 7v01	**703**	The short name of the gas/liquid being used by the device.
Measurement id 7v01	**801**	The ID of the measurement. Unique for the measurement over the life of the device.
Measurement status 7v01	**802**	The status of the measurement, A: aborted, C: complete, M: in progress, -: not a valid measurement.
Set point	**32**	The current ramp-limited set point. When specified in a location, the currently active set point statistic replaces this statistic.
Set point error 8v00	**133**	Current process value minus the ramp-limited set point.
Status	**26**	The status of the device. This is typically only used internally.
Temperature, external	**16**	Temperature probe reading.
Temperature, external maximum 8v32	**263**	Highest external temperature since reset.
Temperature, external minimum 8v32	**262**	Lowest external temperature since reset.
Temperature, stream	**3**	
Temperature, stream maximum 8v32	**159**	Highest stream temperature since reset.
Temperature, stream minimum 8v32	**158**	Lowest stream temperature since reset.
Temperature, stream average 7v18	**67**	
Temperature, external volumetric flow reference	**20**	The reference temperature for external volumetric flow; temperature probe reading if available, flow temperature reading otherwise.
Temperature, external volumetric flow reference average	**84**	Average reference temperature for external volumetric flow over the time of totalizing.

Statistic	Value	Notes
Temperature, external volumetric flow reference maximum `8v32`	**295**	Highest external volumetric flow reference temperature since reset.
Temperature, external volumetric flow reference minimum `8v32`	**294**	Lowest external volumetric flow reference temperature since reset.
Temperature, external volumetric flow reference peak	**116**	Peak reference temperature for external volumetric flow over the time of totalizing.
Temperature, external volumetric flow reference source	**21**	Probe (or P) if using temperature probe for external volumetric temperature reference, Stream (or S) otherwise.
Temperature, external volumetric flow reference source average `7v01`	**85**	Probe (or P) if the temperature probe was used for external volumetric temperature reference over the entire measurement, Stream (or S) if the probe was never used, St+Pr (or M) if the probe was sometimes used.
Time, measurement remaining	**14**	Amount of time remaining before the currently executing measurement completes normally.
Time, user `7v01`	**392**	The amount of time that has elapsed since power-up (or the time of the device clock), or the start time of the measurement.
Valve drive	**13**	The valve drive signal.
Valve drive set point `8v00`	**45**	The set point directly drives the currently selected valve.
Vapor saturation (relative humidity)	**25**	The fraction of complete saturation the device is currently using. When the vapor used is water, this is relative humidity.
Vapor saturation, average	**89**	Average vapor saturation over the time of totalizing.
Vapor saturation, maximum `8v32`	**335**	Highest vapor saturation since reset.
Vapor saturation, minimum `8v32`	**334**	Lowest vapor saturation since reset.
Vapor saturation, peak	**121**	Peak vapor saturation over the time of totalizing.

APPENDIX B

Engineering units

Commands that take a unit number use the values below. Which table applies depends on the statistic you are working with — for example, use table B-3 for a totaliser that counts standard or normal volume. In tables B-1 and B-3, standard units refer to 21.11 °C and 1013.25 mbar, normal units to 0 °C and 1013.25 mbar.

B-1 Standard and normal flow units

Value	Label	Description
0		Unit not specified; use default values.
1	`---`	Unknown unit; no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
2	`SµL/m`	Standard microlitre per minute
3	`SmL/s`	Standard millilitre per second
4	`SmL/m`	Standard millilitre per minute
5	`SmL/h`	Standard millilitre per hour
6	`SL/s`	Standard litre per second
7	`SLPM`	Standard litre per minute
8	`SL/h`	Standard litre per hour
11	`SCCS`	Standard cubic centimetre per second
12	`SCCM`	Standard cubic centimetre per minute
13	Scm^3/h	Standard cubic centimetre per hour
14	Sm^3/m	Standard cubic metre per minute
15	Sm^3/h	Standard cubic metre per hour
16	Sm^3/d	Standard cubic metre per day
17	Sin^3/m	Standard cubic inch per minute
18	`SCFM`	Standard cubic foot per minute
19	`SCFH`	Standard cubic foot per hour
21	`SCFD`	Standard cubic foot per day (from firmware 6v08)
20	`kSCFM`	1000 standard cubic feet per minute
32	`NµL/m`	Normal microlitre per minute
33	`NmL/s`	Normal millilitre per second
34	`NmL/m`	Normal millilitre per minute
35	`NmL/h`	Normal millilitre per hour
36	`NL/s`	Normal litre per second
37	`NLPM`	Normal litre per minute
38	`NL/h`	Normal litre per hour
41	`NCCS`	Normal cubic centimetre per second
42	`NCCM`	Normal cubic centimetre per minute
43	Ncm^3/h	Normal cubic centimetre per hour
44	Nm^3/m	Normal cubic metre per minute
45	Nm^3/h	Normal cubic metre per hour
46	Nm^3/d	Normal cubic metre per day
62	`Count`	Set point count, 0–64000
63	`%`	Percent of the full scale

B-2 True mass flow units

Value	Label	Description
64	mg/s	Milligram per second
65	mg/m	Milligram per minute
66	g/s	Gram per second
67	g/m	Gram per minute
68	g/h	Gram per hour
69	kg/m	Kilogram per minute
70	kg/h	Kilogram per hour
71	oz/s	Ounce per second
72	oz/m	Ounce per minute
73	lb/m	Pound per minute
74	lb/h	Pound per hour

B-3 Total standard and normal volume units

Value	Label	Description
0		Unit not specified; use default values.
1	---	Unknown unit; no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
2	SµL	Standard microlitre
3	SmL	Standard millilitre
4	SL	Standard litre
6	Scm^3	Standard cubic centimetre

Value	Label	Description
7	Sm^3	Standard cubic metre
8	Sin^3	Standard cubic inch
9	Sft^3	Standard cubic foot
10	$kSft^3$	1000 standard cubic feet
32	NµL	Normal microlitre
33	NmL	Normal millilitre
34	NL	Normal litre
36	Ncm^3	Normal cubic centimetre
37	Nm^3	Normal cubic metre

B-4 Volumetric flow units

Value	Label	Description
0		Unit not specified; use default values.
1	`---`	Unknown unit; no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
2	`µL/m`	Microlitre per minute
3	`mL/s`	Millilitre per second
4	`mL/m`	Millilitre per minute
5	`mL/h`	Millilitre per hour
6	`L/s`	Litre per second
7	`LPM`	Litre per minute
8	`L/h`	Litre per hour
9	`US GPM`	US gallon per minute
10	`US GPH`	US gallon per hour
11	`CCS`	Cubic centimetre per second
12	`CCM`	Cubic centimetre per minute
13	cm^3/h	Cubic centimetre per hour
14	m^3/m	Cubic metre per minute
15	m^3/h	Cubic metre per hour
16	m^3/d	Cubic metre per day
17	in^3/m	Cubic inch per minute
18	`CFM`	Cubic foot per minute
19	`CFH`	Cubic foot per hour
21	`CFD`	Cubic foot per day (from firmware 6v08)
62	`count`	Set point count, 0–64000
63	`%`	Percent of full scale

B-5 Total volume units

Value	Label	Description
0		Unit not specified; use default values.
1	---	Unknown unit; no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
2	µL	Microlitre
3	mL	Millilitre
4	L	Litre
5	US GAL	US gallon
6	cm^3	Cubic centimetre
7	m^3	Cubic metre
8	in^3	Cubic inch
9	ft^3	Cubic foot
61	µP	Micropoise, a measure of viscosity; no conversions are performed to or from other units

B-6 Pressure units

Value	Label	Description
0		Unit not specified; use default values.
1	---	Unknown unit; no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
2	Pa	Pascal
3	hPa	Hectopascal
4	kPa	Kilopascal
5	MPa	Megapascal
6	mbar	Millibar
7	bar	Bar
8	g/cm^2	Gram force per square centimetre
9	kg/cm^2	Kilogram-force per square centimetre
10	PSI	Pound-force per square inch
11	PSF	Pound-force per square foot
12	mTorr	Millitorr
13	torr	Torr
14	mmHg	Millimetre of mercury at 0 °C
15	inHg	Inches of mercury at 0 °C
16	mmH_2O	Millimetre of water at 4 °C (NIST conventional)
17	mmH_2O	Millimetre of water at 60 °F
18	cmH_2O	Centimetre of water at 4 °C (NIST conventional)
19	cmH_2O	Centimetre of water at 60 °F
20	inH_2O	Inch of water at 4 °C (NIST conventional)
21	inH_2O	Inch of water at 60 °F

Value	Label	Description
22	atm	Atmosphere (absolute pressure only, no A/G/D suffix is applied)
61	V	Volt; no conversions are performed to or from other units (intended only for log-linear absolute pressure sensors, no A/G/D suffix is applied)
62	count	Set point count, 0–64000
63	%	Percent of full scale (no A/G/D suffix is applied)

B-7 Temperature units

Value	Label	Description
0		Unit not specified; use default values.
1	---	Unknown unit; no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
2	°C	Degree Celsius
3	°F	Degree Fahrenheit
4	°K	Kelvin
5	°Ra	Degree Rankine

B-8 Time interval units

Value	Label	Description
0		Unit not specified; use default values.
1	---	Unknown unit; no conversions are performed to other units. If calibrated with different units, the value is displayed in those units.
2	h:m:s	The value displayed as hours:minutes:seconds.
3	ms	Millisecond
4	s	Second
5	m	Minute
6	hour	Hour
7	day	Day

APPENDIX C

Gas numbers

Gas numbers are used by active gas (p. 14), set gas (p. 15) and the gas mixture commands. This list shows every gas number; the gases actually installed on your device are shown by list available gases (p. 14). Numbers 236 to 255 are reserved for your own gas mixtures (p. 29).

#	Short name	Long name
0	Air	Air (Clean Dry)
1	Ar	Argon
2	CH_4	Methane
3	CO	Carbon Monoxide
4	CO2	Carbon Dioxide
5	C_2H_6	Ethane
6	H_2	Hydrogen
7	He	Helium
8	N_2	Nitrogen
9	N_2O	Nitrous Oxide
10	Ne	Neon
11	O_2	Oxygen
12	C_3H_8	Propane
13	nC_4H_{10}	Normal Butane
14	C_2H_2	Acetylene
15	C_2H_4	Ethylene (Ethene)
16	iC_4H_{10}	Isobutane
17	Kr	Krypton
18	Xe	Xenon
19	SF_6	Sulfur Hexafluoride[1]
20	C-25	25 % CO_2, 75 % Ar
21	C-10	10 % CO_2, 90 % Ar
22	C-8	8 % CO_2, 92 % Ar
23	C-2	2 % CO_2, 98 % Ar
24	C-75	75 % CO_2, 25 % Ar
25	He-25	25 % He, 75 % Ar
26	He-75	75 % He, 25 % Ar
27	A1025	90 % He, 7.5 % Ar, 2.5 % CO_2
28	Star29	Stargon CS (90 % Ar, 8 % CO_2, 2 % O_2)
29	P-5	5 % CH_4, 95 % Ar
30	NO	Nitric Oxide[2]
31	NF_3	Nitrogen Trifluoride[2]
32	NH_3	Ammonia[2]
33	Cl_2	Chlorine[2]
34	H_2S	Hydrogen Sulfide[2]
35	SO_2	Sulfur Dioxide[2]
36	C_3H_6	Propylene[2]
80	1Buten	1-Butylene[2]
81	cButen	Cis-Butene (cis-2-Butene)[2]
82	iButen	Isobutene[2]
83	tButen	Trans-2-Butene[2]
84	COS	Carbonyl Sulfide[2]
85	DME	Dimethylether (C_2H_6O)[2]
86	SiH_4	Silane[2]
100	R-11	Trichlorofluoro-methane (CCl_3F)[2,3]
101	R-115	Chloropentafluoro-ethane (C_2ClF_5)[2,3]
102	R-116	Hexafluoroethane (C_2F_6)[2]
103	R-124	Chlorotetrafluoro-ethane (C_2HClF_4)[2,3]
104	R-125	Pentafluoroethane (CF_3CHF_2)[2,3]
105	R-134A	Tetrafluoroethane (CH_2FCF_3)[2,3]
106	R-14	Tetrafluoromethane (CF_4)[2]
107	R-142b	Chlorodifluoroethane (CH_3CClF_2)[2,3]
108	R-143a	Trifluoroethane ($C_2H_3F_3$)[2,3]
109	R-152a	Difluoroethane ($C_2H_4F_2$)[2]
110	R-22	Difluoromonochloro-methane ($CHClF_2$)[2,3]
111	R-23	Trifluoromethane (CHF_3)[2,3]
112	R-32	Difluoromethane (CH_2F_2)[2,3]
113	R-318	Octafluorocyclobutane (C_4F_8)[2]
114	R-404A	44 % R-125, 4 % R-134A, 52 % R-143A[2,3]
115	R-407C	23 % R-32, 25 % R-125, 52 % R-134A[2,3]
116	R-410A	50 % R-32, 50 % R-125[2,3]
117	R-507A	50 % R-125, 50 % R-143A[2,3]
140	C-15	15 % CO_2, 85 % Ar
141	C-20	20 % CO_2, 80 % Ar
142	C-50	50 % CO_2, 50 % Ar
143	He-50	50 % He, 50 % Ar
144	He-90	90 % He, 10 % Ar
145	Bio5M	5 % CH_4, 95 % CO_2
146	Bio10M	10 % CH_4, 90 % CO_2
147	Bio15M	15 % CH_4, 85 % CO_2
148	Bio20M	20 % CH_4, 80 % CO_2
149	Bio25M	25 % CH_4, 75 % CO_2
150	Bio30M	30 % CH_4, 70 % CO_2
151	Bio35M	35 % CH_4, 65 % CO_2
152	Bio40M	40 % CH_4, 60 % CO_2
153	Bio45M	45 % CH_4, 55 % CO_2
154	Bio50M	50 % CH_4, 50 % CO_2
155	Bio55M	55 % CH_4, 45 % CO_2
156	Bio60M	60 % CH_4, 40 % CO_2
157	Bio65M	65 % CH_4, 35 % CO_2
158	Bio70M	70 % CH_4, 30 % CO_2
159	Bio75M	75 % CH_4, 25 % CO_2
160	Bio80M	80 % CH_4, 20 % CO_2
161	Bio85M	85 % CH_4, 15 % CO_2
162	Bio90M	90 % CH_4, 10 % CO_2
163	Bio95M	95 % CH_4, 5 % CO_2
164	EAN-32	32 % O_2, 68 % N_2
165	EAN-36	36 % O_2, 64 % N_2
166	EAN-40	40 % O_2, 60 % N_2
167	HeOx20	20 % O_2, 80 % He
168	HeOx21	21 % O_2, 79 % He
169	HeOx30	30 % O_2, 70 % He
170	HeOx40	40 % O_2, 60 % He
171	HeOx50	50 % O_2, 50 % He
172	HeOx60	60 % O_2, 40 % He
173	HeOx80	80 % O_2, 20 % He

#	Short name	Long name
174	HeOx99	99 % O_2, 1 % He
175	EA-40	Enriched air, 40 % O_2
176	EA-60	Enriched air, 60 % O_2
177	EA-80	Enriched air, 80 % O_2
178	Metab	Metabolic Exhalant (16 % O_2, 78.04 % N_2, 5 % CO_2, 0.96 % Ar)
179	LG-4.5	4.5 % CO_2, 13.5 % N_2, 82 % He
180	LG-6	6 % CO_2, 14 % N_2, 80 % He
181	LG-7	7 % CO_2, 14 % N_2, 79 % He
182	LG-9	9 % CO_2, 15 % N_2, 76 % He
183	HeNe-9	9 % Ne, 91 % He
184	LG-9.4	9.4 % CO_2, 19.25 % N_2, 71.35 % He
185	SynG-1	40 % H_2, 29 % CO, 20 % CO_2, 11 % CH_4
186	SynG-2	64 % H_2, 28 % CO, 1 % CO_2, 7 % CH_4
187	SynG-3	70 % H_2, 4 % CO, 25 % CO_2, 1 % CH_4
188	SynG-4	83 % H_2, 14 % CO, 3 % CH_4
189	NatG-1	93 % CH_4, 3 % C_2H_6, 1 % C_3H_8, 2 % N_2, 1 % CO_2
190	NatG-2	95 % CH_4, 3 % C_2H_6, 1 % N_2, 1 % CO_2
191	NatG-3	95.2 % CH_4, 2.5 % C_2H_6, 0.2 % C_3H_8, 0.1 % C_4H_{10}, 1.3 % N_2, 0.7 % CO_2
192	CoalG	50 % H_2, 35 % CH_4, 10 % CO, 5 % C_2H_4
193	Endo	75 % H_2, 25 % N_2
194	HHO	66.67 % H_2, 33.33 % O_2
195	HD-5	LPG: 96.1 % C_3H_8, 1.5 % C_2H_6, 0.4 % C_3H_6, 1.9 % n-C_4H_{10}
196	HD-10	LPG: 85 % C_3H_8, 10 % C_3H_6, 5 % n-C_4H_{10}
197	OCG-89	89 % O_2, 7 % N_2, 4 % Ar
198	OCG-93	93 % O_2, 3 % N_2, 4 % Ar
199	OCG-95	95 % O_2, 1 % N_2, 4 % Ar
200	FG-1	2.5 % O_2, 10.8 % CO_2, 85.7 % N_2, 1 % Ar
201	FG-2	2.9 % O_2, 14 % CO_2, 82.1 % N_2, 1 % Ar
202	FG-3	3.7 % O_2, 15 % CO_2, 80.3 % N_2, 1 % Ar
203	FG-4	7 % O_2, 12 % CO_2, 80 % N_2, 1 % Ar
204	FG-5	10 % O_2, 9.5 % CO_2, 79.5 % N_2, 1 % Ar
205	FG-6	13 % O_2, 7 % CO_2, 79 % N_2, 1 % Ar
206	P-10	10 % CH_4, 90 % Ar
210	D-2	Deuterium

[1] Sulfur hexafluoride is a highly potent greenhouse gas monitored under the Kyoto Protocol.

[2] Corrosion-resistant devices only.

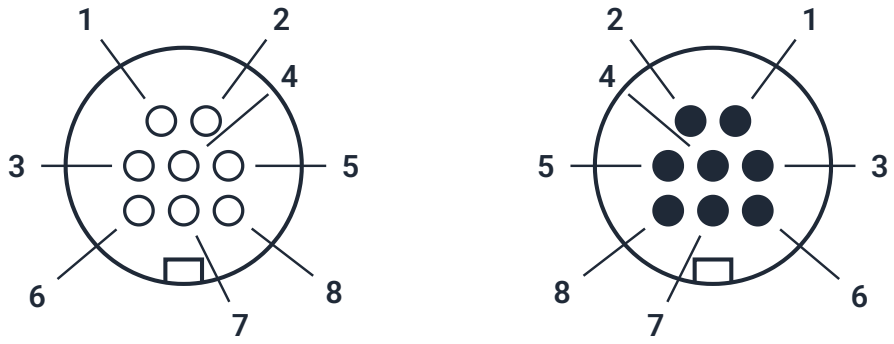
[3] Under the Montreal Protocol and its Kigali Amendment, the production and consumption of these ozone-depleting substances is being, or has been, phased out. Make sure you comply with these regulations before using these gases; the same applies to R-113, R-123 and R-141b.

APPENDIX D

Serial connector pin-outs

Check the calibration data sheet and the pin-out of your own device: the options you ordered decide which output signals are present. The serial lines are on pins 3 (RS-232 receive / RS-485 B+) and 5 (RS-232 send / RS-485 A−) of the 8-pin Mini-DIN, and on pins 2 and 3 of the locking industrial connector; ground is common to power, digital communications, analogue signals and alarms. The 9-pin and 15-pin D-sub connectors follow the Mini-DIN and locking connector below. For the M12 connectors, see Appendix A of the operating manual of your device.

8-pin Mini-DIN



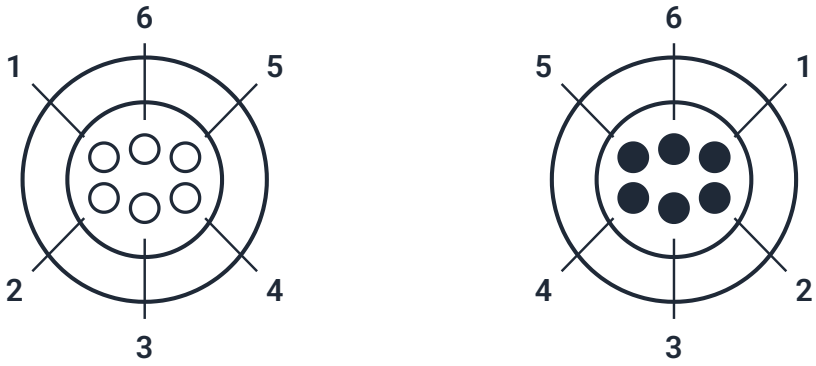
8-pin Mini-DIN: socket on the device (left) and plug on the cable (right), seen from the mating face.

Pin	Function
1	Not connected. Option: 4–20 mA primary output signal.
2	Static 5.12 V DC. Option: secondary analogue output (4–20 mA, 0–5 V DC, 1–5 V DC, 0–10 V DC) or basic alarm.
3	Serial RS-232 RX (receive, input) / RS-485 B(+)
4	Analogue set point input (controllers); remote tare (meters and gauges)
5	Serial RS-232 / RS-485 A(−) output signal (send)
6	0–5 V DC analogue output. Option: 1–5 V DC or 0–10 V DC output signal.
7	Power in
8	Ground (common for power, digital communications, analogue signals and alarms)

NOTICE

Do not connect power to pins 1 to 6: the device can be damaged permanently. Pin 2 is easily taken for the 0–5 V DC analogue output, but it normally carries a constant 5.12 V DC.

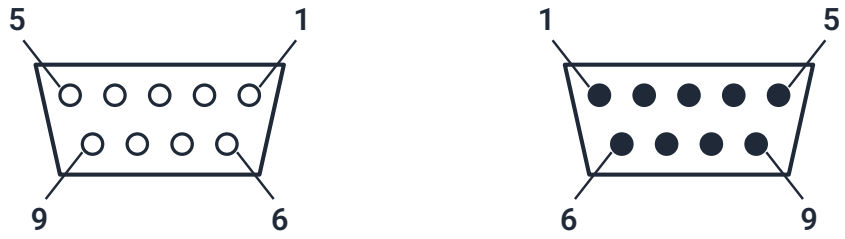
Locking industrial connector



6-pin locking industrial connector: socket on the device (left) and plug on the cable (right), seen from the mating face.

Pin	Function
1	Power in
2	Serial RS-232 TX (send, output) / RS-485 A(−)
3	Serial RS-232 RX (receive, input) / RS-485 B(+)
4	Analogue set point input (controllers)
5	Remote tare (meters and gauges)
6	Ground (common for power, digital communications, analogue signals and alarms)

9-pin D-sub



9-pin D-sub: female connector (left) and male connector (right), seen from the mating face.

Common pin-outs of the 9-pin D-sub, one column per variant. The table is split in two parts. The key of terms follows the 15-pin D-sub table.

Pin	DB9 (female) / DB9M (male)	DB9A and DB9K	DB9R	DB9T	DB9U
1	Current out	NC	TX or A	TX or A	RX or B
2	Analogue out 2	Analogue out	Analogue out	Analogue out	Analogue out
3	RX or B	Power in	Analogue in	Power in	Power in
4	Analogue in	Ground	Ground	Ground	Ground
5	TX or A	TX or A	NC	NC	NC
6	Analogue out	Analogue in	RX or B	Analogue in	Analogue in
7	Power in	Ground	Power in	Ground	Ground
8	Ground	Ground	Ground	Ground	Ground
9	Ground	RX or B	Ground	RX or B	TX or A

Pin	DB9B	DB9G	DB9H	DB9I	DB9N
1	Analogue out 2	RX or B	TX or A	NC	Power in
2	Analogue out	Analogue out	Analogue out	Analogue out	Analogue in
3	Power in	Ground	Analogue in	Power in	Analogue out
4	Ground	Power in	RX or B	Ground	NC
5	Ground	Ground	Analogue out 2	NC	Ground
6	Analogue in	TX or A	NC	Analogue in	Ground
7	Ground	Analogue in	Power in	Ground	RX or B
8	TX or A	Current out	Ground	RX or B	TX or A
9	RX or B	Ground	Ground	TX or A	NC

15-pin D-sub



15-pin D-sub: female connector (left) and male connector (right), seen from the mating face.

Common pin-outs of the 15-pin D-sub, one column per variant.

Pin	DB15	DB15A	DB15B	DB15H	DB15K	DB15O	DB15S
1	Ground	Ground	Ground	NC	NC	Ground	Ground
2	Analogue out	Analogue out	Analogue out	RX or B	Analogue out	NC	Analogue out
3	Ground	Analogue in	Ground	NC	NC	Ground	NC
4	NC	Ground	NC	NC	NC	Analogue out	NC
5	Power in	Ground	Power in	Ground	Ground	Power in	Ground
6	NC	Ground	NC	Analogue out	NC	NC	NC
7	NC	Power in	NC	Ground	Power in	Analogue in	NC
8	Analogue in	TX or A	Analogue in	NC	Analogue in	NC	Analogue in
9	Ground	Ground	Ground	NC	Analogue out 2	Ground	Ground
10	Ground	NC	Ground	Analogue out 2	NC	Ground	Ground
11	Analogue out 2	NC	Analogue out 2	Power in	Ground	Analogue out 2	Analogue out 2
12	NC	Analogue out 2	NC	Ground	Ground	NC	RX or B
13	RX or B	NC	NC	NC	RX or B	NC	Power in
14	Ground	NC	RX or B	Analogue in	TX or A	RX or B	TX or A
15	TX or A	RX or B	TX or A	TX or A	Ground	TX or A	Ground

Key of terms for the D-sub tables

Analogue in	Analogue set point input for controllers; ground to tare on meters and gauges
Analogue out	0–5 V DC output signal (1–5 V DC or 0–10 V DC optional)
Analogue out 2	5.12 V DC or optional secondary analogue output
Current out	Not connected by default. If it is not present, Analogue out includes the current. Optional 4–20 mA analogue output signal.
NC	Not connected
Power in	Supply (+V DC)
RX or B	Serial RS-232 RX or RS-485 (+)
TX or A	Serial RS-232 TX or RS-485 (−)
Ground	Common for power, digital communications, analogue signals and alarms

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