Operating instructions
Magnetic-inductive flow meter
SM6x04
SM7x04
SM8x04

UK
# Contents

1 Preliminary note .................................................................................................................. 3

2 Safety instructions ................................................................................................................ 4

3 Functions and features .......................................................................................................... 4

4 Function .................................................................................................................................. 5
   4.1 Processing of the measured signals .................................................................................. 5
   4.2 Direction of flow ................................................................................................................ 5
   4.3 Analogue function .............................................................................................................. 6
   4.4 Measured value damping (dAP) ......................................................................................... 7

5 Mounting ................................................................................................................................. 8
   5.1 Recommended installation position ..................................................................................... 8
   5.2 Not recommended installation position .............................................................................. 9
   5.3 Grounding .......................................................................................................................... 10
   5.4 Installation in pipes ............................................................................................................ 11

6 Electrical connection .............................................................................................................. 12

7 Operating and display elements ............................................................................................. 13

8 Menu ...................................................................................................................................... 14

9 Set-up ..................................................................................................................................... 16

10 Parameter setting .................................................................................................................. 16
   10.1 Parameter setting in general ............................................................................................ 17
      10.1.1 Change to the menu "Extended functions" ................................................................. 17
      10.1.2 Locking / Unlocking ................................................................................................ 17
      10.1.3 Timeout ..................................................................................................................... 18
   10.2 Scaling of the analogue value for temperature (OUT1) .................................................... 18
   10.3 Scaling of the analogue value for volumetric flow (OUT2) ................................................ 18
   10.4 User settings (optional) .................................................................................................. 18
      10.4.1 Determine the standard unit of measurement for volumetric flow ......................... 18
      10.4.2 Determine the standard unit of measurement for temperature ............................... 18
      10.4.3 Standard display ....................................................................................................... 18
      10.4.4 Measured value damping ......................................................................................... 18
      10.4.5 Error behaviour of the outputs ................................................................................. 19
   10.5 Service functions ............................................................................................................. 19
      10.5.1 Read min/max values ............................................................................................... 19
1 Preliminary note

- Instructions
  - Reaction, result
- [..] Designation of keys, buttons or indications
  - Cross-reference
- Important note
  - Non-compliance may result in malfunction or interference.
- Information
  - Supplementary note.

⚠️ CAUTION
Warning of personal injury.
Slight reversible injuries may result.
2 Safety instructions

• Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.

• If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur.

• Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application. That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.

• In order to guarantee the correct condition of the device for the operating time it is necessary to use the device only for media to which the wetted materials are sufficiently resistant (→ Technical data).

• The responsibility whether the measurement devices are suitable for the respective application lies with the operator. The manufacturer assumes no liability for consequences of misuse by the operator. Improper installation and use of the devices result in a loss of the warranty claims.

3 Functions and features

The unit monitors liquid media. It detects the 2 process categories volumetric flow and medium temperature.

Pressure Equipment Directive (PED)

The units comply with the Pressure Equipment Directive and are designed and manufactured for group 2 fluids in accordance with the sound engineering practice. Use of group 1 fluids on request.

Application area

Conductive liquids with the following properties:

• Conductivity: ≥ 20 µS/cm
• Viscosity: < 70 mm²/s at 40 °C; < 70 cSt at 104 °F
4 Function

- The unit detects the flow based on the magnetic-inductive volumetric flow measuring principle.
- The unit also detects the medium temperature.
- The unit displays the current process value.

4.1 Processing of the measured signals

The unit generates 2 output signals according to the parameter settings:

OUT1: Parameter setting
  - Analogue signal for temperature → 10.2

OUT2: Parameter setting
  - Analogue signal for volumetric flow quantity → 10.3

4.2 Direction of flow

In addition to the flow velocity and the volumetric flow quantity, the unit also detects the direction of flow.

An arrow with the text "flow direction" on the unit indicates the positive flow direction.

<table>
<thead>
<tr>
<th>Flow...</th>
<th>Process value display</th>
</tr>
</thead>
<tbody>
<tr>
<td>corresponds to the marked flow direction</td>
<td>+ (positive)</td>
</tr>
<tr>
<td>against the marked flow direction</td>
<td>- (negative)</td>
</tr>
</tbody>
</table>

Only positive process values are processed for the signal output.
4.3 Analogue function

- The unit provides an analogue signal that is proportional to the volumetric flow quantity and the medium temperature.

- Within the measuring range the analogue signal is 4...20 mA.

- If the measured value is outside the measuring range or in the event of an internal error, the current signals indicated in Figure 1 are provided.

- The measuring range is scalable:
  [ASP] determines at which measured value the output signal is 4 mA.
  [AEP] determines at which measured value the output signal is 20 mA.

Minimum distance between [ASP] and [AEP] = 20 % of the final value of the measuring range.

<table>
<thead>
<tr>
<th>MAW</th>
<th>Initial value of the measuring range</th>
<th>For non-scaled measuring range (= factory setting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEW</td>
<td>Final value of the measuring range</td>
<td>For scaled measuring range</td>
</tr>
<tr>
<td>ASP</td>
<td>Analogue start point</td>
<td></td>
</tr>
<tr>
<td>AEP</td>
<td>Analogue end point</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Definitions

Figure 1: Characteristics of the analogue output according to the standard IEC 60947-5-7.
Q: Flow (a negative flow value means flow against the marked flow direction)
T: Temperature
UL: Below the display range
OL: Above the display range
Err: The unit is in the error state
FOU=On: Default setting at which the analogue signal goes to the upper final value in case of an error.
FOU=OFF: Default setting at which the analogue signal goes to the lower final value in case of an error.

1. Analogue signal
2. Measured value (flow or temperature)
3. Detection zone
4. Display range
5. Measuring range

4.4 Measured value damping (dAP)
The damping time allows to set after how many seconds the output signal has reached 63% of the final value if the flow value changes suddenly. The set damping time stabilises the outputs and the display. The signals [UL] and [OL] (→ 12) are defined under consideration of the damping time.
5 Mounting

⚠️ **CAUTION**

If the medium temperature is above 50 °C (122 °F) parts of the housing can increase in temperature to over 65 °C (149 °F).

- Risk of burns.
- Protect the housing against contact with flammable substances and unintentional contact.

⚠️ Ensure that the system is free of pressure during installation.

⚠️ Ensure that no media can leak at the mounting location during installation.

💡 The unit can be installed independently of the orientation if the following is ensured:

- No air bubbles can form in the pipe system.
- The pipes are always completely filled.

### 5.1 Recommended installation position

- Install the unit so that the measuring pipe is always completely filled.
- Arrange for inlet and outlet pipe lengths. Disturbances caused by bends, valves, reductions, etc. are compensated for. It applies in particular: no shut-off and control devices are allowed directly in front of the unit.

![Diagram](image.png)

S = disturbance (e.g. shut-off / control device, pump, bends)
D = pipe diameter
F = direction of flow
Install in front of or in a rising pipe.

5.2 Not recommended installation position

Avoid the following installation positions:

Directly in front of a falling pipe.

In a falling pipe.
Directly in front of the spout of the pipe.

On the suction side of a pump.

At the highest point of the pipe system.

F = flow direction

5.3 Grounding

⚠ If installed in an ungrounded pipe system (e.g. plastic pipes), the unit must be grounded (functional earth).

Ground brackets for the M12 connector are available as accessories → www.ifm.com.
5.4 Installation in pipes
The units with a G thread can be installed in the pipes using adapters.
Information about the available mounting accessories at www.ifm.com.
A correct fit of the unit and ingress resistance of the connection are only ensured
using ifm adapters.

![Diagram of installation process]

1. Grease the threads of the process connection, adapter and sensor. Use a
   lubricating paste which is suitable and approved for the application.
2. Screw the adapter (B) into the pipe (A).
3. Place the seals (C) and install the unit according to the marked flow direction.
4. Screw the adapter (B) with the threads (D) until it is hand-tight.
5. Tighten the two adapters in opposite direction (Tightening torque: 30 Nm).

After installation air bubbles in the system can affect the measurement.
► Corrective measures: Rinse the system after installation for ventilation.

![Info icon]

In case of horizontal installation:
As a result of design requirements a small quantity of the medium always
remains in the measuring channel after switching off the pump.
6 Electrical connection

⚠️ The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply according to EN 50178, SELV, PELV.

► Disconnect power.
► Connect the unit as follows:

![Diagram of electrical connection with pin numbers and colors]

Colours to DIN EN 60947-5-2

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1</td>
<td>L+</td>
</tr>
<tr>
<td>Pin 3</td>
<td>L-</td>
</tr>
<tr>
<td>Pin 4 (OUT1)</td>
<td>Analogue signal for temperature</td>
</tr>
<tr>
<td>Pin 2 (OUT2)</td>
<td>Analogue signal for volumetric flow quantity</td>
</tr>
</tbody>
</table>
7 Operating and display elements

1-8: Indicator LEDs
- LEDs 1-6: Unit of the currently represented numerical value → 11.1 Reading the process value
- LED 7-8: not used

9: Alphanumeric display, 4 digits
- Current volumetric flow quantity with setting [SELd] = FLOW
- Current medium temperature with setting [SELd] = TEMP
- Parameters and parameter values

10: [Mode/Enter] button
- Change from the RUN mode to the main menu
- Select parameters
- Acknowledge the set parameter value

11: [Set] button
- Change parameter values (hold button pressed)
- Change of the display unit in the normal operating mode (RUN mode)
8 Menu

**RUN**
- l/min → m³/h → °C / °F
- gpm → gph → °C / °F

**EF**
- Hi.F
- Lo.F
- Hi.T
- Lo.T
- FOU1
- FOU2
- dAP
- diS
- uni.F
- uni.T
- SELd
- rES

[Mode / Enter]
[Set]
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Explanation and setting options</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASP1</td>
<td>Analogue start point for temperature on OUT1.</td>
</tr>
<tr>
<td>AEP1</td>
<td>Analogue end point for temperature on OUT1.</td>
</tr>
<tr>
<td>ASP2</td>
<td>Analogue start point for volumetric flow on OUT2.</td>
</tr>
<tr>
<td>AEP2</td>
<td>Analogue end point for volumetric flow on OUT2.</td>
</tr>
<tr>
<td>EF</td>
<td>Extended functions: opening of the lower menu level.</td>
</tr>
<tr>
<td>Hi.F</td>
<td>Maximum value memory for volumetric flow.</td>
</tr>
<tr>
<td>Hi.T</td>
<td>Maximum value memory for temperature.</td>
</tr>
<tr>
<td>Lo.F</td>
<td>Minimum value memory for volumetric flow.</td>
</tr>
<tr>
<td>Lo.T</td>
<td>Minimum value memory for temperature.</td>
</tr>
<tr>
<td>FOU1</td>
<td>Behaviour of OUT1 in case of an internal fault: OU, On, OFF (→ 10.4.5).</td>
</tr>
<tr>
<td>FOU2</td>
<td>Behaviour of OUT2 in case of an internal fault: OU, On, OFF (→ 10.4.5).</td>
</tr>
<tr>
<td>dAP</td>
<td>Measured value damping: damping constant in seconds.</td>
</tr>
<tr>
<td>diS</td>
<td>Update rate and orientation of the display: d1...d3, rd1...rd3, OFF (→ 10.4.3).</td>
</tr>
<tr>
<td>uni.F</td>
<td>Standard unit of measurement for volumetric flow</td>
</tr>
<tr>
<td>uni.T</td>
<td>Standard unit of measurement for temperature</td>
</tr>
<tr>
<td>SELd</td>
<td>Standard measured variable of the display: FLOW (volumetric flow value), TEMP (medium temperature).</td>
</tr>
<tr>
<td>rES</td>
<td>Restoring the factory settings.</td>
</tr>
</tbody>
</table>
9 Set-up
After power on and expiry of the power-on delay time of approx. 5 s the unit is in the RUN mode (= normal operating mode). It carries out its measurement and evaluation functions and generates output signals according to the set parameters.
During the power-on delay time the output signal is at 20 mA.

10 Parameter setting
Parameters can be set before installation or during operation.

⚠️ If you change parameters during operation, this will influence the function.
   ► Ensure that there will be no malfunctions in your plant.

During parameter setting the unit remains in the operating mode. It continues to monitor with the existing parameter until the parameter setting has been completed.

⚠️ CAUTION
If the medium temperature is above 50 °C (122 °F) parts of the housing can increase in temperature to over 65 °C (149 °F).
> Risk of burns.
   ► Do not touch the device with your hands.
   ► Use another object (e.g. a ballpoint pen) to carry out settings on the unit.
## 10.1 Parameter setting in general

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Change from the RUN mode to the main menu and selection of the requested parameter</td>
<td>[Mode/Enter]</td>
</tr>
<tr>
<td>2.</td>
<td>Acknowledge the set parameter value</td>
<td>[Set]</td>
</tr>
<tr>
<td>3.</td>
<td>Change the setting mode</td>
<td>[Set] &gt; 5 s</td>
</tr>
<tr>
<td>4.</td>
<td>Modification of the parameter value - incrementally by pressing once - continuously by keeping the button pressed</td>
<td>[Set]</td>
</tr>
<tr>
<td></td>
<td>To reduce the value: let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Acknowledge the set parameter value</td>
<td>[Mode/Enter]</td>
</tr>
<tr>
<td>6.</td>
<td>Return to the RUN mode</td>
<td>&gt; 30 seconds (timeout) or [Mode/Enter] until the RUN mode is reached.</td>
</tr>
</tbody>
</table>

### 10.1.1 Change to the menu "Extended functions"

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Change from the RUN mode to the main menu and selection of the parameter EF</td>
<td>[Mode/Enter]</td>
</tr>
<tr>
<td>2.</td>
<td>Change to sub-menu EF</td>
<td>[Set]</td>
</tr>
</tbody>
</table>

### 10.1.2 Locking / Unlocking

The unit can be locked electronically to prevent unintentional settings. On delivery: not locked.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Locking** | - Make sure that the unit is in the normal operating mode.  
- Press [Mode/Enter] and [Set] simultaneously for 10 s until [Loc] is displayed. |
| **Unlocking** | - Make sure that the unit is in the normal operating mode.  
- Press [Mode/Enter] and [Set] simultaneously for 10 s until [uLoc] is displayed. |
10.1.3 Timeout
If no button is pressed for 30 s during parameter setting, the unit returns to the operating mode with unchanged values.

10.2 Scaling of the analogue value for temperature (OUT1)
- Select [ASP1] and set the value at which 4 mA is provided.
- Select [AEP1] and set the value at which 20 mA is provided.

10.3 Scaling of the analogue value for volumetric flow (OUT2)
- Select [ASP2] and set the value at which 4 mA is provided.
- Select [AEP2] and set the value at which 20 mA is provided.

10.4 User settings (optional)

10.4.1 Determine the standard unit of measurement for volumetric flow
- Select [uni.F] and set the unit of measurement: L/min, m³/h, GPM or GPH.

10.4.2 Determine the standard unit of measurement for temperature
- Select [uni.T] and set the unit of measurement: °C or °F.

10.4.3 Standard display
- Select [SELd] and define the standard unit of measurement:
  FLOW = display shows the current volumetric flow value in the standard unit of measurement.
  TEMP = display shows the current medium temperature in the standard unit of measurement.
- Select [diS] and set the update rate and orientation of the display:
  d1 = update of the measured values every 50 ms.
  d2 = update of the measured values every 200 ms.
  d3 = update of the measured values every 600 ms.
  rd1, rd2, rd3 = display like d1, d2, d3; rotated by 180.
  OFF = the display is switched off in the operating mode. The LEDs remain active even if the display is deactivated. Error messages are displayed even if the display is deactivated.

10.4.4 Measured value damping
- Select [dAP] and set the damping constant in seconds (τ value 63%).
10.4.5 Error behaviour of the outputs

► Select [FOUx] and set the value:
- **On** = The analogue signal goes to the upper fault value (→ 4.3).
- **OFF** = The analogue value goes to the lower fault value (→ 4.3).
- **OU** = The analogue signal corresponds to the measured value.

10.5 Service functions

10.5.1 Read min/max values

Read minimum or maximum measured values:
► Select Hi.x or Lo.x.
  - Hi.F = maximum volumetric flow, Lo.F = minimum volumetric flow
  - Hi.T = maximum temperature, Lo.T = minimum temperature

Delete memory:
► Select Hi.x or Lo.x.
► Press and hold [Set] until [----] is displayed.
► Briefly press [Mode/Enter].

It makes sense to delete the memories as soon as the unit operates under normal operating conditions for the first time.

10.5.2 Restoring the factory settings

► Select [rES].
► Press and hold [Set] until [----] is displayed.
► Briefly press [Mode/Enter].

→ 14 Factory setting. We recommend taking down your own settings in that table before carrying out a reset.

11 Operation

11.1 Reading the process value

The LEDs 1-6 signal which process value is currently displayed.
The process value to be displayed as standard (volumetric flow quantity or temperature) can be preset → 10.4.3 Standard display.
Moreover, a standard unit of measurement can be defined (volumetric flow → 10.4.1 and temperature → 10.4.2).
11.2 Changing the process value display in the RUN mode

► Briefly press [Set] in the RUN mode. Press the pushbutton to move to the next display unit.

> The unit displays the current measured value in the selected display unit for approx. 30 s, the corresponding indicator LED lights (→ 7).

11.3 Reading the set parameters

► Briefly press [Mode/Enter] to scroll through the parameters.

► Briefly press [Set] when the requested parameter is displayed.

> The unit displays the corresponding parameter value. After about 15 s it returns to the RUN mode.
12 Troubleshooting

The unit has self-diagnostic options. It monitors itself automatically during operation.

Warnings and error states are displayed, even when the display is switched off.

<table>
<thead>
<tr>
<th>Display</th>
<th>Type</th>
<th>Description</th>
<th>Fault correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Err</td>
<td>Error</td>
<td>Unit faulty / malfunction</td>
<td>► Replace the unit.</td>
</tr>
<tr>
<td>Err</td>
<td>Error</td>
<td>• Flow value &lt; -130 % MEW or &gt; 130 % MEW.</td>
<td>► Check flow range / temperature range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Temperature value &lt; -50 °C (-58 °F) or &gt; 110 °C (230 °F).</td>
<td></td>
</tr>
<tr>
<td>No display</td>
<td>Error</td>
<td>• Supply voltage too low.</td>
<td>► Check the supply voltage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Setting [diS] = OFF</td>
<td>► Change the setting [diS] → 10.4.3</td>
</tr>
<tr>
<td>Loc</td>
<td>Warning</td>
<td>Setting pushbuttons on the unit locked, parameter change rejected.</td>
<td>► Unlock the unit → 10.1.2</td>
</tr>
<tr>
<td>UL</td>
<td>Warning</td>
<td>Below the display range.</td>
<td>► Check flow range / temperature range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Current value between -130 % ... -120 % MEW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Temperature value between -50...-40 °C (-58...-40 °F).</td>
<td></td>
</tr>
<tr>
<td>OL</td>
<td>Warning</td>
<td>Display range exceeded.</td>
<td>► Check flow range / temperature range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Current value between 120 % ... 130 % MEW</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Temperature value between 100...110 °C (212...230 °F).</td>
<td></td>
</tr>
</tbody>
</table>

MEW = final value of the measuring range

13 Technical data

## 14 Factory setting

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory setting</th>
<th>User setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASP1 (TEMP)</td>
<td>-20 °C</td>
<td></td>
</tr>
<tr>
<td>AEP1 (TEMP)</td>
<td>80 °C</td>
<td></td>
</tr>
<tr>
<td>ASP2 (FLOW)</td>
<td>MAW</td>
<td></td>
</tr>
<tr>
<td>AEP2 (FLOW)</td>
<td>MEW</td>
<td></td>
</tr>
<tr>
<td>FOU1</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>FOU2</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>dAP</td>
<td>3 s</td>
<td></td>
</tr>
<tr>
<td>diS</td>
<td>d2</td>
<td></td>
</tr>
<tr>
<td>uni.F</td>
<td>SMxx04: l/min, SMx404: l/min, SMx604: gpm</td>
<td></td>
</tr>
<tr>
<td>uni.T</td>
<td>SMxx04: °C, SMx404: °C, SMx604: °F</td>
<td></td>
</tr>
<tr>
<td>SELd</td>
<td>FLOW</td>
<td></td>
</tr>
</tbody>
</table>

MAW = Initial value of the measuring range  
MEW = Final value of the measuring range

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Technical data, approvals, accessories and further information at www.ifm.com.