ANALYT MESSTECHNIK



COMMUNICATION GUIDE

358 Series PROFINET

Cyclic data, acyclic data records, commands and set-up for reading and controlling 358 Series flow devices from a PROFINET controller.

AMTC-CG-0003

Rev. 1 · October 2026

About this guide

This guide explains how to use a 358 Series device ordered with PROFINET: how to connect it, which cyclic data it exchanges with your PROFINET controller, which acyclic data records it offers, and which commands it accepts. It also shows how to add the device to a TIA Portal project.

Each command states the firmware version that introduced it; a device with older firmware does not have it. The firmware of a device is in data record `0x0004` (Instrument firmware version (p. 14)) and on the *Device Summary* page of its web server.

If you are connecting a device for the first time, start with Chapter 1 (p. 5). If you only need slots, indices and command IDs, go straight to the Command and register reference (p. 12).

Modbus and serial communication are described in the *358 Series Modbus RTU and Modbus TCP/IP — Communication guide* (AMTC-CG-0001) and the *358 Series serial interface (RS-232/RS-485) — Communication guide* (AMTC-CG-0002). If your application needs something that is not covered here, the Analyt-MTC application engineers will be glad to help.

Conventions in this guide:

- Status names and values you write or read are set in monospace type, for example `SUCCESS`.
- Hexadecimal values carry the prefix `0x`, for example index `0x0001`. All other numbers are decimal.
- Menu paths on the device display are set in italics, for example *MENU > SETUP > Network*.
- Firmware versions are written as on the device, for example 10v07: major release 10, minor release 07.

Abbreviations

Abbreviation	Meaning
DCP	Discovery and Configuration Protocol (PROFINET name and address assignment)
FOPDT	First-order-plus-dead-time (process model)
GSD, GSDML	General Station Description, in the GSD Markup Language: the device description file of a PROFINET device
IEEE 754	Standard for floating-point numbers; Float32 values are IEEE 754 single-precision
IO	Input/output
IP	Internet Protocol
LED	Light-emitting diode (indicator light)
MAC	Media access control (the physical address of an Ethernet port)
PD²I, PDF	The two closed-loop control algorithms of the controllers
PLC	Programmable logic controller
TIA	Totally Integrated Automation (TIA Portal: PLC engineering software)

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 (on its label, and on the *Device Summary* page of the web server);
- the application and adapter firmware shown on the *Device Summary* page;
- the command ID and argument you sent and the status and return value you read in data record `0x0003`.

Document information

Title	358 Series PROFINET — Communication guide
Document number	AMTC-CG-0003
Revision	Rev. 1 — October 2026
Applies to	358 Series mass flow meters, mass flow controllers and liquid flow meters with PROFINET
Language	English
Related documents	358 Series Modbus RTU and Modbus TCP/IP — Communication guide (AMTC-CG-0001); 358 Series serial interface (RS-232/RS-485) — Communication guide (AMTC-CG-0002); 358 Series M, MB, MLW and MLWB Mass Flow Meters — Operating manual (AMTC-MN-0004); 358 Series MC Mass Flow Controllers — Operating manual (AMTC-MN-0005); 358 Series L Liquid Flow Meters — Operating manual (AMTC-MN-0002)

Revision history

Rev.	Date	Change
1	October 2026	First issue.

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CHAPTER 1

Interface and wiring

358 Series devices with PROFINET

A 358 Series device with PROFINET obtains its IP address through DCP from your PROFINET controller. The devices are certified by PROFIBUS and work as Conformance Class B devices of Netload Class III.

To set up the device in your engineering tool, use the device description file (GSDML file) supplied with the instrument. If you do not have it, ask Analyt-MTC. Adding the device to a TIA Portal project (p. 8) shows the set-up step by step.

The device is built with one of two connector versions: two RJ45 Ethernet ports, or two M12 Ethernet connectors and one M8 power connector.

Getting connected

RJ45 Ethernet ports

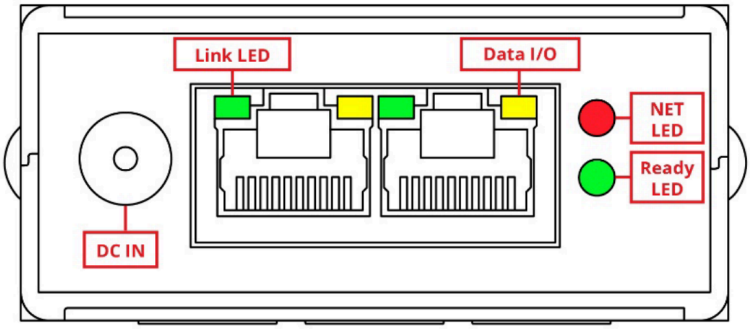


Figure 1. Device with PROFINET and RJ45 ports.

On a device with two RJ45 ports, the ports are labelled P1, the right-hand port next to the LEDs, and P2, the left-hand port next to the power connector.

Each RJ45 port has two LEDs. The green Link LED is lit while the port is connected to the network; if it is off, the device cannot connect to the network. The yellow Data I/O LED flashes as data packets are sent or received.

To the right of the two ports are the NET LED, nearer the back of the device, which shows whether the device is connected to a PLC, and the Ready LED, nearer the display or front of the device, which shows the operating status.

1-1 Ready and NET LEDs

LED state	Ready LED	NET LED
Off	Start-up	Start-up
Flashing red	—	No active data exchange
Flashing green	Flash LED command active	—
Solid green	Configuration complete	Active data exchange

M12 Ethernet and M8 power connectors

A device built with the M12 version has two 4-pin M12 Ethernet connectors on top and one 4-pin M8 power connector on the side, with the pin assignments below.

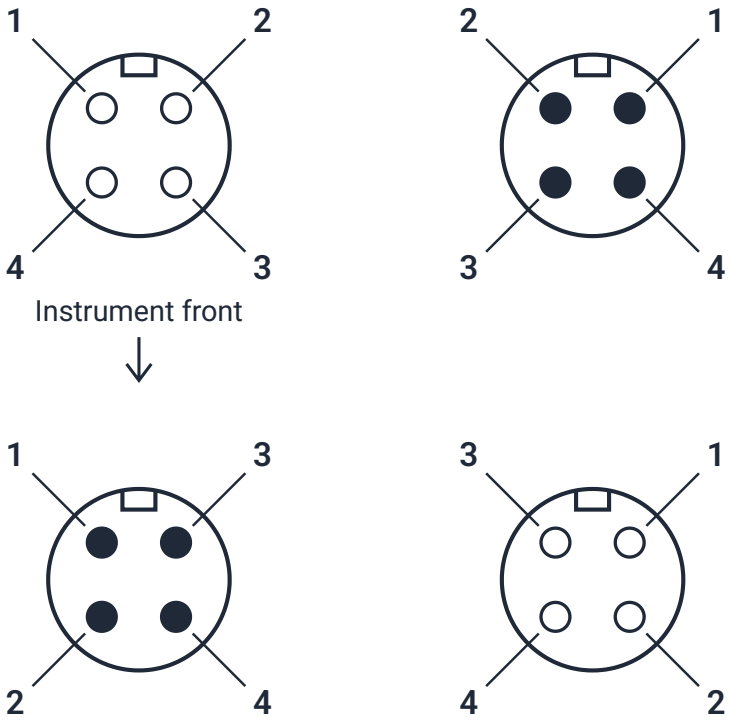


Figure 2. Top: M12 Ethernet, seen from the top, female socket on the device (left) and male plug on the cable (right). Bottom: M8 power, seen from the side, male plug on the device (left) and female socket on the cable (right).

1-2 4-pin M12 Ethernet

Pin	Signal	Function
1	Tx+	Send data +
2	Rx+	Receive data +
3	Tx−	Send data −
4	Rx−	Receive data −

1-3 4-pin M8 power

Pin	Function
1	Reserved. Do not connect.
2	Power in: powers the device.
3	Reserved. Do not connect.
4	Ground: common ground for power and digital communication.

Network settings on the display

The IP address is assigned through DCP. On a device with a display, you can read the assigned address in *MENU > SETUP > Network > Network Status*. The MAC address is printed on the device to help you assign addresses.

A device with PROFINET and a display has an additional communication menu that the operating manual does not describe. Open it with *MENU > SETUP > Network*. It offers *Network Status*, *Format*, *Web Server*, *Cyclic Data* and *Received Commands* (Figure 3).

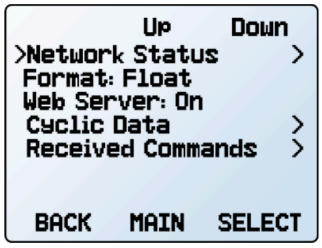


Figure 3. Communication menu: *Network Status*, *Format: Float*, *Web Server: On*, *Cyclic Data*, *Received Commands*.

- **Network Status** — helps you diagnose communication problems. It shows the PROFINET adapter version, the IP address, the MAC address, the link state (*Link Up*) and whether a PLC is connected (*PLC: Connected*).
- **Format** — selects whether the data values are presented as integers or as floating-point numbers (Cyclic data (p. 12)). A change takes effect after 15 seconds.
- **Web Server** — switches the embedded web server on or off (Embedded web server (p. 7)).
- **Cyclic Data** — shows how many times the device has updated the cyclic data readings. *CLEAR* sets the count to 0 (Figure 4).
- **Received Commands** — lists the ten most recent commands written to the device, the most recent at the top (Figure 5). See Commands (p. 15).

In the *Received Commands* screen:

- **HOLD** stops the list from showing new commands sent to the device.
- **UPDATE** is shown only after HOLD; it makes the list show new commands again.
- **DETAIL** opens the selected command (Figure 6): the command ID written to the device, the argument, the status of the command and, where the command returns one, the return value.

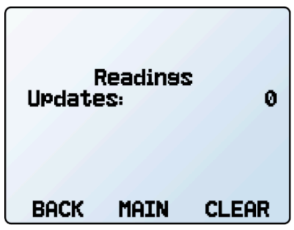


Figure 4. *Cyclic Data* screen.

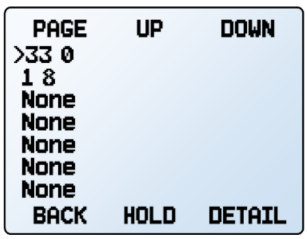


Figure 5. *Received Commands*: command ID and argument.

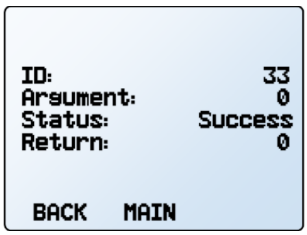


Figure 6. Detail of a received command.

Embedded web server

Every 358 Series device with PROFINET has an embedded web server. It shows device and network information and the configuration of the device. To open it, enter the IP address of the device in the web browser of your computer. You can switch the web server off on the display (*MENU > SETUP > Network > Web Server*).

Device Summary

The first page of the web server shows the device and the state of its network connection:

Field	Meaning
Application Firmware	The firmware version of the device. It decides which commands the device has, how it operates and how its display menus are organised.

Field	Meaning
Adapter Firmware	The communication protocol configured on the device, and its firmware. It reads PROFINET; if it does not, contact Analyt-MTC support.
Serial Number	The serial number of the device. It never changes and is the number on the back of the device.
Port 1 MAC Address	The physical address of Ethernet port 1.
Port 2 MAC Address	The physical address of Ethernet port 2.
IP Address	The current IP address, assigned through DCP.
Subnet Mask	The subnet mask of the network the device is connected to, assigned through DCP.
Gateway	The address of the gateway the device is connected to, assigned through DCP.

IO Modules

This page shows the input and output modules of the device: for each reading, its module ID, format, engineering units and current value. All modules are inputs except the requested set point.

There are two modules, one for floating-point values (Float32) and one for integer values (Integer32). Both work the same; only the format of the readings differs. Select the module on the display (*MENU > SETUP > Network > Format*) and wait at least 15 seconds for the change to take effect. If the device has no display, ask Analyt-MTC to change the module format.

Read/Write Data Records

This page lists the acyclic data records the device has: up to two write records and up to thirteen read records. A record shown on this page can be read or written on this device. For each reading the page shows its minimum and maximum, its engineering units and its number of decimal places. The records are described in Acyclic data records (p. 13).

Internal Configuration

This page is a troubleshooting tool: it reads and writes the device registers that control its settings.

NOTICE

Writing a register on the *Internal Configuration* page without knowing its function can invalidate the calibration, disable communication or permanently damage the device. Contact Analyt-MTC support before you use this page.

Adding the device to a TIA Portal project

The device description file (GSDML file) supplied with the instrument installs two modules: *Float Readings*, which provides the cyclic data in floating-point (Float32) format, and *Integer Readings*, which provides it in integer (Integer32) format. Both work the same; only the format of the readings differs (Cyclic data (p. 12)).

You need the device description file supplied with the instrument; install it before you add the device.

1. Install the device description file in TIA Portal.
2. In the hardware catalogue, open *Other field devices > PROFINET IO > I/O*, then the folder and the device entry that the device description file has installed. The two modules are listed under the device entry.
3. Check the format the device is set to, on the display (Network settings on the display (p. 6)) or on the *IO Modules* page of the web server, and use the module of the same format.
4. If you need to confirm which device you are adding, use the *Flash LED* setting: the display and the Ready LED of the device flash for 15 seconds.

5. Use the device view to find the slot and the address of each part of the module (Figure 7).

			Setpoint_1	0	1	68...71	64...67	Setpoint
			Valve Drive_1	0	2	72...75		Valve Drive
			Primary Pressure_1	0	3	76...79		Primary Pressure
			Secondary Pressure_1	0	4	80...83		Secondary Pressure
			Barometric Pressure_1	0	5	84...87		Barometric Pressure
			Temperature_1	0	6	88...91		Temperature
			Volumetric Flow_1	0	7	92...95		Volumetric Flow
			Mass Flow_1	0	8	96...99		Mass Flow
			Totalizer 1_1	0	9	100...103		Totalizer 1
			Totalizer 2_1	0	10	104...107		Totalizer 2
			Relative Humidity_1	0	11	108...111		Relative Humidity
			Device Status_1	0	12	1...4		Device Status
			Gas Number_1	0	13	112...113		Gas Number
			Active Alarms_1	0	14	5...6		Active Alarms

Figure 7. Device overview of the *Float Readings* module. Columns: module, rack, slot, input address, output address, type. Only the set point (slot 1) has an output address.

The device is now part of the project and exchanges its cyclic data with the PLC; the NET LED is solid green while data is exchanged (Table 1-1).

CHAPTER 2

Protocol conventions

Cyclic and acyclic data

A 358 Series device exchanges two kinds of data with a PROFINET system:

- **Cyclic data** — the readings, the set point, the device status, the gas number and the alarm outputs, in fixed module slots. The slots cannot be changed, so the overall packet size is fixed as well.
- **Acyclic data records** — two write records, to send commands and gas mixes, and up to thirteen read records with the command status, the firmware version and information on each reading. All records are in slot 1 (decimal address 270). Not every record is present on every device; the *Read/Write Data Records* page of the web server lists those your device has.

Data formats

The cyclic data comes in one of two formats: floating point (Float32) or integer (Integer32). Only one format is active at a time; select it on the display (Network settings on the display (p. 6)). The functions of the two modules are the same; only the presentation of the readings differs.

- **Float32** — the readings are IEEE 754 single-precision floating-point values in the engineering units of the reading. An invalid reading reads `0xFFFFFFFF`.
- **Integer32** — the readings are integers with an implied decimal point. To get the value in engineering units, multiply the integer by 10^{-n}, where n is the number of decimal places of the reading, at offset 22 of its information record. An invalid reading reads `-2147483648`.

The acyclic records use the data types Unsigned16, Unsigned32, Integer32 and Float32, given for each byte offset in Chapter 3 (p. 12). Byte offsets count from the start of the record.

Units, types and sources

Several records and commands return a number that stands for a statistic, a data source or an engineering unit. The meaning of each number is in the appendices: statistics in Appendix A (p. 40), engineering units in Appendix B (p. 43), data sources in Appendix C (p. 46) and gas numbers in Appendix D (p. 47).

Sending a command

A command is a command ID and an argument written to the send command record, index `0x0001`: the ID at byte offset 0, the argument at byte offset 4. After running the command, the device sets a status; read it, with the return value, in the command status record, index `0x0003`. The status values are in Command status (p. 15).

> **Note**
> A command cannot be repeated twice in a row. To repeat a command, send command 0, No operation (p. 16), between the two. Sending command 0 before or after every command prevents a command from repeating unintentionally.

Network access and protection

The device takes its IP address, subnet mask and gateway from your PROFINET controller through DCP. Anyone who can reach that address can open the embedded web server; switch the web server off on the display (*MENU > SETUP > Network > Web Server*) if you do not use it. The *Internal Configuration* page of the web server can write device registers; see the notice in Internal Configuration (p. 8).

The device keeps its settings and calibration, including any gas mixes you create. Restore factory settings (p. 34) returns all settings to their factory values.

CHAPTER 3

Command and register reference

The cyclic data modules, every acyclic data record and every command of a 358 Series device with PROFINET, with the firmware version that introduced each command.

Cyclic data

The module slots are fixed. All modules are inputs except the set point, which is both output and input: the output is the requested set point, the input is the current set point.

3-1 Cyclic data, floating-point format (Float32)

Module	Slot	Type	Description
0x1101	1	Float32	Set point, output and input. Output: the requested set point. Input: the current set point.
0x1102	2	Float32	Current valve drive
0x1103	3	Float32	Current pressure reading; the primary pressure if there is a secondary pressure
0x1104	4	Float32	Current secondary pressure reading, from a second pressure sensor or from a barometer
0x1105	5	Float32	Current barometric pressure reading
0x1106	6	Float32	Current temperature reading
0x1107	7	Float32	Current volumetric flow reading
0x1108	8	Float32	Current mass flow reading
0x1109	9	Float32	Current totaliser 1 reading
0x110A	10	Float32	Current totaliser 2 reading
0x110B	11	Float32	Current humidity reading
0x1301	12	Unsigned32	Device status
0x1302	13	Unsigned16	Current gas number
0x1303	14	Unsigned16	Alarm outputs state

In this format an invalid reading reads 0xFFFFFFFF.

3-2 Cyclic data, integer format (Integer32)

Module	Slot	Type	Description	Decimal places in
0x1201	1	Integer32	Set point, output and input. Output: the requested set point. Input: the current set point.	Index 0x0005, offset 22
0x1102	2	Integer32	Current valve drive	Index 0x0006, offset 22
0x1103	3	Integer32	Current pressure reading; the primary pressure if there is a secondary pressure	Index 0x0007, offset 22
0x1104	4	Integer32	Current secondary pressure reading, from a second pressure sensor or from a barometer	Index 0x0008, offset 22
0x1105	5	Integer32	Current barometric pressure reading	Index 0x0009, offset 22
0x1106	6	Integer32	Current temperature reading	Index 0x000A, offset 22
0x1107	7	Integer32	Current volumetric flow reading	Index 0x000B, offset 22
0x1108	8	Integer32	Current mass flow reading	Index 0x000C, offset 22
0x1109	9	Integer32	Current totaliser 1 reading	Index 0x000D, offset 22
0x110A	10	Integer32	Current totaliser 2 reading	Index 0x000E, offset 22

Module	Slot	Type	Description	Decimal places in
0x110B	**11**	Integer32	Current humidity reading	Index 0x000F, offset 22
0x1301	**12**	Unsigned32	Device status	—
0x1302	**13**	Unsigned16	Current gas number	—
0x1303	**14**	Unsigned16	Alarm outputs state	—

In this format an invalid reading reads −2147483648. Multiply an integer reading by 10^{-n}, n being the decimal places given in the last column, for the value in engineering units.

Acyclic data records

All records are in slot 1 (decimal address 270). Not every record is present on every device; the *Read/Write Data Records* page of the web server lists those your device has.

3-3 Data records

Index	Access	Record
0x0001	Write	Send command (p. 13)
0x0002	Write	Write gas mix (p. 13) (mass flow devices only)
0x0003	Read	Command status (p. 14)
0x0004	Read	Instrument firmware version (p. 14)
0x0005–0x000F	Read	Reading information (p. 14): set point, valve drive, pressure, secondary pressure, barometric pressure, temperature, volumetric flow, mass flow, totaliser 1, totaliser 2, humidity

Send command

Index 0x0001. The first of the two write records. It commands the device to perform an action such as a tare, a gas change or locking the display. See Commands (p. 15).

Byte offset	Type	Description
0	Unsigned32	ID of the command
4	Integer32	Argument of the command

Write gas mix

Index 0x0002. The second write record, enabled on mass flow devices only. It stores a custom mix of up to five gases, so that the device reports the mass flow of the mixture accurately.

> **Note**
> This record does not make the device mix gases. The gases must already be mixed in the right proportions before they reach the device.

Write the gas number of each gas (Appendix D (p. 47)), starting at byte offset 0, each followed by its percentage of the mix at the next offset. One count is 0.01 %: 5000 means 50 %. With fewer than five gases, write 0 in the remaining offsets. The percentages must add up to 100 %, or the mix is not created. Then send Create/update gas mix (p. 33).

Byte offset	Type	Description
0	Unsigned16	Gas number of gas 1
2	Unsigned16	Percentage of gas 1; 1 count = 0.01 %
4	Unsigned16	Gas number of gas 2

Byte offset	Type	Description
6	Unsigned16	Percentage of gas 2; 1 count = 0.01 %
8	Unsigned16	Gas number of gas 3
10	Unsigned16	Percentage of gas 3; 1 count = 0.01 %
12	Unsigned16	Gas number of gas 4
14	Unsigned16	Percentage of gas 4; 1 count = 0.01 %
16	Unsigned16	Gas number of gas 5
18	Unsigned16	Percentage of gas 5; 1 count = 0.01 %

Command status

Index `0x0003`. A read record with the command being executed or last completed: its ID, its argument, its status and the value it returned, if any. See Commands (p. 15).

Byte offset	Type	Description
0	Unsigned32	ID of the current or last completed command
4	Integer32	Argument of the current or last completed command
8	Unsigned32	Status of the current or last completed command (Table 3-7 (p. 15))
12	Integer32	Value returned by the command

Instrument firmware version

Index `0x0004`. A read record with the firmware installed on the device.

Byte offset	Type	Description
0	Unsigned16	Major firmware release. Example: the 10 in 10v05.0.
2	Unsigned16	Minor firmware release. Example: the 05 in 10v05.0.
4	Unsigned16	Version of the custom firmware, if any; usually 0. Example: the .0 in 10v05.0.
6	Unsigned16	Reserved for internal use; always 0.

Reading information

Indices `0x0005–0x000F`. Eleven read records, one per reading, give what the reading is (its type, a statistic), where it comes from (its source), its minimum and maximum without overrange, its engineering units and its number of decimal places. All eleven have the layout of Table 3-4; Table 3-5 gives the index of each and where to look up its values.

3-4 Layout of a reading information record

Byte offset	Type	Description
0	Unsigned16	Type: the statistic of the reading (Appendix A (p. 40)). For the set point, the variable being controlled; for the valve drive, what the valve drive controls; for a totaliser, the reading being totalised.
2	Unsigned16	Source: where the reading comes from (Appendix C (p. 46)); for the valve drive, where the valve gets its setting.
4	Float32	Minimum value, without overrange
8	Float32	Maximum value, without overrange
12	Integer32	Minimum value, without overrange. Multiply by 10^{-n}, n being the value at offset 22, for engineering units.
16	Integer32	Maximum value, without overrange. Multiply by 10^{-n}, n being the value at offset 22, for engineering units.
20	Unsigned16	Engineering units (Appendix B (p. 43); the table per record is in Table 3-5)

Byte offset	Type	Description
22	Unsigned16	Decimal places: the number of digits after the decimal point in the current value, the minimum and the maximum

3-5 Reading information records

Index	Reading	Type (offset 0)	Units (offset 20)	Notes
`0x0005`	Set point	Appendix A	Appendix B	—
`0x0006`	Valve drive	Table A-3	Appendix B	—
`0x0007`	Pressure	Table A-2	Table B-6	Type and source are 0 if the reading is not available.
`0x0008`	Secondary pressure	Table A-2	Table B-6	Not always present. Type and source are 0 if the reading is not available.
`0x0009`	Barometric pressure	Table A-2	Table B-6	Type and source are 0 if the reading is not available.
`0x000A`	Temperature	Table A-3	Table B-7	Type and source are 0 if the reading is not available.
`0x000B`	Volumetric flow	Table A-1	Table B-4	Type and source are 0 if the reading is not available.
`0x000C`	Mass flow	Table A-1	Table B-1	Type and source are 0 if the reading is not available.
`0x000D`	Totaliser 1	Table A-1	Table B-3 (mass flow), Table B-5 (volumetric flow)	Type and source are 0 if the reading is not available.
`0x000E`	Totaliser 2	Table A-1	Table B-3 (mass flow), Table B-5 (volumetric flow)	Type and source are 0 if the reading is not available.
`0x000F`	Humidity	Table A-3	Appendix B	Type and source are 0 if the reading is not available.

Commands

Write the command ID to byte offset 0 and the argument to byte offset 4 of the send command record, index `0x0001` (Table 3-6). For example, to tare the flow, write command ID 33 to offset 0 and the tare time in milliseconds to offset 4.

3-6 Send command record

Byte offset	Type	Description
0	Unsigned32	ID of the command
4	Integer32	Argument of the command

After running a command, the device sets a status, which you read at byte offset 8 of the command status record, index `0x0003`:

3-7 Command status

Value	Status	Meaning
0	`SUCCESS`	The last command completed successfully.
1	`IN_PROGRESS`	A command is being executed.
2	`INVALID_ID`	The ID of the last command is not valid.
3	`INVALID_ARGUMENT`	The argument of the last command is not valid.

Value	Status	Meaning
4	`UNSUPPORTED`	The device does not support the last command.
5	`INVALID_MIX_IDX`	The requested gas mix number is not valid.
6	`INVALID_MIX_GAS`	A gas of the mix does not exist on the device.
7	`INVALID_MIX_PCT`	The fractions of the gas mix do not add up to 100 %.

Some commands return a value, at byte offset 12 of the same record; the descriptions below say what it means. A command that defines no return value puts 0 there.

Each command below gives the firmware version that introduced it, the devices it applies to, its ID, its argument and its response.

> **Note**
> A command cannot be repeated twice in a row. Send command 0, No operation (p. 16), between two identical commands, or before or after every command.

Command function

This command makes sure that commands run as intended.

No operation

All devices

```
Command ID 0
```

Does nothing. It separates two commands with the same ID and argument, and may be sent before every command or at any time.

`Argument` Ignored.

Data readings

These commands return information about the readings of the device: their type, source, minimum and maximum, engineering units and decimal places. Where a return value is a number standing for a statistic, a source or a unit, look it up in the appendices. The argument selects the reading:

3-8 Reading argument

Value	Reading
0	Set point
1	Valve drive
2	Pressure
3	Secondary pressure
4	Barometric pressure
5	Temperature
6	Volumetric flow
7	Mass flow
8	Totaliser 1
9	Totaliser 2
10	Humidity

Each data readings command sets `INVALID_ARGUMENT` if the device has no reading for the argument.

Query reading type

10v07 All devices

`Command ID` **28**

Returns the statistic of a reading.

`Argument` The reading, from Table 3-8.

Response: `SUCCESS` if the device has the reading; the return value is its statistic (Appendix A (p. 40)). `INVALID_ARGUMENT` if it has not.

Query reading source

10v07 All devices

`Command ID` **27**

Returns the source of a reading.

`Argument` The reading, from Table 3-8.

Response: `SUCCESS` if the device has the reading; the return value is its source (Appendix C (p. 46)). `INVALID_ARGUMENT` if it has not.

Query reading minimum (integer)

10v07 All devices

`Command ID` **65538**

Returns the minimum value a reading can have, without overrange, as an integer.

`Argument` The reading, from Table 3-8.

Response: `SUCCESS` if the device has the reading; the return value is the minimum as an integer. Multiply it by 10^{-n}, n being the decimal places of the reading, for the minimum in its engineering units. `INVALID_ARGUMENT` if the device has no such reading.

Query reading minimum (float)

10v07 All devices

`Command ID` **65536**

Returns the minimum value a reading can have, without overrange, as a float.

`Argument` The reading, from Table 3-8.

Response: `SUCCESS` if the device has the reading; the return value is the minimum as an IEEE 754 single-precision float in the engineering units of the reading. `INVALID_ARGUMENT` if the device has no such reading.

Query reading maximum (integer)

10v07 All devices

`Command ID` **65539**

Returns the maximum value a reading can have, without overrange, as an integer.

`Argument` The reading, from Table 3-8.

Response: `SUCCESS` if the device has the reading; the return value is the maximum as an integer. Multiply it by 10^{-n}, n being the decimal places of the reading, for the maximum in its engineering units. `INVALID_ARGUMENT` if the device has no such reading.

Query reading maximum (float)

10v07 All devices

```
Command ID 65537
```

Returns the maximum value a reading can have, without overrange, as a float.

`Argument` The reading, from Table 3-8.

Response: `SUCCESS` if the device has the reading; the return value is the maximum as an IEEE 754 single-precision float in the engineering units of the reading. `INVALID_ARGUMENT` if the device has no such reading.

Query reading engineering units

10v07 All devices

```
Command ID 29
```

Returns the current engineering units of a reading.

`Argument` The reading, from Table 3-8.

Response: `SUCCESS` if the device has the reading; the return value is the value of its engineering units (Appendix B (p. 43)). `INVALID_ARGUMENT` if it has not.

Set reading engineering units

10v07 All devices

```
Command ID 65300 + offset
```

Changes the engineering units of a reading. Add the offset of the reading, the value in Table 3-8, to 65300: for the pressure reading, the command ID is 65302. Readings are not all independent: changing the units of the pressure also changes those of the secondary pressure and the barometric pressure.

`Argument` The value of the new engineering units (Appendix B (p. 43)).

Response: `SUCCESS` if the units have changed; the return value is the value of the new units. `UNSUPPORTED` if the offset in the command ID does not apply to the device; `INVALID_ARGUMENT` if the units are not valid for the reading.

Query reading decimal places

10v07 All devices

```
Command ID 30
```

Returns the number of digits after the implied decimal point in the current value, the minimum and the maximum of a reading.

`Argument` The reading, from Table 3-8.

Response: `SUCCESS` if the device has the reading; the return value is its number of decimal places. `INVALID_ARGUMENT` if it has not.

Control

These commands are for controllers only. They manage the set point, the valves and the totaliser batches.

Set power-up set point

7v05 Controllers

`Command ID` **12**

Stores the current set point; the controller uses it straight away the next time it is powered.

`Argument` Ignored.

Response: SUCCESS; the current set point is saved as the power-up set point.

Set point maximum ramp (saved)

10v07 Controllers

`Command ID` **65546**

Sets the maximum ramp rate of the set point and keeps it across power cycles. Do not send it more often than every few minutes.

`Argument` A negative value queries the current maximum ramp; 0 disables it. To set a ramp, take the change in percent of full scale per millisecond and multiply it by 10000000. Example: 1 % of full scale per second is 0.001 % per millisecond, which gives 10000. More values in the table below.

Value	Maximum ramp
1000000000	100 % of full scale every millisecond
10000000	1 % of full scale every millisecond
1000000	100 % of full scale every second
16667	100 % of full scale every minute
10000	1 % of full scale every second
278	100 % of full scale every hour
167	1 % of full scale every minute
28	10 % of full scale every hour

Response: SUCCESS when the command is complete; the return value is the current maximum ramp. Multiply it by 0.0000001 for percent of full scale per millisecond.

Set point maximum ramp (temporary)

10v07 Controllers

`Command ID` **65547**

Sets the maximum ramp rate of the set point without saving it: it is lost when the device loses power.

`Argument` As for Set point maximum ramp (saved) (p. 19): a negative value queries, 0 disables, other values from the table there.

Response: SUCCESS when the command is complete; the return value is the current maximum ramp. Multiply it by 0.0000001 for percent of full scale per millisecond.

Hold valve(s)

7v05 Controllers

> Command ID **6**

Holds the valve(s) and stops further control of the process, or cancels a hold.

`Argument` A value from the table below.

Value	Meaning
0	Cancel the valve hold and resume normal closed-loop control.
1	Hold all valves closed.
2	Hold the valves at their current positions.
3	Exhaust: close the upstream valve and open the downstream valve fully. Dual-valve controllers only.

Response: `SUCCESS` if the valves are set as requested; `UNSUPPORTED` if the device does not support that mode; `INVALID_ARGUMENT` if the value is not valid.

Set active valve

7v16 Controllers

> Command ID **15**

Only on MCT stream-switching controllers. Selects the valve that controls the process.

`Argument` A value from the table below.

Value	Meaning
0	Upstream valve, or the only valve
1	Downstream valve, or an auxiliary valve wired in the downstream position
2	First auxiliary valve (from 10v11.0)
3	Second auxiliary valve (from 10v11.0)
65535	Query the active valve (from 10v11.0)

Response: `SUCCESS` if the active valve changes; the return value is the active valve (0 to 3) for argument 65535, else 0. `UNSUPPORTED` if the device is not an MCT controller; `INVALID_ARGUMENT` if the value is not valid.

Set loop control variable

7v05 Controllers

`Command ID` **11**

Changes the statistic that the controller controls, so a mass flow controller can be set to control pressure or volumetric flow.

`Argument` A value from the table below.

Value	Meaning
0	Mass flow
1	Volumetric flow
2	Differential pressure
3	Absolute pressure
4	Gauge pressure
…	Any set point statistic of Appendix A (p. 40)

Response: `SUCCESS` if the variable changes; `INVALID_ARGUMENT` if the statistic is not available on the device (for example mass flow on a pressure controller).

Set loop control algorithm

7v08 Controllers

`Command ID` **13**

Selects the PDF or the PD²I algorithm for the controller. Only one algorithm is active at a time.

`Argument` A value from the table below.

Value	Meaning
1	PDF closed-loop control algorithm
2	PD²I closed-loop control algorithm

Response: `SUCCESS` if the algorithm is selected; `INVALID_ARGUMENT` if the value is not a valid algorithm.

Read closed-loop gain

7v08 Controllers

`Command ID` **14**

Returns the current value of a gain of the control algorithm.

`Argument` A value from the table below.

Value	Meaning
0	Proportional gain (P gain), PDF or PD²I
1	Derivative gain (D gain), PDF or PD²I
2	Integral gain (I gain), PD²I

Response: `SUCCESS` if the argument is valid; the return value is the gain, 0–65535. `INVALID_ARGUMENT` if the gain is not a valid choice for the control algorithm.

Set proportional closed-loop control gain

7v05 Controllers

`Command ID 8`

Sets the proportional gain (P gain) to the value of the argument.

`Argument` 0–65535.

Response: `SUCCESS` when the command is complete and the gain is set.

Set derivative closed-loop control gain

7v05 Controllers

`Command ID 9`

Sets the derivative gain (D gain) to the value of the argument.

`Argument` 0–65535.

Response: `SUCCESS` when the command is complete and the gain is set.

Set integral closed-loop control gain

7v05 Controllers

`Command ID 10`

Sets the integral gain (I gain) to the value of the argument.

`Argument` 0–65535.

Response: `SUCCESS` when the command is complete and the gain is set.

Set inverse pressure control

7v18 Controllers

`Command ID 16`

Sets the controller to control pressure normally or to control the inverse pressure (usually back pressure), and whether this mode is kept across power cycles.

`Argument` A value from the table below.

Value	Meaning
0	Normal pressure control, not saved across power cycles
1	Inverse pressure (usually back pressure) control, not saved across power cycles
3	Normal pressure control, saved across power cycles
4	Inverse pressure (usually back pressure) control, saved across power cycles

Response: `SUCCESS` if the pressure control mode has changed; `INVALID_ARGUMENT` if the value is not available on the device or has no pressure control mode.

Query totaliser batch (integer)

10v07 Flow controllers

`Command ID 65543`

Returns the batch size of one of the two totalisers.

`Argument` 1 for totaliser 1, 2 for totaliser 2.

Response: `SUCCESS` if the totaliser is enabled; the return value is its batch size. Multiply it by 10^{-n}, n being the decimal places of the totaliser, for the volume in the engineering units of the totaliser. The value is 0 if batching is disabled. `INVALID_ARGUMENT` if the totaliser is not enabled.

Query totaliser batch (float)

10v07 Flow controllers

`Command ID 65540`

Returns the batch size of one of the two totalisers.

`Argument` 1 for totaliser 1, 2 for totaliser 2.

Response: `SUCCESS` if the totaliser is enabled; the return value is its batch size as an IEEE 754 single-precision float in the engineering units of the totaliser. The value is 0 if batching is disabled. `INVALID_ARGUMENT` if the totaliser is not enabled.

Set totaliser batch 1 (integer)

10v07 Flow controllers

`Command ID 65544`

Sets the batch size of totaliser 1.

`Argument` The batch size multiplied by 10^n, n being the decimal places of the totaliser. 0 disables batching.

Response: `SUCCESS` if totaliser 1 is enabled and the batch size is valid; the return value is the batch size. `UNSUPPORTED` if totaliser 1 is not enabled; `INVALID_ARGUMENT` if the batch is larger than totaliser 1 can hold.

Set totaliser batch 1 (float)

10v07 Flow controllers

`Command ID 65541`

Sets the batch size of totaliser 1.

`Argument` The batch size as an IEEE 754 single-precision float in the engineering units of totaliser 1. 0 disables batching.

Response: `SUCCESS` if totaliser 1 is enabled and the batch size is valid; the return value is the batch volume. `UNSUPPORTED` if totaliser 1 is not enabled; `INVALID_ARGUMENT` if the batch is larger than totaliser 1 can hold.

Set totaliser batch 2 (integer)

10v07 Flow controllers

`Command ID 65545`

Sets the batch size of totaliser 2.

`Argument` The batch size multiplied by 10^n, n being the decimal places of the totaliser. 0 disables batching.

Response: `SUCCESS` if totaliser 2 is enabled and the batch size is valid; the return value is the batch size. `UNSUPPORTED` if totaliser 2 is not enabled; `INVALID_ARGUMENT` if the batch is larger than totaliser 2 can hold.

Set totaliser batch 2 (float)

`10v07` Flow controllers

> Command ID **65542**

Sets the batch size of totaliser 2.

`Argument` The batch size as an IEEE 754 single-precision float in the engineering units of totaliser 2. 0 disables batching.

Response: `SUCCESS` if totaliser 2 is enabled and the batch size is valid; the return value is the batch volume. `UNSUPPORTED` if totaliser 2 is not enabled; `INVALID_ARGUMENT` if the batch is larger than totaliser 2 can hold.

Control gain gas compensation

`10v13.0` Mass flow controllers

> Command ID **62**

Sets or queries whether gas compensation is enabled for the closed-loop control gains.

`Argument` A mode from the table below.

Value	Meaning
0	Query only; the gas compensation does not change.
1	Disable gas compensation of the closed-loop gains.
2	Enable gas compensation of the closed-loop gains.
3	Enable gas compensation of the closed-loop gains until you change a closed-loop control gain.

Response: `SUCCESS` if the device supports gas compensation of the closed-loop gains; the return value is the current mode. `UNSUPPORTED` if the device is not a controller or does not support setting the active gas properties; `INVALID_ARGUMENT` if the mode is not a valid value.

Check set point response: test set point (set point counts)

`10v13.0` Controllers

> Command ID **63**

Sets or queries the value to which the set point changes when the set point response is checked.

`Argument` The test set point in set point counts, 0–65534. 65535 queries.

Response: `SUCCESS` if the test set point was set or queried; the return value is the test value of the check, in set point counts. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the test set point is outside 0–65535.

Check set point response: test set point (integer)

10v13.0 Controllers

`Command ID` **65565**

Sets or queries the value to which the set point changes when the set point response is checked.

`Argument` The test set point in set point engineering units, multiplied by 10^n, n being the set point decimal places. −2147483648 queries.

Response: `SUCCESS` if the test set point was set or queried; the return value is the test value of the check. Multiply it by 10^{-n} for set point engineering units. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the test set point is outside the valid range.

Check set point response: test set point (float)

10v13.0 Controllers

`Command ID` **65564**

Sets or queries the value to which the set point changes when the set point response is checked.

`Argument` The test set point in set point engineering units, as an IEEE 754 single-precision float. −3.40282346639e+38 (hexadecimal `ff7fffff`) queries.

Response: `SUCCESS` if the test set point was set or queried; the return value is the test value of the check, as an IEEE 754 single-precision float in set point engineering units. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the test set point is outside the valid range.

Check set point response: collection time

10v13.0 Controllers

`Command ID` **64**

Sets or queries how long a set point response check collects data after it changes the set point.

`Argument` The collection time in seconds, 1–65535. 0 queries.

Response: `SUCCESS` if the collection time was set or queried; the return value is the collection time in seconds. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the collection time is outside 0–65535.

Check set point response: run status

10v13.0 Controllers

`Command ID` **66**

Queries the state of the set point response check, and can start or abort it.

`Argument` An action from the table below.

Value	Action
0	Query the state only; take no action.
1	Start a set point response check. The device changes the set point, overriding the analogue set point if it is enabled, and collects data for the set collection time. The set point returns to normal when data collection is complete.
2	Abort the check being executed. Does nothing if no check is being executed.

Response: `SUCCESS` if the action, if any, was executed; the return value is the status of the check being executed or last completed (table below). `UNSUPPORTED` if the device is

not a controller; `INVALID_ARGUMENT` if the action is not a listed value.

Return value	Status
0	The last check completed successfully and the results are calculated.
1	No check has been executed since power-up.
2	A check cannot start: closed-loop control gain tuning or another check is active.
3	A check is being executed.
4	Data collection was aborted early by user action; the returned values are all zero.
5	Data collection stopped early because of oscillation; the returned values are all zero.

Check set point response: result notes

`10v13.0` Controllers

`Command ID` **67**

Queries notes on unusual circumstances observed during the last completed set point response check.

`Argument` Always 0.

Response: `SUCCESS` if the query was executed; the return value holds notes on circumstances that may affect the accuracy of the results. Several values of the table below can be added together in one return value. `UNSUPPORTED` if the device is not a controller.

Value	Note
0	No notes; the process data showed typical patterns.
+1	The collection time was too short to ensure reliable results; the values may change with a longer collection time.
+2	The process variable oscillated significantly. Control was not stable and the results are not reliable.
+4	The process variable moved little compared with the noise in the system, so the results may not be reliable. This happens most often when the set point change is too small or when the process variable oscillated in a way the oscillation detection did not catch.
+8	A closed valve opened during data collection. The results are correct, but the performance differs significantly from that of moving a valve that is already open.
+16	A valve was opened as far as it could go during data collection. The results are correct, but the performance is probably limited by the size of the valve, not by the control loop configuration.

Check set point response: overshoot (set point counts)

`10v13.0` Controllers

`Command ID` **68**

Queries the overshoot of the last completed set point response check.

`Argument` Always 0.

Response: `SUCCESS` if the overshoot was queried; the return value is the overshoot measured in the last completed check, in set point counts. `UNSUPPORTED` if the device is not a controller.

Check set point response: overshoot (integer)

10v13.0 Controllers

`Command ID` **65567**

Queries the overshoot of the last completed set point response check.

`Argument` Always 0.

Response: `SUCCESS` if the overshoot was queried; the return value is the overshoot measured in the last completed check. Multiply it by 10^{-n}, n being the set point decimal places, for set point engineering units. `UNSUPPORTED` if the device is not a controller.

Check set point response: overshoot (float)

10v13.0 Controllers

`Command ID` **65566**

Queries the overshoot of the last completed set point response check.

`Argument` Always 0.

Response: `SUCCESS` if the overshoot was queried; the return value is the overshoot measured in the last completed check, as an IEEE 754 single-precision float in set point engineering units. `UNSUPPORTED` if the device is not a controller.

Control response analysis

Check set point response: timing results

10v13.0 Controllers

`Command ID` **69**

Queries the timings measured in the last completed set point response check.

`Argument` The timing to query, from the table below.

Value	Timing queried	Return value
0	Time constant	The closed-loop time constant (T63) measured in the trial, in milliseconds. Suitable for a FOPDT model of the device.
1	Dead time	The system dead time or delay measured in the trial, in milliseconds. Suitable for a FOPDT model of the device.
2	Rise time	The time the closed-loop response took to go from 10 % to 90 % of the step in the trial, in milliseconds.
3	Bandwidth	The estimated bandwidth of the closed-loop response, calculated from the rise time. Multiply the number by 0.01 for the bandwidth in hertz.

Response: `SUCCESS` if the query was executed; the return value is the timing requested. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the value is not in the table.

Control optimisation

Control optimisation maximum flow (set point counts)

10v13.0 Controllers

> Command ID **70**

Sets or queries the highest flow that control optimisation will produce on purpose, in set point counts.

`Argument` The maximum flow in set point counts, 1–64000. 0 sets the limit to full-scale flow; 65535 queries.

Response: `SUCCESS` if the maximum flow was set or queried; the return value is the current maximum flow in set point counts. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the maximum flow is outside 0–64000 and not 65535, or below 20 % of full-scale flow.

Control optimisation maximum flow (integer)

10v13.0 Flow controllers

> Command ID **65569**

Sets or queries the highest flow that control optimisation will produce on purpose, as an integer.

`Argument` The maximum flow in set point engineering units, multiplied by 10^{n}, n being the set point decimal places. 0 sets the limit to full-scale flow; a value below 0 queries.

Response: `SUCCESS` if the maximum flow was set or queried; the return value is the current maximum flow. Multiply it by 10^{-n} for set point engineering units. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the maximum flow is not 0 and is below 20 % of full-scale flow.

Control optimisation maximum flow (float)

10v13.0 Flow controllers

> Command ID **65568**

Sets or queries the highest flow that control optimisation will produce on purpose, as a float.

`Argument` The maximum flow in set point engineering units, as an IEEE 754 single-precision float. 0 sets the limit to full-scale flow; a value below 0 queries.

Response: `SUCCESS` if the maximum flow was set or queried; the return value is the current maximum flow, as an IEEE 754 single-precision float in set point engineering units. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the maximum flow is not 0 and is below 20 % of full-scale flow.

Control optimisation speed mode

10v13.0 Flow controllers

`Command ID` **71**

Sets or queries the speed mode of control optimisation.

`Argument` A speed mode from the table below.

Value	Meaning
0	Query the speed mode.
1	The most versatile use, with the slowest speed of response.
2	Versatility before speed of response.
3	Speed of response before versatility.
4	The fastest speed of response (the shortest time constant of the control loop response). A small overshoot of the response is allowed.

Response: `SUCCESS` if the speed mode was set or queried; the return value is the current speed mode. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the speed mode is not in the table.

Control optimisation goal time

10v13.0 Flow controllers

`Command ID` **72**

Sets or queries the goal response time of control optimisation. After optimisation, the control response has a time constant close to this value for the tested set points, if the system can support it. If the requested time constant is shorter than the system can reasonably achieve, optimisation finds the gains with the shortest time constant. If one of the gains reaches 1 during optimisation and cannot become smaller to lengthen the time constant, the resulting time constant may be shorter than requested.

`Argument` The time constant of the control response, in milliseconds. 0 uses the shortest possible time constant (as the fastest speed mode); 65535 queries.

Response: `SUCCESS` if the goal time was set or queried; the return value is the current goal response time in milliseconds, or 0 if a speed mode is active. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the goal time is negative.

Control optimisation control algorithm

10v13.0 Controllers

`Command ID` **73**

Sets or queries the control algorithm that control optimisation uses to determine the gains.

`Argument` A value from the table below.

Value	Meaning
0	Query only; the configured mode does not change.
1	Control optimisation chooses the most suitable algorithm for the device configuration and the optimisation parameters. The algorithm chosen for a situation and configuration may change between firmware versions.
2	Use the PDF algorithm. Speed modes are 2 to 3 times slower than with the other values.
3	Use the PD²I algorithm.

Response: `SUCCESS` if the algorithm was set or queried; the return value is the current algorithm from the table. `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the value is not in the table.

Control optimisation run state

10v13.0 Flow controllers

`Command ID` **74**

Queries the state of control optimisation, and can take an action.

`Argument` An action from the table below.

Action	Meaning
0	Query the state only; take no action.
1	Abort the control optimisation in progress.
2	Start a new control optimisation with the current settings. An optimisation in progress is aborted first.
3	As action 2, but pause the optimisation at every possible point, with the valve(s) closed.
4	Ask the optimisation to pause and close the valves at the next possible point. A pause is most often used to let a restricted volume filled during optimisation bleed off to normal pressure levels. Does nothing if there is no paused optimisation.
5	Resume a paused optimisation.

Response: `SUCCESS` if the action, if any, was performed; the return value is the current activity of control optimisation (table below). `UNSUPPORTED` if the device is not a controller; `INVALID_ARGUMENT` if the action is not in the table.

Return value	Activity
0	Control optimisation is not active.
1	Control optimisation is driving the valves of the device.
2	Control optimisation is active but paused. The valves stay closed until this command is sent with the resume action.
3	An abort was requested, but control optimisation is still active.

Control optimisation result

10v13.0 Flow controllers

`Command ID` **75**

Queries the result of the last completed control optimisation.

`Argument` Always 0.

Response: `SUCCESS` if the result was returned; the return value is the result of the last optimisation (table below). `UNSUPPORTED` if the device is not a controller.

Result	Meaning
0	A control optimisation is in progress.
1	The last control optimisation completed successfully.
2	The last control optimisation was aborted by the user or by an error.
3	An unexpected state occurred during the last control optimisation. Tell Analyt-MTC how to reproduce it.
4	The maximum flow allowed for optimisation is too small.
5	A valve requested for control optimisation is not configured for closed-loop control.
6	The device had no closed-loop control configured at the time of the last control optimisation.
7	There was not enough flow to complete the last control optimisation. Check the inlet and outlet pressures.
8	The last control optimisation found no gains with acceptable performance.

Administrative

These commands tare the sensors, create gas mixes, control the display and restore the factory settings.

Perform tare

7v05 All devices

`Command ID` **4**

Uses the current reading as the zero reading. For a gauge pressure tare the sensor must be open to atmosphere; a differential pressure tare needs a common pressure to measure from; an absolute pressure tare needs a barometer on the device. Perform a flow tare with no flow through the process, best at or as close as possible to the process pressure.

`Argument` A value from the table below.

Value	Meaning
0	Tare gauge or differential pressure
1	Tare absolute pressure
2	Tare mass and/or volumetric flow

Response: `SUCCESS` if the tare is performed; `UNSUPPORTED` if the tare does not apply (for example a mass flow tare on a pressure device).

Perform pressure sensor tare

10v07 · All devices

`Command ID` **31**

Uses the current gauge or differential pressure reading as the zero reading; an absolute pressure tare uses the zero reading of the barometer. For a gauge pressure tare the sensor must be open to atmosphere; a differential pressure tare needs a common pressure to measure from; an absolute pressure tare needs a barometer on the device.

`Argument` The tare time in milliseconds, 0–32767. 0 uses the default of 256 ms.

Response: `SUCCESS` if the tare is performed; `UNSUPPORTED` if the pressure sensor cannot be tared, usually an absolute pressure tare without a barometer; `INVALID_ARGUMENT` if the argument is below 0 or above 32767.

Perform secondary pressure sensor tare

10v07 · All devices

`Command ID` **32**

Uses the current reading of the secondary pressure sensor as the zero reading; an absolute pressure tare uses the zero reading of the barometer. Not all devices have a secondary pressure sensor. For a gauge pressure tare the sensor must be open to atmosphere; a differential pressure tare needs a common pressure to measure from; an absolute pressure tare needs a barometer on the device.

`Argument` The tare time in milliseconds, 0–32767. 0 uses the default of 256 ms.

Response: `SUCCESS` if the tare is performed; `UNSUPPORTED` if the pressure sensor cannot be tared, usually an absolute pressure tare without a barometer or a device without a secondary pressure sensor; `INVALID_ARGUMENT` if the argument is below 0 or above 32767.

Perform flow tare

10v07 · Flow devices

`Command ID` **33**

Uses the current flow reading as the zero reading, for both volumetric and mass flow.

`Argument` The tare time in milliseconds, 0–32767. 0 uses the default of 256 ms.

Response: `SUCCESS` if the tare is performed; `UNSUPPORTED` if the sensor cannot be tared, usually because the device does not read volumetric or mass flow; `INVALID_ARGUMENT` if the argument is below 0 or above 32767.

Reset totaliser

7v05 · Flow devices

`Command ID` **5**

Clears the current count of the totaliser.

`Argument` Not used.

Response: `SUCCESS` when the reset is complete.

Set gas

7v05 Mass flow devices

`Command ID` **1**

Selects the gas the mass flow device is calibrated to read. Set the process gas to read its mass flow accurately.

`Argument` The gas number (Appendix D (p. 47)).

Response: `SUCCESS` if the gas has changed; `INVALID_ARGUMENT` if the gas number does not exist.

Create/update gas mix

7v05 Mass flow devices

`Command ID` **2**

Writes a new gas mix to the gas list of the device. First write the gases and their percentages to the write gas mix record, index `0x0002` (Write gas mix (p. 13)).

`Argument` 0, or 236–255: the gas number of the new mix. 0 makes the device use the first free gas number, starting at 255 and counting down; if none is free, the command fails. To update or overwrite a mix, use its gas number.

Response: `SUCCESS` if the mix was created or updated; the return value is its gas number. `INVALID_MIX_IDX` if the gas number in the argument is outside 236–255; `INVALID_MIX_GAS` if a gas of the mix does not exist on the device; `INVALID_MIX_PCT` if the percentages do not add up to 100 %.

Delete gas mix

7v05 Mass flow devices

`Command ID` **3**

Removes a custom gas mix from the device.

`Argument` The gas number of the mix to delete.

Response: `SUCCESS` if the mix was deleted; `INVALID_MIX_IDX` if the mix does not exist.

Set relative humidity percentage

10v07

Devices with humidity sensor

`Command ID` **24**

Sets the relative humidity used for gas corrections.

`Argument` 0–10000; one count is 0.01 % humidity: 100 is 1 %, 10000 is 100 %.

Response: `SUCCESS` if the relative humidity has changed; `UNSUPPORTED` if the relative humidity cannot be set on the device; `INVALID_ARGUMENT` if the argument is outside 0–10000.

Set relative humidity reference temperature

`10v07`

Devices with humidity sensor

`Command ID 25`

Sets the reference temperature, in degrees Celsius, of the relative humidity used for gas corrections. It should match the relative humidity percentage.

`Argument` −3000 to 10000, that is −30 °C to 100 °C; one count is 0.01 °C.

Response: `SUCCESS` if the reference temperature has changed; `UNSUPPORTED` if the relative humidity cannot be set on the device; `INVALID_ARGUMENT` if the argument is outside −3000 to 10000.

Lock/unlock display

`7v05` All devices

`Command ID 7`

Locks or unlocks the display on the front of the device. A locked device still responds to button presses, but its settings cannot be changed on the display.

`Argument` 0 unlocks the display; any other value locks it.

Response: `SUCCESS` if the display is locked or unlocked as requested.

Flash display

`8v28` All devices

`Command ID 20`

Makes the backlight of the display flash, without time limit or for a set time.

`Argument` 1–65534: flash for that number of seconds. 0 stops the flashing; 65535 flashes without time limit.

Response: `SUCCESS` if the backlight flashes or stops as requested; `UNSUPPORTED` if no display is connected to the device.

Restore factory settings

`10v07` All devices

`Command ID 26`

Returns all settings and configurations of the device to the values stored when the device last left the factory. Power-cycle the device after the restore.

NOTICE

Restoring factory settings removes all third-party calibrations. Use this command only while troubleshooting with Analyt-MTC support.

`Argument` 49374, to confirm the factory restore.

Response: `SUCCESS` if the factory restore is complete; it can be read only briefly before the restore removes the status. `UNSUPPORTED` if an error occurs during the restore; `INVALID_ARGUMENT` if the argument is not 49374.

Read configuration checksum

8v24 · All devices

> Command ID **17**

Computes and returns a checksum of the calibration and configuration of the device. The checksum is computed when the command starts and can take 300 ms; allow a timeout of more than 500 ms. It includes every setting kept across power cycles, and values that may or may not be kept. Because calibration data is included, two devices with identical configurations can have different checksums; after a recalibration the checksum may change, and a firmware change may or may not change it. Set any parameter that changes in routine operation, such as the set point, to a known value before you read the checksum.

`Argument` Always 0.

Response: `SUCCESS` when the checksum is complete and the argument is 0; the return value is the checksum of the whole configuration, 0–65535. `INVALID_ARGUMENT` if the argument is not 0.

CHAPTER 4

Examples

Five common tasks, shown as the values your PROFINET controller writes to and reads from the data records. Use them to check your own configuration.

How to read the examples

Each example lists the byte offsets of a data record in slot 1 and the value at each offset, in decimal. How your engineering tool writes and reads a data record depends on the tool; the record layouts are in Acyclic data records (p. 13). Send command 0, No operation (p. 16), before a command if the previous command had the same ID and argument.

Example 1: tare the flow reading

Command 33 zeroes the mass and volumetric flow readings. Only do this with no flow through the device. Argument 0 uses the default tare time of 256 ms.

Write record `0x0001`, send command

Byte offset	Value	Meaning
0	33	Perform flow tare
4	0	Default tare time

Read record `0x0003`, command status

Byte offset	Value	Meaning
0	33	The last command was the flow tare
4	0	with argument 0
8	0	SUCCESS: the tare is done. While it runs, the status is 1, `IN_PROGRESS`.
12	0	The command defines no return value

Example 2: show pressure in bar

Command 65300 plus the offset of the reading changes its engineering units. Pressure has offset 2, so the command ID is 65302; bar has the value 7 in Table B-6. The secondary and barometric pressure change to bar as well.

Write record `0x0001`, send command

Byte offset	Value	Meaning
0	65302	Set reading engineering units, pressure
4	7	bar

In record `0x0003`, offset 8 then reads 0 (SUCCESS) and offset 12 reads 7, the new units. If offset 8 reads 3 (`INVALID_ARGUMENT`), the units are not valid for the reading.

Example 3: create a gas mix

This example stores a mix of 50 % argon (gas number 1) and 50 % carbon dioxide (gas number 4), on a mass flow device.

1. Write the gases and their percentages to record `0x0002`. One count is 0.01 %, so 50 % is 5000. The offsets of gases 3 to 5 stay at 0.
2. Send command 2, Create/update gas mix (p. 33), with argument 0, so that the device picks the first free gas number.
3. Read record `0x0003`. Offset 8 reads 0 (`SUCCESS`) and offset 12 gives the gas number of the mix: 255 if that number is still free, as the device counts down from 255.

Step 1: write record `0x0002`, write gas mix

Byte offset	Value	Meaning
0	1	Gas 1: argon
2	5000	50.00 %
4	4	Gas 2: carbon dioxide
6	5000	50.00 %
8–18	0	Gases 3 to 5 not used

To select the mix as the process gas, send command 1, Set gas (p. 33), with the gas number read in step 3.

Example 4: scale an integer reading

With the integer format active, the mass flow module in slot 8 delivers an integer. The number of decimal places is at offset 22 of record `0x000C`, mass flow information; the units are at offset 20. If slot 8 reads 12345 and offset 22 reads 2, the mass flow is $12345 \times 10^{-2} = 123.45$ in the units of the reading. The values here are an illustration; your device gives its own.

Example 5: limit the set point ramp

To let the set point of a controller change by at most 1 % of full scale per second, send command 65547, Set point maximum ramp (temporary) (p. 19). 1 % per second is 0.001 % per millisecond; multiplied by 10000000, this gives the argument 10000.

Write record `0x0001`, send command

Byte offset	Value	Meaning
0	65547	Set point maximum ramp, not saved
4	10000	1 % of full scale every second

Offset 12 of record `0x0003` then reads 10000; multiplied by 0.0000001, this is 0.001 % of full scale per millisecond. To keep the ramp across power cycles, use command 65546 instead, and do not send it more often than every few minutes.

CHAPTER 5

Error handling

Common symptoms, their likely causes and what to do. If none of these fits, contact Analyt-MTC support with the information listed in About this guide (p. 2).

Symptoms and remedies

Symptom	Cause and remedy
CONNECTION	
Link LED of a port is off	The port is not connected to the network. Check the cable and the switch port (RJ45 Ethernet ports (p. 5)).
NET LED flashes red	There is no active data exchange with the PLC. Check that the device is part of the project with the module of the right format and that the controller has assigned its IP address through DCP (Adding the device to a TIA Portal project (p. 8)). The *Network Status* screen shows whether a PLC is connected.
Web server cannot be opened	Check the IP address on the *Network Status* screen and that the web server is switched on (*MENU > SETUP > Network > Web Server*).
Adapter Firmware on the *Device Summary* page does not read PROFINET	The device is configured for another protocol. Contact Analyt-MTC support.
Not sure which device in the network you are addressing	Use the *Flash LED* setting in your engineering tool: the display and the Ready LED flash for 15 seconds. Command 20, Flash display (p. 34), flashes the backlight from the PLC.
CYCLIC DATA	
Readings make no sense	The module in the project does not match the format set on the device. Check *MENU > SETUP > Network > Format* and use the module of the same format; after a format change, wait 15 seconds.
A reading reads `0xFFFFFFFF` (float format) or −2147483648 (integer format)	The reading is invalid or not available on this device. The type and source of its information record read 0 if the reading is not available (Reading information (p. 14)).
Integer readings are a factor of 10, 100 or more too high	Integer readings carry an implied decimal point. Multiply by 10^{-n}, n being the decimal places at offset 22 of the information record (Data formats (p. 10)).
The *Cyclic Data* count on the display does not increase	The device is not updating the cyclic data. Check the connection to the PLC as for a flashing red NET LED.
COMMANDS	
A repeated command does nothing	A command cannot be repeated twice in a row. Send command 0 between two identical commands (Sending a command (p. 10)). The *Received Commands* screen shows what the device has received.
Command status 1, `IN_PROGRESS`	The command is still running. Read record `0x0003` again until the status changes.
Command status 2, `INVALID_ID`	The command ID is not valid. Check offset 0 of record `0x0001` against Commands (p. 15), and the firmware that introduced the command (record `0x0004`).
Command status 3, `INVALID_ARGUMENT`	The argument is not allowed for this command, or the device has no reading for it. Check offset 4 of record `0x0001`.
Command status 4, `UNSUPPORTED`	The device does not support the command or the requested mode: for example a control command on a meter, a tare that does not apply, or exhaust on a single-valve controller.
Command status 5, 6 or 7 after a gas mix	The gas number of the mix must be 0 or 236–255 (`INVALID_MIX_IDX`, 5), every gas of the mix must exist on the device (`INVALID_MIX_GAS`, 6) and the percentages must add up to 100 %, that is 10000 counts (`INVALID_MIX_PCT`, 7). See Write gas mix (p. 13).
Create/update gas mix with argument 0 fails	No gas number from 236 to 255 is free. Delete a mix you no longer need with command 3, or give the number of a mix you want to overwrite.

Symptom	Cause and remedy
Status of a factory restore cannot be read	The `SUCCESS` status of command 26 can be read only briefly before the restore removes it. Power-cycle the device after the restore.

APPENDIX A

Statistics

Statistics are the readings and measurements a device provides. Their values are returned at offset 0 of the reading information (p. 14) records and by Query reading type (p. 17), and are used by Set loop control variable (p. 21). Some statistics exist only on certain devices and configurations. A firmware version in brackets gives the version that added the statistic; a statistic without a version is available on all devices. Ask Analyt-MTC about a statistic and how it works with your device.

A-1 Flow statistics

Flow statistic	Value	Notes
Batch mass remaining	**12**	Mass remaining in the totaliser batch
Batch volume remaining	**11**	Volume remaining in the totaliser batch, referenced to flow conditions
Mass flow	**5**	Current mass flow
Mass flow, average	**69**	Average mass flow over the totalising time
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 totalising time
Mass flow set point	**37**	Set point for mass flow
Mass flow set point error (8v00)	**173**	Mass flow minus the ramp-limited set point
Time, totalising	**10**	Time for which the totaliser has been running
Total mass	**9**	Totalised mass
Total volume	**8**	Totalised volume, referenced to flow conditions
Volumetric flow	**4**	Volumetric flow, referenced to flow conditions
Volumetric flow, average	**68**	Average volumetric flow, referenced to flow conditions, over the totalising time
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 totalising time
Volumetric flow set point	**36**	Set point for volumetric flow, referenced to flow conditions
Volumetric flow set point error (8v00)	**165**	Volumetric flow minus the ramp-limited set point

A-2 Pressure statistics

Pressure statistic	Value	Notes
Pressure, absolute	**2**	Current absolute pressure
Pressure, absolute maximum (8v32)	**151**	Highest absolute pressure since reset
Pressure, absolute minimum (8v32)	**150**	Lowest absolute pressure since reset
Pressure, absolute set point	**34**	Set point for absolute pressure
Pressure, absolute set point error (8v00)	**149**	Absolute pressure minus the ramp-limited set point
Pressure, barometric	**15**	Barometer reading
Pressure, barometric maximum (8v32)	**255**	Highest barometric pressure since reset
Pressure, barometric minimum (8v32)	**254**	Lowest barometric pressure since reset
Pressure, differential	**7**	Current differential pressure

Pressure statistic	Value	Notes
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**	Set point for differential pressure
Pressure, differential set point error (8v00)	**189**	Differential pressure minus the ramp-limited set point
Pressure, gauge	**6**	Current gauge pressure
Pressure, gauge maximum (8v32)	**183**	Highest gauge pressure since reset
Pressure, gauge minimum (8v32)	**182**	Lowest gauge pressure since reset
Pressure, gauge set point	**38**	Set point for gauge pressure
Pressure, gauge set point error (8v00)	**181**	Gauge pressure minus the ramp-limited set point
Pressure, second absolute (7v01)	**344**	Absolute pressure of the second sensor, on devices with a second pressure 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**	Set point for the second absolute pressure
Pressure, second absolute set point error (8v00)	**349**	Second absolute pressure minus the ramp-limited set point
Pressure, second differential (7v01)	**360**	Differential pressure of the second sensor, on devices with a second pressure 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**	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**	Gauge pressure of the second sensor, on devices with a pressure sensor in a second location
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**	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

Other statistic	Value	Notes
None	**1**	No statistic; usually an empty location
Set point	**32**	The current ramp-limited set point. Where it is specified, the active set point statistic takes its place.
Set point error (8v00)	**133**	Current process value minus the ramp-limited set point
Status	**26**	Status of the device; usually used only internally
Temperature, stream	**3**	Current stream temperature
Temperature, stream maximum (8v32)	**159**	Highest stream temperature since reset
Temperature, stream minimum (8v32)	**158**	Lowest stream temperature since reset
Valve drive	**13**	Valve drive signal
Valve drive set point (8v00)	**45**	The set point drives the selected valve directly
Vapour fraction (percent water vapour)	**488**	Molecular fraction of vapour in the gas; with water vapour, the percentage of water vapour

Other statistic	Value	Notes
Vapour fraction maximum	**495**	Highest vapour fraction since reset
Vapour fraction minimum	**494**	Lowest vapour fraction since reset
Vapour saturation (relative humidity)	**25**	The fraction of complete saturation the device is using; with water vapour, the relative humidity
Vapour saturation, average	**89**	Average vapour saturation over the totalising time
Vapour saturation, maximum (8v32)	**335**	Highest vapour saturation since reset
Vapour saturation, minimum (8v32)	**334**	Lowest vapour saturation since reset
Vapour saturation, peak	**121**	Peak vapour saturation over the totalising time
Vapour saturation temperature (dew point)	**496**	Temperature at which the vapour would saturate completely; with water vapour, the dew point
Vapour saturation temperature, maximum	**503**	Highest vapour saturation temperature since reset
Vapour saturation temperature, minimum	**502**	Lowest vapour saturation temperature since reset

APPENDIX B

Engineering units

Commands and records that take or return a unit use the values below. Which table applies depends on the statistic: for example, use table B-3 for a totaliser that counts standard or normal volume. Offset 20 of the reading information (p. 14) records gives the units of a reading; to change them, use Set reading engineering units (p. 18).

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 Added in 6v08.0.
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 Added in 6v08.0.
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)
61	V	Volt; no conversions are performed to or from other units (intended only for log-linear absolute pressure sensors)
62	count	Set point count, 0–64000
63	%	Percent of full scale (no A/G/D suffix)

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	Shown as hours:minutes:seconds
3	ms	Millisecond
4	s	Second
5	m	Minute
6	hour	Hour
7	day	Day

APPENDIX C

Data sources

Offset 2 of the reading information (p. 14) records and Query reading source (p. 17) return one of these values.

C-1 Data sources

Data source	Value	Notes
Instant display	**1**	Current readings, smoothed for the display
Instant serial	**2**	Current readings, smoothed for serial values
Totaliser 2	**25**	Readings taken from the second totaliser

APPENDIX D

Gas numbers

Gas numbers are used by Set gas (p. 33), the write gas mix (p. 13) record and the gas mix commands, and are read in the current gas number module (slot 13). Numbers 236 to 255 are for your own gas mixes (Create/update gas mix (p. 33)).

#	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.

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AMTC-CG-0003 · Rev. 1 · 2026-10

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