Programmable Cam Controllers Lineup

Programmable Cam Controllers Lineup

Model Number	Appearance	Type of Encoder	Resolution (Digit)	Number of Outputs	Responsivity	Supply Voltage	Power Source for Sensors
FC2-81F-C-1	 95 W x 80 H x 60.5 D	Absolute encoder	360/720	8	300 rpm/360 resolution 150 rpm/720 resolution	12/24 V DC	—
FC2-161F-C-1	 140 W x 90 H x 60.5 D	Absolute encoder	360/720	16	1600 rpm/ 360 resolution 800 rpm/720 resolution (No advancing setting)	12/24 V DC	—
FC2-321F-C-1	 140 W x 90 H x 60.5 D	Absolute encoder	360/720	32	1600 rpm/ 360 resolution 800 rpm/720 resolution (No advancing setting)	85 to 264 V AC	Dedicated to encoder +12 V 70 mA
FC2-80-C-1	 105 W x 100 H x 66 D	Absolute encoder	360/720	8	300 rpm/360 resolution 150 rpm/720 resolution	12/24 V DC	—
FC2-160-1	 140 W x 100 H x 66 D	Absolute encoder	360/720	16	1600rpm/ 360 resolution 800 rpm/720 resolution	85 to 264 V AC	Dedicated to encoder +12 V 70 mA
FC2-320-1	 195 W x 100 H x 66 D	Absolute encoder	360/720	32	1600 rpm/ 360 resolution 800 rpm/720 resolution (No advancing setting)	85 to 264 V AC	Dedicated to encoder +12 V 70 mA

FC Series Correlation List

Compatibility Between FC and FC2 Series (Unit: mm)

Surface-Mount Installation Type FC-80□			
Items	Difference	FC-80□	FC2-80□
Model Number		FC-80-C (Noted in Japanese) FC-80-C-1 (Noted in English)	— FC2-80-C-1 (Noted in English)
Dimensions	○	105.0 W x 100.0 H x 66.0 D	No change
Installation Method	○	DIN rail / screwed	No change
Power Supply	○	10.8 V to 26.4 V DC	No change
Function / Performance	○		No change
Encoder-connecting Connector			
Manufacturer	×		Not compatible
Protrusion Dimension	×	16.8	30.9
Encoder			
TRD-NA□NWF	△	Usable	Conversion cable F-2GF2 is required.
TRD-NA□NWF2	△	Conversion cable F-2GF-7308 is required.	Usable
TRD-NA□NWE	△	Usable	Conversion cable F-2GF2 is required.
Junction Cables	×	F-□GF	F-□GF2

Surface-Mount Installation Type FC-160□			
Items	Difference	FC-160□	FC2-160□
Model Number		FC-160 (Noted in Japanese) FC-160-1 (Noted in English)	— FC2-160-1 (Noted in English)
Dimensions	○	140.0 W x 100.0 H x 66.0 D	No change
Installation Method	○	DIN rail / screwed	No change
Power Supply	○	85 V to 264 V AC	No change
Function / Performance	○		No change
Encoder-connecting Connector			
Manufacturer	×		Not compatible
Protrusion Dimension	×	16.8	30.9
Encoder			
TRD-NA□NWF	△	Usable	Conversion cable F-2GF2 is required.
TRD-NA□NWF2	△	Conversion cable F-2GF-7308 is required.	Usable
TRD-NA□NWE	△	Usable	Conversion cable F-2GF2 is required.
Junction Cables	×	F-□GF	F-□GF2

Surface-Mount Installation Type FC-320□			
Items	Difference	FC-320□	FC2-320□
Model Number		FC-320 (Noted in Japanese) FC-320-1 (Noted in English)	— FC2-320-1 (Noted in English)
Dimensions	○	195.0 W x 100.0 H x 66.0 D	No change
Installation Method	○	DIN rail / screwed	No change
Power Supply	○	85 V to 264 V AC	No change
Function / Performance	○		No change
Encoder-connecting Connector			
Manufacturer	×		Not compatible
Protrusion Dimension	×	16.8	30.9
Encoder			
TRD-NA□NWF	△	Usable	Conversion cable F-2GF2 is required.
TRD-NA□NWF2	△	Conversion cable F-2GF-7308 is required.	Usable
TRD-NA□NWE	△	Usable	Conversion cable F-2GF2 is required.
Junction Cables	×	F-□GF	F-□GF2

Embedded Installation Type FC-81F□			
Items	Difference	FC-81F□	FC2-81F□
Model Number		FC-81F-C (Noted in Japanese) FC-81F-C-1 (Noted in English)	— FC2-81F-C-1 (Noted in English)
Dimensions (Connector Connection)	○ ×	95.0 W x 80.0 H x 60.5 D 95.0 W x 80.0 H x 60.5 D	No change 95.0 W x 80.0 H x 76.2 D
Installation Method	○	Panel cutout / Mounting brackets	No change
Panel Cutout Dimensions	○	90.0 W x 75.0 H	No change
Thickness of Mounting Plate	○	0.5 to 4.0	No change
Power Supply	○	10.8 V to 26.4 V DC	No change
Function / Performance	○		No change
Encoder-connecting Connector			
Manufacturer	×		Not compatible
Position	×		Not compatible
Encoder			
TRD-NA□NWF	△	Usable	Conversion cable F-2GF2 is required.
TRD-NA□NWF2	△	Conversion cable F-2GF-7308 is required.	Usable
TRD-NA□NWE	△	Usable	Conversion cable F-2GF2 is required.
Junction Cables	×	F-□GF	F-□GF2

Embedded Installation Type FC-161F□			
Items	Difference	FC-161F□	FC2-161F□
Model Number		FC-161F-C (Noted in Japanese) FC-161F-C-1 (Noted in English)	— FC2-161F-C-1 (Noted in English)
Dimensions (Connector Connection)	○ ×	140.0 W x 80.0 H x 60.5 D 140.0 W x 80.0 H x 60.5 D	No change 140.0 W x 80.0 H x 76.2 D
Installation Method	○	Panel cutout / Mounting brackets	No change
Panel Cutout Dimensions	○	135.0 W x 85.0 H	No change
Thickness of Mounting Plate	○	0.5 to 4.0	No change
Power Supply	○	10.8 V to 26.4 V DC	No change
Function / Performance	○		No change
Encoder-connecting Connector			
Manufacturer	×		Not compatible
Position	×		Not compatible
Encoder			
TRD-NA□NWF	△	Usable	Conversion cable F-2GF2 is required.
TRD-NA□NWF2	△	Conversion cable F-2GF-7308 is required.	Usable
TRD-NA□NWE	△	Usable	Conversion cable F-2GF2 is required.
Junction Cables	×	F-□GF	F-□GF2

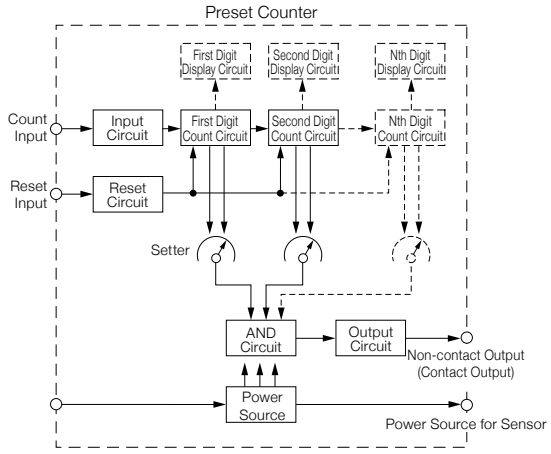
Embedded Installation Type FC-321F□			
Items	Difference	FC-321F□	FC2-321F□
Model Number		FC-321F-C (Noted in Japanese) FC-321F-C-1 (Noted in English)	— FC2-321F-C-1 (Noted in English)
Dimensions (Connector Connection)	○ ×	140.0 W x 80.0 H x 60.5 D 140.0 W x 80.0 H x 60.5 D	No change 140.0 W x 80.0 H x 76.2 D
Installation Method	○	Panel cutout / Mounting brackets	No change
Panel Cutout Dimensions	○	135.0 W x 85.0 H	No change
Thickness of Mounting Plate	○	0.5 to 4.0	No change
Power Supply	○	10.8 V to 26.4 V DC	No change
Function / Performance	○		No change
Encoder-connecting Connector			
Manufacturer	×		Not compatible
Position	×		Not compatible
Encoder			
TRD-NA□NWF	△	Usable	Conversion cable F-2GF2 is required.
TRD-NA□NWF2	△	Conversion cable F-2GF-7308 is required.	Usable
TRD-NA□NWE	△	Usable	Conversion cable F-2GF2 is required.
Junction Cables	×	F-□GF	F-□GF2

FC2-81F□
FC2-161F□/321F□
FC2-80□
FC2-160□/320□

Descriptions of Terms

Preset Counter

The input pulse signal is counted, and if the number of input pulses reaches the numeric value preset by the setter, output is produced.
The block diagram of the preset counter is as shown in the figure below.
《Block diagram KCX series》



Double Preset Counter

The double preset counter has two sets of setters and two output circuits, and can output in the set values.

Total Counter

The total counter only displays the discrete value and does not have control output.

Consolidated Counter

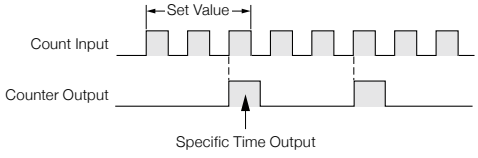
One consolidated counter has the built-in functions of several counters, and when any one of the counters reaches its preset value, it produces output.
The consolidated counter is most suitable for the maintenance of several tools as needed by tool replacement for machining centers and NC machine tools.

A-Type Operation (Specific time output operation)

FC2-81F□
FC2-161F□/321F□

Automatic Reset Repetition

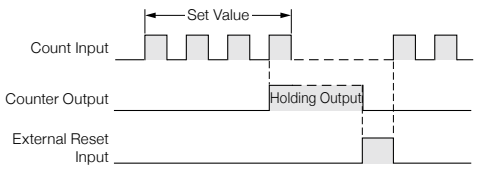
- If the number of input pulse signals reaches the preset value (count up), the output is produced for a specific period of time.
- If the counter counts up, the internal counting circuit is automatically reset and the next input signal can be counted even during output time.
- If you want to reset the internal counting circuit during counting, turn the reset terminal ON (external reset) or shut down the power temporarily (power source reset).



B-type Operation (Self-holding output operation)

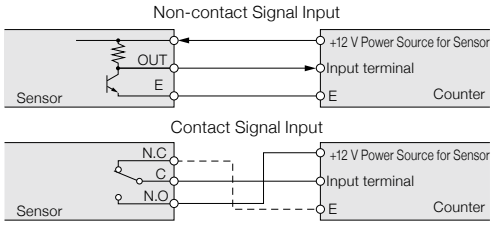
FC2-80□
FC2-160□/320□

- If the number of input pulse signals reaches the preset value, output is produced and held.
- If the reset terminal turns ON (external reset) or the power source is temporarily shut down (power source reset), the internal counting circuit and the output holding circuit reset.



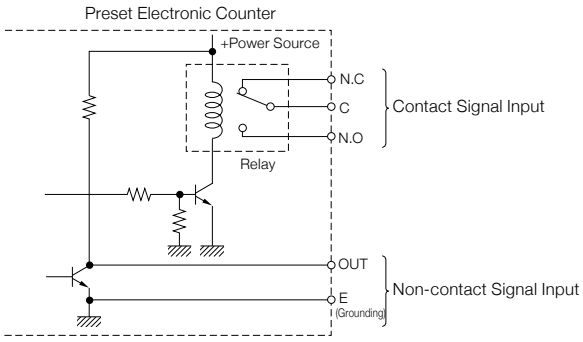
Non-contact Signal Input and Contact Signal Input

A non-contact signal input is an input signal that triggers the output of a semiconductor circuit such as transistor (non-contact output of proximity sensor, photoelectronic sensor, or rotary encoder).
A contact signal input is an signal input triggered by a micro switch, limit switch, push button switch, or relay.



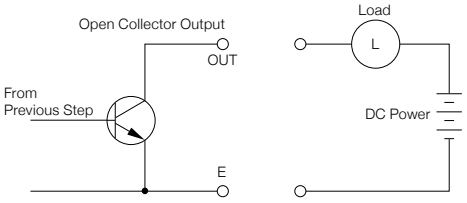
Non-contact Signal Output and Contact Signal Output

A non-contact signal output is a signal output from a semiconductor circuit.
The contact output is a signal output from relay contact built into a counter.



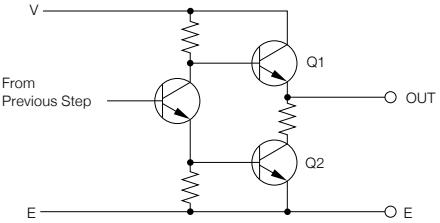
Open Collector Output

Since this circuit is not internally connected to a power source, it is necessary to externally connect a power source and load.
Voltage and current can be freely selected within the standards of the counter.
(Only N load)



Totem-pole Output

A kind of non-contact output, a totem-pole output circuit has transistors Q1 and Q2 of the output circuit connected in series with the output extruding from the intermediate point as shown in the figure below.Therefore, a totem-pole output circuit can take out larger current compared with conventional non-contact output. (Both P load and N load)
A totem-pole output circuit is used in the same way as conventional non-contact output, but can directly drive the relay.



Descriptions of Terms

Maximum Counting Speed

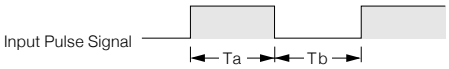
The maximum counting speed shows up to what pulses the input pulse signal of the make ratio 1: 1 (Ta=Tb) can be counted per second, and uses Hz as the unit.
If the make ratio is not 1:1 as shown in (2) and (3) below, the input pulse signal width is limited by Ta MIN. or Tb MIN.

$$\text{Ta MIN.} = \text{Tb MIN.} = \frac{1}{\text{Maximum Counting Speed}} \times \frac{1}{2} \text{ (s)}$$

* This numeric value is provided in the specifications of each model.

(1) Ta = Tb

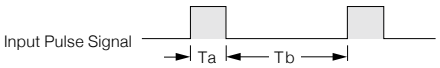
Can be counted if Ta or Tb is longer than Ta MIN. or Tb MIN.



Ta=Tb≧Ta MIN.=Tb MIN.

(2) Ta < Tb

Can be counted if Ta is longer than Ta MIN.



Ta≧Ta MIN.

(3) Ta > Tb

Can be counted if Tb is longer than Tb MIN.

Tb≧Tb MIN.

If the non-contact signal is added as the input pulse signal, the input terminal can be selected according to the counting speed (frequency). If the contact signal is added, the input terminal with the lowest maximum counting speed should be used.

Reset

- Power source reset

The power source reset operates after a certain period of time when the power is supplied. If you want to operate it at any given time, the power source can be reset by shutting down the power once and supplying it again.

- Automatic reset

The automatic reset operates when the counter is used in the A-type operation, and it operates for a certain period of time after the counter counts up. Since this time is shorter than the period of input of the maximum counting speed of the counter, the counter encounters no counting errors and starts counting from "0" again even while counting consecutive inputs.

- External reset

The external reset operates while the predetermined voltage is applied to the reset input terminal. (Some models operate the external reset with an "L" level.)

- Manual reset

The manual reset operates while the push button on the counter surface panel is pressed by manual operation.

Power Source for Sensors

The counter can supply power to the outside from this power source.
Since the power source can be used for supplying power to proximity sensors, photoelectronic sensors, and rotary encoders, the connection with various types of sensors becomes easy.
Koyo Electronics' electronic counters have a built-in power source for sensors. (Excluding the DC type)

Banks

A bank refers to the number of programs.
Each bank can be separately programmed (operation setup).

Explanation of the Technical Terms in the Specifications

Counting Input Inhibit Gate (Responsivity)

Delay ON time: The time until the counting input is shut down after the input of the counting input inhibit gate turns ON.
Delay OFF time: The time until counting is enabled after the input of the counting input inhibit gate turns OFF.

External Setting Input (Responsivity)

Delay ON time: The time until the set circuit starts operating after the external setting input turns ON.
Delay OFF time: The time until the set circuit stops operates after the external setting input turns OFF.

External Reset (Responsivity)

Delay ON time: Delay ON time: The time until the reset after the reset input turns ON.
Delay OFF time: The time until the counting is enabled after the reset input becomes OFF.

Power Source Reset (Reset time)

The time until counting is enabled after the power is resupplied after the power source has been reset.

Automatic Reset (Reset time)

The time until counting is enabled again after the counting circuit is reset simultaneously with count overflow.

Non-contact Output (Responsivity)

The time until the output signal is produced in the non-contact output terminal after the final pulse reaching the preset value enters the counting input terminal.

Contact Output (Responsivity)

The time until the N.O. contact point of the output relay closes after the final pulse reaching the preset value enters the counting input terminal.

Output Prohibition Gate (Responsivity)

Delay ON time: The time until the generation of an output signal is prohibited after the input of the output prohibition gate turns ON.
Delay OFF time: The time until the generation of an output signal is enabled after the input of the output prohibition gate turns OFF.

FC2-81F□, FC2-161F□/321F□

Features

Embedded Installation Type Cam Controller

- The embedded installation type of programmable cams enable constant checking of the operating state from a control panel.
- The programmable cams have enhanced features such as advancing, abnormality detection, and a multipurpose communication port.

Features

- Obtained advanced safety certification

The programmable cams can be used in Category 4 applications of EN954-1, safety integrity level 3 (SIL) of IEC61508, and the performance level e of ISO13849-1: 2006. Users can easily and securely create a safe environment that conforms to international standards.

- Reliable operation based on high level self-diagnosis

The CPU module and the input-output module are equipped with self-monitoring capabilities that constantly monitor for undervoltage and overvoltage, grasp connection and operation status by test pulse, and crosscheck switching by channel monitoring.

- Easy tooling changes

Since the FC2-161F-C-1 can register 8 programs and the FC2-321F-C-1 can register 10 programs, any program can be selected by switching the bank input at the time of tooling change.

- Supporting a wide range of industries

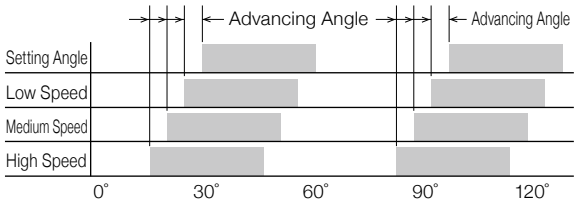
The programmable cams are most suited for the timing control of various kinds of filling machines, wrapping machines, coaters, and bottling machines in the food, packaging, and printing industries.

- Surface-Mount types also available

Surface-Mount type of programmable cams are available in the FC2-80-C-1/FC2-160-1/FC2-320-1.

- Automatic correction of advancing angle (FC2-161F-C-1/FC2-321F-C-1)

If the timing of the machine that changes its rotating speed is controlled by a programmable cam, the difference in operation timing due to actuator delays becomes the problem.
The automatic advancing function corrects this timing difference by outputting the angle equivalent to the operation delay time of the actuator earlier according to the angle calculated from the rotating speed at that time.



[Applications]
- Changing the speed at startup and stopping
- Devices that change speed
- Devices that require speed control

FC2-81F□, FC2-161F□/321F□

Specifications

General Specifications

Items	FC2-81F-C-1	FC2-161F-C-1	FC2-321F-C-1
Supply Voltage	12/24 V DC		
Power Supply Pressure Fluctuation Range	10.8 to 26.4 V DC		
Power Consumption	5 W	8 W	
Ambient Operating Temperature	−10 to 50˚C		
Storage Temperature	−20 to 70˚C (No freezing)		
Use / Storage Ambient Humidity	35 to 85% RH (No condensation)		
Surrounding Atmosphere in Place of Use	No corrosive gases		
Vibration Resistance	Endurance: Displacement amplitude: 0.5 mm, frequency: 10 to 55 Hz, 3 axial directions		
Impact Resistance	Endurance: 500 m/s, 3 axial directions		
Noise Resistance	Between power supply terminals: 1.0 kV	Between power supply terminals: 1.5 kV	
	Pulse width 1μs/start-up 1ns/Square wave pulse		
Protective Structure	IP54: Only the surface sheet		
Size (mm)	95 W x 80 H x 66.7 D	140 W x 90 H x 66.7 D	40 W x 90 H x 66.7 D
Weight (g)	300	420	420

Function/Performance Specifications

Items	FC2-81F-C-1	FC2-161F-C-1	FC2-321F-C-1
Number of Input Points	Starting input: 1 point/ Protection input: 1 point/ Origin input: 1 point	Starting input: 1 point/ Bank input: 3 points/ Protection input: 1 point/ Origin input: 1 point	Starting input: 1 point/ Bank: 4 points/ Protection input: 1 point/ Origin input: 1 point
Encoder Input	H: 7.5 V (OFF)/L: 0 to 2 V (ON)H: 7.5 to 30 V (OFF)/L: 0 to 2 V (ON)		
	Resolution: 360/720 per revolution (Output code: Gray binary)		
Control Input	H: 7.5 V to 30 V (OFF)/L: 0 to 2 V		
Number of Outputs	8 points	16 points	32 points
Output Specifications	NPN open collector Withstanding voltage 35 V or lower / Current 0.1 A or lower		
Number of Output Area Settings	16 settings	64 settings	128 settings
Response Rotating Speed r/min (rpm)	Resolution 360: 300/ Resolution 720: 150	Resolution 360: 1600/ Resolution 720: 800	Resolution 360: 1600/ Resolution 720: 800
Output Response Time	550 μs or less	250 μs or less	250 μs or less
Power Supply Start Time	2 s or less		
Number of Banks	No	8 (Banks 0 to 7)	10 (Banks 0 to 9)
Program Memory	EEPROM		
Resolution	360/720 per revolution (Switched from a DIP switch)		
CW/CCW Direction Switching	Switched from a DIP switch		
RUN Output	ON during normal operation in the operation and adjustment modes (Switched from a DIP switch)		
Display Switching	Angle / Rotating speed (Switched from a DIP switch)		
Origin Correction	Arbitrary point becomes the origin.		
Special Features	Protection function	Protection function, copy function, pulse output function, communication function	
Communication	—	RS-232C Protocol dedicated to FC	
Advancing Function	No	Available	Available
Accessories	Mounting brackets		
Price	Open	Open	Open

FC2-81F□

Each Part Name and Function

Panel Explanation

①Status display
- Displays the angle / rotating speed.

②Angle / Rotating speed display
- Displays the angle / rotating speed.

③Origin key
- Corrects the origin.

④Output display
- Displays the ON/OFF state of output.
- Lights the output No. designated by the [Output] key.

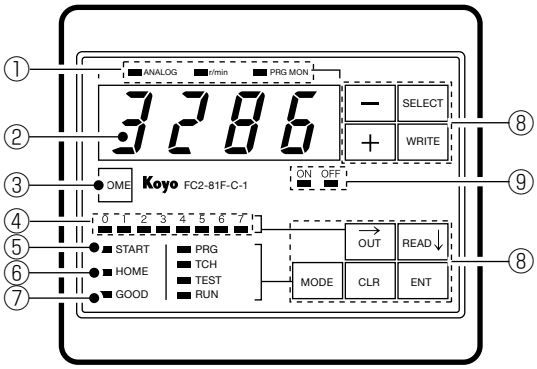
⑤Start input display

⑥External origin input display

⑦Normal display

⑪Connector for encoder

Front



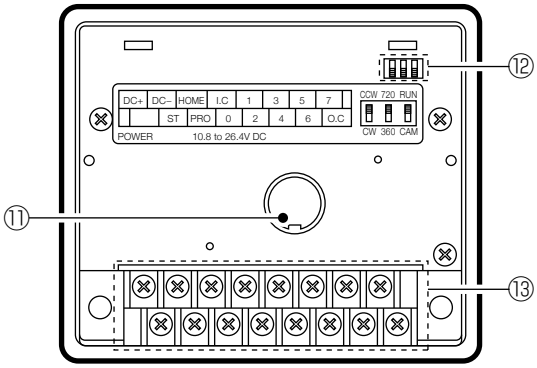
⑧Operation key

⑨Sets the status display.

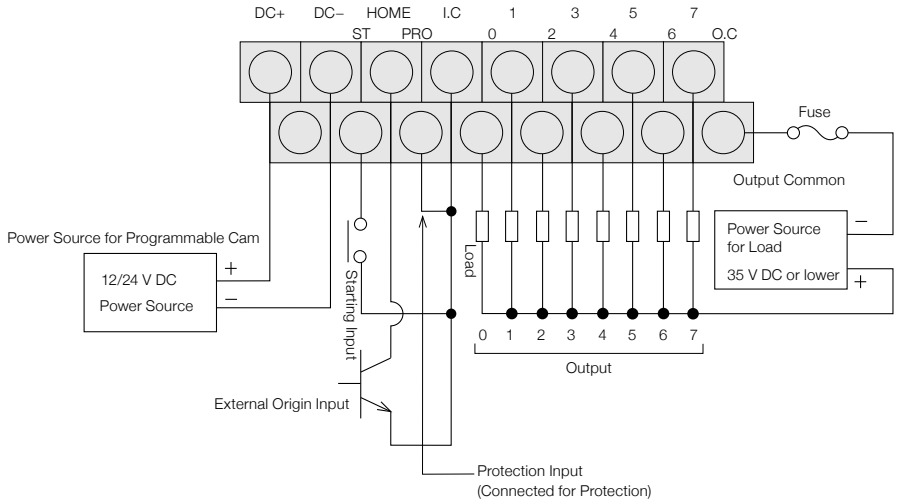
⑫DIP switches

⑬Terminal block
- Provided with the cover

Back



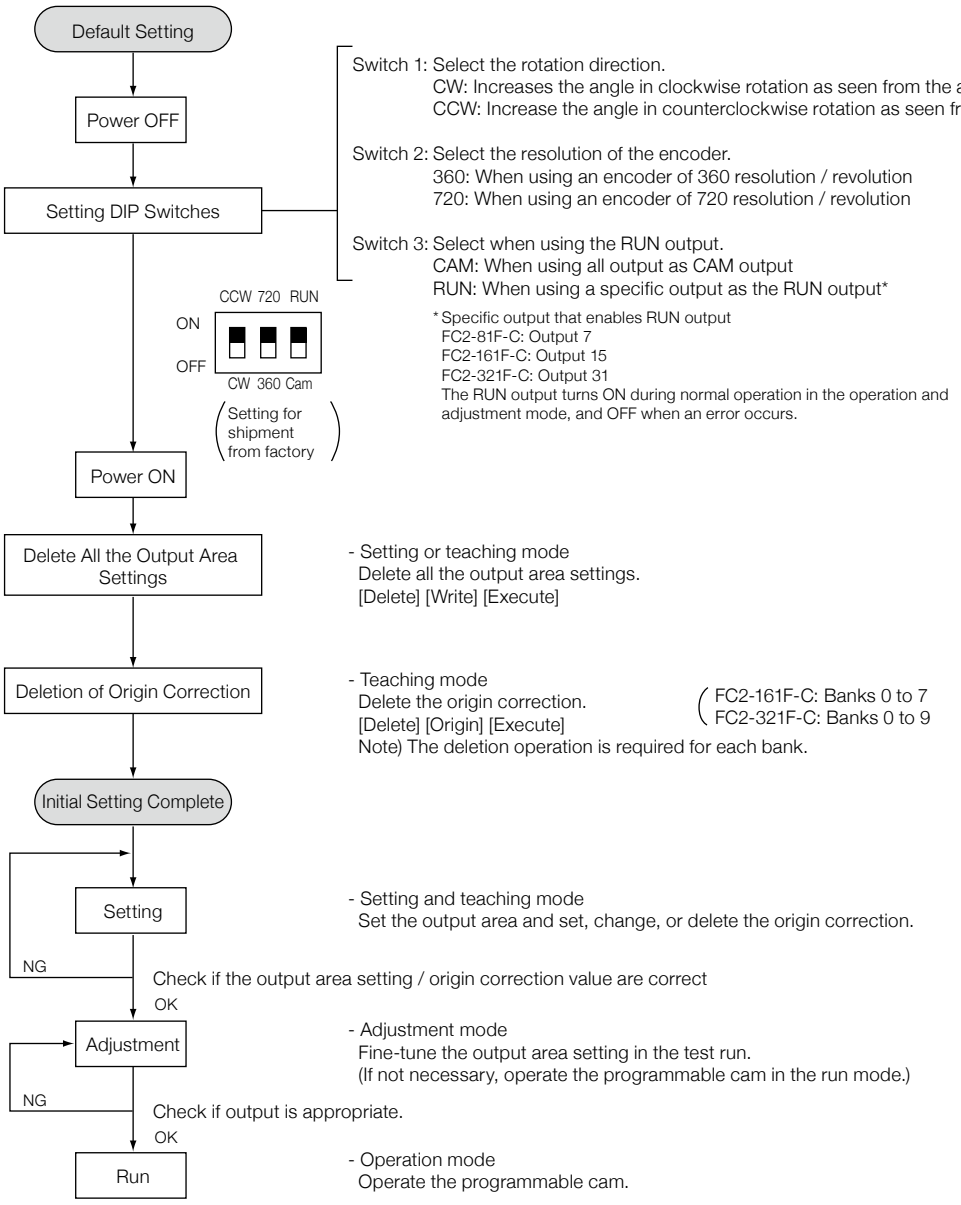
Connection Wiring



1. The external origin input should be connected to a non-contact output that has no chattering.
2. The output common (O.C) and input common (I.C) are internally short-circuited with the power source-(DC-) terminal.

FC2-81F□
Operation Setting

Default Setting



Switch 1: Select the rotation direction.
CW: Increases the angle in clockwise rotation as seen from the axle side of the encoder.
CCW: Increase the angle in counterclockwise rotation as seen from the axle side of the encoder.

Switch 2: Select the resolution of the encoder.
360: When using an encoder of 360 resolution / revolution
720: When using an encoder of 720 resolution / revolution

Switch 3: Select when using the RUN output.
CAM: When using all output as CAM output
RUN: When using a specific output as the RUN output*

*Specific output that enables RUN output
FC2-81F-C: Output 7
FC2-161F-C: Output 15
FC2-321F-C: Output 31
The RUN output turns ON during normal operation in the operation and adjustment mode, and OFF when an error occurs.

- Setting or teaching mode
Delete all the output area settings.
[Delete] [Write] [Execute]

- Teaching mode
Delete the origin correction.
[Delete] [Origin] [Execute]
(FC2-161F-C: Banks 0 to 7
FC2-321F-C: Banks 0 to 9)
Note) The deletion operation is required for each bank.

- Setting and teaching mode
Set the output area and set, change, or delete the origin correction.

- Adjustment mode
Fine-tune the output area setting in the test run.
(If not necessary, operate the programmable cam in the run mode.)

- Operation mode
Operate the programmable cam.

FC2-81F□
FC2-161F□/321F□
FC2-80□
FC2-160□/320□

FC2-81F□

Operation Setting

List of Operations

	Function	Operating Procedures	Operation Mode: Setting	Teaching	Adjustment	Operation
1	Switching of Operation Mode	Select the mode with the [Mode] key. The mode is selected from the current mode sequentially. ┌► Setting ⟶ Teaching ⟶ Adjustment ⟶ Operation ┐ The mode selected with the [Execute] key is determined and becomes the operation mode.	●	●	●	●
2	Display Switching	The angle display and the rotating speed display are alternately switched with the [Display] key.	×	×	●	●
3	Designation of Bank No.	Press the [Bank] (*) key and designate the bank No.	●	●	×	×
4	Designation of Output No.	Press the [Output ⟶] key or the [⟵ Output] (*) key, and designate output. Every time the key is pressed, the lighting position of the output display changes.	●	●	●	●
5	Readout of Output Area Setting	Designate the bank No. (*) and the output No., and press the [Readout ↑] (*) or the [Readout ↓] key. The ON and OFF angle are alternately read out.	●	●	●	●
6	Deletion of One Output Area Setting	After reading out the output area setting you want to delete, press the [Delete] [Execute] keys to delete the read-out output area setting.	●	●	×	×
7	Deletion of All Output Area Settings of Designated Output	Designate the bank No. (*) and the output No., and press the [Delete] [Output ⟶] (or [⟵ Output] (*)) [Execute] keys to delete the settings.	●	●	×	×
8	Deletion of All Output Area Settings in Designated Bank	Designate the bank No. (*) and press the [Delete][Bank][Execute] keys to delete the settings. However, the origin correction setting is not deleted. Note 1	●	●	×	×
9	Deletion of All Output Area Settings	Press the [Delete][Write][Execute] keys to delete the settings. However, the origin correction setting is not deleted.	●	●	×	×
10	Writing of Output Area Setting	Designate the bank No. (*) and the output No. Display the angle you want to set with the [+] key or the [-] key, and write it with the [Write] key. (The angles are set in the order of ON angle and OFF angle.)	●	×	×	×
11	Writing of Output Area Setting (Teaching)	Designate the bank No. (*) and the output No. Rotate and then stop the encoder at the position you want to set, and write the output area setting with the [Write] key. (The angles are set in the order of ON angle and OFF angle.)	×	●	×	×
12	Setting of Origin Correction	Set the bank No. (*),rotate the encoder and then stop it at the mechanical origin, and press the [Origin] key to select the angle of origin. With the operation of the [Write] key, the origin is written and the position becomes 0°.	×	●	×	×
13	Deletion of Origin Correction	Set the bank No. (*) and press the [Delete][Origin][Execute] keys to delete the origin correction. The output angle of the encoder is displayed as it is.	×	●	×	×
14	Change of Output Area Setting	Read out the ON angle or OFF angle set value you want to change. Press the [+] key or the [-] key, and display the set value you want to change. Then, press the [Write] key and write the changed value.	●	×	×	×
15	Fine-Tuning of Output Area Setting During Operation (Enabled Only when Starting Input is ON)	Read out the ON angle or OFF angle set value you want to change. The angles increase with the operation of the [+] key. The angle decreases with the operation of the [-] key. Simultaneously with the completion of changes (fine-tuning), the output operation changes.	×	×	●	×

(* mark): FC2-81F-C-1 does not have the [Bank], [⟵ Output], and [Readout ↑] keys.
Regarding the operation for setting special features, see the operation manual.
Note 1) FC2-161F-C-1/FC2-321F-C-1 are abolished.

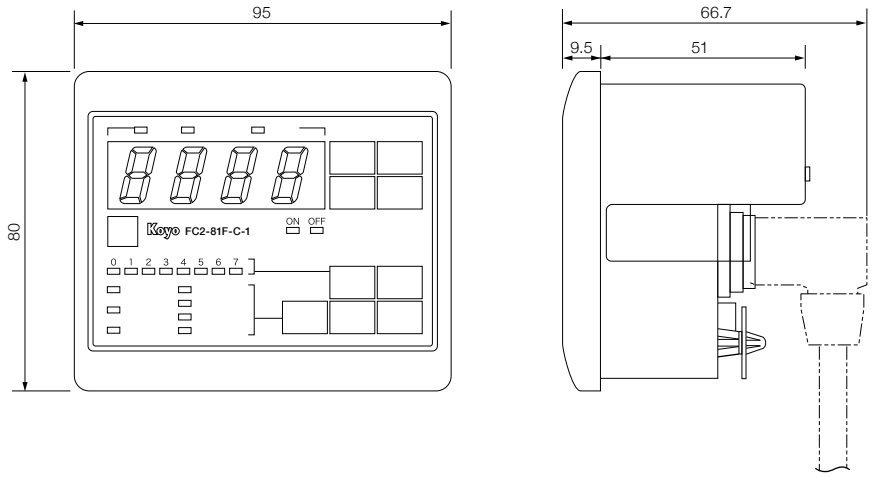
List of Error Codes

Error Code Display	Contents	Description	Cause / Corrective Action
E18	Rotary encoder connection error	The designation of the resolution of the rotary encoder does not correspond to the designation of the resolution of the programmable cam.	- Setting of the DIP switch is different. - Check the resolution of the rotary encoder. - Failure of the rotary encoder.
E19	Rotary encoder code error	The output of a rotary encoder that does not exist was detected.	- Failure of the rotary encoder (Unconnected). - Disconnection or short-circuit of the connection cable of the rotary encoder. - Effects of exogenous noise.
E20		The rotary encoder code is discontinuous.	
E21	Memory change error	The contents of set values (output, origin correction, and advancing) have been changed.	- Effects of excessive noise. - Delete all the set values and reenter all settings.
E30	Rotational speed error	The programmable cam cannot respond to the rotating speed of the rotary encoder.	- Check the rotating speed of the rotary encoder. - Check the resolution of the rotary encoder.
Set Value LED Blinking	Setting value error	The output area setting is duplicated.	- After deleting or changing the duplicated set value, reset the set value.
		The output area setting is protected.	- Check the protection input.
Bank Display A to F	Bank error	A bank that does not exist is designated in the bank input.	- Check the bank input.

FC2-81F□
Dimensions

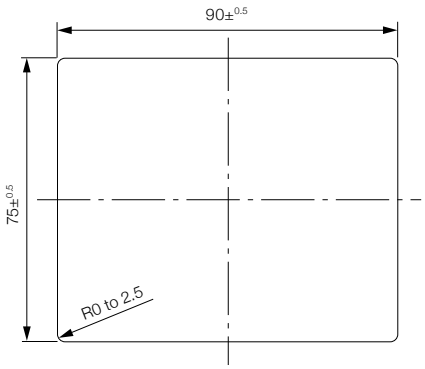
Dimensions (Unit: mm)

Body of the FC2-81F-C-1



Panel-cut Dimensions for Embedded Installation

Panel thickness 0.5 to 4 mm



FC2-161F□/321F□

Each Part Name and Function

Panel Explanation

①Status display
- Displays the Bank / FUN

②Bank / FUN display

③Angle / Rotating speed display
- Displays the angle / rotating speed.

④Bank / FUN key

⑤Output display
- Displays the ON/OFF state of output.
- Lights the output No. designated by the [Output] key.

⑥Start input display

⑦External origin input display

⑧Normal display

⑨Sets the status display.

⑩Operation key

⑪Origin key
- Corrects the origin.

⑫Mode display

⑬Connector for output

⑭Connector for encoder

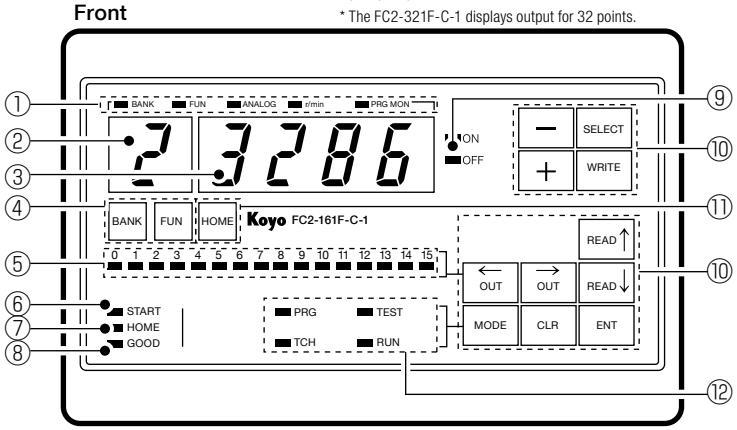
⑮Mode display

⑯Connector for communication
- Connection cable: Z-20JP2 (Sold separately) (RS-232C modular 6 pins)

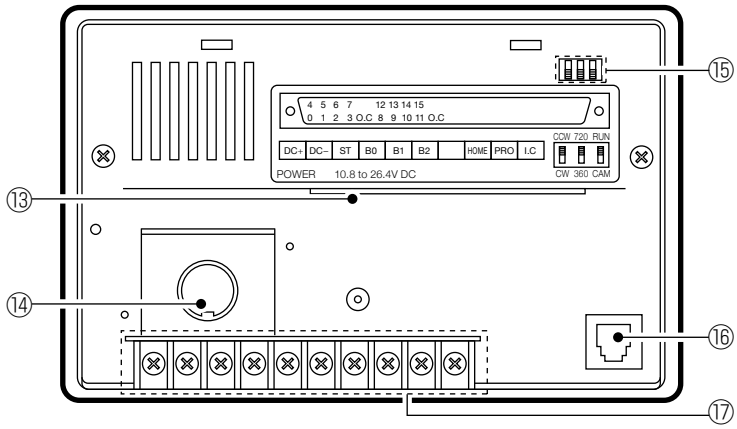
⑰Terminal block
- Provided with the cover

Front

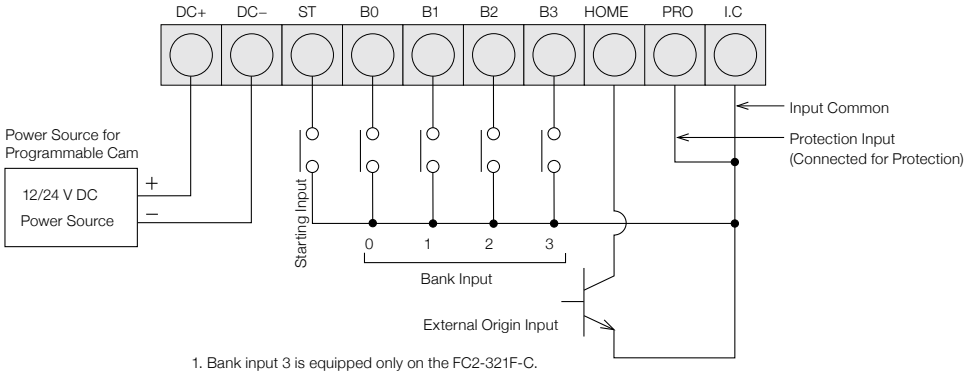
FC2-161F-C-1
* The FC2-321F-C-1 displays output for 32 points.



Back

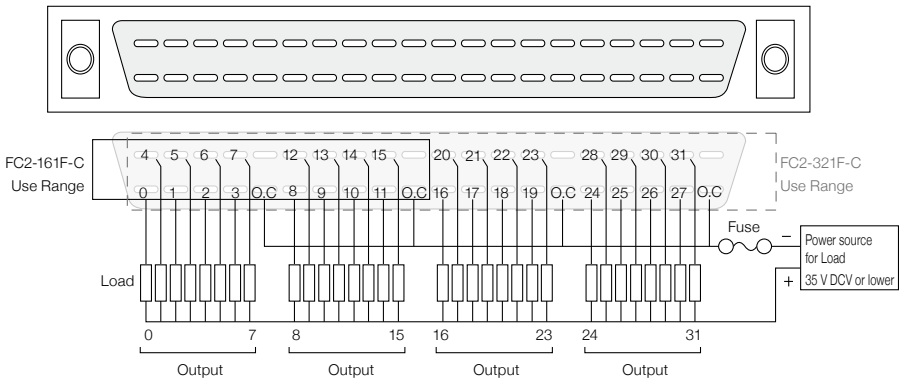


Connection Wiring



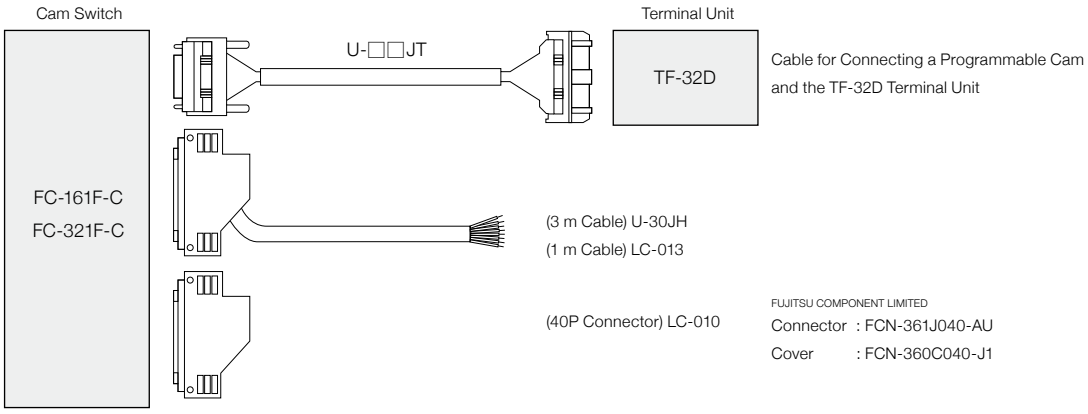
1. Bank input 3 is equipped only on the FC2-321F-C.
2. The external origin input should be connected to a non-contact output that has no chattering.
3. The output common (O.C) and input common (I.C) are internally short-circuited with the power source-(DC-) terminal.

Connector Arrangement



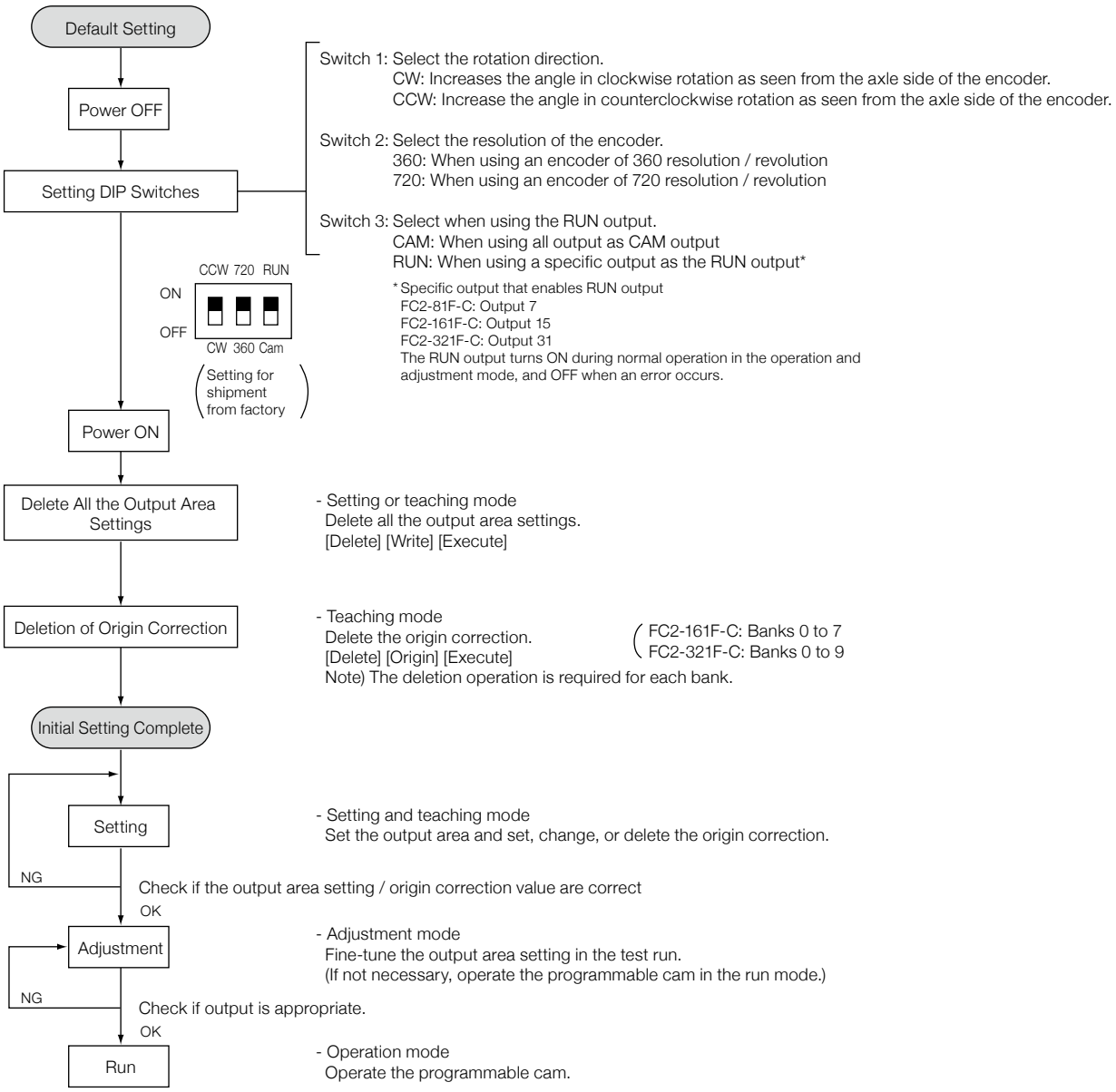
FC2-161F□/321F□
Operation Setting

Connection Connector



Terminal Unit Connection Cable (TF-32D)	U-10JT	1 m	Open price	One-end Loose Wire Cable	U-30JH	3 m	Open price
	U-30JT	3 m	Open price		LC-013	1 m	Open price
	U-50JT	5 m	Open price	40P Connector	LC-010		Open price

Default Setting



FC2-161F□/321F□

Operation Setting

List of Operations

	Function	Operating Procedures	Operation Mode: Setting	Teaching	Adjustment	Operation
1	Switching of Operation Mode	Select the mode with the [Mode] key. The mode is selected from the current mode sequentially. ┌► Setting → Teaching → Adjustment → Operation ┐ The mode selected with the [Execute] key is determined and becomes the operation mode.	●	●	●	●
2	Display Switching	The angle display and the rotating speed display are alternately switched with the [Display] key.	×	×	●	●
3	Designation of Bank No.	Press the [Bank] (*) key and designate the bank No.	●	●	×	×
4	Designation of Output No.	Press the [Output →] key or the [← Output] (*) key, and designate output. Every time the key is pressed, the lighting position of the output display changes.	●	●	●	●
5	Readout of Output Area Setting	Designate the bank No. (*) and the output No., and press the [Readout ↑] (*) or the [Readout ↓] key. The ON and OFF angle are alternately read out.	●	●	●	●
6	Deletion of One Output Area Setting	After reading out the output area setting you want to delete, press the [Delete] [Execute] keys to delete the read-out output area setting.	●	●	×	×
7	Deletion of All Output Area Settings of Designated Output	Designate the bank No. (*) and the output No., and press the [Delete] [Output →] (or [← Output] (*)) [Execute] keys to delete the settings.	●	●	×	×
8	Deletion of All Output Area Settings in Designated Bank	Designate the bank No. (*) and press the [Delete][Bank][Execute] keys to delete the settings. However, the origin correction setting is not deleted. Note 1	●	●	×	×
9	Deletion of All Output Area Settings	Press the [Delete][Write][Execute] keys to delete the settings. However, the origin correction setting is not deleted.	●	●	×	×
10	Writing of Output Area Setting	Designate the bank No. (*) and the output No. Display the angle you want to set with the [+] key or the [-] key, and write it with the [Write] key. (The angles are set in the order of ON angle and OFF angle.)	●	×	×	×
11	Writing of Output Area Setting (Teaching)	Designate the bank No. (*) and the output No. Rotate and then stop the encoder at the position you want to set, and write the output area setting with the [Write] key. (The angles are set in the order of ON angle and OFF angle.)	×	●	×	×
12	Setting of Origin Correction	Set the bank No. (*),rotate the encoder and then stop it at the mechanical origin, and press the [Origin] key to select the angle of origin. With the operation of the [Write] key, the origin is written and the position becomes 0°.	×	●	×	×
13	Deletion of Origin Correction	Set the bank No. (*) and press the [Delete][Origin][Execute] keys to delete the origin correction. The output angle of the encoder is displayed as it is.	×	●	×	×
14	Change of Output Area Setting	Read out the ON angle or OFF angle set value you want to change. Press the [+] key or the [-] key, and display the set value you want to change. Then, press the [Write] key and write the changed value.	●	×	×	×
15	Fine-Tuning of Output Area Setting During Operation (Enabled Only when Starting Input is ON)	Read out the ON angle or OFF angle set value you want to change. The angles increase with the operation of the [+] key. The angle decreases with the operation of the [-] key. Simultaneously with the completion of changes (fine-tuning), the output operation changes.	×	×	●	×

(* mark): FC2-81F-C-1 does not have the [Bank], [← Output], and [Readout ↑] keys.
Regarding the operation for setting special features, see the operation manual.
Note 1) FC2-161F-C-1/FC2-321F-C-1 are abolished.

List of Error Codes

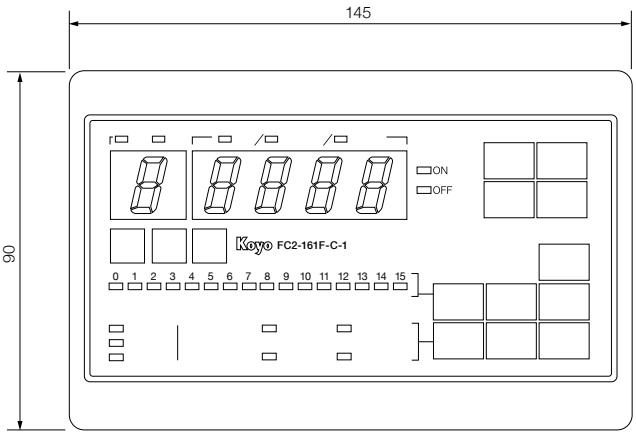
Error Code Display	Contents	Description	Cause / Corrective Action
E18	Rotary encoder connection error	The designation of the resolution of the rotary encoder does not correspond to the designation of the resolution of the programmable cam.	- Setting of the DIP switch is different. - Check the resolution of the rotary encoder. - Failure of the rotary encoder.
E19	Rotary encoder code error	The output of a rotary encoder that does not exist was detected.	- Failure of the rotary encoder (Unconnected). - Disconnection or short-circuit of the connection cable of the rotary encoder. - Effects of exogenous noise.
E20		The rotary encoder code is discontinuous.	
E21	Memory change Error	The contents of set values (output, origin correction, and advancing) have been changed.	- Effects of excessive noise. - Delete all the set values and reenter all settings.
E30	Rotational speed error	The programmable cam cannot respond to the rotating speed of the rotary encoder.	- Check the rotating speed of the rotary encoder. - Check the resolution of the rotary encoder.
Set Value LED Blinking	Setting value error	The output area setting is duplicated.	- After deleting or changing the duplicated set value, reset the set value.
		The output area setting is protected.	- Check the protection input.
Bank Display A to F	Bank error	A bank that does not exist is designated in the bank input.	- Check the bank input.

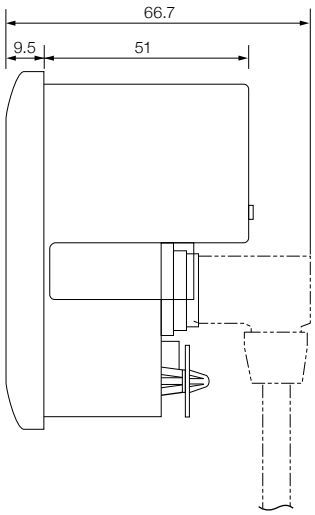
FC2-161F□/321F□

Dimensions

Dimensions (Unit: mm)

Body of the FC2-161F-C-1/321F-C-1

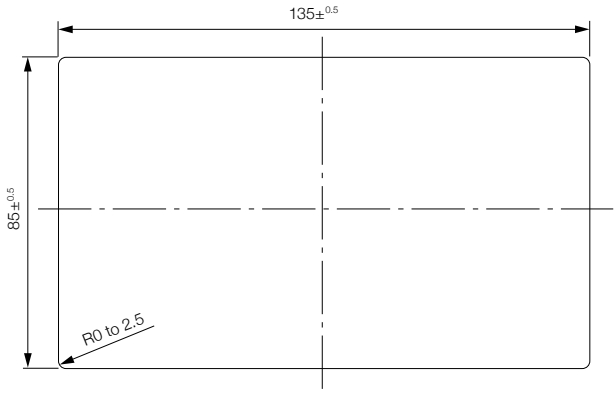




FC2-161F-C-1
* The FC2-321F-C-1 displays output for 32 points.

Panel-cut Dimensions for Embedded Installation

Panel thickness 0.5 to 4 mm



Manual

Name of Reference	Contents
FC Series Operation Manual	How to operate the FC2-81F-C-1, FC2-161F-C-1/321F-C-1

The manuals above can be downloaded from our website at http://www.koyoele.co.jp.

FC2-80□, FC2-160□/320□

Features

Surface-Mount Installation Type Cam Controller

- An electronic programmable cam that features usability and high performance in a compact body
- The surface-mount installation type has three models according to the control scale.

Features

- Easy operation

The programmable cams can be easily operated with the feeling of a digital switch.

- Settings cannot be changed during operation.

Using the adjustment mode, the ON/OFF position can be fine-tuned without stopping the machine.

- Easy tooling change

Since the FC2-160-1 can register 8 programs and the FC2-320-1 can register 10 programs, any program can be selected by switching the bank input at the time of tooling change.

- Automatic correction of advancing angle (FC2-320-1)

To correct the response delay of a machine (actuator), the programmable cam has 8 built-in output points that can automatically correct the ON/OFF timing of the CAM output according to the change in the number of revolutions.

- Equipped with multipurpose communication ports (FC2-160-1, FC2-320-1)

If the ports are used in communications with a PLC, the PLC can issue the operation commands to and change the set values of the programmable cams, and the programmable cams can read the angle and output state from the PLC. Programs can be copied between FC and FC.

- Fully equipped with an enhanced absolute type of rotary encoder as a sensor

The lineup consists of the compact (outside diameter ϕ50mm / depth 35mm) TRD-NA series, robust TRD-K series, and environmental-resistant TRD-KL series, which can be selected according to applications.

- High position accuracy detection / control

Since an optical absolute encoder is used for the sensor, the programmable cam can achieve much better linearity compared with resolvers. Moreover, it causes no errors even when the sensor is replaced.

- High speed response

1600 rpm (800 rpm when the resolution is 720)

- Protection function that prevents malfunctions

If the protection input is short-circuited after adjustments are made or before the shipment of a machine, this feature prevents end users from accidentally operating equipment, thus eliminating trouble.

- Rotation state can be grasped at a glance.

The programmable cams are equipped with a roulette display that enables users to grasp the rotation direction and rotation position at a glance.

- Equipped with an origin correction function.

It is not necessary to align the angle to mount an encoder.

- DIN rail installation

The installation on DIN rails and screws are both supported.

- Battery-less

No battery is required owing to an onboard EEPROM.

FC2-80□, FC2-160□/320□
Specifications

General Specifications

Items	FC2-80-C-1	FC2-160-1	FC2-320-1
Supply Voltage	10.8 to 26.4 V DC	85 to 264 V AC	
Power Consumption	5 W	20 VA	
Ambient Operating Temperature	−10 to +50˚C		
Storage Temperature	−20 to +70˚C (No freezing)		
Use / Storage Ambient Humidity	35 to 85% RH (No condensation)		
Dielectric Voltage	Not specified because the part between the DC power supply and input-output terminal is not insulated.	2 kV 1 min (Between AC line input / input/output and chassis)	
Insulation Resistance		20 MΩ (Between AC line input / input/output and chassis)	
Vibration Resistance	Endurance: Displacement amplitude: 0.5 mm, frequency: 10 to 55 Hz, 3 axial directions Malfunction: Displacement amplitude: 0.35 mm, frequency: 10 to 55 Hz, 3 axial directions		
Impact Resistance	Endurance: 490 m/s^2, 3 axial directions Malfunction: 98 m/s^2, 3 axial directions		
Noise Resistance	Between power supply terminals: 1.0 kV (Pulse width 1 μs / Start-up 1 ns/Square wave pulse)	Between power supply terminals: 1.5 kV	
Size (mm)	105 W x 1000 H x 66 D	140 W x 100 H x 66 D	195 W x 100 H x 66 D
Weight (g)	300	450	550
Accessories	No		
Price	Open	Open	Open

Function/Performance Specifications

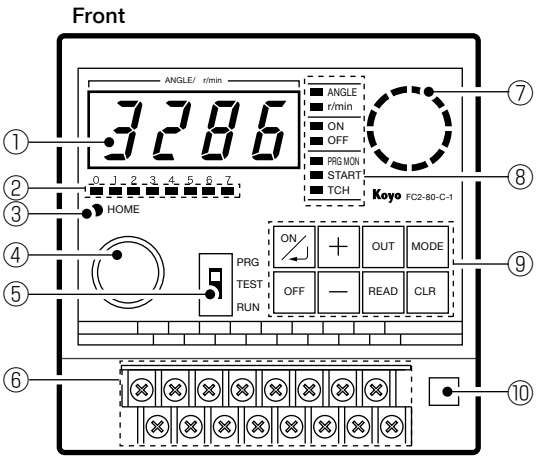
Items	FC2-80-C-1	FC2-160-1	FC2-320-1
Number of Input Points	Starting input: 1 point/ Protection input: 1 point	Starting input: 1 point/ Bank input: 3 points/ Protection input: 1 point	Starting input: 1 point/ Bank input: 4 points/ Protection input: 1 point
Resolution	360/720 per rotation (Switched from a DIP switch)		
Encoder Input	H: 7.5 V (OFF)/L: 0 to 2 V (ON) (Open collector withstanding pressure: 14 V or more)		
Control Input	H: 7.5 to 30 V (OFF)/L: 0 to 2 V (ON)		
Number of Outputs	8 points	16 points	32 points (Advancing angle can be set in 8 points.)
Output Specifications	NPN open collector Withstanding voltage 35 V or lower / Current 0.1 A or lower / Residual voltage: 1.5 V or lower		
Number of Output Area Settings	16 settings for a total of 8 outputs (There is no restriction on the number of settings per output as long as the total number of settings is within 16.)	32 settings for a total of 16 outputs (32 times per bank)	64 settings for a total of 32 outputs (64 times per bank)
Response Rotating Speed r/min (rpm)	Resolution 360: 300/ Resolution 720: 150	Resolution 360: 1600/ Resolution 720: 800	Resolution 360: 1600/ Resolution 720: 800 (No advancing setting)
Output Response Time	550 μs or less	250 μs or less	250 μs or less (No advancing setting)
Power Supply Start Time	2 s or less		
Number of banks	1	8 (Banks 0 to 7)	10 (Banks 0 to 9)
Display Switching	Angle / Rotating speed (Switched from a DIP switch)		
CW/CCW Direction Switching	Switched from a DIP switch		
RUN Output	—	ON at normal time (Switched from a DIP switch): Operation adjustment mode*	
Origin Correction	Arbitrary point becomes the origin.		
Program Memory	EEPROM		
Program Storage	—		
Advancing Function	—		Available (Only output 0 to 7)
Pulse Output Setting	—	The number of pulses that can be set for the resolution can be arbitrarily selected. (One pulse output setting is equivalent to one output area setting.)	

* The output of the final No. is set to either CAM output or RUN output from the DIP switch.
* Memory card for the FC2-320-1 The M-01F has been discontinued.

FC2-80□

Each Part Name and Function

Panel Explanation



①Angle / Rotating speed display
- Displays the angle / rotating speed.

②Output display
- Displays the ON/OFF state of output.
- Lights the output No. designated by the [Output] key.

③Origin key
- Corrects the origin.

④Connector for encoder

⑤Operation mode changing switch
- Selects the setting / adjustment / operation modes.

⑥Terminal block

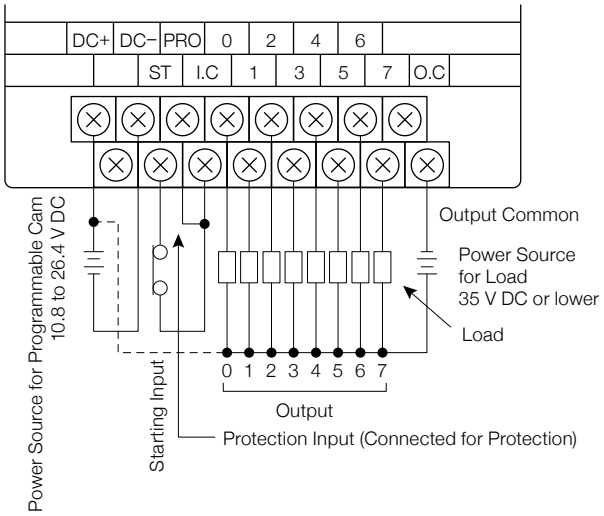
⑦Rotation position display
- Displays the angle in units of 30˚.

⑧Action indication
- Angle / rotating speed / ON/OFF / set value / starting / teaching

⑨Operation key

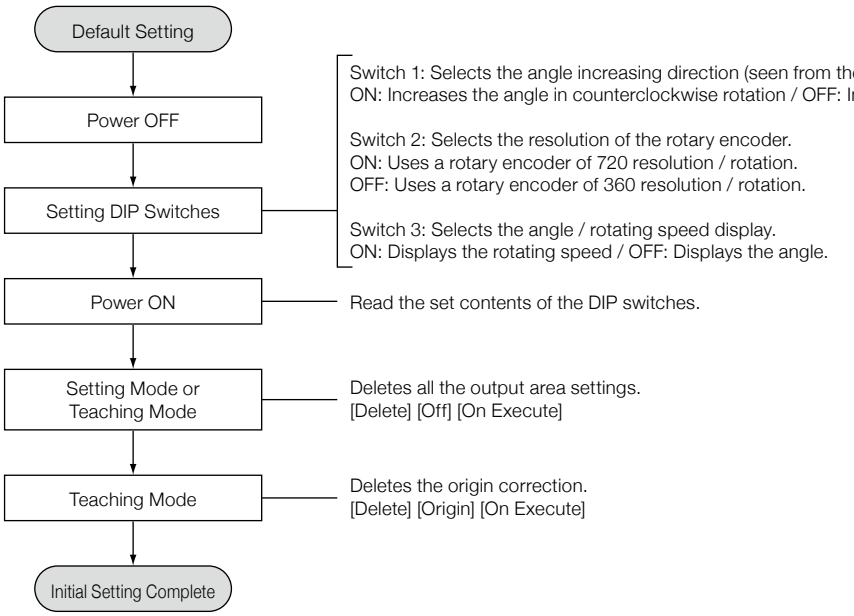
⑩DIP switches
- SW1: Selects the angle increasing direction.
- SW2: Selects the encoder resolution.
- SW3: Selects the angle / rotating speed display.

Connection Wiring



FC2-80□
Operation Setting

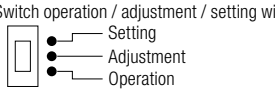
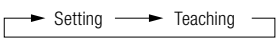
Default Setting



FC2-80□

Operation Setting

List of Operations

	Function	Operating Procedures	Operation Mode: Setting	Teaching	Adjustment	Operation
1	Switching of Operation Mode	Switch operation / adjustment / setting with the mode changing switch  	●	●	●	●
2	Switching of Setting Mode	The setting mode switches sequentially with the [Mode] key.  	●	●	×	×
3	Designation of Output No.	Press the [Output] key and designate the output No. (Every time the key is pressed, the lighting position of the output display changes.)	●	●	●	●
4	Readout of Output Area Setting	Designate the output No. and press the [Readout] key. The ON and OFF angle are alternately read out.	●	●	●	●
5	Deletion of One Output Area Setting	After reading out the ON angle and the OFF angle in the output area setting you want to delete, press the [Delete] [On Execute] keys to delete the setting. If the ON (OFF) angle is deleted, the corresponding ON (OFF) angle is also deleted.	●	●	×	×
6	Deletion of All Output Area Settings of Designated Output	Designate the output No. and press the [Delete] [Output] [On Execute] keys to delete the settings.	●	●	×	×
7	Deletion of All Output Area Settings	Press the [Delete] [Output] [On Execute] keys to delete the settings. However, the origin correction setting is not deleted.	●	●	×	×
8	Writing of Output Area Setting	Designate the output No. Display the angle you want to set with the [+] key or the [-] key, and write the ON angle with the [On Execute] key and the OFF angle with the [Off] key. (Write the output area setting in the order of ON angle and OFF angle.) 《When turning output ON for all angles》 Display the angle of 0° (0.0°), and press the [On Execute][Off] keys to write the output area setting of all angles as ON.	●	×	×	×
9	Writing of Output Area Setting (Teaching)	Designate the output No. Rotate and then stop the rotary encoder at the position you want to set, and write the ON angle with the [On Execute] key and the OFF angle with the [Off] key. (Write the output area setting in the order of ON angle and OFF angle.)	×	●	×	×
10	Setting of Origin Correction	Rotate and then stop the rotary encoder at the mechanical origin, and press the [Origin] key. The position becomes 0°.	×	●	×	×
11	Deletion of Origin Correction	Press the [Delete][Origin][On Execute] keys to delete the origin correction. The output angle of the rotary encoder is displayed as is.	×	●	×	×
12	Change of Output Area Setting	Read out the ON angle or OFF angle set value you want to change. Display the set value you want to change with the [+] key or the [-] key. Write the changed value of ON angle with the [On Execute] key and the changed value of OFF angle with the [Off] key. (The ON/OFF display blinks once.)	●	×	×	×
13	Fine-Tuning of Output Area Setting During Operation	Increase the angle with the [+] key and decrease the angle with the [-] key. Simultaneously with the completion of changes (fine-tuning), the output operation changes. (The ON/OFF display continues to blink until the changes are complete.)	×	×	●	×

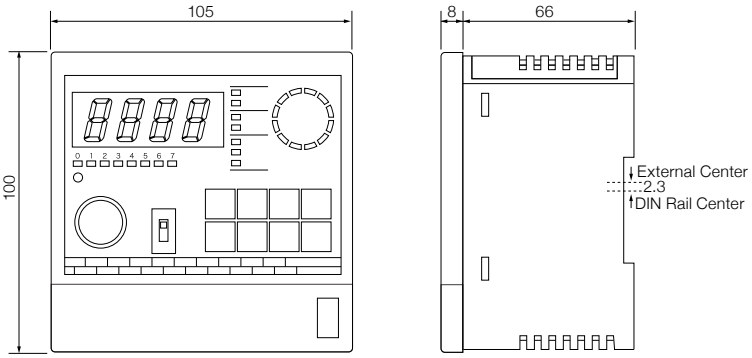
List of Error Codes

Error Code Display	Contents	Description	Cause / Corrective Action
E18	Rotary encoder connection error	The designation of the resolution of the rotary encoder does not correspond to the designation of the resolution of the programmable cam.	- Setting of the DIP switch is different. - Check the resolution of the rotary encoder. - Failure of the rotary encoder.
E19	Rotary encoder code error/ Cord discontinuous error	The output of a rotary encoder that does not exist was detected. The cam-operated switch cannot respond to the rotating speed of the rotary encoder. The rotary encoder code is discontinuous.	- Setting of the DIP switch is different. - Failure of the rotary encoder (Unconnected). - Disconnection or short-circuit of the connection cable of the rotary encoder. - Effects of exogenous noise. - Check the rotating speed of the rotary encoder.
E21	Memory change error	The contents of set values (output, origin correction, and advancing) have been changed.	- Effects of excessive noise. /-Delete all the set values and reenter all settings.
Set Value LED Blinking	Setting value error	The output area setting is duplicated.	- After deleting or changing the duplicated set value, reset the set value.

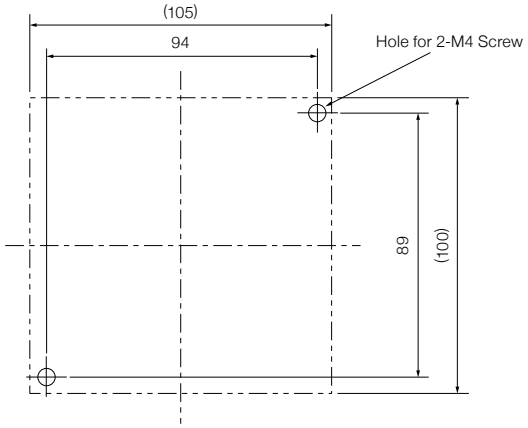
FC2-80□
Dimensions

Dimensions (Unit: mm)

Body of the FC2-80-C-1



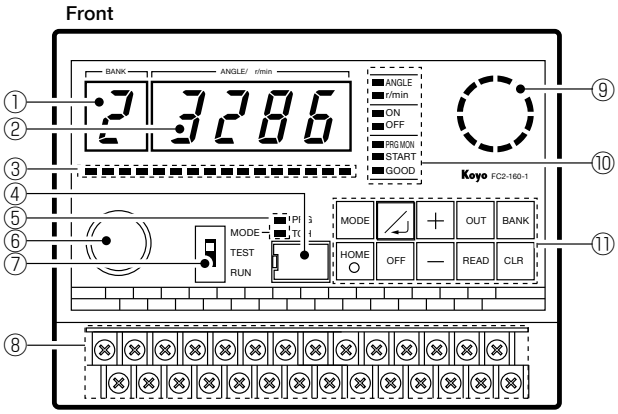
Panel-cut Dimensions for Embedded Installation

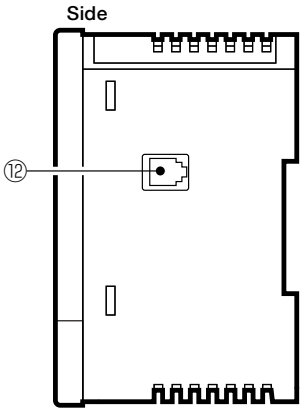


FC2-160□

Each Part Name and Function

Panel Explanation





①Bank display
- Displays the bank No. designated in the bank input.
- Displays the bank No. designated with the [Bank] key.

②Angle / Rotating speed display
- Displays the angle / rotating speed.

③Output display
- Displays the ON/OFF state of output.
- Lights the output No. designated by the [Output] key.

④DIP switches
- SW1: Selects the angle increasing direction.
- SW2: Selects the encoder resolution.
- SW3: Selects the angle / rotating speed display.
- SW4: Selects the RUN output and the CAM output.

⑤Mode display
- Displays the setting / teaching mode.

⑥Connector for encoder

⑦Operation mode changing switch
- Selects the setting / adjustment / operation modes.

⑧Terminal block

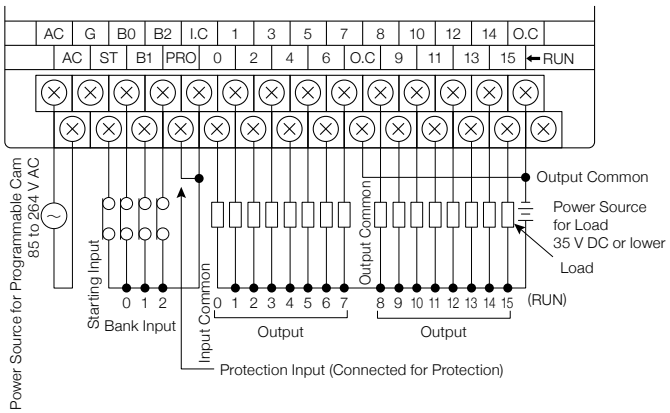
⑨Rotation position display
- Displays the angle in units of 30˚.

⑩Action indication
- Angle / rotating speed / ON/OFF / set value / starting / normal

⑪Operation key

⑫Connector for communication
- RS-232C communication port

Connection Wiring



FC2-320□

Each Part Name and Function

Panel Explanation

① Bank display

- Displays the bank No. designated in the bank input.
- Displays the bank No. designated with the [Bank] key.
- Displays the saving, reproduction, and checking operation selected with the [+] key.

② Angle / Rotating speed display

- Displays the angle / rotating speed.
- Displays the advancing angle or the advancing rotating speed.
- Displays the saving, playback, and checking operation.

③ Output display

- Displays the ON/OFF state of output.
- Lights the output No. designated by the [Output] key.

④ DIP switches

- SW1: Selects the angle increasing direction.
- SW2: Selects the encoder resolution.
- SW3: Selects the angle / rotating speed display.
- SW4: Selects the RUN output and the CAM output.

⑤ Mode display

- Displays the setting / teaching / advancing / saving.

⑥ Connector for encoder

⑦ Operation mode changing switch

- Selects the setting / adjustment / operation modes.

⑧ Terminal block

⑨ Rotation position display

- Displays the angle in units of 30°./ Displays the execution state of the saving, playback, and checking operations.

⑩ Action indication

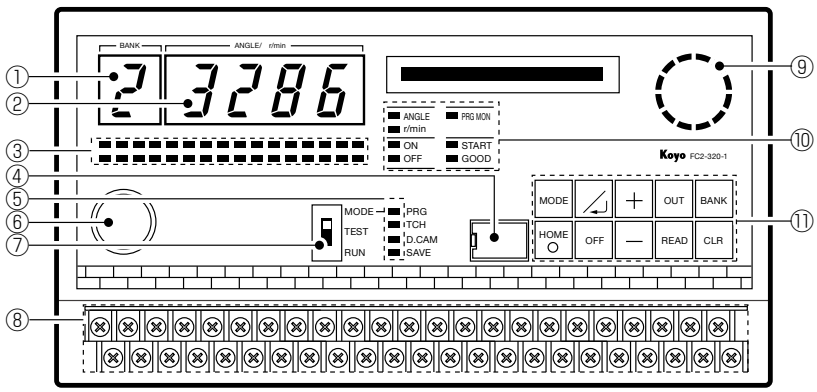
- Angle / rotating speed / ON/OFF / set value / starting / normal

⑪ Operation key

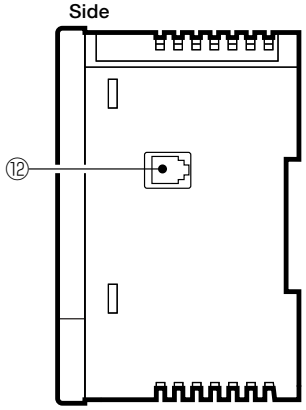
⑫ Connector for communication

- RS-232C communication port

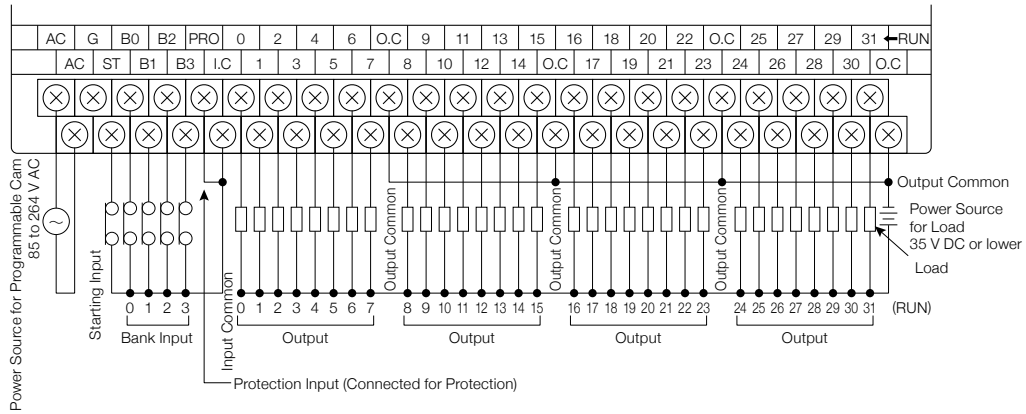
Front



Side



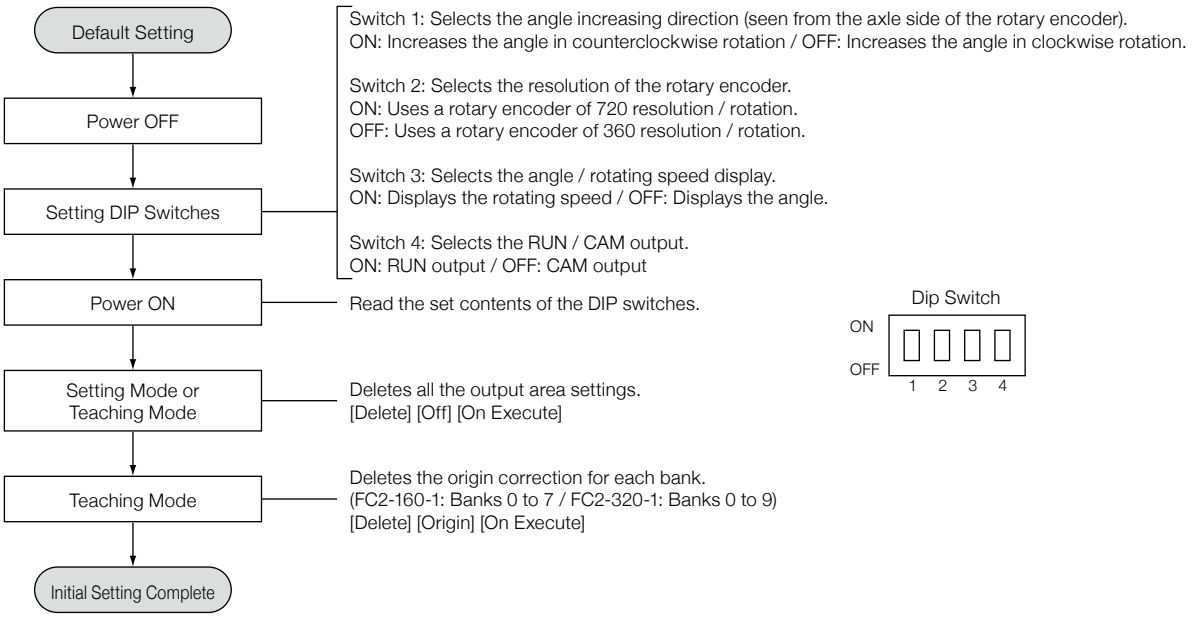
Connection Wiring



FC2-160□/320□

Operation Setting

Default Setting



List of Operations

	Function	Operating Procedures	Model	Operation Mode: Setting	Teaching	Advancing	Saving	Adjustment	Operation
1	Switching of Operation Mode	Switch operation / adjustment / setting with the mode changing switch Setting Adjustment Operation	FC2-160-1	●	●	—	—	●	●
			FC2-320-1			●	●		
2	Switching of Setting Mode	The setting mode switches sequentially with the [Mode] key. Setting → Teaching → (Only FC2-320) Advancing → (Only FC2-320) Saving	FC2-160-1	●	●	—	—	×	×
			FC2-320-1			●	●		
3	Designation of Bank No.	Press the [Bank] key and designate the bank No.	FC2-160-1	●	●	—	—	×	×
			FC2-320-1			●	×		
4	Designation of Output No.	Press the [Output] key and designate the output No. (Every time the key is pressed, the lighting position of the output display changes.)	FC2-160-1	●	●	—	—	●	●
			FC2-320-1			●	×		
5	Readout of Output Area Setting	Designate the bank No. and the output No., and press the [Readout] key. The ON and OFF angle are alternately read out.	FC2-160-1	●	●	—	—	●	●
		《When the pulse output is already set》 The ON start angle of the pulse output and the pulse number are alternately read out.	FC2-320-1			×	×		
6	Deletion of One Output Area Setting	After reading out the ON angle and the OFF angle in the output area setting you want to delete, press the [Delete] [On Execute] keys to delete the setting.	FC2-160-1	●	●	—	—	×	×
			FC2-320-1			×	×		
7	Deletion of All Output Area Settings of Designated Output	Designate the bank No. and the output No., and press the [Delete] [Output] [On Execute] keys to delete the settings.	FC2-160-1	●	●	—	—	×	×
			FC2-320-1			×	×		
8	Deletion of All Output Area Settings in Designated Bank	Designate the bank No. and press the [Delete][Bank][On Execute] keys to delete the settings.	FC2-160-1	●	●	—	—	×	×
			FC2-320-1			×	×		
9	Deletion of all output area settings	Press the [Delete] [Output] [On Execute] keys to delete the settings. However, the origin correction setting is not deleted.	FC2-160-1	●	●	—	—	×	×
			FC2-320-1			×	×		
10	Writing of Output Area Setting	Designate the bank No. and the output No. Designate the output No. Display the angle you want to set with the [+] key or the [-] key, and write the ON angle with the [On Execute] key and the OFF angle with the [Off] key. (Write the output area setting in the order of ON angle and OFF angle.)	FC2-160-1	●	×	—	—	×	×
		《When setting the pulse output》 Designate the bank No. and the output No. Display the ON start angle of pulse with the [+] key or the [-] key, and press the [On Execute][Off] keys. Next, select the pulse number with the [+] key or [-] key, and write the output area setting with the [On Execute] key.	FC2-320-1			×	×		

FC2-160□/320□
Operation Setting

Function		Operating Procedures	Model	Operation Mode: Setting	Teaching	Advancing	Saving	Adjustment	Operation
11	Writing of Output Area Setting (Teaching)	Designate the bank No. and the output No. Rotate and then stop the rotary encoder at the position you want to set, and write the ON angle with the [On Execute] key and the OFF angle with the [Off] key. (Write the output area setting in the order of ON angle and OFF angle.)	FC2-160-1	×	●	—	—	×	×
			FC2-320-1			×	×		
12	Setting of Origin Correction	Designate the bank. Rotate and stop the rotary encoder at the mechanical origin, and press the [Origin] key. The position becomes 0°.	FC2-160-1	×	●	—	—	×	×
			FC2-320-1			×	×		
13	Deletion of Origin Correction	Designate the bank. Press the [Delete][Origin][On Execute] keys to delete the origin correction. The output angle of the encoder is displayed as is.	FC2-160-1	×	●	—	—	×	×
			FC2-320-1			×	×		
14	Change of Output Area Setting	Read out the ON angle or OFF angle set value you want to change. Display the set value you want to change with the [+] key or the [-] key. Write the changed value of ON angle with the [On Execute] key and the changed value of OFF angle with the [Off] key. (The ON/OFF display blinks once.)	FC2-160-1	●	×	—	—	×	×
			FC2-320-1			×	×		
15	Fine-Tuning of Output Area Setting During Operation	Read out the ON angle or OFF angle set value you want to change. Increase the angle with the [+] key and decrease the angle with the [-] key.	FC2-160-1	×	×	—	—	●	×
			FC2-320-1			×	×		
16	Reading Out the Advancing Setting	Designate the bank No. and the output No., and press the [Readout] key. The setting of advancing angle and advancing rotating speed are alternately read out.	FC2-320-1	×	×	●	×	×	×
17	Writing the Advancing Setting	Designate the bank No. and the output No., and read out the advancing angle or the advancing rotating speed you want to set. Next, display the set values (advancing angle and advancing rotating speed) with the [+] key or the [-] key, and press the [On Execute] key to write the set values.	FC2-320-1	×	×	●	×	×	×
18	Deletion of the Advancing Setting	Designate the bank No. and the output No., and press the [Delete][On Execute] keys to delete the advancing setting. Both advancing angle and advancing rotating speed become 0. In the cases of the deletion of all designated output area settings / deletion of all output area settings of designated bank / deletion of all output area settings, the advancing setting is also deleted.	FC2-320-1	×	×	●	×	×	×
19	Copying Between FC and FC	When performing s (save) and l (load), connect the FC2-160-1/FC2-320-1 via the communication port. (Used cable: Z-20JP2)							
	Changing to the Copy Mode	Press the [Delete] [Mode] keys to display COPY in the angle / rotating speed display. Press the [On Execute] key to move to the selection of the copy operation.							
	Selection of the Copy Operation	Select the copy operation with the [+] key or the [-] key.	FC2-160-1	●	×	×	×	×	×
		Press the [On Execute] key to move to the selection of the copy bank.							
	Selection of a Copy Bank and the Execution of the Copy Operation	Display the bank subject to the copy operation with the [Bank] key, and select it with the [On Execute] key. (Display blinks after selection.)	FC2-320-1						
		If you press the [On Execute] key again, the copy operation is executed.							

Select the copy operation with the [+] key or the [-] key.

Bank Display	Angle / Rotating speed display	Operation
S	FC-E	Save (Saving): Saving to external FC2-160-1/320
L	E-FC	Load (Duplicate): Duplication from external FC2-160-1/320
c	-FC-	Copy (Transfer): Copying between internal banks (Operating the FC2-160-1/FC2-320-1)

Display the bank subject to the copy operation with the [Bank] key, and select it with the [On Execute] key. (Display blinks after selection.)

Angle / Rotating speed display	Save	Load	Copy
① — ②	① Self-bank	Other bank	Source bank
	② Other bank	Self-bank	Source bank
ALL	All banks	All banks	—

FC2-160□/320□

Operation Setting

List of Error Codes

Error Code Display	Contents	Description	Cause / Corrective Action
E18	Encoder connection error	The designation of the resolution of the rotary encoder does not correspond to the designation of the resolution of the programmable cam.	- Setting of the DIP switch is different. - Check the resolution of the rotary encoder. - Failure of the rotary encoder.
E19	Encoder code error	The output of a rotary encoder that does not exist was detected.	- Failure of the rotary encoder (Unconnected). - Disconnection or short-circuit of the connection cable of the rotary encoder. - Effects of exogenous noise.
E20	Encoder code error	The rotary encoder code is discontinuous.	
E21	Memory Change Error	The contents of set values (output, origin correction, and advancing) have been changed.	- Effects of excessive noise. - Delete all the set values and reenter all settings.
E30	Rotational speed error	The programmable cam cannot respond to the rotating speed of the rotary encoder.	
E70 E90 to 99	Communication error	Communications were not performed normally.	- Check the communication data. - Check the operation mode. - Check the protection input. - Disconnection or short-circuit of the communication cable. - Effects of exogenous noise.
E80 to 89		Communications were not performed normally in the copy operation.	
Set Value LED Blinking	Setting value error	The output area setting is duplicated.	- After deleting or changing the duplicated set value, reset the set value.
Bank Display A to F	Bank error	A bank that does not exist is designated in the bank input.	- Check the bank input.

Advancing Angle Function of FC2-230-1

* Only the FC2-320-1 has the advancing angle function.

1. Setting and operation

Set the advancing function according to the "17 Writing the advancing setting" in the list of operation.

Advancing angle····· Sets how many degrees the ON/OFF angle of the CAM output should be advanced at any rotating speed (set as the advancing rotating speed).

Advancing rotating speed ····· Sets the advancing rotating speed that is used to specify the rotating speed in the setting of advancing angle (in units of 10 rpm).

2. Advancing operation

Number of Advancing Setting Points		1	2	3	4	5	6	7	8
Output Response Time (Output 0 to 7) μs		345	365	380	400	420	435	465	470
Response Rotating Speed (rpm)	360 Resolution	1,100	1,000	900	800	700	600	500	500
	720 Resolution	550	500	450	400	350	300	250	250

《Reminders》

- Advancing is enabled only when the off width is 2° or more in the output area setting.
- The advancing operation slowly follows the change of the rotating speed.
- If rotation stops, a 0 rotating speed is output within 170 ms from the stop.
- The response rotating speed and response time differ according to the advancing setting point. (Only output 0 to 7)

Example Application [Print Machine Control]

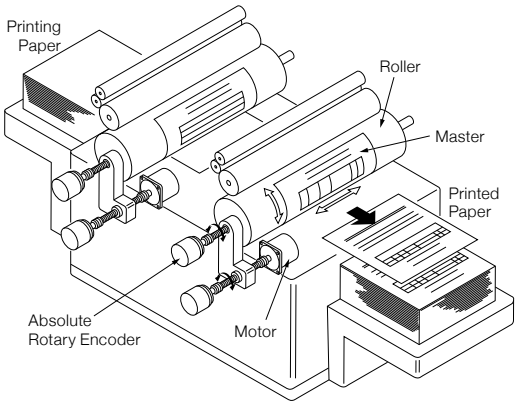
1. The FC is used for controlling the stop angle of the printing cylinder.

The stop position of the machine plate is controlled so that it is placed at the location of clamp when the machine plate is mounted to the printing cylinder.

2. The rotary encoder is used for correcting the color deviation in multicolored printing.

The printing cylinder's angle of mounting to the drive shaft and the left and right position are fine-tuned (±1.00 mm).

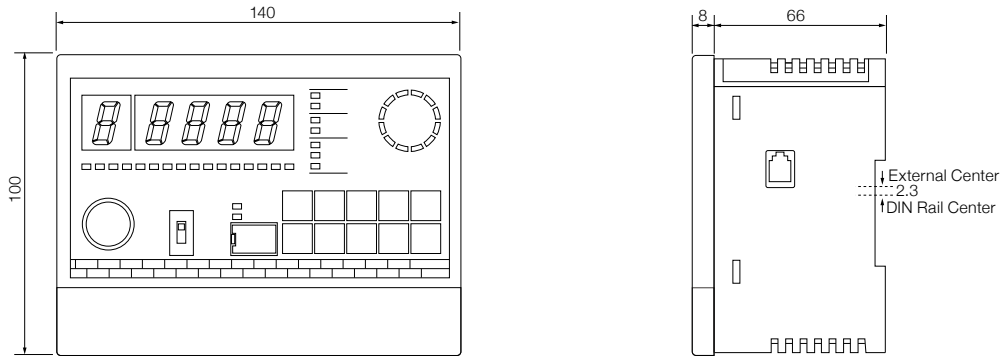
It reduces the machine adjustment man-hours.
It is also used for transport machine control, multistory parking lots, and machine tool control.



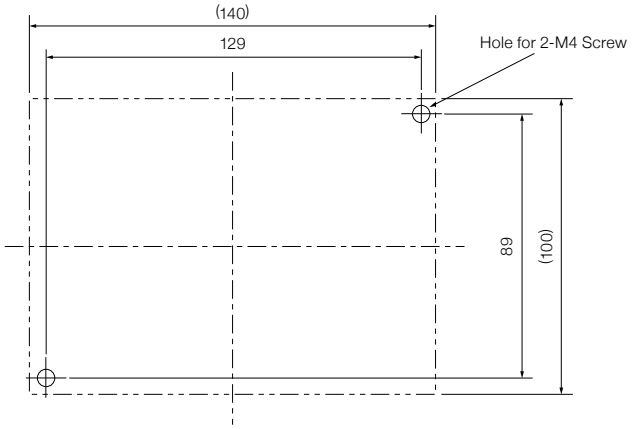
FC2-160□/320□
Dimensions

Dimensions (Unit: mm)

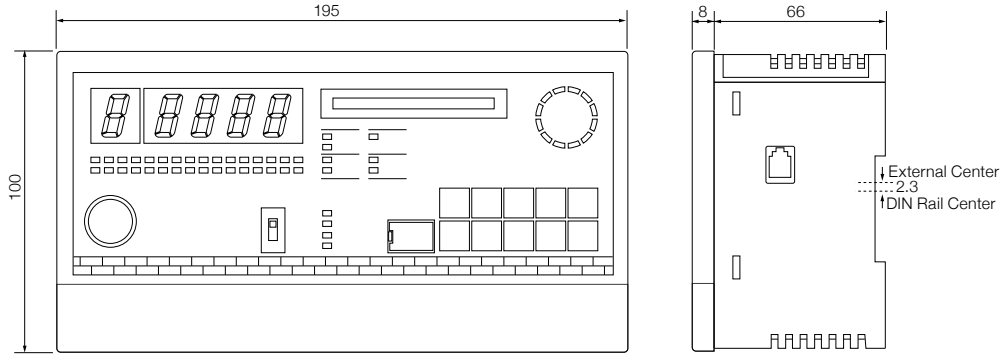
Body of the FC2-160-1



Panel-cut Dimensions for Embedded Installation of FC2-160-1



Body of the FC2-320-1



Panel-cut Dimensions for Embedded Installations of FC2-320-1