Analog I/O Modules

Analog I/O modules are available in 3-I/O types, 2-, 4-, and 8-input types, and 1-, 2- and 4-output types. The input channel can accept voltage and current signals, thermocouple and resistance thermometer signals, or thermistor signals. The output channel generates voltage and current signals.

Analog I/O Module Type Numbers

Name	I/O Signal	I/O Points	Category	Type No.
Analog I/O Module	Voltage (0 to 10V DC) Current (4 to 20mA)	2 inputs	END Refresh Type	FC4A-L03A1
	Voltage (0 to 10V DC) Current (4 to 20mA)	1 output		
	Thermocouple (K, J, T) Resistance thermometer (Pt100)	2 inputs		FC4A-L03AP1
	Voltage (0 to 10V DC) Current (4 to 20mA)	1 output		
Analog Input Module	Voltage (0 to 10V DC) Current (4 to 20mA)	2 inputs		FC4A-J2A1
	Voltage (0 to 10V DC) Current (4 to 20mA) Thermocouple (K, J, T) Resistance thermometer (Pt100, Pt1000, Ni100, Ni1000)	4 inputs	Ladder Refresh Type	FC4A-J4CN1
	Voltage (0 to 10V DC) Current (4 to 20mA)	8 inputs		FC4A-J8C1
	Thermistor (NTC, PTC)	8 inputs		FC4A-J8AT1
Analog Output Module	Voltage (0 to 10V DC) Current (4 to 20mA)	1 output	END Refresh Type	FC4A-K1A1
	Voltage (–10 to +10V DC) Current (4 to 20mA)	2 outputs	Ladder Refresh Type	FC4A-K2C1
	Voltage (0 to 10V DC) Current (4 to 20mA)	4 outputs		FC4A-K4A1

END Refresh Type and Ladder Refresh Type

Depending on the internal circuit design for data refreshing, analog I/O modules are categorized into two types.

Analog I/O Module Category		END Refresh Type	Ladder Refresh Type
While CPU is running	Parameter Refreshing	At the end processing in the first scan	When executing ANST macro
	Analog I/O Data Refreshing	At the end processing	In the step after ANST macro (always refreshed whether input to ANST is on or off)
While CPU is stopped	Analog Output Data Refreshing	When M8025 (maintain outputs while CPU stopped) is on, output data is refreshed. When off, output is turned off.	Maintains output status when the CPU is stopped. Output data can be changed using STPA instruction while the CPU is stopped. See page 9-22.
Data Register Allocation		By default	Optionally designated in ANST macro

END Refresh Type

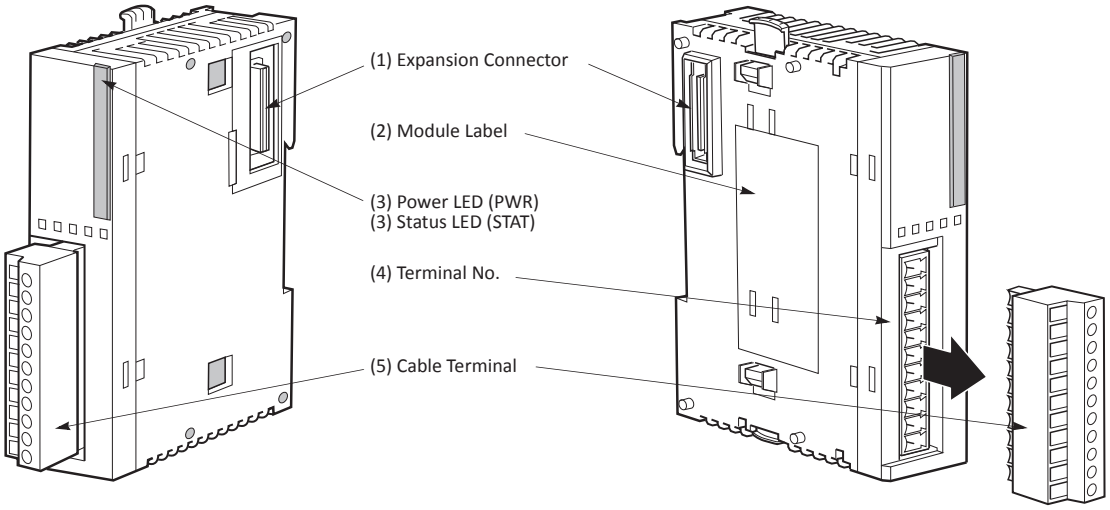
Each END refresh type analog I/O module is allocated 20 data registers to store analog I/O data and parameters for controlling analog I/O operation. These data registers are updated at every end processing while the CPU module is running. WindLDR has ANST macro to program the analog I/O modules.

The CPU module checks the analog I/O configuration only once at the end processing in the first scan. If you have changed the parameter while the CPU is running, stop and restart the CPU to enable the new parameter.

Ladder Refresh Type

Each ladder refresh type analog I/O module can be allocated any data registers to store analog I/O data and parameters for controlling analog I/O operation. The data registers are programmed in the ANST macro. Analog I/O data are updated at the ladder step following the ANST macro. Analog I/O parameters are updated when the ANST macro is executed, so analog I/O parameters can be changed while the CPU is running.

Parts Description

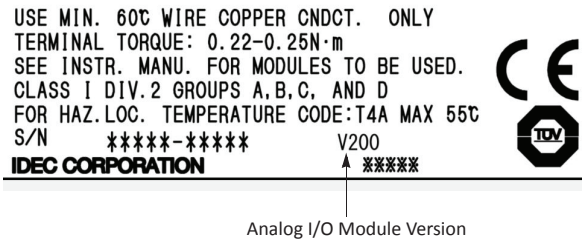


The terminal style depends on the model of analog I/O modules.

(1) Expansion Connector Connects to the CPU and other I/O modules.
(The all-in-one 10- and 16-I/O type CPU modules cannot be connected.)

(2) Module Label Indicates the analog I/O module Type No. and specifications.

Four analog I/O modules FC4A-L03A1, FC4A-L03AP1, FC4A-J2A1, and FC4A-K1A1 of version 200 or higher have the version number indicated on the module label attached to the side of the module. Confirm the version number because some specifications differ depending on the version number. Analog I/O modules earlier than version 200 do not have a version number indicated on the module label.



(3) Power LED (PWR) END refresh type FC4A-L03A1, FC4A-L03AP1, FC4A-J2A1, FC4A-K1A1, FC4A-K4A1 (Note):
Turns on when power is supplied to the analog I/O module.
Note: Power LED of FC4A-K4A1 flashes when external power supply error is occurring. For details about operating status, see pages 9-14 and 9-17.

(3) Status LED (STAT) Ladder refresh type FC4A-J4CN1, FC4A-J8C1, FC4A-J8AT1, FC4A-K2C1:
Indicates the operating status of the analog I/O module.

Status LED	Analog Input Operating Status
OFF	Analog I/O module is stopped
ON	Normal operation
Flash	Initializing Changing configuration Hardware initialization error External power supply error

(4) Terminal No. Indicates terminal numbers.

(5) Cable Terminal All analog I/O modules have a removable terminal block.

Analog I/O Module Specifications

General Specifications (END Refresh Type)

Type No.	FC4A-L03A1	FC4A-L03AP1	FC4A-J2A1	FC4A-K1A1
Rated Power Voltage	24V DC			
Allowable Voltage Range	20.4 to 28.8V DC			
Terminal Arrangement	See Analog I/O Module Terminal Arrangement on pages 2-64 to 2-67.			
Connector on Mother Board	MC1.5/11-G-3.81BK (Phoenix Contact)			
Connector Insertion/Removal Durability	100 times minimum			
Internal Current Draw	50 mA (5V DC) 0 mA (24V DC)	50 mA (5V DC) 0 mA (24V DC)	50 mA (5V DC) 0 mA (24V DC)	50 mA (5V DC) 0 mA (24V DC)
External Current Draw (Note 1)	50 (45) mA (Note 2) (24V DC)	50 (40) mA (Note 2) (24V DC)	40 (35) mA (Note 2) (24V DC)	40 mA (24V DC)
Weight (Approx.)	100g (85g) (Note 2)			

Note 1: The external current draw is the value when all analog inputs are used and the analog output value is at 100%.

Note 2: Values in ( ) represent analog I/O modules earlier than version 200. For analog I/O module version, see page 2-56.

General Specifications (Ladder Refresh Type)

Type No.	FC4A-J4CN1	FC4A-J8C1	FC4A-J8AT1
Rated Power Voltage	24V DC		
Allowable Voltage Range	20.4 to 28.8V DC		
Terminal Arrangement	See Analog I/O Module Terminal Arrangement on pages 2-64 to 2-67.		
Connector on Mother Board	MC1.5/10-G-3.81BK (Phoenix Contact)		
Connector Insertion/Removal Durability	100 times minimum		
Internal Current Draw	50 mA (5V DC) 0 mA (24V DC)	40 mA (5V DC) 0 mA (24V DC)	45 mA (5V DC) 0 mA (24V DC)
External Current Draw (Note)	55 mA (24V DC)	50 mA (24V DC)	55 mA (24V DC)
Weight	140g	140g	125g

Type No.	FC4A-K2C1	FC4A-K4A1
Rated Power Voltage	24V DC	
Allowable Voltage Range	20.4 to 28.8V DC	
Terminal Arrangement	See Analog I/O Module Terminal Arrangement on pages 2-64 to 2-67.	
Connector on Mother Board	MC1.5/10-G-3.81BK (Phoenix Contact)	MC1.5/11-G-3.81BK (Phoenix Contact)
Connector Insertion/Removal Durability	100 times minimum	
Internal Current Draw	60 mA (5V DC) 0 mA (24V DC)	65 mA (5V DC) 0 mA (24V DC)
External Current Draw (Note)	85 mA (24V DC)	130 mA (24V DC)
Weight (Approx.)	110g	100g

Note: The external current draw is the value when all analog inputs are used and the analog output value is at 100%.

Analog Output Specifications

Category			END Refresh Type			Ladder Refresh	
Type No.			FC4A-L03A1	FC4A-L03AP1	FC4A-K1A1	FC4A-K4A1	FC4A-K2C1
Output Range		Voltage	0 to 10V DC				–10 to +10V DC
		Current	4 to 20 mA DC				
Load	Load Impedance		1 (2) kΩ minimum (voltage), 300Ω maximum (current) (Note 1)				
	Applicable Load Type		Resistive load				
DA Conversion	Settling Time		10 (50) ms (Note 1)	10 (130) ms (Note 1)	10 (50) ms (Note 1)	2 ms/ch (Note 2)	1 ms/ch
	Total Output System Transfer Time		Settling time + 1 scan time			2 ms × channels + 1 scan time	1 ms × channels + 1 scan time
Output Error	Maximum Error at 25°C		±0.2% of full scale				
	Temperature Coefficient		±0.015% of full scale/°C				±0.005% of full scale/°C
	Repeatability after Stabilization Time		±0.5% of full scale				
	Output Voltage Drop		±1% of full scale				
	Non-lineality		±0.2% of full scale				
	Output Ripple		1 LSB maximum			20 mV maximum	±0.1% of full scale
	Overshoot		0%				
	Total Error		±1% of full scale				
Data	Digital Resolution		4096 increments (12 bits)				50000 increments (16 bits)
	Output Value of LSB	Voltage	2.5 mV				0.4 mV
		Current	4 µA				0.32 µA
	Data Type in Application Program		Default: 0 to 4095 (voltage, current)				–25000 to 25000 (voltage)
							0 to 50000 (current)
			Optional: –32768 to 32767 (selectable for each channel) (Note 3)				
	Monotonicity		Yes				
	Current Loop Open		Not detectable				
Noise Resistance	Maximum Temporary Deviation during Electrical Noise Tests (Note 4)		±1% (±3%) maximum (Note 1)			±4% maximum	±3% maximum
	Recommended Cable for Noise Immunity		Twisted pair shielded cable				Twisted pair cable
	Crosstalk		No crosstalk because of 1 channel output			2 LSB maximum	
Isolation			Between input and power circuit: Transformer isolated Between input and internal circuit: Photocoupler-isolated				
Effect of Improper Output Connection			No damage				
Selection of Analog Output Signal Type			Using programming software				
Calibration or Verification to Maintain Rated Accuracy			Not possible				

Note 1: Values in ( ) represent analog I/O modules earlier than version 200. For analog I/O module version, see page 2-56.

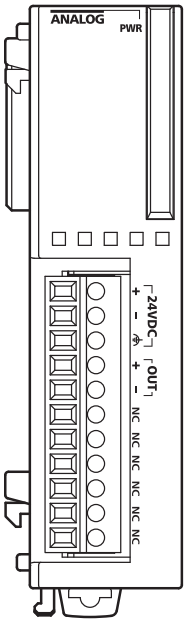
Note 2: Rise time is not included.

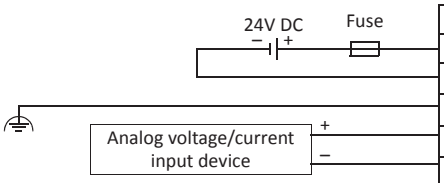
Note 3: The data processed in the analog I/O module can be linear-converted to a value between –32768 and 32767. The optional range designation, and analog I/O data minimum and maximum values can be selected using data registers allocated to analog I/O modules. See page 9-13.

Note 4: For analog I/O modules of version 200 or higher, the value represents when 1 kV is directly applied to the power supply line and a 1 kV clamp voltage is applied to I/O lines. For analog I/O modules earlier than version 200, the value represents when a 500V clamp voltage is applied to the power supply and I/O lines.

FC4A-K1A1 (Analog Output Module) — Screw Terminal Type

Applicable Terminal Block: FC4A-PMT11P (supplied with the analog output module)



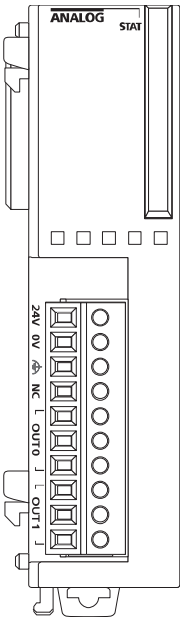


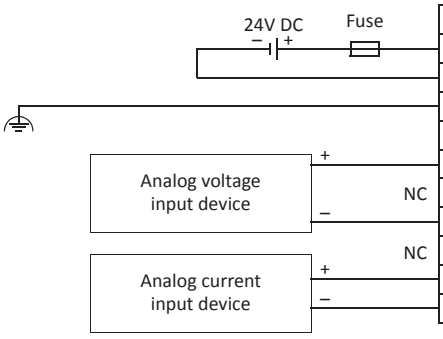
Terminal No.	Channel
+	24V DC
–	
⏚	
+	OUT
–	
NC	—
NC	
NC	
NC	—
NC	
NC	

- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram. This is required when equipment containing the MicroSmart is destined for Europe.
- Do not connect any wiring to unused terminals.
- When the analog I/O module may malfunction due to noise, use the shielded cable for the analog input and output and connect both ends of the shield to a ground.

FC4A-K2C1 (Analog Output Module) — Screw Terminal Type

Applicable Terminal Block: FC4A-PMT10P (supplied with the analog output module)





Terminal No.	Channel
24V	24V DC
0V	
⏚	
NC	—
V+	OUT0
I+	
–	
V+	OUT1
I+	
–	

- Connect a fuse appropriate for the applied voltage and current draw, at the position shown in the diagram. This is required when equipment containing the MicroSmart is destined for Europe.
- Do not connect any wiring to unused terminals.
- – terminals of output channels OUT0 and OUT1 are interconnected.
- When the analog I/O module may malfunction due to noise, use the shielded cable for the analog input and output and connect both ends of the shield to a ground.