IAI
Quality and Innovation

Program Controller XSEL2

COMPLETE

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Complete with 8 functions!

Complete Controller

XSEL2

C	**CODESYS** equipped	Function 1
O	**OPC UA** server equipped as standard	Function 2
M	**Master** [Equipped with EtherNet/IP scanner]	Function 3
P	**Preservation** [Predictive & Preventive Maint. Functions]	Function 4
L	**Library** [Function blocks supported]	Function 5
E	**ELECYLINDER** connection supported	Function 6
T	**Tools** [Support tools/teaching tools supported]	Function 7
E	**Excellence** [Superb functions]	Function 8

Function 1

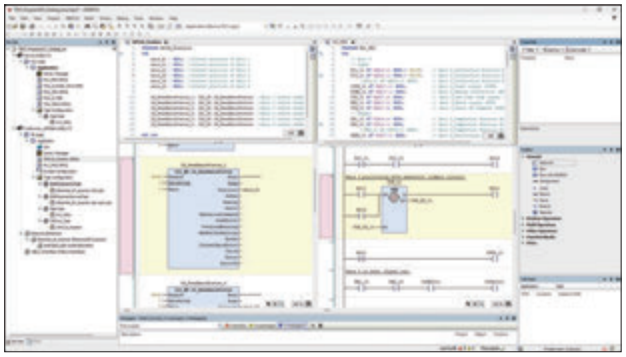
PLC is not required

CODESYS equipped

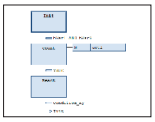
What is CODESYS (CODESYS for XSEL2)?

- CODESYS is a PLC software and peripheral functions compliant with the international PLC programming language standard IEC 61131-3, developed by CODESYS GmbH.
- Among the peripheral functions, XSEL2 adopts the EtherNet/IP scanner and OPC UA server.
- Dedicated programming software (comprehensive development environment) is provided.

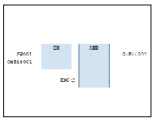
Ex. PLC programming



Ladder Logic (LD)

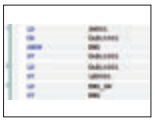


Sequential Function Chart (SFC)



Function Block Diagram (FBD)

Structure Text (ST)



Instruction List (IL)

Function 2

Equipment startup time can be reduced

OPC UA server equipped as standard

Communication is possible across multiple industrial network barriers (standards).

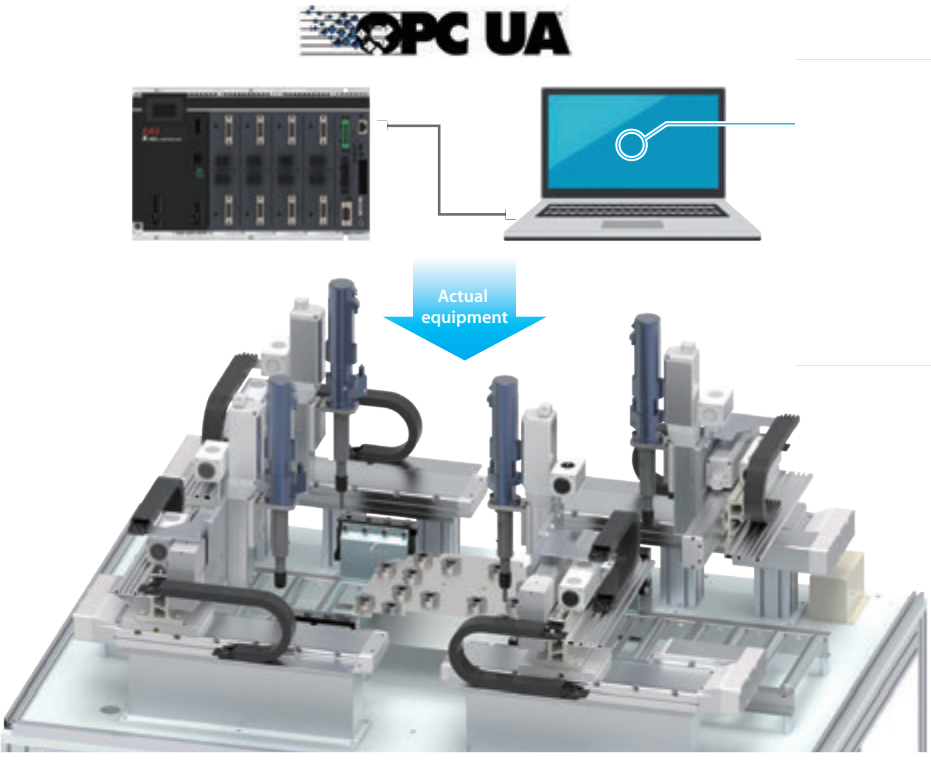
Usage examples

- **Data collection within factories**

  Ex.: MES (production execution system which grasps and manages the manufacturing process as well as providing directions and support to workers)
  SCADA (system which uses a network to collect, monitor, and control equipment and facility information)

- **Digital observation and startup (offline teaching)**

Actuator operation can be confirmed on a 3D simulator by programming with the XSEL2 PLC function and transferring to the 3D simulator with OPC UA.



intelligentactuator.com/XSEL2-3D
3D simulator and actual equipment operation can be confirmed with comparison video

Function 3

Connectable on the same network

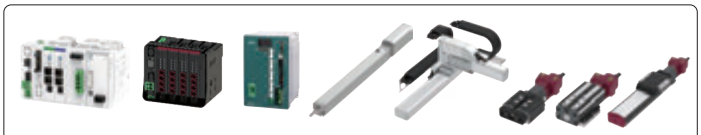
Master [Equipped with EtherNet/IP scanner as standard]

With the XSEL2 as the master, connection with various devices, including IAI devices, is possible.

EtherNet/IP

*The adapter must support EtherNet/IP.

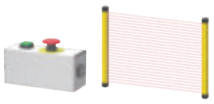
Adapter (slave)



IAI devices

Sensors

Remote I/O



Peripheral devices

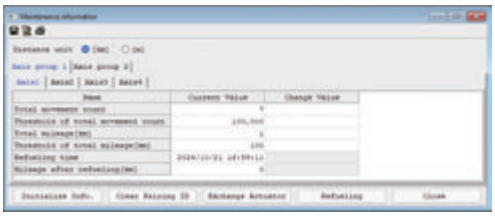
Function 4

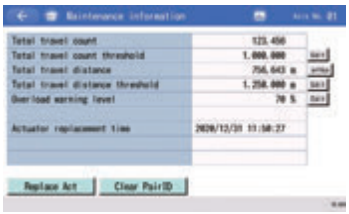
Prevents equipment downtime in advance

Preservation [Predictive maintenance function] [Preventative maintenance function]

Predictive Maintenance

· Fan speed monitor
· Motor overload status monitor





Preventative Maintenance

· Predicting internal capacitor life based on temperature and operating time
· Monitoring present position, motor current value, and maintenance information.
(Maintenance information: Number of travel cycles, running distance, etc.)

Actuator Recognition Function

Actuator information can now be confirmed with teaching tools.
There is also an area where customers can freely write information to the actuator.

Function 5

Programming is simple

Library [Function blocks supported]

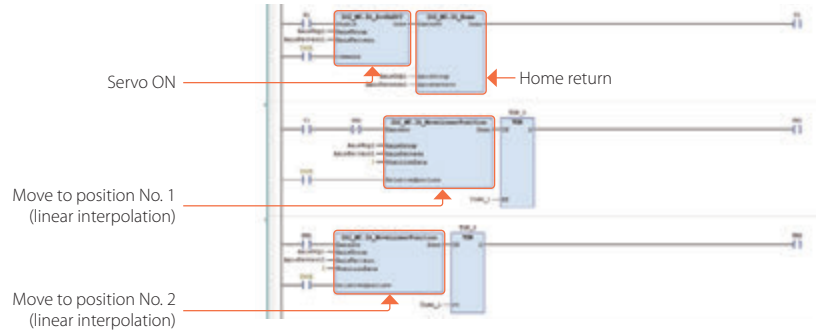
Function blocks for general basic commands and IAI-specific commands are available.

Function blocks

Ex.:
Basic commands
· Timer
· Counter
· Edge detection, etc.
IAI commands
· Home return
· Servo ON/OFF
· Direct value specified travel, etc.

Usage example of IAI-specific function blocks

Ex.: Servo ON → Home return → Linear interpolating travel to registered position No. (reciprocal motion)



Caution: Input/output not using function blocks has been deleted.

Function

ELECYLINDER can be connected

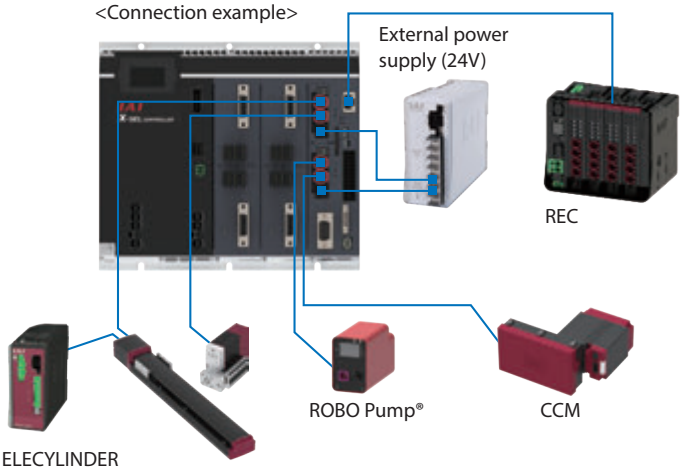
ELECYLINDER connection supported

Connect the ELECYLINDER, CCM, and Robot Pump directly to the ELECYLINDER connection module for control.
Additionally, REC can be connected via EtherNet/IP.

Control method

- SEL commands
- PLC function program
- Communication via PIO or field network

<Connection example>



Function 7

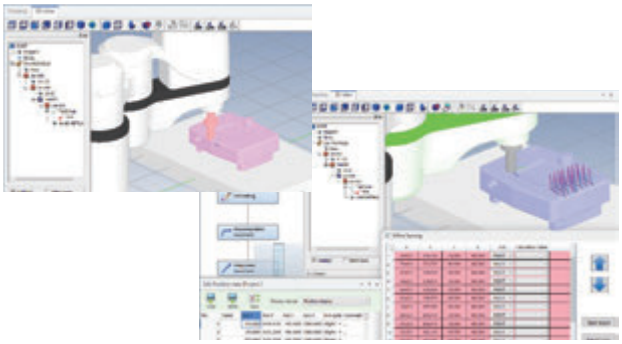
Extended tool functions

Tools [Support tool/teaching tool function]

Support tools

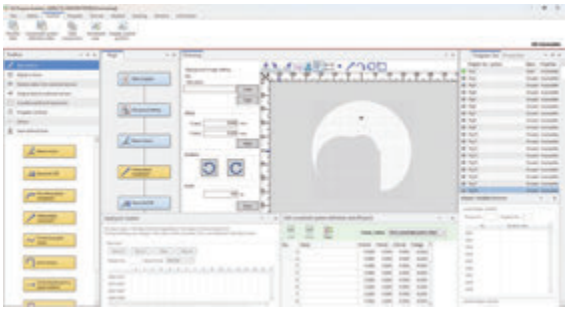
<Simulator function>

Supports 3D model positioning, interference checks, and offline teaching.



<SEL Program Generator function>

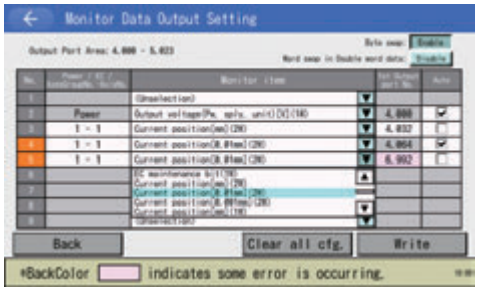
Reads in DXF data and converts it to a position program.



Teaching tools

<Monitor data output function>

Information such as present position or overload level can be output to the PLC with this function.



<Error countermeasure search function>

Search for an error code to display error content details and countermeasures.

Error code search screen

Error content display

Countermeasure display

Function 8

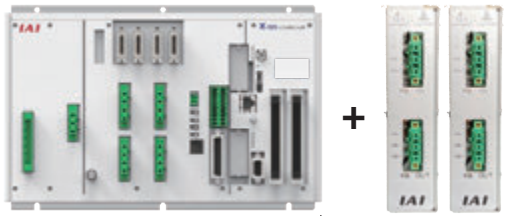
Even more powerful than the conventional XSEL

Excellence [Superb functions]

Compact size

27% smaller than the conventional XSEL controller.

[Conventional model]
XSEL-RA (4-axis specification)



New
XSEL2-TS (4-axis specification)

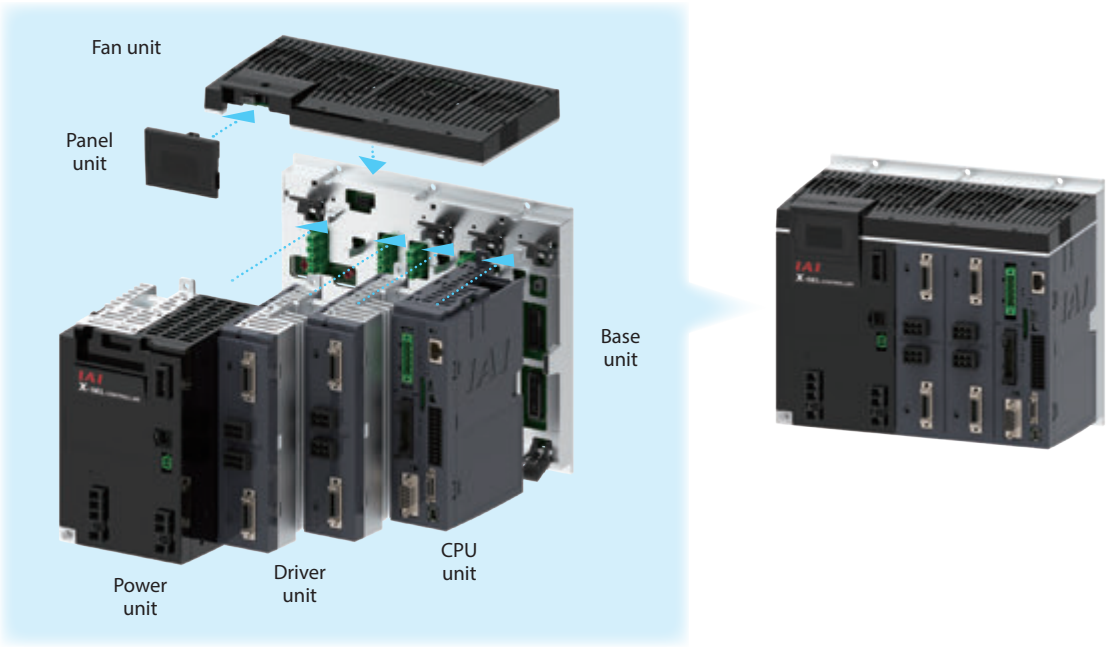
27% reduced

In addition!
Two external regenerative resistance units built in

☆ Within the conditions below, regenerative resistance units **are not required externally!**
- Horizontal 1,200W or less
- Vertical 1,000W or less
- Standard IXA SCARA (arm length 600mm or less)

Unit connection type

This unit combination type makes it easy to replace the required units when specifications change, maintenance is needed, or problems occur.



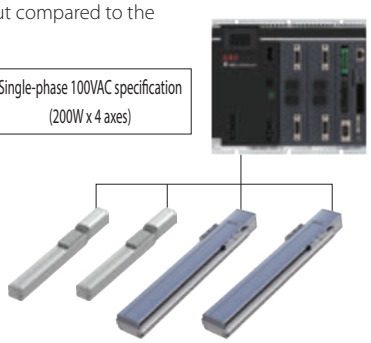
Motor output improved; 100VAC specification supported

A high-volume capacitor greatly increased motor output compared to the previous model.

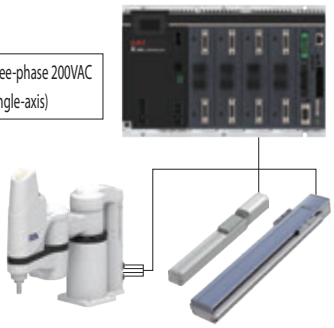
- Three-phase 200VAC : **3,200**W
- Single-phase 200VAC: **2,400**W
- Single-phase 100VAC: **800**W

Connection examples

Single-phase 100VAC specification (200W x 4 axes)



Single-phase/three-phase 200VAC (IXA + single-axis)



Connection configuration

Connecting IAI products

Supports all models equipped with 200VAC servo motor type motors

With XSEL2 alone, almost all IAI products can be controlled

Connecting other companies' products

CODESYS for XSEL2

Software PLC

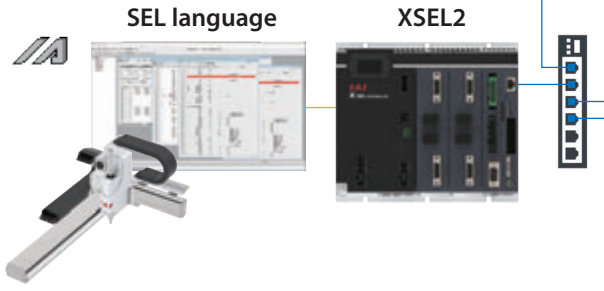
· PLC development environment provided

· Supports PLC programming languages regulated by IEC61131-3

Function blocks

XSEL2 connecting axes, program startup/stop etc. are possible

OPC UA, EtherNet/IP scanner functions

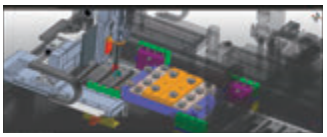


Control with SEL program

· Specialized for robot motion

· Control is possible with simple programs

CODESYS functions



Server functions

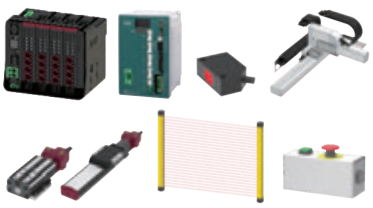
· 3D simulator

· Monitoring and control

· Display

Visualizing the production site

Scanner function



· EtherNet/IP-supported devices can be controlled whether from IAI or otherwise (sensors, switches, controllers, etc.)

Model Specification Items

XSEL2 – [Type] – [Number of Axes] – [Driver Type (Slot 1)] [Driver Type (Slot 2)] [Driver Type (Slot 3)] [Driver Type (Slot 4)] – [I/O Slot (Slot 1)] [I/O Slot (Slot 2)] – [I/O Cable Length] – [Power Supply Voltage] – ([Absolute Battery])

Series: XSEL2

Type	
TS	For single-axis and cartesian (small housing)
TL	For single-axis and cartesian (large housing)
TSX	For SCARA (small housing)
TLX	For SCARA (large housing)

Number of Axes	
1	1-axis specification
2	2-axis specification
3	3-axis specification
4	4-axis specification
5	5-axis specification
6	6-axis specification
7	7-axis specification
8	8-axis specification

* Total axes selected with driver type.

Driver Type (Slot 1)	
S2	200V servo motor: 2-axis
S1	200V servo motor: 1-axis
SH	200V servo motor: 1-axis (1000W)
N	Without driver *1

*1 Slot 1 cannot be selected.
* For selection, see the Selection Notes.

Driver Type (Slot 2) / (Slot 3) / (Slot 4)	
E	Not used
EL	ELECYLINDER connection specification
NP	PIO (NPN) specification (16/16)
PN	PIO (PNP) specification (16/16)
CC	CC-Link connection specification
DV	DeviceNet connection specification
PR	PROFIBUS-DP connection specification
IA	IA-NET connection specification *2
N1	PIO (NPN) specification (32/16) *3
N2	PIO (NPN) specification (16/32) *3
N4	PIO (NPN) specification (24/24) *3
P1	PIO (PNP) specification (32/16) *3
P2	PIO (PNP) specification (16/32) *3
P4	PIO (PNP) specification (24/24) *3
PIN	Pulse-train input, PIO input/output (4/4) specification *2

*2 Either Slot 1 or Slot 2 can be selected, but not both.
*3 Only Slot 1 can be selected; Slot 2 must be "E".

Driver Type (Slot 3) / (Slot 4)	
E	Not used
EL	ELECYLINDER connection specification
NP	PIO (NPN) specification (16/16)
PN	PIO (PNP) specification (16/16)
CIE	CC-Link IE Field connection specification
EC	EtherCAT connection specification
EP	EtherNet/IP connection specification
PRT	PROFINET IO connection specification
IA	IA-NET connection specification *2
PIN	Pulse-train input, PIO input/output (4/4) specification *2

I/O Slot (Slot 1) / (Slot 2)	
0	No cable
2	2m (Standard)
3	3m
5	5m

* When not selecting PIO specification with the I/O slot, use 0 (no cable) for the I/O cable length.

Power Supply Voltage	
1	Single-phase 100VAC *4
2	Single phase 200VAC
3	Three-phase 200VAC

*4 Not available when selecting SCARA and driver type "SH".
* For details, see the Selection Notes.

Absolute Battery	
(Blank)	No absolute battery
AB1	Battery box + 1 battery included
AB2	Battery box + 2 batteries included
AB3	Battery box + 3 batteries included
AB4	Battery box + 4 batteries included
AB5	Battery box + 5 batteries included
AB6	Battery box + 6 batteries included
AB7	Battery box + 7 batteries included
AB8	Battery box + 8 batteries included

* Battery box comes with connection cable to body.

*The driver type when connecting a SCARA robot is to be selected from the table on page 9.

Available Models

❶ Body type

Model
TS
TL
TSX
TLX

❷ Driver type

Model
S1
S2
SH
N

❸ I/O slot

Model
E
EL
NP
PN
N1
N2
N4
P1
P2
P4
PIN
CC
CIE
DV
EC
EP
PR
PRT
IA

❹ Power supply voltage

Model
1
2
3

❺ Absolute battery

Model
AB1
AB2
AB3
AB4
AB5
AB6
AB7
AB8

[Model Selection Example]

(Connected actuator)
First axis: LSA-W21HS-I-1000*
Second axis: ISB-WXM-WA-750*
Third axis: RS-A-60*

Selection

Model: XSEL2 - TS - 3 - SHS2 - NPCIE - 2 - 2 - AB1

❶ ❷ ❸ ❹ ❺

Selection Notes

● Actuators which cannot be connected to XSEL2

· Servo Press: RCS3/RCS2 Series
· ROBO Cylinder: RCS3-RA15R/RA20R
· SCARA Robot: IXA-4NS□80□□/4NS□100□□/4NHN10020/4NH□12040 (Support planned)

Selecting the driver type

<Single Axis Actuator>

Select a driver type based on the motor type of the actuator to be connected.

Driver Type	Motor Type
S2/S1	12W~750W
SH	1000W

<SCARA Robot>

Select a driver type based on the SCARA robot type to be connected.
Additional axes can be connected with some models.
When selecting a connectable actuator, take into consideration the total wattage of the additional axes and power capacity.
When connecting additional axes, the body type should be "TLX".

SCARA Robot model		SCARA Robot body type for connection only	Driver type				Connectable additional axes actuator total motor wattage (W)
			Slot 1	Slot 2	Slot 3	Slot 4	
Standard type	IXA-3NNN1805	TSX	S2	S1	Additional axes possible	Additional axes possible	Single phase 200VAC: Total 1,500W or less Three-phase 200VAC: Total 2,300W or less
	IXA-3NNN3015	TSX	S2	S1	Additional axes possible	Additional axes possible	Single phase 200VAC: Total 700W or less Three-phase 200VAC: Total 1,500W or less
	IXA-3NNN4518/33	TSX	S2	S1	Additional axes possible	Additional axes possible	Single phase 200VAC: Total 700W or less Three-phase 200VAC: Total 1,500W or less
	IXA-3NNN6018/33	TSX	S2	S1	Additional axes possible	Additional axes possible	Single phase 200VAC: Total 700W or less Three-phase 200VAC: Total 1,500W or less
	IXA-4NNN1805	TSX	S2	S2	Additional axes possible	Additional axes possible	Single phase 200VAC: Total 1500W or less Three-phase 200VAC: Total 2,300W or less
	IXA-4NNN3015	TSX	S2	S2	Additional axes possible	Additional axes possible	Single phase 200VAC: Total 600W or less Three-phase 200VAC: Total 1,400W or less
	IXA-4NNN4518/33	TSX	S2	S2	Additional axes possible	Additional axes possible	Single phase 200VAC: Total 600W or less Three-phase 200VAC: Total 1,400W or less
	IXA-4NNN6018/33	TSX	S2	S2	Additional axes possible	Additional axes possible	Single phase 200VAC: Total 600W or less Three-phase 200VAC: Total 1,400W or less
	IXA-4NNN8020/40	TLX	SH	S2	S1	N	-
	IXA-4NNN10020/40	TLX	SH	S2	S1	N	-
High-speed type	IXA-3NSN3015	TSX	S2	S1	Cannot be connected		-
	IXA-3NSN4518/33	TSX	S2	S1			-
	IXA-3NSN6018/33	TSX	S2	S1			-
	IXA-4NSN3015	TSX	S2	S2			-
	IXA-4NSN4518/33	TSX	S2	S2			-
	IXA-4NSN6018/33	TSX	S2	S2			-
Dust-proof/splash-proof specification High-speed type	IXA-4NSW3015	TSX	S2	S2			-
	IXA-4NSW4518/33	TSX	S2	S2			-
	IXA-4NSW6018/33	TSX	S2	S2			-
Cleanroom specification High-speed type	IXA-4NSC3015	TSX	S2	S2			-
	IXA-4NSC4518/33	TSX	S2	S2			-
	IXA-4NSC6018/33	TSX	S2	S2			-

Selecting the power capacity

With regard to the total motor wattage (W) of the connectable single-axis/cartesian robot,
select upon confirmation that it does not exceed the maximum connected total wattage in the table below.
Some models require caution when calculating the wattage. See the next page.

Power supply voltage	Maximum connected total wattage
Single-phase: 100VAC	800W
Single-phase: 200VAC	2,400W
Three-phase: 200VAC	3,200W

Selection Notes

● Calculating the connectable actuator motor wattage when connecting LSA/LSAS

For LSA/LSAS (linear servo actuators) connected to single phase 200VAC, calculate the wattage based on the "Controller wattage calculation output value" in the table below.

In addition, make sure that the total wattage of LSA/LSAS and actuators other than LSA/LSAS is equal to or less than 2,400W.

* Single phase 100VAC cannot be connected.

2,400W ≥ LSA/LSAS total wattage (controller wattage calculation output value) + total wattage of actuators other than LSA/LSAS (motor wattage x number of axes)

Wattage conversion table when connected to single phase 200VAC

Actuator model	Applicable driver output [W]	No. of sliders [pcs]	Controller wattage calculation output value [W]
LSA-S6SS	100	1	300
LSA-S6SM	100	2	600
LSA-S8SS	100	1	300
LSA-S8SM	100	2	600
LSA-S8HS	100	1	300
LSA-S8HM	100	2	600
LSA/LSAS-N10SS	100	1	300
LSA/LSAS-N10SM	100	2	600
LSA-S10SS	200	1	600
LSA-S10SM	200	2	1,200
LSA-S10HS	200	1	600
LSA-S10HM	200	2	1,200
LSA-H8SS/L15SS	200	1	600

Actuator model	Applicable driver output [W]	No. of sliders [pcs]	Controller wattage calculation output value [W]
LSA-H8SM/L15SM	200	2	1,200
LSA-H8HS	200	1	600
LSA-H8HM	200	2	1,200
LSA/LSAS-N15SS	200	1	600
LSA/LSAS-N15SM	200	2	1,200
LSA/LSAS-N15HS	200	1	600
LSA/LSAS-N15HM	200	2	1,200
LSA-N19SS	300	1	600
LSA-N19SM	300	2	1,200
LSA-W21SS	400	1	800
LSA-W21SM	400	2	1,600

●Calculating the wattage and the max. connected units when connecting RCS3-CT8C and CTZ5C

Calculate the wattage based on the "Controller wattage calculation output value" for the models in the table below.

* Single phase 100VAC cannot be connected.

Wattage conversion table when connected to single phase 200VAC/three-phase 200VAC

Actuator model	Applicable driver output [W]	Max. connected units [pcs]	Controller wattage calculation output value [W]
RCS3-CT8C	400	3 (Single phase 200VAC) 4 (Three-phase 200VAC)	800
RCS3-CTZ5C	60	Unlimited	120

● Calculating the connectable actuator motor wattage when connecting direct drive motors (DD/DDA)

When connecting the DD/DDA motor series, calculate the total wattage based on the "Controller wattage calculation output value" in the table below and make sure it does not exceed the maximum number of connected units.

* Single phase 100VAC cannot be connected.

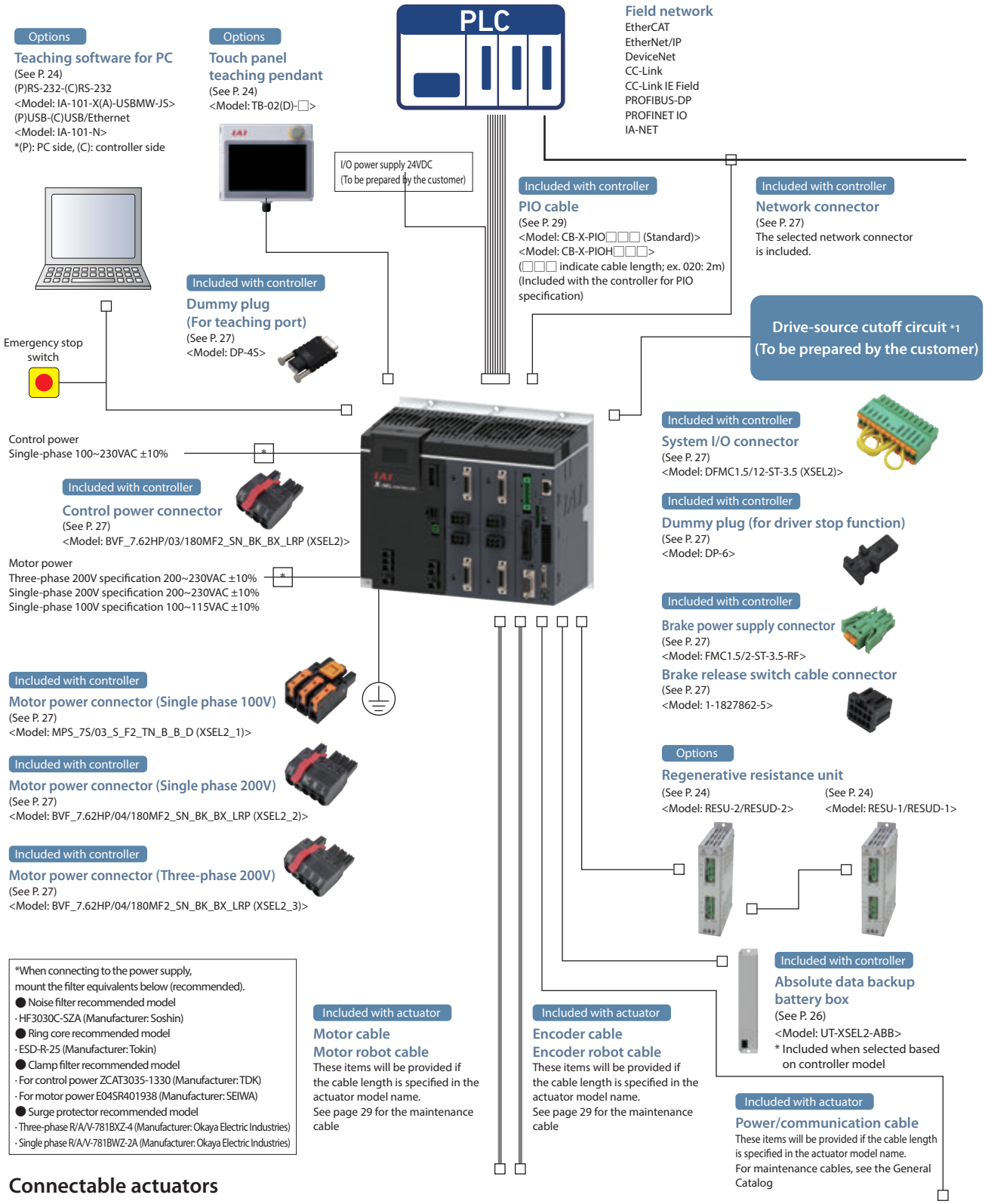
Motor wattage conversion when connected to single phase 200VAC

Actuator model	Applicable driver output [W]	DD/DDA Max. connected units [pcs]	Controller wattage calculation output value [W]
DD(CR/W)-TL18(C)□ DDA(CR)-LT18C□(A)	200	4	600
DD(CR/W)-LH18(C)□ DDA(CR/W)-LH18C□(A)	600	2	1,200

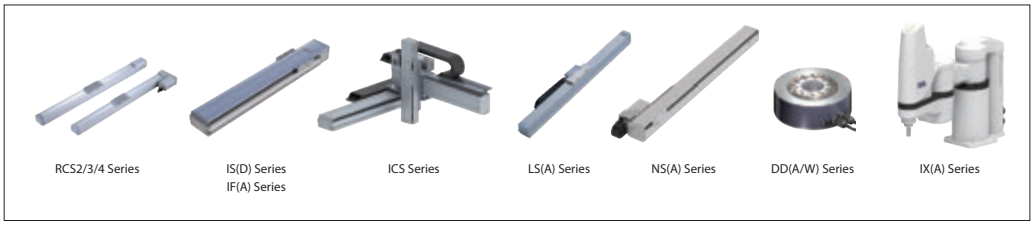
Motor wattage conversion when connected to three-phase 200VAC

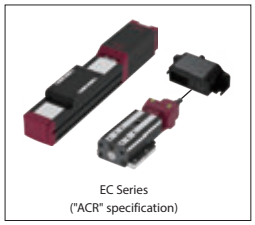
Actuator model	Applicable driver output [W]	DD/DDA Max. connected units [pcs]	Controller wattage calculation output value [W]
DD(CR/W)-TL18(C)□ DDA(CR)-LT18C□(A)	200	8	200
DD(CR/W)-LH18(C)□ DDA(CR/W)-LH18C□(A)	600	4	600

System Configuration



Connectable actuators





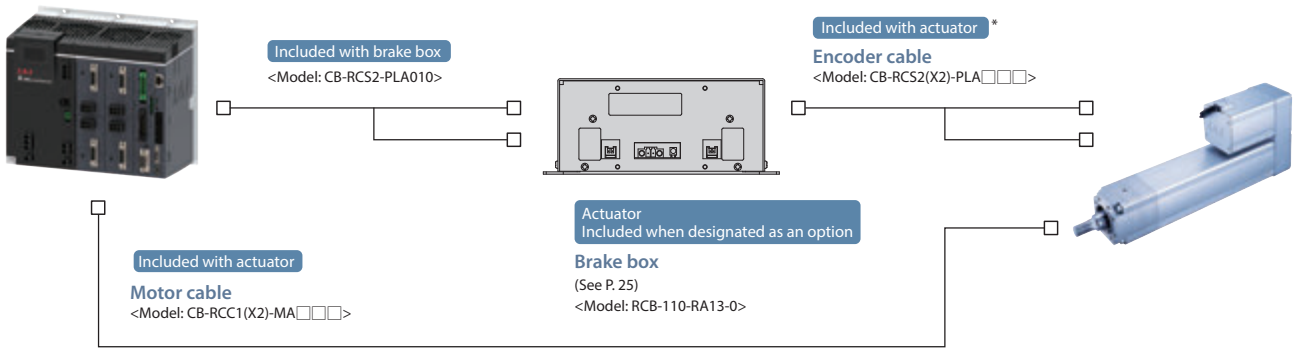
*1 To support up to safety category B~4 (ISO13849-1),
· Assemble an external circuit with the system I/O connector
· Use a teaching pendant (TB-02D) with a dead man's switch

* Connectable only when "EL" is selected for the I/O slot

System Configuration

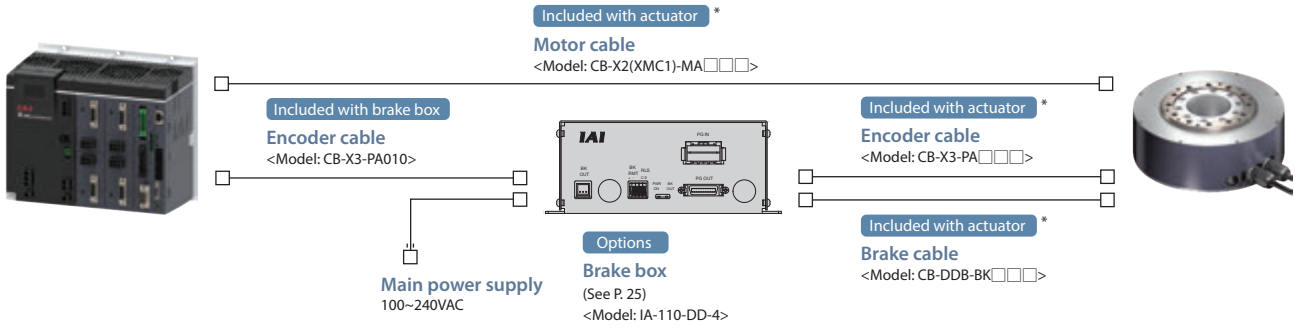
<Connecting the XSEL2 and RCS2-RA13R (brake specification)>

*These items will be provided if the cable length is specified in the actuator model name.
See page 29 for the maintenance cable



<Connecting the XSEL2 and DDA (brake specification)>

*These items will be provided if the cable length is specified in the actuator model name.
See page 29 for the maintenance cable



General Specifications

<XSEL2>

Item		Specification
Number of controlled axes	XSEL2-TS/TSX	1~4 axes
	XSEL2-TL/TLX	1~8 axes
Compatible motor capacity		12-1,000W
Total connectable wattage		Single-phase 100VAC: 800W Single-phase 200VAC: 2,400W Three-phase 200VAC: 3,200W
Controller power supply voltage		Single-phase 100~230VAC ±10%
Motor drive power supply voltage		Single-phase 100~115VAC ±10% Single-phase 200~230VAC ±10% Three-phase 200~230VAC ±10%
Power frequency		50Hz/60Hz
Inrush current (Note 1)	Control power	100A (Max.)
	Motor drive power	Three-phase specification: 60A (Max.) Single phase specification: 100A (Max.)
Leakage current (Note 2) (Excluding harmonic components)	Control power	0.5mA or less
	Motor drive power	3mA or less
Generated heat		See P. 15
PIO power supply (Note 3)		24VDC ± 10% Approx. 0.2A for each PIO board (excluding PIO external input/output current) (supplied from the outside)
Electromagnetic brake power (For actuator with brake)		24VDC ± 10% Approx. 0.4A (constant)/1A (supplied from the outside) for each actuator with brake
Momentary power failure resistance		20ms (when using power frequency 50Hz), 17ms (when using power frequency 60Hz)
Motor control method		Fully digital AC servo
Supported encoders		Battery-less absolute encoder, incremental serial encoder, or absolute serial encoder, ABZ(UVW) parallel encoder
Speed setting		1mm/s~ *Upper limit depends on the actuator specification
Acceleration setting		0.01G~ *Upper limit depends on the actuator specification
Serial communication Interface	Teaching port	Teaching tool dedicated connector (XSEL serial communication protocol (format B)) Connector : Honda Tsushin Kogyo HDR 26-pin
	USB port	USB2.0-compatible Connector: Mini-B
	Ethernet/ EtherNet/IP scanner	10/100/1000BASE-T Connector: RJ-45
	RS-232C	RS-232C: 1CH Speed: Max. 230.4kbps Connector: D-sub 9-pin Cable length: Max. 10m
External interface (Max. 2 specifications selected as options)	PIO specification	PIO board 24VDC dedicated signal input/output (no. of I/O points, NPN/PNP selection)
	Field network specification	DeviceNet, CC-Link, PROFIBUS-DP, EtherNet/IP, EtherCAT, CC-Link IE Field, PROFINET IO, IA-NET (DeviceNet, CC-Link, or PROFIBUS-DP and EtherNet/IP, EtherCAT, CC-Link IE Field, or PROFINET IO can be mounted simultaneously on the board.)
	Pulse-train input specification	Pulse-train input (2 CH) + PIO input/output (4 input/4 output) board
	Other	ELECYLINDER connection specification

General Specifications

Item		Specification		
Data setting, input method		Teaching software for PC, Touch Panel Teaching Pendant TB-02/02D, TB-03		
No. of axis groups		2 (1 group max. 8 axes)		
Programming language		SEL language		
Max. no. of programmable steps		36,000 steps		
Max. no. of programs		512 programs		
Max. no. of multi-tasking programs		16 programs		
Number of positions		Max. no. of positions	FRAM	Flash ROM
	Group No. 1	36,000	No.1 ~ No.5,000	No.5,001 ~ No.36,000
	Group No. 2	18,000 (per group)	No.1 ~ No.2,500	No.2,501 ~ No.18,000
Data retention memory		Flash ROM and FRAM		
Clock function		Retention time after power OFF: Approx. 10 days Charging time after date/time data loss: Approx. 100 hours		
System I/O		Emergency stop input, safety gate input, system ready output and other safety circuit I/O, MANU/AUTO external switching		
Safety circuit configuration	Drive-source cutoff method	All-axis batch shutdown via external safety circuit (duplexing possible)		
	Built-in drive-source cutoff circuit	All-axis batch shutdown via semiconductor (FET)		
	Emergency stop input	b contact (normally closed) input (internal or external power supply)		
	Enable input	b contact (normally closed) input (internal power supply)		
Driver stop Circuit configuration	Driver stop method	Power module control signal forced stop (all-axis batch)		
	Stop input	b contact (normally closed) input (internal or external power supply, duplexing possible)		
	Circuit operation verification output	Dry contact (transistor) output max. 100mA (24VDC)		
System ready output		Dry contact (relay) output max. 200mA (24VDC)		
Protection functionality		Motor overcurrent, overload, temperature abnormality, encoder disconnection detection, brake disconnection detection, soft limit over, system malfunction, battery abnormality, etc.		
Preventative/predictive maintenance function		Electrolytic capacitor capacity decrease, fan rotation speed decrease		
Regenerative resistor		Built-in 110Ω/180W regenerative resistor (Can be extended externally by external regenerative resistance connection)		
Absolute battery		AB-5 (attached to battery box)		
Electric shock protection mechanism		In addition to basic insulation as Class I electric shock prevention, when grounded with a ground terminal		
Overvoltage category		Category II input rating below 300VAC with 2,500V withstanding voltage		
Insulation resistance		500VDC 10MΩ or above (secondary-FG)		
Insulation withstanding voltage		1,500VAC for 1 minute (primary-FG)		
Cooling method		Forced air cooling		
Environment	Ambient operating temperature	0~+55°C		
	Ambient operating humidity	5~85% RH (no condensation)		
	Ambient storage temperature	-20~70°C (Excluding absolute battery)		
	Ambient storage humidity	5~85% RH (no condensation)		
	Operation upper limit altitude	1,000m		
	Vibration resistance	Frequency 10~57Hz Single-side width 0.075mm, Frequency 57~150Hz 9.8m/S^2 XYZ directions: Sweep time: 10 minutes, Number of sweeps: 10		
	Ingress protection	IP20		
	Contamination	Contamination 2		
External dimensions		See P. 19		
Mass	XSEL2-TS/TSX	3.9kg		
	XSEL2-TL/TLX	5.3kg		
Overseas standard support	Amended RoHS Directives	✓		
	CE Marking	✓		
	UL Standard	To be supported		
	TSCA	✓		

(Note 1) Inrush current when turning power on flows for 3ms. Note that the inrush current value varies depending on the impedance of the current line.
(Note 2) As leakage current varies depending on the connected motor capacity, the cable length, and the surrounding environment, when conducting leakage protection, measure leakage current at the earth leakage breaker installation area.
Regarding the earth leakage breaker, select with attention to the purpose (fire prevention, injury prevention, etc.). Use a harmonics supported earth leakage breaker (for inverters).
(Note 3) When not using PIO, power supply is not required.

Power Capacity and Generated Heat

Use the formulae below to calculate power capacity and generated heat.
Rated power capacity [VA] = sum of motor power capacity [VA] + control part power capacity [VA]
Generated heat [W] = sum of output loss [W] + control part generated heat [W]
*When connecting additional axes to a SCARA robot, include the additional axes in the calculation.

Actuator Motor Power Capacity and Output Loss

Actuator motor wattage [W]	Motor power capacity [VA]	Output loss = generated heat [W]
20	26	1.58
30D (excluding RS)	46	2.07
30R (for RS)	138	3.39
60	138	3.39
100	234	6.12
150	328	8.30
200	421	9.12
400	796	19.8
600	1,164	27.2
750	1,521	29.8
100 (Linear actuator LSAS-N10S□) (*1)	379	4.48
200 (Linear actuator LSAS-N15S□) (*1)	486	4.37
200 (Linear actuator LSAS-N15H□) (*1)	773	6.42
400 (LSA-W21S) (*1)	920	16.7
1000 (LSA-W21H) (*1)	1843	37.8
DD/DDA (200W)	503	7.50
DD/DDA (600W)	1,462	20.8
RCS3-CTZ5C (60W) (*2)	197	3.60
RCS3-CT8C (400W) (*2)	1,230	18.0

*1 Linear actuator specification value is the value with 1 slider.
*2 To calculate power capacity, etc., use 120W for RCS3-CTZ5C and 800W for RCS3-CT8C.

SCARA Robot Motor Power Capacity and Output Loss

SCARA Robot	Power [W] (rated output)	Motor power capacity [VA]	Output loss = generated heat [W]
IXA-3NNN1805	319.4	532.3	10.7
IXA-3NNN3015	1,330.4	2,217.3	34.0
IXA-3NNN45□□	1,178.8	1,964.7	33.3
IXA-3NNN60□□	1,469.1	2,448.5	43.6
IXA-4NNN1805	356.0	593.4	14.3
IXA-4NNN3015	1,582.3	2,637.1	40.3
IXA-4NNN45□□	1,370.6	2,284.3	38.6
IXA-4NNN60□□	1,660.9	2,768.1	48.9
IXA-4NNN80□□	3,468.5	5,780.8	82.3
IXA-4NNN100□□	3,398.3	5,663.8	82.3
IXA-3NSN3015	2,343.0	3,905.1	54.0
IXA-3NSN45□□	2,533.6	4,222.7	55.3
IXA-3NSN60□□	2,413.5	4,022.6	56.3
IXA-4NSN3015	2,594.9	4,324.8	60.4
IXA-4NSN45□□	2,725.4	4,542.3	60.5
IXA-4NSN60□□	2,605.3	4,342.2	61.6
IXA-4NSC3015	2,616.5	4,360.8	60.5
IXA-4NSC45□□	2,725.4	4,542.3	60.5
IXA-4NSC60□□	2,656.5	4,427.5	61.6
IXA-4NSW3015	2,555.5	4,259.1	61.6
IXA-4NSW45□□	2,399.3	3,998.9	60.5
IXA-4NSW60□□	2,496.2	4,160.3	61.6

● Control part power capacity and generated heat

<For single-axis and cartesian>

Controller Number of controlled axes		Control part power capacity [VA]	Control part generated heat [W]
1-axis specification	XSEL2-TS-1	114.65	53.07
	XSEL2-TL-1	122.08	56.19
2-axis specification	XSEL2-TS-2	131.08	60.90
	XSEL2-TL-2	138.51	64.02
3-axis specification	XSEL2-TS-3	147.51	68.73
	XSEL2-TL-3	154.94	71.85
4-axis specification	XSEL2-TS-4	163.95	76.55
	XSEL2-TL-4	171.38	79.67
5-axis specification	XSEL2-TL-5	187.81	87.50
6-axis specification	XSEL2-TL-6	204.24	95.33
7-axis specification	XSEL2-TL-7	220.67	103.16
8-axis specification	XSEL2-TL-8	237.10	110.99

<For SCARA>

Controller Number of controlled axes		Control part power capacity [VA]	Control part generated heat [W]
3-axis specification	XSEL2-TSX-3	147.51	68.73
	XSEL2-TLX-3	154.94	71.85
4-axis specification	XSEL2-TSX-4	163.95	76.55
	XSEL2-TLX-4	171.38	79.67
5-axis specification	XSEL2-TLX-5	187.81	87.50
6-axis specification	XSEL2-TLX-6	204.24	95.33
7-axis specification	XSEL2-TLX-7	220.67	103.16
8-axis specification	XSEL2-TLX-8	237.10	110.99

* Control part power capacity and generated heat are the maximum values.
Includes teaching and 2 I/O slots.

■ Circuit Breaker Selection

The controller current reaches 3 times the rated value during acceleration and deceleration.
Select a unit that will not trip when this current is flowing.
If tripped, select a rated breaker one level higher.
Select a unit that will not trip during inrush current.

Single-phase power

<Circuit breaker rated current value>

Rated power capacity [VA] ÷ AC input voltage x safety factor (guideline 1.2~1.4)

Three-phase power

<Circuit breaker rated current value>

Rated power capacity [VA] ÷ AC input voltage x safety factor (guideline 1.2~1.4) ÷√3

■ Earth Leakage Breaker Selection

Regarding the earth leakage breaker, select with attention to the purpose (fire protection, injury prevention, etc.).
As leakage current varies depending on the connected motor capacity, the cable length, and the surrounding environment, when conducting leakage protection, measure leakage current at the earth leakage breaker installation area.
Use a harmonics supported earth leakage breaker.
Use one earth leakage breaker for each controller.

General Specifications (Software)

<PLC>

Item		Specification
Runtime version		V3.5.18.20 + EtherNet/IP 4.4.1.0
Cyclic cycle		1ms up
IEC program capacity		3MB
Source capacity		10MB
Data capacity		1MB
Data capacity (RETAIN)		8KB
Data capacity (PERSISTENT)		4KB
No. of execution tasks		8 (1 when freewheeling)
Programming language		IEC 61131-3 compliant, 5 languages (LD, IL, FBD, ST, SFC) + CFC
Program type		Cyclic, event, status, freewheel
Calculation control method		Stored program method
I/O control method		Refresh method
Calculation processing performance (execution time)	Bit calculation	5ns up
	Integer calculation (excluding subtraction)	9ns up
	Integer calculation (subtraction)	97ns up
	Real number calculation (excluding subtraction)	66ns up
	Real number calculation (subtraction)	87ns up
	Data transfer (integers)	5ns up
	Data transfer (real numbers)	5ns up
Calculation processing performance (PLC-MIX *1)	Basic	15.905
	Applied	5.71
	General	9.974
Connection with CODESYS		Ethernet, USB* When using USB, CODESYS and other tools (teaching software for PC, teaching pendant) cannot be simultaneously connected.
No. of Ethernet port in use		1740: CODESYS 2222, 44818: EtherNet/IP scanner 4840: OPC UA server
No. of I/O points with SEL part		Input 1024 points/output 1024 points (fixed)
EtherNet/IP	No. of connection adapters	16
	Communication cycle (RPI)	10ms up
	Status LED	ML, NL
	Address competition (ACD)	Not supported
OPC UA	Information model	PLC Open Information Model for IEC 61131-3
	No. of connection clients	2
Switch/Display	Panel window	7-segment LED (PLC RUN, PLC ERR. Letters/numbers do not display PLC status.)
	AUTO/MANU mode change switch	AUTO/MANU
Clock function		Retention time: about 10 days, Charging time: about 100 hours
External memory		None
Startup time		Approx. 20 seconds to 1 minute
Momentary power failure		20ms (when using power frequency 50Hz)
		17ms (when using power frequency 60Hz)
Diagnostic functions		Memory abnormality, watchdog timer abnormality, etc.

*1 PLC MIX: PLC calculation processing performance indicator. Number of commands executed per 1 μs weighted by command distribution ratio
Basic PLC-MIX: Used only for basic commands (bit I/O processing and timer/counter)
Applied PLC-MIX: Used for applied command words (calculation and transfer for 16 bits)
General PLC-MIX: Used for both basic and applied commands

<CODESYS operating environment>

Item	Description
Operating system	Windows10 (64-bit) Windows11 (64-bit)
Computer body	PC with supported OS (Windows) operating
CPU	2.5GHz or above recommended
Main memory	8GB or above recommended
Hard disk	12GB or above recommended
Display	WXGA (1366 × 768) or above
Keyboard	Keyboard compatible with PC with supported OS (Windows) operating
Pointing device	Compliant driver such as mouse
Communication port	USB or Ethernet port
Supported languages	Japanese/English/German/Chinese (Simplified)

General Specifications (Software)

<EtherNet/IP scanner>

Item			Details
Cyclic communication	No. of connections		16
	Connection type		Point-to-point Multicast
	Transmit trigger		Cyclic
	Max. data size per connection		1444 bytes
	RPI		Min. 10ms
	Cyclic communication allowable communication band		1600pps
Message communication	Class3	No. of connections	16
	UCMM	No. of connections	16
EtherNet/IP conformance testing			CT19.1

● EtherNet/IP scanner functions use standard Ethernet ports.
● Communication status can be confirmed with network monitor LED.

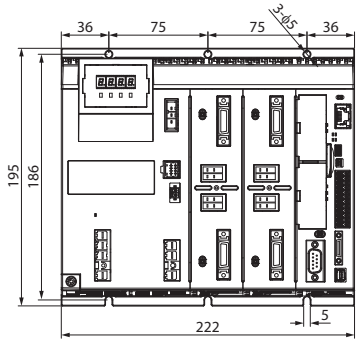
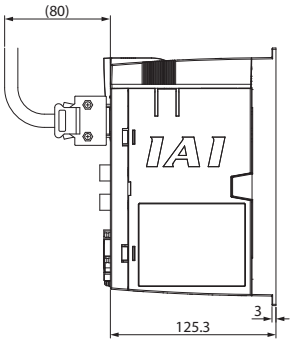
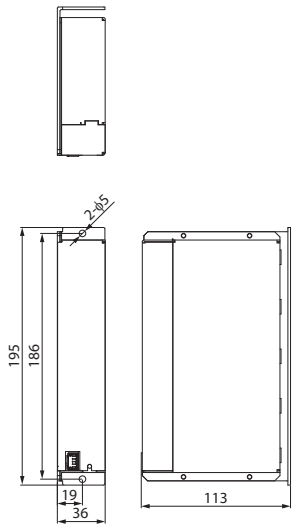
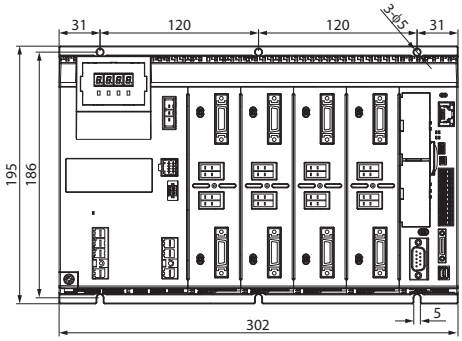
<OPC UA server function specifications>

Item		Description
Connection port used		CPU unit built-in Ethernet port *Can be used simultaneously with other Ethernet communication
Profile		Embedded UA Server Profile 1.04
Information model		PLC Open Information Model for IEC 61131-3
Transport		UA TCP
URL (endpoint URL) designation method		opc.tcp://[IP address]:[Port No.] Ex. opc.tcp://192.168.0.10:4840
Max. no. of sessions (clients)		2
No. of monitor items		200
Variable type not publicized		· Text string type (STRING possible, WSTRING not possible) · Time type (LDATE_AND_TIME (LDT) only possible, other types not possible) · Constant type (const), interface, property · Union, pointer
Variable name restrictions		· Max. 255 characters · 1-byte characters (letters, numbers, symbols)
OPC UA security mode		· None: Signature/encrypting not required · Sign: Signature only required · Sign&Encrypt: Signature/encrypting required
OPC UA security policy		· Basic256Sha256 · Aes128_Sha256_RsaOaep · Aes256_Sha256_RsaPss
Application certification	Certificates	· Own Certificates · Trusted Certificates · UnTrusted Certificates · Quarantined Certificates *8 each can be registered
	Certificate standard	X509 compliant
User certification		· Username&Password

* Sampling cycle is set by OPC UA client. For the XSEL2 OPC UA server, according to the sampling cycle set by the client, 100ms, 300ms, 500ms, 1000ms, 2500ms, or 5000ms is selected for operation.

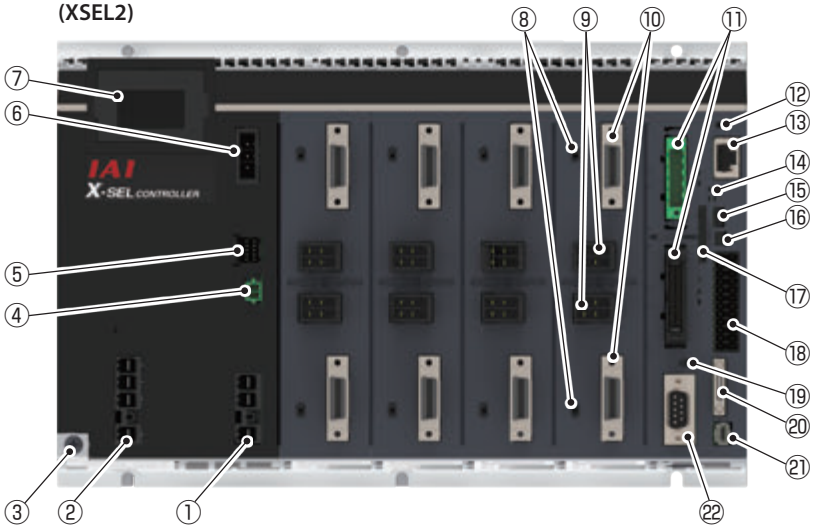
External Dimensions

CAD drawings can be downloaded from our website. www.intelligentactuator.com 2D CAD 3D CAD

Type	Front	Side	Absolute data backup battery box
XSEL2-TS/TSX			
XSEL2-TL/TLX			

Name of Each Component

(XSEL2)



(Absolute data backup battery box)

① AC control power input connector
Connector for control power single phase input.
It consists of 3 terminals: control power terminals L and N and PE terminal.

② Motor power input connector
Connector for motor power input.

③ FG (frame ground) connection terminal
Screw for protective grounding. Be sure to ground.

④ Brake power input connector
Connector for brake release for any actuators equipped with a brake.
Supply 24VDC, approx. 0.4A (per axis).

⑤ Brake release switch cable connector
Connector for remote release of the actuator brake by connecting a remote switch.
SCARA robot brake release is also possible.

⑥ External regenerative resistance unit cable connector
Connector for the external regenerative resistance unit.

⑦ Panel window
4-digit 7-segment display and 4 LEDs indicate controller status.

⑧ Brake release switch
Switch used to forcibly release the brake of the actuator with brake (released by supplying power). When starting up the device or moving the actuator by hand during teaching or in case of abnormality, switch to the RLS side to force the brake to release.
As long as it is not required, keep the switch to the NOM side.

Switch position		Function
RLS Forced release	Top	The brake is forcibly released.
NOM Automatic mode	Bottom	The brake is automatically controlled by the controller. · Servo ON: Brake release · Servo OFF: Brake enabled

⑨ Connector for motor cable
Connector for the actuator motor cable.

⑩ Connector for encoder cable
Connector for the actuator encoder cable.

⑪ I/O slot 1, I/O slot 2
Connector for selected PIO or field network I/O cards.

⑫ AUTO/MANU operation mode change switch
Switch used to specify the operation mode of the controller.
Change position with a thin-tipped tool such as a flathead screwdriver.

Switch No.		Function
MANU (Manual mode)	Left side	This mode is for teaching with PC, TP, etc., and for trial operation. Actuator speed is restricted to safety speed. Teaching tool can be used.
AUTO (Automatic mode)	Right side	This mode is for operation according to set programs. Automatic program start is also possible when the power is on (parameter setting required). Actuator speed operates in accordance with the speed set by the program. Teaching tool cannot be used. (Note) Mount the included dummy plug on the ⑳ teaching connector. If not, the emergency stop cannot be released.

⑬ Ethernet connector
Connector for external Ethernet communication devices.

⑭ Status LED
LED showing CPU unit operation status.

Item	Description
PWR	
STATUS	
ML	
NL	

⑮ System operation setting switch
Switch for setting the system operation mode. Normally, use the settings below.

Switch No.	Settings
1	OFF
2	OFF
3	OFF
4	OFF

⑯ USB connector
USB connector for connecting to a PC.
Using the teaching software for PC, the actuator can be operated, set, and so on.
The connector is a Mini-B.

⑰ SD card memory slot
Commercially available SD/SDHC cards can be used.
(SD/SDHC card 32GB or below, FAT16/32 file system)
*Usable only for update function

⑱ System I/O connector
I/O connector that handles controller safety control.
It is possible to configure safety circuits of up to category 4 with this connector and an external safety circuit.

⑲ General-purpose SIO change switch
Switch that determines whether the system operation setting switch general-purpose SIO port is used with RS-232C or RS-485.
The switch must be operated when the controller power is off.

Switch position	Function
Left side	RS-232C
Right side	RS-485

⑳ Teaching connector
Connector for teaching pendant or PC (teaching software for PC). Used for teaching such as actuator operation, setting, etc.

㉑ Driver stop connector
I/O connector for the function which cuts off motor current and stops the motor.
When not using the driver stop function, the included short-circuit connector (DP-6) must be mounted to render the actuator operable.

㉒ General-purpose SIO connector
Connection port for external RS-232C or RS-485 devices.

㉓ Absolute battery cable connector
Connector for the absolute data backup battery box when the absolute specification is chosen.

㉔ Absolute battery cable connector (absolute data backup battery box)
Connector for the absolute battery connecting cable.

I/O Slot Part

PIO (NP/PN) connection specification

(Input 16 points/output 16 points specification) *Accessory: PIO cable (CB-PAC-PIO□□□)

Pin No.	Signal name	Description	Pin No.	Signal name	Description
(1)(41)	P24	Power (+24V input)	(21)(61)	OUT0	Output
(2)(42)	P24	Power (+24V input)	(22)(62)	OUT1	Output
(3)(43)	-	Not used	(23)(63)	OUT2	Output
(4)(44)	-	Not used	(24)(64)	OUT3	Output
(5)(45)	IN0	Input	(25)(65)	OUT4	Output
(6)(46)	IN1	Input	(26)(66)	OUT5	Output
(7)(47)	IN2	Input	(27)(67)	OUT6	Output
(8)(48)	IN3	Input	(28)(68)	OUT7	Output
(9)(49)	IN4	Input	(29)(69)	OUT8	Output
(10)(50)	IN5	Input	(30)(70)	OUT9	Output
(11)(51)	IN6	Input	(31)(71)	OUT10	Output
(12)(52)	IN7	Input	(32)(72)	OUT11	Output
(13)(53)	IN8	Input	(33)(73)	OUT12	Output
(14)(54)	IN9	Input	(34)(74)	OUT13	Output
(15)(55)	IN10	Input	(35)(75)	OUT14	Output
(16)(56)	IN11	Input	(36)(76)	OUT15	Output
(17)(57)	IN12	Input	(37)(77)	-	
(18)(58)	IN13	Input	(38)(78)	-	
(19)(59)	IN14	Input	(39)(79)	N	Power (0V)
(20)(60)	IN15	Input	(40)(80)	N	Power (0V)

PIO (N1/P1) connection specification

(Input 32 points/output 16 points specification) *Accessory: PIO cable (CB-X-PIO□□□)

Pin No.	Signal name	Description	Pin No.	Signal name	Description
(1)	P24	Power (+24V input)	(26)	IN24	Input
(2)	IN0	Input	(27)	IN25	Input
(3)	IN1	Input	(28)	IN26	Input
(4)	IN2	Input	(29)	IN27	Input
(5)	IN3	Input	(30)	IN28	Input
(6)	IN4	Input	(31)	IN29	Input
(7)	IN5	Input	(32)	IN30	Input
(8)	IN6	Input	(33)	IN31	Input
(9)	IN7	Input	(34)	OUT0	Output
(10)	IN8	Input	(35)	OUT1	Output
(11)	IN9	Input	(36)	OUT2	Output
(12)	IN10	Input	(37)	OUT3	Output
(13)	IN11	Input	(38)	OUT4	Output
(14)	IN12	Input	(39)	OUT5	Output
(15)	IN13	Input	(40)	OUT6	Output
(16)	IN14	Input	(41)	OUT7	Output
(17)	IN15	Input	(42)	OUT8	Output
(18)	IN16	Input	(43)	OUT9	Output
(19)	IN17	Input	(44)	OUT10	Output
(20)	IN18	Input	(45)	OUT11	Output
(21)	IN19	Input	(46)	OUT12	Output
(22)	IN20	Input	(47)	OUT13	Output
(23)	IN21	Input	(48)	OUT14	Output
(24)	IN22	Input	(49)	OUT15	Output
(25)	IN23	Input	(50)	N	Power (0V)

PIO (N2/P2) connection specification

(Input 16 points/output 32 points specification) *Accessory: PIO cable (CB-X-PIO□□□)

Pin No.	Signal name	Description	Pin No.	Signal name	Description
(1)	P24	Power (+24V input)	(26)	OUT8	Output
(2)	IN0	Input	(27)	OUT9	Output
(3)	IN1	Input	(28)	OUT10	Output
(4)	IN2	Input	(29)	OUT11	Output
(5)	IN3	Input	(30)	OUT12	Output
(6)	IN4	Input	(31)	OUT13	Output
(7)	IN5	Input	(32)	OUT14	Output
(8)	IN6	Input	(33)	OUT15	Output
(9)	IN7	Input	(34)	OUT16	Output
(10)	IN8	Input	(35)	OUT17	Output
(11)	IN9	Input	(36)	OUT18	Output
(12)	IN10	Input	(37)	OUT19	Output
(13)	IN11	Input	(38)	OUT20	Output
(14)	IN12	Input	(39)	OUT21	Output
(15)	IN13	Input	(40)	OUT22	Output
(16)	IN14	Input	(41)	OUT23	Output
(17)	IN15	Input	(42)	OUT24	Output
(18)	OUT0	Output	(43)	OUT25	Output
(19)	OUT1	Output	(44)	OUT26	Output
(20)	OUT2	Output	(45)	OUT27	Output
(21)	OUT3	Output	(46)	OUT28	Output
(22)	OUT4	Output	(47)	OUT29	Output
(23)	OUT5	Output	(48)	OUT30	Output
(24)	OUT6	Output	(49)	OUT31	Output
(25)	OUT7	Output	(50)	N	Power (0V)

PIO (N4/P4) connection specification

(Input 24 points/output 24 points specification) *Accessory: PIO cable (CB-X-PIO□□□)

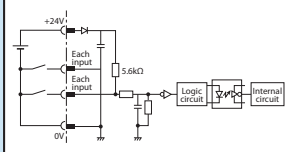
Pin No.	Signal name	Description	Pin No.	Signal name	Description
(1)	P24	Power (+24V input)	(26)	OUT0	Output
(2)	IN0	Input	(27)	OUT1	Output
(3)	IN1	Input	(28)	OUT2	Output
(4)	IN2	Input	(29)	OUT3	Output
(5)	IN3	Input	(30)	OUT4	Output
(6)	IN4	Input	(31)	OUT5	Output
(7)	IN5	Input	(32)	OUT6	Output
(8)	IN6	Input	(33)	OUT7	Output
(9)	IN7	Input	(34)	OUT8	Output
(10)	IN8	Input	(35)	OUT9	Output
(11)	IN9	Input	(36)	OUT10	Output
(12)	IN10	Input	(37)	OUT11	Output
(13)	IN11	Input	(38)	OUT12	Output
(14)	IN12	Input	(39)	OUT13	Output
(15)	IN13	Input	(40)	OUT14	Output
(16)	IN14	Input	(41)	OUT15	Output
(17)	IN15	Input	(42)	OUT16	Output
(18)	IN16	Input	(43)	OUT17	Output
(19)	IN17	Input	(44)	OUT18	Output
(20)	IN18	Input	(45)	OUT19	Output
(21)	IN19	Input	(46)	OUT20	Output
(22)	IN20	Input	(47)	OUT21	Output
(23)	IN21	Input	(48)	OUT22	Output
(24)	IN22	Input	(49)	OUT23	Output
(25)	IN23	Input	(50)	N	Power (0V)

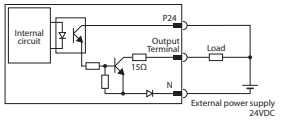
I/O interface

(NP/PN specification)

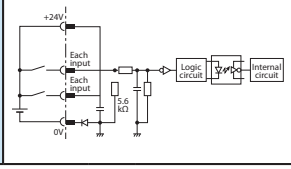
Specification	Input part			Output part	
	Input voltage		24VDC ±10%	Load voltage	24VDC ±10%
	Input current		4mA/1 circuit	Load current	50mA/1 circuit
	ON/OFF voltage	ON	Min. 18.0VDC		
		OFF	Max. 6.0VDC		
	Isolation method		Photocoupler isolation	Isolation method	Photocoupler isolation

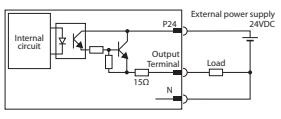
NPN





PNP

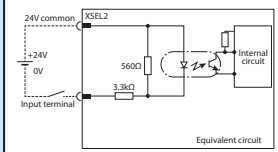


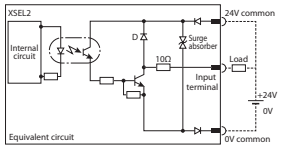


(N1/N2/N4/P1/P2/P4 specifications)

Specification	Input part			Output part	
	Input voltage		24VDC ±10%	Load voltage	24VDC ±10%
	Input current		7mA/1 circuit	Load current	100mA/1 circuit 800mA *1/all ports total
	ON/OFF voltage	ON	Min. 16.0VDC		
		OFF	Max. 5.0VDC		
	Isolation method		Photocoupler isolation	Isolation method	Photocoupler isolation

NPN





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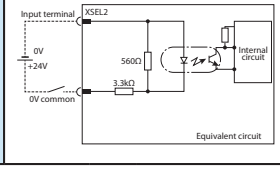
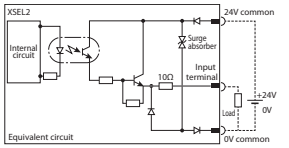




*1 Keep the total load current for all ports at or below 800mA.

CC-Link connection specification

Pin No.	Signal name	Description
1	DA	Communication line A
2	DB	Communication line B
3	DG	Digital GND
4	SLD	Connects shield cable's shield
5	FG	Frame ground

Accessory: Network connector
(Model: MSTB2.5/5-STF-5.08 AU with terminal resistance 110 Ω /130 Ω)

CC-Link IE Field connection specification

Pin No.	Signal name	Description	Compliant wire diameter/cable connector model
1	TP0+	Data 0+	For the Ethernet cable, use a straight STP cable of Category 5e or higher. Ethernet ANSI/TIA/EIA-568-B Category 5e or higher shielded 8P8C modular plug (RJ-45)
2	TP0-	Data 0-	
3	TP1+	Data 1+	
4	TP2+	Data 2+	
5	TP2-	Data 2-	
6	TP1-	Data 1-	
7	TP3+	Data 3+	
8	TP3-	Data 3-	

Recommended communication cable: Enhanced Category 5 standard or higher

DeviceNet connection specification

Pin No.	Signal name	Description
1	Red	Power cable + side
2	White	Communication data high side
3	-	Shield
4	Blue	Communication data low side
5	Black	Power cable - side

Accessory: Network connector (Model: MSTB2.5/5-STF-5.08 AUM)

EtherCAT® connection specification

Pin No.	Signal name	Signal abbreviation
1	Transmitting data +	TD+
2	Transmitting data -	TD-
3	Receiving data +	RD+
4	Not used	
5	Not used	
6	Receiving data -	RD-
7	Not used	
8	Not used	
Connector hood	Function grounding	FG

Recommended communication cable: Category 5 or above (double-shielded aluminum tape braided cable recommended)

EtherNet/IP / PROFINET IO connection specification

Pin No.	Signal name	Signal abbreviation
1	Transmitting data +	TD+
2	Transmitting data -	TD-
3	Receiving data +	RD+
4	Not used	
5	Not used	
6	Receiving data -	RD-
7	Not used	
8	Not used	
Connector hood	Function grounding	FG

Recommended communication cable: Ethernet ANSI/TIA/EIA-568-B Category 5 or above (double-shielded aluminum tape braided cable recommended)

PROFIBUS-DP connection specification

Pin No.	Signal name	Description
1	NC	Not connected
2	NC	Not connected
3	B-Line	Communication line B (RS-485)
4	RTS	Transmission request
5	GND	Signal GND (isolation)
6	+5V	+5V output (isolation)
7	NC	Not connected
8	A-Line	Communication line A (RS-485)
9	NC	Not connected
Housing	Shield	Shielded cable (connected to controller internal FG)

Communication cable: Shielded twisted-pair cable AWG18

IA-NET connection specification

Pin No.	Signal name	Signal abbreviation
1	-	
2	-	
3	-	
4	SB	Transmitting/receiving data B
5	SA	Transmitting/receiving data A
6	-	
7	-	
8	-	

Communication cable: Communication cable for Ethernet LAN
*Straight cable with performance at least equivalent to 10BASE-T, Category 3 or above, common sealed

Pulse-train PIO input/output (PIN) connection specification

Pulse-train

Pin No.	Signal name	Description
(1)(31)	E5.5V	Power output for encoder
(2)(32)	E5.5G	Power GND for encoder
(3)(33)	Z+(CH1)	Encoder differential input Z-phase + (CH1)
(4)(34)	Z-(CH1)	Encoder differential input Z-phase - (CH1)
(5)(35)	B+(CH1)	Encoder differential input B-phase + (CH1)
(6)(36)	B-(CH1)	Encoder differential input B-phase - (CH1)
(7)(37)	A+(CH1)	Encoder differential input A-phase + (CH1)
(8)(38)	A-(CH1)	Encoder differential input A-phase - (CH1)
(9)(39)	NC	Empty
(10)(40)	FG	Sealed wire connected terminal (controller FG)
(11)(41)	E5.5V	Power output for encoder
(12)(42)	E5.5G	Power GND for encoder
(13)(43)	Z+(CH0)	Encoder differential input Z-phase + (CH0)
(14)(44)	Z-(CH0)	Encoder differential input Z-phase - (CH0)
(15)(45)	B+(CH0)	Encoder differential input B-phase + (CH0)
(16)(46)	B-(CH0)	Encoder differential input B-phase - (CH0)
(17)(47)	A+(CH0)	Encoder differential input A-phase + (CH0)
(18)(48)	A-(CH0)	Encoder differential input A-phase - (CH0)
(19)(49)	NC	Empty
(20)(50)	FG	Sealed wire connected terminal (controller FG)

PIO (input 4 points/output 4 points specification)

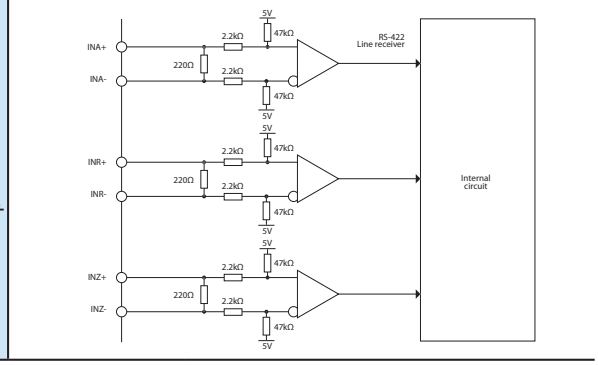
Pin No.	NPN connection		PNP connection	
	Signal name	Description	Signal name	Description
(21)(51)	OUT3	Output	OUT3	Output
(22)(52)	OUT2	Output	OUT2	Output
(23)(53)	OUT1	Output	OUT1	Output
(24)(54)	OUT0	Output	OUT0	Output
(25)(55)	N	Power (0V)	P24	Power (+24V input)
(26)(56)	IN3	Input	IN3	Input
(27)(57)	IN2	Input	IN2	Input
(28)(58)	IN1	Input	IN1	Input
(29)(59)	IN0	Input	IN0	Input
(30)(60)	P24	Power (+24V input)	N	Power (0V)

I/O interface

(pulse-train input part)

	Item	Description
Specification	Signal format	RS-422 compliant differential signal A-phase/B-phase(/Z-phase)
	No. of input channels	2 channels
	Response frequency	Max. 1Mpps (A-phase/B-phase), 50kpps (Z-phase)
	Input resistance	220Ω
	Power output voltage	5.5VDC ±5% (max. 200mA (2-channel total))
	Isolation method	Digital isolator isolation

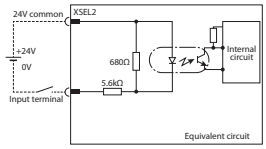
Input circuit

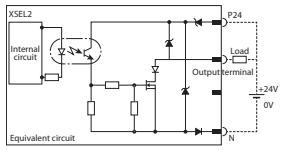


(I/O input part)

		Input part		Output part	
Specification	Input voltage		24VDC ±10%	Load voltage	24VDC ±10%
	Input current		4mA/1 circuit	Load current	50mA/1 circuit
	ON/OFF voltage	ON	Min. 16.0VDC		
		OFF	Max. 5.0VDC		
	Isolation method		Photocoupler isolation	Isolation method	Photocoupler isolation

NPN





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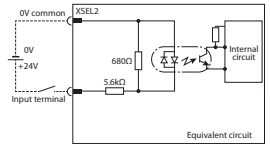
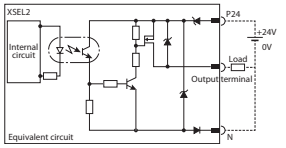




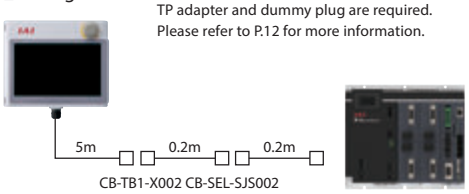
Options

Touch panel teaching pendant

Features A teaching device equipped with functions such as position teaching, trial operation, and monitoring.

Model **TB-02(D)-□**

Configuration *For safety category compliance, a separate TP adapter and dummy plug are required. Please refer to P.12 for more information.



Specifications

Rated voltage	24VDC
Power consumption	3.6W or less (150mA or less)
Ambient operating temperature	0 to 40°C
Ambient operating humidity	5% RH to 85% RH (no condensation or freezing)
Ingress protection	IP20
Mass	470g (TB-02 unit only)

Teaching software for PC

Model **IA-101-N** (software only; for those already equipped with a dedicated connection cable)

* Please purchase through your distributor and a download link will be sent to your valid email address.

Please contact IAI for the current supported versions.

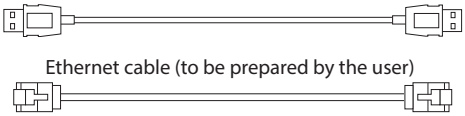
Configuration

Cable	Controller side connector	Maximum cable length
USB cable specification	USB Mini-B	5m
Ethernet cable specification	10/100/1,000BASE-T (RJ-45)	100m

Notes

When operating the actuator by USB connection, be sure to connect the stop switch to the system I/O connector.

Software
(Download Only)



Supported Windows versions: 10/11

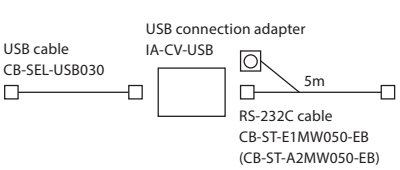
Model **IA-101-X-USBMW-JS/IA-101-XA-USBMW-JS** (safety category 4 compliant)
(With RS-232C cable + connector conversion cable + USB conversion adapter + USB cable)

* Please purchase through your distributor and a download link will be sent to your valid email address.

Please contact IAI for the current supported versions.

Configuration

Teaching software for PC
(Download Only)



Regenerative resistance unit

CAD drawings can be downloaded from our website. www.intelligentactuator.com 2D CAD 3D CAD

Features This unit converts the regenerative current which is generated when the motor decelerates into heat. A regenerative resistor is also built into XSEL2, but for large additions the capacity is insufficient, so an external regenerative resistor will be required.

Model **RESU-1/2** (standard specification)
RESUD-1/2 (DIN rail mounting specification)

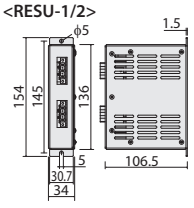
[Precautions for preparation and connection]
· For direct connection with XSEL2, prepare the RESU(D)-2.
· For the second unit on, when connecting regenerative resistance units, prepare the RESU(D)-1.

Specifications

Connection	Direct connection with XSEL2		Connection between regenerative resistance units	
Model	RESU-2	RESUD-2	RESU-1	RESUD-1
Unit weight	About 0.4kg			
Built-in regenerative resistance value	235Ω 80W			
Body mounting method	Screw mount	DIN rail mount	Screw mount	DIN rail mount
Attached cable	CB-SC-REU010		CB-ST-REU010	

External Dimensions

<RESU-1/2>



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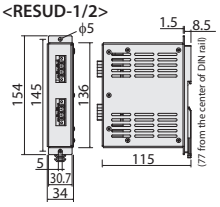


Equipment Standards Determined by the connected axis motor capacity.

<When connecting a single-axis actuator>

Motor total capacity		Regenerative resistor units required
Horizontal	Vertical	
Up to 1,200W	Up to 1,000W	0 (not required)
Up to 1,800W	Up to 1,400W	1
Up to 2,400W	Up to 2,000W	2
Up to 2,800W	Up to 2,400W	3
Up to 3,200W	Up to 2,800W	4
-	Up to 3,200W	5

*When connecting with a combination of single-axis and other special models, add 1 regenerative resistor to the total of the required number of regenerative resistance units for the single-axis total wattage and for the special model.

For the models below, use the table below as a guideline

No. of units connected	Required number of regenerative resistance units		
	DD(A)-LT18□	DD(A/W)-LH18□	RCS2-RA13R
1	0 (not required)	0 (not required)	0 (not required)
2	0 (not required)	2	0 (not required)
3	1	4	1
4	2	6	2
5	3		
6	4		
7	5		
8	6		

<When connecting an IXA SCARA robot>

IXA model		Regenerative resistor units required
Series	Size	
NNN	1805 3015 45□□ 60□□	0 (not required)
	80□□ 100□□	4
NSN NSC	3015 45□□	1
NSW	60□□	2

Brake box

CAD drawings can be downloaded from our website. www.intelligentactuator.com 2D CAD 3D CAD

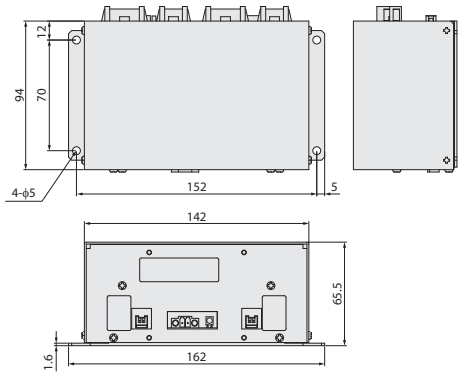
Features: Required when connecting to the RCS2-RA13R actuator.

Model: **RCB-110-RA13-0**

Specifications

Item	Specification
Power supply voltage, current	24VDC ± 10% 1A
Connection cable (included)	Encoder cable (Model CB-RCS2-PLA010) 1m
Number of controlled axes	2

External Dimensions



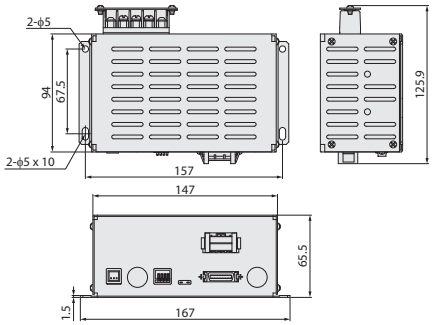
Features: Required when connecting to the DDA actuator with brake.

Model: **IA-110-DD-4**

Specifications

Item		Specification
Input power supply voltage		100~240VAC ±10%
Input power current	Rated excitation	100VAC: 0.25A/200VAC: 0.15A
	Over-excitation	100VAC:0.6A/200VAC:0.3A
Generated heat		6.0W (rated excitation)/10.0W (over-excitation)
Over-excitation time		1.2s ±0.2s
Connection cable (included)		Encoder cable (Model CB-X3-PA010) 1m
Environment	Ambient operating temperature	0 to 40°C
	Ambient operating humidity	5~85% RH or less (no condensation or freezing)
	Ingress protection	IP20
Mass		About 0.4kg

External Dimensions

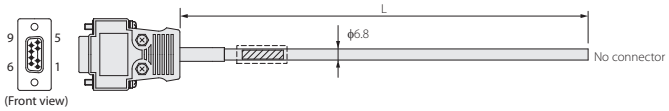


Standard SIO communication cable

Features: Cable for connection with external serial communication devices.

Model: **CB-XSEL2-SIO□□□**

* Please indicate the cable length (L) in □□□, e.g.) 030 = 3m, max. 10m



XM3D-0921

CH	Color	Dot marks / color			Signal	No.
1	AWG26	-	-	-	NC	1
1		Black	/	Black	RXD	2
1		Red	/	Red	TXD	3
1		-	-	-	NC	4
1		Red	/	Red	SG	5
1		-	-	-	NC	6
1		Red	/	Red	SA	7
1		Black	/	Black	SB	8
1		-	-	-	NC	9

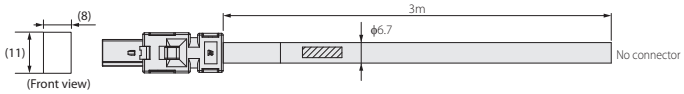
Shield is clamp connected to the hood (FG)

No connector side

Cable for driver stop function

Features: Cable for stopping motor output.

Model: **CB-SC-STO 030**



2013595- 1 (TE)

Wiring	Color	Signal	No.
AWG26	-	-	1
	-	-	2
	Black	/SRI1-	3
	Black/White	/SRI1+	4
	Red	/SRI2-	5
	Red/White	/SRI2+	6
	Green	EDM-	7
	Green/White	EDM+	8

Shield is connected to cable clamp

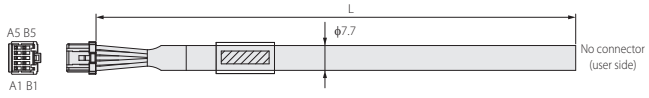
Black
Black/White
Red
Red/White
Green
Green/White
Shield
No connector side

External brake switch connection cable

Features: Connection cable for brake release operation with an external switch.

Model: **CB-XRSA-BK□□□**

* Please indicate the cable length (L) in □□□, e.g.) 030 = 3m, max. 5m



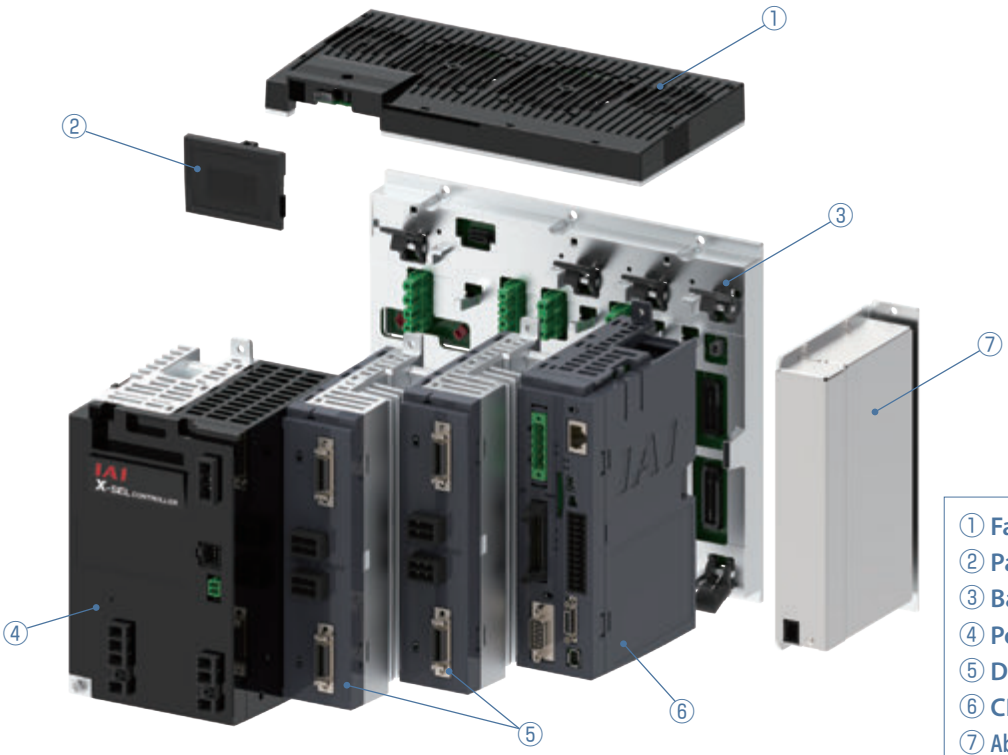
1-1827862-5

Wiring	Color	Signal name	No.
AWG22 (Crimped)	Brown	BKMRL1	A1
	Red	BKMRL2	B1
	Orange	BKMRL3	A2
	Yellow	BKMRL4	B2
	Green	GNDCOM	A3
	Blue	GNDCOM	B3
	Pink	BKMRL5	A4
	Gray	BKMRL6	B4
	White	BKMRL7	A5
	Black	BKMRL8	B5

No connector side (user side)

Maintenance (individual unit)

For specification changes or breakdowns, individual products can be ordered for each unit.



① Fan unit
② Panel unit
③ Base unit
④ Power unit
⑤ Driver unit
⑥ CPU unit
⑦ Absolute data backup battery box

① Fan unit

Specification (type)	Model
For small housing (TS/TSX)	UT-XSEL2-FNS
For large housing (TL/TLX)	UT-XSEL2-FNL

② Panel unit

Specification (type)	Model
For small housing (TS/TSX) For large housing (TL/TLX)	UT-XSEL2-PNL

③ Base unit

Specification (type)	Model
For small housing (TS/TSX)	UT-XSEL2-BAS
For large housing (TL/TLX)	UT-XSEL2-BAL

④ Power unit

Specification		Model
For small housing (TS/TSX) For large housing (TL/TLX)	Single-phase 100VAC	UT-XSEL2-PS1
	Single phase 200VAC	UT-XSEL2-PS2
	Three-phase 200VAC	UT-XSEL2-PS3

⑤ Driver unit

Specification		Model
For small housing (TS/TSX) For large housing (TL/TLX)	1-axis specification (S1)	UT-XSEL2-DS1
	2-axis specification (S2)	UT-XSEL2-DS2
	1-axis specification (SH)	UT-XSEL2-DSH
	No axis (N)	UT-XSEL2-DS0

⑥ CPU unit

Specification		Model
For small housing (TS) For large housing (TL)	Single-axis and cartesian	UT-XSEL2-CPU-□□
For small housing (TSX) For large housing (TLX)	SCARA	UT-XSEL2-CPX-□□

*I/O slot symbol goes in □□.
*Please refer to Model Specification Items (P.7) for symbols.

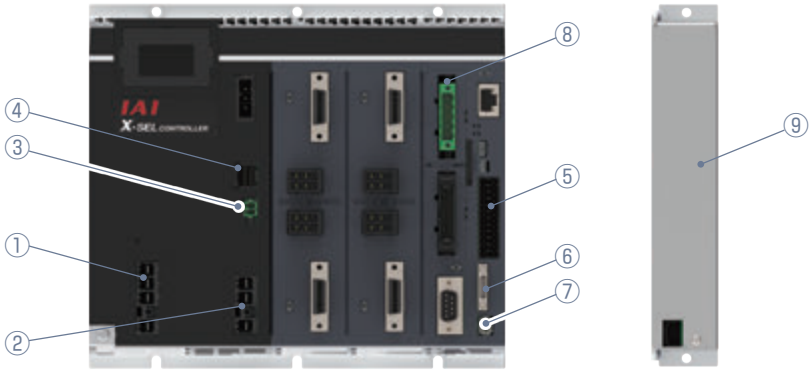
⑦ Absolute data backup battery box

Specification (type)	Model
For small housing (TS/TSX) For large housing (TL/TLX)	UT-XSEL2-ABB

*A separate order is required for the connection cable (CB-XSEL2-AB002).

Maintenance Parts

Normally attached with each unit; when needed due to loss, etc., purchase as a single product.
The numbers below indicate included part locations.



① Motor power connector

Model **MPS_7S/03_S_F2_TN_B_B_D(XSEL2_1)**

*Single-phase 100V specification

Model **BVF_7.62HP/04/180MF2_SN_BK_BX_LRP(XSEL2_2)**

*Single-phase 200V specification

Model **BVF_7.62HP/04/180MF2_SN_BK_BX_LRP(XSEL2_3)**

*Three-phase 200V specification

② Control power connector

Model **BVF_7.62HP/03/180MF2_SN_BK_BX_LRP(XSEL2)**

③ Brake power supply connector

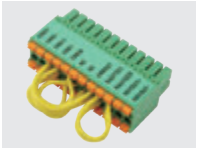
Model **FMC1.5/2-ST-3.5-RF**

④ Brake release switch cable connector

Model **1-1827862-5**

⑤ System I/O connector

Model **DFMC1.5/12-ST-3.5(XSEL2)**



⑥ Dummy plug (for teaching port)

Model **DP-4S**

⑦ Dummy plug (for driver stop function)

Model **DP-6**

⑧ I/O slot part connector

* A connector with the model specification selected with the I/O slot is included.

DeviceNet connector

Model **MSTB2.5/5-STF-5.08 AUM**

CC-Link connector *With terminal resistance 110Ω/130Ω

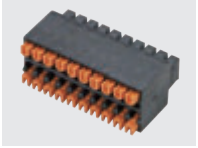
Model **MSTB2.5/5-STF-5.08AU**

IA-NET terminal resistance unit

Model **EIOU-TR**

Pulse-train/PIO connector (for pulse signals)

Model **DFMC 0.5/10-ST-2.54**



Pulse-train/PIO connector (for PIO signals)

Model **DFMC 0.5/ 5-ST-2.54**

Connector for ELECYLINDER

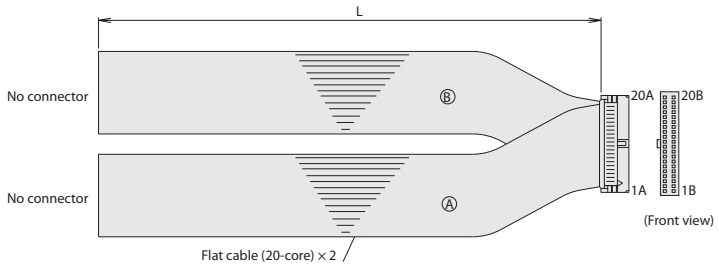
Model **B2CF 3.50/06/180 SN OR BX**

PIO cable

*When purchasing NP or PN specifications with I/O slots, a cable of the designated length is included.

Model **CB-PAC-PIO□□□**

* Please indicate the cable length (L) in □□□,
e.g.) 030 = 3m, max. 10m



HIF6-40D-1.27R (HIROSE ELECTRIC CO., LTD.)

No.	Signal name	Cable color	Wiring
1A	24V	Brown-1	Flat cable Ⓐ (pressure-welded)
2A	24V	Red-1	
3A	-	Orange-1	
4A		Yellow-1	
5A	IN0	Green-1	
6A	IN1	Blue-1	
7A	IN2	Purple-1	
8A	IN3	Gray-1	
9A	IN4	White-1	
10A	IN5	Black-1	
11A	IN6	Brown-2	
12A	IN7	Red-2	
13A	IN8	Orange-2	
14A	IN9	Yellow-2	
15A	IN10	Green-2	
16A	IN11	Blue-2	
17A	IN12	Purple-2	
18A	IN13	Gray-2	
19A	IN14	White-2	
20A	IN15	Black-2	

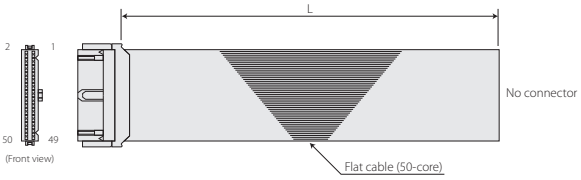
No.	Signal name	Cable color	Wiring
1B	OUT0	Brown-3	Flat cable Ⓑ (pressure-welded) AWG28
2B	OUT1	Red-3	
3B	OUT2	Orange-3	
4B	OUT3	Yellow-3	
5B	OUT4	Green-3	
6B	OUT5	Blue-3	
7B	OUT6	Purple-3	
8B	OUT7	Gray-3	
9B	OUT8	White-3	
10B	OUT9	Black-3	
11B	OUT10	Brown-4	
12B	OUT11	Red-4	
13B	OUT12	Orange-4	
14B	OUT13	Yellow-4	
15B	OUT14	Green-4	
16B	OUT15	Blue-4	
17B	-	Purple-4	
18B		Gray-4	
19B	0V	White-4	
20B	0V	Black-4	

PIO cable

*When purchasing "N1/N2/N4" or "P1/P2/P4" specifications with I/O slots, a cable of the designated length is included.

Model **CB-X-PIO□□□**

* Please indicate the cable length (L) in □□□,
e.g.) 030 = 3m, max. 10m



XG4M-5030-T (Omron)

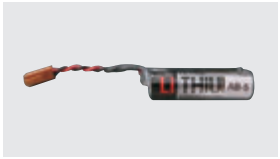
No.	Color	Wiring	No.	Color	Wiring	No.	Color	Wiring
1	Brown -1	Flat cable pressure-welded	18	Gray -2	Flat cable pressure-welded	35	Green -4	Flat cable pressure-welded
2	Red -1		19	White -2		36	Blue -4	
3	Orange -1		20	Black -2		37	Purple -4	
4	Yellow -1		21	Brown -3		38	Gray -4	
5	Green -1		22	Red -3		39	White -4	
6	Blue -1		23	Orange -3		40	Black -4	
7	Purple -1		24	Yellow -3		41	Brown -5	
8	Gray -1		25	Green -3		42	Red -5	
9	White -1		26	Blue -3		43	Orange -5	
10	Black -1		27	Purple -3		44	Yellow -5	
11	Brown -2		28	Gray -3		45	Green -5	
12	Red -2		29	White -3		46	Blue -5	
13	Orange -2		30	Black -3		47	Purple -5	
14	Yellow -2		31	Brown -4		48	Gray -5	
15	Green -2		32	Red -4		49	White -5	
16	Blue -2		33	Orange -4		50	Black -5	
17	Purple -2		34	Yellow -4				

⑨ Absolute data retention battery

Model **AB-5**

Required when connecting an actuator with absolute specification.

(Life guideline: Approx. 2 years/electric discharge type)



Maintenance Parts (Cables)

When placing an order for the replacement cable, please use the model name shown below.

We recommend the cable model search system!
URL: https://www.intelligentactuator.com/iai-cables-search-tool/

■ Table of Compatible Cables

No.	Actuator		Maximum cable length		Connection cable (Note 1)			
	Series	Type	Motor	Encoder	Motor cable	Motor robot cable	Encoder robot cable	Encoder robot cable
(1)	RCS2(CR/W) RCS3(CR)	Models other than (2)~(4)	30m	30m	CB-RCC1-MA□□□	CB-X2-MA□□□	CB-RCS2-PA□□□	CB-X3-PA□□□
(2)	RCS2	RT	30m	30m			CB-RCS2-PLA□□□	CB-X2-PLA□□□
(3)		RA13R (Without load cell /without brake)	30m	30m			CB-RCS2-PLA□□□	CB-X2-PLA□□□
(4)		RA13R (Without load cell /with brake)	30m	30m			CB-RCS2-PLA□□□ *Between controller and brake: CB-RCS2-PLA□□□	CB-X2-PLA□□□ *Between controller and brake: CB-X2-PLA□□□
(5)	RCS3	CTZ5C/CT8C	30m	20m			-	CB-X1-PA□□□
(6)	RCS4(CR)		30m	20m			-	CB-X1-PA□□□
(7)	NS	Without LS	30m	30m	-		-	CB-X3-PA□□□
(8)		With LS	30m	30m	-		-	CB-X2-PLA□□□
(9)	LSA	W□□□	30m	30m	-	CB-XMC1-MA□□□	-	CB-X2-PLA□□□
(10)		Models other than 9	30m	30m	-	CB-X2-MA□□□	-	CB-X3-PA□□□
(11)	LSAS	N	30m	20m	-		-	CB-X1-PA□□□
(12)	DDA/DDACR/DDW	LT18□	30m	30m	-		-	CB-X3-PA□□□
(13)		LH18□	30m	30m	-	CB-XMC1-MA□□□	-	
(14)	DDA/DDACR/DDW (with brake)	LT18□	30m	30m	-	CB-X2-MA□□□	-	CB-X3-PA□□□ *Between brake box and actuator: CB-DDB-BK□□□ (Max. 20m)
(15)		LH18□	30m	30m	-	CB-XMC1-MA□□□	-	
(16)	IS(P)WA	S/M/L	30m	30m	-	CB-XEU1-MA□□□	-	CB-X1-PA□□□-WC
(17)	ZR		30m	Z-axis: 20m R-axis: 30m	-	CB-X2-MA□□□	-	Z-axis: CB-X1-PA□□□ R-axis: CB-X1-PLA□□□ *Between controller and brake box: CB-RCS2-PLA□□□
(18)	Models other than 1~17		30m	20m	-		-	CB-X1-PA□□□ (for 20m or less) *
			30m	30m				CB-X1-PA□□□-AWG24 (For 21m or more)
(19)	Models other than 1~17 (with LS specification)		30m	30m	-		-	CB-X1-PLA□□□-AWG24 (For 21m or more)
			30m	30m				
(20)	IXA IX (joint cable specification)		30m	20m	-		-	CB-X1-PA□□□

(Note 1) Max. cable length varies by series.
For details, check the cable table in the product specifications of the actuator to be connected.

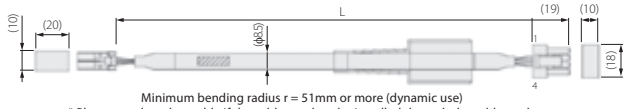
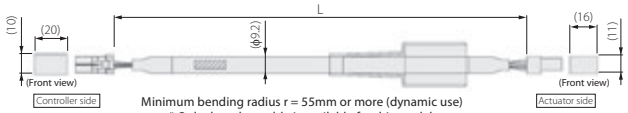
Motor cable

* Please indicate the cable length (L) in □□□, e.g.) 030 = 3m, max. 30m

Model number	External view
CB-RCC1-MA□□□	 Minimum bending radius r = 51mm or more (dynamic use) * Please use the robot cable if the cable needs to be installed through the cable track.

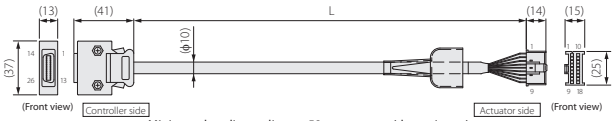
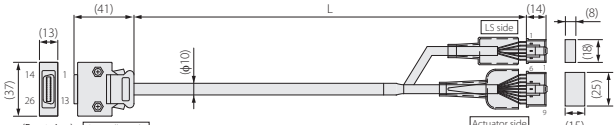
Motor robot cable

* Please indicate the cable length (L) in □□□, e.g.) 030 = 3m, max. 30m

Model number	External view
CB-X2-MA□□□	 Minimum bending radius r = 51mm or more (dynamic use) * Please use the robot cable if the cable needs to be installed through the cable track.
CB-XMC1-MA□□□	 Minimum bending radius r = 55mm or more (dynamic use) * Only the robot cable is available for this model.
CB-XEU1-MA□□□	 Minimum bending radius r = 48mm or more (dynamic use) * Only the robot cable is available for this model.

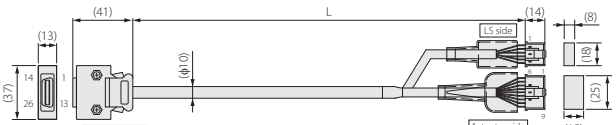
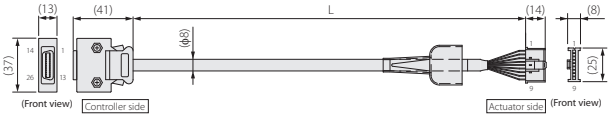
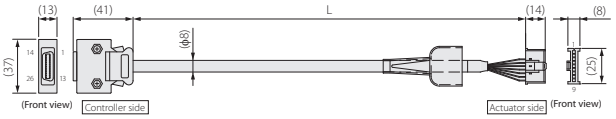
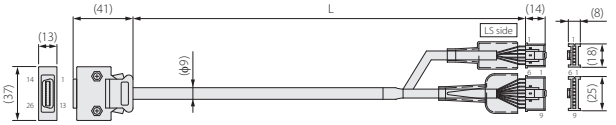
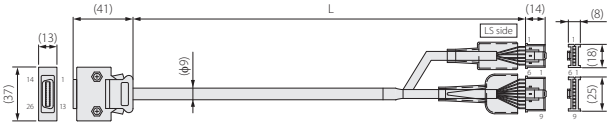
Encoder cable

* Please indicate the cable length (L) in □□□, e.g.) 030 = 3m, max. 30m

Model number	External view
CB-RCS2-PA□□□	 Minimum bending radius r = 58mm or more (dynamic use) * Please use the robot cable if the cable needs to be installed through the cable track.
CB-RCS2-PLA□□□	 Minimum bending radius r = 58mm or more (dynamic use) * Please use the robot cable if the cable needs to be installed through the cable track.

Encoder robot cable

* Please indicate the cable length (L) in □□□, e.g.) 030 = 3m, max. 30m

Model number	External view	
CB-X3-PA□□□	 Minimum bending radius r = 58mm or more (dynamic use) * Please use the robot cable if the cable needs to be installed through the cable track.	
CB-X2-PLA□□□	 Minimum bending radius r = 58mm or more (dynamic use) * Please use the robot cable if the cable needs to be installed through the cable track.	
CB-X1-PA□□□	 Minimum bending radius r = 44mm or more (dynamic use) * Only the robot cable is available for this model.	
CB-X1-PA□□□-AWG24	 Minimum bending radius r = 44mm or more (dynamic use) * Only the robot cable is available for this model.	* Min. length (L): 21m Max. length (L): 30m
CB-X1-PLA□□□	 Minimum bending radius r = 54mm or more (dynamic use) * Only the robot cable is available for this model.	
CB-X1-PLA□□□-AWG24	 Minimum bending radius r = 54mm or more (dynamic use) * Only the robot cable is available for this model.	* Min. length (L): 21m Max. length (L): 30m

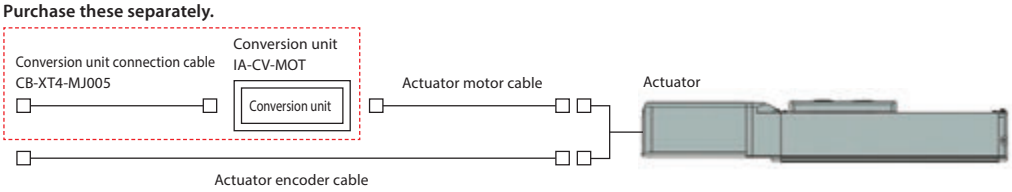
● Precautions for the connection cable when switching from XSEL to XSEL2

When connecting to an actuator with a "T2" applicable controller

Connection as is cannot be done, because the motor cable uses a different connector on the controller side.

To connect, a conversion unit and conversion unit connection cable are required.

Purchase these separately.



Catalog No. CE0419-1A (2025MAR)

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