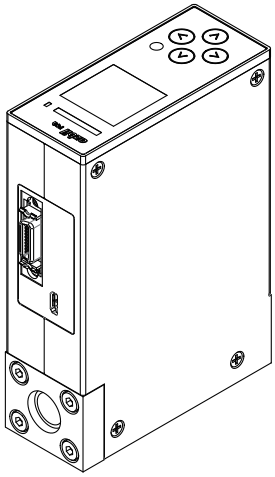
(Not for use in Japan)

No. CP-SP-1461E

Digital Mass Flow Controller

Model F4Q

User's Manual



Thank you for purchasing this product.

This manual contains information for ensuring the safe and correct use of the product.

Those designing or maintaining equipment that uses this product should first read and understand this manual. This manual contains information not only for installation, but also for maintenance, troubleshooting, etc. Be sure to keep it nearby for handy reference.

Azbil Corporation

NOTICE

Please make sure that this manual is available to the user of the product.

Unauthorized duplication of this user's manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is complete and accurate, but if you should find an omission or error, please contact us.

In no event is Azbil Corporation liable to anyone for any indirect, special, or consequential damages as a result of using this product.

Conventions Used in This Manual

■ The safety precautions explained below aim to prevent injury to you and others, and to prevent property damage.

⚠WARNING	**Warnings are indicated when mishandling this product may result in death or serious injury.**
⚠CAUTION	**Cautions are indicated when mishandling this product may result in minor injury or property damage only.**

■ In describing the product, this manual uses the icons and conventions listed below.

Indicates that caution is required in handling.

The indicated action is prohibited.

Be sure to follow the indicated instructions.

Handling Precautions:

Information to be aware of when handling.

Note: Indicates information that may be useful.

☞: Indicates an item or page to which the user may refer.

(1) (2) (3): Steps in a sequence or parts of a figure, etc.

≫: Indicates the result of an operation, or the status after the operation.

“XXXXXXXX” Indicates a message shown on the screen of the PC, this device, etc.

[XXX] or [XX] button: Square brackets indicate a window name, button, or menu shown on the screen of the PC, this device, etc.

Safety Precautions

⚠ WARNING

Never allow gases that are within explosive limits to pass through this device. Doing so might result in an explosion.
If you allowed a gas that contains oil to pass through this device, do not allow oxygen to enter this device afterward. The oil on the gas-contacting parts may catch fire.
Do not use this device in explosive atmospheres or near flammable fluids or steam.

⚠ CAUTION

If an overcurrent continuously flows through an output terminal for a long time due to a load current above the rating, a load short, or other cause, smoke or fire may occur. Install a safety circuit such as a fuse outside the device.
Make sure that devices or equipment connected to this device have reinforced insulation or double insulation suitable for the maximum voltages of this device's power supply and input/output components. Otherwise, there is a danger of electric shock.
Do not allow lint, metal shavings, water, etc., to enter the case of this device. A malfunction or failure may result.
This device is a precision instrument. Do not drop it or subject it to impact, or it might be damaged.
When carrying and storing the device, put it in a plastic bag, etc., to prevent foreign matter from entering the flow path.
If damage could result from the abnormal functioning of this device, include appropriate redundancy in the system design.
When mounting this device on a pipe, make sure that the top panel does not face downward. If the top panel faces downward, device failure may result.
When installing, securely attach the device using the mounting holes on its base to prevent vibration. Otherwise, a malfunction or failure may result.
Prevent foreign matter from entering the flow path of this device. If rust, water droplets, oil mist, or dust from the pipes enters the device, a measurement or control error may occur, or the device may be damaged.
When using this device for the air-fuel ratio control of a burner, prevent the occurrence of flashback and also take countermeasures for the instrumentation to protect the device even if flashback occurs. A pressure increase or fire in the pipes caused by the backfire of the burner could damage the device.
If there is a risk of a power surge caused by lightning, use a surge absorber (surge protector). Otherwise, there is a danger of fire or device failure.
Observe the following when using this device for oxygen gas: **• Piping should be done by a specialist experienced in handling oxygen.** **• Use degreased pipes and parts.** **• Be sure to remove foreign matter, burrs, etc., from the pipes before connecting this device.** **• Do not touch the gas-contacting parts with bare hands.**

CAUTION

Check the product connections and pipe connections for leakage before use. Also, check the connections for leakage regularly after the start of use. It is the user's responsibility to ensure that gas leaks can be reliably detected. This is especially important if a dangerous gas is used.
Mount this device in a location that satisfies the operating conditions given in the specifications. Otherwise, there is a danger of fire or device failure.
If the device is installed in an environment subject to large temperature changes, introduce a flow of sufficiently dry gas through the pipes to remove any remaining wet gas in order to prevent water from condensing. Otherwise, there is a danger of device failure.
Use this device within the flow rate range given 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 the flow rate. If the flow rate exceeds the upper limit, both the flow rate display and the output voltage/current may indicate considerably lower values than the actual flow rate.
Do not subject the product to pressure beyond the rated pressure resistance range. The product may be damaged.
Make sure that the wiring is correct before turning the power on. Incorrect wiring may result in damage or malfunction.
Do not apply excessive force on the cable or connector while the connector cable is connected. Excessive force may damage the product.
Do not disassemble this device. There is a danger of device failure.
Azbil products are industrial products subject to the WEEE Directive. Do not dispose of electrical and electronic equipment in the same way as household waste. Old products contain valuable raw materials and must be returned to an authorized collection point for correct disposal or recycling.
Change the operational mode to fully closed before switching the gas type with external contact input or before switching the flow rate range in order to change the analog input/ output voltage range. Switching while control is in progress causes a large disturbance in the control results.
Do not blow air through the device or wipe the inside of the flow path with a rag. Doing so may cause sensor malfunction.
Do not wash the device or steam-clean the inside of the flow path. Doing so may cause sensor malfunction.
Do not apply a negative voltage or a voltage exceeding 5 V to the flow rate setting input (+) terminal. A malfunction or failure may result.
If the gas must be completely shut off, provide a shutoff valve outside the device. The valve on this device cannot completely stop the flow of gas.
Do not turn off the power when settings are being written via RS-485 communication, when settings are being changed using the PC loader, or during zero point adjustment. There is a danger of device failure.
Do not apply voltage to the instantaneous flow rate setting input terminal while the power is off. A malfunction or device failure may result.

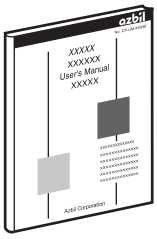
CAUTION

Before mounting, removing, or wiring this device, be sure to turn off the power to this device and connected devices. Otherwise, there is a danger of electric shock.
Wire the device properly by following established standards and using the specified supply power and installation methods.
This device is intended for use in an industrial electromagnetic environment. When using this device in a residential environment, appropriate measures must be taken because this device can cause interference.
During EMC testing, the reading or output may fluctuate. Please refer to "Standards compliance" in Chapter 8, "Specifications."
If you wish to use this device for a nonstandard gas, be sure to consult with us in advance. Otherwise, there is a danger of device failure.
Do not connect a connector or supply power to this device if the connector of this device is dusty or dirty. There is a danger of smoke or device failure.
If an external shutoff valve is closed, close this device's valve also. Otherwise, there is a danger of device failure.
When carrying this device, hold the bottom. Otherwise, injury or device failure may result.
Do not connect equipment that causes a large amount of throttling or pressure loss near this device. Hunting may occur and the specified accuracy may not be satisfied. Continuous hunting may cause valve failure. In order to reduce the pressure loss, use pipes, fittings, and other pipe connection equipment whose narrowest part has the inner diameter shown below or whose flow path has the cross-sectional area shown below. **Model F4Q9200, F4Q9500, F4Q0002: 4 mm or more** **Model F4Q0005, F4Q0020, F4Q0050(B,C), F4Q0100: 7 mm or more** **Model F4Q0050(J,K), F4Q0200: 10 mm or more**
Only the following gases can be used with EPDM gasket specifications. If this device is used for a gas that is not allowed, deterioration of the seal may result. **- Compatible gases: air, nitrogen, argon, carbon dioxide, ammonia, and acetylene**
Newton's rings may appear on the display due to the protective parts of the display unit. There is no problem with the performance of the display unit.
When the valve of this device starts to open from the fully closed position, overshoot may occur. Check how this device operates with the actual equipment before use.
The valve of model F4Q0050(J,K)/0200 is located on the outside. Do not touch the valve while this device is in operation. Because it is hot, there is a risk of burns.
To release the fluid pressure inside the F4Q, vent the gas from the outlet port. Releasing the fluid pressure from the inlet port may affect the rectifying section and cause errors in measurement and control.

The Role of This Manual

There are four different manuals related to model F4Q. Read them as necessary for your specific requirements.

If a manual you require is not available, contact the azbil Group or one of its dealers.



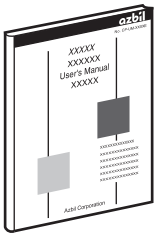
Digital Mass Flow Controller Model F4Q User's Manual

Document No. CP-SP-1461E

This manual.

This manual describes the hardware and all functions of this device. Personnel in charge of the design, manufacture, operation, or maintenance of equipment that incorporates this device should read this manual thoroughly.

The manual covers installation, wiring, all functions and settings, operation, troubleshooting, and specifications.

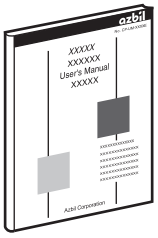


Digital Mass Flow Controller Model F4Q User's Manual for RS-485 Communication Functions

Document No. CP-SP-1458E

Personnel who use this device's communications functions should read this manual.

The manual gives an overview of communications, describes wiring, transmission protocols, communications data, and troubleshooting, and gives communications specifications.

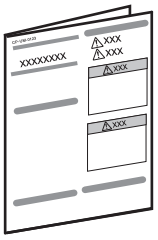


User's Manual for Loader Package Model MLP-F4Q for Digital Mass Flow Controller Model F4Q

Document No. CP-SP-1457E

The user can specify and check parameters of this device on a PC using the loader package.

Personnel in charge of the design or configuration of equipment that incorporates this device should read this manual thoroughly. The manual describes installation of the software on a PC, the method for connecting the loader to this device, various functions of the loader, procedures for setting up this device, and operation of the PC.



Digital Mass Flow Controller Model F4Q User's Manual

Document No. CP-UM-5978JECK

This manual is supplied with the product.

Personnel in charge of the design or configuration of equipment that incorporates this device and personnel in charge of installation of this device should read this manual thoroughly.

The manual covers safety precautions, installation, wiring, and main specifications.

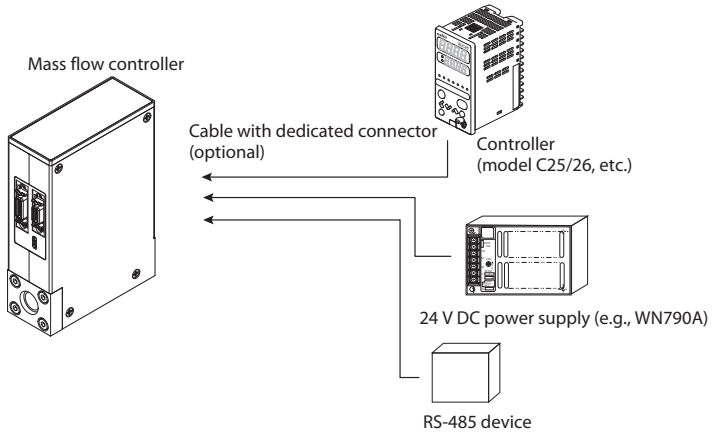
Contents

-MEMO-

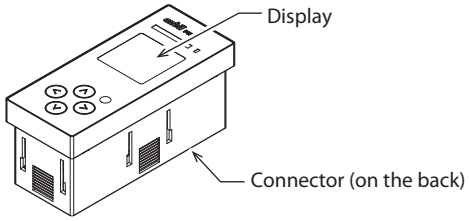
Chapter 1. Overview

■ Overview

This device is a high-performance digital mass flow controller with advanced functions for the general industrial market. It features high accuracy, high-speed response, and a wide control range.



Configuration diagram



■ Features

- High-speed controllability
  High-speed response of 300 ms (typ.).*
  (700 ms for F4Q0050(J,K)/0200)

  * When control begins from the fully closed state or when the setting is changed during control, the controlled flow rate reaches the set value ± 2 % within 300 ms.

- Low differential pressure operation
  This device can be used even at a low differential pressures.
  (The minimum operating differential pressure differs depending on the model)

- Wide control range
  Provides a wide control range of 1–100 % full scale (FS).

- A lineup of products suited to customers' applications
  The lineup consists of integrated-display models and separate-display models. With a separate-display model, a special 2 m cable (included) can be used for remote display and operation of the controller.

- Ease of use
  The product runs on 24 V DC from a single general-purpose power supply. In addition, the power supply circuit and I/O circuit inside the device are isolated. When multiple F4Qs are driven through analog input/output using a programmable logic controller (PLC) or the like, even if the analog module channels on the PLC side are not isolated, a common power supply can be used to power the units.
  Even without using an individual power supply for each device, there is no need for concern regarding effects from one circuit on adjacent ones.
  In addition, for easy use in a laboratory, a convenient AC adapter (optional) is available.

- Ease of setup
  This device can be set up easily by connecting it and a PC with a general-purpose USB 2.0 cable and using the dedicated PC loader software.
  There is no need for an external power supply during setup because power is supplied from the PC through the USB cable.
  (Note that USB power cannot be used for control or for powering the display.)

- Changeable display orientation
  The orientation of the display unit can be changed according to the gas flow direction to make it easy to read.

- Better design
  A large indicator for better visibility and design.
  The use of an LCD on the display makes it easy to check settings and numerical values.

- A variety of functions
  A variety of functions are included as standard features.
  ☞ ■ Functions (p. 1-7) (for details)

■ Model selection guide

● Face-to-face: 90 mm (with fluoroelastomer gaskets)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Basic model No.			Standard flow rate range				Model type	Flow path material	Pipe connection	Gas type	Communication	O-ring material	Option 1	Option 2	Option 3	Code	Description
F	4	Q															
			9	2	0	0											2 to 200 mL/min (normal)*1
			9	5	0	0											0.005 to 0.5 L/min (normal)*1
			0	0	0	2											0.02 to 2 L/min (normal)*1
			0	0	0	5											0.05 to 5 L/min (normal)*1
			0	0	2	0											0.2 to 20 L/min (normal)*1
			0	0	5	0											0.5 to 50 L/min (normal)*1
			0	1	0	0											1 to 100 L/min (normal)*1
							B										Integrated-display model
							C										Separate-display model
								6									SUS316
									T								Rc ¼
									S								¼ Swagelok fittings (Model F4Q0100 only: ⅜ Swagelok)*2
									V								¼ VCR fittings (Model F4Q0100 only: ½ VCR or the equivalent)*2
									U								9/16-18 UNF
										N							Air/nitrogen*3
											1						RS-485 communication (CPL/Modbus RTU, switchable)
												0					Fluororubber
													0				No optional function
														0			No optional function
															0		0: Without inspection report
															D		D: With inspection report
															Y		Y: With inspection report and traceability
																0	Product version

*1. Control flow rate range for air and nitrogen. The notations "mL/min (normal)" and "L/min (normal)" indicate the volumetric flow rate (mL/min and L/min) converted to conditions of 0 °C and 1 atm (101.3 kPa (abs)).

*2. Before connecting pipes with Swagelok or VCR fittings, check the instructions in the manual provided by the manufacturer of the fitting.

*3. The device can be used for gases other than air and nitrogen by changing the gas type setting. The controllable flow rate range varies depending on the gas type. ☞ Chapter 8. Specifications (for details)

● Face-to-face: 90 mm (with EPDM gaskets)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Basic model No.			Standard flow rate range				Model type	Flow path material	Pipe connection	Gas type	Communication	O-ring material	Option 1	Option 2	Option 3	Code	Description
F	4	Q															
			9	2	0	0											2 to 200 mL/min (normal)*1
			9	5	0	0											0.005 to 0.5 L/min (normal)*1
			0	0	0	2											0.02 to 2 L/min (normal)*1
			0	0	0	5											0.05 to 5 L/min (normal)*1
			0	0	2	0											0.2 to 20 L/min (normal)*1
			0	0	5	0											0.5 to 50 L/min (normal)*1
							B										Integrated-display model
							C										Separate-display model
								6									SUS316
									T								Rc ¼
									S								¼ Swagelok fittings*2
										N							Air/nitrogen*3
											1						RS-485 communication (CPL/Modbus RTU, switchable)
												E					EPDM*4
													0				No optional function
														0			No optional function
															0		0: Without inspection report
															D		D: With inspection report
															Y		Y: With inspection report and traceability
																0	Product version

*1. Control flow rate range for air and nitrogen. The notations "mL/min (normal)" and "L/min (normal)" indicate the volumetric flow rate (mL/min and L/min) converted to conditions of 0 °C and 1 atm (101.3 kPa (abs)).

*2. Before connecting pipes with Swagelok fittings, check the instructions in the manual provided by the manufacturer of the fitting.

*3. The device can be used for gases other than air and nitrogen by changing the gas type setting. The controllable flow rate range varies depending on the gas type. ☞ Chapter 8. Specifications (for details)

*4. Only the following gases can be used with a model with the EPDM gasket specification. If this device is used for a gas that is not allowed, deterioration of the seal may result.
Compatible gases: air, nitrogen, argon, carbon dioxide, ammonia, and acetylene

● **Face-to-face: 150 mm (with fluoroelastomer gasket)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Basic model No.			Standard flow rate range				Model type	Flow path material	Pipe connection	Gas type	Communication	O-ring material	Option 1	Option 2	Option 3	Code	Description
F	4	Q															
			0	0	5	0											0.5 to 50 L/min (normal)*1, *4
			0	2	0	0											2 to 200 L/min (normal)*1
							J										Integrated-display model
							K										Separate-display model
								6									SUS316
									T								Rc ½
									S								½ Swagelok fittings*2
									V								½ VCR fittings or the equivalent*2
									U								3/4-16 UNF
										N							Air/nitrogen*3
											1						RS-485 communication (CPL/Modbus RTU, switchable)
												0					Fluororubber
													0				No optional function
														0			No optional function
															0		0: Without inspection report
															D		D: With inspection report
															Y		Y: With inspection report and traceability
																0	Product version

*1. Control flow rate range for air and nitrogen. The notations "mL/min (normal)" and "L/min (normal)" indicate the volumetric flow rate (mL/min and L/min) converted to conditions of 0 °C and 1 atm (101.3 kPa (abs)).

*2. Before connecting pipes with Swagelok or VCR fittings, check the instructions in the manual provided by the manufacturer of the fitting.

*3. This device can be used for gases other than air and nitrogen by changing the gas type setting. The controllable flow rate range varies depending on the gas type. ☞ Chapter 8. Specifications (for details)

*4. F4Q0050(J,K) can be used for low differential pressure application. It can control a high flow rate range with an operating differential pressure lower than F4Q0050(B,C).

● **Face-to-face: 150 mm (with EPDM gaskets)**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Basic model No.			Standard flow rate range				Model type	Flow path material	Pipe connection	Gas type	Communication	O-ring material	Option 1	Option 2	Option 3	Code	Description
F	4	Q															
			0	2	0	0											2 to 200 L/min (normal)*1
							J										Integrated-display model
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								6									SUS316
									T								Rc ½
									S								½ Swagelok fittings*2
										N							Air/nitrogen*3
											1						RS-485 communication (CPL/Modbus RTU, switchable)
												E					EPDM*4
													0				No optional function
														0			No optional function
															0		0: Without inspection report
															D		D: With inspection report
															Y		Y: With inspection report and traceability
																0	Product version

*1. Control flow rate range for air and nitrogen. The notations "mL/min (normal)" and "L/min (normal)" indicate the volumetric flow rate (mL/min and L/min) converted to conditions of 0 °C and 1 atm (101.3 kPa (abs)).

*2. Before connecting pipes with Swagelok fittings, check the instructions in the manual provided by the manufacturer of the fitting.

*3. This device can be used for gases other than air and nitrogen by changing the gas type setting. The controllable flow rate range varies depending on the gas type. ☞ Chapter 8. Specifications (for details)

*4. Only the following gases can be used with a model with the EPDM gasket specification. If this device is used for a gas that is not allowed, deterioration of the seal may result.
Compatible gases: air, nitrogen, argon, carbon dioxide, ammonia, and acetylene

■ Functions

The configuration of the main screen and operations often used during steady operation, such as flow rate setting and switching of the valve operation mode, are described in ☞ Chapter 4. Basic Operations. Other functions and screen display switching are described in ☞ Chapter 5. Advanced Operations.
Additional functions that can be used with the loader are described in ☞ Chapter 6. Operations Using the PC Loader.

Function		Overview	Refer to
Display-related	Display orientation setup	The screen display and key orientation can be changed to match the device's orientation.	☞ Chapter 5. Advanced Operations
	Multi-information display	Various kinds of information, including process data such as instantaneous flow rate and device status, can be displayed.	☞ Chapter 4. Basic Operations
	Key lock function	Key operation on the display panel of this device can be limited to prevent operation errors and as a security measure.	☞ Chapter 5. Advanced Operations
	Flow rate display change (units and digits after the decimal point)	The unit of measurement and the number of digits after the decimal point for instantaneous flow rate data display can be changed.	
	Totalized flow rate display change (unit)	The unit of measurement and the number of digits after the decimal point for totalized flow rate data display can be changed.	
	Automatic display-off function	This function turns off the LCD if the keys on the display panel are not used for a certain amount of time.	
	PV display filter time constant setting	The displayed PV (instantaneous flow rate) can be filtered.	
	User tag specification	Any character string can be displayed at the bottom of the main screen on the display of this device.	☞ Chapter 6. Operations Using the PC Loader

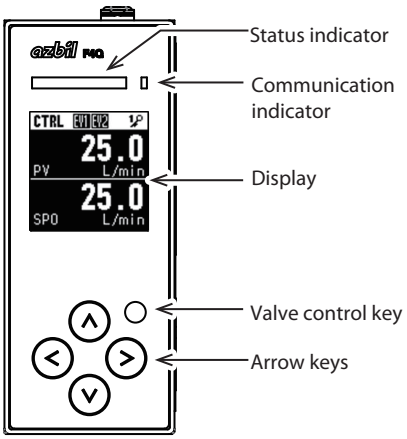
Function		Overview	Refer to
Flow rate control	Flow rate setting	The flow rate can be changed using the operation keys, digital input, analog input, or communication.	☞ Chapter 4. Basic Operations
	Direct setup function	When the flow rate setting is changed using the keys, the entered value is applied immediately as the control SP.	
	Valve operation mode switching	The valve operation mode can be switched between control mode, fully closed mode, and fully open mode.	
	SP limit	The lower and upper limits of the flow rate setting range can be freely set (to prevent incorrect setting due to operator error).	☞ Chapter 5. Advanced Operations
	Control response setup	Control can be optimized.	
	PID constants	Any PID constant can be set.	☞ Chapter 6. Operations Using the PC Loader
	Flow rate OK judgment	This function determines whether the control flow rate is within the set value ± the allowable range.	☞ Chapter 5. Advanced Operations
	Flow rate deviation event	Event output can be set for upper and lower deviation of instantaneous flow rate from the flow rate set point. The operating mode can be set to change automatically if an event occurs.	
	SP ramp control	The change rate per second (gradient) of the flow rate set point can be kept constant when control starts and when the flow rate setting is changed.	
Measurement conditions, flow rate correction	Standard temperature setting for flow rate display	You can select the standard temperature used when converting from the measured mass flow rate to volumetric flow rate.	☞ Chapter 5. Advanced Operations
	Gas type selection	The gas type can be selected from the standard compatible gases.	
	PV filter	The output PV can be smoothed.	
	PV fluctuation control function when fully closed	The PV filter can be expanded after a delay when the flow rate set point is set to zero or when the valve changes to fully closed mode.	
	Low flow cutoff	The flow rate below the specified threshold is regarded as zero.	
	Flow rate zero point adjustment	Drift in the zero point of the sensor can be adjusted.	
	Device orientation & pressure compensation	Compensation can be made for sensor drift due to the orientation of the pipe on which the device is mounted or due to the effect of pressure.	
	Filter application during response	Whether to apply the PV filter to the output PV during control response can be selected.	☞ Chapter 6. Operations Using the PC Loader
	Full-scale flow rate setting for the gas type set by the user	The control range of the gas type set by the user can be changed freely.	
	Multipoint flow rate correction	Linear compensation function for up to 10 points. The control flow rate can be fine-tuned to the reference device.	

Function		Overview	Refer to
Analog input/ output	Analog input/output function	The analog input/output type can be selected from 0–5 V, 1–5 V, and 4–20 mA. In addition, PV output or SP output can be selected as the output item.	☞ Chapter 5. Advanced Operations
	Optional analog scaling	The flow rate corresponding to 100 % analog input/ output (5 V or 20 mA) can be freely changed to any value.	
	Analog input/output adjustment	Span adjustment and offset can be applied to the analog input and analog output.	☞ Chapter 6. Operations Using the PC Loader
Digital input/ output	Digital input function	The device can be remotely operated by assigning functions to the three digital inputs.	☞ Chapter 5. Advanced Operations
	Digital output function	The device can be remotely monitored by allocating the device status, event, or other item to the three digital outputs.	
Flow volume totalization	Total flow volume count pause	Flow volume totalization can be paused with digital input.	
	Total flow volume reset	The totalized flow volume can be reset to zero using the keys, digital input, communication, or other means.	
	Totalizer pulse output	A pulse can be output every time the specified volume of flow is measured.	
	Totalized flow volume event	An event can be output when the totalized flow volume reaches the specified value. In addition, the device can be automatically switched to fully closed mode if the event occurs.	
Diagnostic function	Self-diagnostic function	Problems such as circuit failure, parameter error, or flow rate control error are detected and output as device status information.	☞ Chapter 7. Troubleshooting
	Diagnostic information	Information such as total operating time, full-close count, and abnormal device status since the product was shipped are internally recorded.	
	Fail-safe function	The operating mode or analog output can be set to change automatically if an error occurs.	☞ Chapter 5. Advanced Operations
Communication function	RS-485	Data can be exchanged with host devices (master stations) such as a PC or a PLC via RS-485 communication. ☞ *Digital Mass Flow Controller Model F4Q User's Manual for RS-485 Communication Functions* (CP-SP-1458E)	–
Loader	Device setup and monitoring	A simplified engineering software tool (loader) that runs on a PC can be used for a variety of purposes related to settings, monitoring, etc.	☞ Chapter 6. Operations Using the PC Loader

-MEMO-

Chapter 2. Names and Functions of Parts

■ Top panel



Part name	Application
Status indicator	An LED to indicate abnormalities or valve control status • Lit green: normal (under control) • Blinks green (slowly): normal (fully closed or fully open) • Blinks green (fast): warning • Blinks red (fast): alarm • Lit red: error • Lit orange: fallback operation by USB in progress
Communication indicator	An LED to indicate the communication status of the device • Lit: standby • Blinks green: communicating
Display	Used to monitor controlled values or to specify settings.
Valve control key	Used to switch between valve operation modes.
Arrow keys	Used for general purposes such as screen transitions, cursor movement, and numerical value input.

Handling Precautions

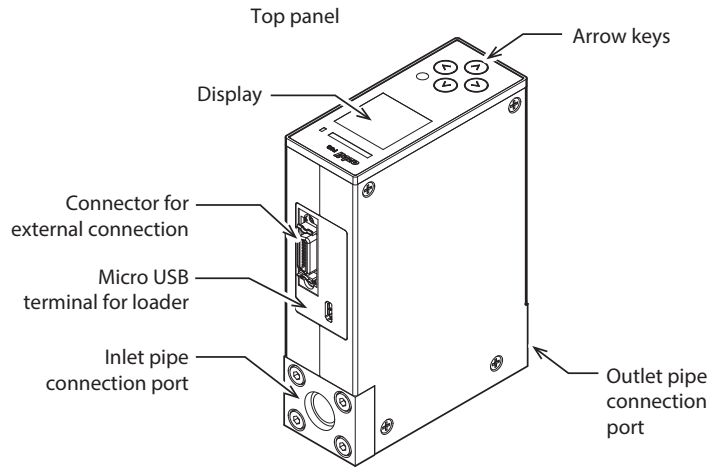
- Do not press the keys with a screwdriver, needle, or other sharp-tipped object. Device failure may result.

Note

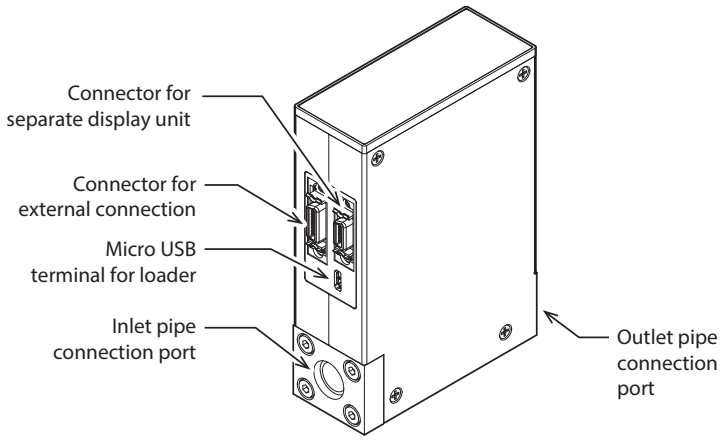
- The orientation of the display and the assignments of the keys on the top panel can be switched according to the device's orientation.
  ☞ ● Display orientation setup (p. 5-9) (for details)

■ Main unit (model F4Q9200/9500/0002/0005/0020/0050(B,C)/0100)

● Integrated model



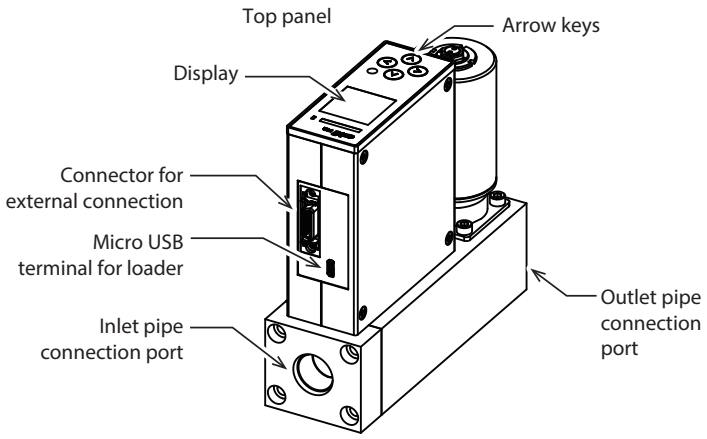
● Separate model



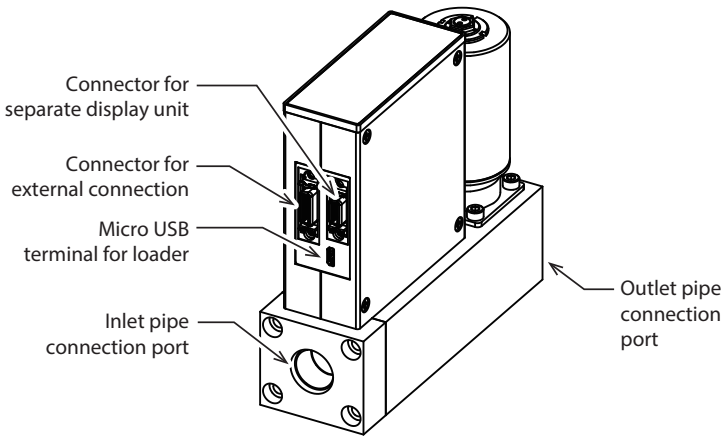
Connector for external connection	: For connection of input and output signals. Use the cable with the dedicated connector.
Micro USB terminal for loader	: Connect a general-purpose USB 2.0 cable when using the PC loader.
Connector for separate display unit	: Connects the display of a separate-display model.
Inlet pipe connection port	: Gas flow inlet.
Outlet pipe connection port	: Gas flow outlet.

■ Main unit (model F4Q0050(J,K)/0200)

● Integrated model



● Separate model



Connector for external connection	: For connection of input and output signals. Use the cable with the dedicated connector.
Micro USB terminal for loader	: Connect a general-purpose USB 2.0 cable when using the PC loader.
Connector for separate display unit	: Connects the display of a separate-display model.
Inlet pipe connection port	: Gas flow inlet.
Outlet pipe connection port	: Gas flow outlet.

-MEMO-

Chapter 3. Mounting and Wiring

⚠ WARNING

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

Do not use this device in explosive atmospheres or near flammable fluids or steam.

⚠ CAUTION

Do not allow lint, metal shavings, water, etc., to enter the case of this device. A malfunction or failure may result.

This device is a precision instrument. Do not drop it or subject it to impact, or it might be damaged.

If damage could result from the abnormal functioning of this device, include appropriate redundancy in the system design.

When using this device for the air-fuel ratio control of a burner, prevent the occurrence of flashback and also take countermeasures for the instrumentation to protect the device even if flashback occurs. A pressure increase or fire in the pipes caused by the backfire of the burner could damage the device.

Observe the following when using this device for oxygen gas:

- **Piping should be done by a specialist experienced in handling oxygen.**
- **Use degreased pipes and parts.**
- **Be sure to remove foreign matter, burrs, etc., from the pipes before connecting this device.**
- **Do not touch the gas-contacting parts with bare hands.**

Do not subject the product to pressure beyond the rated pressure resistance range.

The product may be damaged.

When mounting this device on a pipe, make sure that the top panel does not face downward. If the top panel faces downward, device failure may result.

Do not connect a connector or supply power to this device if the connector of this device is dusty or dirty. There is a danger of smoke or device failure.

■ Mounting

CAUTION
When installing, securely attach the device using the mounting holes on its base to prevent vibration. Otherwise, a malfunction or failure may result.
Mount this device in a location that satisfies the operating conditions given in the specifications. Otherwise, there is a danger of fire or device failure.
If the device is installed in an environment with significant temperature change, flow a sufficiently dry gas through the pipes to remove any remaining wet gas in order to prevent water condensation. Otherwise, there is a danger of device failure.
If the gas must be completely shut off, provide a shutoff valve outside the device. The valve on this device cannot completely stop the flow of gas.
Do not connect equipment that causes a large amount of throttling or pressure loss near this device. Hunting may occur and the specified accuracy may not be satisfied. Continuous hunting may cause valve failure. In order to reduce the pressure loss, use pipes, fittings, and other pipe connection equipment whose narrowest part has the inner diameter shown below or whose flow path has the cross-sectional area shown below. **Model F4Q9200, F4Q9500, F4Q0002: 4 mm or more** **Model F4Q0005, F4Q0020, F4Q0050(B,C), F4Q0100: 7 mm or more** **Model F4Q0050(J,K), F4Q0200: 10 mm or more**

● Installation location

Do not install this product in a place with any of the following characteristics:

- Temperature or humidity outside the specified high and low limits
- Large amounts of dust, salt, iron powder or other conductive substances, water droplets, oil mist, or organic solvents
- Direct sunlight, wind, or rain
- Mechanical vibration or shock outside the range of the specifications
- Proximity to high-voltage lines, welding machines, or other sources of electrical noise
- Strong electromagnetic fields

Handling Precautions

- The valve on this device cannot completely stop the flow of gas. If complete shutoff is required, provide a separate shutoff valve.

● Change of the display orientation

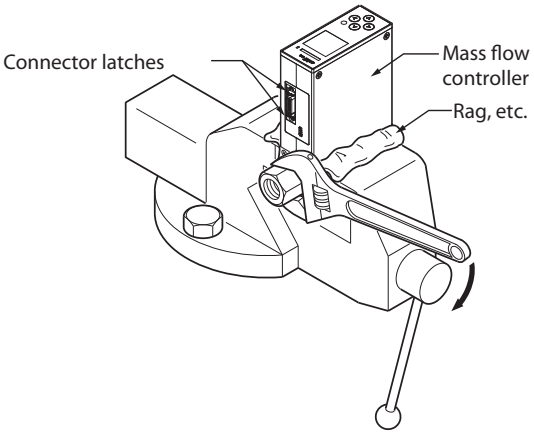
If the display is upside down when this device is mounted, the orientation of the display can be changed by changing the setting.

Note

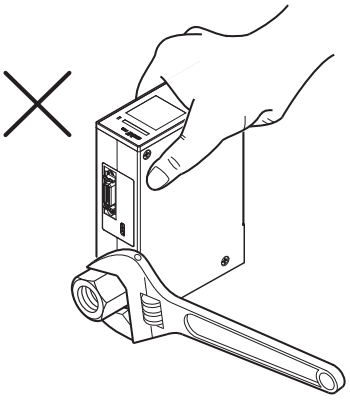
- ☞ Chapter 4. Basic Operations (for details on the setting procedure)

● Installing fittings for UNF connections

When attaching the fitting (on a UNF connection), hold the lower part of the main unit in a vise gripped between rags to protect the finished surfaces, and turn the fitting to tighten. The device may be damaged if the lower part of it is not secured.



Do not hold the upper part of the main unit when tightening the fitting. Doing so may cause deformation and damage.



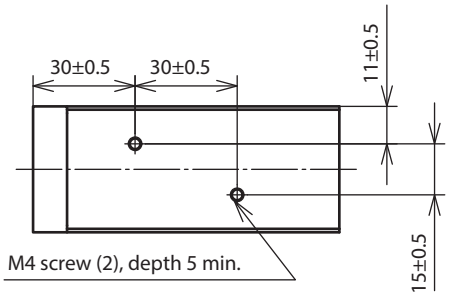
● Model F4Q9200/9500/0002/0005/0020/0050(B,C)/0100

Installing the device using the F9Y4QB1 (an optional part) is recommended.

☞ Mounting bracket for model F4Q (for 90 mm face-to-face length) (page 8-25) (for information on the F9Y4QB1)

The figure below shows the positions of the mounting holes on the base of the device. Install the device with two M4 screws using the mounting holes in its base.

Unit: mm



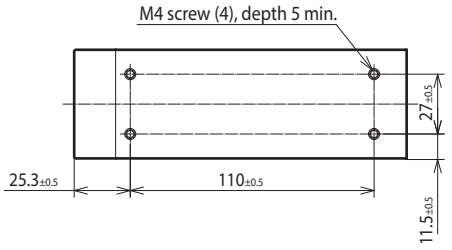
● Model F4Q0050(J,K)/0200

Installing the device using the F9Y4QB2 (an optional part) is recommended.

☞ Mounting bracket for model F4Q (for 150 mm face-to-face length) (page 8-26) (for information on the F9Y4QB2)

The figure below shows the positions of the mounting holes on the base of the device. Install the device with four M4 screws using the mounting holes in its base.

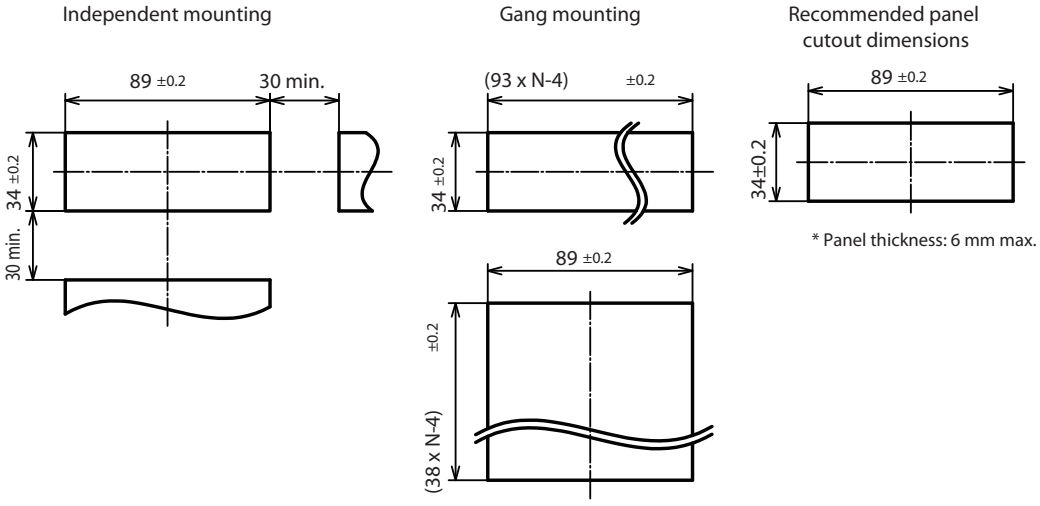
Unit: mm



● Installing the separate display unit

When a separate-display model is used

- Advance preparation
  Make mounting holes in the panel according to the panel cutout dimensions.

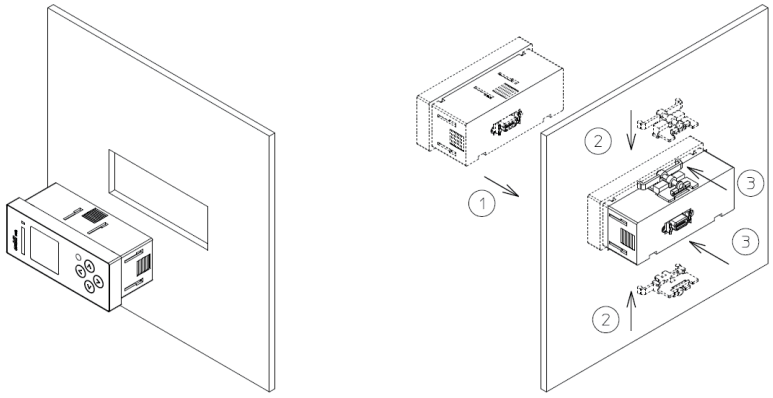


! Handling Precautions

- If the display unit is installed in a panel cutout made for model MQV, make sure that the unit is positioned in the center of the cutout.

● Installation

Install according to the following procedure.



(1) Insert the display unit from the front of the panel.

(2) Attach the mounting brackets to the side of the display unit.

(3) From behind the panel, push the mounting bracket supplied with the display unit onto the panel until the catches of the bracket are fully engaged with the grooves in the display unit.

(4) Tighten the screws at the top and bottom of the bracket.

Handling Precautions

- When installing the display unit on the panel, tighten the supplied mounting bracket screws until there is no play between the bracket and the panel, and then make an additional half a turn. Excessive tightening of the screws may deform the case.

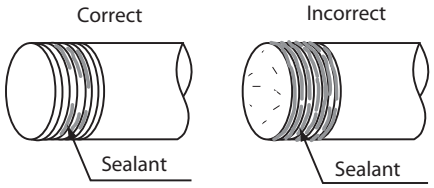
■ Piping

⚠ CAUTION

Prevent foreign matter from entering the flow path of this device. If rust, water droplets, oil mist, or dust from the pipes enters the device, a measurement or control error may occur, or the device may be damaged.

Check the product connections and pipe connections for leakage before use. Also, check the connections for leakage regularly after the start of use. It is the user's responsibility to ensure that gas leaks can be reliably detected. This is especially important if a dangerous gas is used.

- When connecting the device to the pipes, hold the hexagonal part of the fitting in place and turn the pipe. After connecting the piping, check for gas leaks.
- Make sure that the gas flows into the device in the direction indicated by <<< on the main unit. If the gas direction is reversed, the flow rate cannot be controlled correctly.
- After connecting the piping, check for gas leaks.
- Apply an appropriate amount of sealant. Do not put sealant on the two threads closest to the tip. In addition, remove any dust or burrs from the inside of the pipes.



Handling Precautions

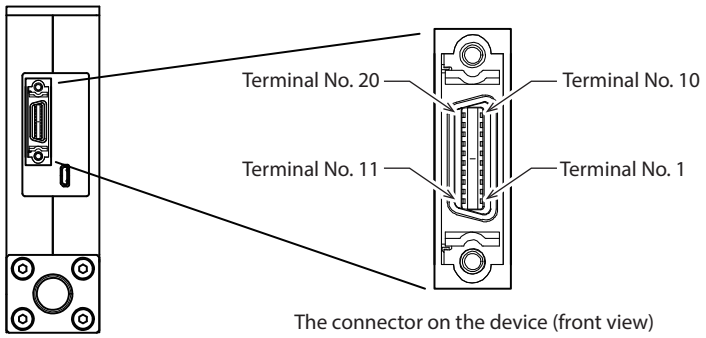
- Before connecting pipes with Swagelok or VCR fittings, check the instructions in the manual provided by the manufacturer of the fitting.
- If there is a possibility of foreign matter entering the device, install an upstream filter, strainer, or mist trap capable of eliminating foreign matter 0.1 µm or greater in diameter. Be sure to inspect and replace the filter at regular intervals.
- If using Rc connections, take care not to coat with too much sealant. Foreign matter or burrs in the pipes may cause measurement errors.

■ Wiring

CAUTION
Make sure that devices or equipment connected to this device have reinforced insulation or double insulation suitable for the maximum voltages of this device's power supply and input/output components. Otherwise, there is a danger of electric shock.
If there is a risk of a power surge caused by lightning, use a surge absorber (surge protector). Otherwise, there is a danger of fire or device failure.
Make sure that the wiring is correct before turning the power on. Incorrect wiring may result in damage or malfunction.
Do not apply excessive force on the cable or connector while the connector cable is connected. Excessive force may damage the product.
Change the operational mode to fully closed before switching the gas type with external contact input or before switching the flow rate range in order to change the analog input/output voltage range. Switching while control is in progress causes a large disturbance in the control results.
Do not apply a negative voltage or a voltage exceeding 5 V to the flow rate setting input (+) terminal. A malfunction or failure may result.
Do not apply voltage to the instantaneous flow rate setting input terminal while the power is off. A malfunction or device failure may result.
Before mounting, removing, or wiring this device, be sure to turn off the power to this device and connected devices. Otherwise, there is a danger of electric shock.
Wire the device properly by following established standards and using the specified supply power and installation methods.

● Connector pin layout

Connector model No.: DF02R020NA4
Manufacturer: Japan Aviation Electronics Industry, Ltd.



The connector on the device (front view)

● Compatible connectors (all made by Japan Aviation Electronics Industry, Ltd.)

● Solder-type connector

Number of wires	Compatible wire	Plug	Hood				Clamp plate	Appropriate dimensions (reference)
20	22 to 30 AWG	DF02P020F22A1	Hood for EMI shielding	Lock spring	Straight long	DF02D020A11	DF02HCLP05A	φ6.5–7.0
							DF02HCLP02A	φ7.0–7.5
							DF02HCLP01A	φ7.5–8.0
							DF02HCLP10A	φ8.5–9.0
			Hood without resin coating	Lock spring	Straight long	DF02D020A22		φ11.0–12.0
				Lock spring	Straight long	DF02D020B22		

● Crimp type

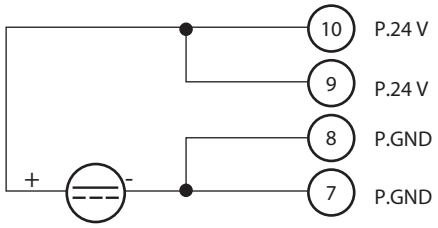
Number of wires	Compatible wire	Plug	Hood				Clamp plate	Appropriate dimensions (reference)
20	28 AWG	DF02P020G28A1	Hood for EMI shielding	Lock spring	Straight long	DF02D020A11	DF02HCLP05A	φ6.5–7.0
							DF02HCLP02A	φ7.0–7.5
							DF02HCLP01A	φ7.5–8.0
							DF02HCLP10A	φ8.5–9.0
			Hood without resin coating	Lock spring	Straight long	DF02D020A22		φ11.0–12.0
				Lock spring	Straight long	DF02D020B22		

● Connector signal table

Pin No.	Signal name	Description	Notes
1	DA	RS-485 comm., DA	☞ *Digital Mass Flow Controller Model F4Q User's Manual for RS-485 Communication Functions* (CP-SP-1458E) (for the connection procedure)
2	DB	RS-485 comm., DB	
3	S.GND	RS-485 comm. (–)	
4	AI	Analog input (+)	Flow rate set point (SP) input 0–5 V, 1–5 V, or 4–20 mA input
5	AO	Analog output (+)	Controlled flow rate (PV) or flow rate set point (SP) output 0–5 V, 1–5 V, or 4–20 mA output
6	A.GND	Analog signal (–)	Common ground for analog signals
7	P.GND	24 V DC (–) power	Rated 24 V DC ±10 % Connect two wires each in parallel to the power supply to reduce the voltage drop caused by wiring resistance.
8	P.GND	24 V DC (–) power	
9	P.24 V	24 V DC (+) power	
10	P.24 V	24 V DC (+) power	
11	DO1	Digital output 1 (+)	Nch open drain non-isolated output
12	DO2	Digital output 2 (+)	
13	DO3	Digital output 3 (+)	
14	D.GND	Digital signal (–)	Common ground for digital signals
15	DI1	Digital input 1 (+)	2-way (OPEN/GND) switching input
16	DI2	Digital input 2 (+)	
17	DI3	Digital input 3 (+)	
18	D.GND	Digital signal (–)	Common ground for digital signals
19	–	Not connected	
20	–	Not connected	

● Wiring

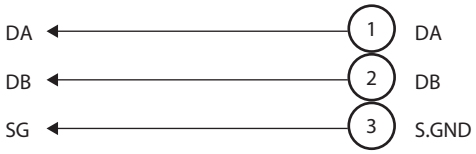
● Power



Handling Precautions

- Connect two wires in parallel to the power supply in order to reduce voltage drop caused by wiring resistance.

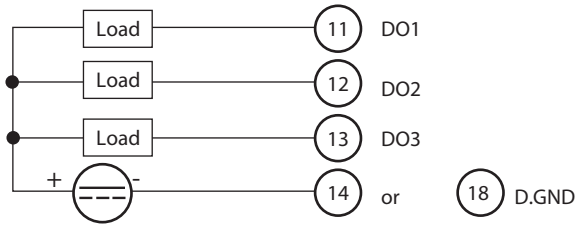
● RS-485 communication



Note

- ☞ *Digital Mass Flow Controller Model F4Q User's Manual for RS-485 Communication Functions* (CP-SP-1458E) (for the connection method of RS-485 communication)

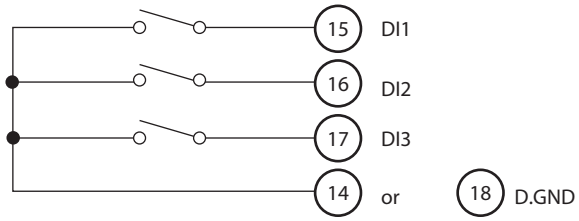
● Digital output



Handling Precautions

- Be careful not to exceed the rated output of this device. In addition, when driving a relay, use a relay with a built-in diode for absorbing coil surge.

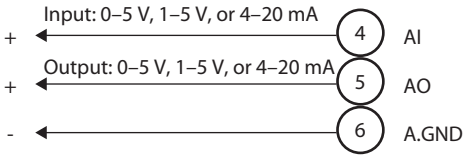
● Digital input



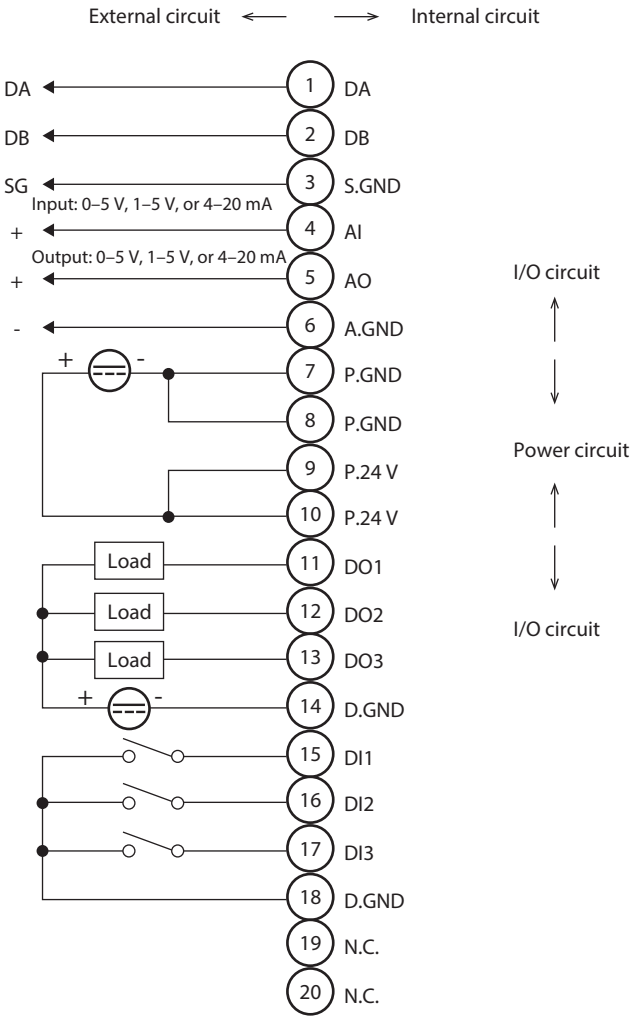
Handling Precautions

- When switching the digital input by relay contacts, use an appropriate relay intended for microcurrent use (with gold contacts). Failure to use a relay designed for microcurrents may result in malfunction due to poor contact.

● **Analog input/output**



● **Wiring example**



Handling Precautions

- The power supply circuit and I/O circuit inside the device are isolated.
- Even though the A.GND, D.GND, and S.GND are connected internally, be sure to ground them separately.
- Do not input any signal to pin Nos. 19 and 20.

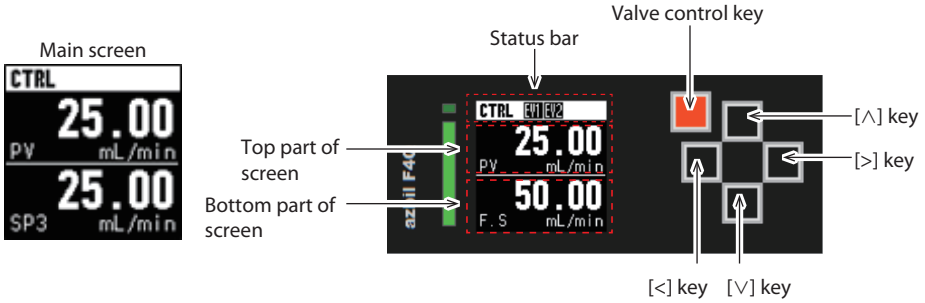
Chapter 4. Basic Operations

4 - 1 Main Screen Display

CAUTION

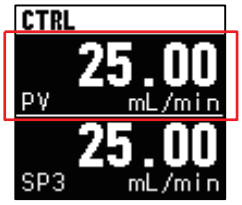
Do not operate the keys with a sharp-tipped object such as mechanical pencil or screwdriver. Device failure may result.

The screen that appears on the display after power-on is called the main screen. The main screen consists of the top section, the bottom section, and the status bar.

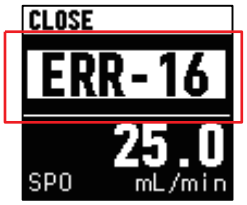


■ Top section of the main screen: Display of PV and errors or alarms

The PV is always displayed in the top section of the main screen that appears at power-on.
If an error or alarm has occurred, the PV and the error or alarm are alternately displayed.
The F4Q can display a value of up to 7 digits (including "–" (minus) and "." comma).
A value exceeding 7 digits will be displayed as "-------".



If neither an error nor an alarm has occurred
: The PV is always displayed.



If an error or alarm has occurred
: The PV and the error or alarm are alternately displayed.

Handling Precautions

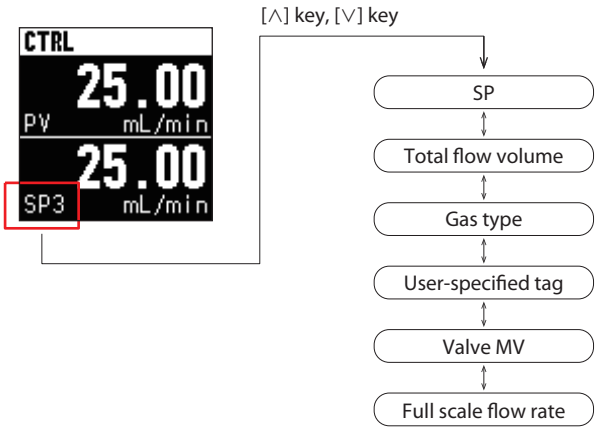
- In fully open mode, the instantaneous flow rate may exceed the maximum measurable flow rate depending on the operating differential pressure. In this case, the maximum measurable flow rate is displayed as PV.

Note

- ☞ Chapter 7. Troubleshooting (p. 7-1) (for details on errors and alarms)

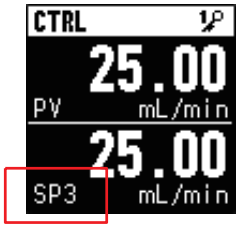
■ Bottom section of the main screen: Multi-information display

The SP is displayed in the bottom section of the main screen that appears at power-on.
You can display the following multiple types of information by pressing the [∧] or [∨] key.
SP, totalized flow volume, gas type, user-specified tag, valve opening, full-scale flow rate



● SP

When the SP is displayed at the bottom section of the screen, how the current SP is set is displayed at the lower left of the screen.



Note

- ☞ 4-2 Flow Rate Setting (p. 4-7) (for details on the SP setting procedure)

Display at the lower left of the screen	Description
SPx (x: 0 to 7)	Select the SP from SP-0 to SP-7.
SP: AI	SP set with analog input
SPx:DI (x: 0 to 7)	Digital input switches the SP in a range between SP-0 and SP-7.
SP: COM	Online SP

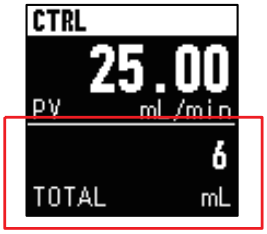
● Totalized flow volume

The display unit for the totalized flow volume can be selected from [mL], [L], and [m³] with C43 (totalized flow rate unit (display)).

Note

- ☞ ● Function code setup (p. 5-1) (for how to set the function codes)

Up to 10 digits can be displayed.
If mL is selected as the unit of measurement, it is automatically switched to L if the value has more than 10 digits. The backup cycle for the totalized flow volume is 1 second.

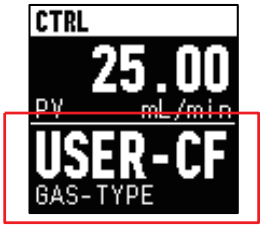


Note

- ☞ ● Total flow volume reset (p. 5-41) (for totalized flow volume reset)

● Gas type

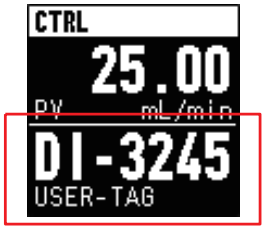
The gas type displays the currently selected gas.



Display	Description
USER-CF	Gas type set by the user
AIR	Air/nitrogen
O_2	Oxygen
Ar	Argon
CO_2	Carbon dioxide (CO_2)
C_3H_8	100 % propane
CH_4	100 % methane
C_4H_{10}	100 % butane
13A45MJ	Fuel gas 13A (45MJ/m³)

● User-specified tag

Any character string consisting of up to seven characters can be displayed.

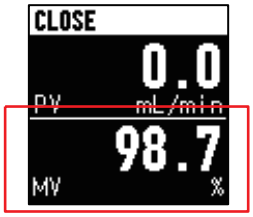


Note

- The user-specified tag can be set using the loader.
  ☞ ● User tag specification (p. 6-5) (for details)

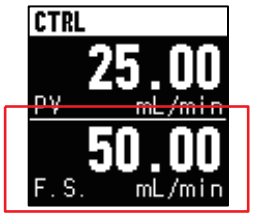
● Valve opening

The degree of valve opening (MV) is displayed by 0 to 100 %.



● Full-scale flow rate

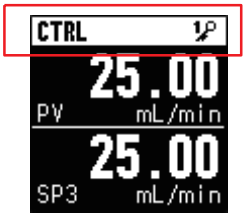
The full-scale flow rate (the maximum control range for the selected gas type) is displayed. The full-scale flow rate is determined by the combination of the model and the gas type. ☞ ■ Standard gases: gas types and control ranges (p. 8-12) (for details)



■ Status bar

Various kinds of information (valve operation mode, event status, and key lock status) can be seen on the status bar.

Status bar



● Valve operation mode

Control

Fully open

Fully closed

Maintaining

Note

- ☞ 4-3 Valve Operation Mode Switching (p. 4-14) (for how to switch the valve's operation mode)

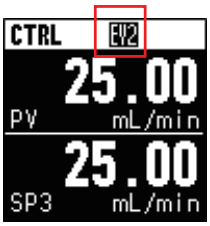
● Event occurrence and clearing (EV1: flow rate deviation event, EV2: totalized flow volume event)

EV1: The flow rate deviation event has occurred.

When the EV1 icon is not displayed

The flow rate deviation event is cleared.

EV2: The totalized flow volume event has occurred.



When the EV2 icon is not displayed

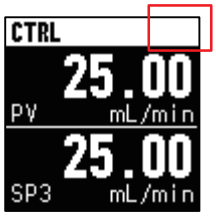
The totalized flow volume event is cleared.

Note

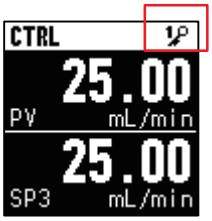
- ☞ ● Flow rate deviation event (p. 5-22) (for details on the flow rate deviation event)
  ☞ ● Totalized flow volume event (p. 5-32) (for details on the totalized flow volume event)

● **Key lock status**

Key lock disabled



Settings other than flow rate (SP) and valve control key are key-locked



All settings are key-locked

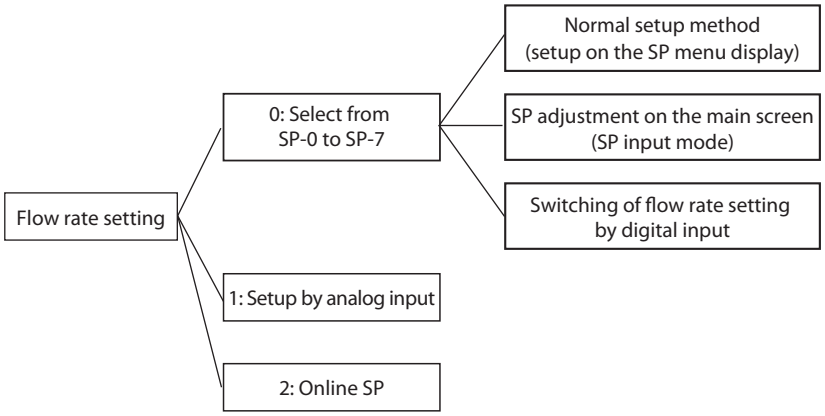
Note

- ☞ ● Key lock function (display panel of this device) (p. 5-10) (for details on key lock)

4 - 2 Flow Rate Setting

■ Flow rate setup method (SP setup method selection)

You can set the flow rate with the procedures shown below.
You can select from SP-0 to SP-7 or use setup by analog input or online SP.



● Related function codes and parameters

Function code	Name	Description and setting range	Initial value	Notes
C03	Flow rate setup method (SP setup method selection)	0: Select from SP-0 to SP-7 1: Setup by analog input 2: Online SP	0	0: Select from 8 preset SPs (SP-0 to SP-7). 1: Change the SP using the designated external voltage or current input. 2: Use RS-485 communication or the loader. The value set by the online SP method is used as is.

Note

- ☞ ● Function code setup (p. 5-1) (for how to set the function code)

● Switching the flow rate setup method with digital input (advanced use)

The flow rate setup method can be switched by turning the digital input ON or OFF.
If the relevant digital input is OFF, the setting in C03 (flow rate setup method (SP setup method selection)) is applied. If the relevant digital input is ON, setup by analog input is used.

Note

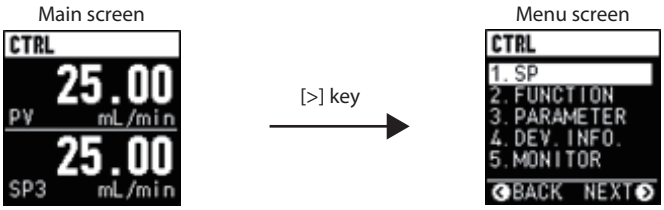
- ☞ ● Digital input functions (p. 5-16) (for details on assignment of functions to digital inputs 1, 2, and 3)
- ☞ ■ Setup by analog input (p. 4-13) (for details on flow rate change with setup by analog input)

■ Select from SP-0 to SP-7

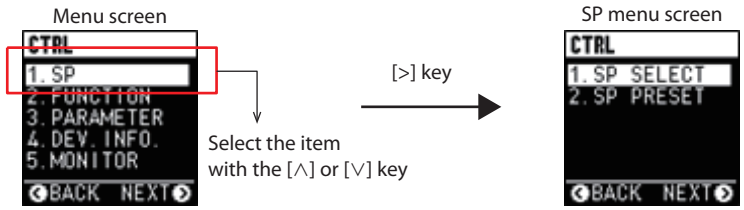
Select "0" (select from SP-0 to SP-7) for C03 (flow rate setup method (SP setup method selection)) to be able to select the SP from eight preset values (SP-0 to SP-7).

● Normal setup method (setup on the SP menu display)

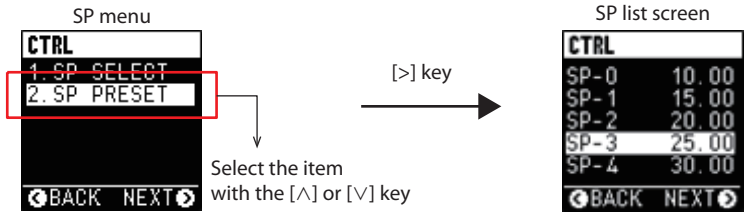
(1) Press the [>] key with the main screen displayed.
≫ The menu screen is displayed.



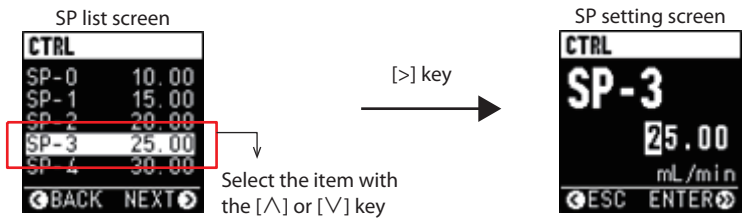
(2) Select [1. SP] on the menu screen with the [∧] or [∨] key and press the [>] key.
≫ The SP menu screen is displayed.



(3) Press the [∧] or [∨] key to select [2. SP PRESET] and press the [>] key.
≫ The SP list screen is displayed.



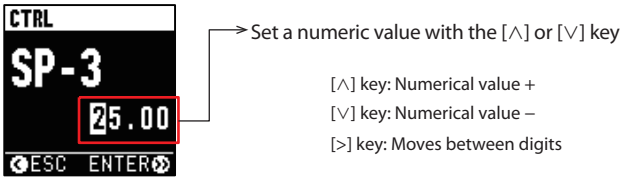
(4) Press the [∧] or [∨] key to select the desired item and then press the [>] key.
≫ The SP setting screen is displayed.



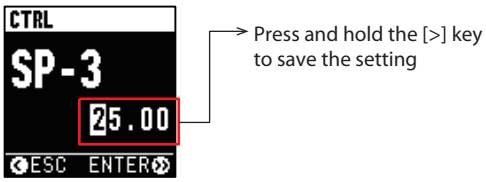
(5) Change the value using the [∨], [∧], and [>] keys.

Handling Precautions

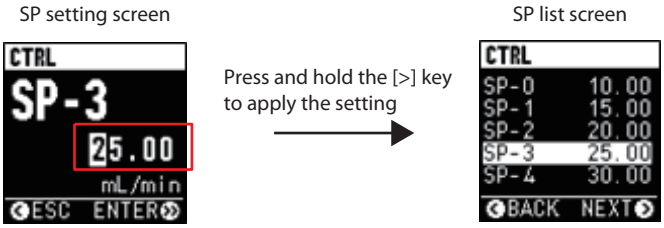
- The valid control range for the SP is from 1 to 100 % FS. Set 0 or a value in the range from 1 to 100 % FS.



(6) Press and hold the [>] key.

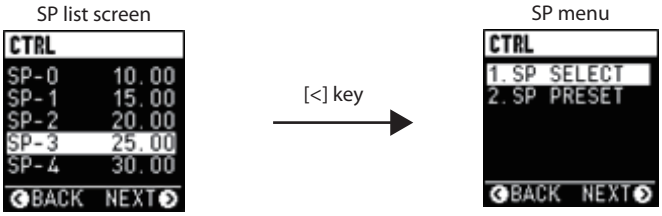


≫ The set value is applied and the display returns to the SP list screen. (The set value is saved at this time.)

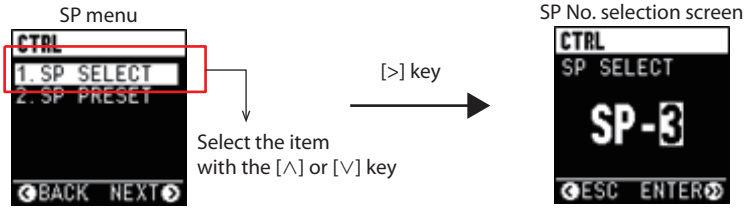


(7) To set other SPs, repeat steps (4) to (6).

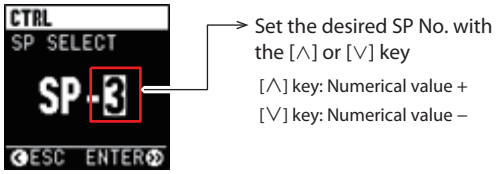
(8) Press the [<] key to return to the SP menu screen.



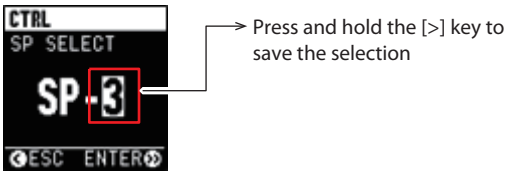
(9) Press the [∧] or [∨] key to select [1. SP SELECT] and press the [>] key.
≫ The SP No. selection screen is displayed.



(10) Press the [∧] or [∨] key to select the desired SP No.



(11) Press and hold the [>] key.

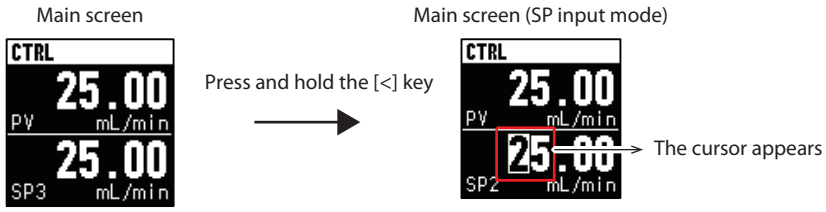


≫ The SP No. is applied and the display returns to the SP menu screen. (The SP No. is saved at this time.)

● SP setup on the main screen (SP input mode)

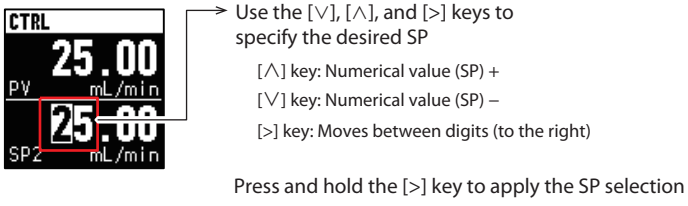
You can also directly adjust the SP on the main display without opening the SP menu screen.

(1) When you press and hold the [<] key with the main screen displayed, the SP input mode is enabled. (The SP input mode can be enabled only if "0" (select from SP-0 to SP-7) is selected for C03 (flow rate setup method (SP setup method selection)).) In SP input mode, the cursor appears and is highlighted.



(2) Press the [∨], [∧], and [>] keys to select the desired SP.

Main screen (SP input mode)



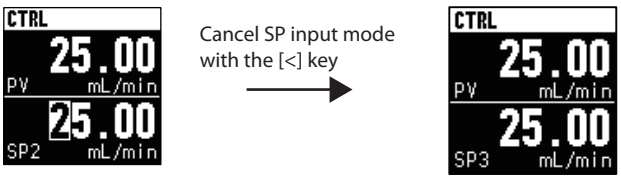
(3) After entering a value, press and hold the [>] key and apply the SP.

! Handling Precautions

- The valid control range for the SP is from 1 to 100 % FS. Set 0 or a value in the range from 1 to 100 % FS.

(4) To return from SP input mode to the previous screen, press the [<] key.

Main screen (SP input mode)



● Direct setup function (advanced use)

If gradual changing of the SP is desired, set C21 (direct setup function) to 1 (Enabled) in order to use the currently input SP in SP input mode for control. When you exit the SP input mode, the SP will return to its original value. Press and hold the [>] key to apply the adjusted SP.

● Related function codes and parameters

No.	Name	Description and setting range	Initial value	Notes
C21	Direct setup function	0: Disabled 1: Enabled	0	Use this function to directly adjust the SP on the main screen in SP input mode. 0: The entered value is not applied as the control SP until the confirmation operation is completed. 1: The entered value is immediately used as the control SP. (Control will follow the changing SP.)

Note

- ☞ ● Function code setup (p. 5-1) (for how to set the function code)

● SP No. switching with digital input

You can select one of the eight SPs (SP-0 to SP-7) set with the normal setup method by ON/OFF combinations of digital inputs.

Note

- ☞ ● Digital input functions (p. 5-16) (for details on assignment of functions to digital inputs 1, 2, and 3)

● When C10 (digital input 1 function assignment), C11 (digital input 2 function assignment) and C12 (digital input 3 function assignment) are all set to "3" (SP No. switching)

	Input 3 (DI3)	Input 2 (DI2)	Input 1 (DI1)	Selected SP No.
Digital input status	OFF	OFF	OFF	SP-0
	OFF	OFF	ON	SP-1
	OFF	ON	OFF	SP-2
	OFF	ON	ON	SP-3
	ON	OFF	OFF	SP-4
	ON	OFF	ON	SP-5
	ON	ON	OFF	SP-6
	ON	ON	ON	SP-7

- **When any two of C10 (digital input 1 function assignment), C11 (digital input 2 function assignment) and C12 (digital input 3 function assignment) are set to "3" (SP No. switching)**

	Combination of digital inputs		Selected SP No.
	DI2	DI1	
	DI3	DI1	
	DI3	DI2	
Digital input status	OFF	OFF	SP-0
	OFF	ON	SP-1
	ON	OFF	SP-2
	ON	ON	SP-3

- **When one of C10 (digital input 1 function assignment), C11 (digital input 2 function assignment) and C12 (digital input 3 function assignment) is set to "3" (SP No. switching)**

	DI1/DI2/DI3	Selected SP No.
Digital input status	OFF	SP-0
	ON	SP-1

Handling Precautions

- When one of C10 (digital input 1 function assignment), C11 (digital input 2 function assignment) and C12 (digital input 3 function assignment) is set to "3" (SP No. switching), the display cannot be operated and the SP No. cannot be changed through communication or with the loader. (The values for SP-0 to SP-7 can be changed.)

■ Setup by analog input

When 1 (setup by analog input) is selected for C03 (flow rate setup method (SP setup method selection)), the SP (flow rate set point) can be changed with external voltage or current for setup.
For setup by analog input, the voltage and current values for the SP can be calculated using the relevant formula in the following table.
The valid control range of the SP is from 1 to 100 % FS. Set 0 or a value in the 1–100 % FS range.

C06 (analog input and output type and range selection)	Input voltage/ current range	Voltage/current calculation formula for setup*
0: 0–5 V (PV output) 4: 0–5 V (SP output)	0–5 V	Setup voltage [V] = Flow rate set point ÷ Full-scale flow rate × 5
1: 1–5 V (PV output) 5: 1–5 V (SP output)	1–5 V	Setup voltage [V] = Flow rate set point ÷ Full-scale flow rate × 4 + 1
3: 4–20 mA (PV output) 7: 4–20 mA (SP output)	4–20 mA	Setup current [mA] = Flow rate set point ÷ Full-scale flow rate × 16 + 4

* Use a setup voltage or current that causes the flow rate set point to fall within the 1–100 % FS range.

Note

- The full-scale flow rate can be checked with the ☞ multi-information display shown at the bottom section of the main display.

● Advanced use

By enabling the optional analog scaling function, you can freely change the full-scale flow rate when using setup by analog input. In that case, the full-scale flow rate for analog flow rate output voltage/current (PV output voltage/current) will change accordingly.

Note

- ☞ ● Optional analog scaling (two types) (p. 5-14) (for details)

■ Online SP

When "2" (online SP) is selected for C03 (flow rate setup method (SP setup method selection)), the value written into the online SP parameter through RS-485 communication or loader communication is used as the flow rate set point. Note that the online SP will be reset to zero if the power is turned off.

Note

- ☞ *User's Manual for Loader Package Model MLP-F4Q for Digital Mass Flow Controller Model F4Q* (CP-SP-1457E) (for details on RS-485 communication)
- ☞ Chapter 6. Operations Using the PC Loader (for details on the loader)

4-3 Valve Operation Mode Switching

The valve can be switched between the following three operation modes:

- Control
- Fully closed
- Fully open

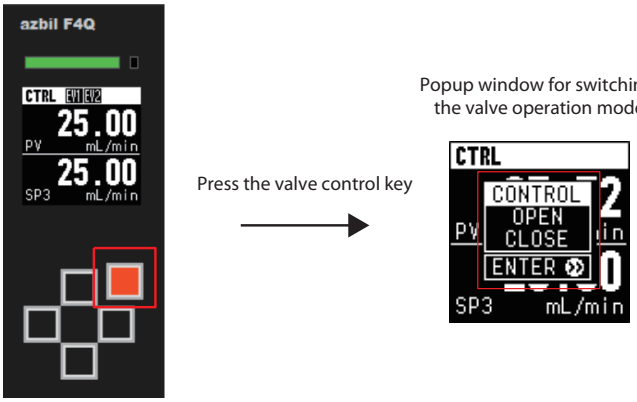
The valve's operation mode can be switched with the valve control key on the device or by digital input. The operational mode can also be set to switch automatically if an error or event occurs.

Note

- ☞ ● Valve operation mode switching when an error occurs (p. 5-34) (for details on mode switching in case of an error)
- ☞ ● Valve operation mode changeover when flow rate deviation event occurs (p. 5-23) or ● Automatic valve shutoff when the totalized flow volume event occurs (p. 5-33) (for details on mode switching in case of an event)
- The current valve operation mode can be checked on the status bar. ☞ ■ Status bar (p. 4-5) (for details)

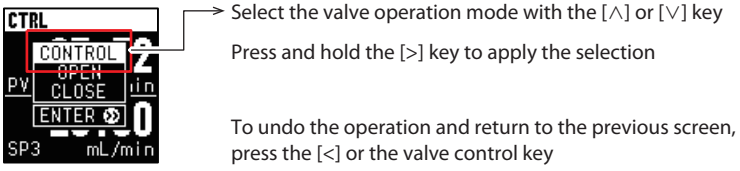
■ Switching with the keys

(1) Press the valve control key. (This operation can be performed on any screen.)
≫ A popup window for switching the valve's operation mode is shown.



(2) Select the desired valve operation mode by pressing the [∨] or [∧] key.

(3) Press and hold the [>] key.
(To undo the operation and return to the previous screen, press the [<] or the valve control key.)



≫ The valve's new operation mode is applied.

Handling Precautions

- When C01 (key lock) is set to "1" (all settings are key-locked), pressing the valve control key does not switch the valve's operation mode.

■ Valve operation mode switching with digital input

Set the relevant value in the following table to C10, C11, or C12 (digital input 1/2/3 function assignment) to switch to or forcibly set the valve operation mode by turning the digital input ON or OFF.

Setting	Function	Notes
5	Operational mode forced fully closed by contact ON	The original operational mode is enabled again if digital input is turned OFF again.
6	Operational mode forced fully open by contact ON	
8	Operational mode switching (control by contact ON, forced fully closed by contact OFF)	When digital input is turned ON, control mode is enabled. However, the operational mode can be changed while digital input is ON if an event or error occurs or if there is another request by communication or by use of the keys.

Note

- ☞ "Digital input functions" (for details on assignment of functions to digital inputs 1, 2, and 3)

Handling Precautions

- If there is a conflict between forced full-close and forced full-open commands from two digital inputs, both inputs are considered invalid.
- When the above function has forced the fully closed or open mode, the valve operation mode cannot be changed by the valve control key or by communication.

■ Operational mode selection when the power is turned ON

The operation mode when the power is turned ON can be selected from control mode, the mode before the power was shut down, and the fully closed mode, depending on the setting of C02 (operational mode selection when power turned ON). However, the device will start in fully closed mode immediately after power-on (for about 1 second).

- **Related function codes and parameters**

Function code	Name	Description and setting range	Unit	Initial value	Notes
C02	Operational mode selection when power turned ON	0: Control mode 1: Mode before power shutdown 2: Fully closed mode	-	1	1: The operational mode is saved on a 1 second cycle. If the power needs to be turned off after changing the operational mode, allow enough time for doing so.

Note

- ☞ ● Function code setup (p. 5-1) (for how to set the function code)

Chapter 5. Advanced Operations

5 - 1 Function Setup

This section describes how to set up functions.

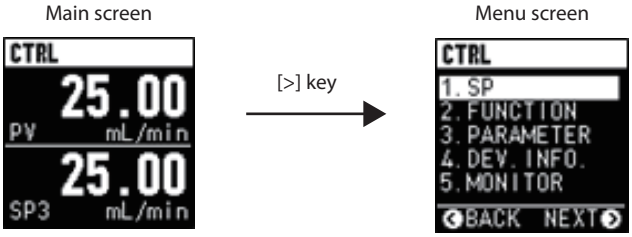
Note

- ☞ 5 - 2 Function Details (for details on the functions)

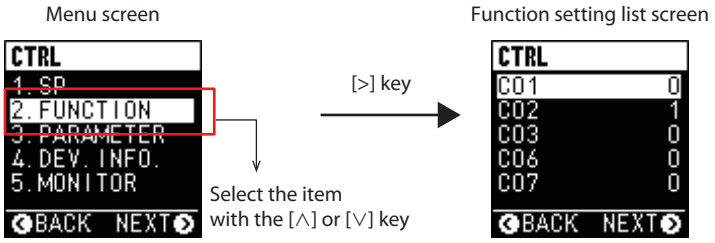
■ Setup procedure

● Function code setup

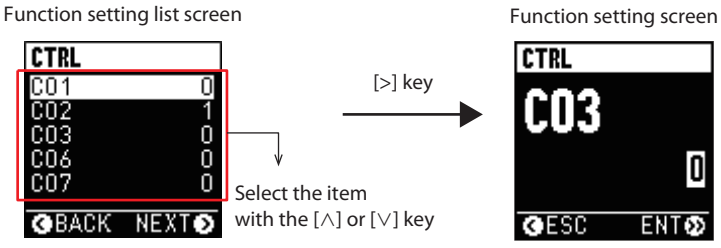
(1) Press the [>] key on the main screen (or press the [<] key several times on the current display) to display the menu screen.



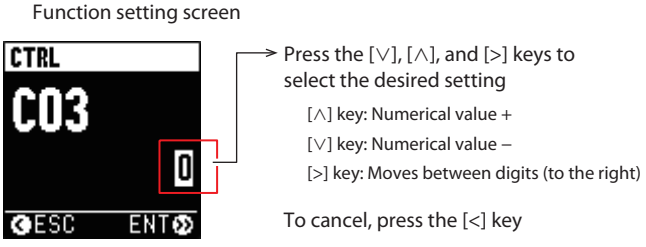
(2) Select [2. FUNCTION] on the main screen with the [∨] or [∧] key and press the [>] key.
≫ The function setting list screen is displayed.



(3) Press the [∨] or [∧] key to select the desired item and then press the [>] key.
≫ The function setting screen is displayed.



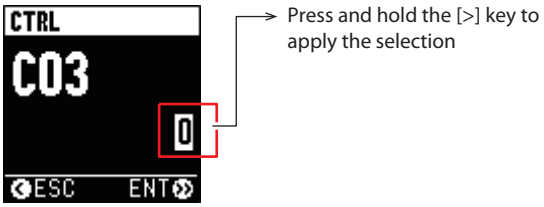
(4) Press the [∨], [∧], and [>] keys to select the desired setting (value).
Use the [>] key to move to the input digit.
To cancel, press the [<] key to return to the previous screen.



(5) Press and hold the [>] key.

≫ The set value is applied. (The set value is saved at this time.)

Function setting screen

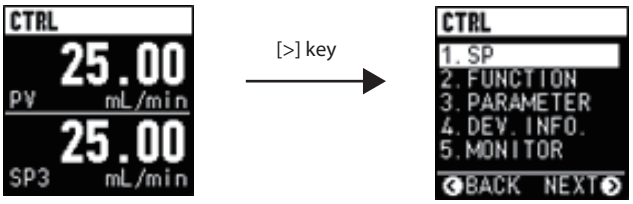


● Parameter setup

(1) Press the [>] key on the main screen (or press the [<] key several times on the current display) to display the menu screen.

Main screen

Menu screen

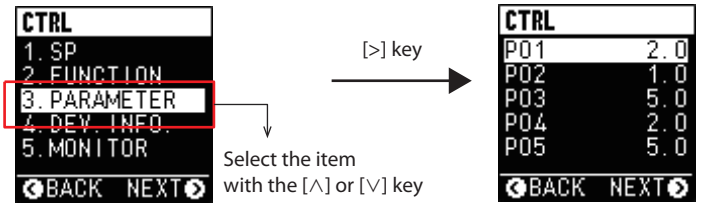


(2) Select [3. PARAMETER] on the main screen with the [∨] or [∧] key and press the [>] key.

≫ The parameter setting list screen is displayed.

Menu screen

Parameter setting list screen

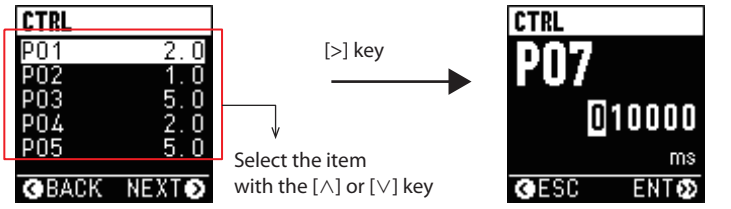


(3) Press the [∨] or [∧] key to select the desired item and then press the [>] key.

≫ The parameter setting screen is displayed.

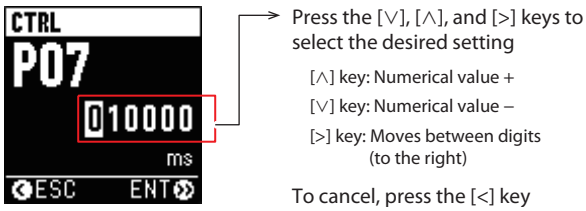
Parameter setting list screen

Parameter setting screen



(4) Press the [∨], [∧], and [>] keys to select the desired setting (value).
Use the [>] key to move to the input digit.
To cancel, press the [<] key to return to the previous screen.

Parameter setting screen



(5) Press and hold the [>] key.

≫ The set value is applied. (The set value is saved at this time.)

■ Settings

Function code	Item	Description and setting range	Initial value	Notes	Related function codes and parameters
C01	Key lock	0: Key lock disabled 1: Settings except flow rate (SP) and RUN are key-locked 2: All settings are key-locked	0	0:Keys are always unlocked. (The lock status cannot be changed.) 1: Only valve control and SP setting are available. (Also, the lock status can be changed.) 2: No settings can be changed (except the lock status). Note: Press the [<] key and [>] key at the same time to change the lock status. When the password is set with P31 (key lock password), you must also enter the password.	P31
C02	Operational mode selection when power turned ON	0: Control mode 1: Mode before power shutdown 2: Fully closed mode	1	1: The operational mode is saved on a 1 second cycle. If the power needs to be turned off after changing the operational mode, allow enough time for doing so.	-
C03	Flow rate setup method (SP setup method selection)	0: Select from SP-0 to SP-7 1: Setup by analog input 2: Online SP	0	0: Select from 8 preset SPs (SP-0 to SP-7). 1: Change the SP using the designated external voltage or current input. 2: Use RS-485 communication or the loader. The value set by the online SP method is used as is.	C10-C12
C06	Analog input and output type and range selection	0: 0–5 V (PV output) 1: 1–5 V (PV output) 3: 4–20 mA (PV output) 4: 0–5 V (SP output) 5: 1–5 V (SP output) 7: 4–20 mA (SP output)	0	The scale can be changed to any analog scale. (☞ C28 Optional analog scaling function)	C28
C07	Digital output 1 type assignment	0: Not used (always OFF) 1: ON when totalized flow volume event occurs 2: Totalizer pulse output 3: ON when flow rate is OK 4: ON when operation mode = control 5: ON when operation mode = fully open 6: ON when operation mode = control or fully open 7: ON when operation mode = fully closed 8: ON when error occurs 9: ON when error or alarm occurs 10: ON when flow rate deviation event occurs –1: OFF when totalized flow volume event occurs –2: Totalizer pulse OFF output –3: OFF when flow rate is OK –4: OFF in control mode –5: OFF in fully open mode –6: OFF in control or fully open mode –7: OFF in fully closed mode –8: OFF when error occurs –9: OFF when error or alarm occurs –10: OFF when flow rate deviation event occurs	0	Selects the value output to digital output 1 (does not affect the other two digital outputs). –1 to –10: Always OFF when the power is off. The delay time can be specified with P08 (digital output 1 delay time). (The value is reflected in items except the totalizer pulse output.)	P08, P01-P02, P03-P07, P18, P33-P34
C08	Digital output 2 type assignment		0	Selects the value output to digital output 2 (does not affect the other two digital outputs). –1 to –10: Always OFF when the power is off. The delay time can be specified with P09 (digital output 2 delay time). (The value is reflected in items except the totalizer pulse output.)	P09, P01–P02, P03–P07, P18, P33–P34

Function code	Item	Description and setting range	Initial value	Notes	Related function codes and parameters
C10	Digital input 1 function assignment	0: Not used 1: Total flow volume reset 2: Totalized flow count pause 3: SP No. switching 4: Flow rate setting method selection 5: Operation mode forced fully closed by contact ON 6: Operation mode forced fully open by contact ON 7: SP ramp control ON/OFF switching 8: Operation mode switching (control by contact ON, forced fully closed by contact OFF) 9: Flow rate zero point adjustment 10: Gas type setting switching 11: Analog scaling switching 12: SP ramp control gradient switching 13: Device status deletion (except for errors)	0	4: Analog setup is used when the input is ON. The setting in C03 (flow rate setup method) is used when the input is OFF. 5, 6, 8: If forced full-close and forced full-open are input to two digital inputs at the same time, both inputs will be invalid. 7: SP ramp control is enabled when the input is ON and disabled when the input is OFF. 9: Enable the fully closed mode or set the SP to zero in control mode and keep the digital input ON for at least 10 seconds. 10: C18 (gas type selection 1) is applied when the input is OFF. C26 (gas type selection 2) is applied when the input is ON. 11: P17 (analog scaling 1) is applied when the input is OFF. P32 (analog scaling 2) is applied when the input is ON. 12: The device operates with P15 (SP ramp control slope 1) when the input is OFF and P16 (SP ramp control slope 2) when the input is ON. 13: The device status (alarm, warning, information) is deleted.	Various
C11	Digital input 2 function assignment				
C12	Digital input 3 function assignment				
C13	Automatic valve shutoff when the totalized flow event occurs	0: Disabled 1: Enabled	0	1: The valve operation mode is automatically switched to fully closed if a totalization event occurs.	P18, P19
C14	On/off of totalized flow reset function at start of control	0: Disabled 1: Enabled	0	1: The totalized flow volume is automatically reset when control starts (when the valve operation mode is set to control mode).	
C15	Flow rate deviation event setup	0: Disabled 1: Enabled only for upper limit event 2: Enabled only for lower limit event 3: Enabled for upper/lower limit event	3	This function code individually enables or disables the upper limit and lower limit flow rate events.	P03–P07, C07, C08, C44
C16	Operational mode at error occurrence	1: No change 2: Forced fully closed 3: Forced fully open 4: Fixed valve MV	1	4: Set a fixed value with P27 (valve manipulated variable when error occurs).	P27
C18	Gas type selection 1	0: Gas type set by the user 1: Air/nitrogen 2: Oxygen 3: Argon 4: Carbon dioxide (CO_2) 6: 100 % propane 7: 100 % methane 8: 100 % butane 11: Fuel gas 13A (45MJ/m^3)	1	If the flow rate range changes due to a change in the gas type, change the flow rate OK range, flow rate deviation event, and other items in the parameter setup as needed. 0: Sets P10 (user-set gas conversion factor (C.F.)). 2, 6, 7, 8, 11: Not available for models with EPDM gasket specifications.	P10, C26
C19	Temperature at reference conditions	0: 20 °C 1: 0 °C 2: 25 °C 3: 35 °C	1	The standard temperature used when converting the measured mass flow rate (mass flow) into the volumetric flow rate can be selected.	
C21	Direct setup function	0: Disabled 1: Enabled	0	Use this function code to directly adjust the SP on the main screen in SP input mode. 0: The entered value is not applied as the control SP until the confirmation operation is completed. 1: The entered value is immediately used as the control SP. (Control will follow the changing SP.)	

Function code	Item	Description and setting range	Initial value	Notes	Related function codes and parameters
C23	PV filter constant	0 to 9999 [ms]	*	First-order lag low-pass filter is applied to the PV value. Setting 0 disables the PV filter. * The initial value differs according to the model. 9200/9500/0002/0005/0020/0050/0100: 100 ms 0200: 150 ms	
C26	Gas type selection 2	0: Gas type set by the user 1: Air/nitrogen 2: Oxygen 3: Argon 4: Carbon dioxide (CO_2) 6: 100 % propane 7: 100 % methane 8: 100 % butane 11: Fuel gas 13A (45MJ/m^3)	1	If the flow rate range changes due to a change in the gas type, change the flow rate OK range, flow rate deviation event, and other items in the parameter setup as needed. 0: Sets P10 (user-set gas conversion factor (C.F.)). 2, 6, 7, 8, 11: Not available for models with EPDM gasket specifications. This setting is enabled only when gas type setting switching is selected for C10, C11, or C12 (digital input 1/2/3 function assignment) and the relevant digital input is ON.	P10, C10–C12
C27	SP ramp control function	0: Disabled 1: Ramp control 1 enabled 2: Ramp control 2 enabled	0	1: The device operates with P15 (ramp control slope 1) when the PV is increasing and P16 (ramp control slope 2) when the PV is decreasing. 2: When SP ramp control slope switching is selected for C10, C11, or C12 (digital input 1/2/3 function assignment), the device operates with P15 (ramp control slope 1) when the relevant digital input is OFF and with P16 (ramp control slope 2) when the relevant digital input is ON.	P15, P16 C10, C11, C12
C28	Optional analog scaling function	0: Disabled 1: Enabled	0	0: The flow rate at analog input/output 100 % (5 V or 20 mA) (called analog scaling) is the full-scale flow rate automatically determined according to the model No. and selected gas type. 1: Analog scaling can be freely changed (10 % FS to 1000 % FS). The value can be set with P17 (analog scaling 1).	P17, P32 C10–C12
C29	PV filter option	0: None 1: PV fluctuation control function when fully closed: enabled 2: Filter application during response: enabled 3: Both the above functions are enabled.	3	1: The filter time constant is switched to the set value (which can be changed only with the loader, using "PV fluctuation control filter time constant in fully closed mode") after the delay time has passed since the valve was fully closed (including the case where the SP is 0 in control mode).	P20
C30	Communication address setting	0: Communication function disabled 1 to 127: Communication address	0	Specifies the device address for RS-485 communication.	
C31	Transfer speed selection	0: 38400 bps 1: 19200 bps 2: 9600 bps 3: 4800 bps	1	Specifies the transfer speed for RS-485 communication.	
C32	Data format selection	0: Even parity, 1 stop bit 1: No parity, 2 stop bits	0	Specifies the communication conditions for RS-485 communication.	
C33	Communication protocol	0: Modbus-RTU 1: CPL	1	Specifies the communication protocol for RS-485 communication. Restart the device to apply the new setting.	
C34	Installation orientation setup	0: Horizontal → 1: Vertical ↑ 2: Vertical ↓	0	1:Corrects flow rate characteristics of a gas flowing upward. 2:Corrects flow rate characteristics of a gas flowing downward. If 1 or 2 is set, be sure to set P23 (primary pressure specification) and adjust the flow rate zero point.	P23
C35	SP limit function	0: Disabled 1: Only upper limit enabled 2: Only lower limit enabled 3: Upper and lower limits enabled	0	Flow rate controllability can be optimized for the use environment (primary pressure and secondary pressure). Select "3" (PID set by user) to freely set the PID values using the PC loader.	P21, P22

Function code	Item	Description and setting range	Initial value	Notes	Related function codes and parameters
C36	Control response setup	0: Response prioritized 1: Standard 2: Stability prioritized 3: PID set by user	1	Flow rate controllability can be optimized for the operating environment. 0: Select this when faster control response is desired. Suitable for low differential pressure applications. 2: Select this to suppress ringing, etc. Suitable for high differential pressure applications. 3: Any PID values can be specified using the PC loader.	
C37	Flow rate display unit change function	0: mL/min 1: L/min 2: m^3/h	*	You can change the unit for the flow rate value displayed on the display panel of the device. * The initial value varies depending on the model.	
C38	Flow rate digits after decimal point (display)	0 to 3	*	You can change the digits after the decimal point for the flow rate value displayed on the display panel of the device. * The initial value varies depending on the model.	
C43	Totalized flow rate unit (display)	0: mL 1: L 2: m^3	*	You can change the unit for the total flow rate value displayed on the display panel of the device. If 0 (mL) is set, the display unit is automatically switched to L if the value has more than 10 digits. * The initial value varies depending on the model.	
C44	Digital output 3 type assignment	Same as C07 and C08.	8	Selects the value output to digital output 3 (does not affect the other two digital outputs). −1 to −10: Always OFF when the power is off. The delay time can be specified with P28 (digital output 3 delay time). (The value is reflected in items other than totalizer pulse output.)	P28
C46	Operation when flow rate deviation event occurs	0: No change 1: Fully closed 2: Fully open	0	The valve operation mode is automatically switched if a flow rate deviation event occurs.	C15, P03, P04, P05, P06, P07
C47	Totalized flow rate communication data format	0: First 4 digits + last 4 digits 1: Upper 16 bits + lower 16 bits	0	Specifies the totalized flow volume communication data format used for RS-485 communication. ☞ *Digital Mass Flow Controller Model F4Q User's Manual for RS-485 Communication Functions* (CP-SP-1458E) (for details)	
C48	Flow rate unit (communication)	0: mL/min 1: L/min 2: m^3/h	*	Specifies the unit and the digits after the decimal point for the flow rate used for RS-485 communication. ☞ *Digital Mass Flow Controller Model F4Q User's Manual for RS-485 Communication Functions* (CP-SP-1458E) (for details) * The initial value varies depending on the model.	
C49	Flow rate digits after the decimal point (communication)	0 to 3	*		
C50	Totalized flow rate unit (communication)	0: mL 1: L 2: m^3	*	Specifies the unit and the digits after the decimal point for the totalized flow volume used for RS-485 communication. ☞ *Digital Mass Flow Controller Model F4Q User's Manual for RS-485 Communication Functions* (CP-SP-1458E) (for details) * The initial value varies depending on the model.	
C51	Totalized flow rate digits after the decimal point (communication)	0–3	*		
C52	Display orientation setup	0: LEDs left, keys right 1: LEDs below, keys above 2: LEDs above, keys below 3: LEDs right, keys left	0	The display direction and key allocation of the LCD can be switched to make it easy to read according to the installation direction.	
C53	Analog output when error occurs	0: Normal output 1: Zero output 2: Full output	0	0: Same analog output as at normal times. 1: 0 V or 0 mA is output. Voltage or current is determined by the setting for C06 (analog input and output type and range selection). 2: 6 V or higher or 24 mA or higher is output. Voltage or current is determined by the setting for C06 (analog input and output type and range selection). Note: The analog output may not be as set if an error has occurred, since in that case perfect operation cannot be guaranteed.	

Parameter No.	Item	Description and setting range	Initial value	Notes	Related function codes and parameters
P01	Flow rate OK judgment range	(0.5 to 100 % FS)*1	(2 % FS)*1	Specifies the allowable range for flow rate OK judgment.	C07, C08, C44
P02	Flow rate OK judgment hysteresis	(0.5 to 100 % FS)*1	(1 % FS)*1	Specifies the hysteresis for flow rate OK judgment. Specify a value smaller than P01 (flow rate OK judgment range).	
P03	Flow rate deviation upper limit event	(0.5 to 100 % FS)*1	(10 % FS)*1	Ensure that P03 (flow rate deviation upper limit event) is greater than or equal to P04 (flow rate deviation upper limit event hysteresis).	C15, C46, C07, C08, C44
P04	Flow rate deviation upper limit event hysteresis	(0.5 to 100 % FS)*1	(2 % FS)*1		
P05	Flow rate deviation lower limit event	(0.5 to 100 % FS)*1	(10 % FS)*1	Ensure that P05 (flow rate deviation lower limit event) is greater than or equal to P06 (flow rate deviation lower limit event hysteresis).	
P06	Flow rate deviation lower limit event hysteresis	(0.5 to 100 % FS)*1	(2 % FS)*1		
P07	Flow rate deviation event judgment delay time	500 to 999,900 [ms]	10000	Specifies the delay time for the flow rate deviation event.	
P08	Digital output 1 delay time	0 to 999,900 [ms]	0	Specifies the delay time for digital output 1. (The value is reflected in items except the totalizer pulse output.)	C07
P09	Digital output 2 delay time	0 to 999,900 [ms]	0	Specifies the delay time for digital output 2. (The value is reflected in items except the totalizer pulse output.)	C08
P10	User-set gas conversion factor (C.F.)	0.040 to 9.999	1.000	This value is applied when 0 (gas type set by the user) is selected for C18 (gas type selection 1) or C26 (gas type selection 2).	C18, C26
P15	SP ramp control slope 1	Model F4Q9200/9500: 0.0 to 999.9 [mL/min] Model F4Q0002/0005: 0.000 to 9.999 [L/min] Model F4Q0020/0050: 0.00 to 99.99 [L/min] Model F4Q0200: 0.0 to 999.9 [L/min]	0	Specifies the change in flow rate per second. When you set 0 (initial value), SP ramp control is disabled. (The value immediately changes to the changed SP.)	C27
P16	SP ramp control slope 2				
P17	Analog scaling 1	(10 to 1000 % FS)*1	(100 % FS)*1	Specifies the flow rate at analog input/output 100 % (5 V or 20 mA) (called analog scaling) when C28 (optional analog scaling function) is set to enabled.	C28
P18	Cumulative flow event setting	0 to 999,999,999,999,999 [mL]	0	When this is 0, the totalization event is disabled.	C13, C07, C08, C44
P20	PV fluctuation control delay time when fully closed	0 to 9,999,999 [ms]	5000	Specifies the time from when the valve is fully closed to when the PV fluctuation control function starts operating.	C29
P21	SP upper limit flow rate	(10 to 100 % FS)*1	(100 % FS)*1	Ensure that P21 (SP upper limit flow rate) is greater than or equal to P22 (SP lower limit flow rate).	C35
P22	SP lower limit flow rate	(10 to 100 % FS)*1	(0 % FS)*1		
P23	Primary pressure specification	5 to 500 [kPa (gauge)]	*	This setting is valid only when C34 (installation orientation setup) is set to "1" (vertical ↑) or "2" (vertical ↓). *The initial value differs according to the model. F4Q0050(J,K): 50 kPa Other: 200 kPa	C34, C18, C26

Parameter No.	Item	Description and setting range	Initial value	Notes	Related function codes and parameters
P26	Low flow cutoff threshold	0 to 99.99 [% FS]	0.50	PV is regarded as 0 when the measured flow rate is less than the flow rate specified with this parameter.	
P27	Valve manipulated variable when error occurs	0 to 100 [%]	50	Set C16 (operational mode at error occurrence) to 4 (fixed value MV) to automatically switch the valve opening to this set value if an error occurs.	C16
P28	Digital output 3 delay time	0 to 999,900 [ms]	0	Specifies the delay time for digital output 3. (The value is reflected in items except the totalizer pulse output.)	C44
P29	Automatic display off time	0: Always on (automatic display off function disabled) 1 to 9999: automatic display off time	0	The display is automatically turned off if the keys are not used for the amount of time set by this value.	
P30	PV display filter time constant	0 to 10000 [ms]	300	The first-order lag low-pass filter is only applied to the displayed PV value. (The PV display filter applies to the PV filter and the PV to which the low flow cutoff is applied.) Setting 0 disables the PV display filter.	
P31	Key lock password	0000: Disabled (Password input is not requested.) 0001 to 9999: Key lock password	0000	You can request password input authentication to unlock keys to enhance security when the key lock function is used (C01 (key lock function)).	C01
P32	Analog scaling 2	(10 to 1000 % FS)*1	(100 % FS)*1	Sets the flow rate at analog input/output 100 % (5 V or 20 mA) (called analog scaling). When C28 (optional analog scaling function) is set to 1 (enabled) and 11 (analog scaling switching) is selected for C10, C11, or C12 (digital input 1/2/3 function assignment), this setting is applied when the relevant digital input is ON. The setting in P17 (analog scaling 1) is applied when the relevant digital input is OFF.	C28, C10– C12
P33	Totalization pulse weight	0 to 1,000,000 [mL]	*	Sets the volume of flow per pulse. * The initial value differs according to the model. F4Q9200/9500: 10 [mL/pulse] F4Q0002/0005: 100 [mL/pulse] F4Q0020/0050: 1 [L/pulse] F4Q0100/0200: 0.01 [m^3/pulse]	C07, C08, C44
P34	Totalization pulse width	20 to 100 [ms]	100	Sets the pulse output ON time. Set a multiple of 20.	

*1. The setting range and the initial value are the full-scale flow rate multiplied by the percentage in parentheses. (The full-scale flow rate varies depending on the model and gas type.)

5 - 2 Function Details

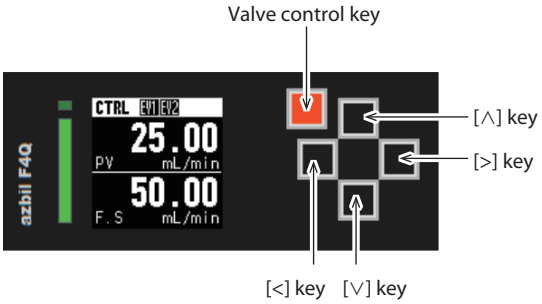
This section describes each function in detail.

■ Display-related

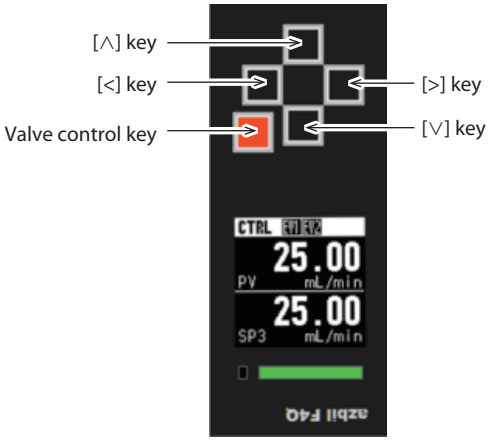
● Display orientation setup

You can set the display of this device to be in one of four directions. The display orientation on the LCD and the key assignments can be changed to make it easy to read in whatever way the product is installed.

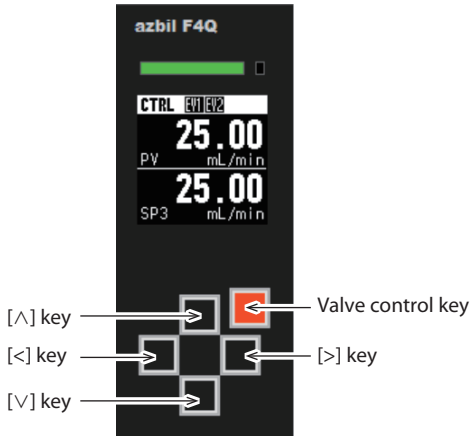
● C52 (display orientation setup) = 0: LEDs left, keys right



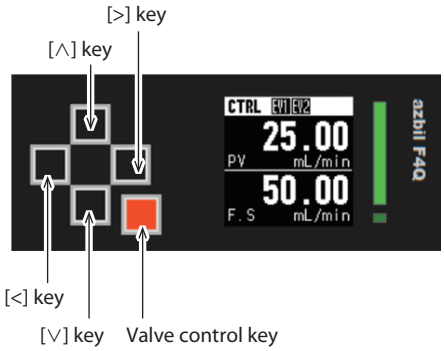
● C52 (display orientation setup) = 1: LEDs below, keys above



● C52 (display orientation setup) = 2: LEDs above, keys below



● **C52 (display orientation setup) = 3: LEDs right, keys left**



● **Related function codes and parameters**

Function code	Name	Description and setting range	Initial value	Notes
C52	Display orientation setup	0: LEDs left, keys right 1: LEDs below, keys above 2: LEDs above, keys below 3: LEDs right, keys left	0	The display orientation on the LCD and the key assignments can be changed to make it easy to read in whatever way the product is installed.

Note

- ☞ ● Function code setup (p. 5-1) (for how to set the function code)

● **Key lock function (display panel of this device)**

This function prevents an unauthorized person from changing settings by using the display panel of this device.
You can allow operations related to flow rate control (key lock that applies to the settings except for SP and valve control key) or prohibit all operations (key lock that applies to all the settings).

● **Related function codes and parameters**

Function code	Name	Description and setting range	Initial value	Notes
C01	Key lock	0: Key lock disabled 1: Settings other than flow rate (SP) and RUN are key-locked 2: All settings are key-locked	0	0: Keys are always unlocked. (The lock status cannot be changed.) 1: Only valve control and SP setting are available. (Also, the lock status can be changed.) 2: No settings can be changed (except the lock status). Note: Press the [<] key and [>] key at the same time to change the lock status. If the use of a password is set with P31 (key lock password), you must also enter the password.

Parameter No.	Name	Description and setting range	Initial value	Notes
P31	Key lock password	0000: Disabled (Password input is not requested.) 0001 to 9999 : Key lock password	0000	For enhanced security, password input authentication to unlock the keys can be required when the key lock function (C01) is used.

● Operations allowed with C01 (key lock)

C01 (key lock)	Possible operations				
	SP setting	Valve control ([RUN] key)	Function code setup	Parameter setup	Maintenance operation
0: Key lock disabled	✓	✓	✓	✓	✓
1: Settings other than flow rate (SP) and valve control key are key-locked	✓	✓	–	–	–
2: All settings are key-locked	–	–	–	–	–

Note

- The current lock status can be checked by viewing the icon on the status bar at the upper right of the display.
  ☞ ■ "Status bar"● Key lock status (p. 4-6) (for details)

● How to change the lock status

● Changing with the keys

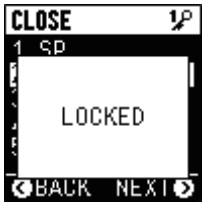
You can change the lock status by pressing [<] and [>] at the same time.

● Changing with the keys and password

You can also strengthen security by requiring a password when someone tries to unlock the keys by pressing [<] and [>] at the same time.
If the password is set to 0000, the password is disabled. In this case, you can change the lock status using only the keys without having to enter the password.

Handling Precautions

- Keys are locked when the power is turned on.
  (If C01 (key lock) is set to a value other than [Key lock disabled])
- If keys are not operated for a certain amount of time in unlocked mode, they are automatically locked again.
- A warning message appears if you try a prohibited operation in locked mode.



- Key lock is intended to prevent transition to a prohibited screen. Therefore, if the key lock is enabled on a prohibited screen, that screen can still be used as usual. However, the keys will be locked if you move from that screen and then try to go back to it.

● Flow rate display change (unit and digits after the decimal point)

You can change the unit and number of digits after the decimal point for the flow rate value displayed on the display panel of the device. (These are settings for the display panel. They are not related to the settings and display values for the loader and communication.)

● Related function codes and parameters

Function code	Name	Description and setting range	Initial value	Notes
C37	Flow rate display unit change function	0: mL/min 1: L/min 2: m^3/h	*	You can change the unit of measurement for the flow rate value displayed on the display panel of the device. * The initial value varies depending on the model.
C38	Flow rate digits after decimal point (display)	0–3	*	You can change the digits after the decimal point for the flow rate value displayed on the display panel of the device. * The initial value varies depending on the model.

● Totalized flow volume display change (unit)

You can change the unit of measurement for the total flow volume displayed on the display panel of the device (main screen display only).

! Handling Precautions

- This is a setting for the display panel. It is not related to the settings and display values for the loader and communication.

● Related function codes and parameters

Function code	Name	Description and setting range	Initial value	Notes
C43	Totalized flow rate unit (display)	0: mL 1: L 2: m^3	*	You can change the unit for the total flow volume value displayed on the display panel of the device. If 0 (mL) is set, the display unit automatically switches to 1 (L) if the value has more than 10 digits. * The initial value varies depending on the model.

● Automatic display-off function

The display is automatically turned off if the keys are not used for a certain amount of time.
When the display is off, it becomes active again when you press a key. LED display cannot be turned off.

● Related function codes and parameters

Parameter No.	Name	Description and setting range	Initial value	Notes
P29	Automatic display-off time	0: Always on (automatic display-off function disabled) 1 to 9999: Automatic display-off time [s]	0	The display is automatically turned off if the keys are not used for the amount of time set by this value.

● PV display filter time constant setting

You can apply a first-order lag low-pass filter only to the displayed PV value (main display) by setting the PV display filter time constant. This can reduce the fluctuation in the displayed PV value.
The PV display filter applies to the PV filter and to a PV to which the low flow cutoff is applied.

● Related function codes and parameters

Parameter No.	Name	Description and setting range	Initial value	Notes
P30	PV display filter time constant	0 to 10,000 [ms]	300	The first-order lag low-pass filter is only applied to the displayed PV value. (The PV display filter applies to the PV filter and to a PV to which the low flow cutoff is applied.) Setting 0 disables the PV display filter.

■ Analog input/output

● Analog input/output function

The analog input/output type can be selected from various voltage and current ranges.
You can select PV output (instantaneous flow rate output) or SP (flow rate set point output) for the analog output. (There is one analog output.)

● Related function codes and parameters

Function code	Name	Description and setting range	Initial value	Notes
C06	Analog input and output type and range selection	0: 0–5 V (PV output) 1: 1–5 V (PV output) 3: 4–20 mA (PV output) 4: 0–5 V (SP output) 5: 1–5 V (SP output) 7: 4–20 mA (SP output)	0	The scale can be changed to any flow rate range. (☞ C28 Optional analog scaling function)

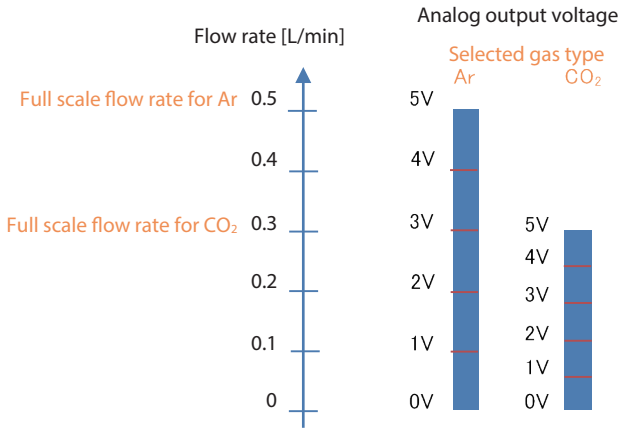
● Optional analog scaling (two types)

The flow rate at analog input/output 100 % (5 V or 20 mA) (called analog scaling) can be changed to any value.
You can set two analog scaling values and switch between them by turning the digital input ON or OFF.

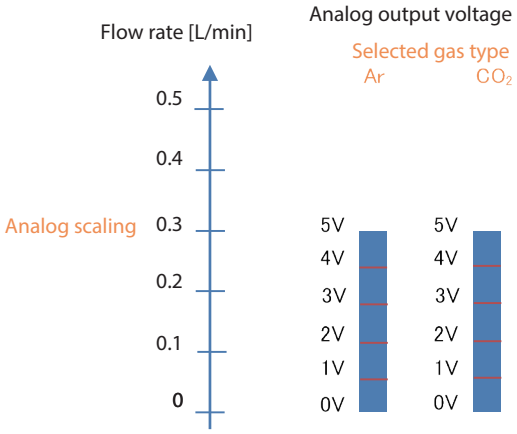
- Enabling or disabling optional analog scaling

		Analog scaling	Notes
Optional analog scaling function	Disabled	Automatically determined according to model No. and selected gas type. (☞■ Procedure for displaying device information (p. 5-36) (for how to check the full-scale flow rate))	The flow rate for the same analog input/output differs depending on the gas type.*1
	Enabled	P18 (analog scaling 1)	The flow rate for the same analog input/output can be fixed even if the full-scale flow rate is changed after you change the gas type. In addition, a fine analog resolution can be used when only a low flow rate is used for the full-scale flow rate.*2

*1. When 0–5 V is selected for C06 (analog input/output type) in the F4Q9500



*2. When 0–5 V is selected for C06 (analog input/output type) in the F4Q9500 and 0.3 L/min is set in P17 (analog scaling 1)



● **Related function codes and parameters**

Function code	Name	Description and setting range	Initial value	Notes
C28	Optional analog scaling function	0: Disabled 1: Enabled	0	0: The flow rate at analog input/output 100 % (5 V or 20 mA) (called analog scaling) is the full-scale flow rate automatically determined according to the model No. and selected gas type. 1: Analog scaling can be freely changed (10 % to 1000 % FS). The value can be set with P17 (analog scaling 1).

Parameter No.	Name	Description and setting range	Initial value	Notes
P17	Analog scaling 1	(10 to 1000 % FS)	(100 % FS)	Specifies the flow rate at analog input/output 100 % (5 V or 20 mA) (called analog scaling) when C28 (optional analog scaling function) is set to enabled.
P32	Analog scaling 2	(10 to 1000 % FS)	(100 % FS)	Sets the flow rate at analog input/output 100 % (5 V or 20 mA) (called analog scaling). When C28 (optional analog scaling function) is set to 1 (enabled) and 11 (analog scaling switching) is selected for C10, C11, or C12 (digital input 1/2/3 function assignment), this setting is applied when the relevant digital input is ON. The setting in P17 (analog scaling 1) is applied when the relevant digital input is OFF.

Note: The setting range and the initial value are the full-scale flow rate multiplied by the percentage in parentheses. (The full-scale flow rate varies depending on the model and gas type.)

Note

- Changing the analog scale value with digital input
  If analog scaling switching for digital input 1, 2, or 3 is selected with the digital input function and if C28 (optional analog scaling function) is enabled, the device operates with P17 (analog scaling 1) when the relevant digital input is OFF and with P32 (analog scaling 2) when the relevant digital input is ON.

■ Digital input/output

● Digital input functions

This device has three digital inputs. A separate function can be assigned to each digital input. This device can be remotely operated by switching the digital input from outside.

The following functions can be assigned.

- Related to totalization (total flow volume reset and totalized flow count pause)
  Totalization-related operations can be remotely controlled.
  ☞ ● Total flow volume reset (p. 5-41) (for details on total flow volume reset)
  ☞ ● Totalized flow count pause (p. 5-31) (for details on totalized flow count pause)

- Related to control flow rate change (SP No. switching and flow rate setup method selection)

  ☞ ● Switching the flow rate setup method with digital input (advanced use) (p. 4-7) (for details on SP No. switching)

  ☞ ● Switching the flow rate setup method with digital input (advanced use) (p. 4-7) (for details on flow rate setup method selection)

- Valve operation mode switching (ON for fully closed, ON for fully open, ON for control, OFF for fully closed)
  ☞■ Valve operation mode switching with digital input (p. 4-15) (for details on valve operation mode switching)

- Related to SP ramp control (enabling or disabling and slope switching)
  ☞ ● SP ramp control (p. 5-24) (for details)

- Execution of flow rate zero point adjustment
  ☞ ● Flow rate zero point adjustment (p. 5-43) (for details)

- Gas type selection switching
  ☞ ● Gas type selection (p. 5-29) (for details)

- Analog scaling switching
  ☞ ● Optional analog scaling (two types) (p. 5-14) (for details)

- Device status deletion (except for errors)
  The current device status is deleted when the relevant digital input is switched from OFF to ON.

Handling Precautions

- The device status (alarm, warning, information) is deleted.
- Errors are not deleted.

● **Related function code and parameters**

Function code	Name	Description and setting range	Initial value	Notes
C10	Digital input 1 function assignment	0: Not used 1: Total flow volume reset 2: Totalized flow count pause 3: SP No. switching 4: Flow rate setting method selection 5: Operation mode forced fully closed by contact ON 6: Operation mode forced fully open by contact ON 7: SP ramp control ON/OFF switching 8: Operation mode switching (control by contact ON, forced fully closed by contact OFF) 9: Flow rate zero adjustment 10: Gas type setting switching 11: Analog scaling switching 12: SP ramp control gradient switching 13: Device status deletion (except for errors)	0	4: Analog setup is used when the input is ON. The setting in C03 (flow rate setup method) is used when the input is OFF. 5, 6, 8: If forced full-close and forced full-open are input at two digital inputs at the same time, both inputs will be invalid. 7: SP ramp control is enabled when the input is ON and disabled when the input is OFF. 9: Enable the fully closed mode or set the SP to zero in control mode and keep the digital input ON for at least 10 seconds. 10: C18 (gas type selection 1) is applied when the input is OFF. C26 (gas type selection 2) is applied when the input is ON. 11: P17 (analog scaling 1) is applied when the input is OFF. P32 (analog scaling 2) is applied when the input is ON. 12: The device operates with P15 (SP ramp control slope 1) when the input is OFF and P16 (SP ramp control slope 2) when the input is ON. 13: The device status (alarm, warning, information) is deleted.
C11	Digital input 2 function assignment			
C12	Digital input 3 function assignment			

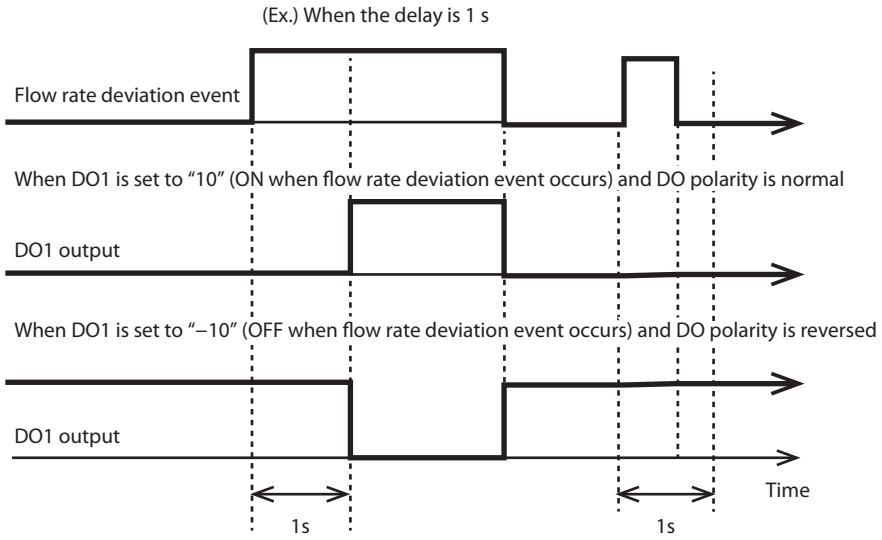
● Digital output functions

This device has three digital outputs. A device status, event, or other item can be assigned to each digital output.
The following items can assigned.

- Event output (totalized flow volume event and flow rate deviation event)
  ☞ ● Totalized flow volume event (p. 5-32) and ☞ ● Flow rate deviation event (p. 5-22) (for event settings)
- Totalizer pulse output
  ☞ ● Totalizer pulse output (p. 5-32) (for the totalized pulse setting)
- Flow rate OK output
  ☞ ● Totalizer pulse output (p. 5-32) (for flow rate OK judgment)
- Operation mode output (control mode / fully open mode / control or fully open mode / fully closed mode)
- Device status output (error/error or alarm)

In addition, output polarity can be changed.

A delay time can also be specified (except for totalizer pulse output).



Note

- ☞ ● Digital input/output signal status (p. 5-38) (for how to check the digital output status)

- **Related function code and parameters**

Function code	Name	Description and setting range	Initial value	Notes
C07	Digital output 1 type assignment	0: Not used (always OFF) 1: ON when totalized flow volume event occurs 2: Totalizer pulse output 3: ON when flow rate is OK 4: ON when operation mode = control 5: ON when operation mode = fully open 6: ON when operation mode = control or fully open 7: ON when operation mode = fully closed 8: ON when error occurs 9: ON when error or alarm occurs 10: ON when flow rate deviation event occurs −1: OFF when totalized flow volume event occurs −2: Totalizer pulse OFF output −3: OFF when flow rate is OK −4: OFF in control mode −5: OFF in fully open mode −6: OFF in control or fully open mode −7: OFF in fully closed mode −8: OFF when error occurs −9: OFF when error or alarm occurs −10: OFF when flow rate deviation event occurs	0	Selects the value output to digital output 1 (does not affect the other two digital outputs). The delay time can be specified with P08 (digital output 1 delay time). (The value is reflected in items except the totalizer pulse output.)
C08	Digital output 2 type assignment		0	Selects the value output to digital output 2 (does not affect the other two digital outputs). The delay time can be specified with P09 (digital output 2 delay time). (The value is reflected in items except the totalizer pulse output.)
C44	Digital output 3 type assignment		0	Selects the value output to digital output 3 (does not affect the other two digital outputs). The delay time can be specified with P28 (digital output 3 delay time). (The value is reflected in items except the totalizer pulse output.)

Parameter No.	Name	Description and setting range	Initial value	Notes
P08	Digital output 1 delay time	0 to 999,900 [ms]	0	Specifies the delay time for digital output 1. (The value is reflected in items except the totalizer pulse output.)
P09	Digital output 2 delay time	0 to 999,900 [ms]	0	Specifies the delay time for digital output 2. (The value is reflected in items except the totalizer pulse output.)
P28	Digital output 3 delay time	0 to 999,900 [ms]	0	Specifies the delay time for digital output 3. (The value is reflected in items except the totalizer pulse output.)

■ Flow rate control

● SP limit

The lower and upper limit values of the flow rate setting range can be freely set. This prevents improper setting due to an operator error or abnormal fluctuation of analog input.

Handling Precautions

- If an SP out of the range between the upper and lower limits is set, this device treats it as the SP upper or lower limit value. (A value out of the SP limit setting range cannot be set on the display panel. This is the case where such a value is set, for example, with the loader or through communication.) In this case, a warning occurs.

● Related function code and parameters

Function code	Name	Description and setting range	Initial value	Notes
C35	SP limit function	0: Disabled 1: Only upper limit enabled 2: Only lower limit enabled 3: Upper and lower limits enabled	0	This function code individually enables or disables the SP upper and lower limits. The upper and lower limit values of the flow rate setting range can be freely set.

Parameter No.	Name	Description and setting range	Initial value	Notes
P21	SP upper limit flow rate	(0 to 100 % FS)	(100 % FS)	Ensure that P21 (SP upper limit flow rate) is greater than or equal to P22 (SP lower limit flow rate).
P22	SP lower limit flow rate	(0 to 100 % FS)	(0 % FS)	

Note: The setting range and the initial value are the full-scale flow rate multiplied by the percentage in parentheses. (The full-scale flow rate varies depending on the model and gas type.)

● Control response setup

This function optimizes flow rate controllability according to the operating environment. Controllability can be selected from four options: “response prioritized,” “standard,” “stability prioritized,” “PID set by user”

Response prioritized: Controllability is adjusted so that the control is optimal at the lowest operating differential pressure. In addition to low differential pressure applications, it can be used when faster control response is desired, but please note that a greater overshoot or ringing may result.

Standard: Controllability is adjusted so that the control is optimal at the standard operating differential pressure (300 kPa for 100 L models).

Stability prioritized: Controllability is adjusted so that the control is optimal at the highest operating differential pressure.
In addition to high differential pressure applications, it can be used to suppress overshoot or ringing, but please note that slower control response may result.

PID set by user: Any PID constants can be specified using the loader.
(☞ ● PID constants (p. 6-6)) (for details)

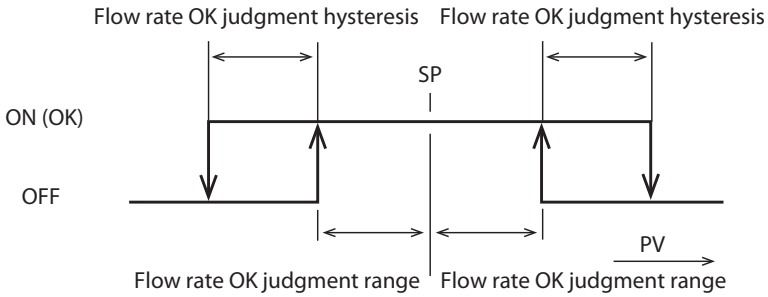
● **Related function code and parameters**

Function code	Name	Description and setting range	Initial value	Notes
C36	Control response setup	0: Response prioritized 1: Standard 2: Stability prioritized 3: PID set by user	1	Flow rate controllability can be optimized for the use environment (primary pressure and secondary pressure). Select the PID set by the user to freely set the PID value.

● Flow rate OK judgment

This function determines whether the flow rate is normal (whether the PV is within the specified allowable range around the SP in control mode).

You can export the judgment result by assigning it to a digital output.
(☞ ● Digital output functions (p. 5-18))
You can also use this result as the interlock signal for the next process by importing it into a sequencer, etc.



Note When the PV is the same as the boundary value in the above figure, the OK judgment status is ON (OK).

● **Related function code and parameters**

Parameter No.	Name	Description and setting range	Initial value	Notes
P01	Flow rate OK judgment range	(0.5 to 100 % FS)	(2 % FS)	Specifies the allowable range for flow rate OK judgment.
P02	Flow rate OK judgment hysteresis	(0.5 to 100 % FS)	(1 % FS)	Specifies the hysteresis for flow rate OK judgment.

Note: The setting range and the initial value are the full-scale flow rate multiplied by the percentage in parentheses. (The full-scale flow rate varies depending on the model and gas type.)

Note

- ☞ ● Parameter setup (p. 5-2) (for how to set the parameters)

● Flow rate deviation event

A flow rate deviation event occurs if the deviation between the SP and the PV goes outside the range between the upper and lower limit thresholds in control mode. A delay time can be set to avoid the flow rate deviation event immediately after the SP is changed or immediately after the valve mode is changed to the control mode.

Note

- You can export the event status by assigning it to a digital output.
  ☞ ● Digital output functions (p. 5-18) (for details)

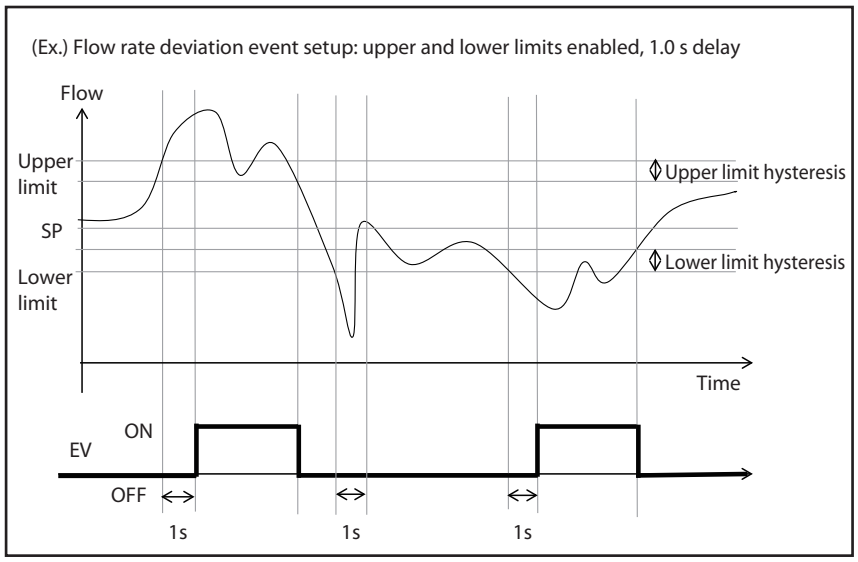
Handling Precautions

- The event is cleared if the PV falls within the flow rate deviation event range between the upper and lower limit thresholds in control mode.

Note

- Whether the flow rate deviation event has occurred can be checked on the status bar. ☞ ■ "Status bar" ● Event occurrence and clearing (EV1: flow rate deviation event, EV2: totalized flow volume event) (p. 4-5) (for details)

Operation of flow rate deviation upper/lower limit alarm judgment



● **Related function code and parameters**

Function code	Name	Description and setting range	Initial value	Notes
C15	Flow rate deviation event setup	0: Disabled 1: Enabled only for upper limit event 2: Enabled only for lower limit event 3: Enabled for upper/lower limit event	3	This function code individually enables or disables the upper limit and lower limit flow rate events.

Parameter No.	Name	Description and setting range	Initial value	Notes
P03	Flow rate deviation upper limit event	(0.5 to 100 % FS)*	(10 % FS)*	Ensure that P03 (flow rate deviation upper limit event) is greater than or equal to P04 (flow rate deviation upper limit event hysteresis).
P04	Flow rate deviation upper limit event hysteresis	(0.5 to 100 % FS)*	(2 % FS)*	
P05	Flow rate deviation lower limit event	(0.5 to 100 % FS)*	(10 % FS)*	Make sure that P05 (flow rate deviation lower limit event) is greater than or equal to P06 (flow rate deviation lower limit event hysteresis).
P06	Flow rate deviation lower limit event hysteresis	(0.5 to 100 % FS)*	(2 % FS)*	
P07	Flow rate deviation event judgment delay time	500 to 999,900 [ms]	10000	Specifies the delay time for the flow rate deviation event.

* The setting range and the initial value are the full-scale flow rate multiplied by the percentage in parentheses. (The full-scale flow rate varies depending on the model and gas type.)

● **Valve operation mode changeover when flow rate deviation event occurs**

This function automatically switches the valve operation mode if a flow rate deviation event occurs. After this function changes the mode, you can change the mode again using the keys or by another procedure. (The mode may not remain the same while the event exists.)

Handling Precautions

- Even when the flow rate deviation event is cleared, the original valve operation mode is not automatically enabled.

Note

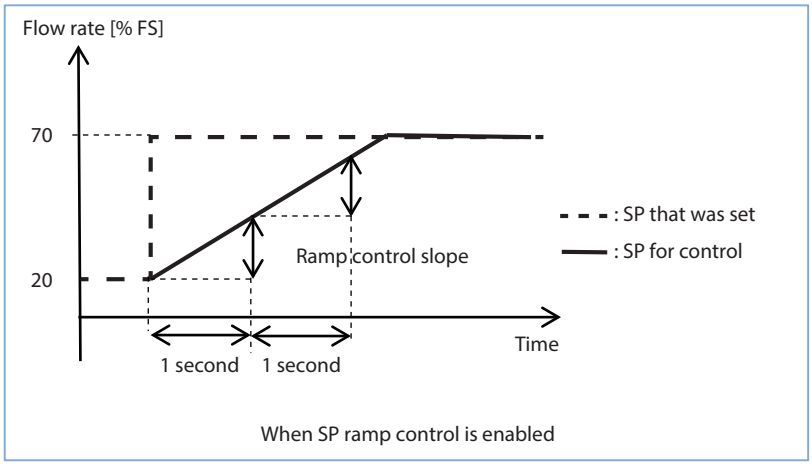
- The valve operation mode can be checked on the status bar. ☞ ■ "Status bar" ● Valve operation mode (p. 4-5) (for details)

● **Related function code and parameters**

Function code	Name	Description and setting range	Initial value	Notes
C46	Operation when flow rate deviation event occurs	0: No change 1: Fully closed 2: Fully open	0	The valve operation mode is automatically switched if a flow rate deviation event occurs.

● SP ramp control

This function can keep the amount of SP change per second (gradient) constant when control starts (when the control mode is enabled) and when the SP is changed.
You can set two ramp control slopes and switch between them according to the increase or decrease of the PV or by turning the digital input ON or OFF.



When SP ramp control is enabled

● SP ramp control setting

- ON/OFF
  If C27 (SP ramp control setting) is disabled, normal PID control is performed. This control is also disabled if P15 (SP ramp control slope 1) or P16 (SP ramp control slope 2) is set to 0.

- Switching the SP ramp control slope depending on whether the PV is increasing or decreasing
  The device operates with P15 (SP ramp control slope 1) when the PV is increasing and P16 (SP ramp control slope 2) when the PV is decreasing if C27 (SP ramp control setting) is enabled (ramp control 1).

● Related function code and parameters

Function code	Name	Description and setting range	Initial value	Notes
C27	SP ramp control function	0: Disabled 1: Ramp control 1 enabled 2: Ramp control 2 enabled	0	1: The device operates with P15 (ramp control slope 1) when the PV is increasing and P16 (ramp control slope 2) when the PV is decreasing. 2: When SP ramp control slope switching is selected for C10, C11, or C12 (digital input 1/2/3 function assignment), the device operates with P15 (ramp control slope 1) when the relevant digital input is OFF and with P16 (ramp control slope 2) when the relevant digital input is ON.

Parameter No.	Name	Description and setting range	Initial value	Notes
P15	SP ramp control slope 1	Model F4Q9200/9500: 0.0 to 999.9 [mL/min] Model F4Q0002/0005: 0.000 to 9.999 [L/min] Model F4Q0020/0050: 0.00 to 99.99 [L/min] Model F4Q0200: 0.0 to 999.9 [L/min]	0	Specifies the change in flow rate per second. If you set 0 (initial value), SP ramp control is disabled. (The value immediately changes to the changed SP.)
P16	SP ramp control slope 2		0	

- **Enabling or disabling SP ramp control with digital input**

When SP ramp control ON/OFF switching is selected for digital input 1, 2, or 3 with the digital input function, SP ramp control is enabled when the relevant digital input is ON. (The control is disabled when the relevant digital input is OFF.)

- **Switching the SP ramp control slope with digital input**

When SP ramp control slope switching is selected for digital input 1, 2, or 3 with the digital input function and C27 (SP ramp control setting) is enabled (ramp control 2), the device operates with P15 (SP ramp control slope 1) when the relevant digital input is OFF and with P16 (SP ramp control slope 2) when the relevant digital input is ON.

SP ramp control is performed as described in the following table.

		SP ramp control function					
		0: Disabled	1: Enabled (SP ramp control 1)		2: Enabled (SP ramp control 2)		
Digital input x function assignment	7 (ON/OFF)	–	OFF	ON or NA	OFF	ON or NA	
	12 (slope switching)	–	–	–	–	OFF or NA	ON
SP ramp control slope with which the device operates		None	None	When the PV is increasing (↗): Slope 1 When the PV is decreasing (↘): Slope 2	None	Slope 1	Slope 2

– : The ramp control slope is determined independently of the status.

ON : At least one of the digital inputs allocated to the switching function is ON.

OFF : All the digital inputs allocated to the switching function are OFF.

NA (not assigned) : No digital input is assigned to the setting.

■ Measurement conditions, flow rate correction

● Setting of standard temperature for flow rate display

You can specify the standard temperature used when converting the flow rate measured in mass flow rate (mass flow) to volumetric flow rate.

● Related function code and parameters

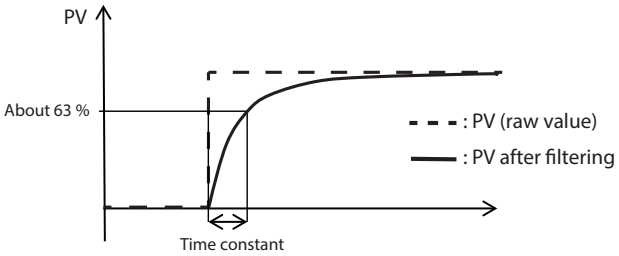
Function code	Name	Description and setting range	Initial value	Notes
C19	Temperature at reference conditions	0: 20 °C 1: 0 °C 2: 25 °C 3: 35 °C	1	The PV can be used as the volumetric flow rate when the flow rate is converted with this standard temperature setting. (The volumetric flow rate differs depending on the gas temperature.)

● PV filter

You can apply a first-order lag low-pass filter to the PV value (instantaneous flow rate and control flow rate) by setting the PV filter time constant. This reduces the effect of minute pressure fluctuations, etc.

Handling Precautions

- The PV filter value affects the flow rate value and the total flow volume in analog output or communication but does not affect control.



Effects of the PV filter

● Related function code and parameters

Function code	Name	Description and setting range	Initial value	Notes
C23	PV filter constant	0 to 9999 [ms]	*	First-order lag low-pass filter is applied to the PV value. Setting 0 disables the PV filter. * The initial value differs according to the model. 9200/9500/0002/0005/0020/0050/0100: 100 ms 0200: 150 ms

● PV filter option

● PV fluctuation control function when fully closed

This function switches the filter time constant to the set value (which can only be changed with the loader) after the delay time when the SP is set to 0 in control mode or when the valve operation mode is changed to the fully closed mode.

If the pressure fluctuates upstream after the control valve is closed (for example, due to pump pulsation or opening of an upstream shutoff valve), gas may temporarily move around the sensor and this movement can be output as PV even though liquid is not actually flowing downstream. When you increase the filter time constant, the device tolerates more pressure fluctuations and reduces the fluctuation of PV with low flow cutoff.
If the PV fluctuates with this function enabled, the PV may fluctuate, not due to upstream pressure fluctuation, but rather to drift of the sensor value resulting from the following causes:

- Foreign matter on or near the flow rate sensor
- Foreign matter stuck in the control valve
- Broken control valve

● Filter application during response

Whether to apply the PV filter when the instantaneous flow rate is fluctuating (for example, immediately after the SP is changed) can be selected.

● Related function code and parameters

Function code	Name	Description and setting range	Initial value	Notes
C29	PV filter option	0: None 1: PV fluctuation control function when fully closed: enabled 2: Filter application during response: enabled 3: Both the above functions are enabled.	3	1:The filter time constant is switched to the set value (which can be changed only with the loader, using "PV fluctuation control filter time constant in fully closed mode") after the delay time has passed since the valve was fully closed (including the case where the SP is 0 in control mode).

Parameter No.	Name	Description and setting range	Initial value	Notes
P20	PV fluctuation control delay time when fully closed	0 to 9,999,999 [ms]	5000	Specifies the delay time for the function to control PV fluctuation when the valve is fully closed.
The setting can be changed only with the loader.				
	Filter time constant for PV fluctuation control when the valve is fully closed	0 to 60,000 [ms]	1000	The setting can be changed only with the loader.

● Low flow cutoff

This function regards PV as 0.0 when the measured flow rate is less than the flow rate specified with P26 (low flow cutoff threshold).

Handling Precautions

- The PV after low flow cutoff is used for display, analog output, and flow totalization.

● Related function code and parameters

Parameter No.	Name	Description and setting range	Initial value	Notes
P26	Low flow cutoff threshold	0.00 to 99.99 [% FS]	0.50	PV is regarded as 0 when the measured flow rate is less than the flow rate specified with this parameter. This function applies in any valve operation mode. Note: Set a percentage of the full-scale flow rate for the standard gas.

● Gas type selection

The operating gas can be selected from the standard compatible gases. A gas type set by the user (for gases other than the standard compatible gases or mixed gas) can also be selected.

! Handling Precautions

- Accuracy is guaranteed only for the standard gases.
- Two gas types can be set. (They can be switched as described in the next section.)
- Do not change the gas type more than once within 2 seconds.
- Do not change the SP immediately after changing the gas type. (Change the SP at least 2 seconds after changing the gas type.)
- When changing the gas type, enable the fully closed mode or set the SP to 0 in control mode.

● Standard compatible gases

This device supports the following gases as standard:
Air/nitrogen, oxygen, argon, carbon dioxide gas (CO_2), propane, methane, butane, fuel gas 13A (45MJ/m^3)

● Gas type set by the user

You can use a gas other than the standard compatible gases or mixed gas by setting P10 (user-set gas conversion factor (C.F.)).

To find out whether a gas can be used and the C.F. for the gas, please contact the azbil Group.

! Handling Precautions

- When a gas other than a gas type set by the user is selected for C18 or C26 (gas type selection 1/2), the value set in P10 (user-set gas conversion factor (C.F.)) is not applied.
- Please consider using multipoint flow rate correction as well when using a gas type set by the user. (☞ ● Multipoint flow rate correction (p. 6-8))

● Related function code and parameters

Function code	Name	Description and setting range	Initial value	Notes
C18	Gas type selection 1	0: Gas type set by the user 1: Air/nitrogen 2: Oxygen 3: Argon 4: Carbon dioxide (CO_2) 6: 100 % propane 7: 100 % methane 8: 100 % butane 11: Fuel gas 13A (45MJ/m^3)	1	0: Set P10 (user-set gas conversion factor (C.F.)). 2, 6, 7, 8, 11: Not available for models with EPDM gasket specifications. Gas type selection 2 is selected when gas type setting switching is selected for C10, C11, or C12 (digital input 1/2/3 function assignment), and the relevant digital input is ON.
C26	Gas type selection 2			

Parameter No.	Name	Description and setting range	Initial value	Notes
P10	User-set gas conversion factor (C.F.)	0.040 to 9.999	1.000	This value is applied when 0 (gas type set by the user) is selected for C18 (gas type selection 1) or C26 (gas type selection 2).

● Gas type switching with digital input

When gas type setting switching is selected for digital input 1, 2, or 3 with the digital input function, the gas set in C26 (gas type selection 2) is selected when the relevant digital input is ON and the gas set in C18 (gas type selection 1) is selected when the relevant digital input is OFF.

● Device orientation & pressure compensation

When the device orientation is vertical (when the device is mounted on a vertical pipe), the PV drift can be compensated for.
PV drift compensation is based on the device orientation and the set primary pressure value.

! Handling Precautions

- When mounting the device vertically, be sure to carry out ☞ ● Flow rate zero point adjustment (p. 5-43) after setting the function code and parameter shown below.

● Related function code and parameters

Function code	Name	Description and setting range	Initial value	Notes
C34	Installation orientation setup	0: Horizontal → 1: Vertical ↑ 2: Vertical ↓	0	1:Corrects flow rate characteristics of a gas flowing upward. 2:Corrects flow rate characteristics of a gas flowing downward. Be sure to set P23 (primary pressure specification) and adjust flow rate zero point when selecting 1 or 2.

Parameter No.	Name	Description and setting range	Initial value	Notes
P23	Primary pressure specification	5 to 500 [kPa (gauge)]	*	This setting is valid only when C34 (installation orientation setup) is set to "1" (vertical ↑) or "2" (vertical ↓). * The initial value differs according to the model. F4Q0050(J,K): 50 kPa Other: 200 kPa

■ Flow rate totalization

● Totalized flow count pause

When totalized flow count pause is selected for digital input 1, 2, or 3 with the digital input function, flow rate totalization is paused when the relevant digital input is ON. Totalization restarts when the digital input is turned OFF.
Use this function not to totalize the flow volume during a purge, for example.

● Total flow volume reset

The total flow volume can be reset to 0 with the following four steps:

- Total flow volume reset by using the keys on the device

- Total flow volume reset using the loader

Note

- ☞ ● Total flow volume reset (p. 5-41) (for the use of the keys on the device)
- ☞ *User's Manual for Loader Package Model MLP-F4Q for Digital Mass Flow Controller Model F4Q* (CP-SP-1457E) (for the operation using the loader)

- Total flow volume reset with digital input
  When total flow volume reset is selected for digital input 1, 2, or 3 with the digital input function, the total flow volume is reset when the relevant digital input is turned ON.
  The total flow volume remains 0 and is not totalized while the relevant digital input is ON. Totalization restarts when the relevant digital input is turned OFF.

- Automatic total flow volume reset at start of control

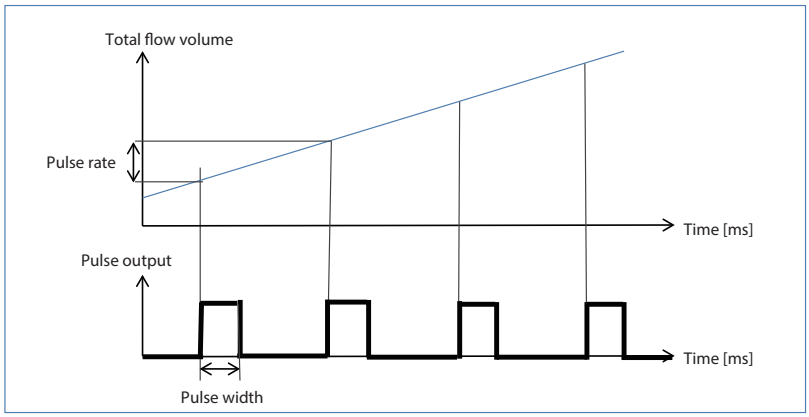
  This function automatically resets the total flow volume when control starts (when the valve operation mode is set to control mode). Totalization automatically starts after reset.
  Start of control and total flow volume reset can be done at the same time with one action (using the keys or digital input). By using this function in combination with the function to shut off the valve automatically when the totalized flow volume event occurs, the process of filling a certain amount of gas and closing the valve automatically can be repeated easily. You can omit digital input for reset that should be used for total flow volume reset with digital input by using this function for a filling application, etc.

● Related function code and parameters

Parameter No.	Name	Description and setting range	Initial value	Notes
C14	On/off of totalized flow reset function at start of control	0: Disabled 1: Enabled	0	1:The totalized flow volume is automatically reset when control starts (when the valve operation mode is set to control mode).

● Totalizer pulse output

You can set the totalized pulse waveform output when totalizer pulse output is selected for digital output 1, 2, or 3 with the digital output function.



● Related function code and parameters

Parameter No.	Name	Description and setting range	Initial value	Notes
P33	Totalization pulse weight	0 to 1,000,000	*	Sets the volume of flow per pulse. * The initial value differs according to the model. F4Q9200/9500: 10 [mL/pulse] F4Q0002/0005: 100 [mL/pulse] F4Q0020/0050: 1 [L/pulse]
P34	Totalization pulse width	20–100 [ms]	100	Sets the pulse output ON time. Set a multiple of 20.

● Totalized flow volume event

A totalized flow volume event occurs when the total flow volume exceeds the Cumulative flow event setting (P18).
This item can be assigned to digital output (☞ ● Digital output functions (p. 5-18)).
Totalization continues even after the totalized flow volume event occurs. (Totalization is neither reset nor stopped.)

Note

- Whether the totalized flow volume event has occurred can be checked on the status bar. ☞ ■ "Status bar" ● Event occurrence and clearing (EV1: flow rate deviation event, EV2: totalized flow volume event) (p. 4-5) (for details)

[How to clear the current totalization event]
A totalization event is cleared when the total flow volume is reset. (☞ ● Total flow volume reset (p. 5-41))

● Automatic valve shutoff when the totalized flow volume event occurs

This function automatically switches the valve operation mode to the fully closed mode if a totalized flow volume event occurs.

Handling Precautions

- After this function changes the mode, you can change the mode again using the keys or by another procedure. (The mode may not remain the same while the event exists. Even when the totalized flow volume event is cleared, the original valve operation mode is not automatically enabled.)

Note

- The valve operation mode can be checked on the status bar. ☞ ■ "Status bar" ● Valve operation mode (p. 4-5) (for details)

● Related function code and parameters

Function code	Name	Description and setting range	Initial value	Notes
C13	Automatic valve shutoff when the totalized flow event occurs	0: Disabled 1: Enabled	0	1:The valve operation mode is automatically switched to fully closed if a totalization event occurs.

Parameter No.	Name	Description and setting range	Initial value	Notes
P18	Cumulative flow event setting (last digits)	0 to 999,999,999,999,999 [mL]	0	When this is 0, the totalization event is disabled.

■ Fail-safe function

The operation mode and analog output in case of error can be set.

● Valve operation mode switching when an error occurs

The valve operation mode can be automatically switched if an error occurs.

Handling Precautions

- Changes to the valve operation mode using this function have top priority. Even if digital input forces the valve operation mode, the valve operation mode is changed if an error occurs. However, operation is not guaranteed if an error has occurred. Therefore, the valve operation mode or valve opening setting may not be changeable.

Note

- ☞ Chapter 7. Troubleshooting (for details on errors)

● Related function code and parameters

Function code	Name	Description and setting range	Initial value	Notes
C16	Operational mode at error occurrence	1: No change 2: Forced fully closed 3: Forced fully open 4: Fixed valve MV	1	4: Set a fixed value with P27 (valve manipulated variable when error occurs).

Parameter No.	Name	Description and setting range	Initial value	Notes
P27	Valve manipulated variable when error occurs	0 to 100 [%]	50	Set C16 (operational mode at error occurrence) to 4 (fixed value MV) to automatically switch the valve opening to this set value if an error occurs.

● Analog output changeover when an error occurs

The analog output value can be automatically switched if an error occurs. However, the analog output setting may not be changeable because operation cannot be guaranteed if an error occurs.

Note

- ☞ Chapter 7. Troubleshooting (for details on errors)

● Related function code and parameters

Function code	Name	Description and setting range	Initial value	Notes
C53	Analog output when error occurs	0: Normal output 1: Zero output 2: Full output	0	The analog output value can be switched automatically if an error occurs.

Note

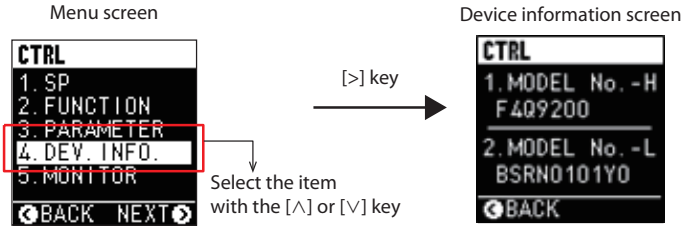
- ☞ ● Function code setup (p. 5-1) (for how to set the function code)

5 - 3 Displaying Device Information

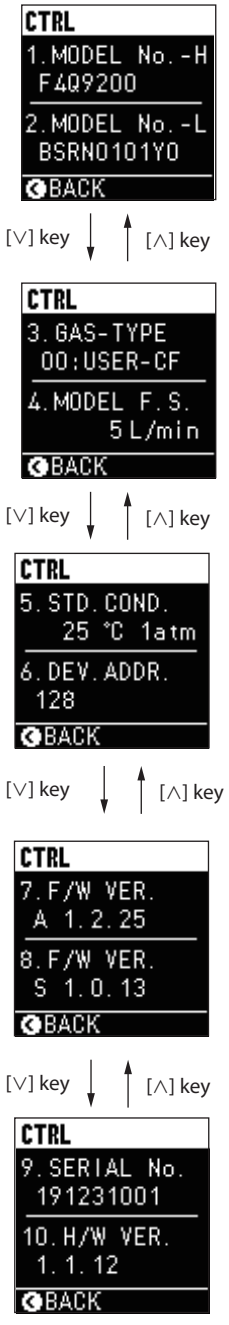
■ Procedure for displaying device information

(1) Select [4. DEV.INFO.] on the main screen with the [∨] or [∧] key and press the [>] key.

≫ The device information screen is displayed.



(1) You can see various kinds of device information by pressing the [∨] or [∧] key.



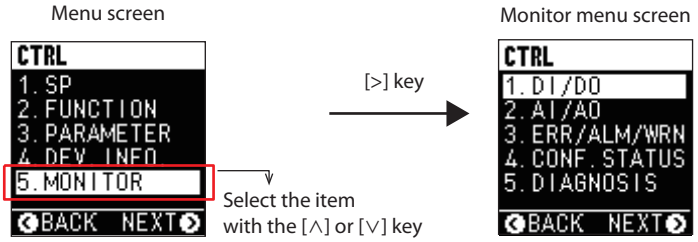
■ Device information display items

Display	Description
1.MODEL No. -H	First 7 digits of product model No.
2.MODEL No. -L	Last 10 digits of product model No.
3.GAS_TYPE	Currently selected gas type
4.FULL SCALE	Full-scale flow rate
5.STD.COND.	Standard conditions [°C 1 atm]
6.DEV.ADDR.	Device address
7.F/W VER. A.	Firmware version (app)
8.F/W VER. S.	Firmware version (sensor)
9.SERIAL No.	Serial No.
10.H/W VER.	Hardware version

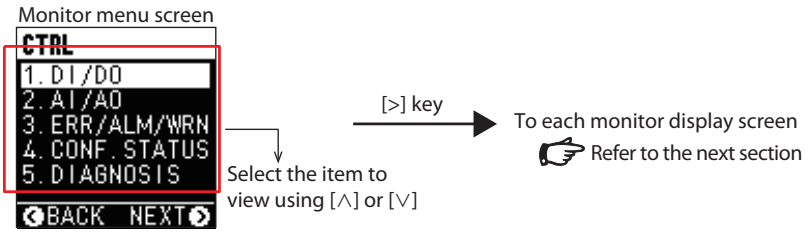
5 - 4 Displaying the Monitor Screen

■ Procedure for displaying the monitor screen

(1) Select [5. MONITOR] on the main screen with the [∨] or [∧] key and press the [>] key.
≫ The monitor menu screen is displayed.



(1) Press the [∨] or [∧] key to select the item you want to view and press the [>] key.



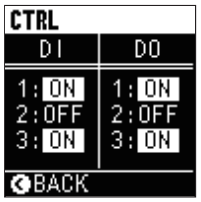
Display	Description
1.DI/DO	Digital input/output signal status
2.AI/AO	Analog input/output signal status*
3.ERR/ALM/WRN	Device status
4.CONF.STATUS	Parameter setup error status
5.DIAGNOSIS	Diagnostic information

* The AI value converted by zero point offset and span adjustment and the AO value before the conversion are displayed.

■ Items displayed on the monitor screen

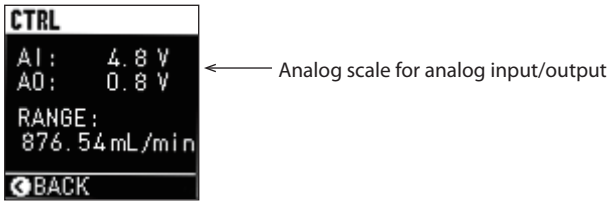
● Digital input/output signal status

The ON/OFF status of digital input and digital output are displayed in real time.



● Analog input/output signal status

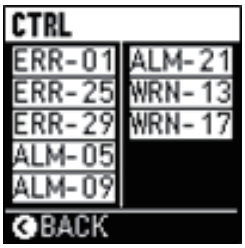
The voltage or current values of analog input and output are displayed in real time.



● Device status

The device status (error, alarm, or warning) is displayed in real time.

If there is an error



If there is no error

Up to 10 statuses are displayed in order of priority

Priorities: error > alarm > warning

Within priorities, 01 > 02 > ... > 31 > 32

Note

- ☞ Chapter 7. Troubleshooting (for the device status)

● Parameter setup error status

If parameter settings are not appropriate (if ALM-06 or WRN-06 has occurred in the device status above), inappropriate parameter settings are displayed.

Displayed error message	Description
MISOKJUDGE	Mutual condition nonconformity 1 (flow rate OK judgment)
MISDEVEVT	Mutual condition nonconformity 2 (flow rate deviation event)
MISSPLIMIT	Mutual condition nonconformity 3 (SP limit)
MISMLTCOEF	Mutual condition nonconformity 4 (multipoint flow rate correction)
SPOVER	SP setting over range
PULSEOVER	Pulse output over
MISAIOTYPE	Analog input/output setting error
GASTYPENG	Gas setting error
ILLEGALMODE	Mode error
PRESSNG	Primary pressure setting error
MINMAXOVER	Boundary value error

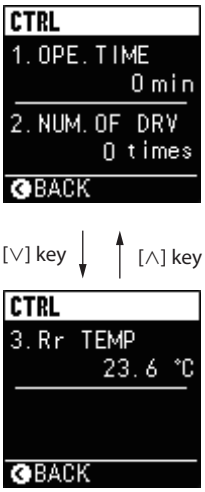
If there is an error

If there is no error

● Diagnostic information

Device diagnostic information is displayed in real time for maintenance.

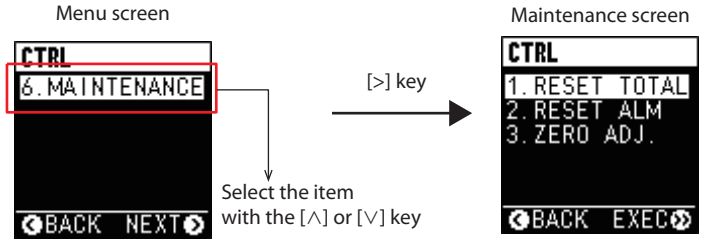
Display	Description
1.OPE.TIME	The elapsed time since power-on is displayed [min.].
2.NUM.OF.DRV	How many times the valve has been shut off is displayed.
3.RrTEMP	The Rr temperature (flow path temperature [°C]) is displayed.



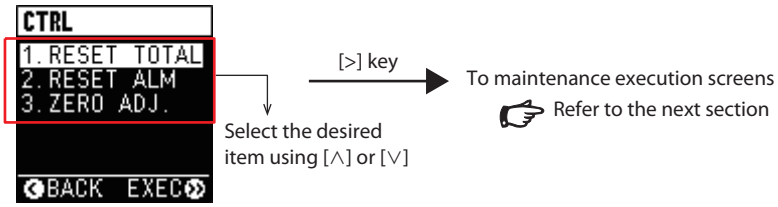
5 - 5 Maintenance

■ Maintenance procedure

(1) Select [6. MAINTENANCE] on the main screen with the [∨] or [∧] key and press the [>] key.
≫ The maintenance screen is displayed.



(1) Press the [∨] or [∧] key to select the item you want to maintain and press the [>] key.



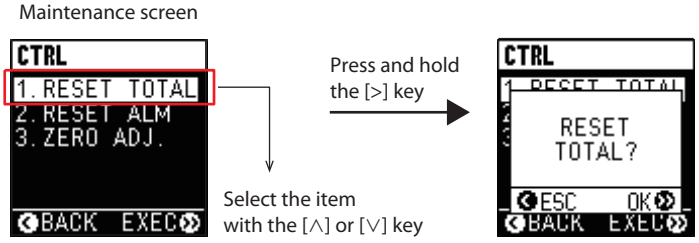
Menu item	Item description
1. RESET TOTAL	Total flow volume reset
2. RESET ALM	Device status deletion
3. ZERO ADJ.	Flow rate zero point adjustment

■ Maintenance items

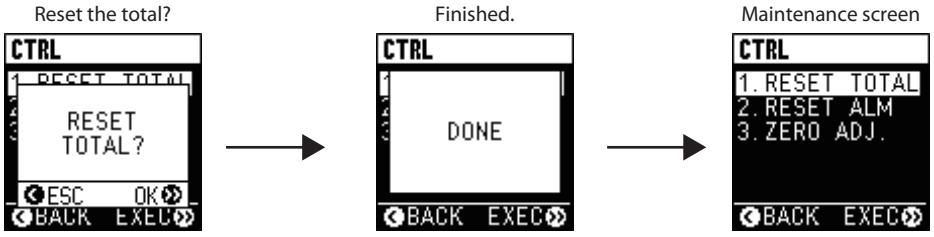
● Total flow volume reset

The total flow volume value can be reset to 0.

(1) Select [1. RESET TOTAL] on the maintenance screen with the [∨] or [∧] key and press and hold the [>] key.



(2) Press and hold the [>] key.
(If you do not wish to proceed with this operation, press the [<] key to return to the maintenance screen.)
≫ The total flow volume is reset and the exit screen is displayed. Then, the maintenance screen reappears.



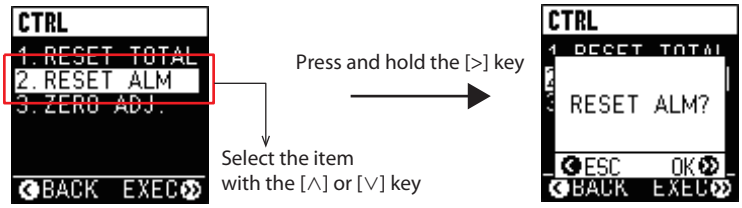
● Device status deletion

The current device status can be cleared.

! Handling Precautions

- The device status (alarm, warning, information) is deleted.
- Errors are not deleted.

(1) Select [2. RESET ALM] on the maintenance screen with the [∨] or [∧] key and press and hold the [>] key.



(2) Press and hold the [>] key.
(If you do not wish to proceed with this operation, press the [<] key to return to the maintenance screen.)

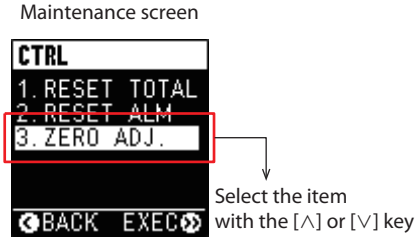
≫ The device status is deleted and the exit screen is displayed. Then, the maintenance screen reappears.

● Flow rate zero point adjustment

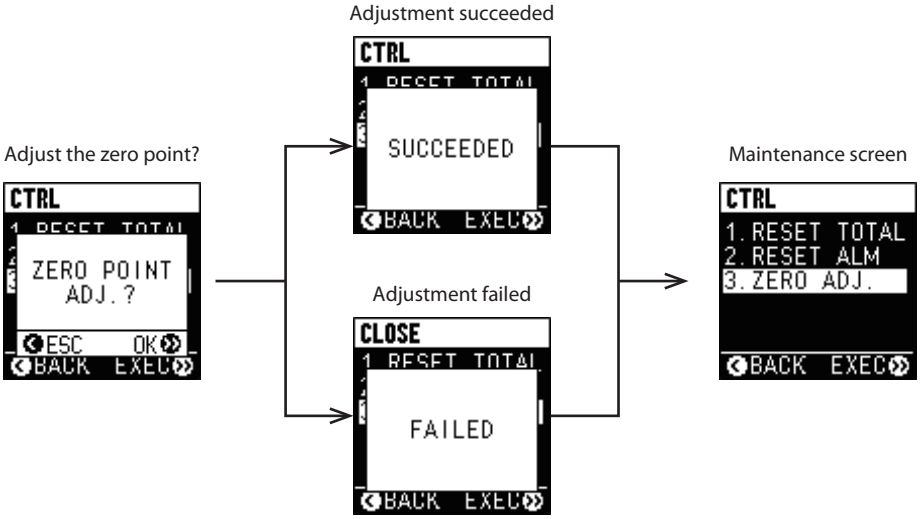
Drift in the zero point of the measured flow rate can be compensated for.
The flow rate zero point can be adjusted in fully closed mode or when the SP is 0 in control mode.

The flow rate zero point can be adjusted with the following three steps.

(1) Select [3. ZERO ADJ.] with the [∨] or [∧] key on the maintenance screen and press and hold the [>] key.



(2) Press and hold the [>] key.
(If you do not wish to proceed with this operation, press the [<] key to return to the maintenance screen.)
≫ The flow rate zero point is adjusted and the exit screen is displayed. Then, the maintenance screen reappears.



- Flow rate zero point adjustment using the loader

Note

- *User's Manual for Loader Package Model MLP-F4Q for Digital Mass Flow Controller Model F4Q* (CP-SP-1457E) (for the operation using the loader)

- Flow rate zero point adjustment with digital input

(1) Select flow rate zero point adjustment for digital input 1, 2, or 3 with the digital input function.

(2) Enable the fully closed mode or set the SP to 0 in control mode.

(3) Set the relevant digital input to ON and keep the ON state for at least 10 seconds.
≫ The flow rate zero point is adjusted.

Handling Precautions

- Do not adjust the flow rate zero point for 2 seconds after changing settings (including gas type switching).
- Before adjusting the flow rate zero point, completely replace the air in the flow path with the gas you will actually use, set the pressure specified by P23 (primary pressure specification), and stabilize the actual flow rate at zero.
- The flow rate zero point can be adjusted in fully closed mode or when the SP is set to 0 in control mode.

Note

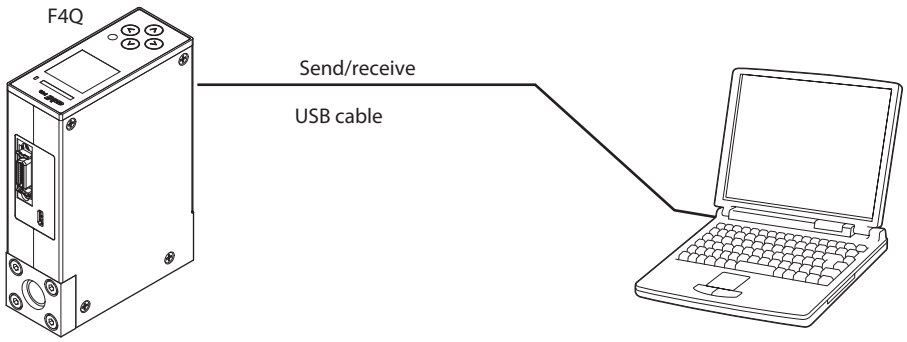
- ☞ ■ Abnormal statuses and corrective actions (p. 7-2) (if this process fails)

Chapter 6. Operations Using the PC Loader

The MLP-F4Q Loader Package for F4Q digital mass flow controllers (hereafter “the loader”) is provided as a simplified engineering software tool for configuring various settings in this device and for monitoring. The loader runs on a PC.

6 - 1 Connection

Connect a Windows PC and this device with a USB cable before starting loader communication.



You can upload and download parameters with the power supplied through the USB cable without having to turn on the main power supply (24 V DC) for this device.
The status indicator is lit in orange during USB-powered operation.

Handling Precautions

- When handling the cable, make sure that the electrodes of the connector are free from water droplets and dust. Otherwise, a failure might occur.
- Functions other than parameter upload and download do not normally operate during USB-powered operation. Be sure to turn on the main power supply for device operation.
- Do not use the loader during RS-485 communication. Data may not be written properly.

6 - 2 Monitoring Parameters

The loader can be used to check measured values and various statuses.

Note

- ☞ *User's Manual for Loader Package Model MLP-F4Q for Digital Mass Flow Controller Model F4Q* (CP-SP-1457E) (for details on the check procedure)

■ Monitoring parameters

Type	Parameter name	Writing	Description
Flow rate control info. (for startup adjustment)	Operational mode	Depends	The valve operation status (control, fully closed, or fully open mode) is displayed. Data cannot be written while the status is forced with digital input or due to error.
	Number of the SP currently in use	Depends	The selected one is displayed from SP-0 to SP-7. Data cannot be written while the status is forced with digital input.
	SP currently in use		Current SP flow rate
	Online SP	Yes	SP that applies when C-03 (flow rate setup method) is set to 2 (online SP).
	PV		Instantaneous flow rate
	Valve manipulated variable (MV)		The current valve opening is displayed as a percentage.
	Analog input		The external input voltage (or current) is displayed.
	Analog output		The external output voltage (or current) is displayed.
	Total flow volume		Totalized volume of instantaneous flow rate
	Operation status		Various statuses including flow rate OK judgment, ramp control status, flow rate deviation event, SP setup method selection status, gas type selection status, and external power supply status are displayed.
	Digital input status		ON/OFF statuses of digital inputs 1–3
	Digital output status		ON/OFF statuses of digital outputs 1–3
	Error		Device status. ☞ Chapter 7. Troubleshooting (for details and corrective actions)
	Alarm		
	Warning		
	Information		
	Detailed information (alarm)		
	Detailed information (warning)		

Type	Parameter name	Writing	Description
Flow rate control info. (settings, etc.)	SP setup method	Yes	Currently applied SP setup method. When you update function settings or parameter settings or turn on the power again, the method selected with C-03 (flow rate setup method) is applied again.
	Gas type		Currently selected gas type
	Full-scale flow rate		Maximum control range for the currently selected gas type
	Total flow volume status		Various statuses related to the total flow volume such as totalization event, total flow volume reset in progress, and totalization paused are displayed.
	Analog input/output type		Whether the input/output type is current or voltage is displayed.
	Analog scale		Flow rate for when analog input/output is 100 % (5 V or 20 mA)
	High-speed sampling mode	Yes	The mode of the high-speed sampling function available in the loader can be set. ☞ *User's Manual for Loader Package Model MLP-F4Q for Digital Mass Flow Controller Model F4Q* (CP-SP-1457E) (for details)
Engineer information	Forced test flag 1	Yes	The specified forced value is output when the forced flag is set to ON. Set the forced flag to OFF after use. The forced value is automatically cleared if the forced test flag is not written to for about 10 minutes. When forced output of the MV is turned ON by forced test flag 1, the MV temporarily changes to zero.
	Forced analog output value	Yes	
	Forced output valve manipulated variable (MV) value	Yes	
	Forced test flag 2	Yes	
	Forced digital output value	Yes	
	Totalizer pulse output count		Total of pulses that have been output
	Totalizer pulse output count reset flag	Yes	You can set the totalizer pulse output count to zero by setting the reset flag to ON.
	Elapsed time since power-on		The elapsed time since power-on is displayed. The time is reset when the power is turned on again.
	Total operating time (resettable)		Total power-on time is displayed.
	Total operating time (not resettable)		Total power-on time since shipment of the product is displayed.
	Cumulative flow rate (not resettable)		Total instantaneous flow volume since shipment of the product is displayed.
	Total valve closed count		How many times the valve has been shut off since shipment of the product is displayed.
	Sensor AD value		(for maintenance)
	AD value at zero point when the product was shipped		(for maintenance)
	Rr resistance temperature		(for maintenance)
	Rh resistance temperature – Rr resistance temperature		(for maintenance)
	Heater power		(for maintenance)
	Flow rate zero point adjustment value		(for maintenance)
	Firmware version (A)		Firmware version
	Firmware version (S)		
Device status history	Device status history		The most recent 16 device statuses (error, alarm, warning, and information) after power-on are displayed.

6 - 3 Functions Only Available in the Loader

This section describes the functions that can be set in the loader. (They cannot be set on the display of the device.)

Note

- ☞ *User's Manual for Loader Package Model MLP-F4Q for Digital Mass Flow Controller Model F4Q* (CP-SP-1457E) (for details on the setting procedure)

■ Display-related

● User tag specification

Any character string can be set as a tag at the bottom of the main screen.

This tag can be used to identify devices when multiple F4Q units are used.

Note

- ☞ ■ Bottom section of the main screen: Multi-information display (p. 4-2) (for how to display the user-specified tag on the display of the device)

● Related setting data

No.	Name	Description and setting range	Initial value	Notes
–	User-specified tag	–	-------	· Numbers, uppercase and lowercase characters, plus sign (+), hyphen/minus (-), period (.), and spaces ( ) can be used. · Up to seven characters can be displayed on the display of the device.

■ Analog input/output

● Analog input/output adjustment

The zero point offset and span can be adjusted (with any scaling factor) for analog input and analog output.
The value after adjustment is calculated with the following formulas:

Analog input value =
Analog input span adjustment × (Analog input value before application of this setting) + Analog input zero point offset

Analog output value =
Analog output span adjustment × (Analog output value before application of this setting) + Analog output zero point offset

● Related setting data

No.	Name	Description and setting range	Initial value	Notes
-	Analog input span adjustment	0.1 to 2	1	
-	Analog input zero point offset	−20 to +20 [V] or [mA]	0	
-	Analog output span adjustment	0.1 to 2	1	
-	Analog output zero point offset	−20 to +20 [V] or [mA]	0	

■ Flow rate control

● PID constants

The PID constant (proportional gain, integration time, derivative time) settings for flow rate control can be freely customized.
They are applied when the PID set by the user is set in C36 (control response setup).

Note

- ☞ ● Control response setup (p. 5-20) (for details on control response setup)

● Related setting data

No.	Name	Description and setting range	Initial value	Notes
-	P (proportional gain)	-	*	They are applied to flow rate control when the PID set by the user is set in C36 (control response setup).
-	I (integration time)	-		
-	D (derivative time)	-		

* The initial value differs according to the model.

■ Measurement conditions, flow rate correction

● Filter application during response

Whether to apply the PV filter during control response (rise/fall) can be selected. Increasing the filter with C-23 (PV filter constant) stabilizes PV output but slows down output response. You can combine both stability and response of output PV by temporarily setting 0 to the PV filter constant during control response and applying the PV filter only during settling.

● Related setting data

No.	Name	Description and setting range	Initial value	Notes
-	Filter application during response	Enabled or disabled	Disabled	

● Full-scale flow rate setting for the gas type set by the user

You can change the full-scale flow rate when the gas type set by the user is set for the gas type selection.

Note

- ☞ ● Gas type selection (p. 5-29) (for details on gas type selection)

- Related setting data

No.	Name	Description and setting range	Initial value	Notes
-	Full-scale flow rate when using the gas type set by the user	-	Depends on the model No.*	This setting changes to the full-scale flow rate if the gas type set by the user is set for the gas type selection.

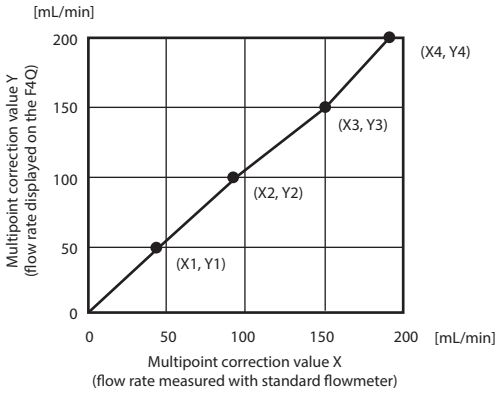
* The initial value is the same as the full-scale flow rate of the standard gas.

● Multipoint flow rate correction

This function corrects the control flow rate (PV) using measurements.
PVs indicated on this device and values measured with a flowmeter that serves as a standard can be paired (10 pairs max.) for fine correction of the flow rate.

Use this function, for example, when the control flow rate cannot be sufficiently corrected only by using the value set in P10 (user-set gas conversion factor (C.F)) when a gas type set by the user is used.

- Application example
  The full-scale flow rate is 200.0 mL/min and "1" (air/nitrogen) is selected for gas type selection in model F4Q9200. Now, suppose that the reference device reads 195.0 mL/min when this model is controlled at SP = 200.0 mL/min (100 % FS). If "195.0" is set for "Multi-point flow rate correction value Y4," control will be corrected so that the reading of the reference device is 200.0 when SP = 200.0 mL/min.



! Handling Precautions

- Set the line for monotonic increase. Otherwise, the operation will not be performed correctly.
- Up to 10 pairs can be specified. If the necessary number of pairs is less than 10, set (Xn, Yn) = (0, 0) for unnecessary pairs. For example, when using three pairs, set 0 for the settings of the fourth and subsequent pairs.
- The interval between correction points Xn and Xn+1 (flow rates measured with a standard flowmeter) must be at least 2 % of the standard full-scale flow rate. For adjustment of the zero point, use the flow rate zero point adjustment function instead of the multipoint flow rate correction function.

● **Related setting data**

No.	Name	Description and setting range	Initial value	Notes
Settings that can be changed only with the loader.				
-	Multipoint flow rate correction	Enabled or disabled	Disabled	Multipoint flow rate correction is enabled or disabled at each point.
-	Multipoint flow rate correction values X1 to X10	-	All 0	Sets the correct flow rate to be used for multipoint flow rate correction. Set this for monotonic increase. To disable multipoint flow rate correction, set X1 to 0. The interval between correction points must be at least 2 % of the standard full-scale flow rate.
-	Multipoint flow rate correction values Y1 to Y10	-	All 0	Sets the flow rate (PV) measured in this device to be used for multipoint flow rate correction. Set this for monotonic increase.

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Chapter 7. Troubleshooting

■ Types of device status and corrective actions

● Types of device status

There are four types of device status of the device: Error, alarm, warning, and information. ☞ 5-4 Displaying the Monitor Screen (p. 5-38) (for how to display the device status) The device status can also be checked using the PC loader.

● Error

An error has a significant impact on the operation of this device.
If it is caused by a transient problem such as electrical noise, the device may return to normal status after its power is turned off and back on. If not, request repair.

● Alarm

An alarm affects flow rate control. If an alarm occurs, flow rate control continues, but the accuracy of the flow rate is not guaranteed.

● Warning

A warning has a small impact on the measurement of the flow rate.
Whether a warning has occurred can be checked with the LED indicator or by the PC loader.
If a warning occurs, flow rate measurement continues.

● Information

This is not an abnormal status. Information is displayed for reference This status can be checked using the PC loader.

Note

- The operational mode and analog output in case of error can be set.
  ☞ "Operation in case of error" (for details)

■ Abnormal statuses and corrective actions

The following table lists abnormal statuses and corrective actions.
(Category E: Error, A: Alarm, W: Warning, I: Information)

No.	Type	Message	Description	Likely cause	Corrective action	Automatic recovery
1	A	ALM-01	Flow rate zero point adjustment failed	• The flow rate zero point was adjusted when the fluid was moving. • Foreign object on the sensor.	Check that the pipe is full of the fluid to be measured and that the fluid is not moving, and try again. If this does not solve the problem, request repair.	Yes
	W	WRN-01*1	Flow rate zero point adjustment completed (completion with warning)			
	I	None	Flow rate zero point adjustment completed (successful completion)	Flow rate zero point adjustment succeeded.	-	
2	W	WRN-02*1	SP is being limited	• The SP is limited because the original SP is outside of the range between 0 % and 100 %. • The SP is limited by the SP limit function.	Check the SP setting.	Yes
3	W	WRN-03*1	Valve overheat prevention limit activated*2	In control or fully open mode, the gas is shut off by an external device.	If the gas is continuously shut off by an external device, set the flow rate set point to zero or enable the fully closed mode.	Yes
				• Insufficient primary pressure*3 • Excessive ambient temperature*3	Check for the problems to the left.	
4	A	ALM-04	Flow rate correction error	The correction values calculated with various corrections (temperature correction, device orientation correction, and pressure correction) are incorrect.	Check the temperature and pressure status.	Yes
	W	WRN-04*1	Reverse flow detection	The flow rate value is below –10 % FS.	Check the upstream and downstream pressure and the installation orientation of this device.	Yes
	W	WRN-04*1	Excessive flow rate detection	The measured PV is saturated. Note This warning may occur depending on the primary pressure when the valve is fully open.	If this occurs in control mode, check whether the primary pressure is within the allowable inlet pressure range.	

No.	Type	Message	Description	Likely cause	Corrective action	Automatic recovery
6	A	ALM-06	User-defined settings error ()	Function settings or parameter settings are incorrect and the device does not function as set. • The SP lower limit is larger than the SP upper limit. • Multipoint flow rate correction settings are incorrect. • An incompatible gas is selected. • The primary pressure setting is outside of the specification range. among others	Review the settings. ☞ 5 - 4 Displaying the Monitor Screen (p. 5-38) (for how to check the user-defined settings error status)	Yes
	W	WRN-06*1	User-defined settings warning	Function settings or parameter settings are incorrect but the device functions as set. • The OK judgment hysteresis is larger than the judgment range. • The hysteresis for the upper or lower limit flow rate deviation event is larger than the threshold. • The flow rate set point is outside the guaranteed accuracy range, etc.	Check the settings. ☞ 5 - 4 Displaying the Monitor Screen (p. 5-38) (for how to check the user-defined settings error status)	Yes
7	W	WRN-07*1	Communication protocol error	Because the power was not cycled off-on after the protocol setting was changed, the new setting has not been applied.	Turn the power off and back on again.	–
8	A	ALM-08	Flow rate control error	• Insufficient primary pressure • Excessive primary pressure • Insufficient power supply voltage • Operating temperature exceeded, among others	Check for the problems to the left. If they do not solve the problem, request repair.	Yes
9	A	ALM-09	Watchdog time-out	The device was reset due to a malfunction resulting from electrical noise or other cause.	If the error persists after turning the power off and back on, request repair.	–
10	E	ERR-10	Valve error	• The valve cannot be shut due to foreign matter. • The valve cannot be shut because the valve drive circuit has failed.	If the error persists after turning the power off and back on, request repair.	–

No.	Type	Message	Description	Likely cause	Corrective action	Automatic recovery
11	E	ERR-11	Sensor module error	• There is a problem with the sensor module. • Communication is not established with the sensor module due to connector disconnection or other cause.	If the error persists after turning the power off and back on, request repair.	–
	A	ALM-11	Minor problem with the sensor module	• There is a problem with the sensor module.	If the error persists after turning the power off and back on, request repair.	–
12	E/A	ERR-12/ ALM-12	Parameter mismatch	Parameters set when the product was shipped are invalid.	If the error persists after turning the power off and back on, request repair.	–
13	E	ERR-13	Parameter error (not restorable from backup)	The data in the device is corrupt.	If the error persists after changing the parameter setting and turning the power off and back on, request repair.	–
	W	WRN-13*1	Parameter error (corrected from backup)	Internal data in this device was corrupted due to power shutdown during parameter writing but was restored using a backup.	Function settings and parameter settings may have been changed. Check the settings and turn on the power again.	–
14	E	ERR-14	Hardware error	• The electric circuit has failed. • The sensor unit has failed.	If the error persists after turning the power off and back on, request repair.	–
15	E	ERR-15	Programmable ROM error	Data mismatch was detected in a cyclic redundancy check (CRC) for the ROM.	If the error persists after turning the power off and back on, request repair.	–
16	E	ERR-16	Software execution error	An error other than the above has occurred.	If the error persists after turning the power off and back on, request repair.	–

*1. Warnings are not displayed on the main screen. To check for warnings, select [ERR/ALM/WRN] on the monitor menu screen. ☞ 5 - 4 Displaying the Monitor Screen (p. 5-38) (for the operation method) * The initial value differs according to the model.

*2. If the valve overheat prevention limit is activated, the valve MV is forcibly limited.

*3. If a gas other than air or nitrogen is used, the valve overheat prevention limit may be activated even when this device is operating within the operating differential pressure range and the operating temperature range. Increase the supply pressure or lower the ambient temperature.

Note

- ☞ ■ Top section of the main screen: Display of PV and errors or alarms (p. 4-1) (for errors and alarms of the device status codes)
- ☞ ● Device status deletion (p. 5-42) (for how to clear the device status code)

■ Other problems

Symptom	Cause	Remedy
Actual flow rate is zero but flow rate display does not read zero. (The PV display is not 0 even if the valve is fully closed.)	• The device is mounted on a vertical (or inclined) pipe and the settings are incorrect. • Condensation on the sensor. • Drift in the zero point of the sensor. • Foreign object on the sensor.	• If the device is mounted on a vertical pipe, check C-34 (installation orientation setup) and P-23 (primary pressure specification) and adjust the flow rate zero point. • Adjust the flow rate zero point. • ☞● Flow rate zero point adjustment (p. 5-43) (for how to adjust the flow rate zero point) • Increase P-26 (low flow cutoff threshold). • Insert a mist trap upstream. • Request repair.
Flow rate does not stabilize.	• Operating differential pressure is excessive. • Large inlet pressure fluctuation. • Pressure regulator interference. • Large pressure loss in piping (large fluctuation in operating differential pressure according to the flow rate) • Check for valve vibration. • C-36 (control response setup) is incorrect.	• Reduce the inlet pressure. • Insert a pressure regulator upstream. • Change the regulator pressure setting or increase the piping capacity between the device and regulator. • Use a larger diameter pipe. • Remove equipment causing a large pressure loss or insert a control between this device and the equipment. • Change the check valve to one with a low cracking pressure. • Increase C-23 (PV filter constant). • Set "2" (stability prioritized) in C-36 (control response setup). • Set "3" (PID set by user) in C-36 (control response setup) and set appropriate PID constants.
Poor accuracy	• Temperature standard does not match that of the reference flowmeter. • Regulator is vibrating slightly. • Foreign object on the sensor.	• Adjust the temperature standard. (It can be changed with function setting C-19.) • Change the regulator pressure setting. • Request repair.
The LCD display is unreadable.	Malfunction due to electrical noise	Force the display to refresh by pressing and holding both the [∧] and [∨] keys for 3 seconds. If the error persists, turn the power off and back on.

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Chapter 8. Specifications

■ Individual specifications

● Model F4Q9200/9500/0002

Item		Model F4Q9200	Model F4Q9500	Model F4Q0002
Valve type		Proportional solenoid valve		
Valve operation		Normally closed (N.C.) when not powered		
Standard full-scale flow rate (air/nitrogen)*1		200 mL/min	0.5 L/min	2 L/min
Standard compatible gas type*2	Fluoroelastomer gasket	Air/nitrogen, oxygen, argon, carbon dioxide, fuel gas 13A (45 MJ/m³), 100 % methane, 100 % propane, 100 % butane		
	EPDM gasket	Air/nitrogen, argon, carbon dioxide		
Control	Control range	1 to 100 % FS		
	Response time*3	0.3 s (typ.) to the setting ±2 % FS (when control begins with the valve fully closed, or when the setting is changed during control)		
	Accuracy (under standard conditions. Q: flow rate)*4	±1 % SP (40 ≤ Q ≤ 100 %) ±0.4 % FS (1 ≤ Q < 40 %)	±1 % SP (15 ≤ Q ≤ 100 %) ±0.15 % FS (1 ≤ Q < 15 %)	
	Repeatability (Q: Flow rate)	±0.25 % SP (40 ≤ Q ≤ 100 %) ±0.1 % FS (1 ≤ Q < 40 %)	±0.25 % SP (15 ≤ Q ≤ 100 %) ±0.0375 % FS (1 ≤ Q < 15 %)	
	Effect of temperature (Q: Flow rate)*3, *5	±0.1 % SP/°C (40 ≤ Q ≤ 100 %) ±0.015 % FS/°C (1 ≤ Q < 40 %)	±0.1 % SP/°C (15 ≤ Q ≤ 100 %) ±0.015 % FS/°C (1 ≤ Q < 15 %)	
	Effect of pressure*5	0.3 % FS / 100 kPa		
Pressure	Standard differential pressure	200 kPa (inlet pressure: 200 kPa (gauge); outlet pressure: 0 kPa (gauge))		
	Operating differential pressure*6, *7	50 to 300 kPa	5 to 300 kPa	50 to 300 kPa
	Allowable inlet pressure	0.5 MPa (gauge)		
	Pressure resistance	1 MPa (gauge)		
Operating conditions	Ambient temperature	–10 to + 60 °C		
	Ambient humidity	10 to 90 % RH (without condensation)		
	Vibration condition	No vibration		
Transport/storage conditions	Ambient temperature	–20 °C to +70 °C		
	Drop	0.8 m (when packed)		
	Vibration resistance	4.9 m/s² (10 to 60 Hz, in the X, Y, and Z directions for two hours when mounted with the bracket)		
	Shock resistance	X direction: 147 m/s² Y and Z directions: 490 m/s² (three times in each direction when mounted with the bracket ☞ ■ External dimensions (p. 8-17) (for the directions))		
External leakage		1×10⁻⁸ Pa•m³/s (He)(not including O-ring permeability)		
Flow rate setting	Method	(1) Use of the keys, (2) External analog input, (3) Loader communication, (4) RS-485 communication (3-wire system)		
Analog input	Input type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)		
	Input impedance	1 MΩ ±10 % for DC voltage input, 250 Ω ±10 % for current input		

Item		Model F4Q9200	Model F4Q9500	Model F4Q0002
Analog output	Output type	Instantaneous flow rate (PV) output or flow rate set point (SP) output (switchable)		
	Output scale	0 to full-scale flow rate (scale can be changed)		
	Output type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)		
	Maximum output	7 V DC or less / 28 mA or less		
	Accuracy	±0.3 % FS (overall output accuracy: indication accuracy ±0.3 % FS)		
	External load resistance	250 kΩ min. for voltage output, 300 Ω max. for current output		
Digital output	Number of outputs	3		
	Output rating	External power supply: 30 V DC max., maximum load current: 30 mA max. (Nch open drain non-isolated output, when power off: open contacts)		
	Totalization pulse width	20–100 ms (when totalizer pulse output is selected, output at multiples of 20 ms)		
	Totalization pulse weight	1 to 1,000,000 mL/ pulse	2 to 1,000,000 mL/ pulse	10 to 1,000,000 mL/ pulse
Digital input	Number of inputs	3		
	Required circuit type	Non-voltage contacts or open collector		
	Terminal voltage with contacts OFF	5 ±0.5 V		
	Terminal current with contacts ON	Approx. 0.5 mA (current to contacts)		
	Allowable ON contact resistance	250 Ω max.		
	Allowable OFF contact resistance	100 kΩ min.		
	Allowable ON residual voltage	1.0 V max. (with open collector)		
	Allowable OFF leakage current	100 µA max. (with open collector)		
Communication	Method*8	(1) USB 2.0 (2) RS-485 communication (3-wire system, CPL or Modbus RTU)		
	Transfer speed selection	4800, 9600, 19200, 38400 bps (with RS-485 communication)		
Power	Rating	24 V DC, current consumption: 300 mA max.		
	Allowable supply voltage range	21.6–26.4 V DC (ripple: 5 % max.)		
	Isolation	The power supply circuit and I/O circuit are isolated.		
Connection method*9		Rc ¼, ¼ Swagelok, ¼ VCR, 9/16–18 UNF		
Main gas-contacting materials*10	Fluoroelastomer gasket	SUS316, SUS316L, K-M35F, Teflon, fluoroelastomer		
	EPDM gasket	SUS316, SUS316L, K-M35F, Teflon, EPDM		
Mounting orientation*11		Horizontally (the top panel should not face downward) or vertically		
Weight		About 1.2 kg		
Protective structure		IP40*12		
Standards compliance*15		EN 61326-1, EN 61326-2-3		

● Model F4Q0005/0020

Item		Model F4Q0005	Model F4Q0020
Valve type		Proportional solenoid valve	
Valve operation		Normally closed (N.C.) when not powered	
Standard full-scale flow rate (air/nitrogen)*1		5 L/min	20 L/min
Standard compatible gas type*2	Fluoroelastomer gasket	Air/nitrogen, oxygen, argon, carbon dioxide, fuel gas 13A (45 MJ/m³), 100 % methane, 100 % propane, 100 % butane	
	EPDM gasket	Air/nitrogen, argon, carbon dioxide	
Control	Control range	1 to 100 % FS	
	Response time*3	0.3 s (typ.) to the setting ±2 % FS (when control begins with the valve fully closed, or when the setting is changed during control)	
	Accuracy (under standard conditions. Q: flow rate)*4	±1 % SP (15 ≤ Q ≤ 100 %) ±0.15 % FS (1 ≤ Q < 15 %)	
	Repeatability (Q: Flow rate)	±0.25 % SP (15 ≤ Q ≤ 100 %) ±0.0375 % FS (1 ≤ Q < 15 %)	
	Effect of temperature (Q: Flow rate)*3, *5	±0.1 % SP/°C (15 ≤ Q ≤ 100 %) ±0.015 % FS/°C (1 ≤ Q < 15 %)	
	Effect of pressure*5	0.3 % FS / 100 kPa	
Pressure	Standard differential pressure	200 kPa (inlet pressure: 200 kPa (gauge); outlet pressure: 0 kPa (gauge))	
	Operating differential pressure*6, *7	5 to 300 kPa	50 to 300 kPa
	Allowable inlet pressure	0.5 MPa (gauge)	
	Pressure resistance	1 MPa (gauge)	
Operating conditions	Ambient temperature	–10 to + 60 °C	
	Ambient humidity	10 to 90 % RH (without condensation)	
	Vibration condition	No vibration	
Transport/storage conditions	Ambient temperature	–20 to +70 °C	
	Drop	0.8 m (when packed)	
	Vibration resistance	4.9 m/s² (10 to 60 Hz, in the X, Y, and Z directions for two hours when mounted with the bracket)	
	Shock resistance	X direction: 147 m/s² Y and Z directions: 490 m/s² (three times in each direction when mounted with the bracket ☞ ■ External dimensions (p. 8-17) (for directions))	
External leakage		1×10⁻⁸ Pa•m³/s (He)(not including O-ring permeability)	
Flow rate setting	Method	(1) Use of the keys, (2) External analog input, (3) Loader communication, (4) RS-485 communication (3-wire system)	
Analog input	Input type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)	
	Input impedance	1 MΩ ±10 % for DC voltage input, 250 Ω ±10 % for current input	
Analog output	Output type	Instantaneous flow rate (PV) output or flow rate set point (SP) output (switchable)	
	Output scale	0 to full-scale flow rate (scale can be changed)	
	Output type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)	
	Maximum output	7 V DC or less / 28 mA or less	
	Accuracy	±0.3 % FS (overall output accuracy: indication accuracy ±0.3 % FS)	
	External load resistance	250 kΩ min. for voltage output, 300 Ω max. for current output	

Item		Model F4Q0005	Model F4Q0020
Digital output	Number of outputs	3	
	Output rating	External power supply: 30 V DC max., maximum load current: 30 mA max. (Nch open drain non-isolated output, when power off: open contacts)	
	Totalization pulse width	20–100 ms (when totalizer pulse output is selected, output at multiples of 20 ms)	
	Totalization pulse weight	20 to 1,000,000 mL/pulse	100 to 1,000,000 mL/pulse
Digital input	Number of inputs	3	
	Required circuit type	Non-voltage contacts or open collector	
	Terminal voltage with contacts OFF	5 ±0.5 V	
	Terminal current with contacts ON	Approx. 0.5 mA (current to contacts)	
	Allowable ON contact resistance	250 Ω max.	
	Allowable OFF contact resistance	100 kΩ min.	
	Allowable ON residual voltage	1.0 V max. (with open collector)	
	Allowable OFF leakage current	100 µA max. (with open collector)	
Communication	Method*8	(1) USB 2.0 (2) RS-485 communication (3-wire system, CPL or Modbus RTU)	
	Transfer speed selection	4800, 9600, 19200, 38400 bps (with RS-485 communication)	
Power	Rating	24 V DC, current consumption: 300 mA max.	
	Allowable supply voltage range	21.6–26.4 V DC (ripple: 5 % max.)	
	Isolation	The power supply circuit and I/O circuit are isolated.	
Connection method*9		Rc ¼, ¼ Swagelok, ¼ VCR, 9/16–18 UNF	
Main gas-contacting materials*10	Fluoroelastomer gasket	SUS316, SUS316L, K-M35F, Teflon, fluoroelastomer	
	EPDM gasket	SUS316, SUS316L, K-M35F, Teflon, EPDM	
Mounting orientation*11		Horizontally (the top panel should not face downward) or vertically	
Weight		About 1.2 kg	
Protective structure		IP40*12	
Standards compliance*15		EN 61326-1, EN 61326-2-3	

● **Model F4Q0050(B,C)**

Item		Model F4Q0050(B,C)
Valve type		Proportional solenoid valve
Valve operation		Normally closed (N.C.) when not powered
Standard full-scale flow rate (air/nitrogen)*1		50 L/min
Standard compatible gas type*2	Fluoroelastomer gasket	Air/nitrogen, oxygen, argon, carbon dioxide, fuel gas 13A (45 MJ/m³), 100 % methane, 100 % propane, 100 % butane
	EPDM gasket	Air/nitrogen, argon, carbon dioxide
Control	Control range	1 to 100 % FS
	Response time*3	0.3 s (typ.) to the setting ±2 % FS (when control begins with the valve fully closed, or when the setting is changed during control)
	Accuracy (under standard conditions. Q: flow rate)*4	±1 % SP (15 ≤ Q ≤ 100 %) ±0.15 % FS (1 ≤ Q < 15 %)
	Repeatability (Q: Flow rate)	±0.25 % SP (15 ≤ Q ≤ 100 %) ±0.0375 % FS (1 ≤ Q < 15 %)
	Effect of temperature (Q: Flow rate)*3, *5	±0.1 % SP/°C (15 ≤ Q ≤ 100 %) ±0.015 % FS/°C (1 ≤ Q < 15 %)
	Effect of pressure*5	0.3 % FS / 100 kPa
Pressure	Standard differential pressure	200 kPa (Inlet pressure = 200 kPa [gauge], outlet pressure = 0 kPa [gauge])
	Operating differential pressure*6, *7	100 to 300 kPa
	Allowable inlet pressure	0.5 MPa (gauge)
	Pressure resistance	1 MPa (gauge)
Operating conditions	Ambient temperature	–10 to + 60 °C
	Ambient humidity	10 to 90 % RH (without condensation)
	Vibration condition	No vibration
Transport/storage conditions	Ambient temperature	–20 to +70 °C
	Drop	0.8 m (when packed)
	Vibration resistance	4.9 m/s² (10 to 60 Hz, in the X, Y, and Z directions for two hours when mounted with the bracket)
	Shock resistance	X direction: 147 m/s² Y and Z directions: 490 m/s² (three times in each direction when mounted with the bracket ☞ ■ External dimensions (p. 8-17) (for directions))
External leakage		1×10⁻⁸ Pa•m³/s (He)(not including O-ring permeability)
Flow rate setting	Method	(1) Use of the keys, (2) External analog input, (3) Loader communication, (4) RS-485 communication (3-wire system)
Analog input	Input type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)
	Input impedance	1 MΩ ±10 % for DC voltage input, 250 Ω ±10 % for current input
Analog output	Output type	Instantaneous flow rate (PV) output or flow rate set point (SP) output (switchable)
	Output scale	0 to full-scale flow rate (scale can be changed)
	Output type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)
	Maximum output	7 V DC or less / 28 mA or less
	Accuracy	±0.3 % FS (overall output accuracy: indication accuracy ±0.3 % FS)
	External load resistance	250 kΩ min. for voltage output, 300 Ω max. for current output

Item		Model F4Q0050(B,C)
Digital output	Number of outputs	3
	Output rating	External power supply: 30 V DC max., maximum load current: 30 mA max.
	Totalization pulse width	20–100 ms (when totalizer pulse output is selected, output at multiples of 20 ms)
	Totalization pulse weight	200 to 1,000,000 mL/pulse
Digital input	Number of inputs	3
	Required circuit type	Non-voltage contacts or open collector
	Terminal voltage with contacts OFF	5 ±0.5 V
	Terminal current with contacts ON	Approx. 0.5 mA (current to contacts)
	Allowable ON contact resistance	250 Ω max.
	Allowable OFF contact resistance	100 kΩ min.
	Allowable ON residual voltage	1.0 V max. (with open collector)
	Allowable OFF leakage current	100 µA max. (with open collector)
Communication	Method*8	(1) USB 2.0 (2) RS-485 communication (3-wire system, CPL or Modbus RTU)
	Transfer speed selection	4800, 9600, 19200, 38400 bps (with RS-485 communication)
Power	Rating	24 V DC, current consumption: 300 mA max.
	Allowable supply voltage range	21.6–26.4 V DC (ripple: 5 % max.)
	Isolation	The power supply circuit and I/O circuit are isolated.
Connection method*9		Rc ¼, ¼ Swagelok, ¼ VCR, 9/16–18 UNF
Main gas-contacting materials*10	Fluoroelastomer gasket	SUS316, SUS316L, K-M35F, Teflon, fluoroelastomer
	EPDM gasket	SUS316, SUS316L, K-M35F, Teflon, EPDM
Mounting orientation*11		Horizontally (the top panel should not face downward) or vertically
Weight		About 1.2 kg
Protective structure		IP40*12
Standards compliance*15		EN 61326-1, EN 61326-2-3

● **Model F4Q0050(J,K)**

Item		Model F4Q0050(J,K)
Valve type		Pilot valve
Valve operation		Normally closed (N.C.) when not powered
Standard full-scale flow rate (air/nitrogen)*1		50 L/min
Standard compatible gas type*2	Fluoroelastomer gasket	Air/nitrogen, oxygen, argon, carbon dioxide, fuel gas 13A (45 MJ/m³), 100 % methane, 100 % propane, 100 % butane
	EPDM gasket	–
Control	Control range	1 to 100 % FS
	Response time*3	0.7 s (typ.) to the setting ±2 % FS (when control begins with the valve fully closed, or when the setting is changed during control)
	Accuracy (under standard conditions. Q: flow rate)*4	±1.5 % SP (30 ≤ Q ≤ 100 %) ±0.45 % FS (0 ≤ Q < 30 %)
	Repeatability (Q: Flow rate)	±0.375 % SP (30 ≤ Q ≤ 100 %) ±0.113 % FS (0 ≤ Q < 30 %)
	Effect of temperature (Q: Flow rate)*3, *5	±0.15 % SP/°C (30 ≤ Q ≤ 100 %) ±0.045 % FS (0 ≤ Q < 30 %)
	Effect of pressure*5	0.3 % FS / 100 kPa
Pressure	Standard differential pressure	50 kPa (Inlet pressure = 50 kPa [gauge], outlet pressure = 0 kPa [gauge])
	Operating differential pressure*6, *7	10 to 100 kPa
	Allowable inlet pressure	0.5 MPa (gauge)
	Pressure resistance	1 MPa (gauge)
Operating conditions	Ambient temperature	–10 to + 60 °C
	Ambient humidity	10 to 90 % RH (without condensation)
	Vibration condition	No vibration
Transport/storage conditions	Ambient temperature	–20 to +70 °C
	Drop	0.8 m (when packed)
	Vibration resistance	4.9 m/s² (10 to 60 Hz, in the X, Y, and Z directions for two hours when mounted with the bracket)
	Shock resistance	X direction: 147 m/s² Y and Z directions: 490 m/s² (three times in each direction when mounted with the bracket ☞ ■ External dimensions (p. 8-17) (for directions))
External leakage		1×10⁻⁸ Pa•m³/s (He)(not including O-ring permeability)
Flow rate setting	Method	(1) Use of the keys, (2) External analog input, (3) Loader communication, (4) RS-485 communication (3-wire system)
Analog input	Input type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)
	Input impedance	1 MΩ ±10 % for DC voltage input, 250 Ω ±10 % for current input
Analog output	Output type	Instantaneous flow rate (PV) output or flow rate set point (SP) output (switchable)
	Output scale	0 to full-scale flow rate (scale can be changed)
	Output type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)
	Maximum output	7 V DC or less / 28 mA or less
	Accuracy	±0.3 % FS (overall output accuracy: indication accuracy ±0.3 % FS)
	External load resistance	250 kΩ min. for voltage output, 300 Ω max. for current output

Item		Model F4Q0050(J,K)
Digital output	Number of outputs	3
	Output rating	External power supply: 30 V DC max., maximum load current: 30 mA max.
	Totalization pulse width	20–100 ms (when totalizer pulse output is selected, output at multiples of 20 ms)
	Totalization pulse weight	200 to 1,000,000 mL/pulse
Digital input	Number of inputs	3
	Required circuit type	Non-voltage contacts or open collector
	Terminal voltage with contacts OFF	5 ±0.5 V
	Terminal current with contacts ON	Approx. 0.5 mA (current to contacts)
	Allowable ON contact resistance	250 Ω max.
	Allowable OFF contact resistance	100 kΩ min.
	Allowable ON residual voltage	1.0 V max. (with open collector)
	Allowable OFF leakage current	100 µA max. (with open collector)
Communication	Method*8	(1) USB 2.0 (2) RS-485 communication (3-wire system, CPL or Modbus RTU)
	Transfer speed selection	4800, 9600, 19200, 38400 bps (with RS-485 communication)
Power	Rating	24 V DC, current consumption: 400 mA max.
	Allowable supply voltage range	21.6–26.4 V DC (ripple: 5 % max.)
	Isolation	The power supply circuit and I/O circuit are isolated.
Connection method*9		Rc ½, ½ Swagelok, ½ VCR, 3/4–16 UNF
Main gas-contacting materials*10	Fluoroelastomer gasket	SUS316, SUS316L, K-M35F, Teflon, fluoroelastomer
	EPDM gasket	–
Mounting orientation*11		Horizontally (the top panel should not face downward) or vertically
Weight		About 3.1 kg
Protective structure		IP40*13
Standards compliance*15		EN 61326-1, EN 61326-2-3

● **Model F4Q0100/0200**

Item		Model F4Q0100	Model F4Q0200
Valve type		Pilot valve	
Valve operation		Normally closed (N.C.) when not powered	
Standard full-scale flow rate (air/nitrogen)*1		100 L/min	200 L/min
Standard compatible gas type*2	Fluoroelastomer gasket	Air/nitrogen, oxygen, argon, carbon dioxide, fuel gas 13A (45 MJ/m³), 100 % methane, 100 % propane, 100 % butane	
	EPDM gasket	–	Air/nitrogen, argon, carbon dioxide
Control	Control range	1 to 100 % FS	
	Response time*3	0.3 s (typ.) to the setting ±2 % FS	0.7 s (typ.) to the setting ±2 % FS
		(when control begins with the valve fully closed, or when the setting is changed during control)	
	Accuracy (under standard conditions. Q: flow rate)*4	±1.5 % SP (60 ≤ Q ≤ 100 %) ±0.9 % FS (0 ≤ Q < 60 %)	±1 % SP (30 ≤ Q ≤ 100 %) ±0.3 % FS (0 ≤ Q < 30 %)
	Repeatability (Q: Flow rate)	±0.375 % SP (60 ≤ Q ≤ 100 %) ±0.225 % FS (0 ≤ Q < 60 %)	±0.25 % SP (30 ≤ Q ≤ 100 %) ±0.075 % FS (0 ≤ Q < 30 %)
	Effect of temperature (Q: Flow rate)*3, *5	±0.15 % SP/°C (60 ≤ Q ≤ 100 %) ±0.09 % FS/°C (0 ≤ Q < 60 %)	±0.1 % SP/°C (30 % ≤ Q ≤ 100 %) ±0.05 % FS/°C (0 % ≤ Q < 30 %)
	Effect of pressure*5	0.3 % FS / 100 kPa	
Pressure	Standard differential pressure	200 kPa (Inlet pressure = 200 kPa [gauge], outlet pressure = 0 kPa [gauge])	
	Operating differential pressure*6, *7	200 to 400 kPa	100 to 300 kPa
	Allowable inlet pressure	0.5 MPa (gauge)	
	Pressure resistance	1 MPa (gauge)	
Operating conditions	Ambient temperature	–10 to + 60 °C	–10 to + 60 °C (Condition: power voltage = 24 V)*14
	Ambient humidity	10 to 90 % RH (without condensation)	
	Vibration condition	No vibration	
Transport/storage conditions	Ambient temperature	–20 to +70 °C	
	Drop	0.8 m (when packed)	
	Vibration resistance	4.9 m/s² (10 to 60 Hz, in the X, Y, and Z directions for two hours when mounted with the bracket)	
	Shock resistance	X direction: 147 m/s² Y and Z directions: 490 m/s² (three times in each direction when mounted with the bracket ☞ ■ External dimensions (p. 8-17) (for directions))	
External leakage		1×10⁻⁸ Pa•m³/s (He)(not including O-ring permeability)	
Flow rate setting	Method	(1) Use of the keys, (2) External analog input, (3) Loader communication, (4) RS-485 communication (3-wire system)	
Analog input	Input type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)	
	Input impedance	1 MΩ ±10 % for DC voltage input, 250 Ω ±10 % for current input	
Analog output	Output type	Instantaneous flow rate (PV) output or flow rate set point (SP) output (switchable)	
	Output scale	0 to full-scale flow rate (scale can be changed)	
	Output type	0–5 V DC, 1–5 V DC, 4–20 mA (switchable)	
	Maximum output	7 V DC or less / 28 mA or less	
	Accuracy	±0.3 % FS (overall output accuracy: indication accuracy ±0.3 % FS)	
	External load resistance	250 kΩ min. for voltage output, 300 Ω max. for current output	

Item		Model F4Q0100	Model F4Q0200
Digital output	Number of outputs	3	
	Output rating	External power supply: 30 V DC max., maximum load current: 30 mA max. (Nch open drain non-isolated output, when power off: open contacts)	
	Totalization pulse width	20–100 ms (when totalizer pulse output is selected, output at multiples of 20 ms)	
	Totalization pulse weight	500 to 1,000,000 mL/pulse	1,000 to 1,000,000 mL/pulse
Digital input	Number of inputs	3	
	Required circuit type	Non-voltage contacts or open collector	
	Terminal voltage with contacts OFF	5 ±0.5 V	
	Terminal current with contacts ON	Approx. 0.5 mA (current to contacts)	
	Allowable ON contact resistance	250 Ω max.	
	Allowable OFF contact resistance	100 kΩ min.	
	Allowable ON residual voltage	1.0 V max. (with open collector)	
	Allowable OFF leakage current	100 µA max. (with open collector)	
Communication	Method*8	(1) USB 2.0 (2) RS-485 communication (3-wire system, CPL or Modbus RTU)	
	Transfer speed selection	4800, 9600, 19200, 38400 bps (with RS-485 communication)	
Power	Rating	24 V DC, current consumption: 300 mA max.	
	Allowable supply voltage range	21.6–26.4 V DC (ripple: 5 % max.)	
	Isolation	The power supply circuit and I/O circuit are isolated.	
Connection method*9		Rc ¼, ⅜ Swagelok, ½ VCR, 9/16–18 UNF	Rc ½, ½ Swagelok, ½ VCR, 3/4–16 UNF
Main gas-contacting materials*10	Fluoroelastomer gasket	SUS316, SUS316L, K-M35F, Teflon, fluoroelastomer	
	EPDM gasket	–	SUS316, SUS316L, K-M35F, Teflon, EPDM
Mounting orientation*11		Horizontally (the top panel should not face downward) or vertically	
Weight		About 1.2 kg	About 3.1 kg
Protective structure		IP40*12	IP40*13
Standards compliance*15		EN 61326-1, EN 61326-2-3	

*1. mL/min and L/min indicate the volumetric flow rate per minute converted to conditions of 0 °C and 101.325 kPa (1 atm). The controllable flow rate range varies depending on the gas type. Refer to the gas type and control range.

*2. The gas must be dry and not contain corrosive components (chlorine, sulfur, acid, etc.). Also, it must be clean, without dust or oil mist.

*3. Value at standard differential pressure.

*4. Instrument error under standard conditions according to our equipment.
● Fluid: air ● Inlet pressure: standard differential pressure ±15 kPa (gauge) ● Outlet pressure: atmospheric pressure ● Ambient temperature: 23 ±2 °C ● Gas temperature: same as ambient temperature ● Operational mode: control mode ● Vibration/pulsation: none ● Warm-up time: leave at ambient temperature for 2 hours or more, and leave for 30 minutes or more after turning on the power ● Device orientation: horizontal with the display facing upward ● Straight pipe length: any (F4Q9200/9500/0002/0005/0020/0050), 25 mm (F4Q0100), 50 mm (F4Q0200)

*5. Fluid: value is for air.

*6. Operation is possible below the minimum operating differential pressure, but the controllable flow rate range narrows.

*7. If a gas other than air or nitrogen is used and if the ambient temperature is high, the gas may not flow at the maximum flow rate even when this device is operating within the operating differential pressure range. Increase the supply pressure or lower the ambient temperature.

*8. USB 2.0 is used when connecting to Azbil's PC loader software. This device supports micro USB Type-B (2 m max.) connection.

*9. Before connecting pipes with Swagelok or VCR fittings, check the instructions in the manual provided by the manufacturer of the fitting.

*10. The gas-contacting parts are degreased.

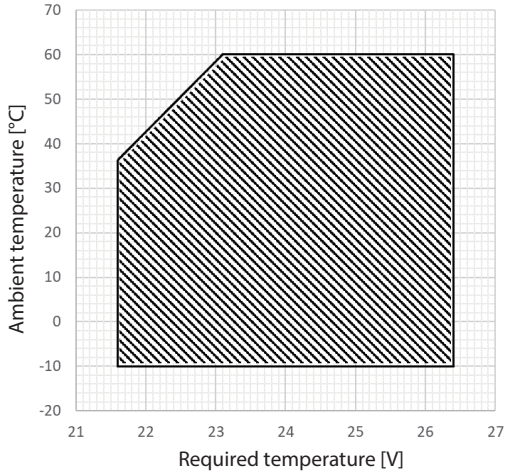
*11. In the case of vertical mounting, an error occurs in measurements. The error can be corrected with device settings.

*12. Main unit: only when the connector is connected.
Separate display unit: only the front of the display

*13. Main unit: only when the connector is connected. The location where the valve cable enters the unit is not included.
Separate display unit: only the front of the display

*14. The maximum operating ambient temperature of the F4Q0200 differs depending on the power voltage. See the graph below. If the operating conditions are outside the shaded area, the control range may be narrower.

F4Q0200: Relationship between power voltage and maximum ambient temperature



*15. During EMC testing, fluctuations equivalent to ±10 % FS in the reading and output may occur.

■ Standard gases: gas types and control ranges

The controllable flow rate range varies depending on the gas type. For details, see the following table.

Depending on the ambient temperature and differential pressure, gases may not flow at the maximum flow rate.

Increase the supply pressure or lower the ambient temperature.

Model No. / Gas type	F4Q9200	F4Q9500	F4Q0002
	Control flow rate range [mL/min (normal)]	Control flow rate range [L/min (normal)]	Control flow rate range [L/min (normal)]
Air/nitrogen	2–200	0.005–0.500	0.02–2
Oxygen	2–200	0.005–0.500	0.02–2
Argon	2–200	0.005–0.500	0.02–2
Carbon dioxide	1.2–120	0.003–0.300	0.012–1.2
Fuel gas 13A (45 MJ/m³)	2–200	0.005–0.500	0.02–2
100 % methane	2–200	0.005–0.500	0.02–2
100 % propane	0.6–60	0.002–0.160	0.006–0.6
100 % butane	0.5–50	0.001–0.120	0.004–0.4

Model No. / Gas type	F4Q0005	F4Q0020	F4Q0050(B,C)
	Control flow rate range [L/min (normal)]	Control flow rate range [L/min (normal)]	Control flow rate range [L/min (normal)]
Air/nitrogen	0.05–5	0.2–20	0.5–50
Oxygen	0.05–5	0.2–20	0.5–50
Argon	0.05–5	0.2–20	0.5–50
Carbon dioxide	0.03–3	0.12–12	0.3–30
Fuel gas 13A (45 MJ/m³)	0.05–5	0.2–20	0.5–50
100 % methane	0.05–5	0.2–20	0.5–50
100 % propane	0.016–1.6	0.06–6	0.16–16
100 % butane	0.012–1.2	0.04–4	0.1–10

Model No. / Gas type	F4Q0050(J,K)	F4Q0100	F4Q0200
	Control flow rate range [L/min (normal)]	Control flow rate range [L/min (normal)]	Control flow rate range [L/min (normal)]
Air/nitrogen	0.5–50	1–100	2–200
Oxygen	0.5–50	1–100	2–200
Argon	0.5–50	1–100	2–200
Carbon dioxide	0.3–30	0.8–80	1.2–120
Fuel gas 13A (45 MJ/m³)	0.5–50	0.8–80	2–200
100 % methane	0.5–50	0.9–90	2–200
100 % propane	0.16–16	0.32–32	0.6–60
100 % butane	0.12–12	0.2–20	0.4–40

■ Other than standard gases: main gas types, C.F.s, and control ranges

⚠WARNING

Acetylene and ammonia cannot be used with fluoroelastomer gasket models. Use an EPDM gasket model instead.

Ammonia becomes corrosive when exposed to moisture in the air, which may cause a malfunction. Observe the following when using this device:

- **The dew point of the gas to be measured should be –20 °C or below. (If the gas is supplied from a cylinder, the dew point should be –40 °C or below.)**
- **Before introducing ammonia into the pipes, thoroughly purge the pipes with a gas like dry nitrogen to dry the gas-contacting parts.**
- **Do not open the piping to the atmosphere. (Because moisture is contained in the atmosphere, if the piping is open to the atmosphere, the surface of the gas-contacting parts will be wet, causing corrosion.)**

	Model F4Q9200		Model F4Q9500		Model F4Q0002	
	C.F.	Control flow rate range [mL/min (normal)]	C.F.	Control flow rate range [L/min (normal)]	C.F.	Control flow rate range [L/min (normal)]
Acetylene	0.560	2–120	0.560	0.005–0.300	0.610	0.02–1.2
Ammonia	0.760	3–160	0.760	0.007–0.400	0.770	0.03–1.6
Helium	6.812	14–640	6.750	0.034–3.300	5.001	0.10–6.4

	Model F4Q0005		Model F4Q0020		Model F4Q0050(B,C)	
	C.F.	Control flow rate range [L/min (normal)]	C.F.	Control flow rate range [L/min (normal)]	C.F.	Control flow rate range [L/min (normal)]
Acetylene	0.560	0.05–3	0.610	0.2–12	0.610	0.5–30
Ammonia	0.760	0.07–4	0.770	0.3–16	0.770	0.7–40
Helium	7.129	0.36–35	5.027	1.0–64	4.973	2.5–160

	Model F4Q0050(J,K)		Model F4Q0100		Model F4Q0200	
	C.F.	Control flow rate range [L/min (normal)]	C.F.	Control flow rate range [L/min (normal)]	C.F.	Control flow rate range [L/min (normal)]
Acetylene	–	–	–	–	0.610	1–120
Ammonia	–	–	–	–	0.770	2–160
Helium	7.082	3.5–350	4.637	4.2–320	4.935	9.7–640

● How to use

Before using this device, set the conversion factor (C.F.) for the gas using the following procedure.

(1) Change function setting C18 (gas type selection 1) to "0" (gas type set by the user).

(2) Referring to the tables above, change parameter setting P10 (user-set gas conversion factor (C.F.) in accordance with the type of gas and model number.

Note 1: The conversion factors given in the tables above are estimated values, so their accuracy for the gas you actually use is not guaranteed and a large error may occur. Therefore, please check the accuracy before using the product.

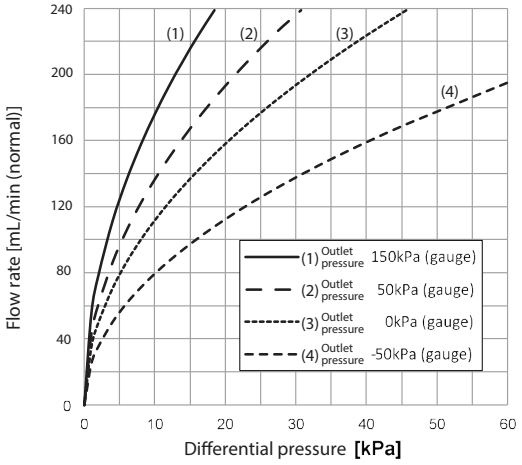
Note 2: When setting the C.F., set a flow rate set point (SP) that is within the control range. Note that, if an SP outside the control range is set, the flow rate cannot be controlled correctly.

Note 3: To find out whether other gases or mixed gases can be used and their C.F., please contact the azbil Group.

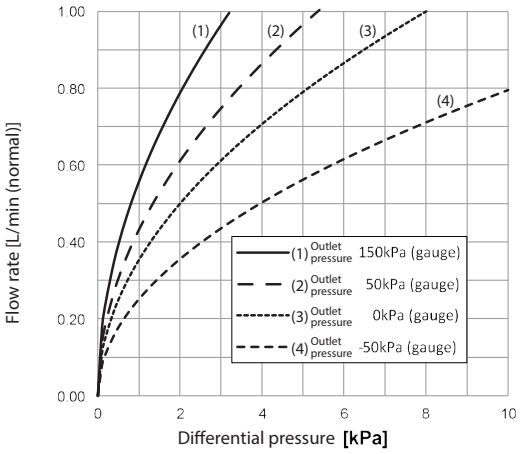
Note 4: Even if the C.F. is specified, the full-scale flow rate set in this device will not change automatically. Use the loader to change the full-scale flow rate setting for a user-set gas. When the product is shipped, the full-scale flow rate for air and nitrogen is set for the user-set gas. (Example: 0.5 L/min for the F4Q9500)

Note 5: Depending on the ambient temperature and differential pressure, gases may not flow at the maximum flow rate. Increase the supply pressure or lower the ambient temperature.

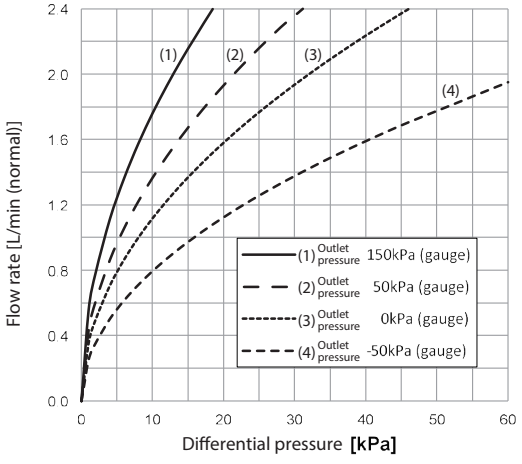
■ Relationship between differential pressure and flow rate when the valve is open fully (for air)



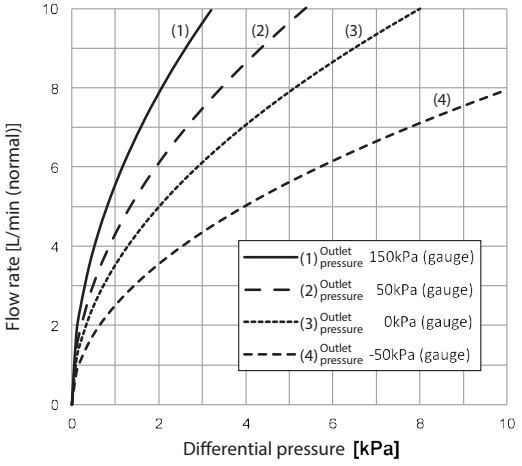
F4Q9200



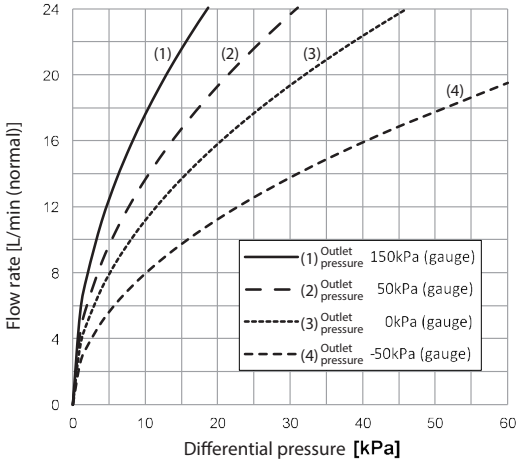
F4Q9500



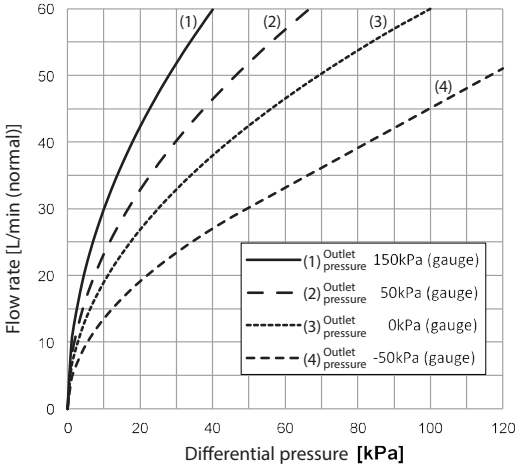
F4Q0002



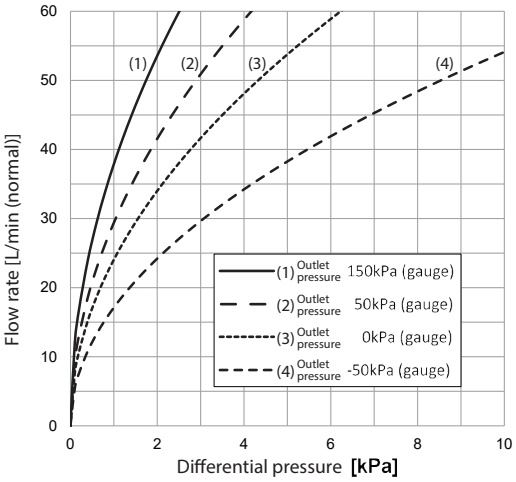
F4Q0005



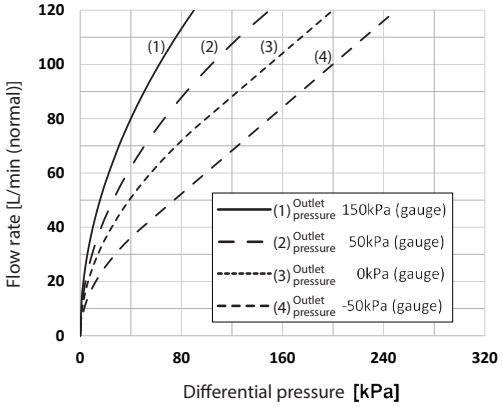
F4Q0020



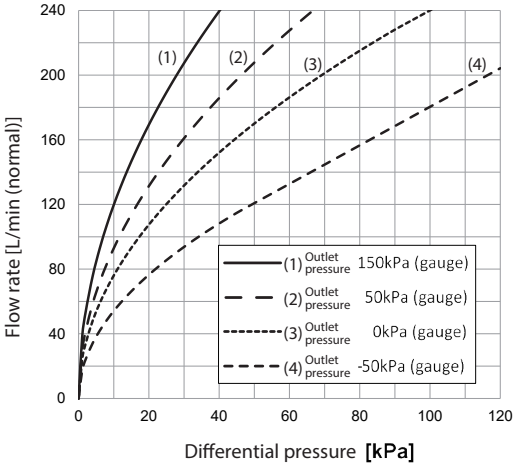
F4Q0050(B,C)



F4Q0050(J,K)



F4Q0100



F4Q0200

Handling Precautions

- For an output pressure not shown on the graphs above, calculate the flow rate with one of the formulas below.
  (1) If P2/P1 > 0.53, $Q = C1\sqrt{(P1-P2)P2}$
  (2) P2/P1 ≤ 0.53, $Q = C2 \cdot P1$
  P1 : Inlet absolute pressure [kPa (abs)]
  P2 : Outlet absolute pressure [kPa (abs)]
  (Absolute pressure = gauge pressure + 101.3 kPa)
  Q : Flow rate [L/min (normal)]
  C1, C2 : Constant values according to the model
  F4Q9200: C1 = 0.003513, C2 = 0.001753
  F4Q9500: C1 = 0.03513, C2 = 0.01753
  F4Q0002: C1 = 0.03513, C2 = 0.01753
  F4Q0005: C1 = 0.3513, C2 = 0.1753
  F4Q0020: C1 = 0.3513, C2 = 0.1753
  F4Q0050(B,C): C1 = 0.5971, C2 = 0.2981
  F4Q0050(J,K): C1 = 2.389, C2 = 1.192
  F4Q0100: C1 = 0.7979, C2 = 0.3983
  F4Q0200: C1 = 2.389, C2 = 1.192
- For a gas other than air, use the formula below for conversion.

  Flow rate = air flow rate $\div\sqrt{\text{specific gravity of the desired gas}}$

  Specific gravity of standard compatible gases (air = 1.0)

Gas type	Specific gravity
Oxygen	1.11
Argon	1.38
Carbon dioxide	1.53
Fuel gas 13A (45 MJ/m^3)	0.64
Methane	0.56
Propane	1.56
Butane	2.08

■ Optional parts

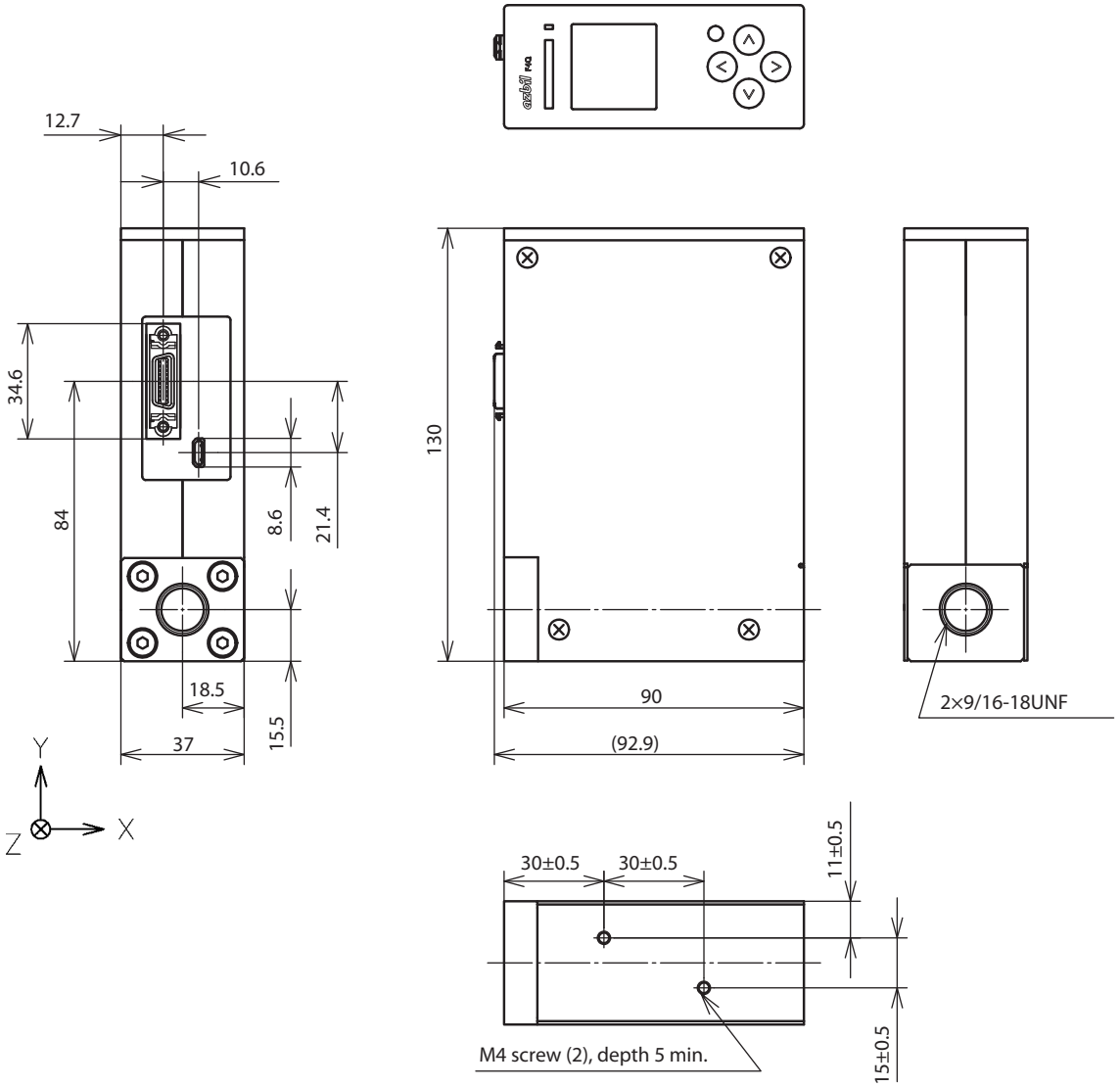
Name	Part No.	Notes
Dedicated cable with half pitch connector (2 m)	F9Y4QHP2	20-wire cable assembly used for power supply to this device and signal connection
Dedicated cable with half pitch connector (5 m)	F9Y4QHP5	
Model F4Q PC loader	MLP-F4QJ91	For PC loader Note: The PC loader can be downloaded from the following website (Japanese only): https://www.compoclub.com
Model MQV - model F4Q input conversion adapter harness	F9Y4QA1	Conversion cable to connect the 20-wire flat cable used in model MQV and this device
Harness for connecting AC adapter	F9Y4QA2	Conversion cable to supply power to this device with an AC adapter sold separately
Mounting bracket (for 90 mm face-to-face length)	F9Y4QB1	Bracket to mount the model with 90 mm face-to-face length
Mounting bracket (for 150 mm face-to-face length)	F9Y4QB2	Bracket to mount the model with 150 mm face-to-face length

■ External dimensions

● Model F4Q9200/9500/0002/0005/0020/0050(B,C)/0100

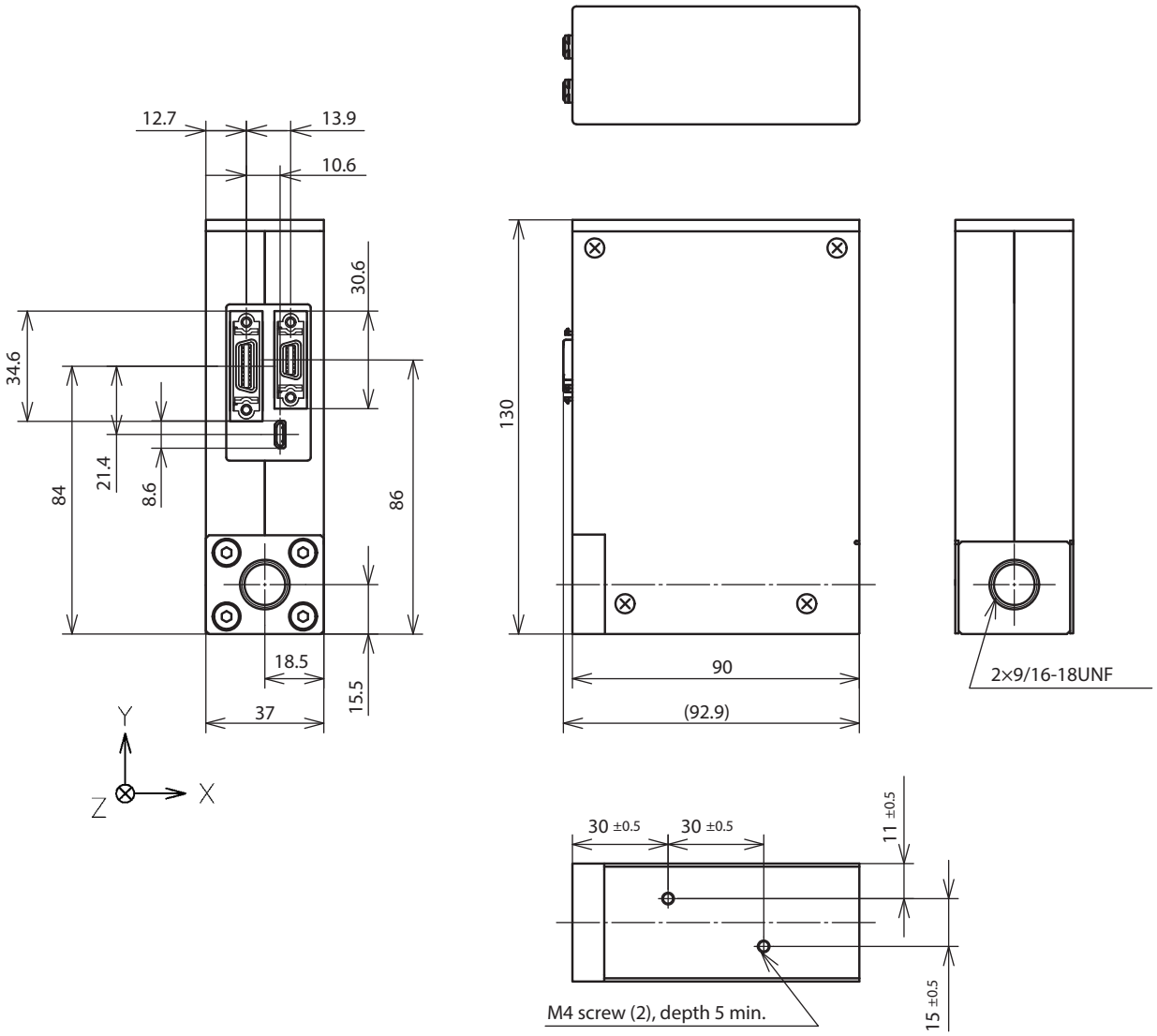
● Integrated-display model

Unit: mm



● Separate-display model

Unit: mm

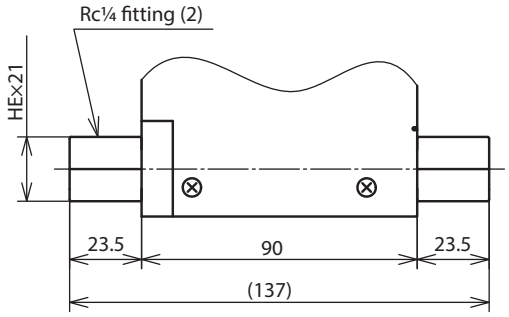


● Face-to-face length of fittings

Unit: mm

F4Q _ _ _ _B _T _ _ _ _ _ _ _

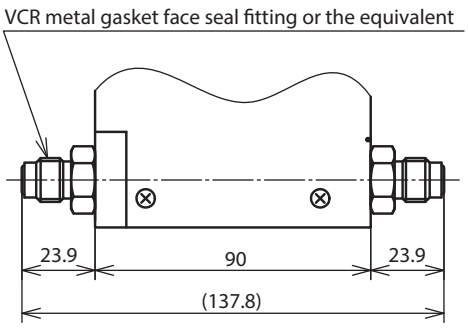
F4Q _ _ _ _C _T _ _ _ _ _ _ _



Rc¼ connection type

F4Q _ _ _ _B _V _ _0 _ _ _ _

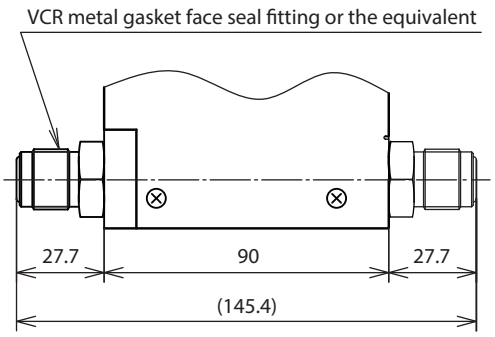
F4Q _ _ _ _C _V _ _0 _ _ _ _



¼ VCR connection type

F4Q0100B _T _ _ _ _ _ _ _

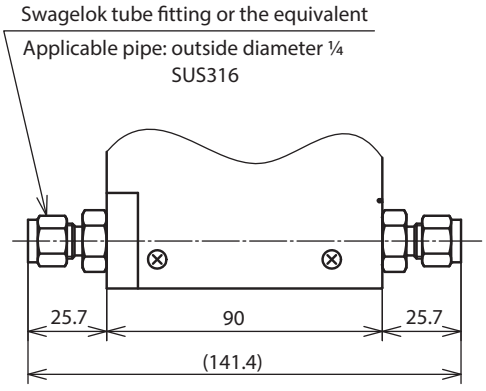
F4Q0100C _T _ _ _ _ _ _ _



½ VCR connection type

F4Q _ _ _ _B _S _ _ _ _ _ _ _

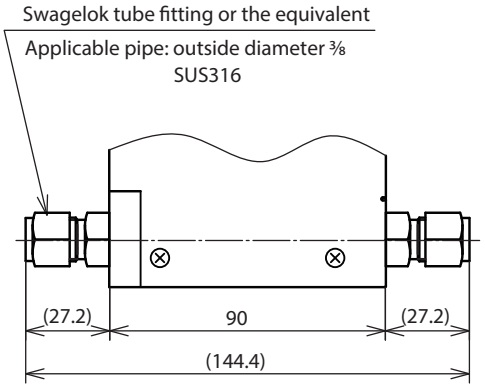
F4Q _ _ _ _C _S _ _ _ _ _ _ _



¼ Swagelok connection type

F4Q0100B _S _ _ _ _ _ _ _

F4Q0100C _S _ _ _ _ _ _ _

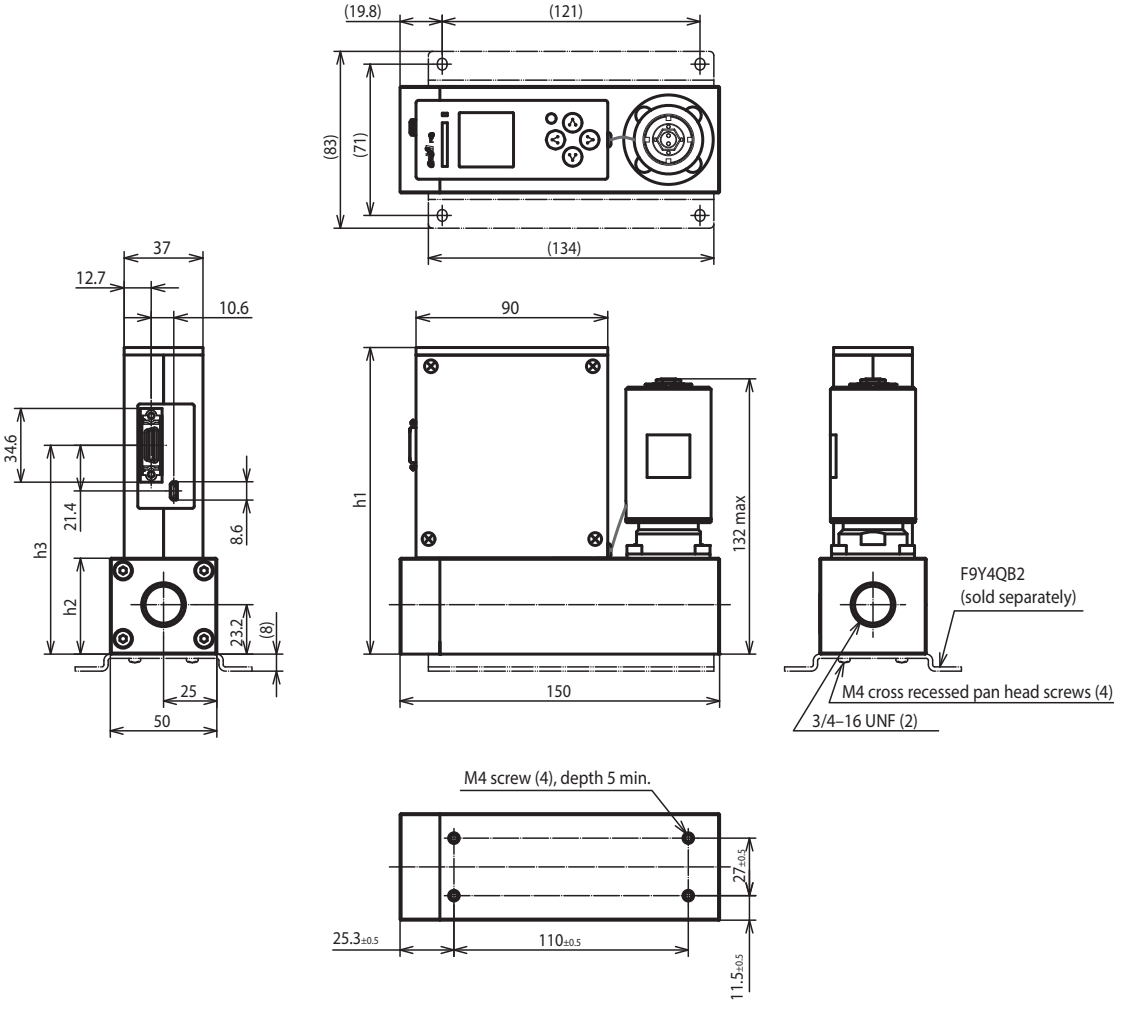


⅜ Swagelok connection type

● Model F4Q0050(J,K)/0200

● Integrated-display model

Unit: mm

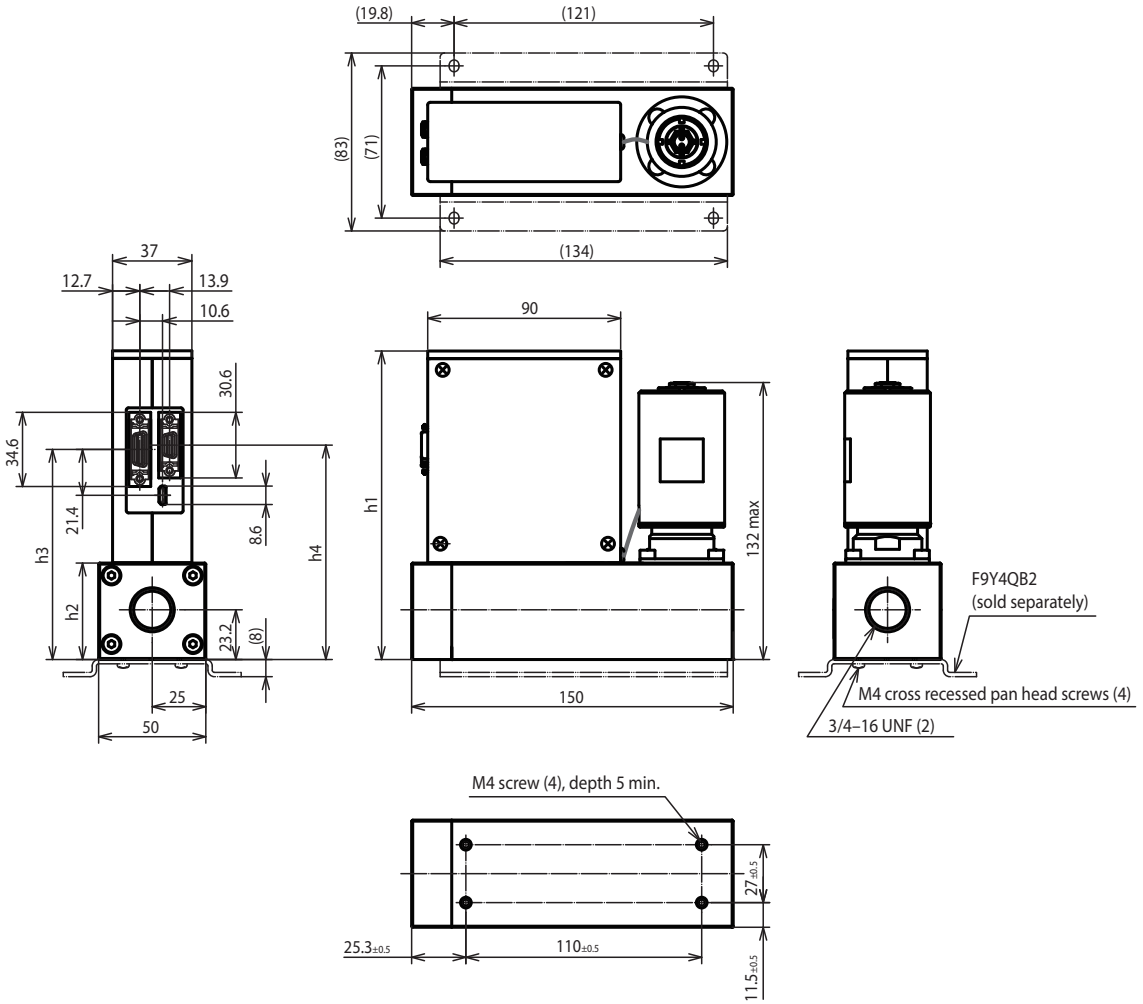


h1-4 size

Model	h1	h2	h3	h4
F4Q0050J,K/F4Q0200J,K	143.9	45	98	100

● Separate-display model

Unit: mm



h1-4 size

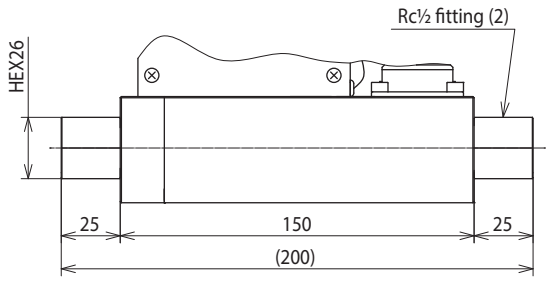
Model	h1	h2	h3	h4
F4Q0050J,K/F4Q0200J,K	143.9	45	98	100

● Face-to-face length of fittings

Unit: mm

F4Q _ _ _ _J _R _ _ _ _ _ _ _

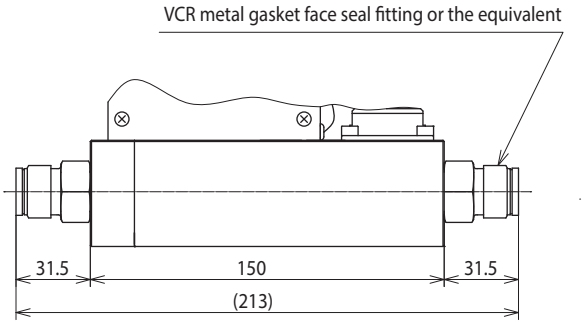
F4Q _ _ _ _K _R _ _ _ _ _ _ _



Rc½ connection type

F4Q _ _ _ _J _V _ _0 _ _ _ _

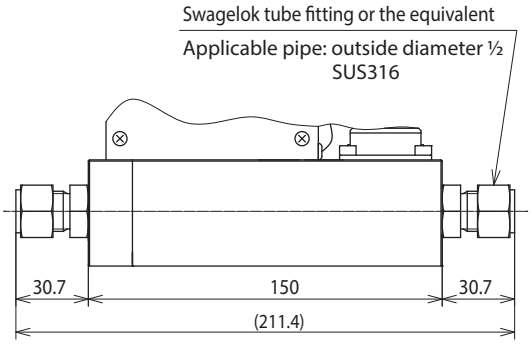
F4Q _ _ _ _K _V _ _0 _ _ _ _



½ VCR connection type

F4Q _ _ _ _J _S _ _ _ _ _ _ _

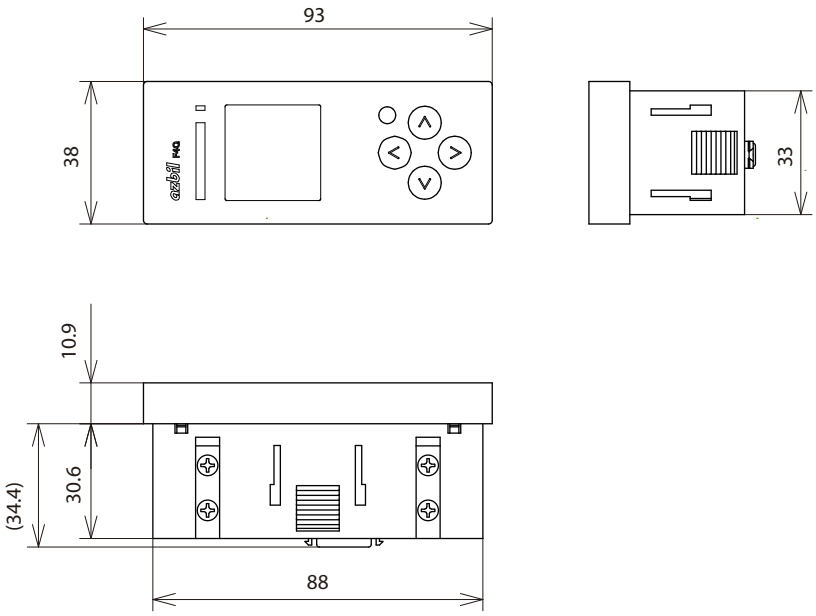
F4Q _ _ _ _K _S _ _ _ _ _ _ _



½ Swagelok connection type

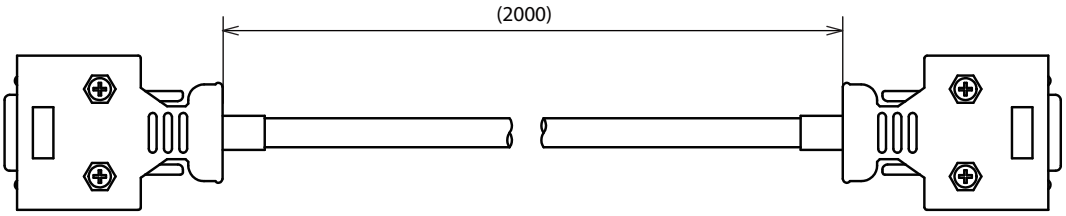
■ Separate display unit

Unit: mm



■ Cable for separate display unit

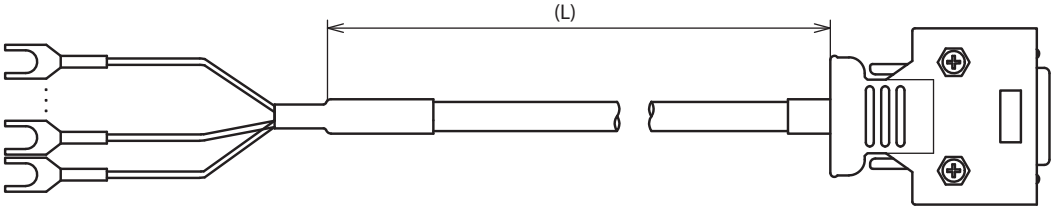
Unit: mm



■ Dimensions of optional cables

● Model F9Y4QHP2, model F9Y4QHP5

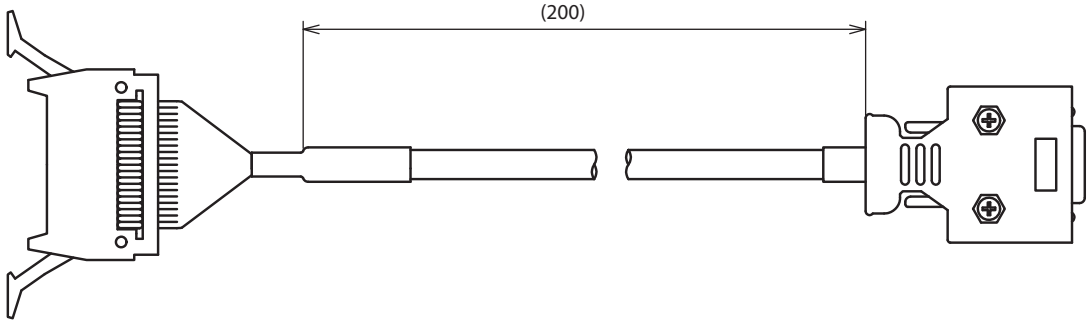
Unit: mm



Model No.	L [mm]
F9Y4QHP2	2000
F9Y4QHP5	5000

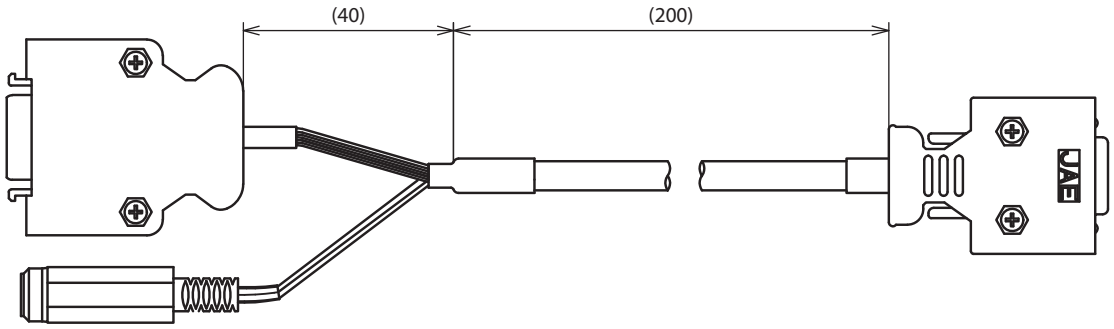
● Model F9Y4QA1

Unit: mm



● Model F9Y4QA2

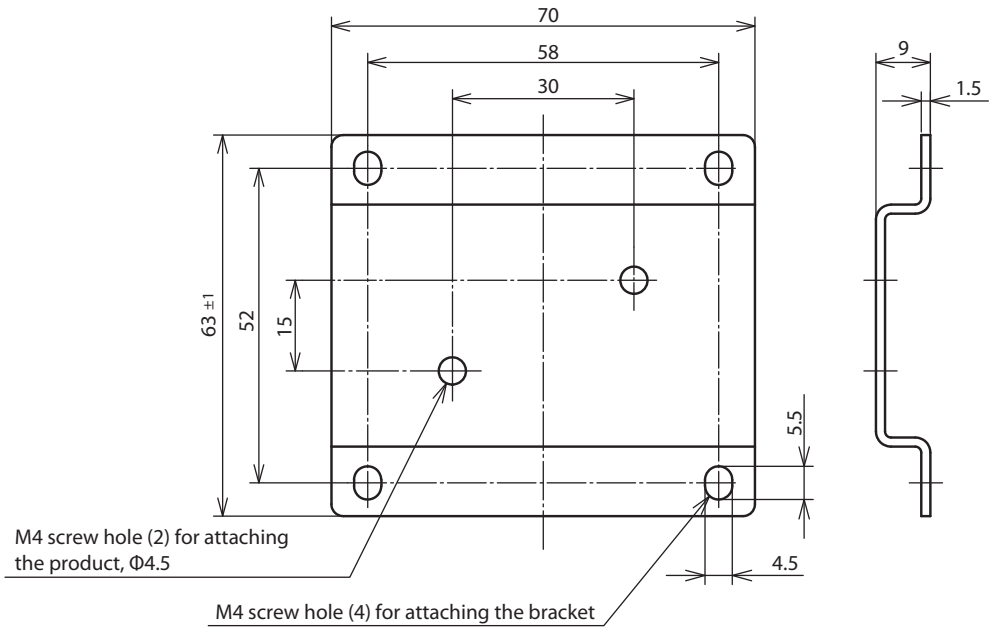
Unit: mm

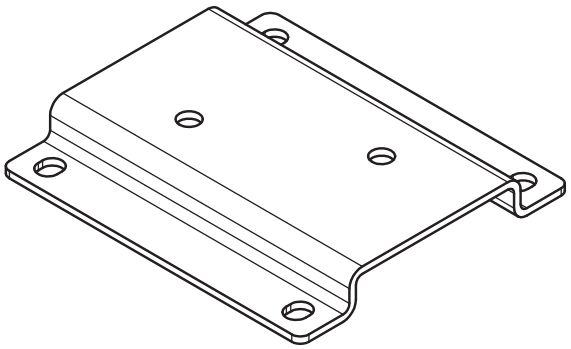


■ Dimensions of optional bracket

● Mounting bracket for model F4Q (for 90 mm face-to-face length)

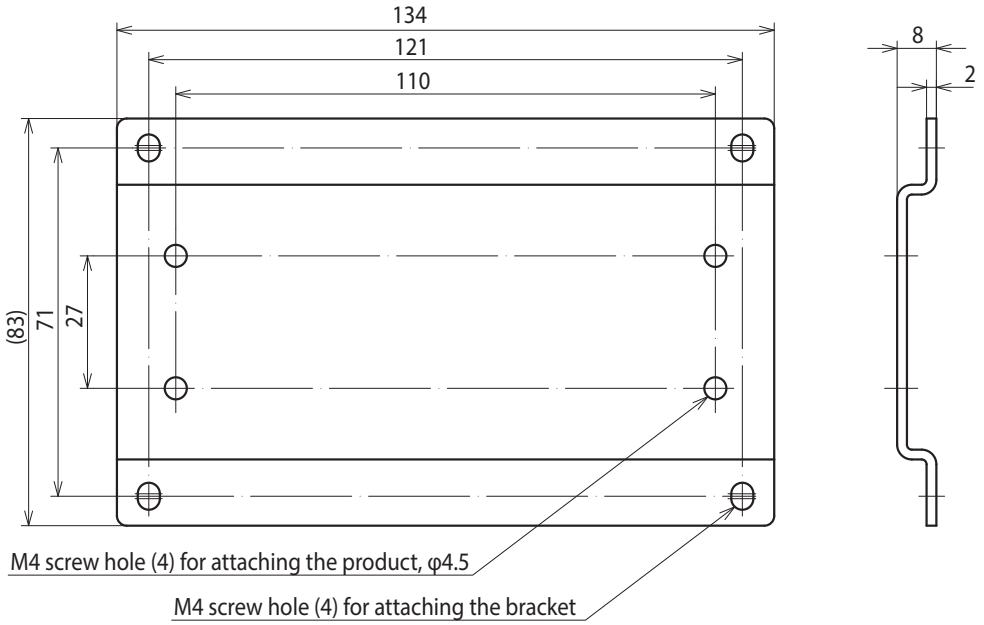
Unit: mm

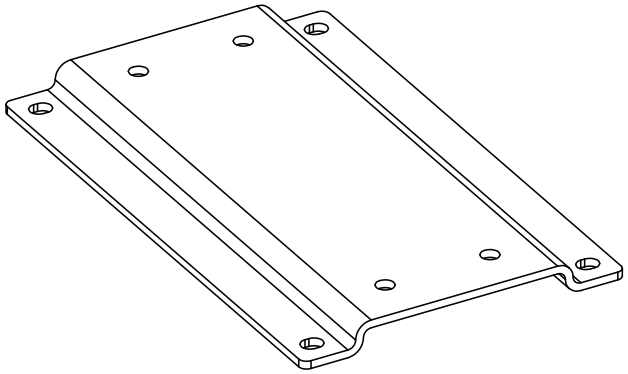




● Mounting bracket for model F4Q (for 150 mm face-to-face length)

Unit: mm





Revision History (CP-SP-1461E)

Date	Edn.	(New) Page No.	Description
Sept. 2021	**1**		
Jan. 2022	**2**	1-1	"Features": Changed the descriptions.
		2-1	"Top panel": Modified the table.
		3-4	Added "Handling Precautions."
		3-6	"Connector pin layout": Changed the drawing.
		4-3	"Totalized flow volume": Added descriptions.
		4-11	Deleted the units column of the table.
		4-15	"Operational mode selection when the power is turned ON": Changed the notes in the table.
		5-3	C01 & C02: Changed the notes. C07 & C08: Changed related function codes and parameters.
		5-4	C14 & C18: Changed the notes.
		5-5	C26 & C34: Changed the notes. C29: Changed the descriptions.
		5-6	C36: Changed the notes. Deleted related function codes and parameters. C37, C38, C43, C48, C49, C50, C51: Changed the initial value and the notes. C53: Changed the notes.
		5-7, 5-8	Changed the descriptions in the table. Deleted the units column of the table.
		5-8	Added a note to the table.
		5-11, 5-13	Deleted the units column of the table.
		5-12	Modified tables in "Flow rate display change (unit and digits after the decimal point)," and "Totalized flow volume display change (unit)."
		5-13	Modified tables in "Automatic display-off function."
		5-15	Parameter P32: Corrected the notes. Added a note to the table.
		5-19	Parameters P08, P09, P28: Changed the setting range and unit. Deleted the units column of the table.
		5-20	Parameters P21 & P22: Deleted the units column of the table. Added a note to the table.
		5-21	Parameters P01 & P02: Changed the initial value. Deleted the units column. Added a note to the table.
		5-23	Parameter P03, 04, 05, 06, 07: Deleted the units column of the table. Parameter P07: Changed the setting range, unit, and initial value. Added a note to the table.
		5-25	Parameter P15 & 16: Deleted the units column of the table.
		5-26	Function code C19: Changed the initial value. Function code C23: Changed the setting range.
		5-27	"PV filter option": Added a subsection and changed the descriptions in tables.
		5-28 to 5-34	Modified tables (deleted the units column, changed notes, etc.).
		5-30	"Handling Precautions": Changed the descriptions.
		5-38	"Procedure for displaying the monitor screen": Added a note to the table.
		5-44	"Handling Precautions": Changed the descriptions.
		6-4	"Engineer information": Added descriptions.
		6-5, 6-6, 6-7, 6-9	Deleted the units column of the table.
		6-6	Deleted "Handling Precautions" and modified tables.
		7-4	"Automatic recovery" for No.11-A: Changed from "Yes" to "–".
		8-7	Deleted the units column of the table. Changed "Gas type and control range" to "Standard gases: types and control ranges."
		8-8	Added "Semi-standard gases: types, C.F.s, and control ranges."
		8-14	"Separate display unit": Changed the drawings.

Date	Edn.	(New) Page No.	Description
Jun. 2022	**3**	5-4, 5-7, 5-34	Function code C16 in the settings table: Changed the description, setting range, initial value, and notes.
Jan. 2023	**4**	C2	Added a trademark attribution statement for Swagelok Company.
		iv	Caution: Changed and added cautions.
		1-1	"Features": Added "(700 ms for F4Q0050(J,K)/0200)."
		1-3	"Model selection guide": Added "0100" as standard flow rate range.
		1-5	Added the "Face-to-face: 150 mm (with fluoroelastomer gaskets)" section.
		1-6	Added the "Face-to-face: 150 mm (with EPDM gaskets)" section.
		2-2	Added "0100" to the subtitle "Main unit (model F4Q9200/9500/0002/0005/0020/0050."
		2-3	Added the "Model F4Q0050(J,K)/0200," "Integrated-display model," and "Separate-display model" sections.
		3-2	Caution: Changed the description of a caution.
		3-3	Added "0100" to the subtitle "Model F4Q9200/9500/0002/0005/0020/0050(B/C)". Added the "F4Q0050(J,K)/0200" section and the base diagram.
		3-7	"Connector signal table": Changed "POWER(24V)" to "P.24V."
		3-8, 3-9	"Wiring": Changed "POWER(24V)" to "P.24V."
		4-1	"Top section of the main screen: Display of PV and errors or alarms": Added "The F4Q can display a value of up to 7 digits (including "–" (minus) and "." comma). A value exceeding 7 digits will be displayed as "-------"."
		4-3	"Gas type": Changed "Fuel gas 13A" to "Fuel gas 13A (45 MJ/m³)."
		5-4	"Settings": Changed "Fuel gas 13A" to "Fuel gas 13A (45 MJ/m³)."
			Changed the initial value of C18 from an asterisk to "1."
		5-5	Changed the initial value of C23 from "100" to an asterisk and added "The initial value differs according to the model" to notes.
			C26: Changed "Fuel gas 13A" to "Fuel gas 13A (45 MJ/m³)."
			Changed the initial value of C26 from an asterisk to "1" and C29 from "1" to "3."
			C34, notes: Changed "Select this value if the gas flows upward/downward." to "Corrects flow rate characteristics of a gas flowing upward/downward."
			C34, related function codes and parameters: Deleted parameters C18 and C26.
		5-6	C36, notes: Deleted "(primary and secondary pressure)." Added and changed descriptions of settings 1–3.
			C53: Changed the note.
		5-7	P16, Description and setting range: Added "F4Q0200: 0.0 to 999.9 [L/min]."
			P23: Added the note.
		5-8	P33: Added a range.
		5-13	P29, notes: Deleted "Setting 0 disables this function. (The display is always on.)"
		5-20	"Control response setup" description: Deleted "(primary pressure and secondary pressure)" and added the description of the "PID set by user" setting.
		5-26	"Related function code and parameters": Changed the initial value of C23 from "100" to an asterisk and added "The initial value differs according to the model" to notes.
		5-29	"Gas type selection": Changed "Fuel gas 13A" to "Fuel gas 13A (45 MJ/m³)."
		5-30	C34, notes: Changed "Select this value if the gas flows upward/downward." to "Corrects flow rate characteristics of a gas that flows upward/downward."
			P23: Added the note.
		6-8	"Handling Precautions": Added a precaution.

Date	Edn.	(New) Page No.	Description
Jan. 2023	**4**	7-2, 7-3, 7-4	"Abnormal statuses and corrective actions": Added the "Message" column to the table.
		7-2	No. 3: Added *2 and *3, and descriptions.
		7-4	Added *1 and *3.
		8-1, 8-3, 8-5	"Individual specifications": Added *7.
		8-2, 8-4, 8-6	"Individual specifications," main gas-contacting materials: Added "SUS316L, K-M35F."
		8-7, 8-8, 8-9, 8-10	Added tables for F4Q0050(J,K), F4Q0100, and F4Q0200.
		8-12	Changed the subtitle to "Standard gases: gas types and control ranges" and added a description. Added tables for F4Q0050(J,K), F4Q0100, and F4Q0200.
		8-13	Changed the subtitle to "Other than standard gases: main gas types, C.F.s, and control ranges." Added tables for F4Q0050(J,K), F4Q0100, and F4Q0200. "How to use": Added note 5.
		8-15	Added graphs for F4Q0050(J,K), F4Q0100, and F4Q0200.
		8-16	"Optional parts": Added an optional part.
		8-17	Added "0100" to the subtitle "Model F4Q9200/9500/0002/0005/0020/0050(B,C)."
		8-19	Added figures for ½ VCR and ⅜ Swagelok connections.
		8-20, 8-21, 8-22	Added the "Model F4Q0050(J,K)/0200," "Integrated-display model," "Separate-display model," and "Face-to-face length of fittings" sections.
		8-23	Added the "Cable for separate display unit" section.
		8-26	Added the "Mounting bracket for model F4Q (for 150 mm face-to-face length)" section.
July 2023	**5**	iv	Caution: Added cautions.
		3-3	"Model F4Q0050(J,K)/0200": Changed the descriptions and figures. "Model F4Q9200/9500/0002/0005/0020/0050(B,C)/0100": Changed the descriptions and figures.
		6-8	"Multipoint flow rate correction": Changed the descriptions and figures.
		6-9	"Related setting data": Added the descriptions.
		8-2, 8-4, 8-6, 8-10	"Protective structure": Moved *12 from "Protective structure" to "IP40".
		8-2, 8-4, 8-6, 8-8, 8-10	"Standards compliance": Changed *14 to *15.
		8-8	"Protective structure": Deleted *12" from "Protective structure." Added *13 to "IP40."
		8-9	"Operating conditions": Changed *13 to *14.
		8-10	"Protective structure" for F4Q0200: Added "IP40*13."
		8-11	Changed the descriptions of *12. Added the descriptions of *13. Changed *13 to *14, and *14 to *15.

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

   1.1 Warranty period

   Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

   1.2 Warranty scope

   In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

   (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
   (2) Failure caused for other reasons than Azbil Corporation's product;
   (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;
   (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;
   (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or
   (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

   Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

   You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

   (1) Regulations and standards or laws that your Equipment is to comply with.
   (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
   (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use
   Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

   *1. A design that is safe even if the user makes an error.
   *2. A design that is safe even if the device fails.
   *3. Avoidance of device failure by using highly reliable components, etc.
   *4. The use of redundancy.

3. Precautions and restrictions on application

   3.1 Restrictions on application

   Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality*5 required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

   *5. Nuclear power quality: compliance with JEAG 4121 required
   *6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes,"etc.
   *7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

   Any Azbil Corporation's products shall not be used for/with medical equipment.

   The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

   3.2 Precautions on application

   you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

(1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
(2) For use of specific purposes, such as:
    * Nuclear energy/radiation related facilities
      [When used outside a radiation controlled area and where nuclear power quality is not required]
      [When the limit switch for nuclear power is used]
    * Machinery or equipment for space/sea bottom
    * Transportation equipment
      [Railway, aircraft, vessels, vehicle equipment, etc.]
    * Antidisaster/crime-prevention equipment
    * Burning appliances
    * Electrothermal equipment
    * Amusement facilities
    * Facilities/applications associated directly with billing
(3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
(4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
(5) Machinery or equipment that may affect human lives, human bodies or properties
(6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. Scope of services

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

(1) Installation, adjustment, guidance, and attendance at a test run
(2) Maintenance, inspection, adjustment, and repair
(3) Technical guidance and technical education
(4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

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Specifications are subject to change without notice. (30)

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