FS-L

Actuator Module

Example of Gantry System

Guide Module

FS LARGE TYPE ACTUATOR

FEATURES:

- The larger design enables the FS-L to provide up to a 3000mm stroke.
- Tne FS-L focuses on 2 main types: A High Speed Type (maximum speed: 2000mm/sec) and a High Payload Type (maximum payload: 60kg).
- Timing Belt Drive Method provides a quieter motion.
- Gantry-Type Systems with larger work areas are achievable using guide modules also available in this series.

IAI

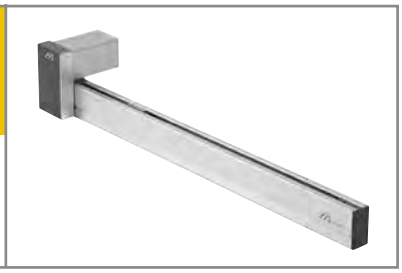
Quality and Innovation

www.intelligentactuator.com

Catalog # FS-L-Series-UST-1-0213

FS-LM-400

Single-axis robot / Slim belt type / Actuator width: 75mm / 400W
High payload specification



Model Specification Items

FS	—	☐	—	☐	—	400	—	☐	—	☐	—	☐	—	☐
Series		Type		Encoder type		Motor type		Stroke		Applicable controller		Cable length		Options
		11LM: Single slider specification 12LM: Double slider specification		A: Absolute specification I: Incremental specification		400: 400W		1000: 1000mm 〜 3000: 3000mm (in 100mm increments)		T1: XSEL-J/K T2: SCON SSEL XSEL-P/Q		N: None S: 3m M: 5m X☐☐: Specified length		Refer to the options table below.

Model Number/Specification

Model number	Encoder type	Motor output (W)	Slider	Stroke in 100mm increments (mm)	Speed (mm/s)	Payload (Note 1)		Rated thrust (N)
						Horizontal (kg)	Vertical (kg)	
FS-11LM-①-400-②-③-④-⑤	Absolute Incremental	400	Single	1000~3000	1~1250	15	Designed exclusively for horizontal use	196
FS-12LM-①-400-②-③-④-⑤			Double			60 (Note 2)		

* In the above model numbers, ① indicates the encoder type, ② indicates the stroke, ③ indicates the applicable controller, ④ indicates the cable length, and ⑤ indicates the option(s).

Option

Name	Model number	Reference page	Notes
Reversed-home specification	NM	—	Available for11LM only
No motor (cover only)	NQ	—	
Motor positioned on the opposite side	R	—	
Motor positioned at the bottom	U	—	Custom-order

Common Specifications

Positioning repeatability	±0.08mm
Drive method	Timing belt
Lost Motion	0.1mm max.
Allowable static load moment	Refer to P. FS-4 (Technical Reference)
Allowable dynamic load moment	Refer to P. FS-5 (Technical Reference)
Overhang load length	Refer to P. FS-5 (Technical Reference)
Base	Material: Aluminum, with white alumite treatment
Applicable controller	T1: XSEL-J/K T2: XSEL-P/Q, SSEL, SCON
Cable length (Note 3)	N: None, S: 3m, M: 5m, X☐☐: Specified length
Ambient operating temperature/humidity	0 to 40°C, 85%RH max. (non-condensing)

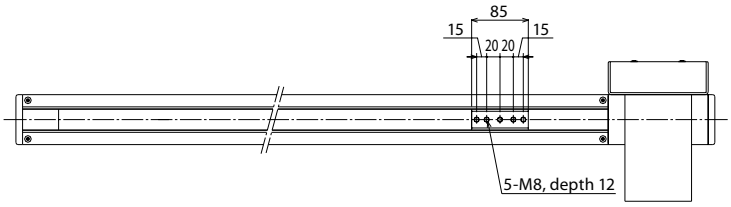
Diagram

CAD drawings are available for download from our website.

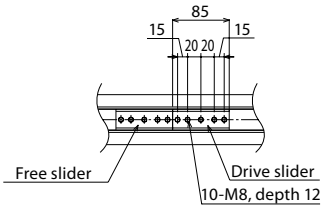
2D CAD

RoHS

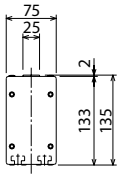
11LM (Single slider)



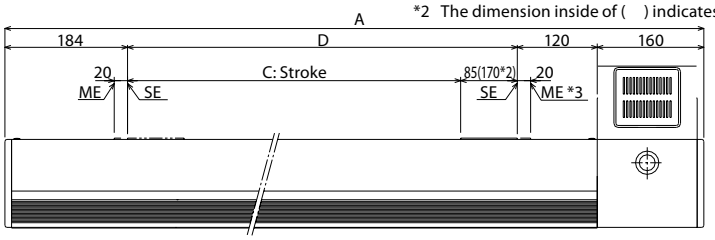
12LM (Double slider)

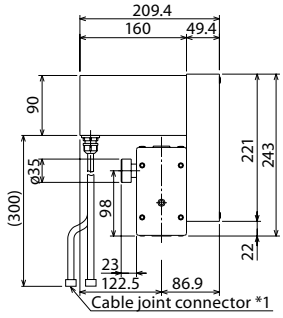


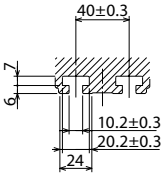
SE: Stroke End
ME: Mechanical End



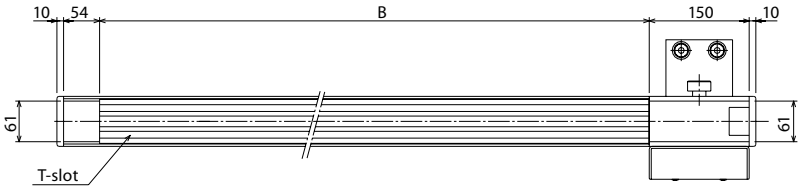
*2 The dimension inside of ( ) indicates 12LM.







T-slot dimension



*1
Connect the motor cable and encoder cable. Refer to P. FS-7 & FS-8 for the cables.

*3
During the home return, the slider moves to the ME, so pay attention not to let the slider hit surrounding parts.

* Refer to P. FS-6 for the actuator installation method.

FS-11LM-400

Stroke	1000	1500	2000	2500	3000
A	1549	2049	2549	3049	3549
B	1325	1825	2325	2825	3325
C	1000	1500	2000	2500	3000
D	1085	1585	2085	2585	3085
Mass (kg)	28	34	40	47	53
Payload (kg)	15				

FS-12LM-400

Stroke	1000	1500	2000	2500	3000
A	1649	2149	2649	3149	3649
B	1425	1925	2425	2925	3425
C	1015	1515	2015	2515	3015
D	1185	1685	2185	2685	3185
Mass (kg)	31	37	43	49	56
Payload (kg)	60		44	36	28

* 1000~3000mm strokes are available in 100mm increments.
Dimensions A~D increase by 100mm for every 100mm stroke increment.

Applicable Controller Specifications

Applicable Controller	Maximum number of controlled axes	Connectable encoder type	Operating method	Power-supply voltage	Reference page
X-SEL-P/Q	6 axes	Absolute/ incremental	Program	Single/three-phase 200 VAC	—
X-SEL-J/K	4 axes			Single-phase 100/200 VAC	—
SSEL	2 axes				—
SCON	1 axis		Positioner pulse train control	Single-phase 200 VAC	—

CAUTION

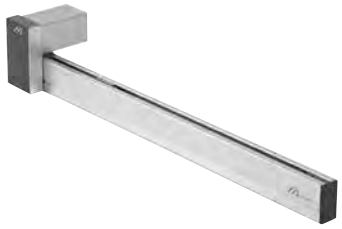
(Note 1) The payload is the value when operated at 0.3 G acceleration.

(Note 2) Note that when the stroke increases, the payload will drop. (Refer to the tables above for payload by stroke.)

(Note 3) The maximum cable length is 30 m. Specify a desired length in meters. (Example. X08 = 8 m)

FS-HM-400

Single-axis robot / Slim belt type / Actuator width: 75mm / 400W
High speed specification



Model Specification Items

FS	—	☐	—	☐	—	400	—	☐	—	☐	—	☐	—	☐
Series		Type		Encoder type		Motor type		Stroke		Applicable controller		Cable length		Options
		11HM: Single slider specification 12HM: Double slider specification		A: Absolute specification I: Incremental specification		400: 400W		1000: 1000mm 〜 3000: 3000mm (in 100mm increments)		T1: XSEL-J/K T2: SCON SSEL XSEL-P/Q		N : None S : 3m M: 5m X☐☐: Specified length		Refer to the options table below.

Model Number/Specification

Model number	Encoder type	Motor output (W)	Slider	Stroke in 100mm increments (mm)	Speed (mm/s)	Payload (Note 1)		Rated thrust (N)
						Horizontal (kg)	Vertical (kg)	
FS-11HM-①-400-②-③-④-⑤	Absolute Incremental	400	Single	1000~3000	1~2000	10	Designed exclusively for horizontal use	127
FS-12HM-①-400-②-③-④-⑤			Double			40 (Note 2)		

* In the above model numbers, ① indicates the encoder type, ② indicates the stroke, ③ indicates the applicable controller, ④ indicates the cable length, and ⑤ indicates the option(s).

Option

Name	Model number	Reference page	Notes
Reversed-home specification	NM	—	Available for11HM only
No motor (cover only)	NQ	—	
Motor positioned on the opposite side	R	—	
Motor positioned at the bottom	U	—	Custom-order

Common Specifications

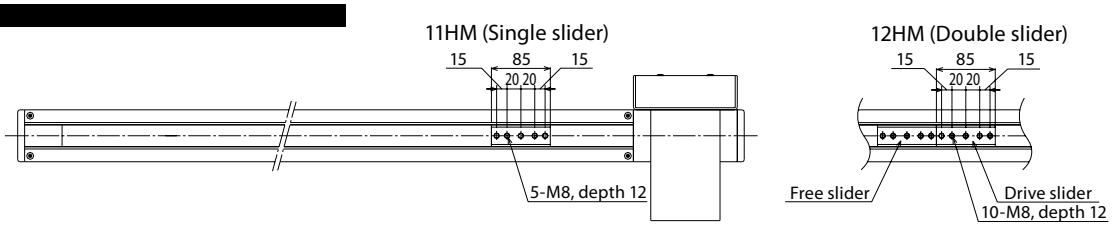
Positioning repeatability	±0.08mm
Drive method	Timing belt
Lost Motion	0.1mm max.
Allowable static load moment	Refer to P. FS-4 (Technical Reference)
Allowable dynamic load moment	Refer to P. FS-5 (Technical Reference)
Overhang load length	Refer to P. FS-5 (Technical Reference)
Base	Material: Aluminum, with white alumite treatment
Applicable controller	T1: XSEL-J/K T2: XSEL-P/Q, SSEL, SCON
Cable length (Note 3)	N: None, S: 3m, M: 5m, X☐☐: Specified length
Ambient operating temperature/humidity	0 to 40°C, 85%RH max. (non-condensing)

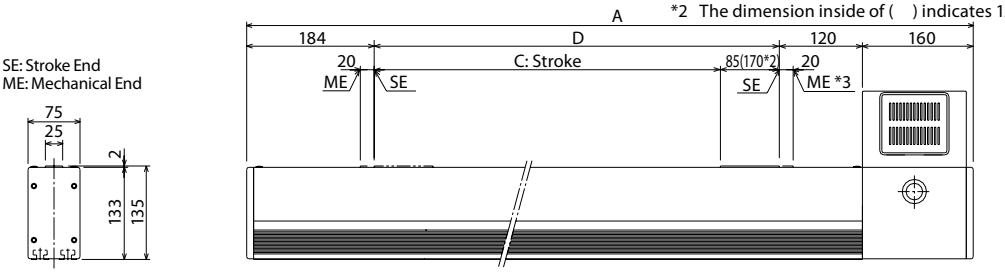
Diagram

CAD drawings are available for download from our website.

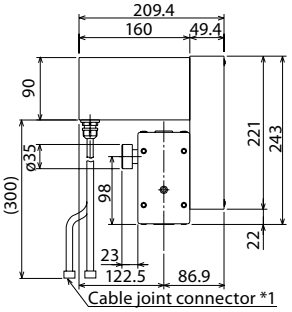
2D CAD

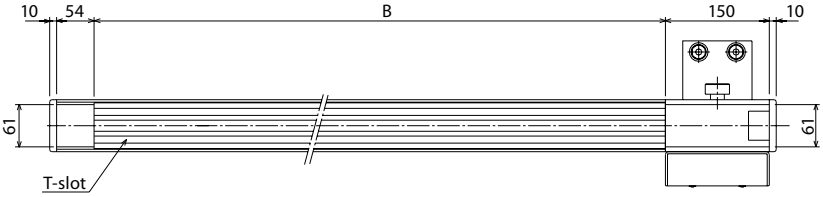
RoHS

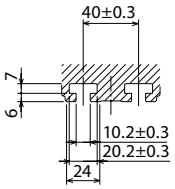




SE: Stroke End
ME: Mechanical End







T-slot dimension

* Refer to P. FS-6 for the actuator installation method.

*1
Connect the motor cable and encoder cable. Refer to P. FS-7 & FS-8 for the cables.

*3
During the home return, the slider moves to the ME, so pay attention not to let the slider hit surrounding parts.

FS-11HM-400

Stroke	1000	1500	2000	2500	3000
A	1549	2049	2549	3049	3549
B	1325	1825	2325	2825	3325
C	1000	1500	2000	2500	3000
D	1085	1585	2085	2585	3085
Mass (kg)	28	34	40	47	53
Payload (kg)	10				

FS-12HM-400

Stroke	1000	1500	2000	2500	3000
A	1649	2149	2649	3149	3649
B	1425	1925	2425	2925	3425
C	1015	1515	2015	2515	3015
D	1185	1685	2185	2685	3185
Mass (kg)	31	37	43	49	56
Payload (kg)	40		30	25	20

* 1000~3000mm strokes are available in 100mm increments.
Dimensions A~D increase by 100mm for every 100mm stroke increment.

Applicable Controller Specifications

Applicable Controller	Maximum number of controlled axes	Connectable encoder type	Operating method	Power-supply voltage	Reference page
X-SEL-P/Q	6 axes	Absolute/ incremental	Program	Single/three-phase 200 VAC	—
X-SEL-J/K	4 axes			Single-phase 100/200 VAC	—
SSEL	2 axes				—
SCON	1 axis		Positioner pulse train control	Single-phase 200 VAC	—

CAUTION

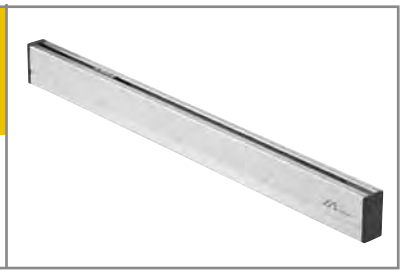
(Note 1) The payload is the value when operated at 0.3 G acceleration.

(Note 2) Note that when the stroke increases, the payload will drop. (Refer to the tables above for payload by stroke.)

(Note 3) The maximum cable length is 30 m. Specify a desired length in meters. (Example. X08 = 8 m)

FS-LO

Single-axis robot / Actuator width: 75mm / Guide module



Model Specification Items

FS — [Type] — 0 — [Stroke]

- FS: Series
- Type: 11LO: Single slider specification; 12LO: Double slider specification
- 0: Motor type (0: No motor)
- Stroke: 1000: 1000mm ~ 3000: 3000mm (in 100mm increments)

Model Number/Specification

Model number	Encoder type	Motor output (W)	Slider	Stroke in 100mm increments (mm)	Speed (mm/s)	Payload (Note 1)		Rated thrust (N)
						Horizontal (kg)	Vertical (kg)	
FS-11LO-0-①	—	—	Single	1000~3000	—	—	—	—
FS-12LO-0-①			Double					

* In the above model numbers, ① indicates the stroke.

Option

Name	Model number	Reference page	Notes

Common Specifications

Positioning repeatability	—
Drive method	—
Lost Motion	—
Allowable static load moment	Refer to P. FS-4 (Technical Reference)
Allowable dynamic load moment	Refer to P. FS-5 (Technical Reference)
Overhang load length	Refer to P. FS-5 (Technical Reference)
Base	Material: Aluminum, with white alumite treatment
Cable length	—
Ambient operating temperature/humidity	0 to 40°C, 85%RH max. (non-condensing)

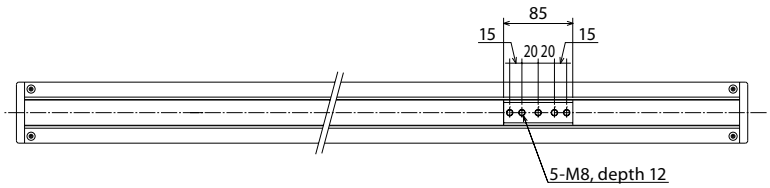
Diagram

CAD drawings are available for download from our website.

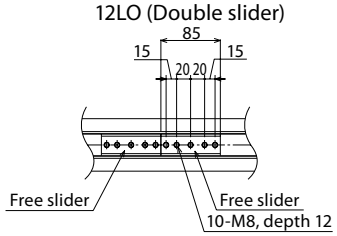
2D CAD

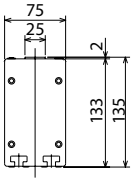
RoHS

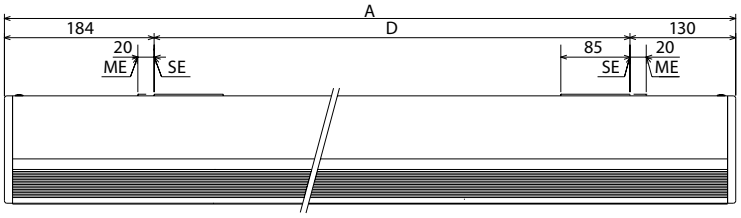
11LO (Single slider)



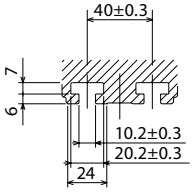
12LO (Double slider)



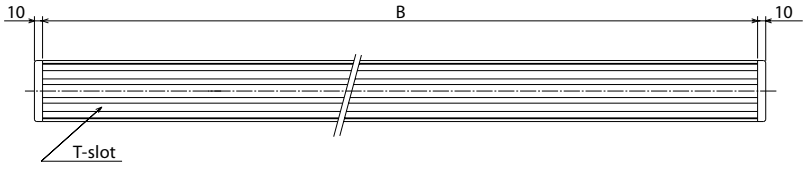




SE: Stroke End
ME: Mechanical End



T-slot dimension



* Refer to P. FS-6 for the actuator installation method.

FS-11LO-0

Stroke	1000	1500	2000	2500	3000
A	1403	1903	2403	2903	3403
B	1379	1879	2379	2879	3379
C	1000	1500	2000	2500	3000
D	1085	1585	2085	2585	3085
Mass (kg)	19	25	31	38	44
Payload (kg)	–				

FS-12LO-0

Stroke	1000	1500	2000	2500	3000
A	1503	2003	2503	3003	3503
B	1479	1979	2479	2979	3479
C	1015	1515	2015	2525	3025
D	1185	1685	2185	2685	3185
Mass (kg)	22	28	34	40	46
Payload (kg)	–				

* 1000~3000mm strokes are available in 100mm increments.
Dimensions A~D increase by 100mm for every 100mm stroke increment.

Applicable Controller Specifications

Applicable Controller	Maximum number of controlled axes	Connectable encoder type	Operating method	Power-supply voltage	Reference page
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

Allowable Dynamic Moment and Allowable Static Moment

There are two types of moment that can be applied to the the guide: the allowable dynamic moment and the allowable static moment.
The allowable dynamic moment is calculated from the travel life (when flaking occurs) when moved with the moment load applied.
In contrast, the static moment is calculated from the load that causes permanent deformation to the steel ball or its rolling surface (i.e. rated static moment), taking into account the rigidity and deformity of the base.

[Allowable Dynamic Moment]

IAI's catalog contains the allowable dynamic moments based on a load coefficient of 1.2 and 10,000km or 5,000km.
This value is different from the so-called basic rated dynamic moment, which is based on a 50km travel life.
To calculate the basic rated dynamic moment for a 50km travel life, use the following equation.

$$M_{50} = f_w \times M_S \div \left(\frac{50}{S}\right)^{\frac{1}{3}} \quad \cdots\cdots \text{Equation 1}$$

M_S : Allowable dynamic moment at an assumed travel distance (catalog value)
S : IAI catalog assumed travel life (5,000km or 10,000km)
f_w : Load coefficient (=1.2)
M_{50} : Basic rated dynamic moment (50km travel life)

The allowable dynamic moments mentioned in the catalog (10,000km or 5,000km life) are based on a load coefficient fw=1.2. To calculate the service life of a guide with a different load coefficient, use Table 1 below to determine the load coefficient that matches your requirements.

Table 1: Load Coefficients

Operation and Load Requirements	Load Coefficient fw
Slow operation with light vibration/shock (1500mm/s or less, 0.3G or less)	1.0～1.5
Moderate vibration/shock, abrupt braking and accelerating (2500mm/s or less, 1.0G or less)	1.5～2.0
Operation with abrupt acceleration/deceleration with heavy vibration/shock (2500mm/s or faster, 1.0G or faster)	2.0～3.5

$$L_{10} = \left(\frac{C_{IA}}{P} \cdot \frac{1.2}{f_w}\right)^3 \times S \quad \cdots\cdots \text{Equation (2)}$$

L_{10} : Service life (90% Survival Probability)
C_{IA} : Allowable dynamic moment in IAI Catalog (5,000km or 10,000km)
P : Moment used (≤ CIA)
S : IAI catalog assumed travel life (5,000km or 10,000km)
f_w : Load coefficient (from Table 1)

[Allowable Static Moment]

The maximum moment that can be applied to a slider at rest.
These values are calculated by taking the basic rated static moment of the slider and multiplying with the safety rate that takes into consideration any effects from the rigidity and deformity of the base.
Therefore, if a moment load is applied to the slider at rest, keep the moment within this allowable static moment. However, use caution to avoid adding any unexpected shock load from any inertia that reacts on the load.

[Basic Rated Static Moment]

The basic rated static moment is the moment value at which the sum of the permanent deformation at the center of contact between the rolling body (steel ball) and the rolling surface (rail) is 0.0001 times the diameter of the rolling body.
These values are simply calculated strictly from the permanent deformation done to the steel ball and its rolling surface. However, the actual moment value is restricted by the rigidity and deformation of the base. Hence, the allowable static moment the actual moment that can be applied statically, taking into account those factors.

FS Series Technical Refernce

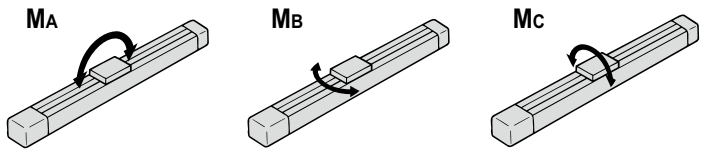
Allowable dynamic moment, Overhang load length

With each type of FS Series, a single or double slider can be selected.
The allowable dynamic moment and overhang load length vary depending on the length of the slider.
Refer to the typical examples shown below.

Directions of allowable dynamic moments

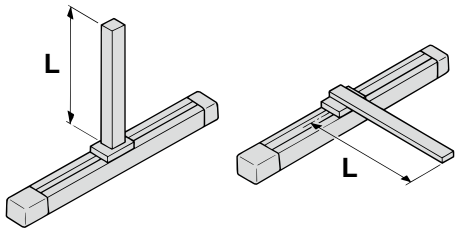
■ Allowable dynamic moment values are based on a 20,000 km service life. Please note that applying a moment exceeding the allowable value will reduce the service life of the guide.

Directions of load moments

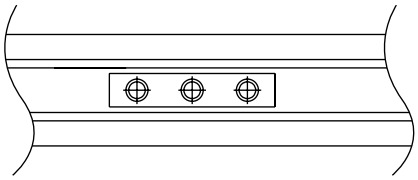


Overhang load length

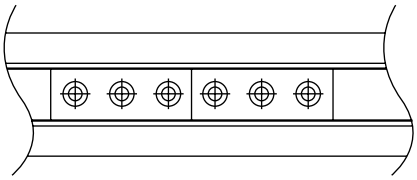
■ When each model is used with an overhang load exceeding the allowable length, vibration may occur. Be sure to keep the overhang load length within the allowable value.



Single slider (Fig. 1)



Double slider (Fig. 2)



Type			Allowable dynamic moment (*) N•m (Kgf•m)	Overhang L mm
FS-11NM FS-11NO	Fig. 1	Single slider	Ma: 2.9 (0.3) Mb: 2.9 (0.3) Mc: 4.5 (0.46)	Ma, Mb, Mc directions: 200mm or less
FS-12NM FS-12NO	Fig. 2	Double slider (when sliders are joined together)	Ma: 20.5 (2.1) Mb: 18.6 (1.9) Mc: 9.1 (0.93)	Ma, Mb, Mc directions: 500mm or less
FS-11WM FS-11WO	Fig. 1	Single slider	Ma: 4.4 (0.45) Mb: 3.9 (0.4) Mc: 5.8 (0.6)	Ma, Mb, Mc directions: 240mm or less
FS-12WM FS-12WO	Fig. 2	Double slider (when sliders are joined together)	Ma: 27.4 (2.8) Mb: 25.4 (2.6) Mc: 11.7 (1.2)	Ma, Mb, Mc directions: 600mm or less
FS-11LM FS-11LO FS-11HM	Fig. 1	Single slider	Ma: 8.8 (0.9) Mb: 7.8 (0.8) Mc: 12.7 (1.3)	Ma, Mb, Mc directions: 300mm or less
FS-12LM FS-12LO FS-12HM	Fig. 2	Double slider (when sliders are joined together)	Ma: 51.9 (5.3) Mb: 47.0 (4.8) Mc: 25.4 (2.6)	Ma, Mb, Mc directions: 750mm or less

(*) For case of 20,000km service life (fw=1.2)

FS Actuator Installation Method / Mounting Orientation

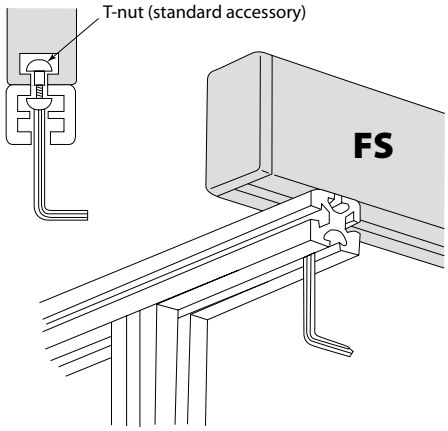
Installtion method

FS Series

NM, NO, WM, WO, LM, LO, HM

■ Using the T-groove on the back of the base, secure the body with the T-nut supplied with the actuator.

- FS-NM (T-slot 1 line) : T-nut M8
- FS-NO (T-slot 1 line) : T-nut M8
- FS-WM (T-slot 1 line) : T-nut M8
- FS-WO (T-slot 1 line) : T-nut M8
- FS-LM (T-slot 2 lines) : T-nut M8
- FS-LO (T-slot 2 lines) : T-nut M8
- FS-HM (T-slot 2 lines) : T-nut M8



■ Quantity of T-nut included

Stroke	Quantity
300~1000	5
1100~1500	6
1600~2000	7
2100~2500	8
2600~3000	9

* Double the numbers for LM/LO/HM models.

Mounting orientation

○: Installable —: Not installable

		Orientation			
					
Series	Type	Horizontal, flat	Vertical	Side-mounted	Ceiling mounted
FS	HL-400 HM-400 LO	○	—	—	○

Motor Cable / Encoder Cable

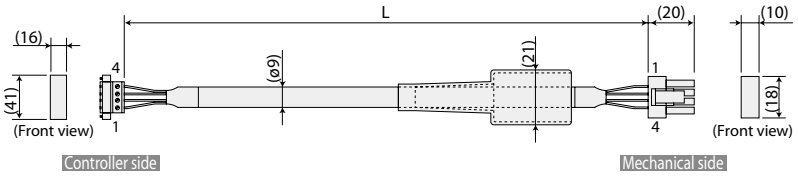
These are joint cables to connect the actuator cable joint connector and the controller.
There are two kinds of cables; a motor cable for the motor power, and an encoder cable for the encoder signals.
Also, when you use the cable with a cable track, please use the robot cable which is heavy-duty and has excellent bending resistance. (*)

(*) For motor/encoder cables for single-axis robots, all the standard cables are robot cables.

Motor cable (for XSEL-J/K/P/Q, SSEL, SCON)

Model: **CB-X-MA□□□**

* □□□ is the cable length (L); supports up to 30m.
Example: 080 = 8m



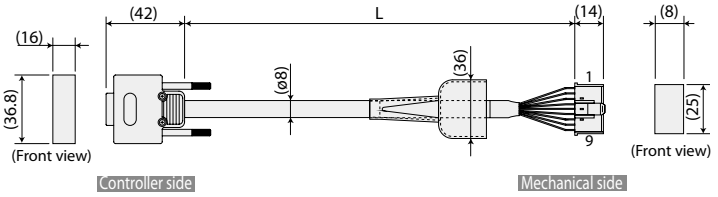
Minimum bend radius R: r = 51mm or larger (for movable use)

Wire	Color	Signal	No.		No.	Signal	Color	Wire
0.75sq	Green	PE	1		1	U	Red	0.75sq (crimped)
	Red	U	2		2	V	White	
	White	V	3		3	W	Black	
	Black	W	4		4	PE	Green	

Encoder cable (for XSEL-J/K)

Model: **CB-X-PA□□□**

* □□□ is the cable length (L); supports up to 30m.
Example: 080 = 8m



Minimum bend radius R: r = 44mm or larger (for movable use)

Wire	Color	Signal	No.		No.	Signal	Color	Wire
0.15sq (crimped)	—	—	1		1	BAT+	Black	0.15sq (crimped)
	—	—	2		2	BAT-	Yellow	
	—	—	3		3	SD	Blue	
	—	—	4		4	$\overline{SD}$	Orange	
	—	—	5		5	VCC	Green	
	—	—	6		6	GND	Brown	
	Blue	SD	7		7	FG	Ground	
	Orange	$\overline{SD}$	8		8	BK-	Gray	
	Black	BAT+	9		9	BK+	Red	
	Yellow	BAT-	10					
	Green	VCC	11					
	Brown	GND	12					
	Gray	BK-	13					
	Red	BK+	14					
	—	—	15					

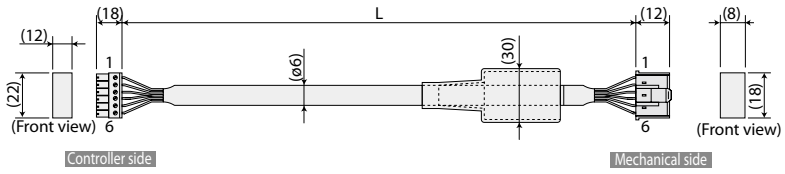
The shield is clamped to the hood

Braided ground & shield wire

Limit switch cable (for XSEL-J/K)

Model: **CB-X-LC□□□**

* □□□ is the cable length (L); supports up to 30m.
Example: 080 = 8m



Minimum bend radius R: r = 33mm or larger (for movable use)

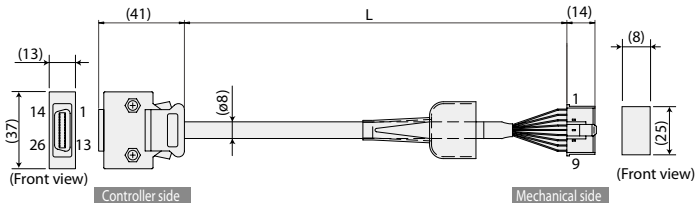
Wire	Color	Signal	No.		No.	Signal	Color	Wire
AWG24	Light Blue	24VOUT	6		1	24VOUT	Light Blue	AWG24 (crimped)
	Pink	N	5		2	N	Pink	
	Light Green	LS	4		3	LS	Light Green	
	Orange	CREEP	3		4	CREEP	Orange	
	Gray	OT	2		5	OT	Gray	
	1B/Light Blue	RSV	1		6	RSV	1B/Light Blue	

Note) 1B indicates one black dot mark.

Encoder cable (for XSEL-P/Q, SSEL, SCON)

Model: **CB-X1-PA□□□**

* □□□ is the cable length (L); supports up to 30m.
Example: 080 = 8m



Plug housing: XMP-09V (Nichiatsu)
Socket contact: BXA-001T-P0.6 (Nichiatsu) x 9
Retainer: XMS-09V (Nichiatsu)

Minimum bend radius R: r = 44mm or larger (for movable use)

Wire	Color	Signal	No.
AWG26 (soldered)	—	—	10
	—	—	11
	—	E24V	12
	—	OV	13
	—	LS	26
	—	CREEP	25
	—	OT	24
	—	RSV	23
	—	—	9
	—	—	18
	—	—	19
	—	A+	1
	—	A-	2
	—	B+	3
	—	B-	4
	—	Z+	5
	—	Z-	6
	Orange	SRD+	7
	Green	SRD-	8
	Purple	BAT+	14
	Gray	BAT-	15
	Red	VCC	16
	Black	GND	17
	Blue	BKR-	20
	Yellow	BKR+	21
	—	—	22
The shield is clamped to the hood			

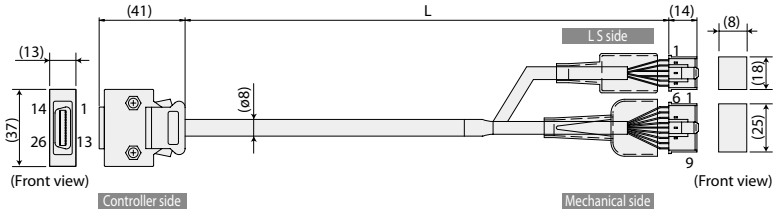
No.	Signal	Color	Wire
1	BAT+	Purple	AWG26 (crimped)
2	BAT-	Gray	
3	SD	Orange	
4	SD	Green	
5	VCC	Red	
6	GND	Black	
7	FG	Ground	
8	BK-	Blue	
9	BK+	Yellow	

Braided ground & shield wire

Encoder Cable (for XSEL-P/Q, SSEL, SCON, and LS equipped connection)

Model: **CB-X1-PLA□□□**

* □□□ is the cable length (L); supports up to 30m.
Example: 080 = 8m



Minimum bend radius R: r = 54mm or larger (for movable use)

Wire	Color	Signal	No.
AWG26 (soldered)	—	—	10
	—	—	11
	White/Blue	E24V	12
	White/Yellow	OV	13
	White/Red	LS	26
	White/Black	CREEP	25
	White/Purple	OT	24
	White/Gray	RSV	23
	—	—	9
	—	—	18
	—	—	19
	—	A+	1
	—	A-	2
	—	B+	3
	—	B-	4
	—	Z+	5
	—	Z-	6
	Orange	SRD+	7
	Green	SRD-	8
	Purple	BAT+	14
	Gray	BAT-	15
	Red	VCC	16
	Black	GND	17
	Blue	BKR-	20
	Yellow	BKR+	21
	—	—	22
The shield is clamped to the hood			

No.	Signal	Color	Wire
1	E24V	White/Blue	AWG26 (crimped)
2	OV	White/Yellow	
3	LS	White/Red	
4	CREEP	White/Black	
5	OT	White/Purple	
6	RSV	White/Gray	

No.	Signal	Color	Wire
1	BAT+	Purple	AWG26 (crimped)
2	BAT-	Gray	
3	SD	Orange	
4	SD	Green	
5	VCC	Red	
6	GND	Black	
7	FG	Ground	
8	BK-	Blue	
9	BK+	Yellow	

Braided ground & shield wire

(White/Blue in cable color indicates the colors of line/insulator.)