Be sure to use this device within the flow rate range stated in the specifications. To prevent excessive flow, use a suitable means to control the supply pressure or use a throttle valve or the like to control flow rate. If damage could result from the abnormal functioning of this device, include appropriate redundancy in the system design. If there is a risk of a power surge caused by lightning, use a surge absorber (surge protector) to prevent fire or device failure. When carrying the flowmeter or connecting it to the pipe, do not hold it by the measurement module. Doing so could cause damage, or the device could drop, causing an injury. To avoid damaging this device, do not use it outside of the operating pressure range. Also, do not subject it to a pressure above its pressure resistance.

When maintaining or replacing the measurement module, release the internal pressure of this device before removing the measurement module.

### MOUNTING

**Avoid mounting this device in places characterized by any of the following.**
- Temperature below -10 °C or above +60 °C
- Humidity exceeding 90 % RH
- Sudden changes in temperature, or condensation
- Corrosive or flammable gases
- Heavy concentration of conductive substances (e.g., dust, salt or iron dust), water droplets, oil mist or organic solvents
- Vibration or shock
- Excess sunlight
- Splashing by fluids (e.g. oil, chemicals)
- Vibration or shock
- Splashing by fluids (e.g. oil, chemicals)
- Strong magnetic or electrical fields

### Piping

**Cautions for pipe installation**

- The MCF is a precision instrument. Do not drop it nor subject it to shock.
- Do not install so that the direction of gas flow matches the arrow on the side of the MCF
- Do not apply force to the measurement module during installation.
- When attaching the MCF to the pipe, fix the MCF in place and rotate the pipe to the recommended tightening torque.

**Measurements and Straight Pipe Length**

When the MCF is mounted a horizontal piping and the display unit faces the left from the air inlet, the instantaneous flow rate deviation is 1.5 % FS ±1 digit or less as compared with the accuracy in the normal position at 0.3 MPa.
- 0.5 % FS ±0.1 MPa = 0.3 MPa ±1.5 % FS

When the MCF is mounted a horizontal piping and the display unit faces the left from the air inlet, the instantaneous flow rate deviation is -1.5 % FS ±1 digit or less as compared with the accuracy in the normal position at 0.3 MPa.
- 0.5 % FS ±0.1 MPa = 0.3 MPa ±1.5 % FS

### SAFETY PRECAUTIONS

Safety precautions are for ensuring safe and correct use of this product, and for preventing injury to the operator and other people or damage to property. You must observe these safety precautions. Also, be sure to read and understand the contents of this user’s manual.

**Key to symbols**

Be sure to keep this manual nearby for handy reference. Please read “Terms and Conditions” from the following URL before ordering and use. http://www.azbil.com/products/factory/order.html

WARNING

Warnings are indicated when mishandling this product might result in death or serious injury to the user.

CAUTION

Cautions are indicated when mishandling this product might result in minor injury to the user, or physical damage to this product.

WARNING

Never allow gases that are within explosive limits to pass through this device. Doing so could result in an explosion.

Never use this device for oxygen gas. Doing so could result in a serious accident.

### MCF0080/0150/0151/0250/0400/0500 Air Flowmeter NPT Model User’s Manual for Installation

Thank you for purchasing this product. Before operating this product described in this User’s Manual, please take note of the following points regarding safety. Be sure to keep this manual nearby for handy reference. Please read “Terms and Conditions” from the following URL before ordering and use. http://www.azbil.com/products/factory/order.html

The MCF air flowmeter uses a µF (Micro Flow) sensor in its sensing unit. If rust, water droplets, oil mist or organic solvents get into the sensor, measurement error might be caused by the mounting direction. However, if the MCF is mounted on horizontal piping with the display unit facing downward, foreign matter (rust, water droplets, oil mist, dust) in the pipes act to accumulate in the sensor, causing measurement error or damage.

Do not install this device near the outlet of a compressor or bell pipe, or in a location where the regulator or the check valve causes hunting. Doing so could cause measurement error.

### Mounting direction

**Normal installation**

Normally the MCF is mounted on a horizontal pipe with the display unit facing upward. Though the mounting position is unrestricted, measurement error might be caused by the display direction.

**Normal position on horizontal pipe with display facing upward**

- Horizontal pipe with display facing to the right as seen from air inlet (Position 2)
- Horizontal pipe with display facing to the left as seen from air inlet (Position 3)

### Notice

For accuracy and straight pipe length

Connection with different size pipe, valve or filter

“Straight pipe section” refers to a straight pipe with the same diameter as the MCF port. The following types of pipe are suitable: Carbon Steel Pipes for Ordinary Piping (JIS G3452), ANSI schedule 40 or less, Carbon Steel Pipes for Pressure Service (JIS G3454), ANSI schedule 40 or less, Stainless Steel Pipes (JIS G3439).

If a device that is not listed in the table is installed either upstream or downstream, contact the azbil Group for the length of the straight pipe section. If reverse flow is also expected, it is necessary to have the same length of straight pipe downstream as upstream.

### E1
When connecting the MCF to a pipe 2 sizes larger than the MCF port (for example, the MCF080 to a 1/2 inch pipe), to determine the straight pipe length use the section of the table marked “Pipe one size smaller in dia. (connected with reducer).” In addition, on the upstream side add 5D to the example, the MCF0150 to a 1/4 inch pipe, to determine the straight pipe length compared with the actual rate.

Do not connect a smaller size pipe to the MCF without a straight pipe section. Doing so might cause a reverse flow in the measurement module, even though there is a regular forward flow in the main flow path. Therefore, the display might indicate a negative value or an extremely low flow rate and event output common lines are all connected inside this device. If these lines are connected to an external device through a common power supply, interference could occur causing device failure or operation error.

*7 The figures below show examples of connection with a single elbow and double elbows.

*8 This valve does not have an internal throttle. If possible, install a flow regulating valve downstream from the MCF.

*9 A reducer should be 2000 mm away from this device. The pipe from the regulator to this device may be composed of an air tube and elbow. However, if the elbow is connected to this device, use the necessary straight pipe section for the elbow.

Cautions for wiring

- Supply a power voltage within the specified range.
- Keep the MCF wiring (conduct) away from power wiring or high voltage wires.
- When connecting the connector, push the two parts together, and then tighten the nut by hand to 4 to 6 m. Improper tightening can damage the MCF, or lead to a loss of the IP65 seal, or allow the connector to come loose due to vibration.
- Do not pull the cable forcibly and do not lift the MCF by the cable (pull-out strength 40 N max., bending force 20 N max.). Do not bend the cable repetitively or put a constant pulling stress on it.

Note

- Wire color and pin number for MCF connector cable

- Wiring example

- Flow rate display:
  This 7-segment LED indicates instantaneous flow rate or integrated flow amount. For the integrated flow, the first 4 digits and last 5 digits are displayed separately. The 7-segment display also indicates settings in mode and alarm codes when an alarm occurs.
  
  **LED lamps**
  - **CFH**: Lights up when instantaneous flow rate is indicated.
  - **CF**: Lights up when integrated flow is indicated.
  - **SYN**: Synchronized with event output.
  - **AL**: Lights up when an alarm occurs.

- **Keys**
  - (mode): Changes the display or switches to setting mode, etc.
  - ()(/): Increases or decreases the value of a setting, changes the display mode, etc.
  - (enter): Used to finalize function settings and parameter settings.

- **Main flow path**
  - Connects to pipes. Inlet and outlet are marked.
  - Measurement module:
    - Removable for maintenance. Can be changed with a new one for the MCF0200, MCF4000 and MCF5000.
    - Display unit:
      - Can be rotated in a plane parallel to the flow path.

- **WIRING**

**PART NAMES AND FUNCTIONS**

**Flow rate display**

**Flow rate display**

**State transitions**

When the power is turned on, the normal indication is indicated on the instantaneous flow rate display. Normal indication means display of the instantaneous flow rate or integrated flow and no display, depending on the setting of function setup (CON). The setting determined by the above flow rate display after the power is turned on. After setting normal indication mode, the device enters function setup mode.

**Resetting totaled flow counter**

To reset the integrated total flow, press and hold [V] key and [A] key at the same time for 5 seconds or more while the first or last part of the total flow amount is indicated on the display.

Note:
- If an alarm occurs, the alarm code and normal indication alternate every two seconds.
- For details on the peak instantaneous flow rate display, lowest instantaneous flow rate display, device information display and maintenance mode, see the following user’s manuals:
  - In the Lights Out mode, all LEDs are off except the “CF (CFH)” LED. If there is an alarm, the alarm indicator lights up.

**FUNCTION SETTINGS**

**Flow rate units**

- Unit of instantaneous flow rate and integrated flow:
  - L/min
  - m3/min
  - m3/min
  - L/min
  - m3/min
  - 10 liter
  - CFM, CF

- Unit of instantaneous flow rate upper limit and lower limit:
  - 300 L/min (CFM)
  - 100 m3/min
  - 100 m3/min
  - 15 m3/min
  - 15 m3/min
  - 25 m3/min
  - 25 m3/min

- Function setup:
  - Integrate only normal flow
  - Integrate flow from standby to present
  - No display
  - Integrate flow first five digits
  - Integrate flow first four digits
  - No display

**Alarm**

- 25.2 Vdc
  - Between the power source ground, instantaneous flow rate output common, terminating resistor and event output.

- 22.8 to 25.2 Vdc
  - Terminating resistor (with RS-485 communications) (DB)

- 2 s or more
  - Resetting totalized flow counter

**Device information**

- If the mounting direction is reversed, the peak value and the lowest value are reset.
- If the reference temperature is changed, the peak value and the lowest value are reset.
### Parameter settings

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Setting range</th>
<th>Factory setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supply voltage</td>
<td>100 to 240 V</td>
<td>230 V</td>
<td>The supply voltage range for the MCF.</td>
</tr>
<tr>
<td>2</td>
<td>Temperature</td>
<td>0 to 40 °C</td>
<td>0 to 40 °C</td>
<td>The temperature range for which the MCF is designed.</td>
</tr>
</tbody>
</table>

### An Analog output scaling

The output current is calculated as follows:

\[
\text{Output current} = \begin{cases} 
\text{Output range} = \text{Low flow rate} \times 4 \text{ mA flow rate} \\
\text{Output range} = \text{High flow rate} \times 20 \text{ mA flow rate}
\end{cases}
\]

Where:

- 4 mA flow rate: Flow rate assignment for 4 mA analog output
- 20 mA flow rate: Flow rate assignment for 20 mA analog output

- The minimum output for reverse flow is 3.2 mA and the maximum output for normal flow is 20.8 mA.

### Flow rate cost calculation

The flow rate cost calculation is related to the setting range for flow rate units in function setup 1.

### Measurement error

- If the MCF is mounted where the ambient temperature or the temperature of the measured gas fluctuates widely, the MCF might detect convection inside the pipe as a flow. Try measuring after the temperature stabilizes.
- If the MCF is mounted on a horizontal pipe and the display unit faces the side, zero point drift may be caused by the weight of the display unit. Set the low flow setup to 0.5% FS.

### Alarm codes and remedies

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Item</th>
<th>Contents</th>
<th>Causes</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Flow range exceeded</td>
<td>Flow exceeds the upper limit for indication.</td>
<td>Flow rate exceeds the reverse flow range.</td>
<td>Check for excessive flow. If a relief valve is shown on the flow rate display when the alarm occurs, there might be a reverse flow. Correct the cause of the reverse flow.</td>
</tr>
<tr>
<td>01</td>
<td>Registered data error 1</td>
<td>The registered data path identifiers are incorrect.</td>
<td>The flow rate range is not calculated correctly.</td>
<td>Set the correct flow rate path identifiers in the operation mode if the MCF does not return to normal after the settings are changed, reboot it. If the MCF does not return to normal after being restarted, call for repair.</td>
</tr>
<tr>
<td>02</td>
<td>Registered data error 2</td>
<td>The registered properties of the flow sensor are incorrect.</td>
<td>The registered properties might be corrupted.</td>
<td>If the MCF does not return to normal after reloading, call for repair.</td>
</tr>
<tr>
<td>03</td>
<td>Error 1</td>
<td>The signal flow is outside the normal range.</td>
<td>The flow signal can decrease severely if foreign matter causes a short circuit.</td>
<td>If the cause of the alarm is excessive reverse flow, the MCF will return to normal automatically when the flow rate falls within the measurable range. If the alarm does not turn off in spite of a normal reverse flow, ask for repair.</td>
</tr>
<tr>
<td>04</td>
<td>Error 2</td>
<td>The flow signal may differ from the normal range.</td>
<td>The signal may be corrupted or the sensor may be damaged.</td>
<td>If the MCF does not return to normal after a few hours of dry air flow, call for repair.</td>
</tr>
<tr>
<td>05</td>
<td>Memory error</td>
<td>Device data error</td>
<td>Checksum error during EEPROM read/write process.</td>
<td>Data might be corrupted by electrical noise. Try data setup again. If the MCF does not return to normal after reloading, call for repair.</td>
</tr>
</tbody>
</table>

### Troubleshooting

<table>
<thead>
<tr>
<th>Phenomenon</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>The display does not indicate anything.</td>
<td>Check that the supply power and polarity are correct. Check that the connector is connected correctly.</td>
</tr>
<tr>
<td>The front and back values of the MCF, etc., the actual flow rate should be zero, but the flow rate display does not indicate zero.</td>
<td>Check for gas leaks. Check that setting is correct.</td>
</tr>
<tr>
<td>If 4 mA flow rate ≥ 20 mA flow rate, the fixed output for alarm occurrence is output.</td>
<td>Check that the cause of this alarm is excessive reverse flow.</td>
</tr>
<tr>
<td>If the difference between the flow rate ranges for 20 mA and for 4 mA is smaller than the full-scale flow rate, the resulting lower resolution may make it impossible to get the desired output.</td>
<td>If the MCF does not return to normal after reloading, call for repair.</td>
</tr>
<tr>
<td>If the flow rate units are changed, the decimal point is not shown in the display.</td>
<td>If the flow rate units are changed, the decimal point is added to the display.</td>
</tr>
<tr>
<td>The decimal point is not shown in the setting range.</td>
<td>If the flow rate units are changed, the decimal point is added to the display.</td>
</tr>
<tr>
<td>When the MCF is mounted on a horizontal pipe and the display unit faces the side, zero point drift may be caused by the weight of the display unit. Set the low flow setup to 0.5% FS.</td>
<td>If the MCF is mounted where the ambient temperature or the temperature of the measured gas fluctuates widely, the MCF might detect convection inside the pipe as a flow. Try measuring after the temperature stabilizes.</td>
</tr>
<tr>
<td>The measurement error has increased and exceeds the accuracy specifications.</td>
<td>Check for gas leaks. Check that setting is correct.</td>
</tr>
<tr>
<td>If the MCF is mounted on a horizontal pipe and the display unit faces the side, zero point drift may be caused by the weight of the display unit. Set the low flow setup to 0.5% FS.</td>
<td>After detaching the measurement module from the main path, check if foreign matter is stuck on the main path orifices. If so, lips off and replace them.</td>
</tr>
<tr>
<td>If the cause of this alarm is excessive reverse flow, the MCF will return to normal automatically when the flow rate falls within the measurable range.</td>
<td>After detaching the measurement module from the main path, check if the internal filter is stained. If so, clean it. If the flow rate display does not indicate zero, check for gas leaks. Check that setting is correct.</td>
</tr>
<tr>
<td>If the cause of this alarm is excessive reverse flow, the MCF will return to normal automatically when the flow rate falls within the measurable range.</td>
<td>After detaching the measurement module from the main path, check if the internal filter is stained. If so, clean it. If the flow rate display does not indicate zero, check for gas leaks. Check that setting is correct.</td>
</tr>
<tr>
<td>If the cause of this alarm is excessive reverse flow, the MCF will return to normal automatically when the flow rate falls within the measurable range.</td>
<td>After detaching the measurement module from the main path, check if the internal filter is stained. If so, clean it. If the flow rate display does not indicate zero, check for gas leaks. Check that setting is correct.</td>
</tr>
<tr>
<td>Measurement error has increased and exceeds the accuracy specifications.</td>
<td>Check for gas leaks. Check that setting is correct.</td>
</tr>
</tbody>
</table>

### Setting range

The setting range depends on the model number and the flow rate indication units. See the table below.

<table>
<thead>
<tr>
<th>Model</th>
<th>Setting range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCF081</td>
<td>0 to 1000</td>
<td>MCF081 model number</td>
</tr>
<tr>
<td>MCF082</td>
<td>0 to 2000</td>
<td>MCF082 model number</td>
</tr>
<tr>
<td>MCF083</td>
<td>0 to 4000</td>
<td>MCF083 model number</td>
</tr>
<tr>
<td>MCF084</td>
<td>0 to 8000</td>
<td>MCF084 model number</td>
</tr>
<tr>
<td>MCF085</td>
<td>0 to 16000</td>
<td>MCF085 model number</td>
</tr>
<tr>
<td>MCF086</td>
<td>0 to 32000</td>
<td>MCF086 model number</td>
</tr>
<tr>
<td>MCF087</td>
<td>0 to 64000</td>
<td>MCF087 model number</td>
</tr>
<tr>
<td>MCF088</td>
<td>0 to 128000</td>
<td>MCF088 model number</td>
</tr>
</tbody>
</table>

### Reference

1. If selected for RS-485 communications models, no communications begin.
2. Cannot be selected for RS-485 communications models only.
3. Can be selected for RS-485 communications models only.
4. Minimum unit: MCF080/030/051/030: 10 L/min (0.1 m³/h, 0.01 kg/l) pulse

### Parameter settings

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Setting range</th>
<th>Factory setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flow rate assignment for 20 mA analog output</td>
<td>0 to 400 % FS</td>
<td>100 % FS</td>
<td>The decimal point is not shown in the setting range.</td>
</tr>
</tbody>
</table>
MODEL SELECTION GUIDE - OPTIONAL PARTS

Model selection guide

Name | Model number | Cable length | Cable properties | Lead color
--- | --- | --- | --- | ---
KX-45335K-E | 2 m | 24 resistant, bend-resistant wire | Brown, Blue, Black
KX-45335K-E | 5 m | 24 resistant, bend-resistant wire | Brown, Blue, Black
KX-45332K-E | 2 m | 24 resistant, bend-resistant wire | Brown, Blue, Black
KX-45332K-E | 5 m | 24 resistant, bend-resistant wire | Brown, Blue, Black
KX-45329K-E | 2 m | 24 resistant, bend-resistant wire | Brown, Blue, Black
KX-45329K-E | 5 m | 24 resistant, bend-resistant wire | Brown, Blue, Black
KX-45326K-E | 2 m | 24 resistant, bend-resistant wire | Brown, Blue, Black
KX-45326K-E | 5 m | 24 resistant, bend-resistant wire | Brown, Blue, Black

### Optional parts (sold separately)

#### Measurement cycle
- Measurement cycle: 50 ±5 ms (factory setting)

#### Indication repeatability for instantaneous flow rate
- Indication repeatability for instantaneous flow rate: ±1 % FS ±1 digit (2 to 100 % of FS flow rate)

#### Pressure characteristics of instantaneous flow
- Pressure characteristics of instantaneous flow: ±0.25 % FS / 0.01 MPa ±1 digit or less (2 to 40 % of FS flow rate)
- Pressure characteristics of instantaneous flow: ±0.25 % FS / 0.1 MPa ±1 digit or less (5 to 100 % of FS flow rate)
- Pressure characteristics of instantaneous flow: ±0.5 % FS / 0.01 MPa ±1 digit or less (5 to 100 % of FS flow rate)
- Pressure characteristics of instantaneous flow: ±0.5 % FS / 0.1 MPa ±1 digit or less (5 to 100 % of FS flow rate)

#### Temperature characteristics
- Temperature characteristics: ±0.5 °C or ±1 °C

### Specifications

#### Full scale (FS) flow rate
- Full scale (FS) flow rate: [L/min]

#### Measured gas
- Measured gas: Air/Nitrogen

#### Gas requirements
- Gas must be dry and not contain corrosive components such as chlorine, sulfur and acid.
- Gas must be clean, without dust.

#### Operating temperature range
- Operating temperature range: -10 to +60 °C (without freezing)

#### Operating humidity range
- Operating humidity range: 0 to 90 % RH (without condensation)

#### Measurement module (RS-485 communications models only)
- Measurement module: For RS-485 communications models only
- Transmission speed: 9600, 38400, 19200 bps
- Protocol: MODBUS
- Partly cooling: None, even or odd
- Partly heating: 1 or 2

#### Data storage
- Data storage: EEPROM non-volatile semiconductor memory
- Data storage duration: 10 years

#### Insulation resistance
- Insulation resistance: 50 MΩ or more between contacts of connector and main flow path or mounting bolts, with 500 Vdc tester

#### Protective structure
- Protective structure: IP65 (JIS C0920 and IEC529) ingress protection for indoor installation

#### Material and Treatments
- Material and Treatments: Steel substrate, stainless steel, aluminum alloy, hard metal, plastic, etc.

#### Event output
- Event output: NPN open collector, 10 Vdc, 5 mA max. sink type (not selectable from following functions)
- Event output: Instantaneous flow rate switch (upper limit, lower limit, within range)
- Event output: Integrated flow switch (count-up, countdown)
- Event output: Pulse output (3 assignable pulse weights)

#### Maximum output current
- Maximum output current: 24 mA max.

#### Alarm output
- Alarm output: Options:渌F or oil-inhibiting treatment, refer to "Material and Treatments" in the specifications.

#### Transmission speed
- Transmission speed: 9600, 38400, 19200 bps

#### Power supply, communications, output
- Power supply, communications, output: Options:渌F or oil-inhibiting treatment, refer to "Material and Treatments" in the specifications.

#### Lead length
- Lead length: 5 m

#### Cable properties
- Cable properties: Flame-resistant cable, Oil resistant, EN-compliant

#### Connector
- Connector: MCF cable connector

#### Mounting
- Mounting: Horizontal piping with the display facing left as seen from the air inlet (Position 3)
- Mounting: 2-M4, Thread depth 7
- Mounting: 4.5 - Black, 3 - Blue

#### Table of Optional parts

<table>
<thead>
<tr>
<th>Name</th>
<th>Model number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>KX-45335K-E</td>
<td>2 m</td>
</tr>
<tr>
<td>L</td>
<td>KX-45335K-E</td>
<td>5 m</td>
</tr>
<tr>
<td>M</td>
<td>KX-45329K-E</td>
<td>2 m</td>
</tr>
<tr>
<td>N</td>
<td>KX-45329K-E</td>
<td>5 m</td>
</tr>
<tr>
<td>O</td>
<td>KX-45326K-E</td>
<td>2 m</td>
</tr>
<tr>
<td>P</td>
<td>KX-45326K-E</td>
<td>5 m</td>
</tr>
<tr>
<td>Q</td>
<td>KX-45326K-E</td>
<td>2 m</td>
</tr>
<tr>
<td>R</td>
<td>KX-45326K-E</td>
<td>5 m</td>
</tr>
</tbody>
</table>

### externa Dimensions

<table>
<thead>
<tr>
<th>Unit</th>
<th>MCF0080/0150/0151/0250</th>
<th>MCF0400/0500</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>165</td>
<td>130</td>
</tr>
<tr>
<td>W</td>
<td>50</td>
<td>106.8</td>
</tr>
<tr>
<td>H</td>
<td>79.8</td>
<td>74.5</td>
</tr>
</tbody>
</table>

Specifications are subject to change without notice. (R)

E4