General Specification

GS 34M06H62-04E

FA-M3
F3CU04-0H, F3CU04-1H
Temperature Control and PID Module

FA-M3

■ General

The temperature control and PID module (hereafter called “the module”) is an I/O module to be mounted on the FA-M3 base module. The module is provided with multiple input and output circuits and performs multiple PID control functions.

The module is provided with four controller functions and one setup and control interface for the controller functions for controlling four loops. The controller functions can be configured to act inter-dependently or independently to support a wide variety of applications.

Three controller modes are available: single loop, cascade control, and two-input changeover control. In the single loop mode (default), individual controller functions operate independently. In the cascade or two-input changeover control mode, two controller functions are combined to act as a single controller function.

■ Features

- High accuracy, high resolution, high speed
  The input sampling period may be selected from 10ms, 100ms, or 200ms. The input conversion accuracy is ±0.1% of full scale, and the input resolution is 0.1°C (using 5-digit representation). Low-resolution operation (using 4-digit representation) is also available.
- Universal input
  The input type may be set to thermocouple, RTD, or DC voltage for each loop.
- Dynamic auto-tuning
  In the dynamic auto-tuning mode, what you have to do before starting operation is to simply set the input type, output type, and set point. The dynamic auto-tuning function automatically determines and tunes the PID parameters during operation. You may disable the function, where appropriate.
- Startup cooperative operation
  The Startup cooperative operation function aligns the rise times of the temperature between loops. This can be useful, for example, when overshooting occurs due to the temperature of the adjacent loop.
- ToolBox for Temperature Control and PID Modules
  A dedicated ToolBox software is provided for this module. With this software, you can easily set up various parameters of the module, as well as perform action tests, tuning and monitoring by following screen instructions.

● Specifications

General

- The module, occupying a single slot, controls up to four loops.
- PID constants, set points and some other control parameters are stored in the module, eliminating the need to set up parameters before each operation. A specific SP backup procedure needs to be executed to store set points to the Non-volatile memory. Otherwise, set points are not stored to the Non-volatile memory when updated.

Input

- Individual input channels are isolated from each other, as well as from the internal circuit.

Control

- Auto-tuning and the “super” feature that makes use of fuzzy logic to suppress output overshooting are provided as standard functions to achieve optimal control.
- Heating and cooling control are also supported.
- The module offers cascade control and other compound loop controls.

Output

- The control output type is time-proportional PID. Depending on the wiring, the module can be connected to a relay or an SSR.
- The F3CU04-1H also provides continuous PID output (4-20 mA).

■ Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Description
F3CU04	-0H	—	—	4 loops of universal input Time-proportional PID output (open collector) Single-slot size
	-1H	—	—	4 loops of universal input and output (open collector, continuous 4-20 mA output) Single-slot size

■ Specifications

● General Specifications

Item		Specification	
		F3CU04-0H	F3CU04-1H
Number of loops		4 Loops	
Isolation	Between input terminals and internal circuit	Isolation (photocouplers, and capacitive/inductive couplling devices) (tested for 1500 V AC voltage withstanding for 1 minute)	
	Between input terminals		
	Between output terminals and internal circuit		
	Between output terminals	Not isolated.	
Alarm types		12 types of alarm: Upper input limit, lower input limit, upper deviation limit, lower deviation limit, upper/lower deviation limit, and deviation range, all with or without waiting	
Number of alarm outputs (input relays)		4 points per loop (only alarms 1 and 2 have input relays)	
Alarm delay timer		Yes	
Warm-up time		30 minutes min.	
Max. allowable ambient temperature change rate*1		10°C/h max.	
Mounting position		Horizontal or inverted orientation not allowed	
External connection		40-pin spring terminal block*2	
External dimensions*3		28.9 (W) x 100 (H) x 104.2 (D) mm	
Current consumption		200 mA at 5 V DC	
Weight		160 g	165 g
Surrounding air temperature range		Operating : 0 to 55°C	
		Storage :-20 to 75°C	
Surrounding humidity range		Operating : 10 to 90% RH (non-condensing)	
		Storage : 10 to 90% RH (non-condensing)	
Surrounding atmosphere		Must be free of corrosive gases, flammable gases or heavy dust.	

*1: The stated accuracy for the reference junction for thermocouple input deteriorates if the ambient temperature change exceeds this rate.
*2: When wiring to this module, be sure to use the terminal block provided. The 40-pin spring terminal block (Part No.: T9113PL) for this module can be purchased separately as a spare part.
*3: External dimensions excluding protrusions (for details, see the External Dimensions drawing).

● Input specifications

Item		Specification	
		F3CU04-0H	F3CU04-1H
Input sampling period*1		10 ms, 100 ms, 200 ms	
Input types and ranges		Universal input. Individual inputs separately configurable by software or collectively by hardware Thermocouple input : 15 ranges RTD input : 9 ranges DC voltage input : 6 ranges	
Burnout detection		Thermocouples or RTDs are checked for burnout. Up-scale, down-scale, or none may be selected.	
Detection current	Thermocouple	100 nA max.	
	RTD	100 nA max.	
Input insulation resistance		1 MΩ min.	
Allowable signal Source resistance	Thermocouple or DC mV input	250 Ω max.	
	DC voltage input	2 kΩ max.	
Allowable wiring resistance	RTD	10 Ω max. per wire (three wires must have the same resistance)	
Measuring current	RTD	Approx. 250 μA	
Reference junction Compensation	Thermocouple*2	± 2.0°C (0 to 55°C)	
Allowable input voltage range		-20 to 20 V DC	
Noise reduction*3*4*5	Common mode	120 dB (50/60 Hz) min.	
	Normal mode	40 dB (50/60 Hz) min.	
Effect of ambient temperature		± 0.01%/°C or ± 1μV/°C, whichever is greater	

*1: You can select an input sampling period of 10 ms for 4 loops, 100 ms for 2 loops, 100 ms for 4 loops, or 200 ms for 4 loops. The control period is the same as the input sampling period.
*2: This value assumes that all input terminals are correctly wired (that is, using ferrule, wire diameters and connections are correct).
*3: This value assumes that the power supply frequency is correctly selected.
*4: This module continues to operate at a input accuracy of ±0.5% max. of F.S. during the radiated electromagnetic field test.
*5: This is the value when an input sampling period of 100ms or 200ms is selected. If 10ms is selected, 50/60 Hz noise canceling is not be enabled.

• **Instrument Range and Accuracy (for high resolution operation) 1/2**

Input Category	Input Type[*1]	Instrument Range[*2]	Input Type Selector witch[*3] SW1-3	SW1-4	SW5	Software Setting	Accuracy[*4]	Resolution[*2]
Software setting (factory setting)			OFF	OFF	0	Instrument ranges may be specified by software using one of the following codes.		
Thermocouple	K[*5]	-200.0 to 1370.0°C	OFF	OFF	1	1 ($01)	± 0.5°C[*5]	0.1°C[*5]
		-200.0 to 1000.0°C			2	2 ($02)	± 0.5°C[*5]	0.1°C[*5]
		-200.0 to 500.0°C			3	3 ($03)	± 0.5°C[*6]	0.1°C[*6]
	J	-200.0 to 1200.0°C			4	4 ($04)	± 0.5°C[*7]	0.1°C[*7]
		-200.0 to 500.0°C			5	5 ($05)	± 0.5°C[*8]	0.1°C[*8]
	T	-270.0 to 400.0°C			6	6 ($06)	± 0.5°C[*9]	0.1°C[*9]
	B[*10]	0.0 to 1600.0°C			7	7 ($07)	± 1.0°C[*10]	0.1°C[*10]
	S[*11]	0.0 to 1600.0°C			8	8 ($08)	± 1.0°C[*11]	0.1°C[*11]
	R[*11]	0.0 to 1600.0°C			9	9 ($09)	± 1.0°C[*11]	0.1°C[*11]
	N	-200.0 to 1300.0°C			A	10 ($0A)	± 0.6°C[*12]	0.1°C[*12]
	E	-270.0 to 1000.0°C			B	11 ($0B)	± 0.5°C[*13]	0.1°C[*13]
	L	-200.0 to 900.0°C			C	12 ($0C)	± 0.6°C	0.1°C
	U	-200.0 to 400.0°C			D	13 ($0D)	± 0.6°C	0.1°C
	W[*14]	0.0 to 1600.0°C			E	14 ($0E)	± 0.8°C[*14]	0.1°C[*14]
	Platinel 2	0.0 to 1390.0°C			F	15 ($0F)	± 0.6°C	0.1°C
RTD	JPt100	-200.0 to 500.0°C	OFF	ON	0	16 ($10)	± 0.4°C	0.1°C
		-200.0 to 200.0°C			1	17 ($11)	± 0.4°C	0.1°C
		0.0 to 300.0°C			2	18 ($12)	± 0.3°C	0.1°C
		0.00 to 150.00°C			3	19 ($13)	± 0.20°C	0.02°C
	Pt100	-200.0 to 850.0°C			4	20 ($14)	± 0.4°C	0.1°C
		-200.0 to 500.0°C			5	21 ($15)	± 0.4°C	0.1°C
		-200.0 to 200.0°C			6	22 ($16)	± 0.4°C	0.1°C
		0.0 to 300.0°C			7	23 ($17)	± 0.3°C	0.1°C
		0.00 to 150.00°C			8	24 ($18)	± 0.20°C	0.02°C
DC voltage	DC mV input[*15]	0 to 10.00 mV DC	— [*16]	ON	9	25 ($19)	± 0.1% of instrument range ± 1 digit[*15]	
		0 to 100.0 mV DC			A	26 ($1A)		
	DC V input[*15]	0.000 to 1.000 V DC			B	27 ($1B)		
		0.000 to 5.000 V DC			D	29 ($1D)		
		1.000 to 5.000 V DC			E	30 ($1E)		
		0.00 to 10.00 V DC			F	31 ($1F)		

*1: Applicable standard is JIS/IEC/DIN (ITS-90) for thermocouples and RTD.
*2: For thermocouples K, B, S, R, W, and for RTD in the 0.00 to 150.00°C range, the input ranges may be set wider than their instrument range. However, if the difference between the upper and lower limit settings exceeds 1600°C, the resolution will be twice the stated value. Furthermore, the actual range for an acceptable input is the input range ±5%.
*3: When you turn on the power after changing the hardware switch settings, data stored in the Non-volatile memory is initialized to follow the switch settings.
*4: This accuracy applies if the ambient temperature is 25 ± 5°C and the input value is within the instrument range. If the input type is thermocouple and reference junction compensation is used, you should also take into consideration the accuracy of the reference junction compensation. If the input sampling period of 10 ms is selected, the accuracy will be twice the stated value.
*5: For K-type thermocouples, the input range may be set from -270.0 to 1370.0°C beyond its instrument range. The accuracy and resolution depend on measured temperatures as follows:
-270.0 to -200.0°C: Neither accuracy or resolution is guaranteed.
-200.0 to 0.0°C: ±1.0°C accuracy, 0.2°C resolution
*6: For K-type thermocouples, the accuracy and resolution depend on measured temperatures as follows:
-200.0 to -180.0°C: ±0.9°C accuracy, 0.2°C resolution
-180.0 to -100.0°C: ±0.6°C accuracy, 0.1°C resolution
*7: For J-type thermocouples, the accuracy and resolution depend on measured temperatures as follows:
-200.0 to -100.0°C: ±1.0°C accuracy, 0.2°C resolution
*8: For J-type thermocouples, the accuracy and resolution depend on measured temperatures as follows:
-200.0 to -150.0°C: ±0.6°C accuracy, 0.1°C resolution
*9: For T-type thermocouples, the accuracy and resolution depend on measured temperatures as follows:
-270.0 to -200.0°C: ±3.5°C accuracy, 0.5°C resolution
-200.0 to -100.0°C: ±1.0°C accuracy, 0.1°C resolution
*10: For B-type thermocouples, the input range may be set from 0.0 to 1800.0°C beyond its instrument range. The accuracy and resolution depend on measured temperatures as follows:
0.0 to 300.0°C: Neither accuracy nor resolution is guaranteed.
300.0 to 900.0°C: ±2.5°C accuracy, 0.3°C resolution
*11: For S-type and R-type thermocouples, the input range may be set from 0.0 to 1700.0°C beyond its instrument range. The accuracy and resolution depend on measured temperatures as follows:
0.0 to 200.0°C: ±1.5°C accuracy, 0.2°C resolution
*12: For N-type thermocouples, the accuracy and resolution depend on measured temperatures as follows:
-200.0 to 0.0°C: ±1.3°C accuracy, 0.3°C resolution
*13: For E-type thermocouples, the accuracy and resolution depend on measured temperatures as follows:
-270.0 to -200.0°C: ±6.5°C accuracy, 2.0°C resolution
-200.0 to -100.0°C: ±1.0°C accuracy, 0.2°C resolution
*14: For W-type thermocouples, the input range may be set from 0.0 to 2300.0°C beyond its instrument range. The accuracy and resolution depend on measured temperatures as follows:
0.0 to 100.0°C: ±1.0°C accuracy, 0.2°C resolution
*15: Resolution is determined by the upper and lower limits for the input range, as well as the upper and lower scaling limits. It is represented by one digit.
*16: "–" means that the value is ignored.

• Instrument Range and Accuracy (for low resolution operation) 2/2

Input Category	Input Type[*1]	Instrument Range[*2]	Input Type Selector Switch[*3] SW1-3	SW1-4	SW5	Software Setting	Accuracy[*4]	Resolution[*2]
Software setting			ON	OFF	0	Instrument ranges may be specified by software using one of the following codes.		
Thermocouple	K[*5]	-200 to1370°C	ON	OFF	1	33 ($21)	± 2°C[*5]	1°C[*5]
		-200 to1000°C			2	34 ($22)	± 2°C[*5]	1°C[*5]
		-200 to500°C			3	35 ($23)	± 2°C	1°C
	J	-200 to 1200°C			4	36 ($24)	± 2°C	1°C
		-200 to 500°C			5	37 ($25)	± 2°C	1°C
	T[*6]	-270 to 400°C			6	38 ($26)	± 2°C[*6]	1°C
	B[*7]	0 to 1600°C			7	39 ($27)	± 2°C[*7]	1°C[*7]
	S[*8]	0 to 1600°C			8	40 ($28)	± 2°C[*8]	1°C
	R[*8]	0 to 1600°C			9	41 ($29)	± 2°C[*8]	1°C
	N[*9]	-200 to 1300°C			A	42 ($2A)	± 2°C[*9]	1°C
	E[*10]	-270 to 1000°C			B	43 ($2B)	± 2°C[*10]	1°C[*10]
	L	-200 to 900°C			C	44 ($2C)	± 2°C	1°C
	U	-200 to 400°C			D	45 ($2D)	± 2°C	1°C
	W[*11]	0 to 1600°C			E	46 ($2E)	± 2°C	1°C
	Platinel 2	0 to 1390°C			F	47 ($2F)	± 2°C	1°C
RTD	JPt100	-200 to 500°C	ON	ON	0	48 ($30)	± 2°C	1°C
		-200 to 200°C			1	49 ($31)	± 2°C	1°C
		0 to 300°C			2	50 ($32)	± 2°C	1°C
		0.0 to 150.0°C			3	51 ($33)	± 0.3°C	0.1°C
	Pt100	-200 to 850°C			4	52 ($34)	± 2°C	1°C
		-200 to 500°C			5	53 ($35)	± 2°C	1°C
		-200 to 200°C			6	54 ($36)	± 2°C	1°C
		0 to 300°C			7	55 ($37)	± 2°C	1°C
		0.0 to 150.0°C			8	56 ($38)	± 0.3°C	0.1°C

*1: Applicable standard is JIS/IEC/DIN (ITS-90) for thermocouples and RTD.
*2: For thermocouples K, B, S, R, W, and for RTD in the 0.0 to 150.0°C range, the input ranges may be set wider than their instrument range. Furthermore, the actual range for an acceptable input is the input range ±5%.
*3: When you turn on the power after changing the hardware switch settings, data stored in the Non-volatile memory is initialized to follow the switch settings.
*4: This accuracy applies if the ambient temperature is 25 ± 5°C and the input value is within the instrument range. If the input type is thermocouple and reference junction compensation is used, you should also take into consideration the accuracy of the reference junction compensation.
*5: For K-type thermocouples, the upper and lower input range limits may be set from -270 to 1370°C. The accuracy and resolution depend on measured temperatures as follows:
-270 to -200°C: Neither accuracy nor resolution is guaranteed.
*6: For T-type thermocouples, the accuracy and resolution depend on measured temperatures as follows:
-270 to -200°C: ±4°C accuracy, 1°C resolution
*7: For B-type thermocouples, the upper and lower input range limits may be set from 0 to 1800°C. The accuracy and resolution depend on measured temperatures as follows:
0 to 300°C: Neither accuracy nor resolution is guaranteed.
300 to 900°C: ±3°C accuracy, 1°C resolution
*8: For S-type and R-type thermocouples, the upper and lower input range limits may be set from 0 to 1700°C.
*9: For N-type thermocouples, the accuracy and resolution depend on measured temperatures as follows:
-200 to 0°C: ±3°C accuracy, 1°C resolution
*10: For E-type thermocouples, the detailed accuracy and resolution are as follows:
-270 to -200°C: ±8°C accuracy, 2°C resolution
-200 to 1000°C: ±2°C accuracy, 1°C resolution
*11: For W-type thermocouples, the upper and lower input range limits may be set from 0 to 2300°C.

• Power Supply Frequency

Power Supply Frequency	Input Type Selector Switch[*1] SW1-2	SW1-4	SW5	Remarks
Software setting	Any	OFF	0	Power supply frequency may be specified by software. (Factory setting)
50Hz	OFF	Other than the above.		Removes 50 Hz power supply frequency noise overlapping input signals. [*2]
60Hz	ON			Removes 60 Hz power supply frequency noise overlapping input signals. [*2]

*1: When you turn on the power after changing the hardware switch settings, data stored in the Non-volatile memory is initialized to follow the switch settings.
*2: If an input sampling period of 10ms is selected, 50/60 Hz noise canceling is not be enabled.

● Control Specifications (can be set for individual loops)

Item		Specification	
		F3CU04-0H	F3CU04-1H
Control mode *1		Normal, cascade, two-input changeover, and setting output	
Output mode selection		ON/OFF control, PID control, and heating/cooling control	
Number of setting groups		4 groups: set point, proportional band, integration time, derivative time, manual reset value, and forward/reverse operation	
	Changeover method	Zone changeover using set point number or input temperature	
Auto-tuning		Calculates PID parameters using limit cycle method (when specified)	
“Dynamic auto-tuning" *2		PID parameters are automatically recalculated at control start, set point change, or hunching.	
“Super” *3		Suppresses overshooting using fuzzy logic theory	
Operation mode		RUN/STOP, automatic output/manual output, local/remote, set point number, and cascade output/automatic output/manual output (when cascade is used)	
Set point gradient setting		Both acceleration and deceleration can be set	
Output limit		Both upper and lower limits can be set	
Control period		Equivalent to input sampling period	

*1: Cascade or two-input changeover mode uses two loops of input and output terminals.
*2: Not available in the heating/cooling or zone PID control mode.
*3: Not available in the ON/OFF control mode.

● Output Specifications

Item		Specification	
		F3CU04-0H	F3CU04-1H
Number of outputs		8	8
External power supply *1		24 V DC ±10%, 20 mA	24 V DC ±10%, 250 mA
Time-proportional PID output (open collector output)	Rated load voltage	24 V DC	
	Maximum load current	0.1 A per point and 0.4 A for 8 points	
	ON residual voltage	0.5 V DC max.	
	OFF leakage current	0.1 mA max.	
	Response time	OFF→ON: 1 ms max., ON→OFF: 1 ms max.	
	Cycle time	0.5 to 120 s	
	Time-proportional resolution	10 ms or 0.05% of F.S., whichever is greater	
Continuous PID output (analog output)	Output range	N.A.	4-20 mA (3.2-20.8 mA)
	Allowable load resistance		600Ω max.
	Output accuracy		±1.0% of F.S.
	Output resolution		0.05% of F.S.
	Output update period		Equivalent to input sampling period
	Output response time		Normal: 0%→100% Approx. 200ms High-speed: 0%→100% Approx. 10ms

*1: External power supply is not required if no output terminal is used (that is, if only input terminals are used).

■ Functions List

・**Function List 1/2**

Category	Functions		Description
Controller	Input sampling period		Sets the input sampling period.
	Controller mode selection		Specifies the controller mode for a pair of 2 loops.
	Controller mode	Single loop	Basic controller mode with one control and computation function where two loops operate independently.
		Cascade control	Two control and computation functions perform cascade control (using 2 loops of input and output).
		Two-input changeover	Switches between two measured inputs (using a register or measured value range) and handles them as one measured input (using 2 loops of input).
		Disabled	Loops specified as 'disabled' are not used.
Output processing	Control type selection		Selects from on/off, PID, and heating/cooling control types.
	Control type	ON/OFF	Performs control by turning on (100% output) or turning off the output (0% output). *1
		PID	Controls output according to PID computation results.
		Heating/cooling	Controls both heating and cooling outputs according to PID computation results.
		Sample PI	Controls output according to Sample PI computation results.
	Output limiter	Output limiter	Sets the upper and lower limits for the control output.
		Rate-of-change limit	Sets the maximum allowable rate-of-change for the control output.
	Output type selection *2		Selects between time-proportional output (open collector) and continuous output (4-20 mA analog output).
	Analog output *2		Specifies a fixed value output for any output terminal not used in a control loop (e.g. when disabled).
	Output Broken-line approximation		Correct output by Broken-line approximation
Input processing	Input type selection		Sets input type using switches (for all loops) or software (for individual loops).
	Power supply frequency specification		Specifies the power supply frequency. An appropriate setting value will reduce the effect of common mode noise.
	Input range setting		Sets input ranges.
	PV range setting		Sets PV range for two-input changeover mode.
	Burnout selection		Selectable from Up-scale, Down-scale, or OFF (no burnout detection) for thermocouple or RTD input open-circuit detection. *3
	Reference junction compensation		Sets thermocouple reference junction compensation to 'On' or 'Fixed Value'.
	Input computation	Broken-line biasing	Specifies any temperature and its bias value. A compensation value based on the linear interpolation of the specified bias values is automatically added to a measured input. This function is particularly useful for a deteriorated sensor, for which input compensation is desirable.
		Fixed biasing	Specifies a fixed bias value to be automatically added to measured input values. This function is useful when a measured input suffers a fixed deviation due to a known physical problem with a sensor, or when fine adjustment of measured input is desirable for better consistency with values indicated by other equipment, even though data deviation is within tolerance.
		Input filtering	Filtering can be used to remove high frequency noise from measured inputs such as flow rate and pressure.
		Square root extraction	Performs square root extraction on measured inputs. This function is useful for converting differential pressure signals (of orifice, nozzle, or other types of restriction flowmeter) to flow rate signals.
	Two-input changeover		Sets the two-input changeover mode to perform changeover based on temperature range, preset temperature value, or register value.
	External PV input		External values may be used as control input values. Measured input values that have undergone required processing by a CPU module or other means, may be used as input values.

*1: Numbers within parentheses (100% and 0%) applies when the output is configured as a continuous output (for F3CU04-1H only).

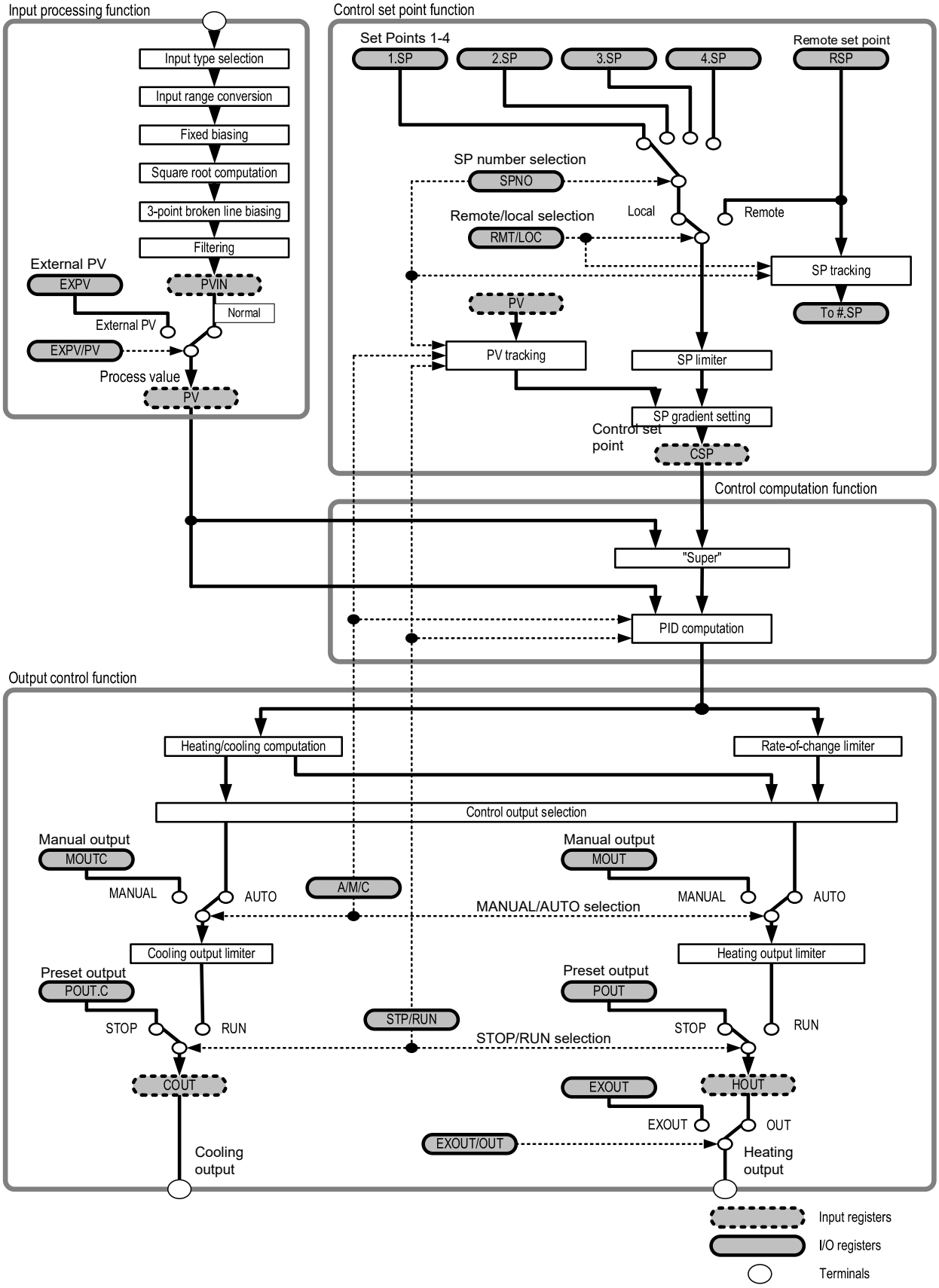
*2: Available for F3CU04-1H only.

*3: When burnout selection is set to OFF, the measured input value at the time of burnout (open circuit) is unpredictable and may approach either the upper limit or the lower limit. Furthermore, the burnout relay is not set.
However +OVER or -OVER detection is performed.

・**Function List 2/2**

Category	Functions		Description
Control and computation	Set point	Set points	Four set points can be predefined for each loop. A predefined set point can be selected using the SP number parameter.
		Remote set point	Can be used to continually change the set point value from the CPU module or by other means.
		SP tracking	Retains the set point value when switching from remote to local mode.
		SP limiter	Limits the set point within specified limits in remote or cascade control mode.
		SP gradient setting	Defines acceleration and deceleration independently for varying the control set point at a fixed rate or to prevent an abrupt change in the control set point.
		PV tracking	When a switchover is made from Stop to Run, from Manual to Automatic, or from one SP number to another, the control set point is first set to the current PV value and then gradually changed to the required value at the rate defined by the SP gradient parameters.
		Startup cooperative operation	Coordination between loops can be achieved by setting the PV of the parent loop to the SP of the child loop.
	Auto-tuning	Dynamic auto-tuning	Automatically recalculates PID constants to achieve continuous stable control at the beginning of a control operation or when control becomes unstable.
		Auto-tuning	When a start tuning instruction is issued, measures the characteristics of a control object by switching on and then switching off the output, and automatically determines and sets optimal PID constants.
	Control and compu-tation	Forward/reverse operation	Defines the direction of output change (increase or decrease) corresponding to a positive deviation.
		PID control mode	The combination of the CMD parameter (0: standard PID control mode, 1: fixed-point control mode) and the remote/local switch determines the PID control method (PV derivative type PID control or deviation derivative type PID control) with or without bumping.
		Super	Suppresses overshooting using fuzzy logic.
		Anti-reset windup	Prevents excessive integration and hence overshooting by suspending PID computation. The deviation width for resuming PID computation can be set using a parameter.
	PID selection		Selects one of the four PID parameter groups belonging to each loop.
	PID selection method	SP number selection	Switches between four PID parameter groups according to the value of the SP Number Selection parameter.
		Zone PID selection	Automatically switches between PID parameter groups according to PV value. In addition, allows switching to a specific PID parameter group when the deviation is large.
	Operation control		Switches between run/stop, automatic/manual/cascade, remote/local, and other operating modes.
Alarm	Alarm	Alarm setup	Defines four alarms for each loop. Alarms may be defined to trigger with respect to the upper or lower input limit or differential upper or lower limit.
		Waiting	Suppresses alarms during the startup period after power on until the operation stabilizes.
		Delay timer	Reports an alarm only if an alarm condition persists for a minimum duration.
Backup function (Storing of preset values)			Holds parameters in non-volatile memory. It can be rewritten 10 million times (100,000 times before REV:01:00).

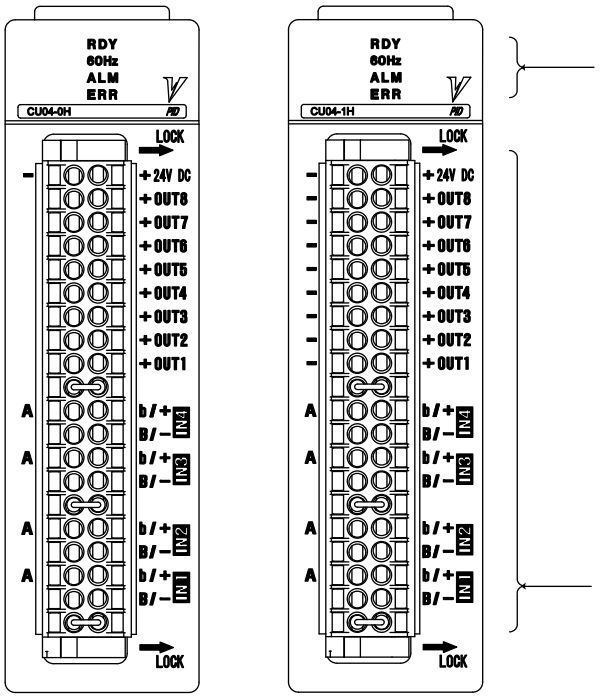
• Function block diagram for F3CU04 (single-loop operation)



■ Components and Functions

● Front view

F3CU04-0H F3CU04-1H



Status Indicators

RDY (green)

Lit when the internal circuit is functioning normally.
Turns off when an error occurs in the module.

60 Hz (green)

Indicates the frequency of the commercial power supply,
Off: 50Hz;
On: 60 Hz.

ALM (orange)

Lit when an alarm occurs in any loop.

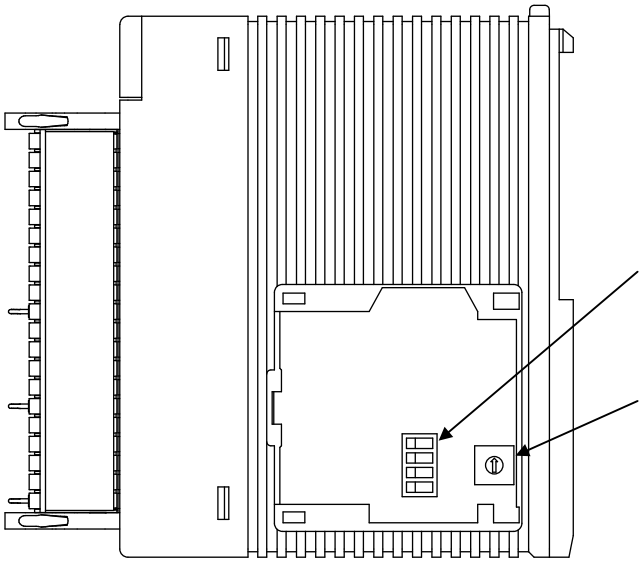
ERR (red)

Lit or flashes when a hardware failure is detected or an error is detected in stored data.
Lit when an error is detected in RAM, ROM, system data, calibration values, ADC, RJC or Non-volatile memory.
Flashes when a parameter error or burnout is detected.

I/O terminal block

40-pin spring terminal block.

● Right side view



SW1-1: Not used (Always OFF)
SW1-2: Power frequency selector switch
SW1-3: Input type selector switch
SW1-4: Input type selector switch

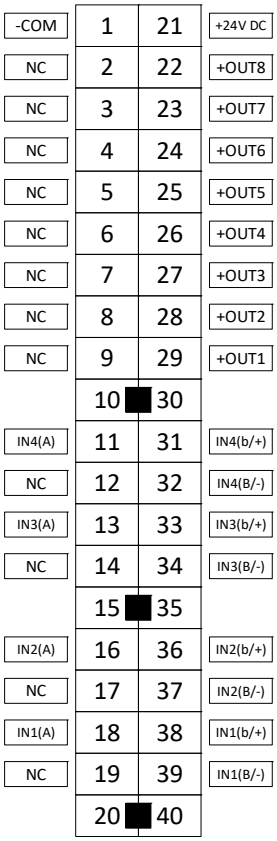
SW5: Input type selector switch
(Input type is determined by the combined values of SW1-3, SW1-4, and SW5.)

Note: This is the right side view of the module with its cover removed.

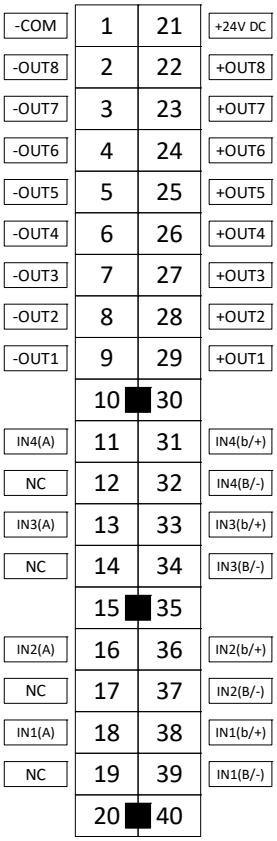
■ External Connection Diagram

● Terminal Wiring Diagram

F3CU04-0H

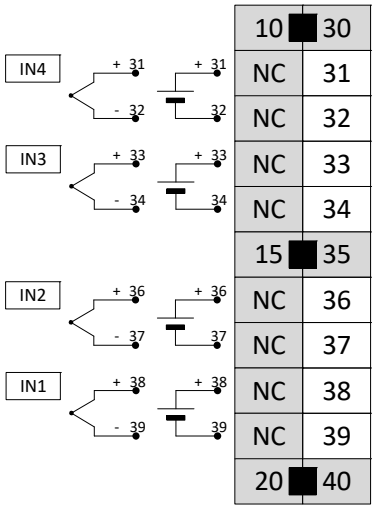


F3CU04-1H

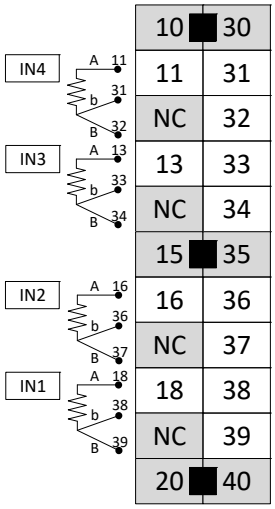


● Input Terminal Wiring Examples

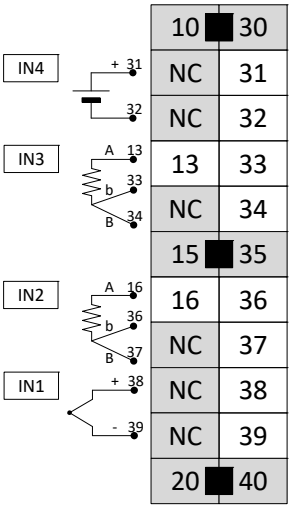
・For thermocouple and DC voltage input



・For RTD input

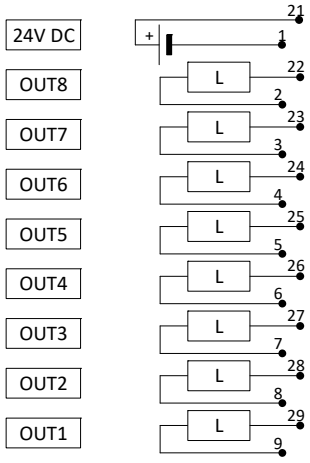


・With IN1 as the thermocouple input,
IN2-3 as the RTD input, and IN4 as the DC voltage input



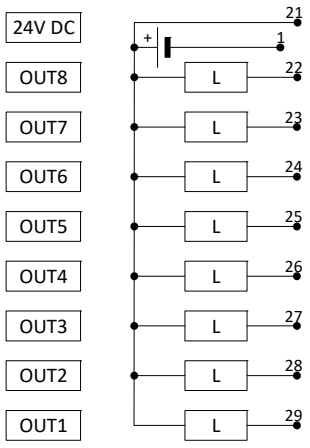
● Output Terminal Wiring Examples

・For 4-20 mA analog output (continuous output)



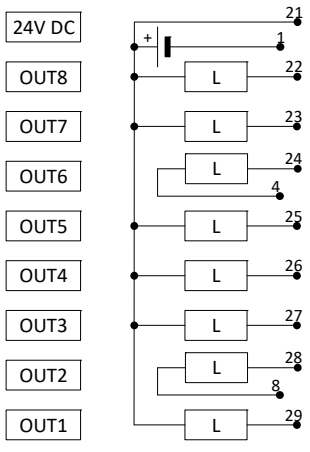
1	21
2	22
3	23
4	24
5	25
6	26
7	27
8	28
9	29

・For open collector output (time proportional output)



1	21
NC	22
NC	23
NC	24
NC	25
NC	26
NC	27
NC	28
NC	29

・With OUT1, 3-5, and 7-8 as open collector outputs, and OUT2 and OUT6 as analog outputs



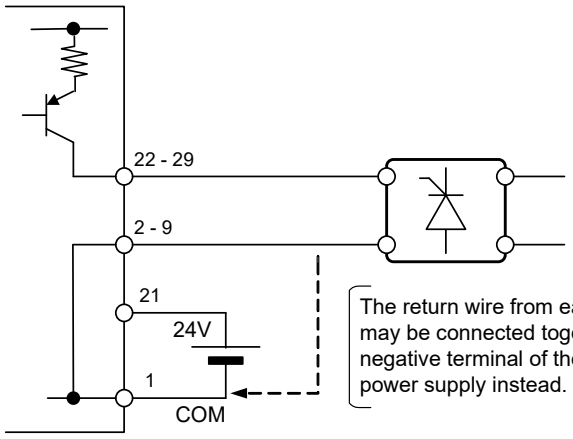
1	21
NC	22
NC	23
4	24
NC	25
NC	26
NC	27
8	28
NC	29

● Wiring Example of the Output Section

The outputs of the F3CU04-0H are open collector outputs (time proportional outputs).

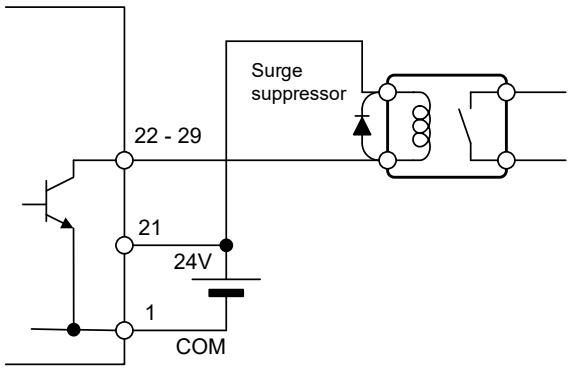
The outputs of the F3CU04-1H can be configured either for open collector output (time proportional output) or 4-20 mA analog output (continuous output) for each loop by software.

・For connecting an SCR (analog output)

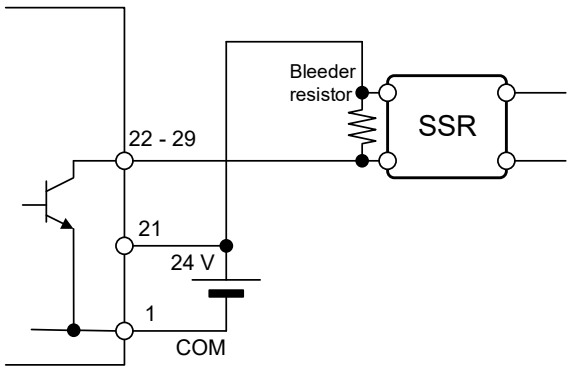


The return wire from each SCR may be connected together at the negative terminal of the 24V DC power supply instead.

・For connecting a relay (open collector output)



・For connecting an SSR (open collector output)



■ Cable and Crimp-style Terminal

Cable Type	Shielded twist-pair wire
Cable temperature rating	75°C min.
Cable connection method	Using ferrule

	Manufacturer	Model	Compatible Wire
Crimp-style terminals and compatible wires	Phoenix Contact	AI 0,34-8 TQ	AWG22 (0.34 mm^2)
		AI 0,5-10 WH	AWG20 (0.52 mm^2)
		AI 0,75-10 GY	AWG18 (0.75 mm^2)
		AI 1-10 RD	AWG18 (1.00 mm^2)

■ Operating Environment

● CPU Modules

There is no restriction on the type of CPU modules that can be used with this module.

However, this module cannot be accessed by Byte size. If using the RTOS-CPU module, use Word size access.

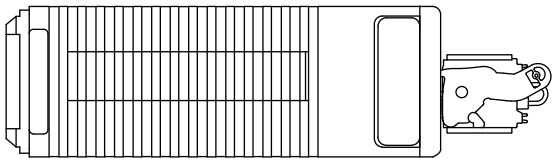
● FA-M3 ToolBox for Temperature Control and Monitoring Modules

This module supports R7.03 and later of the FA-M3 ToolBox for Temperature Control and Monitoring Modules. However, R7.03 has the following functional restrictions.

- Input sampling periods of 10 ms and 100 ms for 4 loops cannot be selected.
- Continuous output response time selection (OUTRT) cannot be set. Set to “0: Normal”.
- For the F3CU04-0H, the Output Terminal Selection (OUTSEL5–8) settings cannot be changed, and remain at the default settings.
- Sample PI control cannot be selected.
- Startup cooperative operation cannot be set.
- Output broken-line approximation function cannot be set.
- The upper and lower limits of the RTD input range cannot be set to a value that exceeds the default value.

R7.04 and later will no longer have any functional restrictions in R7.03.

■ External Dimensions



Unit : mm