ANALYT MESSTECHNIK



OPERATING MANUAL

Aalborg XFM Digital Mass Flow Meters

Installation, wiring, operation, digital communication, calibration and maintenance of Aalborg XFM 07, 17, 37, 47, 57, 67 and 77 digital thermal mass flow meters.

AMTC-MN-0015

Rev. 2 · October 2026

About this manual

This manual explains how to install, wire, operate, calibrate and maintain Aalborg XFM digital mass flow meters. It covers the models XFM 07, 17, 37, 47, 57, 67 and 77, in aluminium and in stainless steel, with or without the built-in display. The XFM is made by Aalborg; Analyt-MTC supplies it and looks after it once it is in your hands.

Read Safety (p. 6) before you install the meter. To set up a new meter, follow Installation (p. 10) with its electrical connections (p. 11), Commissioning (p. 15) and Operation (p. 16) in that order. If a computer or programmable logic controller (PLC) configures and reads the meter, Communication (p. 20) lists every command. The Specifications (p. 32) and the appendices are reference material.

The front label of your meter gives its gas and flow range. Sections that apply only to an option, such as the display, say so.

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

Conventions in this manual:

- Keys, buttons and menu entries are printed like this: **<CR>**.
- A menu path such as **Tools** › **Diagnostic** means that you open each entry in turn.
- Commands you send and replies the device returns are set in monospace type, for example `Z`, `N`.

Abbreviations

Abbreviation	Meaning
ASCII	American Standard Code for Information Interchange
CPU	Central processing unit
EEPROM	Electrically erasable programmable read-only memory
EMC	Electromagnetic compatibility
EPR	Ethylene propylene rubber
FFKM	Perfluoroelastomer
FKM	Fluoroelastomer
FS	Full scale
GND	Ground
LCD	Liquid crystal display
NBR	Nitrile rubber
NIST	National Institute of Standards and Technology
NPT	National Pipe Taper, the US tapered pipe thread
RTS	Request to send, a serial handshake line
RX	Receive
SPDT	Single pole, double throw
TD	Transmit data, a serial line
TX	Transmit
UNC	Unified National Coarse, the US coarse screw thread

Safety notices in this manual

⚠ WARNING

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

NOTICE

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

Note

Information that helps understanding; never a hazard.

Document information

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CHAPTER 1

Safety

Read this chapter before you install, wire, adjust or service the meter. Each point is repeated, with its context, in the section where it applies.

Intended use

The XFM measures the mass flow of clean gases. It cannot measure liquids: never let liquid enter the meter. Filter any gas that may carry particles before it reaches the meter, because they block the sensor tube and the flow passages.

The built-in protection is specified for installation and operation as described in this manual. For any other use, agree the conditions in writing with Analyt-MTC first.

Have periodic calibrations done by qualified personnel with suitable calibration equipment (Calibration and verification (p. 23)).

⚠ WARNING

The XFM is not intended for life-support applications. A failure or a wrong reading in such an application could endanger a person's life or health. Do not use the XFM where a failure or a wrong reading could endanger a person.

Before you start

Gas and pressure

⚠ WARNING

Oxygen service: a meter that is not suitable or not cleaned for oxygen is a hazard in oxygen applications. Using it with oxygen can cause damage or personal injury. You are responsible for deciding whether the meter suits your oxygen application. If your application requires oxygen cleaning, specify it when you order.

NOTICE

A pressure above 34.47 bar (500 psia) seriously damages the flow sensor. Make sure no part of your gas system can apply more.

NOTICE

Corrosion resistance depends on how your gas reacts with the wetted materials, and a gas that reacts with them can corrode the meter. Choosing a model whose materials suit your gas is your responsibility; ask Analyt-MTC if you are unsure.

Note

K factors are approximations at best. Do not rely on them where you need an accuracy better than ±5 to 10 %. For that, have the meter calibrated on the actual gas.

Electrical connections

NOTICE

Connecting or disconnecting a cable with the power on can damage the meter. Switch the power off before you connect or disconnect any cable.

NOTICE

Some components are sensitive to electrostatic discharge. A discharge can damage them. Wear a grounded wrist strap when you change jumpers or service the meter.

NOTICE

A supply voltage above 26 V DC damages the meter or disturbs its operation. Never apply more than 26 V DC.

NOTICE

The 4–20 mA output powers its own loop and is not isolated, and an external voltage source on the output pins damages it. Never connect an external voltage source to the output pins.

Service

⚠ WARNING

A meter that has carried toxic, corrosive, infectious or radioactive media can hold hazardous residues. These residues endanger the people who open or service it. Purge the meter and neutralize all residues before you open it or send it for service.

Unpacking and inspection

The meter is shipped in a sturdy carton with anti-static cushioning. When it arrives:

1. Inspect the outside of the carton. If it is damaged, report the damage to the carrier immediately.
2. Open the carton carefully from the top and check the meter for hidden transport damage. If you find any, report it to the carrier and send a copy of the damage report to Analyt-MTC.
3. Check the contents against the packing list (Supplied items and accessories (p. 9)) and report anything missing to Analyt-MTC straight away.

To send a meter back to Analyt-MTC for repair or calibration, follow Returning a meter (p. 38).

CHAPTER 2

Product description

The XFM is a thermal mass flow meter with a microcontroller on board. It stores up to ten gas calibrations, shows the flow in the unit you choose, totalizes it, raises alarms on two relays, and reports everything over a serial interface and an analogue output.



Figure 2-1. XFM 47 with the LCD readout.

How the XFM measures

The gas entering the meter divides into two paths. A small part flows through a capillary sensor tube of stainless steel; the rest flows through the main flow channel. Both paths are designed for laminar flow, so the flow in the sensor tube is always the same fraction of the total flow.

Two precision-wound heater and sensor coils on the sensor tube heat the gas through the thin tube wall. The flowing gas carries heat from the upstream coil to the downstream coil, and the electronics detect the resulting difference in coil resistance. This temperature difference is directly proportional to the flow at that moment. Because it depends on the amount of heat the gas carries away, the measurement responds to the mass of the gas, not to its volume.

A microcontroller converts the sensor signal into a flow reading. Its non-volatile memory holds the instrument's own settings and up to ten calibration tables.

Functions

- **Ten gas calibrations** in memory; you select the one in use (Gas tables (p. 17)).
- **23 engineering units**, volumetric or mass based, including one you define (Engineering units (p. 16)).
- **Gas conversion factors** for 36 gases stored in the meter, plus one factor of your own (K factors (p. 17)).
- **Totaliser** with a start threshold and a preset total that can switch a relay (Totaliser (p. 17)).
- **Flow alarm** on a low limit, a high limit or the range between them, with an adjustable delay (Flow alarm (p. 18)).

- **Two changeover (SPDT) relay outputs**, each assigned to an alarm, the totaliser or manual switching (Relays (p. 18)).
- **Automatic zero**, started with the push button on the meter or over the interface (Auto zero (p. 19)).
- **Analogue output** 0–5 V DC or 4–20 mA, selected with jumpers (Analogue output (p. 12)).
- **Digital interface** RS-485 as standard, RS-232 or Profibus DP as options (Communication (p. 20)).
- **Self-diagnostics** shown by a multicolour status LED (Status LED and diagnostics (p. 16)).
- **Display (option)**: two lines of 16 characters with adjustable backlight, showing flow, total and diagnostic messages.

Supplied items and accessories

Each meter is supplied with the interface cable CBL-XFM: a 15-pin D-sub female connector with two 6 ft branches with stripped ends for power and the digital interface; no analogue or relay signals.

The accessories that exist, such as power supplies, a cable for your own supply, USB adapters, a baseplate and a transport case, are in Table 11-2 (p. 37) (Ordering information).

Models and flow ranges

The model number gives the size of the flow body and its range of full-scale flows; the range code of your meter is on its front label. Full-scale flows are for nitrogen at 21.11 °C, 1013.25 mbar. For another gas, multiply by its K factor (Appendix A (p. 40)).

Table 2-1 XFM 17 (low flow), 21.11 °C, 1013.25 mbar

Code	Full scale	Code	Full scale
00	5 smL/min	06	500 smL/min
01	10 smL/min	07	1 sL/min
02	20 smL/min	08	2 sL/min
03	50 smL/min	09	5 sL/min
04	100 smL/min	10	10 sL/min
05	200 smL/min		

Table 2-2 XFM 37 (medium flow), 21.11 °C, 1013.25 mbar

Code	Full scale
30	20 sL/min
31	30 sL/min
32	40 sL/min
33	50 sL/min

Table 2-3 XFM 47, 57, 67, 77 (high flow), 21.11 °C, 1013.25 mbar

Model	Code	Full scale
XFM 47	40	60 sL/min
XFM 47	41	80 sL/min
XFM 47	42	100 sL/min
XFM 57	50	200 sL/min
XFM 67	60	500 sL/min
XFM 77	70	1000 sL/min

All ranges start at zero. The XFM 07 shares the flow body dimensions of the XFM 17 (Appendix C (p. 45)); ask Analyt-MTC for its flow ranges.

CHAPTER 3

Installation

Install the meter in a stable place with its flow path horizontal, connect the gas lines in the direction of the arrow, and keep the line pressure below the limit of the flow sensor. Then wire it as described in Electrical connections (p. 11).

Gas quality

Only clean gases may enter the meter. The sensor is a fine capillary tube that particles, condensate or crystallizing gas components block easily. Filter any gas that may carry contaminants, and never let liquid into the meter. The filter screen in the inlet — 50 µm on the XFM 17, 60 µm on the larger models — is a last line of defence, not a substitute for a clean gas supply.

⚠ WARNING

Oxygen service: a meter that is not suitable or not cleaned for oxygen is a hazard in oxygen applications. Using it with oxygen can cause damage or personal injury. You are responsible for deciding whether the meter suits your oxygen application. If your application requires oxygen cleaning, specify it when you order.

Location and orientation

Mount the meter with its flow path horizontal. It is calibrated in this position and keeps its calibrated accuracy within a tilt of ±15°. If you have to mount it in another orientation, it may need to be recalibrated for that position.

Choose a stable location, free from sudden or frequent temperature changes, high humidity and draughts. Keep the meter away from vibration, heat, corrosive atmospheres and strong radio-frequency or magnetic fields. The meter can stand on a bench or be screwed down through the threaded holes in the base of its flow body (Appendix C (p. 45)).

Connecting the gas lines

1. Inspect the pipework, fittings and ferrules and remove any dust or other contamination.
2. Find the flow-direction arrow on the front of the meter and connect the gas supply to the inlet side.
3. Push the tubing into each compression fitting until the tube end sits against the shoulder of the fitting.

   NOTICE

   Tightening beyond one and a quarter turns damages the restrictor flow element (RFE) inside the flow body. Do not tighten a fitting further than that.

4. Tighten each fitting by one and a quarter turns, following the fitting manufacturer's instructions.
5. Leak-test the installation before you put the meter into service.

Process connections

Model	Standard connection
XFM 07, XFM 17, XFM 37	1/4 in compression fittings

Model	Standard connection
XFM 47, XFM 57	3/8 in compression fittings
XFM 67	1/2 in compression fittings
XFM 77	3/4 in NPT female ports

1/8 in or 3/8 in compression fittings and 1/4 in VCR fittings are options; ask Analyt-MTC. Leave the fittings on the meter once they are installed; remove them only to clean the flow path or to recalibrate the meter for a new flow range.

Pressure limit

The pressure in the gas line must never exceed 34.47 bar (500 psia). The meter is most accurate at the pressure it was calibrated at; for the best results, have it calibrated at your operating conditions (Calibration and verification (p. 23)).

NOTICE

A pressure above 34.47 bar (500 psia) seriously damages the flow sensor. Make sure no part of your gas system can apply more.

Electrical connections

Power, the analogue output, both relays and the serial interface all pass through the 15-pin D connector on the side of the meter. Jumpers behind the maintenance window above the connector select the analogue signal and the RS-485 terminating resistor.

Before you wire

NOTICE

Connecting or disconnecting a cable with the power on can damage the meter. Switch the power off before you connect or disconnect any cable.

NOTICE

Some components are sensitive to electrostatic discharge. A discharge can damage them. Wear a grounded wrist strap when you change jumpers or service the meter.

Pin assignment

Pin	Function
1	Common for the flow signal on pin 2 (4–20 mA return)
2	Flow signal output, 0–5 V DC or 4–20 mA
3	Relay 2, normally open contact
4	Relay 2, common contact
5	Power supply common (−)
6	Relay 1, common contact
7	Power supply (+), 11–26 V DC
8	RS-485 (−); RS-232 TX on the RS-232 option
9	RS-232 signal ground; RS-485 ground (optional)
10	Do not connect (test and maintenance)
11	Relay 2, normally closed contact
12	Relay 1, normally open contact
13	Relay 1, normally closed contact
14	Do not connect (test and maintenance)
15	RS-485 (+); RS-232 RX on the RS-232 option
Shield	Chassis ground

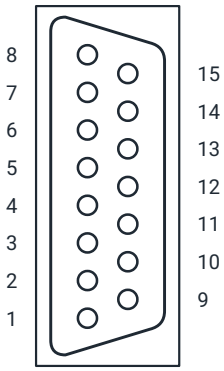


Figure 3-1. Pin numbering of the 15-pin D connector on the meter.

Note
Most D connectors share the same pin numbering, but some mating connectors are numbered differently. Wire by function, matching the table above, whatever numbers your mating connector shows. Take the same care with cables made for other manufacturers' instruments.

Power supply

The meter runs on any DC voltage from 11 to 26 V DC. It draws at most 200 mA at 12 V DC and 100 mA at 24 V DC; if one power supply feeds several meters, choose one whose current rating covers all of them. Keep the power cable no longer than 3 m (9.5 ft).

NOTICE

A supply voltage above 26 V DC damages the meter or disturbs its operation. Never apply more than 26 V DC.

Connect the positive supply to pin 7 and the negative supply to pin 5.

Fuse protection

The positive and the negative power input each have a 300 mA resettable fuse with medium time lag, and the circuit board is protected against reversed polarity. A short circuit or reversed polarity trips the fuse and cuts the power to the meter. To reset it, disconnect the power, remove the fault and reconnect the power.

Analogue output

The meter has one analogue flow output, calibrated at the factory for both 0–5 V DC and 4–20 mA; the jumpers (p. 13) select which one is active. The signal is linear from 0 to 100 % of the full-scale flow. The serial interface works at the same time as the analogue output.

A 0–5 V DC output needs a load of at least 3000 Ω; a 4–20 mA loop may have a resistance of at most 500 Ω. To keep noise off the signal, run the power and the signal lines through separate cable entries.

NOTICE

The 4–20 mA output powers its own loop and is not isolated, and an external voltage source on the output pins damages it. Never connect an external voltage source to the output pins.

NOTICE

Overloading the output, or a wiring error, can damage the meter or make it work incorrectly. Do not load the output beyond the values in Electrical data (p. 33). Check the wiring and the polarity of the supply before you switch on.

Connect the load to pin 2 (+) and pin 1 (−).

Configuration jumpers

Jumper header J7 sits behind the maintenance window on the right side of the meter, above the 15-pin connector, next to the maintenance push button. Columns A, B and C select the analogue output; column D switches the RS-485 terminating resistor. Figure C-3 in Appendix C (p. 47) shows where J7 sits on the circuit board.

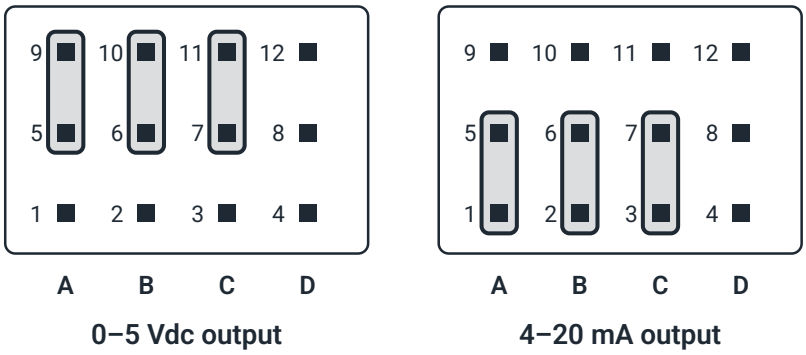


Figure 3-2. Jumper header J7 seen through the maintenance window. Left: jumpers set for 0–5 V DC. Right: jumpers set for 4–20 mA. Column D (RS-485 terminating resistor) is set independently.

Table 3-1 Jumper settings on J7

Function	Setting	J7A	J7B	J7C	J7D
Analogue output	0–5 V DC	5–9	6–10	7–11	—
	4–20 mA	1–5	2–6	3–7	—
RS-485 terminating resistor	Off	—	—	—	8–12
	On	—	—	—	4–8

Relay outputs

The two relays are SPDT dry contacts for switching your own equipment. Relay 1 uses pins 6 (common), 12 (normally open) and 13 (normally closed); relay 2 uses pins 4 (common), 3 (normally open) and 11 (normally closed). What switches each relay is set over the serial interface (Relays (p. 18)).

Serial interface

The standard interface is RS-485; RS-232 is an option, and Profibus DP a separate interface option; ask Analyt-MTC. Set the computer's serial port to these values:

Baud rate	9600
Data bits	8
Parity	None
Stop bits	1
Flow control	None

RS-485

Configure the RS-485 converter or adapter for multidrop, two-wire, half-duplex operation. Its transmitter must be enabled by TD or by RTS, whichever the converter offers; set the receiver to follow the same signal so that the converter does not echo what it sends.

Converter	XFM pin
T(−) or R(−)	8
T(+) or R(+)	15
GND, if available	9

RS-232

RS-232 needs a crossover connection: the computer's receive line goes to the meter's transmit pin and vice versa.

Computer, 9-pin D-sub	XFM pin
Pin 2 (RX)	8 (TX)
Pin 3 (TX)	15 (RX)
Pin 5 (GND)	9 (GND)

CHAPTER 4

Commissioning

Switching on and warm-up

Install and leak-test the meter first (Installation (p. 10)), and keep the gas flow off. When you switch on the power, a meter with display shows two start-up screens for about two seconds each, then the main screen. What the screens show depends on the model and its configuration.

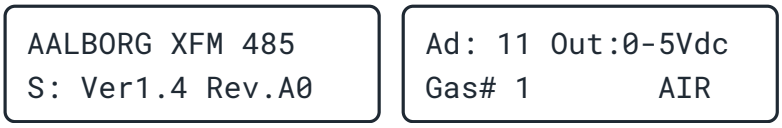


Figure 4-1. Start-up screens. Left: product, firmware version and revision of the memory table. Right: RS-485 address, analogue output setting and the selected gas table.

The main screen shows the flow in the current engineering unit on the upper line and the totalized volume or mass on the lower line.



Figure 4-2. Main screen (left), and during warm-up with the display diagnostics switched on (right): the lower line counts down the remaining warm-up time in minutes and seconds and alternates with the totaliser every two seconds.

Allow the meter to warm up for at least 6 minutes before you rely on its readings. During warm-up the status LED is constantly amber; when the meter is ready to measure it turns constantly green. Just after switching on, the flow output reads higher than normal because the sensor has not yet reached its operating temperature; the reading falls back to zero by itself within a few minutes.

CHAPTER 5

Operation

Once powered, the XFM warms up for six minutes and then measures without further attention. Its settings — gas table, units, totaliser, alarms and relays — are made over the serial interface; the commands are in Communication (p. 20). Two tasks can also be done at the meter with the maintenance push button: the auto zero and a totaliser reset.

Overrange (swamping)

If the flow exceeds the full scale of the meter by more than 10 %, the sensor is “swamped”: its readings are then neither accurate nor linear. Reduce the flow to below 110 % of full scale; once it is back in the calibrated range, the meter recovers by itself. The longer it runs above 110 %, the longer the recovery can take.

Status LED and diagnostics

The multicolour status LED reports the state of the meter; a meter with display also shows the event on screen. When several events are present at once, the one with the highest priority (0 is the highest) is shown. The serial interface reports all present events at the same time (Command reference (p. 21), command D).

Table 5-1 Diagnostic events

Priority	Event	Status LED
0	Auto zero running	Red, flashing irregularly
1	Fatal error: reset or service needed to return to normal operation	Red, constant
2	CPU temperature too high (electronics overheating)	Flashing red and amber
3	Sensor warm-up, first 6 minutes after power-up (normal, no critical event)	Amber, constant
4	Flow sensor temperature too low	Amber, flashing on and off
5	Flow sensor temperature too high	Red, flashing on and off
6	Totaliser has reached its preset limit	Flashing green and amber
7	Low flow alarm	Green, flashing on and off
8	High flow alarm	Flashing green and red
9	Normal operation, no diagnostic event	Green, constant

What to do about each event is in Troubleshooting (p. 30).

Engineering units

The meter can show the flow in 23 engineering units. The totaliser follows automatically: when you change the flow unit, the totaliser switches to the matching volume or mass unit. Read and set the unit with command U.

Table 5-2 Engineering units

Index	Flow	Totaliser
0	% of full scale	%·s

1	mL/s	mL
2	mL/min	mL
3	mL/h	mL
4	L/s	L
5	L/min	L
6	L/h	L
7	m³/s	m³
8	m³/min	m³
9	m³/h	m³
10	ft³/s	ft³
11	ft³/min	ft³

Index	Flow	Totaliser
12	ft³/h	ft³
13	g/s	g
14	g/min	g
15	g/h	g
16	kg/s	kg
17	kg/min	kg
18	kg/h	kg
19	lb/s	lb
20	lb/min	lb
21	lb/h	lb
22	User defined	User defined

The index is the value stored in memory location 9 (Appendix B (p. 43)). The display and the serial interface show the units as `L/min`, `Ltr`, `m3/hr`, `f3` and so on; the exact names are listed with command U.

Gas tables

The meter stores calibration data for up to ten gases, in tables numbered 0 to 9. It is shipped with at least one calibrated table, more if additional calibrations were ordered. Read the active table, or select another, with command G; the reply gives the table number and the gas name.

> **Note**
> If the display or the interface shows “Uncalibrated” instead of a gas name, the selected table has no calibration. Readings from an uncalibrated table are wrong; select a calibrated one.

K factors

To measure a gas for which the meter has no calibration, you can apply a conversion factor (K factor) to the active calibration. The meter holds K factors relative to nitrogen for 36 gases (index 0 to 35, listed in Appendix A (p. 40)) and one factor you enter yourself. Command K selects one of three settings:

- **Disabled** — no conversion (K = 1). This is the default.
- **Internal** — a factor from the internal table, chosen by its index.
- **User defined** — a factor you enter.

When a K factor is active, the meter does the conversion itself; you read the converted flow directly. K factors are not applied when the unit is % of full scale.

> **Note**
> K factors are approximations at best. Do not rely on them where you need an accuracy better than ±5 to 10 %. For that, have the meter calibrated on the actual gas.

Totaliser

The totaliser integrates the measured flow over time. Over the interface (command T) you can reset it to zero, set the flow at which it starts counting, set a total at which an action follows, switch it on and

off, and read it. A meter with display shows the total on the lower line of the main screen.

Start value	Entered in % of full scale. The totaliser counts only while the flow is at or above this value.
Stop value (limit)	Entered in the current volume or mass unit. When the total equals this value, the totaliser event becomes true: the LED flashes green and amber, and a relay assigned to the totaliser switches. Set it to 0 if you do not need it.
Warm-up delay	When enabled, the totaliser does not count during the first 6 minutes after power-up. Off by default.

Note
Configure all totaliser settings before you enable the totaliser. The meter saves the total in its memory every 6 minutes.

Resetting the totaliser at the meter

The maintenance push button behind the maintenance window, above the 15-pin connector, resets the totaliser when it is held down during power-up:

1. Disconnect the power from the meter.
2. Press and hold the maintenance push button.
3. Reconnect the power while you keep the button pressed.
4. Release the button after 6 seconds — on a meter with display, when the main screen appears.

Flow alarm

The flow alarm watches the flow against a low and a high limit. An alarm is shown by the status LED and on the display, and can switch a relay. All alarm settings are made with command A.

Mode	Enables or disables the alarm. Disabled by default.
Low limit	In % of full scale. A flow below it is a low alarm. Must be lower than the high limit.
High limit	In % of full scale. A flow above it is a high alarm. Must be higher than the low limit.
Action delay	How long the flow must stay beyond a limit before the alarm is raised, 0–3600 s.
Latch mode	By default the alarm is not latching: it is shown only while the flow is beyond the limit. A relay assigned to an alarm can be made to latch: 0 = no latch; 1 = relay 1 latches; 2 = relay 2 latches; 3 = both relays latch.

Relays

Each of the two relays is assigned to one event with command R. The relay coil is energized while its event is true.

Code	Relay switches when
N	Never: not assigned, not energized (default)
T	The totaliser has reached its limit
H	High flow alarm
L	Low flow alarm
R	The flow is in the range between the low and the high limit
M	Manual: energized regardless of alarm and totaliser

Auto zero

The zero was adjusted at the factory. Run the auto zero only if the meter shows a reading with no gas flowing. During the procedure the meter adjusts its sensor until the reading at zero flow is 120 counts.

NOTICE

Running the auto zero with gas flowing through the meter, or before the meter has warmed up, sets the zero incorrectly or makes the auto zero fail. Run the auto zero only after the meter has been powered for at least 15 minutes, and only with absolutely no flow through it. Shut off the gas; to make sure no gas seeps or leaks in, disconnect the gas source. The push button does not start the auto zero during the 6-minute warm-up.

1. Shut off the gas flow and disconnect the gas source.
2. Press the maintenance push button, or send the auto zero command `Z,N`. The status LED flashes red irregularly; a meter with display shows `AUTOZERO IS ON!`.
3. Wait. The procedure normally takes 1 to 2 minutes; the sensor count (S) and the zero count (DP) on the display change every 3 to 6 seconds. The meter does not answer other commands meanwhile.
4. Check the result. If the sensor reading is within 120 ±10 counts, the auto zero has succeeded: the LED returns to constant green and the display shows `AutoZero is Done`. If not, the LED stays constantly red and the display shows `AutoZero ERROR!` — see Troubleshooting (p. 30).



Figure 5-1. Auto zero in progress (left) and completed (right). The counts differ from meter to meter. Without a display, the interface reports the auto zero status (command Z).

CHAPTER 6

Communication

Every setting of the XFM, and every reading, is available over its serial interface as plain ASCII commands. Any program that can write to a serial port works, from a terminal emulator to your own software or a PLC. Wiring and port settings are in Serial interface (p. 13).

Command structure

A command is one line of printable ASCII characters, with its fields separated by commas and ended by a carriage return (**<CR>**, the Enter key in a terminal). The meter ignores line feeds.

```
!Addr,Cmd,Arg1,Arg2,Arg3,Arg4<CR>
```

`!`	Start character. RS-485 only.
`Addr`	Address of the meter on the RS-485 bus: two hexadecimal characters, `01`–`FF`. RS-485 only.
`Cmd`	The command, one or two characters (Command reference (p. 21)).
`Arg1` … `Arg4`	Arguments, as many as the command needs, separated by commas.

Note

On a meter with the RS-232 option, leave out the start character and the address: the command begins with `Cmd`. Example: `F<CR>` instead of `!11,F<CR>`.

RS-485 addresses

NOTICE

Address `00` is reserved for global commands: every meter on the bus executes them, and none replies. Two meters with the same address on one bus reply at once, and communication fails. Never assign `00` to a meter, and never give two meters on one bus the same address.

Every meter leaves the factory with address `11`. Before you connect several meters to one bus, give each one its own address. To change the address of a meter whose address you do not know, connect it alone to the bus and send the memory write command to the global address `00`:

```
!00,MW,7,XX<CR>
```

`XX` is the new address, `01` to `FF`. From then on the meter answers only to its new address.

Examples

These examples address a meter with address `12` (hexadecimal, 18 decimal).

Task	Send	Reply
Read the active gas table	`!12,G<CR>`	`!12,G 0 AIR` — table 0, calibrated for air
Read the alarm status	`!12,A,R<CR>`	`!12,N` — no alarm
Read the flow	`!12,F<CR>`	`!12,50.0` — here 50 % of full scale

Task	Send	Reply
Set the high alarm limit to 85 % of full scale	`!12,A,H,85.0<CR>`	`!12,AH85.0`

Command reference

The table lists each command with its arguments and the reply, without the start character and address. An asterisk (*) marks the setting after power-up. Some functions are not available on every model.

Cmd	Argument(s)	Reply	Function
READINGS			
F	—	`value`	Flow in the current engineering unit.
E	—	`value`	Full-scale flow in sL/min, without the K factor.
C	`R` / `C`	`hours` / `CC`	Maintenance timer: hours since the last calibration; `C` resets it to zero.
GAS, UNITS AND K FACTOR			
G	`0`* to 9; none = read	`Gn`, `gas name`	Selects gas table `n` (Gas tables (p. 17)).
U	`unit`, e.g. `%`*, `mL/min`, `L/min`, `m3/hr`, `f3/min`, `g/sec`, `kg/hr`, `Lb/min`; none = read	`U:unit`; read: `U,unit`	Sets the unit of flow and totaliser. The names follow the pattern `mL`, `L`, `m3`, `f3`, `g`, `kg`, `Lb` with `/sec`, `/min` or `/hr`.
	`USER,factor,time,density`	`U:USER,…`	User-defined unit: `factor` converts from sL/min; `time` base `S`, `M` or `H`; `density` `Y` (use gas density) or `N`. The totaliser unit is not per unit of time.
K	`D`*	`KD`	K factor off (K = 1).
	`I` [,`index` 0–35]	`KI,index,gas`	Internal K factor; without an index, re-enables the one set before.
	`U` [,`value` 0–1000]	`KU,value`	User K factor (decimal); without a value, re-enables the one set before.
	`S`	`SK,mode,index,value`	Status: mode `D`, `I` or `U`. K factors do not apply in % of full scale.
N	`E` / `D`*; none = read	`N:E` / `N:D`	Switches the roll-back-to-N2 (nitrogen conversion) mode on or off; memory index 49.
TOTALISER			
T	`Z`	`TZ`	Resets the total to zero.
	`F,value`	`TFvalue`	Start value in % of full scale.
	`L,value`	`TLvalue`	Limit (stop value) in the current volume or mass unit.
	`E` / `D`	`TE` / `TD`	Enables / disables the totaliser.
	`R`	`value`	Reads the total in the current unit.
	`W,E` / `W,D`*	`TW:E` / `TW:D`	Warm-up delay: no totalizing during the first 6 minutes after power-up.
	`S`	`TS:` mode, start, limit, warm-up	Reads the settings.
FLOW ALARM AND RELAYS			
A	`H,value` / `L,value`	`AHvalue` / `ALvalue`	High / low limit, 0–100 % of full scale; high must be above low.
	`A,seconds`	`AA:value`	Action delay, 0–3600 s.
	`E` / `D`*	`AE` / `AD`	Enables / disables the alarm.
	`B,value`	`AB:value`	Latch mode 0* to 3 (Flow alarm (p. 18)).

Cmd	Argument(s)	Reply	Function
	R	N, H or L	Alarm status: none, high (flow above the high limit), low (flow below the low limit).
	S	AS:M,L,H,D,B	Settings: mode (E/D), low and high limit (% FS), delay (s), latch mode.
R	1 or 2, then N*, T, H, L, R or M	R1N … R2M	Assigns relay 1 or 2 to an event (Relays (p. 18)). Example: !11,R,1,H.
	1 or 2, then S	Rxcode	Reads the assignment.
ZERO AND DIAGNOSTICS			
Z	N	ZN	Starts the auto zero. Only with absolutely no flow and not earlier than 15 minutes after power-up. It can take several minutes; the meter does not answer other commands meanwhile.
	S	ZNI,value	Status while the auto zero is running.
	W	ZW	Writes the zero to memory (when done).
	V	ZV,value	Reads the zero value.
D	none	D:0x0,L:9,E	Diagnostic word (here 0x0), current LED state (priority (p. 16) 9) and display diagnostics mode (E).
	E / D	D:E / D:D	Display only: switches the diagnostic messages on the display on or off.
B	0–100 (%); none = read	B:counts (0–4095)	Display only: backlight, 0 = off, 100 = maximum.
MEMORY			
MR	index 0–999	value	Reads a memory location (Appendix B (p. 43)).
MW	index, value	MW,index,value	Writes a memory location. Some locations are write-protected.

NOTICE

A wrong value written with MW can make the meter malfunction or invalidate its calibration. Use the memory write command MW with care, and note the value you are about to change, with MR, before you write a new one.

Error codes

When the meter cannot execute a command, it replies with an error number:

Code	Meaning
1	Command not supported, or the protected (back-door) mode is not enabled
2	Wrong number of arguments
3	Memory index out of range (MR, MW)
4	Wrong number of characters in an argument
5	Attempt to change a write-protected memory area
6	Command or argument not found
7	Wrong argument value
8	Reserved
9	Manufacturer key wrong or disabled

CHAPTER 7

Calibration and verification

Every XFM leaves the factory calibrated for the gas and the flow range on its front label. This chapter explains how a calibration is checked and adjusted: the zero, the gas linearization table and the analogue output. All adjustments are made over the serial interface; nothing inside the meter has to be opened or turned.

Before you adjust anything

Adjust a meter only if a check against a reference shows that it is needed — for linearity, for a new flow range or for an additional gas calibration. Sending the meter to Analyt-MTC for calibration is usually the quicker route; ask Analyt-MTC about a calibration for your gas and your operating conditions (Service, warranty and contacts (p. 38)).

Periodic calibrations are done by qualified personnel with suitable calibration equipment.

> **Note**
> Removing the factory calibration seals, or changing the linearization table or the analogue output variables, invalidates the factory calibration of the meter. Note the original values before you change anything.

Calibration conditions

Factory calibrations use NIST-traceable precision volumetric calibrators. The standard conditions are dry nitrogen at 21.1 °C (70.0 °F), an inlet pressure of 20 psia (137.9 kPa absolute) and an outlet pressure of 0 psig. Other gases are then covered by K factors (Converting between gases (p. 27)). For a gas whose properties differ much from nitrogen, a reference gas that resembles it more closely gives a better approximation. The best accuracy comes from calibrating the meter at its actual operating conditions.

The meter can be recalibrated in the field for the flow range it was calibrated for at the factory. A different flow range may need a different restrictor flow element (RFE); ask Analyt-MTC.

Equipment

- A flow calibration standard with an accuracy at least four times better than that of the meter.
- A computer with an RS-485 or RS-232 interface (Serial interface (p. 13)). Calibration software that talks to the meter over this interface can automate most of the steps below.
- A certified, high-sensitivity multimeter (analogue output calibration only).
- An insulated (plastic) screwdriver.
- A flow regulator upstream of the meter, for example a metering needle valve.
- A pressure-regulated source of dry, filtered nitrogen or another suitable reference gas.

Set the gas and ambient temperature and the inlet and outlet pressures to match your operating conditions.

Warm-up and zero check

1. Power the meter for at least 15 minutes before you start.
2. Connect the computer and establish communication.
3. With absolutely no flow through the meter, read the sensor value. In the calibration software, open **`Tools`** › **`Diagnostic`** and tick **`Sensor Comp.`** to show the compensated average sensor counts.
4. The reading must be 120 ±10 counts. If it is not, run the auto zero (p. 19).

Adjusting the gas linearization table

Each gas table in memory holds an 11-point linearization table: for 0, 10, 20 … 100 % of full scale, a pair of values made of the sensor reading and the actual flow. Sensor readings are counts of the 12-bit converter, 0 to 4095. Actual flows are fractions of full scale, 0.000000 to 1.000000 (up to six decimals); 1.000000 is 100 %. The memory indexes are listed in Appendix B (p. 44): the sensor values are at the odd indexes 113 to 133, the flows at the even indexes 114 to 134.

> **Note**
> Every change applies to the active gas table, and a change to the wrong table or to its zero point makes the readings wrong. Make sure the table you want to adjust is the active one (command G). Never change indexes 113 (must be 120 counts) and 114 (must be 0.0): they are the zero point of the table.

1. Start at 100 % of full scale when you build a new table. To correct linearity only, you can start at any point.
2. Set the flow to 100 % of full scale with the flow regulator and compare the meter reading with the calibration standard.
3. If they differ by more than 0.5 % of full scale, correct the sensor value of that point, index 133. If the meter reads higher than the standard, decrease the counts; if it reads lower, increase them.
4. Compare again and repeat the correction until the reading agrees.
5. Treat the other nine points (indexes 115 to 131) the same way.

From a terminal, read a value with the memory read command and write the corrected one with the memory write command. For a meter with address 11:

```
!11,MR,133<CR>
```

```
!11,MW,133,3450<CR>
```

The first command reads index 133; the second writes 3450 counts into it.

Calibrating the analogue output

The analogue output was calibrated at the factory. It needs a new calibration only after the memory chip has been replaced or when its offset or span has to be corrected. The output is computed from three memory variables: index 25 `AoutScaleV` (0–5 V DC scale), index 27 `AoutScale_mA` (4–20 mA scale) and index 28 `AoutOffset_mA` (4–20 mA offset). The 0–5 V DC output has a scale only.

The commands below assume address 11. With calibration software, follow its prompts instead.

> **Note**
> Changing the analogue output variables invalidates the factory calibration of the output. Note the original values (`MR`) before you start.

NOTICE

Some components are sensitive to electrostatic discharge. A discharge can damage them. Wear a grounded wrist strap when you change jumpers or service the meter.

NOTICE

Connecting or disconnecting a cable with the power on can damage the meter. The output calibration runs with the meter powered: connect only the multimeter, to pin 2 (+) and pin 1 (−) as the steps say, and switch the power off before you connect or disconnect any other cable.

Preparation

1. Power the meter for at least 15 minutes, with absolutely no flow through it, and establish communication.
2. Enable the protected (back-door) mode: send `!11,MW,1000,1<CR>`. The meter replies `!11,BackDoorEnabled: Y`.
3. Stop the automatic update of the output: send `!11,WRITE,4,D<CR>`. The meter replies `!11,DisableUpdate: D`.

0–5 V DC output

1. Set the J7 jumpers for 0–5 V DC (Configuration jumpers (p. 13)).
2. Connect the multimeter, set to voltage, to pin 2 (+) and pin 1 (−) of the 15-pin connector.
3. Write 4000 counts to the output: `!11,WRITE,1,4000<CR>`.
4. Read the voltage `U` in volts and calculate `AoutScaleV` = 20000 / `U`.
5. Store the result `X`: `!11,MW,25,X<CR>`.

4–20 mA output

1. Set the J7 jumpers for 4–20 mA.
2. Connect the multimeter, set to current, to pin 2 (+) and pin 1 (−).
3. Write 4000 counts to the output: `!11,WRITE,1,4000<CR>`.
4. Read the current `I` in mA and calculate `AoutScale_mA` = 4000 / `I`.
5. Write zero counts to the output: `!11,WRITE,1,0<CR>`.

6. Read the offset current I_0 in mA and calculate `AoutOffset_mA` = −`AoutScale_mA` × I_0.
7. Store both results: `!11,MW,27,Y<CR>` for the scale and `!11,MW,28,Z<CR>` for the offset.

Finishing

NOTICE

While the update is stopped, the analogue output does not follow the flow. Always finish with both steps.

1. Restart the automatic update of the output: `!11,WRITE,4,N<CR>`. The meter replies `!11,DisableUpdate: N`.
2. Close the protected mode: `!11,MW,1000,0<CR>`. The meter replies `!11,BackDoorEnabled: N`.

Converting between gases

A thermal mass flow meter responds to the heat a gas carries, so a meter calibrated with one gas reads another gas differently. The K factor relates the two. For diatomic gases it follows from the density d (g/L) and the specific heat c_p (cal/g), both taken at the same conditions:

$$K_{gas} = 1 / (d \times c_p)$$

For a meter whose flow range stays the same, the flow of the actual gas Q_a relates to the flow of the reference gas Q_r through their K factors:

$$K = Q_a / Q_r = K_a / K_r$$

Example. A meter calibrated with nitrogen reads 1000 smL/min. With oxygen (K = 0.9926 relative to nitrogen) the actual flow is 1000 × 0.9926 = 992.6 smL/min.

If you activate a K factor in the meter (K factors (p. 17)), it does this conversion itself.

CHAPTER 8

Maintenance

What needs maintenance

Apart from occasional cleaning of the inlet filter screen and the flow paths, the XFM needs no routine maintenance. The sensor is a fine capillary tube, and the other flow passages are narrow too: particles or crystallizing gas components block them easily. Clean, filtered gas is therefore the best maintenance (Gas quality (p. 10)).

Have the calibration checked at the intervals your quality system requires, by qualified staff with suitable calibration equipment (Calibration and verification (p. 23)). For repair and calibration, return meters to Analyt-MTC.

⚠ WARNING

A meter that has carried toxic, corrosive, infectious or radioactive media can hold hazardous residues. These residues endanger the people who open or service it. Purge the meter and neutralize all residues before you open it or send it for service.

Cleaning the flow path

NOTICE

Any disassembly of the XFM 37, 47, 57, 67 or 77 makes a recalibration necessary. Never take the sensor apart, and do not dismantle or repair these meters yourself. If flushing does not clear a blocked sensor tube, return the meter.

1. Remove the meter from the gas line and look into the inlet and the outlet for debris.
2. Remove any debris you find.
3. If the flow path is still blocked, clean the inlet filter (XFM 17, below) or return the meter to Analyt-MTC.

Cleaning the inlet filter (XFM 17)

On the XFM 17, the 50 µm inlet filter screen sits in the RFE sub-assembly, together with the restrictor flow element. The RFE is a precision flow divider that sends a set share of the gas through the sensor; it is chosen for the gas and the flow range of the meter. You need an 11/16 in open-ended wrench, a 1/2 in wide flat screwdriver, a pin or small screwdriver of 3/32 to 1/8 in diameter, and hex keys of 1/4 in and 5/32 in.

NOTICE

Taking the RFE sub-assembly apart can affect the calibration. After you have refitted it, check at least one calibration point.

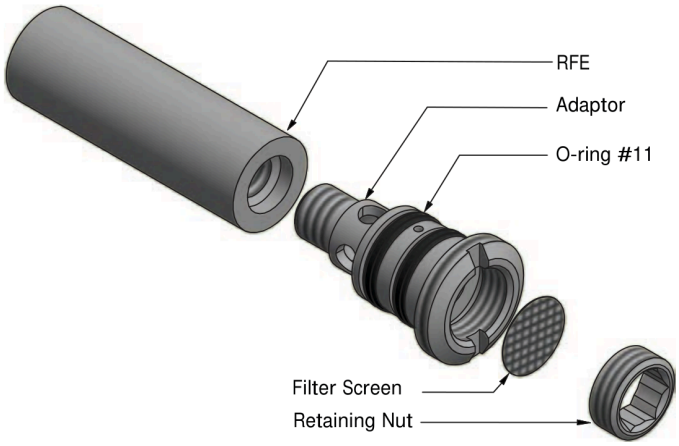


Figure 8-1. RFE sub-assembly of the XFM 17 with the inlet filter screen.

1. Unscrew the inlet and outlet compression fittings from the meter with the 11/16 in wrench.
2. Unscrew the RFE sub-assembly from the inlet side with the flat screwdriver.
3. Push the pin through the holes of the adaptor to hold it, and unscrew the retaining nut with the 1/4 in hex key. The filter screen is now accessible.
4. Separate the RFE from the adaptor with the 5/32 in hex key.
5. Clean or replace the parts as needed. If you clean with alcohol, let the parts dry. Inspect the flow path inside the meter; if necessary, flush it with alcohol and dry it thoroughly with clean, dry gas. Make sure no dust has settled on the O-ring.

   NOTICE

   Excess tightening torque deforms the RFE and makes it unusable. Screw the RFE sub-assembly only into the inlet side, never into the outlet side, and do not over-tighten it.

6. Reassemble the RFE sub-assembly and screw it carefully into the **inlet** side.
7. Screw the compression fittings back in, then check at least one calibration point.

CHAPTER 9

Troubleshooting

Every meter is checked at several stages of manufacture and calibrated for your gas and conditions before it is shipped. If it does not seem to work properly, check these points first:

- Are all cables connected correctly, and do the pin assignments match (Pin assignment (p. 12))? Take particular care with cables made for other manufacturers' instruments.
- Is the installation leak-free?
- Does the power supply meet the requirements? If one supply feeds several meters, is its current rating sufficient?
- Is the pressure difference across the meter sufficient for the flow?

Table 9-1 Troubleshooting

Symptom	Likely cause	Remedy
POWER, LED AND DISPLAY		
LED and display stay dark after switching on; the analogue output does not respond to flow	Power supply faulty or polarity reversed	Measure the voltage between pins 7 and 5. If it is outside 11–26 V DC, replace the supply; if it is negative, correct the polarity.
	Circuit board defective	Return the meter to Analyt-MTC.
LED flashes amber on and off rapidly	Sensor temperature too low	Bring the ambient and gas temperature within range (above 5 °C).
LED flashes red on and off rapidly	Sensor temperature too high	Bring the ambient and gas temperature within range (below 50 °C).
LED flashes red and amber	Microcontroller too hot (overload)	Disconnect the power. Make sure the ambient temperature is below 50 °C and let the meter cool down for at least 15 minutes. Reconnect the power. If the overload is indicated again, return the meter.
LED constantly red	Fatal error (memory or auto zero error)	Switch the power off and on. If the LED is still red, wait 15 minutes and run the auto zero (p. 19). If the error comes back after that, return the meter.
ZERO AND CALIBRATION		
No zero reading after 15 minutes of warm-up with no flow	The internal temperature has changed	Run the auto zero (p. 19).
Calibration off by more than ±1.0 % of full scale	Zero has shifted	Shut off the gas and disconnect the gas source so that nothing seeps in. Wait 15 minutes with no flow, then run the auto zero.
FLOW READING		
Reading above full scale, 0–5 V DC output above 5.0 V DC while gas flows	Sensor swamped: flow more than 10 % above full scale	Reduce the flow into the calibrated range or shut it off. The meter recovers by itself (Overrange (p. 16)).
	Circuit board defective	Return the meter.
Gas flows, but neither display nor 0–5 V DC output responds	Flow too low for this model	Check the full-scale flow on the front label and adjust the flow.
	XFM 17: RFE not properly connected to the inlet fitting	Unscrew the inlet fitting and refit the RFE (Cleaning the inlet filter (p. 28)). The calibration can be affected.
	Sensor or circuit board defective	Return the meter.
No gas flows with inlet pressure applied; display and output read zero	Inlet filter screen blocked	Flush or clean the filter screen, or replace it (Cleaning the flow path (p. 28)). The calibration can be affected.

Symptom	Likely cause	Remedy
Gas flows, but the 0–5 V DC output stays at about 1 mV	Flow direction reversed	Check the flow arrow on the front of the meter and reconnect the lines.
	Back pressure and a gas leak in the system	Find and repair the leak. If the meter leaks internally, return it.
ANALOGUE OUTPUT		
Display and/or 0–5 V DC output fluctuate widely during measurement	Output (pins 2 and 1) shorted to ground or overloaded	Check the connections to pins 2 and 1. The load must be at least 3000 Ω (Analogue output (p. 12)).
Display correct, but the 0–5 V DC output does not change (constant or about zero)	Voltage output stage damaged	Return the meter.
	Output scale and offset variables corrupted	Restore the original memory values or recalibrate the output (Calibrating the analogue output (p. 25)).
Display and 0–5 V DC correct, but the 4–20 mA output does not change (constant or about 4.0 mA)	Loop open, or loop resistance above 500 Ω	Check the connections to pins 2 and 1. The loop resistance must be below 500 Ω.
	Current output stage damaged	Return the meter.

If the problem remains, contact Analyt-MTC with the model and serial number of the meter (Contact (p. 38)).

CHAPTER 10

Specifications

The data below apply to standard XFM meters. The front label of your meter gives its gas, its flow range and its calibration conditions.

Performance

Flow medium	Clean gases only; not for liquids
Flow ranges	5 smL/min–1000 sL/min full scale, nitrogen at 21.11 °C, 1013.25 mbar (Models and flow ranges (p. 9))
Accuracy, including linearity	±1 % of full scale at calibration temperature and pressure
Repeatability	±0.15 % of full scale
Temperature coefficient	0.15 % of full scale per °C or better
Pressure coefficient	0.01 % of full scale per psi (6.895 kPa) or better
Response time	600 ms time constant; about 2 s to within ±2 % of the flow, for flows of 25–100 % of full scale
Attitude sensitivity	Up to 1 % additional deviation from the stated accuracy, after re-zeroing; calibrated horizontal, ±15° tilt allowed (Location and orientation (p. 10))
Calibration conditions	101.4 kPa (14.7 psia) and 21.1 °C (70 °F), unless otherwise requested or stated
Calibration	One 10-point calibration, NIST-traceable, as standard; for up to 9 additional calibrations, ask Analyt-MTC
Gas tables	Up to 10 calibrations in memory
Engineering units	23, including one user-defined
Gas conversion factors	36 internal, plus one user-defined

Operating limits

Maximum gas pressure	34.47 bar (500 psia) (Pressure limit (p. 11))
Gas and ambient temperature	0–50 °C (32–122 °F); −10 to 50 °C (14–122 °F) with dry gases only
Relative humidity of the gas	Up to 70 %
Leak integrity	1×10^{-9} sccs helium, maximum, to the outside
Environment (IEC 664)	Installation category II, pollution degree 2

Pressure drop

Table 10-1 Maximum pressure drop by model and flow

Model	Flow, sL/min	mm H_2O	psid	kPa
XFM 17	up to 10	130	0.18	1.275
XFM 37	20	300	0.44	3.03
	30	800	1.18	8.13
	40	1480	2.18	15.03
	50	2722	3.8	26.2
XFM 47	60	3100	4.56	31.4
	100	–	11.8	81.4
XFM 57	200	2720	4.0	27.6
XFM 67	500	3400	5.0	34.5
XFM 77	1000	6120	9.0	62.0

Electrical data

Supply voltage	11–26 V DC
Current consumption	200 mA maximum at 12 V DC; 100 mA maximum at 24 V DC
Protection	Reverse-polarity protection; 300 mA resettable fuse in each supply line
Analogue output	Linear 0–5 V DC, load at least 3000 Ω, noise 20 mV peak to peak maximum; or linear 4–20 mA, loop resistance 500 Ω maximum; selected with jumpers
Relay outputs	Two SPDT dry contacts, programmable
Digital interface	RS-485 (standard); RS-232 or Profibus DP (options)
Connector	15-pin D-sub (Pin assignment (p. 12))
Display (option)	LCD, 2 lines of 16 characters, adjustable backlight

Materials and connections

Wetted materials	Anodized aluminium, brass, 316 stainless steel, 416 stainless steel, FKM O-rings; NBR (Buna), EPR or FFKM O-rings as options
Process connections	XFM 07, 17, 37: 1/4 in compression; XFM 47, 57: 3/8 in compression; XFM 67: 1/2 in compression; XFM 77: 3/4 in NPT female. Options: 1/8 in or 3/8 in compression, 1/4 in VCR
Inlet filter screen	50 µm (XFM 17); 60 µm (XFM 37, 47, 57, 67, 77)

NOTICE

Corrosion resistance depends on how your gas reacts with the wetted materials, and a gas that reacts with them can corrode the meter. Choosing a model whose materials suit your gas is your responsibility; ask Analyt-MTC if you are unsure.

Weights

Model	Meter	Shipping weight
XFM 17	2.20 lb (1.00 kg)	3.70 lb (1.68 kg)
XFM 37, XFM 47	2.95 lb (1.33 kg)	4.34 lb (1.97 kg)
XFM 57	4.12 lb (1.87 kg)	5.62 lb (2.55 kg)
XFM 67	6.1 lb (2.8 kg)	8.2 lb (3.72 kg)
XFM 77	8.3 lb (3.8 kg)	10 lb (4.54 kg)

Dimensions: Appendix C (p. 45).

Conformity

EMC	Directive 89/336/EEC as amended
Emission	EN 55011:1991, group 1, class A
Immunity	EN 55082-1:1992

CHAPTER 11

Ordering information

Order from Analyt-MTC with the order codes. The meters below are the standard versions; for any other version, contact Analyt-MTC.

Meters

The versions in Table 11-1 are calibrated for air at standard conditions (21.11 °C, 1013.25 mbar). They have FKM seals, the standard process connections (Process connections (p. 10)), the universal 11–26 V DC power input and the 0–5 V DC analogue output. Each model comes with an aluminium or a stainless steel body, without display or with the LCD readout, and with the RS-232 or the Profibus DP interface. For another gas, flow range, seal material, connection, output or interface, including RS-485, contact Analyt-MTC.

Table 11-1 Meters, versions with an order code (air, 21.11 °C, 1013.25 mbar)

Full scale	Body	Display	Interface	Order code
XFM 07				
	Aluminium	None	RS-232	XFM07A-N0
	Aluminium	LCD	RS-232	XFM07A-L0
	Aluminium	None	Profibus DP	XFM07A-NP
	Stainless steel	None	RS-232	XFM07S-N0
	Stainless steel	LCD	RS-232	XFM07S-L0
	Stainless steel	None	Profibus DP	XFM07S-NP
XFM 17				
5 smL/min – 10 sL/min	Aluminium	None	RS-232	XFM17A-N0
	Aluminium	LCD	RS-232	XFM17A-L0
	Aluminium	None	Profibus DP	XFM17A-NP
	Stainless steel	None	RS-232	XFM17S-N0
	Stainless steel	LCD	RS-232	XFM17S-L0
	Stainless steel	None	Profibus DP	XFM17S-NP
XFM 37				
20–50 sL/min	Aluminium	None	RS-232	XFM37A-N0
	Aluminium	LCD	RS-232	XFM37A-L0
	Aluminium	None	Profibus DP	XFM37A-NP
	Stainless steel	None	RS-232	XFM37S-N0
	Stainless steel	LCD	RS-232	XFM37S-L0
	Stainless steel	None	Profibus DP	XFM37S-NP

Full scale	Body	Display	Interface	Order code
XFM 47				
60–100 sL/min	Aluminium	None	RS-232	XFM47A-N0
	Aluminium	LCD	RS-232	XFM47A-L0
	Aluminium	None	Profibus DP	XFM47A-NP
	Stainless steel	None	RS-232	XFM47S-N0
	Stainless steel	LCD	RS-232	XFM47S-L0
	Stainless steel	None	Profibus DP	XFM47S-NP
XFM 57				
200 sL/min	Aluminium	None	RS-232	XFM57A-N0
	Aluminium	LCD	RS-232	XFM57A-L0
	Aluminium	None	Profibus DP	XFM57A-NP
	Stainless steel	None	RS-232	XFM57S-N0
	Stainless steel	LCD	RS-232	XFM57S-L0
	Stainless steel	None	Profibus DP	XFM57S-NP
XFM 67				
500 sL/min	Aluminium	None	RS-232	XFM67A-N0
	Aluminium	LCD	RS-232	XFM67A-L0
	Aluminium	None	Profibus DP	XFM67A-NP
	Stainless steel	None	RS-232	XFM67S-N0
	Stainless steel	LCD	RS-232	XFM67S-L0
	Stainless steel	None	Profibus DP	XFM67S-NP
XFM 77				
1000 sL/min	Aluminium	None	RS-232	XFM77A-N0
	Aluminium	LCD	RS-232	XFM77A-L0
	Aluminium	None	Profibus DP	XFM77A-NP
	Stainless steel	None	RS-232	XFM77S-N0
	Stainless steel	LCD	RS-232	XFM77S-L0
	Stainless steel	None	Profibus DP	XFM77S-NP

Accessories

Table 11-2 Accessories

Description	Order code
Power supply and cable assembly, 230 V AC (EU plug), 12 V DC, with a 6 ft communication interface branch with stripped ends; without the analogue output and relay connections	PS-XFM-230EU-2
Power supply and cable assembly as above, with the analogue output and relay connections	PS-XFM-230EU-2-A
Power supply and cable assembly, 110 V AC (North American plug), 12 V DC, without or with the analogue output and relay connections	PS-XFM-110NA-2 (without) PS-XFM-110NA-2-A (with)
Power supply and cable assembly, 240 V AC (Australian plug), 12 V DC, without or with the analogue output and relay connections	PS-XFM-240AU-2 (without) PS-XFM-240AU-2-A (with)
Power supply and cable assembly, 240 V AC (UK plug), 12 V DC, without or with the analogue output and relay connections	PS-XFM-240UK-2 (without) PS-XFM-240UK-2-A (with)
Shielded cable, 15-pin D-sub female connector, 6 ft, stripped ends, for your own power supply; gives access to all signals	CBL-DGS
USB to RS-232 adapter	35782
USB to RS-232 adapter, 8 ports	USB-RS232
Universal baseplate: bench-top stand for flow meters, controllers and rotameters	35780
Transport case with foam (Peli 1200)	1200-000-110E

CHAPTER 12

Service, warranty and contacts

Contact

Analyt-MTC is your contact for everything after delivery: technical questions, calibration, repairs and warranty.

ANALYT-MTC Messtechnik GmbH

German Headquarters

Klosterrunsstraße 18, 79379 Müllheim
Germany

+49 7631 5545

info@analyt-mtc.de

French Subsidiary

175 Avenue d'Alsace, 68000 Colmar
France

+33 3 89 41 47 78

info@analyt-mtc.fr

www.analyt-mtc.com

Before you contact Analyt-MTC

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

- the model number and serial number from the labels on the meter;
- the gas and the flow range on the front label;
- a description of the fault and of what you have already checked (Troubleshooting (p. 30)).

Returning a meter

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

   WARNING

   A meter that has carried hazardous media can hold residues. Residues endanger the people who unpack and service it. Never ship such a meter without purging and neutralizing it.

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

When the meter arrives, it is registered and assessed, and you receive a quote before any work begins: no work is done without your agreement. If you decline the quote, a bench fee and return transport are charged. Every instrument passes a final check before it is returned with its documentation. A

standard service typically takes one to two weeks from arrival to dispatch; this lead time is indicative. Express service can be requested in the service request.

Warranty

For the warranty terms that apply to your meter, contact Analyt-MTC.

Disposal

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

APPENDIX A

Gas conversion factors

K factors relative to nitrogen. For a meter calibrated with nitrogen, multiply the reading by the K factor of the gas you are using, or let the meter do it by activating the factor (K factors (p. 17), Converting between gases (p. 27)).

NOTICE

K factors are approximations at best, accurate to no better than about ±5 to 10 %. Do not rely on them where you need a better accuracy.

Factors stored in the meter

Select one of these with its index: command `K`, `I`, `index` (Command reference (p. 21)).

Index	Gas	K
0	Acetylene C_2H_2	0.5829
1	Air	1.000
2	Allene (propadiene) C_3H_4	0.4346
3	Ammonia NH_3	0.7310
4	Argon Ar	1.4573
5	Arsine AsH_3	0.6735
6	Boron trichloride BCl_3	0.4089
7	Boron trifluoride BF_3	0.5082
8	Bromine Br_2	0.8083
9	Boron tribromide BBr_3	0.38
10	Bromine pentafluoride BrF_5	0.26
11	Bromine trifluoride BrF_3	0.3855
12	Bromotrifluoromethane $CBrF_3$	0.3697
13	1,3-Butadiene C_4H_6	0.3224
14	Butane C_4H_{10}	0.2631
15	1-Butene C_4H_8	0.2994
16	cis-2-Butene C_4H_8	0.324
17	trans-2-Butene C_4H_8	0.291

Index	Gas	K
18	Carbon dioxide CO_2	0.7382
19	Carbon disulfide CS_2	0.6026
20	Carbon monoxide CO	1.00
21	Carbon tetrachloride CCl_4	0.31
22	Carbon tetrafluoride (Freon-14) CF_4	0.42
23	Carbonyl fluoride COF_2	0.5428
24	Carbonyl sulfide COS	0.6606
25	Chlorine Cl_2	0.86
26	Chlorine trifluoride ClF_3	0.4016
27	Chlorodifluoromethane (Freon-22) $CHClF_2$	0.4589
28	Chloroform $CHCl_3$	0.3912
29	Chloropentafluoroethane (Freon-115) C_2ClF_5	0.2418
30	Chlorotrifluoromethane (Freon-13) $CClF_3$	0.3834
31	Cyanogen C_2N_2	0.61
32	Helium He	1.454
33	Hydrogen H_2	1.0106
34	Hydrogen, above 100 sL/min H_2	1.92
35	Oxygen O_2	0.9926

Gas factor table

The full table, with the specific heat c_p and the density d from which the factors are derived. For argon, carbon dioxide, helium, hydrogen and methane the factor depends on the full-scale flow of the meter. Two gases are printed with slightly different values in the two lists, because the meter stores a rounded factor: hydrogen above 100 sL/min is 1.92 in the internal list and 1.9 in this table, and carbon tetrafluoride is 0.42 and 0.4210. A gas that is not in the internal list can be applied as a user-defined factor (command `K`, `U`, `value`).

Gas	K	c_p cal/g	d g/L
A			
Acetylene C_2H_2	**0.5829**	0.4036	1.162
Air	**1.0000**	0.240	1.293
Allene (propadiene) C_3H_4	**0.4346**	0.352	1.787
Ammonia NH_3	**0.7310**	0.492	0.760
Argon, up to 10 sL/min Ar	**1.4573**	0.1244	1.782
Argon, above 10 sL/min Ar	**1.205**	0.1244	1.782
Arsine AsH_3	**0.6735**	0.1167	3.478
B			
Boron tribromide BBr_3	**0.38**	0.0647	11.18
Boron trichloride BCl_3	**0.4089**	0.1279	5.227
Boron trifluoride BF_3	**0.5082**	0.1778	3.025
Bromine Br_2	**0.8083**	0.0539	7.130
Bromine pentafluoride BrF_5	**0.26**	0.1369	7.803
Bromine trifluoride BrF_3	**0.3855**	0.1161	6.108
Bromotrifluoromethane (Freon-13B1) $CBrF_3$	**0.3697**	0.1113	6.644
1,3-Butadiene C_4H_6	**0.3224**	0.3514	2.413
Butane C_4H_{10}	**0.2631**	0.4007	2.593
1-Butene C_4H_8	**0.2994**	0.3648	2.503
cis-2-Butene C_4H_8	**0.324**	0.336	2.503
trans-2-Butene C_4H_8	**0.291**	0.374	2.503
C			
Carbon dioxide, up to 10 sL/min CO_2	**0.7382**	0.2016	1.964
Carbon dioxide, above 10 sL/min CO_2	**0.658**	0.2016	1.964
Carbon disulfide CS_2	**0.6026**	0.1428	3.397
Carbon monoxide CO	**1.00**	0.2488	1.250
Carbon tetrachloride CCl_4	**0.31**	0.1655	6.860
Carbon tetrafluoride (Freon-14) CF_4	**0.4210**	0.1654	3.926
Carbonyl fluoride COF_2	**0.5428**	0.1710	2.945
Carbonyl sulfide COS	**0.6606**	0.1651	2.680
Chlorine Cl_2	**0.86**	0.114	3.163
Chlorine trifluoride ClF_3	**0.4016**	0.1650	4.125
Chlorodifluoromethane (Freon-22) $CHClF_2$	**0.4589**	0.1544	3.858
Chloroform $CHCl_3$	**0.3912**	0.1309	5.326
Chloropentafluoroethane (Freon-115) C_2ClF_5	**0.2418**	0.164	6.892
Chlorotrifluoromethane (Freon-13) $CClF_3$	**0.3834**	0.153	4.660
Cyanogen C_2N_2	**0.61**	0.2613	2.322
Cyanogen chloride ClCN	**0.6130**	0.1739	2.742
Cyclopropane C_3H_6	**0.4584**	0.3177	1.877
D			
Deuterium D_2	**1.00**	1.722	1.799
Diborane B_2H_6	**0.4357**	0.508	1.235
Dibromodifluoromethane CBr_2F_2	**0.1947**	0.15	9.362
Dichlorodifluoromethane (Freon-12) CCl_2F_2	**0.3538**	0.1432	5.395
Dichlorofluoromethane (Freon-21) $CHCl_2F$	**0.4252**	0.140	4.592
Dichloromethylsilane $(CH_3)_2SiCl_2$	**0.2522**	0.1882	5.758
Dichlorosilane SiH_2Cl_2	**0.4044**	0.150	4.506
Dichlorotetrafluoroethane (Freon-114) $C_2Cl_2F_4$	**0.2235**	0.1604	7.626
1,1-Difluoroethylene (Freon-1132A) $C_2H_2F_2$	**0.4271**	0.224	2.857
Dimethyl ether $(CH_3)_2O$	**0.3896**	0.3414	2.055
Dimethylamine $(CH_3)_2NH$	**0.3714**	0.366	2.011
2,2-Dimethylpropane C_5H_{12}	**0.2170**	0.3914	3.219
E			
Ethane C_2H_6	**0.50**	0.420	1.342
Ethanol C_2H_6O	**0.3918**	0.3395	2.055
Ethyl acetylene C_4H_6	**0.3225**	0.3513	2.413
Ethyl chloride C_2H_5Cl	**0.3891**	0.244	2.879
Ethylene C_2H_4	**0.60**	0.365	1.251
Ethylene oxide C_2H_4O	**0.5191**	0.268	1.965
F			
Fluorine F_2	**0.9784**	0.1873	1.695
Fluoroform (Freon-23) CHF_3	**0.4967**	0.176	3.127
Freon refrigerants are listed under their chemical names, with the Freon number in brackets: Freon-14, for example, under Carbon tetrafluoride.			
G			
Germane GeH_4	**0.5696**	0.1404	3.418
Germanium tetrachloride $GeCl_4$	**0.2668**	0.1071	9.565
H			
Helium, up to 10 sL/min He	**1.454**	1.241	0.1786
Helium, above 10–50 sL/min He	**2.05**	1.241	0.1786
Helium, above 50 sL/min He	**2.43**	1.241	0.1786
Hexafluoroethane (Freon-116) C_2F_6	**0.2421**	0.1834	6.157
Hexane C_6H_{14}	**0.1792**	0.3968	3.845
Hydrogen bromide HBr	**1.000**	0.0861	3.610
Hydrogen chloride HCl	**1.000**	0.1912	1.627
Hydrogen cyanide HCN	**0.764**	0.3171	1.206

Gas	K	c_p cal/g	d g/L
Hydrogen fluoride HF	**0.9998**	0.3479	0.893
Hydrogen iodide HI	**0.9987**	0.0545	5.707
Hydrogen selenide H_2Se	**0.7893**	0.1025	3.613
Hydrogen sulfide H_2S	**0.80**	0.2397	1.520
Hydrogen, up to 10 sL/min H_2	**1.0106**	3.419	0.0899
Hydrogen, above 10–100 sL/min H_2	**1.35**	3.419	0.0899
Hydrogen, above 100 sL/min H_2	**1.9**	3.419	0.0899
I			
Iodine pentafluoride IF_5	**0.2492**	0.1108	9.90
Isobutane $CH(CH_3)_3$	**0.27**	0.3872	3.593
Isobutylene C_4H_8	**0.2951**	0.3701	2.503
K			
Krypton Kr	**1.453**	0.0593	3.739
M			
Methane, up to 10 sL/min CH_4	**0.7175**	0.5328	0.715
Methane, above 10 sL/min CH_4	**0.75**	0.5328	0.715
Methanol CH_3OH	**0.5843**	0.3274	1.429
Methyl acetylene C_3H_4	**0.4313**	0.3547	1.787
Methyl bromide CH_3Br	**0.5835**	0.1106	4.236
Methyl chloride CH_3Cl	**0.6299**	0.1926	2.253
Methyl fluoride CH_3F	**0.68**	0.3221	1.518
Methyl mercaptan CH_3SH	**0.5180**	0.2459	2.146
Methyltrichlorosilane $(CH_3)SiCl_3$	**0.2499**	0.164	6.669
Molybdenum hexafluoride MoF_6	**0.2126**	0.1373	9.366
Monoethylamine $C_2H_5NH_2$	**0.3512**	0.387	2.011
Monomethylamine CH_3NH_2	**0.51**	0.4343	1.386
N			
Neon Ne	**1.46**	0.246	0.900
Nitric oxide NO	**0.990**	0.2328	1.339
Nitrogen N_2	**1.000**	0.2485	1.25
Nitrogen dioxide NO_2	**0.737**	0.1933	2.052
Nitrogen trifluoride NF_3	**0.4802**	0.1797	3.168
Nitrosyl chloride NOCl	**0.6134**	0.1632	2.920
Nitrous oxide N_2O	**0.7128**	0.2088	1.964
O			
Octafluorocyclobutane (Freon-C318) C_4F_8	**0.176**	0.185	8.397
Oxygen O_2	**0.9926**	0.2193	1.427
Oxygen difluoride OF_2	**0.6337**	0.1917	2.406
Ozone O_3	**0.446**	0.195	2.144
P			
Pentaborane B_5H_9	**0.2554**	0.38	2.816
Pentane C_5H_{12}	**0.2134**	0.398	3.219
Perchloryl fluoride ClO_3F	**0.3950**	0.1514	4.571
Perfluoropropane C_3F_8	**0.174**	0.197	8.388
Phosgene $COCl_2$	**0.4438**	0.1394	4.418
Phosphine PH_3	**0.759**	0.2374	1.517
Phosphorus oxychloride $POCl_3$	**0.36**	0.1324	6.843
Phosphorus pentafluoride PF_5	**0.3021**	0.1610	5.620
Phosphorus trichloride PCl_3	**0.30**	0.1250	6.127
Propane C_3H_8	**0.35**	0.399	1.967
Propylene C_3H_6	**0.40**	0.366	1.877
S			
Silane SiH_4	**0.5982**	0.3189	1.433
Silicon tetrachloride $SiCl_4$	**0.284**	0.1270	7.580
Silicon tetrafluoride SiF_4	**0.3482**	0.1691	4.643
Sulfur dioxide SO_2	**0.69**	0.1488	2.858
Sulfur hexafluoride SF_6	**0.2635**	0.1592	6.516
Sulfuryl fluoride SO_2F_2	**0.3883**	0.1543	4.562
T			
Tetrafluoroethane (R-134a) CF_3CH_2F	**0.5096**	0.127	4.224
Tetrafluorohydrazine N_2F_4	**0.3237**	0.182	4.64
Titanium tetrachloride $TiCl_4$	**0.2691**	0.120	8.465
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113) CCl_2FCClF_2	**0.2031**	0.161	8.36
Trichloroethylene C_2HCl_3	**0.32**	0.163	5.95
Trichlorofluoromethane (Freon-11) CCl_3F	**0.3287**	0.1357	6.129
Trichlorosilane $SiHCl_3$	**0.3278**	0.1380	6.043
Triisobutylaluminium $(C_4H_9)_3Al$	**0.0608**	0.508	8.848
Trimethylamine $(CH_3)_3N$	**0.2792**	0.3710	2.639
Tungsten hexafluoride WF_6	**0.2541**	0.0810	13.28
V			
Vinyl bromide CH_2CHBr	**0.4616**	0.1241	4.772
Vinyl chloride CH_2CHCl	**0.48**	0.12054	2.788
X			
Xenon Xe	**1.44**	0.0378	5.858

APPENDIX B

Memory variables

The settings and calibration data of the XFM are stored in its non-volatile memory (EEPROM). Each variable has an index; read it with `MR` and write it with `MW` (Command reference (p. 21)). Variables marked protected cannot be written.

NOTICE

A wrong value can make the meter malfunction or invalidate its calibration. Change only what you need, note the original value first, and never change the variables marked “do not alter”.

Gas-independent variables

Index	Name	Type	Content
0	`BlankEEPROM`	char[10]	Table revision; protected, do not modify
1	`SerialNumber`	char[20]	Serial number; protected
2	`ModelNumber`	char[20]	Model number; protected
3	`SoftwareVer`	char[10]	Firmware version; protected
4	`TimeSinceCalHr`	float	Time since the last calibration, hours
5	`Options1`	uint	Miscellaneous options
6	`BackLight`	int	Backlight level, 0–4095
7	`AddressRS485`	char[4]	Two-character RS-485 address
8	`GasNumber`	int	Active gas table, 0–9
9	`FlowUnits`	int	Active engineering unit, 0–22 (Table 5-2 (p. 16))
10	`AlarmMode`	char	Alarm mode: `E` enabled, `D` disabled
11	`LowAlarmPFS`	float	Low alarm limit, % of full scale; 0 = disabled
12	`HiAlarmPFS`	float	High alarm limit, % of full scale; 0 = disabled
13	`AlmDelay`	uint	Alarm action delay, 0–3600 s; 0 = disabled
14	`RelaySetting`	char[4]	Relay assignment (N, T, H, L, R, M)
15	`TotalMode`	char	Totaliser mode: `E` enabled, `D` disabled
16	`Total`	float	Totalized volume in %·s, saved every 6 minutes
17	`TotalFlowStart`	float	Totaliser start flow, % of full scale; 0 = disabled
18	`TotalVolStop`	float	Totaliser action limit in %·s; 0 = disabled
19	`KfactorMode`	char	K factor: `D` disabled, `I` internal, `U` user-defined
20	`KfactorIndex`	int	Internal K factor index, 0–35
21	`UserDefKfactor`	float	User-defined K factor
22	`UDUnitKfactor`	float	Conversion factor of the user-defined unit
23	`UDUnitTimeBase`	int	Time base of the user-defined unit: 1, 60 or 3600 s
24	`UDUnitDensity`	char	User-defined unit uses density: `Y` / `N`
25	`AoutScaleV`	float	0–5 V DC output scale
26	`AoutOffsetV`	float	0–5 V DC output offset
27	`AoutScale_mA`	float	4–20 mA output scale
28	`AoutOffset_mA`	float	4–20 mA output offset

Index	Name	Type	Content
29	SensorZero	uint	Sensor zero value, 0–1023
30–35	Klag[0] … Klag[5]	float	Dynamic response compensation lag constants; do not alter
36–41	Kgain[0] … Kgain[5]	float	Gains for the lag constants; do not alter
42	Zero_T	float	Resistance at the last auto zero, 0–4095 counts
43	Tcor_K	float	Resistance correction coefficient, % of full scale per count
44	AlarmLatch	uint	Alarm latch mode, 0–3
45	TotalWarmDisable	char	Totaliser warm-up delay: D / E
46	Reserved1	uint	Reserved
47	LCD_Diagnostic	char	Display diagnostics: E / D
48	Reserved2	uint	Flow reading averaging: 0, 1, 2 (100, 250, 1000 ms); default −1
49	N2_RollBack	char	Roll-back-to-N2 mode: E / D
50	Reserved3	uint	Reserved for troubleshooting; do not change

Gas-dependent variables

Each of the ten gas tables has its own set of these variables. Reading and writing them always applies to the active gas table.

Index	Name	Type	Content
100	GasIdentifer	char[20]	Gas name; “Uncalibrated” if the table has no calibration
101	FullScaleFlow	float	Full-scale flow, sL/min
102	StdTemp	float	Standard temperature
103	StdPressure	float	Standard pressure
104	StdDensity	float	Standard density of the gas
105	CalibrationGas	char[20]	Gas used for the calibration; “Uncalibrated” if none
106	CalibratedBy	char[20]	Person who performed the calibration
107	CalibratedAt	char[20]	Calibration facility
108	DateCalibrated	char[12]	Calibration date
109	DateCalibrationDue	char[12]	Date the next calibration is due
110	K_N2	float	K factor of the gas relative to nitrogen
111, 112	K_F1	float	Reserved
113	SensorTbl[0] sensor	uint	Zero point: must be 120; do not alter
114	SensorTbl[0] flow	float	Zero point: must be 0.0; do not alter
115, 116	SensorTbl[1]	uint, float	10 % point: sensor counts; actual flow as fraction of full scale (0.1)
117, 118	SensorTbl[2]	uint, float	20 % point (0.2)
119, 120	SensorTbl[3]	uint, float	30 % point (0.3)
121, 122	SensorTbl[4]	uint, float	40 % point (0.4)
123, 124	SensorTbl[5]	uint, float	50 % point (0.5)
125, 126	SensorTbl[6]	uint, float	60 % point (0.6)
127, 128	SensorTbl[7]	uint, float	70 % point (0.7)
129, 130	SensorTbl[8]	uint, float	80 % point (0.8)
131, 132	SensorTbl[9]	uint, float	90 % point (0.9)
133	SensorTbl[10] sensor	uint	100 % point: sensor counts
134	SensorTbl[10] flow	float	100 % point: should be 1.0; do not alter

APPENDIX C

Dimensions

The letters in the drawings refer to the tables below them. Dimensions are the same with and without the display. Designs and dimensions can change; for certified drawings of your configuration, ask Analyt-MTC.

XFM 07, 17, 37 and 47

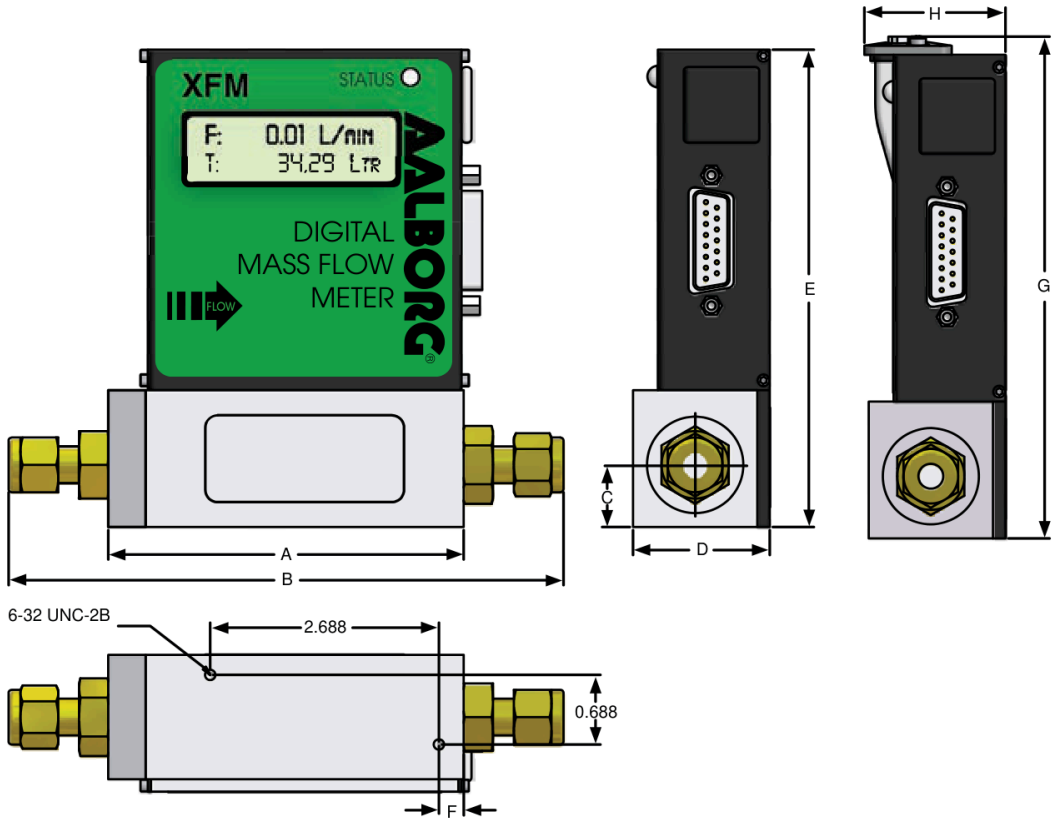


Figure C-1. XFM 07, 17, 37 and 47: front, side and bottom views. The side view on the right shows the Profibus version (dimensions G, the overall height, and H, the width). The base has two 6-32 UNC-2B mounting holes, 2.688 in apart along the flow axis and 0.688 in across it.

Table C-1 Dimensions in mm

Model	Connection	A	B	C	D	E	F	G	H
XFM 07, XFM 17	1/4 in	78.6	129.7	12.7	28.6	126.6	4.0	132.6	35.9
XFM 37	1/4 in	104.8	156.0	15.9	31.8	136.1	9.2	142.4	36.8
XFM 47	3/8 in	104.8	158.8	15.9	31.8	136.1	9.2	142.4	36.8

Table C-2 Dimensions in inches

Model	Connection	A	B	C	D	E	F	G	H
XFM 07, XFM 17	1/4 in	3.09	5.11	0.50	1.13	4.99	0.16	5.22	1.41
XFM 37	1/4 in	4.13	6.14	0.63	1.25	5.36	0.36	5.60	1.45
XFM 47	3/8 in	4.13	6.25	0.63	1.25	5.36	0.36	5.60	1.45

XFM 57, 67 and 77

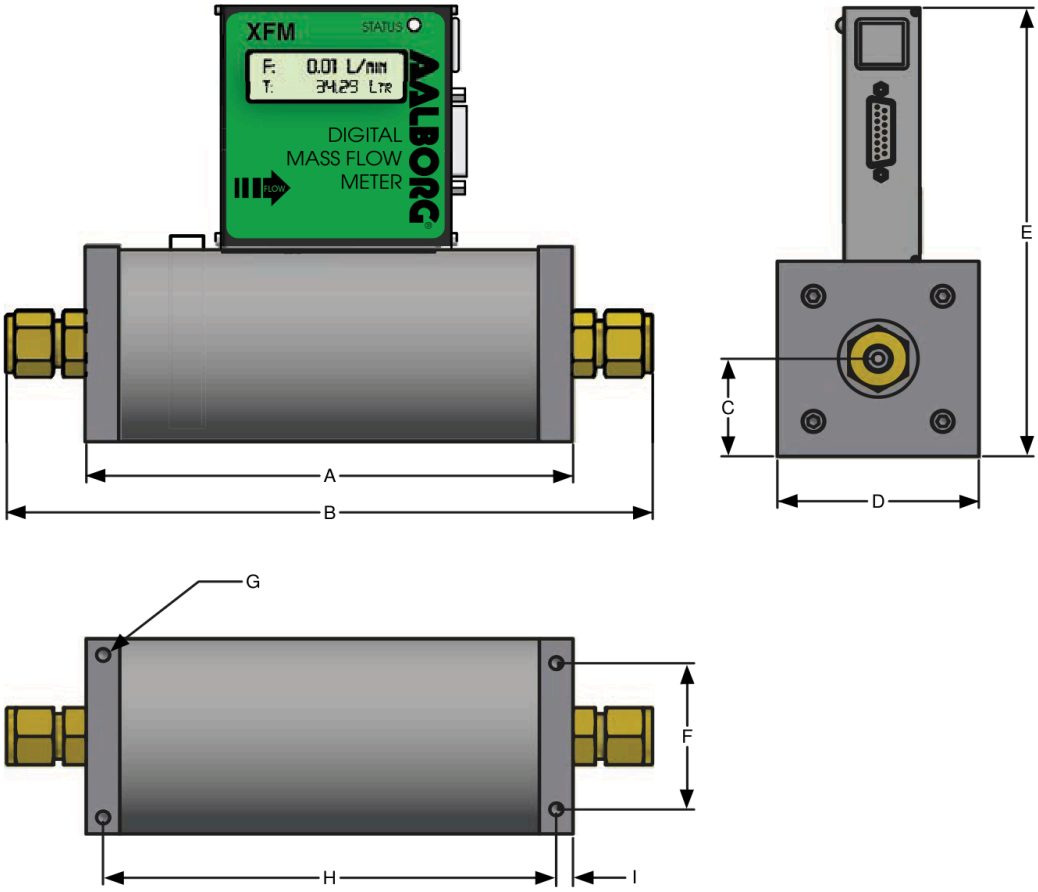


Figure C-2. XFM 57, 67 and 77: front, end and bottom views. G marks the four threaded mounting holes in the base; F and H give their spacing, I their distance from the end of the flow body.

Table C-3 Dimensions in mm (inches)

Dimension	XFM 57	XFM 67	XFM 77
Connection	3/8 in compression	1/2 in compression	3/4 in NPT female
A, flow body length	169.8 (6.69)	184.2 (7.25)	184.2 (7.25)
B, length over fittings	223.7 (8.81)	244.3 (9.62)	— (no fittings)
C	22.2 (0.88)	38.1 (1.50)	50.8 (2.00)
D, flow body width	44.5 (1.75)	76.2 (3.00)	101.6 (4.00)
E, height	152.0 (5.99)	175.2 (6.90)	201.2 (7.92)
F	35.3 (1.39)	57.2 (2.25)	76.2 (3.00)
H	119.0 (4.69)	171.4 (6.75)	171.4 (6.75)
I	25.4 (1.00)	6.4 (0.25)	6.4 (0.25)
G, mounting thread	10-24 UNC	1/4-20 UNC	1/4-20 UNC

Component layout

Component diagrams of the circuit board, top and bottom side. They show where the jumper header J7 sits on the board (Configuration jumpers (p. 13)).

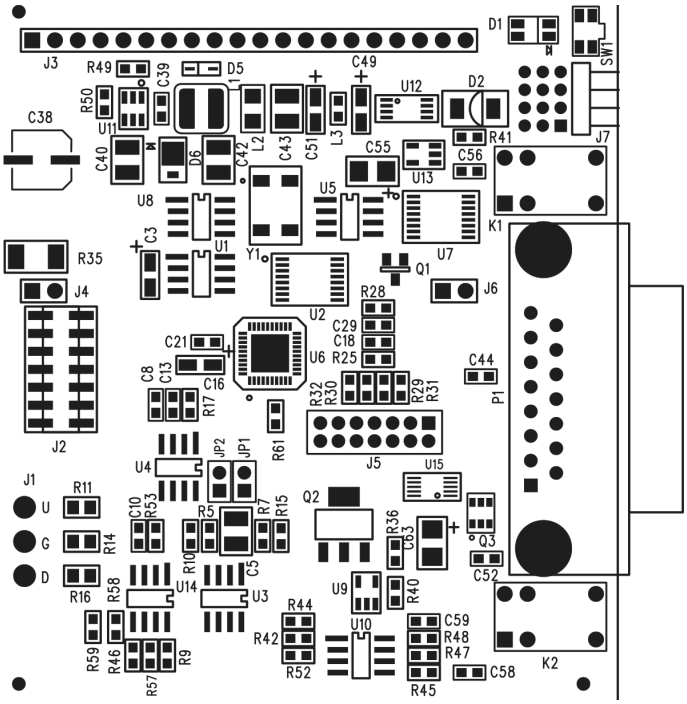


Figure C-3. Circuit board, top component side.

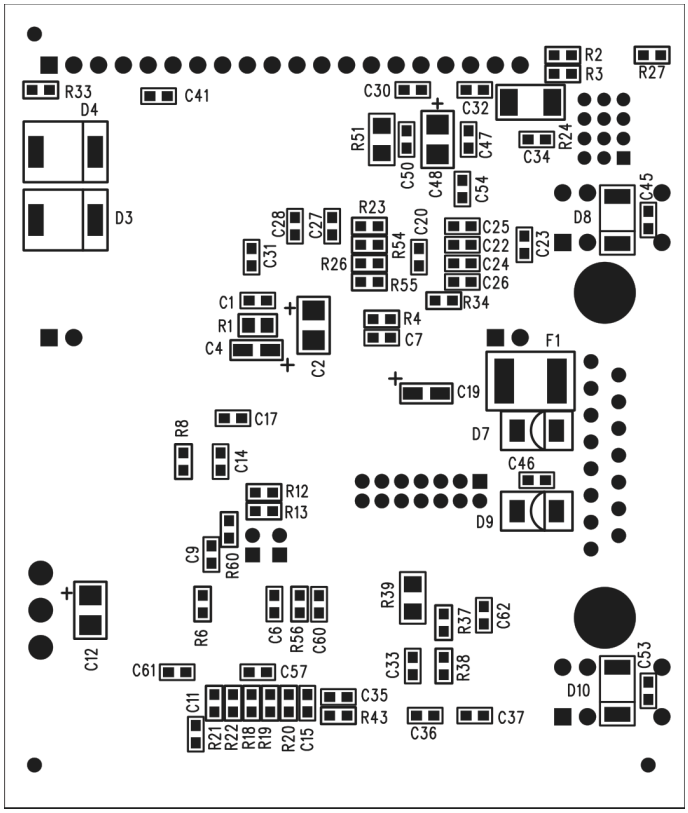


Figure C-4. Circuit board, bottom component side.

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