

XSEL-P/Q  
Controller Option

# Electronic Cam Function

ELECTRONIC CAM



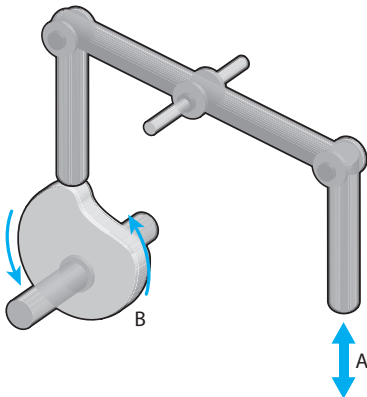
# The controller recreates the movements of mechanical cams!

A cam mechanism is used in situations where a given operation should be performed in conjunction with another operation in a production facility.

If a cam mechanism is used, however, the cam itself must be redesigned from scratch when the stroke or pattern is to be changed, which makes the adjustment process time-consuming and cumbersome. An electronic cam function solves this problem.

## Example of Cam Mechanism

To change the vertical travel (A) or operation pattern, the cam (B) must be given additional machining or redesigned.



## What Is Electronic Cam?

An electronic cam controls the slave axis in synchronization with the master axis, using pulse trains, according to a pre-defined electronic cam table.

## Features of Electronic Cam

### 1 Shorter system cycle time

Since the position relationships of operating axes can be specified in a cam table, the stopping time of each axis can be minimized and consequently the cycle time can be reduced significantly.

### 2 Easy adjustment when changing the operation pattern

Unlike with a mechanical cam, no parts must be machined when changing the operation pattern. All you need is to change the data of the electronic cam table, and you will be able to change the positions and timings.

Since the position relationships of the master axis do not change due to speed, timings can be adjusted at a sufficiently low speed, which makes adjustments very easy.

### 3 Up to 16 axes can be controlled

Eight slave axes can be operated with one pulse-train board installed in the XSEL controller. Up to two pulse-train boards can be installed, which means that up to 16 axes can be controlled.

## Example of Electronic Cam Table

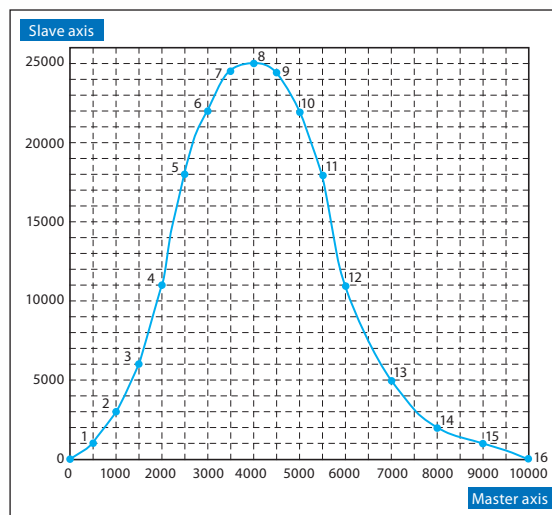
The electronic cam table is a data table used for specifying the positions of slave axes that move in conjunction with the movements of the master axis. The horizontal axis represents the phase of the master axis, while the vertical axis represents the displacement of the slave axis.

When values are entered in the electronic cam table, points appear on the graph area of the electronic cam table and a curved line linking all these points gives an operating curve of the slave axis.

•Electronic cam table data

No.	Master axis phase	Slave axis phase
0	0	0
1	500	1000
2	1000	3000
3	1500	6000
4	2000	11000
5	2500	18000
6	3000	22000
7	3500	24500
8	4000	25000
9	4500	24500
10	5000	22000
11	5500	18000
12	6000	11000
13	7000	5000
14	8000	2000
15	9000	1000
16	10000	0

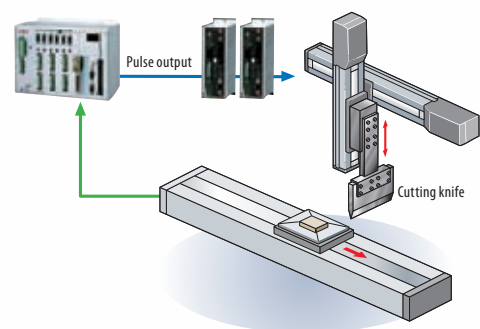
•Electronic cam table



<Note> The above table and graph are provided for illustration purposes only and may differ from the actual table and graph shown on the software screen.

## Example of Use of Electronic Cam

By designating a single-axis robot as the master axis and moving a cutting knife up and down in conjunction with the movements of this single-axis robot, the work part can be cut without stopping the work part.



## Other Useful Functions

### 1. Electronic shaft function

All slave axes move in the same manner as the master axis moves. A gear ratio can be set for master/slave-axis movements, which means that the ratio of the travels of master and slave axes can be changed accordingly.

### 2. Positioner function

Just like in any normal positioning operation, the actuator can be operated by setting position data. Movement by linear interpolation is also supported in addition to PTP operation. Up to 512 position points can be set, where the maximum number of position points changes depending on the number of connected axes.

### 3. Input pulse counter function

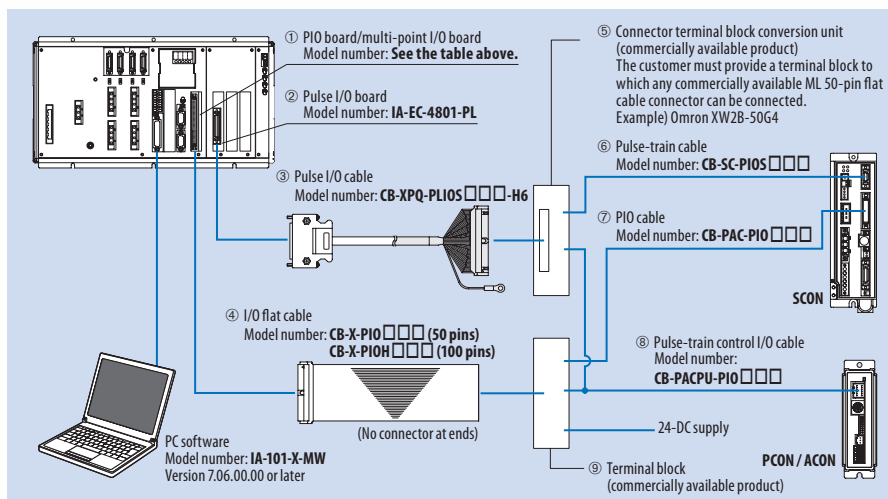
Pulses input from the pulse input channel are counted by the SEL program. It is also possible to use input pulses as the master axis of the electronic cam.

## System Configuration | Required Equipment

The following equipment will be required when an electronic cam is used.

Applicable controllers: XSEL-P/Q

Name	Master axis phase	Slave axis phase
① PIO board	N1: IA-103-X-32 N2: IA-103-X-16 N3: IA-IO-3204-NP P1: IA-103-X-32-P P2: IA-103-X-16-P P3: IA-IO-3204-PN	Specify a desired code from among "N1," "N2," "N3," "P1," "P2" and "P3" in the standard or expansion I/O field of the controller model number.
② Pulse I/O board	IA-EC-4801-PL	Enter the code "MC" in the expansion I/O field of the controller model number. If nine or more controllers are connected, two pulse I/O boards are required.
③ Pulse I/O cable	CB-XPQ-PLIOS□□□-H6	This cable comes with the pulse I/O board.
④ I/O flat cable	CB-X-PIO□□□□(for 50 pins) CB-X-PIOH□□□□(for multi-point I/Os)	This cable comes with the controller or multi-point I/O board.
⑤ Connector terminal block conversion unit	—	Purchase a terminal block to which any commercially available ML 50-pin flat cable connector can be connected. (Example: Omron XW2B-50G4)
⑥ SCON pulse-train cable	CB-SC-PIOS□□□□	Specify the model number shown to the left when ordering this cable.
⑦ SCON PIO cable	CB-PAC-PIO□□□□	This cable comes with the SCON controller.
⑧ Pulse-train control I/O cable	CB-PACPU-PIO□□□□	This cable comes with the PCON/ACON controller.
⑨ Terminal block	—	Use a commercially available terminal block.



One pulse I/O board has eight pulse output channels and two pulse input channels. Up to two pulse I/O board can be installed in one controller, meaning that up to 16 RoboCylinder controllers of pulse I/O type can be connected. If a RoboCylinder controller is connected, PIO connection is required in addition to pulse I/O connection. Use the table below to check the number of signals required by each controller and add a PIO board according to the number of controllers to be operated.

	Number of I/Os required per controller	
	Input	Output
SCON controller	5 points	3 points
PCON/ACON controller	4 points	3 points

## Model number

XSEL — [ ] — [ ] — [ ] — [ ] — [ ] — [ ]

Type      Actuator specification      (Slot 1)      (Slot 2) (Slot 3) (Slot 4)      Cable/power supply specification

Standard I/O      (Expansion I/O)

P	Single-axis/Cartesian large-capacity type	E	Not used	MC	Up to two pulse I/O boards can be installed	P1	32 inputs/16 outputs (PNP)
Q	Single-axis/Cartesian large-capacity type conforming to safety category	N1	32 inputs/16 outputs (NPN)	E	Not used	P2	16 inputs/32 outputs (PNP)
		N2	16 inputs/32 outputs (NPN)	N1	32 inputs/16 outputs (NPN)	P3	48 inputs/48 outputs (PNP)
		N3	48 inputs/48 outputs (NPN)	N2	16 inputs/32 outputs (NPN)		
		P1	32 inputs/16 outputs (PNP)	N3	48 inputs/48 outputs (NPN)		
		P2	16 inputs/32 outputs (PNP)				
		P3	48 inputs/48 outputs (PNP)				

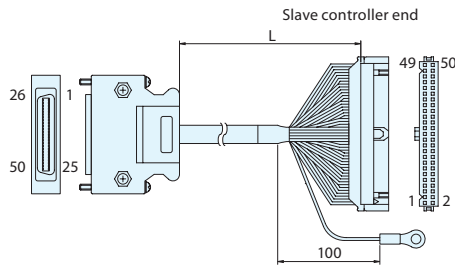
## Specifications

Item	Description	Remarks
Applicable controller	XSEL-P/Q	
PC software	Version 7.06.00.00 or later	
I/O I/F	Pulse I/Os by 2 input channels and 8 output channels (1 board)	
Number of installed boards	Up to 2 boards	Installed in expansion I/O slots.
Number of controlled axes	Up to 16 axes (when 2 pulse I/O boards are used)	
Connection pulse-train driver	SCON, ACON-PL, PCON-PL	Only differential drivers are supported.
Synchronous control function	Synchronous electronic cam (master axis specification), single electronic cam (time specification), electronic shaft	
Positioning function	Servo ON/OFF, home return, PTP movement (absolute/relative), movement by linear interpolation (absolute/relative), movement by direct numerical specification (absolute/relative)	
Input pulse counter function	Clear pulse counter, get pulse count	Max. 500 Kpps
Other functions	Jog/Incremental move (only via a tool), axis movement stop, pause, cancel, soft limit, command position teaching	

## Cable

- Pulse I/O cable

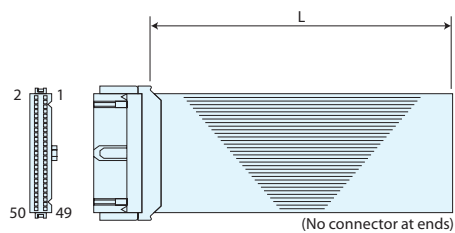
**Model number: CB-XPQ-PLIOS□□□-H6** \*□□□ indicates the cable length (L). A desired length of up to 5 m can be specified in meters. Example: 020 = 2 m



Pin No.	Wire color	Signal	Channel No.	Function	Pin No.	Wire color	Signal	Channel No.	Function
1	Blue	0A+	0	Pulse output phase A+	27	Gray/White 2	1A+	1	Pulse output phase A+
2	Orange	0A-		Pulse output phase A-	28	Red/White 2	1A-		Pulse output phase A-
3	Green	0B+		Pulse output phase B+	29	Black/White 2	1B+		Pulse output phase B+
4	Brown	0B-		Pulse output phase B-	30	Yellow/Black 2	1B-		Pulse output phase B-
5	Gray	2A+	2	Pulse output phase A+	31	Pink/Black 2	3A+	3	Pulse output phase A+
6	Red	2A-		Pulse output phase A-	32	Purple/White 2	3A-		Pulse output phase A-
7	Black	2B+		Pulse output phase B+	33	White/Blue 2	3B+		Pulse output phase B+
8	Yellow	2B-		Pulse output phase B-	34	Blue/Black 1	3B-		Pulse output phase B-
9	Pink	4A+	4	Pulse output phase A+	35	Orange/Black 1	5A+	5	Pulse output phase A+
10	Purple	4A-		Pulse output phase A-	36	Green/Black 1	5A-		Pulse output phase A-
11	White	4B+		Pulse output phase B+	37	Brown/Black 1	5B+		Pulse output phase B+
12	Blue/Red 1	4B-		Pulse output phase B-	38	Gray/Black 1	5B-		Pulse output phase B-
13	Orange/White 1	6A+	6	Pulse output phase A+	39	Red/Black 1	7A+	7	Pulse output phase A+
14	Green/White 1	6A-		Pulse output phase A-	40	Yellow/Red 1	7A-		Pulse output phase A-
15	Brown/White 1	6B+		Pulse output phase B+	41	Pink/Red 1	7B+		Pulse output phase B+
16	Gray/White 1	6B-		Pulse output phase B-	42	Purple/Black 1	7B-		Pulse output phase B-
17	Red/White 1	INA+0	0	Pulse input phase A+	43	White/Black 1	INA+1	1	Pulse input phase A+
18	Black/White 1	INA-0		Pulse input phase A-	44	Blue/Black 2	INA-1		Pulse input phase A-
19	Yellow/Black 1	INB+0		Pulse input phase B+	45	Orange/Black 2	INB+1		Pulse input phase B+
20	Pink/Black 1	INB-0		Pulse input phase B-	46	Green/Black 2	INB-1		Pulse input phase B-
21	Purple/White 1	INZ+0		47	Brown/Black 2	INZ+1			Do not connect anything to this signal.
22	White/Blue 1	INZ-0		48	Gray/Black 2	INZ-1			Do not connect anything to this signal.
23	Blue/Red 2	ESV_0		49	Red/Black 2	ESV_1			Encoder power output (5 VDC): 100 mA max.
24	Orange/White 2	EOV_0		50	Yellow/Red 2	EOV_1			Encoder power output (5 VDC): 100 mA max.
25	Green/White 2	RSV_COM1	-						Do not connect anything to this signal.
26	Brown/White 2	RSV_COM2	-						Do not connect anything to this signal.

- I/O flat cable (50-pin specification for PIO board)

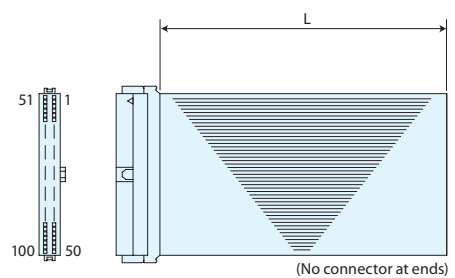
**Model number: CB-X-PIO□□□** \*□□□ indicates the cable length (L). A desired length of up to 10 m can be specified in meters. Example: 020 = 2 m



Pin No.	Wire color	Standard I/O		Expansion I/O		Pin No.	Wire color	Standard I/O		Expansion I/O	
		When I/O code N1/P1 is selected	When I/O code N2/P2 is selected	When I/O code N1/P1 is selected	When I/O code N2/P2 is selected			When I/O code N1/P1 is selected	When I/O code N2/P2 is selected		
1	Brown 1	24 V, externally supplied	24 V, externally supplied	24 V, externally supplied	24 V, externally supplied	26	Blue 3	General-purpose input	General-purpose output	General-purpose output	General-purpose output
2	Red 1	General-purpose input	General-purpose input	General-purpose input	General-purpose input	27	Purple 3				
3	Orange 1					28	Gray 3				
4	Yellow 1					29	White 3				
5	Green 1					30	Black 3				
6	Blue 1	General-purpose output	General-purpose output	General-purpose output	General-purpose output	31	Brown 4				
7	Purple 1					32	Red 4				
8	Gray 1					33	Orange 4				
9	White 1					34	Yellow 4				
10	Black 1	Program specification (PRG No. 1)	General-purpose output	General-purpose output	General-purpose output	35	Green 4				
11	Brown 2	Program specification (PRG No. 2)				36	Blue 4				
12	Red 2	Program specification (PRG No. 4)				37	Purple 4				
13	Orange 2	Program specification (PRG No. 8)				38	Gray 4				
14	Yellow 2	Program specification (PRG No. 10)	General-purpose output	General-purpose output	General-purpose output	39	White 4				
15	Green 2	Program specification (PRG No. 20)				40	Black 4				
16	Blue 2	General-purpose input				41	Brown 5				
17	Purple 2	General-purpose input				42	Red 5				
18	Gray 2	Alarm output	General-purpose output	General-purpose output	General-purpose output	43	Orange 5				
19	White 2	Ready output				44	Yellow 5				
20	Black 2	Emergency stop output				45	Green 5				
21	Brown 3	General-purpose output				46	Blue 5				
22	Red 3		47	Purple 5							
23	Orange 3		48	Gray 5							
24	Yellow 3		49	White 5							
25	Green 3	50	Black 5	0 V, externally supplied	0 V, externally supplied	0 V, externally supplied	0 V, externally supplied				

- I/O flat cable (100-pin specification for multi-point I/O board)

**Model number: CB-X-PIOH□□□** \*□□□ indicates the cable length (L). A desired length of up to 10 m can be specified in meters. Example: 020 = 2 m



Pin No.	Standard I/O	Expansion I/O	Pin No.	Standard I/O	Expansion I/O	Pin No.	Standard I/O	Expansion I/O	Pin No.	Standard I/O	Expansion I/O
1	24 V, externally supplied	24 V, externally supplied	26	24 V, externally supplied	24 V, externally supplied	51	Alarm output	General-purpose output	76		
2	Program start	General-purpose input	27			52	Ready output		77		
3	General-purpose input		28			53	Emergency stop output		78		
4			29			54			79		
5			30			55		80			
6		31			56		81				
7	32	General-purpose input	33			57		82			
8	33		34			58		83			
9	Program specification		35			59		84			
10	Program specification		36			60		85			
11	Program specification	37			61		86				
12	Program specification	38			62		87				
13	Program specification	39			63		88				
14	Program specification	40			64		89				
15	Program specification	41			65		90				
16		42			66		91				
17		43			67		92				
18		44			68		93				
19		45			69		94				
20	General-purpose input	46			70		95				
21		47			71		96				
22		48			72		97				
23		49			73		98				
24		50			74		99				
25					75	0 V, externally supplied	0 V, externally supplied	100	0 V, externally supplied	0 V, externally supplied	