

# PowerCON SCARA **IXP** Series

## PowerCON SCARA Program Controllers **MSEL-PCX/PGX**



# Introducing the Cost-effective Pulse Motor Type IXP to the IX Series of SCARA Robots

All models come standard with battery-less absolute encoders.



## 1 More Affordable Due to Pulse Motors

By adopting pulse motors...

...the IXP costs around **1/2** a conventional model.

\* Compared against an IAI robot based on an arm length of 350mm.

The IXP achieves a payload equivalent to that of a conventional model by adopting high-output drivers.

## 2 All Models Come Standard with Battery-less Absolute Encoders

All IXP models come standard with battery-less absolute encoders that does not require batteries. Since battery replacement is no longer necessary, maintenance man-hours are reduced.

### Advantages of Battery-less Absolute Encoders

- The machine will not stop due to battery errors (low voltage, etc.)
- No cost of battery replacement
- No need for absolute reset or other physical tasks associated with battery replacement

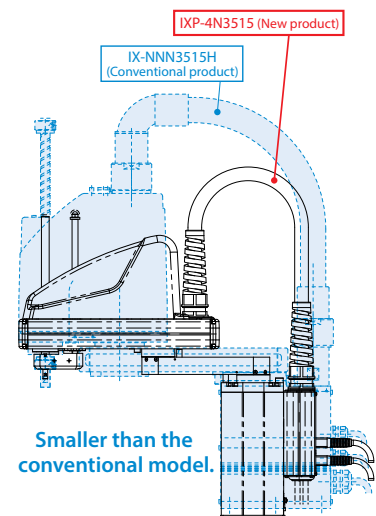
## 3 Lighter than a Conventional Model

The robot weighs approx. **30% less.**

(Compared to: IX-NNN3515)

The lightweight robot can be easily assembled into your equipment.

| Model | IX-NNN3515H (Conventional product) | IXP-4N3515 (New product)  |
|-------|------------------------------------|---------------------------|
| Mass  | 18kg                               | <b>-5kg</b> → <b>13kg</b> |



# 4

## Added 3-axis Specification and 4-axis\* Gripper Specification

The 3-axis specification has no rotational axis for greater allowable inertial load moment. It can be combined with a dedicated gripper to constitute a transfer robot with ease.

\* The gripper type has four axes including three SCARA robot axes and one gripper axis.

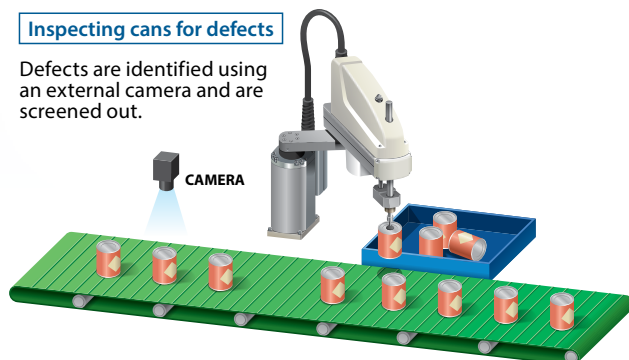


### Use Examples of the 3-axis Specification

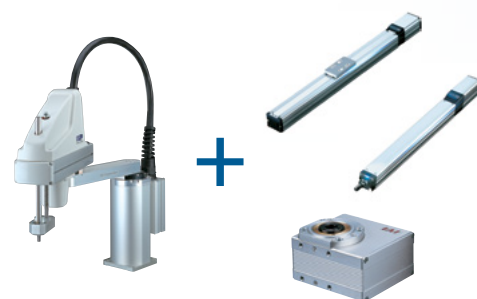
- Work processes that require only three axes
  - ➔ Pickup and placement of circular parts, non-directional transfer, etc.

#### Inspecting cans for defects

Defects are identified using an external camera and are screened out.











- Connecting an actuator as the fourth axis  
A ROBO Cylinder of a rotary type, rod type, slider type, etc., can be connected to a SCARA robot 3-axis specification as its fourth axis.



# 5

## Product Lineup

| Arm length |                                   | 350mm  |  | 450mm  |  |
|------------|-----------------------------------|--|--|--|--|
| SCARA type |                                   | 3 axes   | 4 axes<br>(with rotational axis)   | 3 axes   | 4 axes<br>(with rotational axis)   |
| Gripper    | None                              | <br>IXP-3N3515<br>Controller:<br>MSEL, 3-axis specification   | <br>IXP-4N3515<br>Controller:<br>MSEL, 4-axis specification | <br>IXP-3N4515<br>Controller:<br>MSEL, 3-axis specification   | <br>IXP-4N4515<br>Controller:<br>MSEL, 4-axis specification |
|            | Medium gripper type<br>RCP4-GRSML | <br>IXP-3N3515GM<br>Controller:<br>MSEL, 4-axis specification | —  | <br>IXP-3N4515GM<br>Controller:<br>MSEL, 4-axis specification | —  |
|            | Large gripper type<br>RCP4-GRSLL  | <br>IXP-3N3510GL<br>Controller:<br>MSEL, 4-axis specification | —  | <br>IXP-3N4510GL<br>Controller:<br>MSEL, 4-axis specification | —  |

# Introducing the PowerCON SCARA Robot Program Controller **MSEL** with High-output Driver (PowerCON)



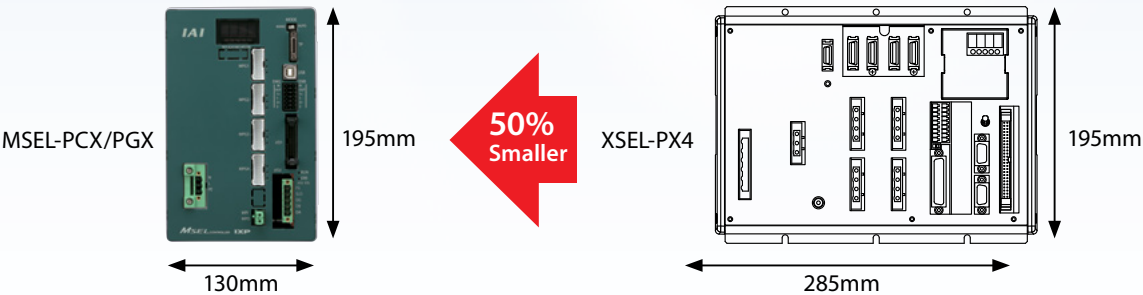
## 1 Accommodating Significantly More Programs and Positions

The greater storage capacity accommodates significantly more programs and positions.

|                     | XSEL-PX<br>(Conventional product) | <b>MSEL (New product)</b> |
|---------------------|-----------------------------------|---------------------------|
| Number of programs  | 128                               | <b>255</b>                |
| Number of positions | 20,000                            | <b>30,000</b>             |

## 2 Smaller Size

Having a size of 130mm in width x 195mm in height, the MSEL is significantly smaller than a conventional controller and saves space in your control panel. The MSEL can be installed with screws or using a DIN rail.

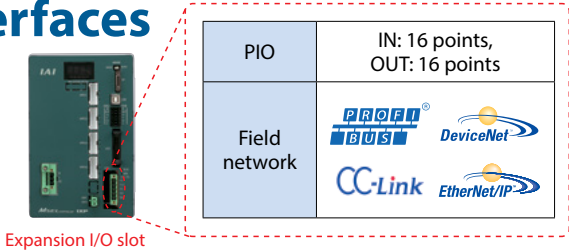


## 3 Safety Category Compliant

By building an appropriate external circuit, the MSEL meets the safety circuit requirements of any of Safety Categories 1 to 3.

## 4 Supporting Diverse I/O Interfaces

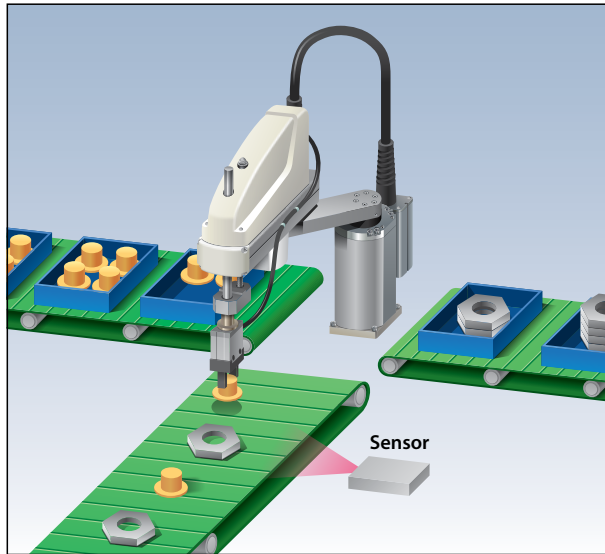
Standard PIOs (IN: 16 points, OUT: 16 points) and one expansion I/O slot are available. For the expansion I/O slot, PIOs (IN: 16 points, OUT: 16 points) or field network (CC-Link, DeviceNet, PROFIBUS-DP or EtherNet/IP) can be selected.



## Applications

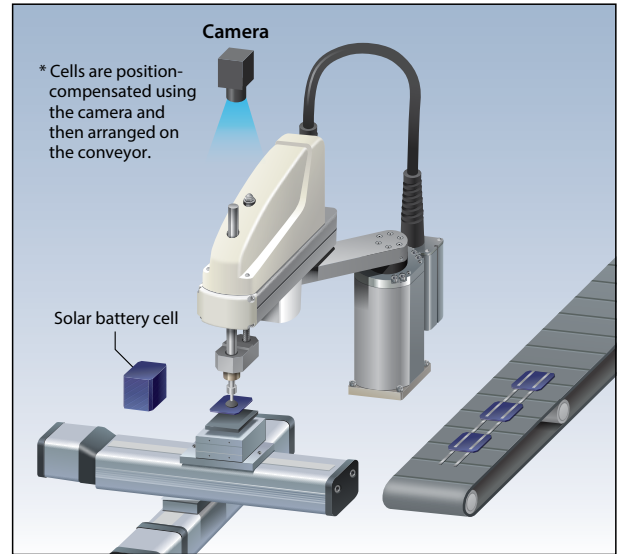
### Part Screening

Parts of two different sizes are discriminated using a sensor and sorted into different boxes.



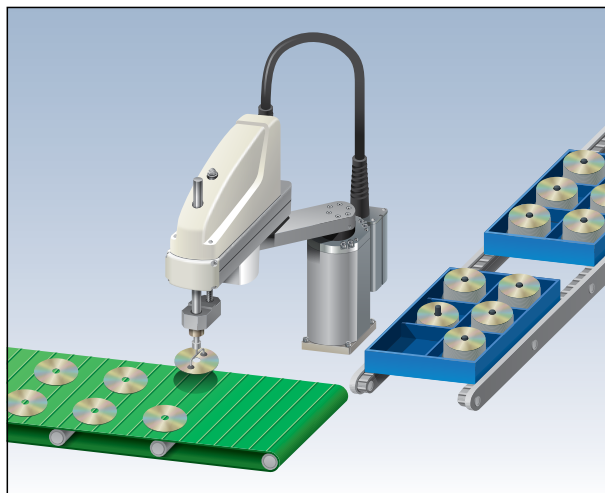
### Solar Battery Module Tab Solder

Solar battery module cells are transferred while position-compensated so that electrodes can be soldered onto the cells.



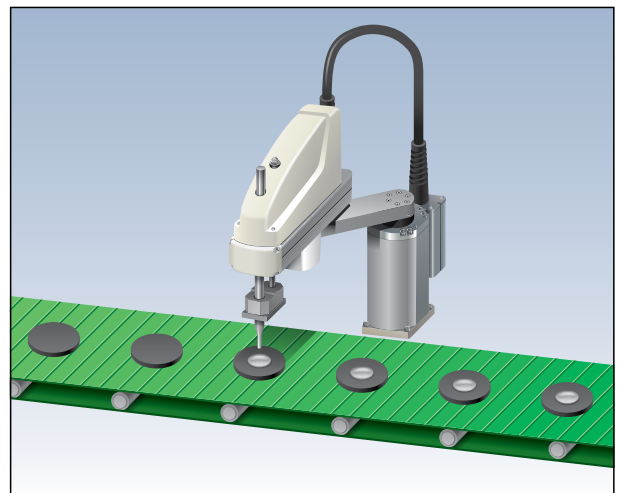
### DVD-R Packing

DVD-Rs are picked up from the conveyor and placed.



### Adhesive Application

Adhesive is applied onto circular parts.





## Cautionary Notes

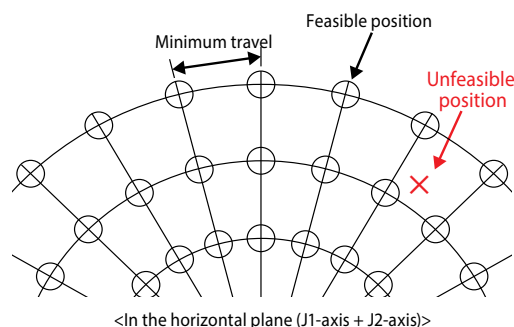
### \*1 Positioning Repeatability

Positioning repeatability refers to the degree to which the robot can repeat the same positioning when operated at the same speed and acceleration/deceleration using the same arm system between two points including the start position and target position. (The values were measured at a constant ambient temperature of 20°C). Note that the positioning repeatability may be out of specification if the arm is changed, if the positioning is from multiple different positions to a single set position, or if the operating conditions, such as the operating speed and acceleration/deceleration settings, are changed.

#### Notes on the Low-resolution Encoders

Since the IXP is equipped with low-resolution encoders, feasible positioning points of the robot are wider apart and positioning to a specific command position may not be possible. Also note that the target position cannot be finely adjusted by less than the minimum travel.

|                |  |        | IXP-3N3515<br>3N3510 | IXP-3N4515<br>3N4510 | IXP-4N3515     | IXP-4N4515     |
|----------------|--|--------|----------------------|----------------------|----------------|----------------|
| Minimum travel | In the horizontal plane<br>(Arm 1 + Arm 2) | mm     | 0.202<br>(MAX)       | 0.179<br>(MAX)       | 0.202<br>(MAX) | 0.179<br>(MAX) |
|                | Vertical axis                              | mm     | 0.009                | 0.009                | 0.009          | 0.009          |
|                | Rotational axis                            | Degree | —                    | —                    | 0.113          | 0.113          |



### \*2 Maximum Operating Speed for PTP Operation

The maximum operating speed in the specification table assumes PTP command operation.

The speed is limited for CP operation command (interpolation) operation. For details, refer to “CP Operation” under “Rough Guide for SCARA Robot Acceleration/Deceleration Setting” on P. 18. Also note that the speed/acceleration must be reduced as deemed appropriate when operating the vertical axis at the bottom end.

### \*3 Payload

The payload may be the rated payload or the maximum payload.

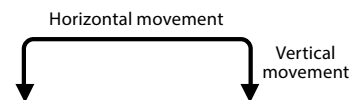
The rated payload is the maximum mass that can be transferred at the maximum speed and maximum acceleration. The maximum payload is the maximum mass the actuator can transfer at a reduced speed/acceleration.

When transferring a mass greater than the rated payload, set the load mass and inertial moment in the program, and an optimal speed/acceleration will be applied automatically.

### \*4 Standard Cycle Time

The standard cycle time refers to the time required to cycle back and forth at maximum speed under the following conditions. This is a general estimate of the high-speed performance.

(Arm length: 350 to 450), 1 kg load, vertical distance: 25mm; horizontal distance: 300mm

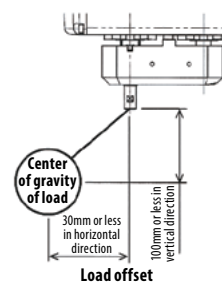


### \*5 Allowable Inertial Moment at the Tip of the Vertical Axis

The allowable inertial moment at the tip of the vertical axis represents an equivalent allowable inertial moment at the tip of the vertical axis of a SCARA robot (measured at the center of the guide shaft in the case of a 3-axis specification, or center of the rotating axis in the case of a 4-axis specification).

Keep the offset from the center of rotation of the tip of the vertical axis to the center of gravity of the load to 30mm or less in the horizontal direction or 100mm or less in the vertical direction.

If the center of gravity of the tool is away from the center of the tip of the vertical axis, the speed/acceleration must be reduced as deemed appropriate.



### Work Envelope

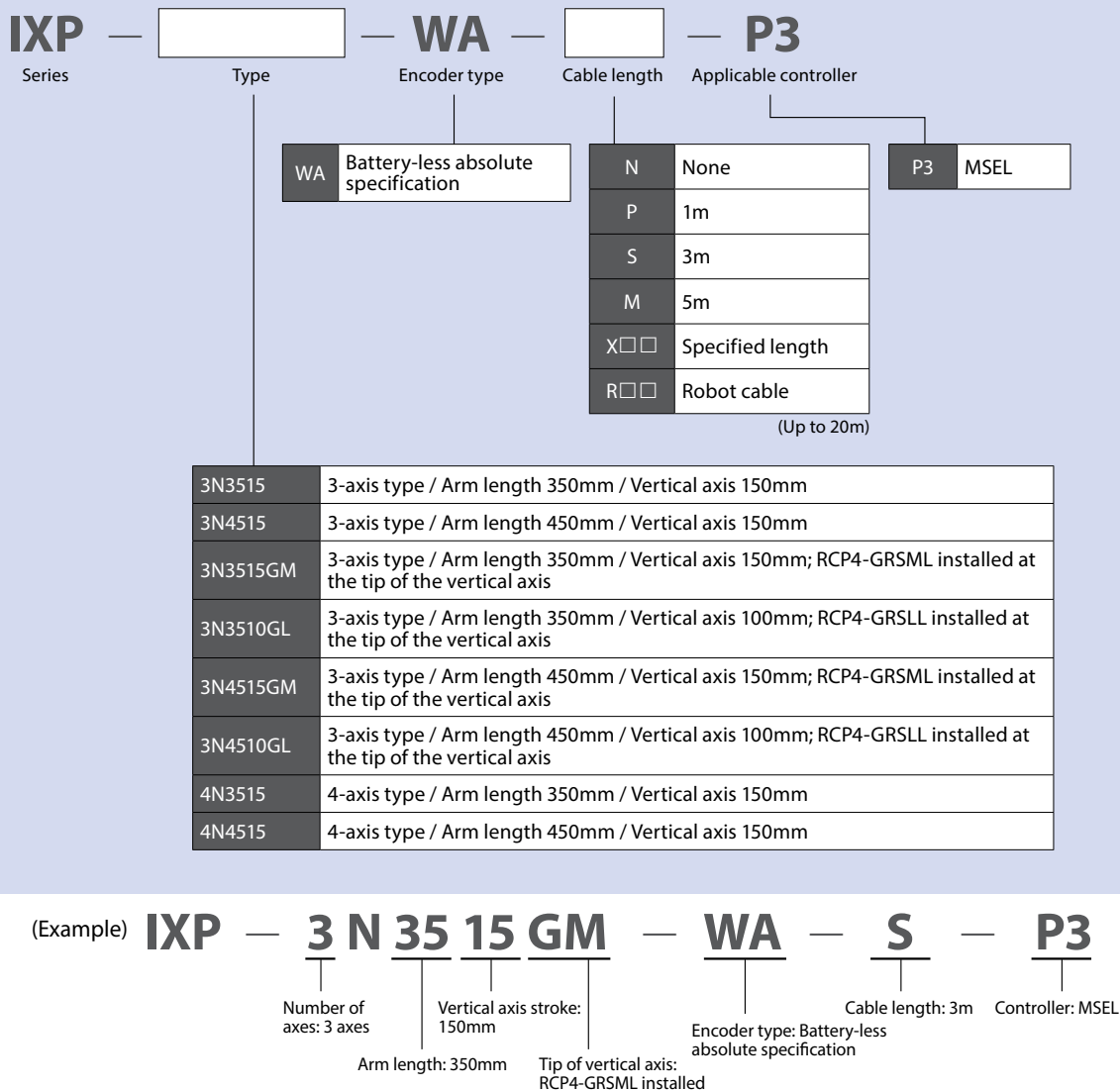
When changing the arm, be careful that no peripheral objects will obstruct the arm when it fully extends.

### Acceleration/Deceleration Setting

For the setting of acceleration/deceleration, refer to “Reference for SCARA Robot Acceleration/Deceleration Settings” on P. 18.

\*1 to \*5 above correspond to the numbers on the main text pages (P. 7, P. 9).

## Explanation of the Model Items



# IXP- 3N3515 / 4N3515

Arm length 350mm  
Vertical axis 100mm/150mm

| Model Specification Items | IXP                    | N 35      | WA   | P3  |
|---------------------------|------------------------|-----------|--|---|
| Series                    | IXP                    | N 35      | WA   | P3  |
| Number of axes            | 3: 3 axes<br>4: 4 axes | 35: 350mm | 15 : 150mm, no gripper<br>15GM: 150mm, medium gripper installed<br>10GL : 100mm, large gripper installed<br>* Refer to "Component Axes" for the gripper types. | WA: Battery-less absolute specification<br>N: None<br>P: 1m<br>S: 3m<br>M: 5m |
| Arm length                |                        |           |  |   |
| Vertical axis stroke      |                        |           |  |   |
| Gripper                   |                        |           |  |   |
| Encoder type              |                        |           |  |   |
| Cable length              |                        |           |  |   |
| Applicable controller     |                        |           |  |   |



\* The photograph shows a 4-axis specification.



Refer to P. 5 for \*1 through \*5.  
 • The vertical axis has no brake.  
 The unique structure holds the load in place even when the servo is turned off.  
 • The vertical axis does not support push-motion control.  
 • If a tool is installed or a spring or other buffer is provided for push-motion, the allowable push force is 60 N or less.  
 • Refer to P. 5 for the work envelope, and P. 18 for the notes on acceleration/deceleration setting.

## Robot Specifications

| Axis configuration |                   | Arm length (mm) | Work envelope       | Positioning repeatability *1 | Maximum operating speed in PTP mode *2 |                             |                             | Payload (kg) *3                                |         |
|--------------------|-------------------|-----------------|---------------------|------------------------------|--|-----------------------------|-----------------------------|--|---------|
|                    |                   |                 |                     |                              | No gripper                             | With medium gripper (GM)    | With large gripper (GL)     | Rated  | Maximum |
| Axis 1             | Arm 1             | 160             | ±127°               | ±0.03mm                      | 2,726mm/s (Composite speed)            | 2,726mm/s (Composite speed) | 1,908mm/s (Composite speed) | 1  | 3       |
| Axis 2             | Arm 2             | 190             | ±127°               |                              | 270mm/s                                | 270mm/s                     | 189mm/s                     |  |         |
| Axis 3             | Vertical axis     | —               | 150mm *             | ±0.02mm                      | 1000°/s                                | —                           | —                           | Refer to the catalog of the gripper "RCP4-GR□" |         |
| Axis 4             | Rotating axis     | —               | ±360°               | ±0.02°                       | —                                      | —                           | —                           |  |         |
|                    | Medium gripper GM | —               | 14mm (Both fingers) | ±0.01mm                      | —                                      | 94mm/s (One finger)         | 125mm/s (One finger)        |  |         |
|                    | Large gripper GL  | —               | 22mm (Both fingers) | ±0.01mm                      | —                                      | —                           | —                           |  |         |

\* When the large gripper is installed, the work envelope of the vertical axis becomes 100mm.

## Robot Specifications

|  |                       | 3-axis specification   | 4-axis specification           | 3-axis specification  |                            |
|--|-----------------------|--|--------------------------------|---|----------------------------|
|  |                       | No gripper   |                                | With medium gripper (GM)  | With large gripper (GL)    |
| Encoder type   |                       | Battery-less absolute encoder  |                                |   |                            |
| User wiring  |                       | AWG24x6, AWG26x5P (shielded)<br>* User cables are sold separately. Refer to the operation manual for detail. |                                | User wiring is not supported because the gripper wiring is used |                            |
| User piping  |                       | Air tube (O.D. ø4, I.D. ø2.5) x 3<br>(Normal working pressure 0.8 MPa)                                       |                                |   |                            |
| Standard cycle time<br>*4 (sec)                                  | SCARA                 | 0.69   |                                | 0.69  | 1.08                       |
|  | Gripper (full stroke) | —  |                                | 0.51  | 0.56                       |
| Allowable torque (Axis 4) (N・m)                                  |                       | —  | 1.4                            | —   |                            |
| Allowable moment (N・m)   |                       | 2.9  |                                | Ma 1.9<br>Mb 2.7<br>Mc 2.9                                      | Ma 2.9<br>Mb 2.9<br>Mc 2.9 |
| Allowable inertial moment of tip axis<br>*5 (kg・m <sup>2</sup> ) |                       | Rated: 0.003<br>Maximum: 0.01  | Rated: 0.003<br>Maximum: 0.003 | 0.002   | 0.009                      |
| Ambient temperature/humidity                                     |                       | Temperature: 0~40°C, humidity: 20-85% RH or less (Non-condensing)  |                                |   |                            |
| Unit weight (kg)   |                       | 12   | 13                             | 12.5  | 13                         |

## Component Axes

|              |   |
|--------------|---|
| IXP-3N3515GM | The medium gripper RCP4-GRSML is installed at the tip of the vertical axis. |
| IXP-3N3510GL | The large gripper RCP4-GRSLL is installed at the tip of the vertical axis.  |

## Price List

| Gripper        | SCARA 3-axis specification | Standard price |
|----------------|----------------------------|----------------|
| None           | IXP-3N3515                 | —              |
| Medium gripper | IXP-3N3515GM               | —              |
| Large gripper  | IXP-3N3510GL               | —              |

| Gripper | SCARA 4-axis specification (with rotating axis) | Standard price |
|---------|---|----------------|
| None    | IXP-4N3515                                      | —              |

## Cable Length <Per Axis\*>

| Type           | Cable code          | Standard price |
|----------------|---------------------|----------------|
| Standard type  | P (1m)              | —              |
|                | S (3m)              | —              |
|                | M (5m)              | —              |
| Special length | X06 (6m)~X10 (10m)  | —              |
|                | X11 (11m)~X15 (15m) | —              |
|                | X16 (16m)~X20 (20m) | —              |
| Robot cable    | R01 (1m)~R03 (3m)   | —              |
|                | R04 (4m)~R05 (5m)   | —              |
|                | R06 (6m)~R10 (10m)  | —              |
|                | R11 (11m)~R15 (15m) | —              |
|                | R16 (16m)~R20 (20m) | —              |

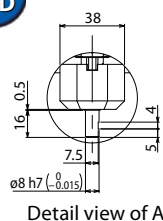
\* The 3-axis specification requires three cables, while the gripper specification and 4-axis specification require four cables.



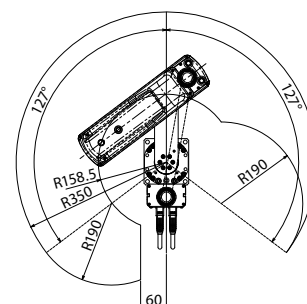
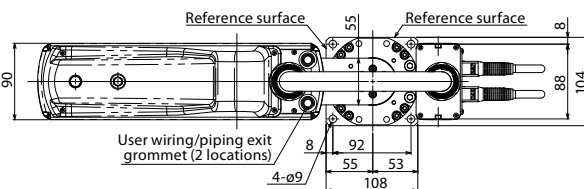
## Dimensions

2D  
CADCAD drawings can be downloaded  
from the website.

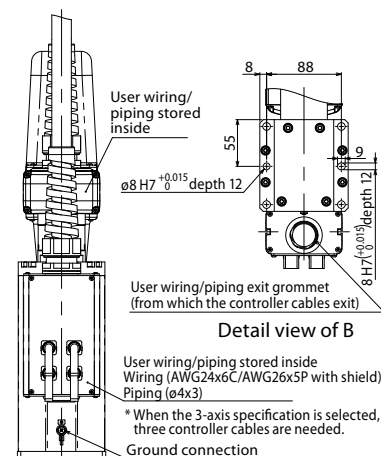
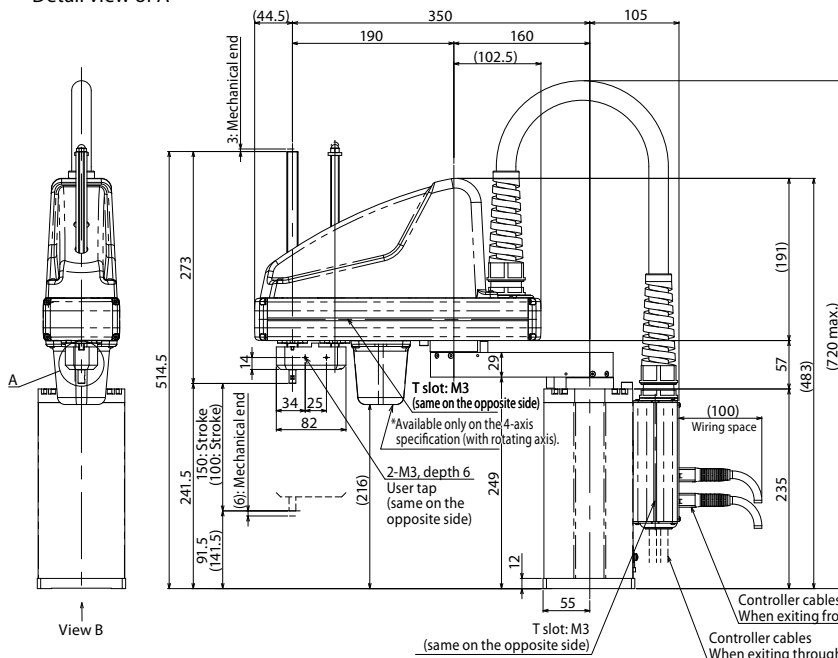
www.intelligentactuator.com



Detail view of A

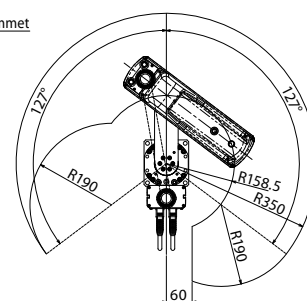


Work envelope of the right-arm system



Detail view of B

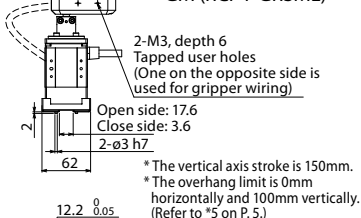
User wiring/piping stored inside  
Wiring (AWG24x6C/AWG26x5P with shield)  
Piping (ø4x3)  
\* When the 3-axis specification is selected,  
three controller cables are needed.  
Ground connection



Work envelope of the left-arm system

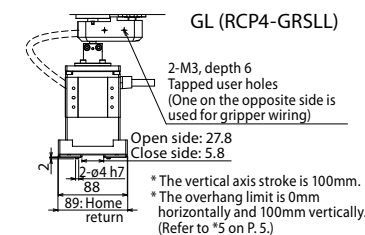
## &lt;Gripper Specification&gt;

## GM (RCP4-GRSML)



\* The vertical axis stroke is 150mm.  
\* The overhang limit is 0mm horizontally and 100mm vertically.  
(Refer to \*5 on P.5.)

## GL (RCP4-GRSLL)

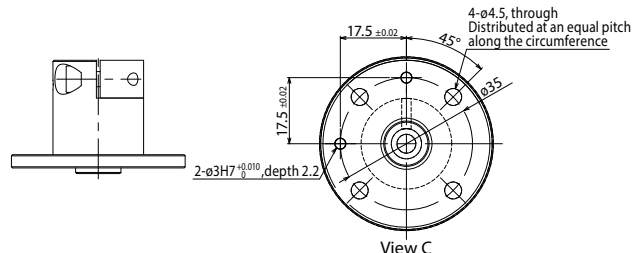
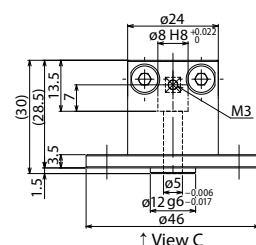


\* The vertical axis stroke is 100mm.  
\* The overhang limit is 0mm horizontally and 100mm vertically.  
(Refer to \*5 on P.5.)


## &lt;Flange Dimensions&gt;

An optional flange is available.  
Use a flange when installing a tool, etc.,  
at the tip of the vertical axis.

| Model type | Standard price | Weight  |
|------------|----------------|---------|
| IXP-FL-2   | —              | 121.95g |



## Applicable Controller Specifications

| Name                      | External view   | Applicable controller | Features     | Standard I/O points (input/output) | Power-supply voltage | Reference page |
|---------------------------|---|-----------------------|--------------|------------------------------------|----------------------|----------------|
| PowerCON SCARA controller |  | MSEL                  | Up to 4 axes | 16 points/<br>16 points            | AC100V~230V          | P. 11          |

# IXP- 3N4515 / 4N4515

Arm length 450mm  
Vertical axis 100mm/150mm

|                                   |  |                        |             |  |           |   |   |                       |
|-----------------------------------|--|------------------------|-------------|--|-----------|---|---|-----------------------|
| ■ Model<br>Specification<br>Items | <b>IXP</b>   | <div></div>            | <b>N 45</b> | <div></div>  | <b>WA</b> | <div></div>                                   | <b>P3</b>   |                       |
|                                   | Series   | Number of<br>axes      | Arm length  | Vertical axis stroke   | Gripper   | Encoder type                                  | Cable length  | Applicable controller |
|                                   |  | 3: 3 axes<br>4: 4 axes | 45: 450mm   | 15 : 150mm, no gripper<br>15GM: 150mm, medium gripper installed<br>10GL : 100mm, large gripper installed |           | WA: Battery-less<br>absolute<br>specification | N: None<br>P: 1m<br>S: 3m<br>M: 5m<br>X□□: Specified length<br>R□□: Robot cable | P3: MSEL              |
|                                   | * Refer to "Component Axes" for the gripper types. |                        |             |  |           |   |   |                       |



\* The photograph shows a 4-axis specification.



Refer to P. 5 for \*1 through \*5.  
 • The vertical axis has no brake.  
 The unique structure holds the load in place even when the servo is turned off.  
 • The vertical axis does not support push-motion control.  
 • If a tool is installed or a spring or other buffer is provided for push-motion, the allowable push force is 60 N or less.  
 • Refer to P. 5 for the work envelope, and P. 18 for the notes on acceleration/ deceleration setting.

## Robot Specifications

| Axis configuration |                   | Arm length (mm) | Work envelope       | Positioning repeatability *1 | Maximum operating speed in PTP mode *2 |                             |                             | Payload (kg) *3                                |         |
|--------------------|-------------------|-----------------|---------------------|------------------------------|--|-----------------------------|-----------------------------|--|---------|
|                    |                   |                 |                     |                              | No gripper                             | With medium gripper (GM)    | With large gripper (GL)     | Rated  | Maximum |
| Axis 1             | Arm 1             | 260             | ±127°               | ±0.03mm                      | 2,438mm/s (Composite speed)            | 2,438mm/s (Composite speed) | 2,060mm/s (Composite speed) | 1  | 3       |
| Axis 2             | Arm 2             | 190             | ±127°               |                              | 270mm/s                                | 270mm/s                     | 189mm/s                     |  |         |
| Axis 3             | Vertical axis     | —               | 150mm *             | ±0.02mm                      | 1,000°/s                               | —                           | —                           | Refer to the catalog of the gripper "RCP4-GR□" |         |
| Axis 4             | Rotating axis     | —               | ±360°               | ±0.02°                       | —                                      | 94mm/s (One finger)         | —                           |  |         |
|                    | Medium gripper GM | —               | 14mm (Both fingers) | ±0.01mm                      | —                                      | 125mm/s (One finger)        | —                           |  |         |
|                    | Large gripper GL  | —               | 22mm (Both fingers) | ±0.01mm                      | —                                      | —                           | —                           |  |         |

\* When the large gripper is installed, the work envelope of the vertical axis becomes 100mm.

## Robot Specifications

|   |                       | 3-axis specification   | 4-axis specification           | 3-axis specification  |                            |
|---|-----------------------|--|--------------------------------|---|----------------------------|
|   |                       | No gripper   |                                | With medium gripper (GM)  | With large gripper (GL)    |
| Encoder type  |                       | Battery-less absolute encoder  |                                |   |                            |
| User wiring   |                       | AWG24x6, AWG26x5P (shielded)<br>* User cables are sold separately. Refer to the operation manual for detail. |                                | User wiring is not supported because the gripper wiring is used |                            |
| User piping   |                       | Air tube (O.D. ø4, I.D. ø2.5) x 3<br>(Normal working pressure 0.8 MPa)                                       |                                |   |                            |
| Standard cycle time<br>*4 (sec)                     | SCARA                 | 0.67   |                                | 0.67  | 0.95                       |
|   | Gripper (full stroke) | —  |                                | 0.51  | 0.56                       |
| Allowable torque (Axis 4) (N・m)                     |                       | —  | 1.4                            | —   |                            |
| Allowable moment (N・m)                              |                       | 2.9  |                                | Ma 1.9<br>Mb 2.7<br>Mc 2.9                                      | Ma 2.9<br>Mb 2.9<br>Mc 2.9 |
| Allowable inertial moment of tip axis<br>*5 (kg・m2) |                       | Rated: 0.003<br>Maximum: 0.01  | Rated: 0.003<br>Maximum: 0.003 | 0.002   | 0.009                      |
| Ambient temperature/humidity                        |                       | Temperature: 0~40°C, humidity: 20-85% RH or less (Non-condensing)  |                                |   |                            |
| Unit weight (kg)                                    |                       | 13   | 14                             | 132.5   | 14                         |

## Component Axes

|              |   |
|--------------|---|
| IXP-3N4515GM | The medium gripper RCP4-GRSML is installed at the tip of the vertical axis. |
| IXP-3N4510GL | The large gripper RCP4-GRSLL is installed at the tip of the vertical axis.  |

## Price List

| Gripper        | SCARA 3-axis specification | Standard price |
|----------------|----------------------------|----------------|
| None           | IXP-3N4515                 | —              |
| Medium gripper | IXP-3N4515GM               | —              |
| Large gripper  | IXP-3N4510GL               | —              |

| Gripper | SCARA 4-axis specification (with rotating axis) | Standard price |
|---------|---|----------------|
| None    | IXP-4N4515                                      | —              |

## Cable Length <Per Axis\*>

| Type           | Cable code          | Standard price |
|----------------|---------------------|----------------|
| Standard type  | P (1m)              | —              |
|                | S (3m)              | —              |
|                | M (5m)              | —              |
| Special length | X06 (6m)~X10 (10m)  | —              |
|                | X11 (11m)~X15 (15m) | —              |
|                | X16 (16m)~X20 (20m) | —              |
| Robot cable    | R01 (1m)~R03 (3m)   | —              |
|                | R04 (4m)~R05 (5m)   | —              |
|                | R06 (6m)~R10 (10m)  | —              |
|                | R11 (11m)~R15 (15m) | —              |
|                | R16 (16m)~R20 (20m) | —              |

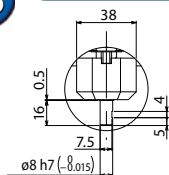
\* The 3-axis specification requires three cables, while the gripper specification and 4-axis specification require four cables.

## Dimensions

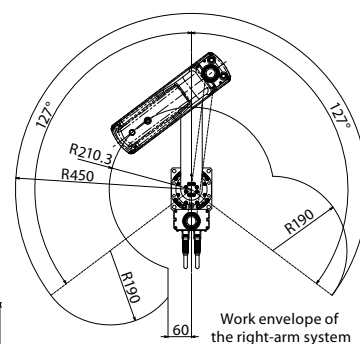
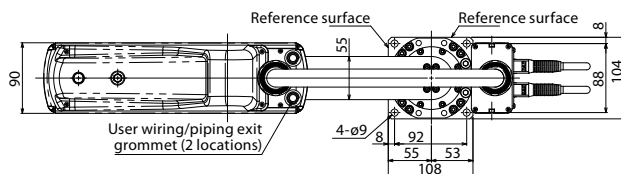


CAD drawings can be downloaded from the website.

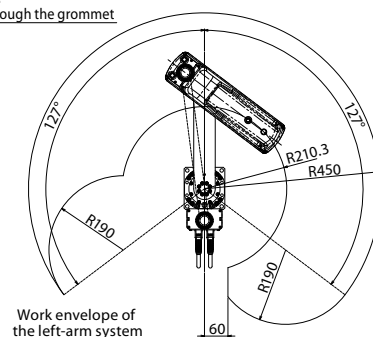
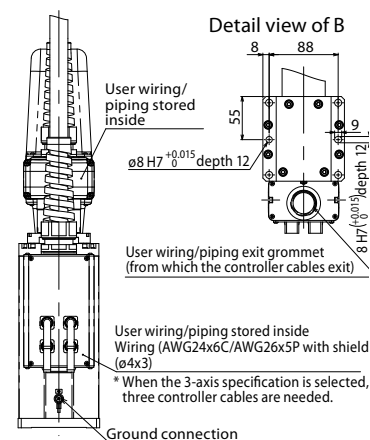
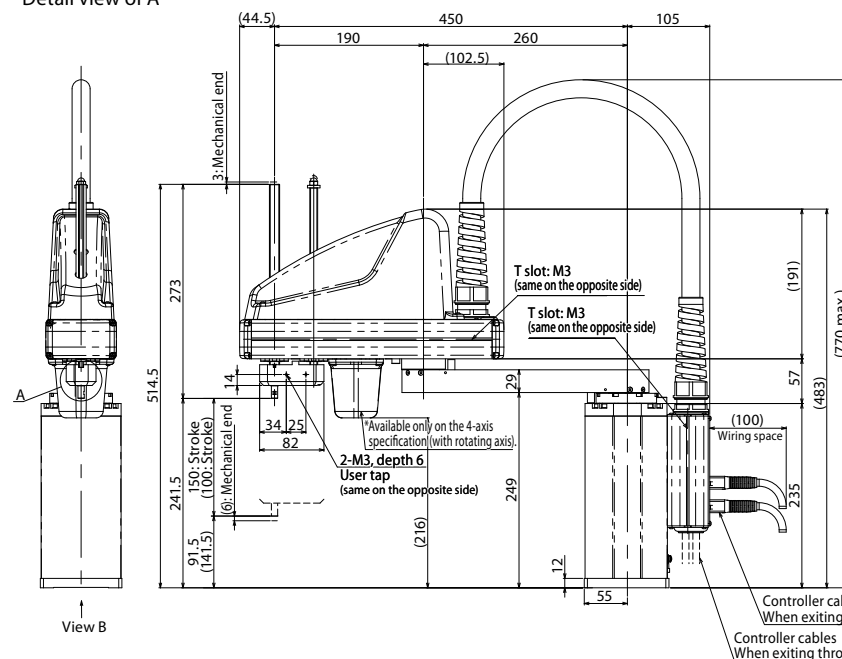
[www.intelligentactuator.com](http://www.intelligentactuator.com)



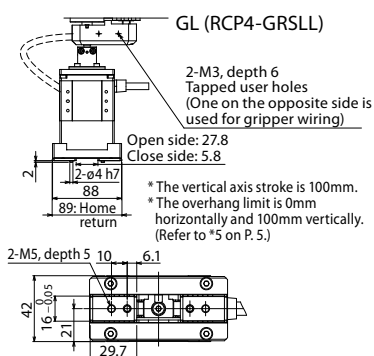
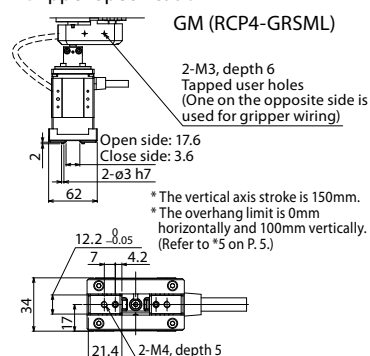
Detail view of A



Detail view of B



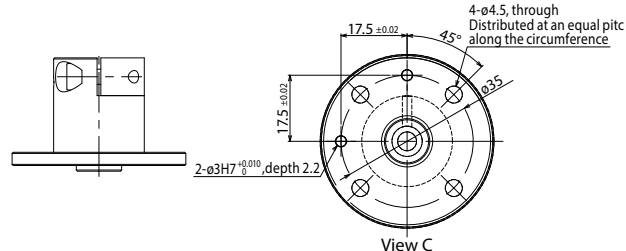
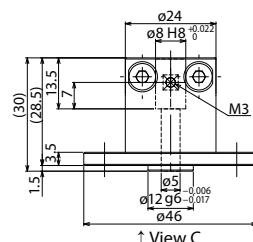
### <Gripper Specification>



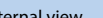
<Flange Dimensions>

An optional flange is available.  
Use a flange when installing a tool, etc.,  
at the tip of the vertical axis.

| Model type | Standard price | Weight  |
|------------|----------------|---------|
| IXP-FL-2   | —              | 121.95g |



## Applicable Controller Specifications




| Name                      | External view   | Applicable controller | Features     | Standard I/O points (input/output) | Power-supply voltage | Reference page |
|---------------------------|---|-----------------------|--------------|------------------------------------|----------------------|----------------|
| PowerCON SCARA controller |  | MSEL                  | Up to 4 axes | 16 points/<br>16 points            | AC100V~230V          | P. 11          |

# MSEL

## MSEL-PCX/PGX Program Controllers for PowerCON SCARA

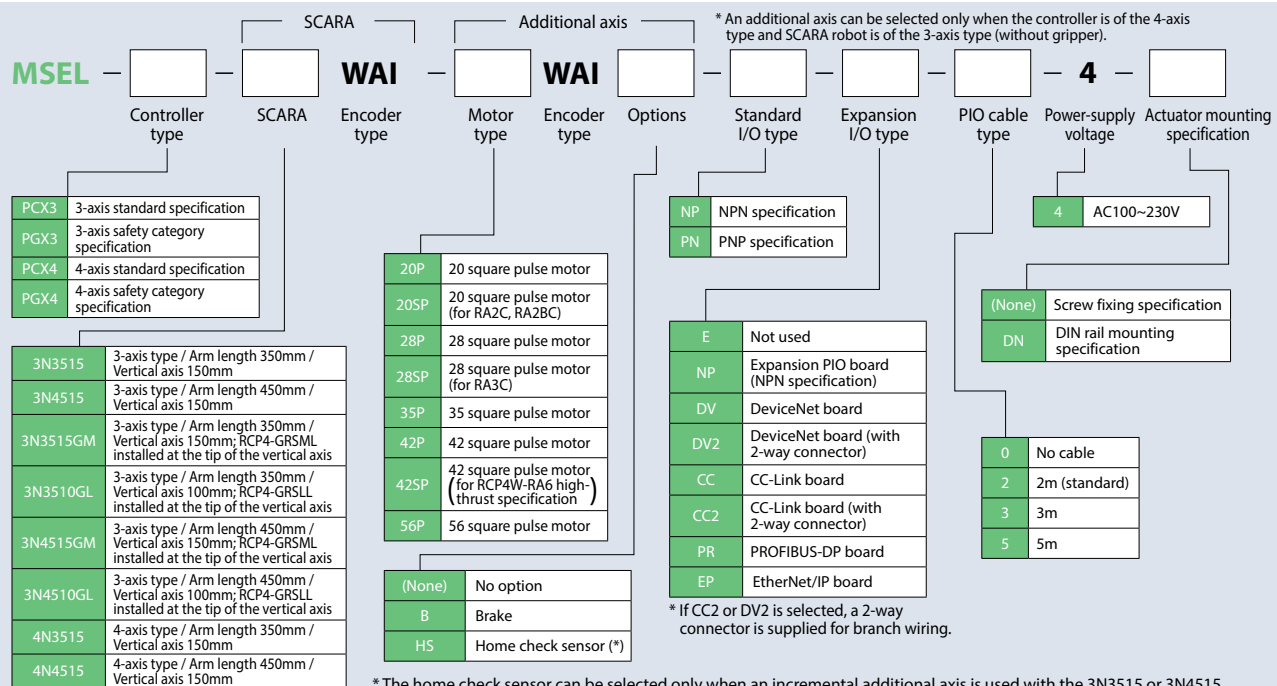


### Model List

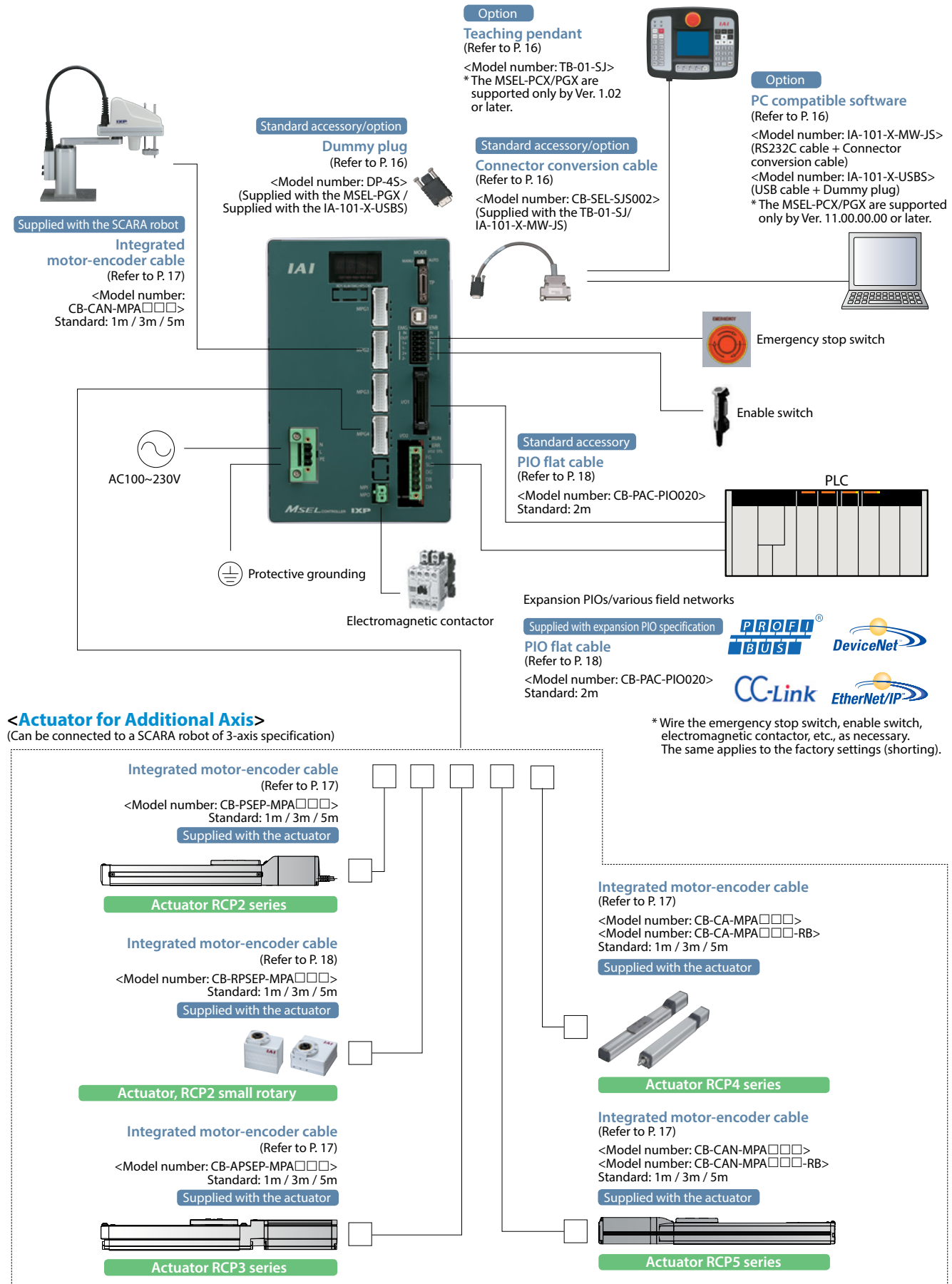
| Name                    | PowerCON SCARA controller   |  |   |  |
|-------------------------|---|--|---|--|
| External view           |  |  |   |  |
| Type name               | PCX3  | PGX3  | PCX4  | PGX4  |
| Type                    | 3-axis standard specification   | 3-axis safety category specification   | 4-axis standard specification   | 4-axis safety category specification   |
| Standard price          | —   | —  | —   | —  |
| Safety category (*1)    | B   | Can be made compliant with category 3  | B   | Can be made compliant with category 3  |
| Connected actuator      | IXP 3-axis specification  |  | IXP 3-axis specification + additional axis<br>IXP 3-axis gripper specification<br>IXP 4-axis specification (with rotating axis) |  |
| Standard I/Os           | NPN, PNP(16IN/16OUT)  |  |   |  |
| Expansion I/Os          | NPN, CC-Link, DeviceNet, PROFIBUS-DP, EtherNet/IP                                 |  |   |  |
| Number of programs      | 255   |  |   |  |
| Number of program steps | 9,999   |  |   |  |
| Number of positions     | 30,000  |  |   |  |
| Power-supply voltage    | Single-phase 100 to 230 VAC   |  |   |  |

\*1: Meeting this safety category requires the customer to install a safety circuit externally to the controller.

### Model



# System Configuration



**Basic Controller Specifications**

| Specification item                |                        |                         | Contents   |
|-----------------------------------|------------------------|-------------------------|--|
| Power-supply input voltage        |                        |                         | Single-phase 100 to 230 VAC±10%  |
| Power-supply current              |                        |                         | 2.9A typ. (AC100V), 1.4A typ. (AC200V), 1.2A typ. (AC230V)   |
| Power-supply frequency range      |                        |                         | 50/60Hz±5%   |
| Motor type                        |                        |                         | Pulse motor (servo control)  |
| Supported encoder                 |                        |                         | Incremental encoder / Battery-less absolute encoder  |
| Data storage device               |                        |                         | FlashROM/FRAM  |
| Number of program steps           |                        |                         | 9,999  |
| Number of positions               |                        |                         | 30,000   |
| Number of programs                |                        |                         | 255  |
| Number of multitasks              |                        |                         | 16   |
| Operation mode                    | Serial communications  |                         | ○  |
|                                   | Program                |                         | ○  |
| SIO interface                     | Communication method   |                         | RS232 (asynchronous communications)  |
|                                   | Baud rate              |                         | 9.6, 19.2, 38.4, 57.6, 76.8, 115.2kbps   |
|                                   | Live wire connection   | TP port                 | ×  |
|                                   |                        | USB                     | ○  |
| Standard PIO interface            | Input Specification    | Number of input points  | 16 points  |
|                                   |                        | Input voltage           | DC24V±10%  |
|                                   |                        | Input current           | 7mA/circuit  |
|                                   |                        | ON voltage              | Min.DC16V  |
|                                   |                        | OFF voltage             | Max.DC5V   |
|                                   |                        | Leak current            | Allowable leak current: 1 mA max.  |
|                                   |                        | Insulation method       | Photocoupler insulation  |
|                                   | Output specification   | Number of output points | 16 points  |
|                                   |                        | Load voltage            | DC24V±10%  |
|                                   |                        | Maximum current         | 100mA per point, 400mA per 8 points Note 1   |
|                                   |                        | Saturated voltage       | Max.3V   |
|                                   |                        | Leak current            | Max.0.1mA  |
| Insulation method                 |                        | Photocoupler insulation |  |
| Compliant expansion I/O interface |                        |                         | Expansion PIO NPN specification (16IN/16OUT)   |
|                                   |                        |                         | CC-Link (remote device station)  |
|                                   |                        |                         | DeviceNet  |
|                                   |                        |                         | PROFIBUS-DP  |
|                                   |                        |                         | EtherNet/IP  |
| Calendar/clock function           | Retention time         |                         | Approx. 10 days  |
|                                   | Charge time            |                         | Approx. 100 hours (fully charged)<br>* Data can be retained even when the batteries are not fully charged. |
| Protective functions              |                        |                         | Overcurrent, abnormal temperature, fan speed low monitoring, encoder disconnection, etc.                   |
| Operating temperature range       |                        |                         | 0~40°C   |
| Operating humidity range          |                        |                         | 85% RH max. (non-condensing, non-freezing)   |
| Installation                      | Installation direction |                         | Installed vertically (exhaust side up)   |
|                                   | Installation method    |                         | Mounted with screws or using a DIN rail  |
| Rush current                      |                        |                         | 15A typ. (100 V AC), 30A typ. (200 V AC): 5ms max. (Ambient temperature 25°C/ No cycling of the power)     |
| Air cooling method                |                        |                         | Forced air cooling   |
| External dimensions               |                        |                         | Width 130mm x Height 195mm x Depth 125mm   |
| Mass                              |                        |                         | Approx. 1,400g   |

Note 1: The total load current shall be 400mA for every eight points from standard I/O No. 316. (The maximum current per point shall be 100mA.)



## PIO Signal Chart

Pin Layouts for Standard PIO Connector/Expansion PIO Connector

| Pin No. | Category | Assignment | Pin No. | Category | Assignment |
|---------|----------|------------|---------|----------|------------|
| 1A      | 24V      | P24        | 1B      | Output   | OUT0       |
| 2A      | 24V      | P24        | 2B      |          | OUT1       |
| 3A      | —        | —          | 3B      |          | OUT2       |
| 4A      | —        | —          | 4B      |          | OUT3       |
| 5A      | Input    | IN0        | 5B      |          | OUT4       |
| 6A      |          | IN1        | 6B      |          | OUT5       |
| 7A      |          | IN2        | 7B      |          | OUT6       |
| 8A      |          | IN3        | 8B      |          | OUT7       |
| 9A      |          | IN4        | 9B      |          | OUT8       |
| 10A     |          | IN5        | 10B     |          | OUT9       |
| 11A     |          | IN6        | 11B     |          | OUT10      |
| 12A     |          | IN7        | 12B     |          | OUT11      |
| 13A     |          | IN8        | 13B     |          | OUT12      |
| 14A     |          | IN9        | 14B     |          | OUT13      |
| 15A     |          | IN10       | 15B     |          | OUT14      |
| 16A     |          | IN11       | 16B     |          | OUT15      |
| 17A     |          | IN12       | 17B     | —        | —          |
| 18A     |          | IN13       | 18B     | —        | —          |
| 19A     |          | IN14       | 19B     | 0V       | N          |
| 20A     |          | IN15       | 20B     | 0V       | N          |

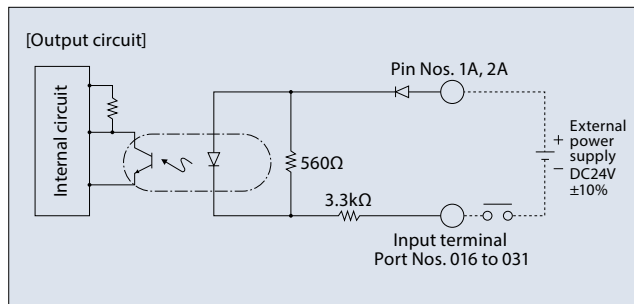
## Internal Circuits for Standard I/Os (NPN Specifications)

[Input section] External input specifications (NPN specifications)

| Item              | Specifications   |
|-------------------|--|
| Input voltage     | DC24V $\pm 10\%$                                       |
| Input current     | 7mA/circuit  |
| On/Off voltage    | On voltage...Min. 16.0 VDC, Off voltage...Max. 5.0 VDC |
| Insulation method | Photocoupler insulation                                |

\* The port numbers in the circuit diagram below represent the factory-set port numbers.

\* When the input is off, the allowable leak current is 1mA max.



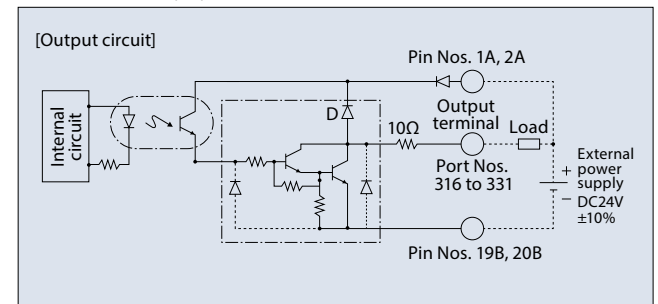
\* For the standard I/Os (PNP specifications), refer to the operation manual.

[Output section] External output specifications (NPN specifications)

| Item                 | Specifications                    |
|----------------------|-----------------------------------|
| Load voltage         | DC24V $\pm 10\%$                  |
| Maximum load current | 100mA/point, 400mA/8 points Note) |
| Leak current         | Max. 0.1mA/point                  |
| Insulation method    | Photocoupler insulation           |

\* The port numbers in the circuit diagram below represent the factory-set port numbers.

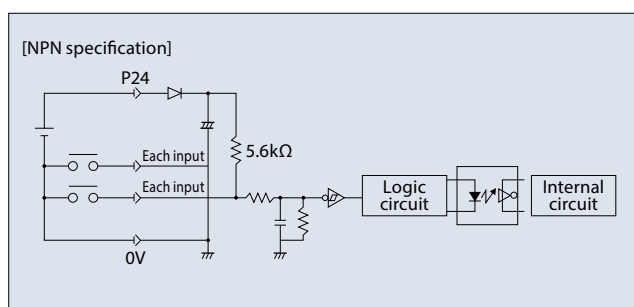
Note: The total load current shall be 400 mA for every eight points from standard I/O No. 316. (The maximum current per point shall be 100mA.)



## Internal Circuits for Expansion I/Os (NPN Specifications)

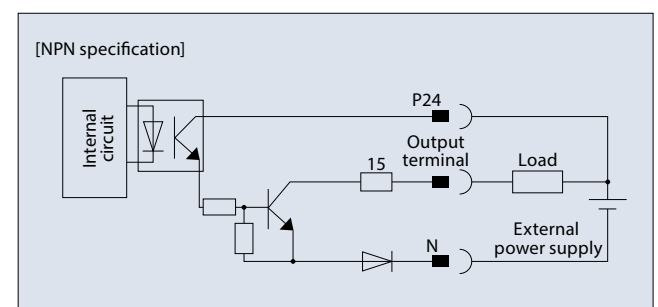
[Input section] External input specifications

| Item                   | Specifications   |
|------------------------|--|
| Number of input points | 16 points  |
| Input voltage          | DC24V $\pm 10\%$   |
| Input current          | 4mA/circuit  |
| On/Off voltage         | On voltage...Min. 18 VDC (3.5mA)<br>Off voltage...Max. 6.0 VDC (1mA) |
| Insulation method      | Photocoupler insulation  |

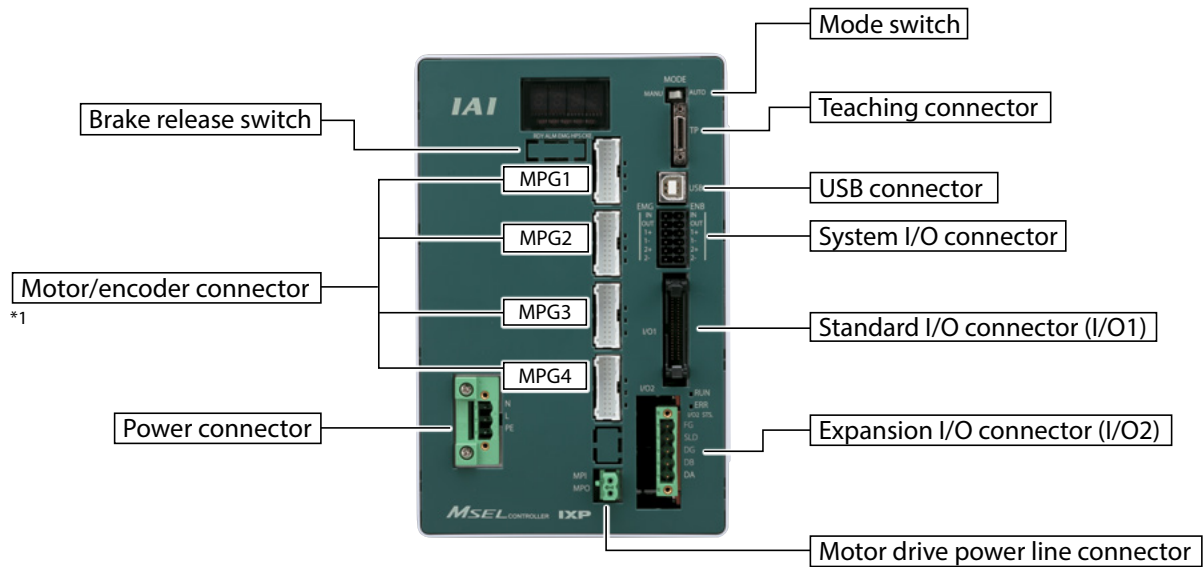


[Output section] External output specifications

| Item                    | Specifications          |
|-------------------------|-------------------------|
| Number of output points | 16 points               |
| Rated load current      | DC24V $\pm 10\%$        |
| Maximum current         | 50mA/circuit            |
| Insulation method       | Photocoupler insulation |

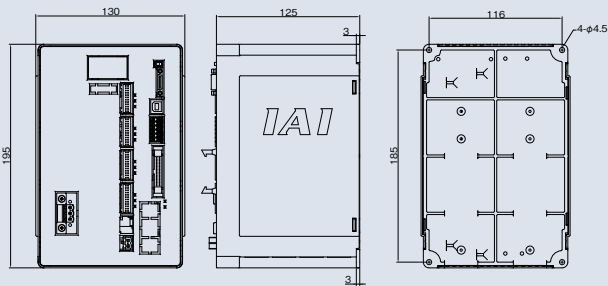


## Name of Each Part

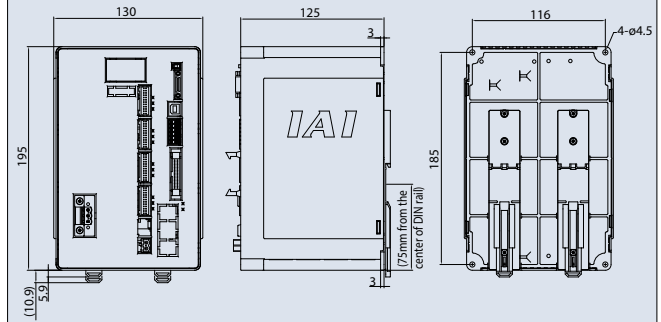


## External dimensions

### Screw fixing specification



### DIN rail mounting specification



## Options

### Teaching Pendant

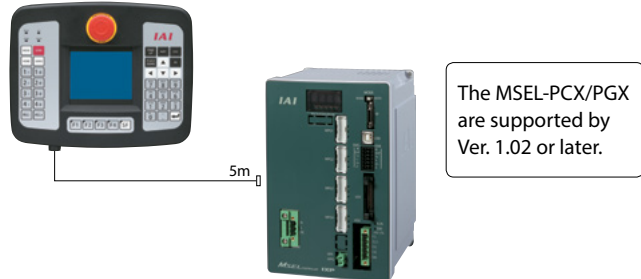
#### Features

A teaching device offering program/position input, trial operation, and monitoring functions.

#### Model number **TB-01-SJ**

\* This model is the standard specification with connector conversion cable. If you are interested in the deadman switch specification, specify the model number of the applicable teaching pendant (TB-01D-N/TB-01DR-N) and that of the cable (CB-TB1-X050-JS).

#### Configuration



### Dummy Plug

#### Features

This plug is required for the safety category specification (MSEL-PGX) and when the MSEL is operated using a USB cable. (The MSEL-PGX type and PC compatible software IA-101-X-USBS come with this dummy plug.)



#### Model number **DP-4S**

### Connector Conversion Cable

#### Features

This cable is used to convert the D-sub 25-pin connector of the teaching pendant or RS232C cable to the MSEL teaching connector. (The TB-01-SJ and IA-101-X-MW-JS come with this connector conversion cable.)

#### Model number **CB-SEL-SJS002**



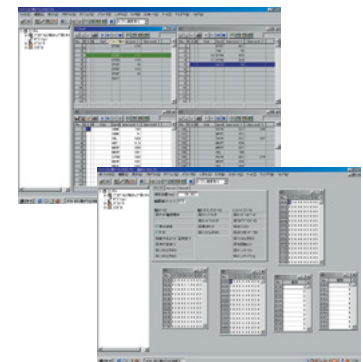
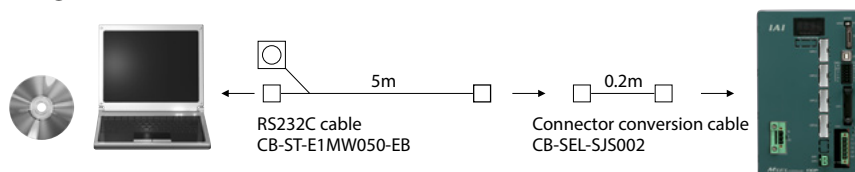
### PC Compatible Software (Windows Only)

#### Features

The startup support software provides program/position input, test operation and monitoring functions, among others. With its enhanced functions required for debugging, this software helps shorten the startup time.

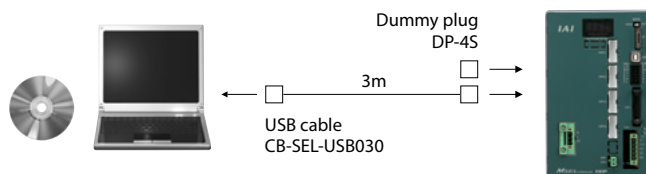
#### Model number **IA-101-X-MW-JS** (RS232C cable + Connector conversion cable)

#### Configuration



#### Model number **IA-101-X-USBS** (USB cable + Dummy plug)

#### Configuration



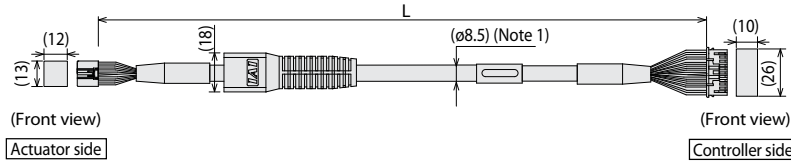
The MSEL-PCX/PGX are supported by Ver. 11.00.00.00 or later.

The CB-ST-E1MW050-EB cannot be used when "Building an enable system that uses a system I/O connector and external power supply" or "Building a redundant safety circuit." (The CB-ST-A1MW050-EB must be used instead.)

Service Parts

|              |                  |                                      |  |
|--------------|------------------|--------------------------------------|--|
| Model Number | CB-CAN-MPA□□□    | Integrated Motor-Encoder Cable       | for RCP4-SA3/RA3/RCP5 as Additional 4th Axis |
|              | CB-CAN-MPA□□□-RB | Integrated Motor-Encoder Robot Cable |  |

\* Please indicate cable length (L) in □□□, maximum 20m. e.g.) 080 = 8m



Minimum bending radius 5m or less length R = 68mm or more (Dynamic bending condition)  
Longer than 5m R = 73mm or more (Dynamic bending condition)

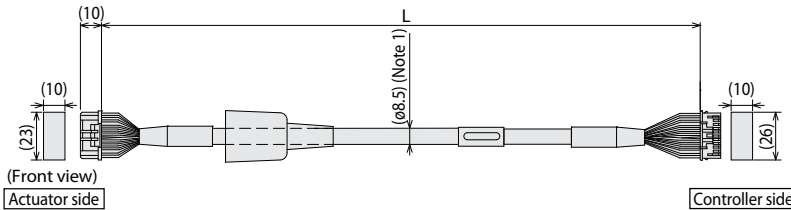
\* The robot cable is designed for flex-resistance: Please use the robot cable if the cable has to be installed through a cable track.

(Note 1) If the cable is 5m or longer, ø9.1 cable diameter applies for a non-robot cable and ø10 for a robot cable.

| Pin No. | Signal name | Pin No. | Signal name |
|---------|-------------|---------|-------------|
| 3       | øA/U        | 1       | øA/U        |
| 5       | VMM/V       | 2       | VMM/V       |
| 10      | ø A/W       | 3       | ø A/W       |
| 9       | øB/-        | 4       | øB/-        |
| 4       | VMM/-       | 5       | VMM/-       |
| 15      | ø B/-       | 6       | ø B/-       |
| 8       | LS+/BK+     | 7       | LS+/BK+     |
| 14      | LS-/BK-     | 5       | LS-/BK-     |
| 12      | -/A+        | 11      | -/A+        |
| 17      | -/A-        | 12      | -/A-        |
| 1       | A+/B+       | 13      | A+/B+       |
| 6       | A-/B-       | 14      | A-/B-       |
| 11      | B+/Z+       | 15      | B+/Z+       |
| 16      | B-/Z-       | 16      | B-/Z-       |
| 20      | BK+/LS+     | 9       | BK+/LS+     |
| 2       | BK-/LS-     | 10      | BK-/LS-     |
| 21      | LS GND      | 17      | LS GND      |
| 7       | VPS         | 19      | VPS         |
| 15      | VCC         | 15      | VCC         |
| 13      | GND         | 20      | GND         |
| 19      | BAT+        | 21      | BAT+        |
| 22      | FG          | 23      | FG          |
| 24      | FG          | 24      | FG          |

|              |                 |                                      |                                 |
|--------------|-----------------|--------------------------------------|---------------------------------|
| Model Number | CB-CA-MPA□□□    | Integrated Motor-Encoder Cable       | for RCP4 as Additional 4th Axis |
|              | CB-CA-MPA□□□-RB | Integrated Motor-Encoder Robot Cable | (*Except RCP4-SA3/RA3)          |

\* Please indicate cable length (L) in □□□, maximum 20m. e.g.) 080 = 8m



Minimum bending radius 5m or less length R = 68mm or more (Dynamic bending condition)  
Longer than 5m R = 73mm or more (Dynamic bending condition)

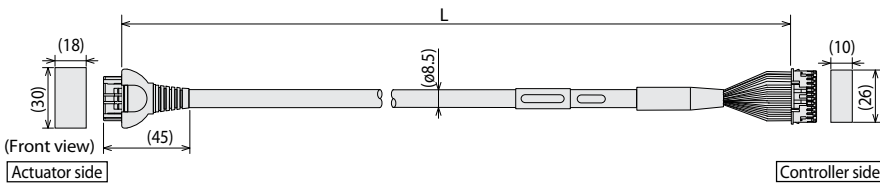
\* The robot cable is designed for flex-resistance: Please use the robot cable if the cable has to be installed through a cable track.

(Note 1) If the cable is 5m or longer, ø9.1 cable diameter applies for a non-robot cable and ø10 for a robot cable.

| Pin No. | Signal name | Pin No. | Signal name |
|---------|-------------|---------|-------------|
| A1      | øA/U        | 1       | øA/U        |
| B1      | VMM/V       | 2       | VMM/V       |
| A2      | ø A/W       | 5       | ø A/W       |
| B2      | øB/-        | 3       | øB/-        |
| A3      | VMM/-       | 4       | VMM/-       |
| B3      | ø B/-       | 6       | ø B/-       |
| A4      | LS+/BK+     | 7       | LS+/BK+     |
| B4      | LS-/BK-     | 8       | LS-/BK-     |
| A6      | -/A+        | 11      | -/A+        |
| B6      | -/A-        | 12      | -/A-        |
| A7      | A+/B+       | 13      | A+/B+       |
| B7      | A-/B-       | 14      | A-/B-       |
| A8      | B+/Z+       | 15      | B+/Z+       |
| B8      | B-/Z-       | 16      | B-/Z-       |
| A5      | BK+/LS+     | 9       | BK+/LS+     |
| B5      | BK-/LS-     | 10      | BK-/LS-     |
| A9      | LS GND      | 20      | LS GND      |
| B9      | VPS         | 18      | VPS         |
| A10     | VCC         | 17      | VCC         |
| B10     | GND         | 19      | GND         |
| A11     | FG          | 21      | FG          |
| B11     | FG          | 22      | FG          |
|         |             | 23      |             |
|         |             | 24      | FG          |

|              |                    |                                      |                        |
|--------------|--------------------|--------------------------------------|------------------------|
| Model Number | CB-APSEP-MPA□□□-LC | Integrated Motor-Encoder Cable       | for RCP3/RCA2, etc.    |
|              | CB-APSEP-MPA□□□    | Integrated Motor-Encoder Robot Cable | as Additional 4th Axis |

\* Please indicate cable length (L) in □□□, maximum 20m. e.g.) 080 = 8m



Minimum bending radius R = 68mm or more (Dynamic bending condition)

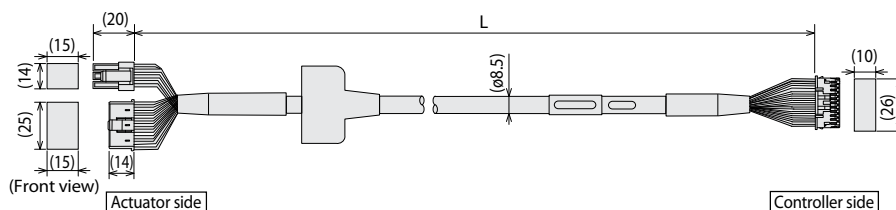
\* The robot cable is designed for flex-resistance: Please use the robot cable if the cable has to be installed through a cable track.

| Actuator side | Signal name      | Controller side | Signal name      |
|---------------|------------------|-----------------|------------------|
| A1            | (øA) (U)         | 1               | (øA) (U)         |
| B1            | (VMM) (V)        | 2               | (VMM) (V)        |
| A2            | (øA) (W)         | 5               | (øA) (W)         |
| B2            | (øB) (-)         | 3               | (øB) (-)         |
| A3            | (VMM) (-)        | 4               | (VMM) (-)        |
| B3            | (øB) (-)         | 6               | (øB) (-)         |
| A4            | (LS+) (BK+)      | 7               | (LS+) (BK+)      |
| B4            | (LS-) (BK-)      | 8               | (LS-) (BK-)      |
| A6            | (-) (A+)         | 11              | (-) (A+)         |
| B6            | (-) (A-)         | 12              | (-) (A-)         |
| A7            | (A+) (B+)        | 13              | (A+) (B+)        |
| B7            | (A-) (B-)        | 14              | (A-) (B-)        |
| A8            | (B+) (Z+)        | 15              | (B+) (Z+)        |
| B8            | (B-) (Z-)        | 16              | (B-) (Z-)        |
| A5            | (BK+) (LS+)      | 9               | (BK+) (LS+)      |
| B5            | (BK-) (LS-)      | 10              | (BK-) (LS-)      |
| A9            | (GNDLS) (GNDLS)  | 20              | (GNDLS) (GNDLS)  |
| B9            | (VPS) (VPS)      | 18              | (VPS) (VPS)      |
| A10           | (VCC) (VCC)      | 17              | (VCC) (VCC)      |
| B10           | (GND) (GND)      | 19              | (GND) (GND)      |
| A11           | NC               | 21              | NC               |
| B11           | NC               | 22              | NC               |
|               | Shield (FG) (FG) | 24              | Shield (FG) (FG) |
|               |                  | 23              |                  |

|              |                |                                      |                                 |
|--------------|----------------|--------------------------------------|---------------------------------|
| Model Number | CB-PSEP-MPA□□□ | Integrated Motor-Encoder Robot Cable | for RCP2 as Additional 4th Axis |
|--------------|----------------|--------------------------------------|---------------------------------|

\*Only robot cable is available for this model.

\* Please indicate cable length (L) in □□□, maximum 20m. e.g.) 080 = 8m



Minimum bending radius R = 68mm or more (Dynamic bending condition)

| Actuator side | Signal name | Controller side | Signal name |
|---------------|-------------|-----------------|-------------|
| 1             | (øA) (U)    | 1               | (øA) (U)    |
| 2             | (VMM) (V)   | 2               | (VMM) (V)   |
| 4             | (øA) (W)    | 5               | (øA) (W)    |
| 5             | (VMM) (-)   | 4               | (VMM) (-)   |
| 3             | (øB) (-)    | 6               | (øB) (-)    |
| 6             | (BK+) (LS+) | 7               | (BK+) (LS+) |
| 16            | (BK-) (LS-) | 8               | (BK-) (LS-) |
| 5             | NC          | 11              | NC          |
| 6             | NC          | 12              | NC          |
| 13            | (LS+) (A+)  | 9               | (LS+) (A+)  |
| 14            | (LS-) (A-)  | 10              | (LS-) (A-)  |
| 2             | (A+) (B+)   | 13              | (A+) (B+)   |
| 4             | (A-) (B-)   | 14              | (A-) (B-)   |
| 7             | (B+) (Z+)   | 15              | (B+) (Z+)   |
| 10            | (B-) (Z-)   | 16              | (B-) (Z-)   |
| 11            | (VCC) (VCC) | 17              | (VCC) (VCC) |
| 9             | (VPS) (VPS) | 18              | (VPS) (VPS) |
| 12            | (GND) (GND) | 19              | (GND) (GND) |
| 15            | (Spare)     | 20              | (Spare)     |
| 7             | NC          | 21              | NC          |
| 8             | NC          | 22              | NC          |
| 18            | NC          | 23              | NC          |
|               | Shield (FG) | 24              | Shield (FG) |

|              |                 |                                      |   |
|--------------|-----------------|--------------------------------------|---|
| Model Number | CB-RPSEP-MPA□□□ | Integrated Motor-Encoder Robot Cable | for RCP2-RTBS/RTBSL/RTCS/RTCSL as Additional 4th Axis |
|--------------|-----------------|--------------------------------------|---|

\*Only robot cable is available for this model.

\* Please indicate cable length (L) in □□□, maximum 20m. e.g.) 080 = 8m

Actuator side

Controller side

Minimum bending radius R = 68mm or more (Dynamic bending condition)

| Actuator side |         | Controller side |         |
|---------------|---------|-----------------|---------|
| Pin No.       | Signal  | Pin No.         | Signal  |
| A1            | (eA)    | 1               | (eA)    |
| B1            | (VMM)   | 2               | (eA)    |
| A2            | (eA)    | 3               | (eB)    |
| B2            | (VMM)   | 4               | (eB)    |
| A3            | (VMM)   | 5               | (LS+)   |
| B3            | (LS+)   | 6               | (LS-)   |
| A6            | (A+)    | 7               | (A-)    |
| B6            | (A-)    | 8               | (B+)    |
| A7            | (B+)    | 9               | (B-)    |
| B7            | (B-)    | 10              | (GNDLS) |
| A8            | (VPS)   | 11              | (VCC)   |
| B8            | (VCC)   | 12              | (GND)   |
| A4            | NC      | 13              | NC      |
| B4            | NC      | 14              | NC      |
| A5            | (BK+)   | 15              | (BK-)   |
| B5            | (BK-)   | 16              | (GNDLS) |
| A9            | (GNDLS) | 17              | (VPS)   |
| B9            | (VPS)   | 18              | (VCC)   |
| A10           | (VCC)   | 19              | (GND)   |
| B10           | (GND)   | 20              | NC      |
| A11           | NC      | 21              | NC      |
| B11           | NC      | 22              | NC      |
|               |         | 23              | NC      |

|              |               |                |                          |
|--------------|---------------|----------------|--------------------------|
| Model Number | CB-PAC-PIO□□□ | PIO Flat Cable | for MSEL/PCON-CA/MSEP-LC |
|--------------|---------------|----------------|--------------------------|

\* Please indicate cable length (L) in □□□, maximum 10m. e.g.) 080 = 8m

No connector

No connector

Flat cable (20-core) x 2

Half-pitch MIL socket: HIF6-40D-1.27R (Hirose)

| No. | Signal name | Cable color | Wiring                         | No. | Signal name | Cable color | Wiring                         |
|-----|-------------|-------------|--------------------------------|-----|-------------|-------------|--------------------------------|
| A1  | 24V         | Brown-1     | Flat cable (A) (crimped) AWG28 | B1  | OUT0        | Brown-3     | Flat cable (B) (crimped) AWG28 |
| A2  | 24V         | Red-1       |                                | B2  | OUT1        | Red-3       |                                |
| A3  | —           | Orange-1    |                                | B3  | OUT2        | Orange-3    |                                |
| A4  | —           | Yellow-1    |                                | B4  | OUT3        | Yellow-3    |                                |
| A5  | IN0         | Green-1     |                                | B5  | OUT4        | Green-3     |                                |
| A6  | IN1         | Blue-1      |                                | B6  | OUT5        | Blue-3      |                                |
| A7  | IN2         | Purple-1    |                                | B7  | OUT6        | Purple-3    |                                |
| A8  | IN3         | Gray-1      |                                | B8  | OUT7        | Gray-3      |                                |
| A9  | IN4         | White-1     |                                | B9  | OUT8        | White-3     |                                |
| A10 | IN5         | Black-1     |                                | B10 | OUT9        | Black-3     |                                |
| A11 | IN6         | Brown-2     | Flat cable (A) (crimped) AWG28 | B11 | OUT10       | Brown-4     | Flat cable (B) (crimped) AWG28 |
| A12 | IN7         | Red-2       |                                | B12 | OUT11       | Red-4       |                                |
| A13 | IN8         | Orange-2    |                                | B13 | OUT12       | Orange-4    |                                |
| A14 | IN9         | Yellow-2    |                                | B14 | OUT13       | Yellow-4    |                                |
| A15 | IN10        | Green-2     |                                | B15 | OUT14       | Green-4     |                                |
| A16 | IN11        | Blue-2      |                                | B16 | OUT15       | Blue-4      |                                |
| A17 | IN12        | Purple-2    |                                | B17 | —           | Purple-4    |                                |
| A18 | IN13        | Gray-2      |                                | B18 | —           | Gray-4      |                                |
| A19 | IN14        | White-2     |                                | B19 | 0V          | White-4     |                                |
| A20 | IN15        | Black-2     |                                | B20 | 0V          | Black-4     |                                |

## Reference for SCARA Robot Acceleration/Deceleration Settings

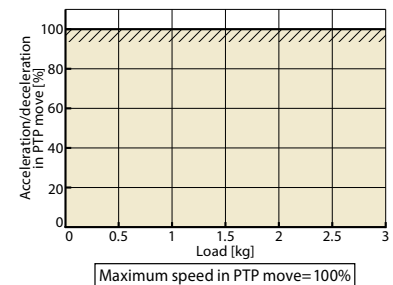
If the robot must be operated continuously, make sure its operations fall within the ranges of the reference graphs for acceleration/deceleration setting and duty cycle setting.

### PTP Move

The maximum speed and acceleration/deceleration at which the robot can operate carrying the applicable load are applied as 100% (optimal speed & optimal acceleration/deceleration function). Make adjustments so that the target speed and acceleration/deceleration can be achieved.

#### Notes

- The optimal speed & optimal acceleration/deceleration function does not guarantee robot operation in all operation patterns.
- If significant vibration generates, reduce the speed and/or acceleration/deceleration because the robot may fail or die prematurely.

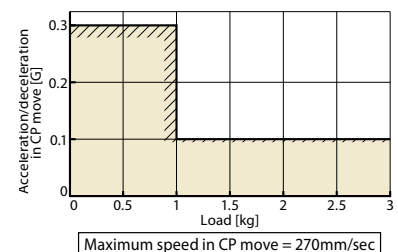


### CP Move

Set the speed and acceleration/deceleration at or below the applicable values according to the graph on the right.

#### Notes

- If significant vibration generates, reduce the speed and/or acceleration/deceleration because the robot may fail or die prematurely.



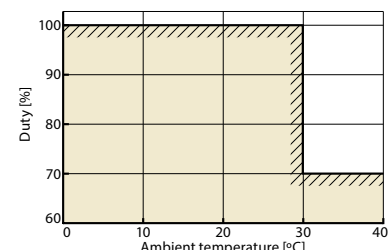
### Duty Cycle Setting

The duty cycle refers to a utilization ratio expressed by the percentage of the robot operating time per cycle.

For this robot, the duty cycle is limited according to the ambient temperature in order to suppress heat generation from the motor unit and reduction gears. In both PTP move and CP move, the maximum value according to the graph on the right must not be exceeded. Also remember to complete a continuous operation within 30 minutes.

#### Notes

- The duty cycle must not exceed the maximum limit, as it may significantly reduce the life of the motor unit or reduction gears.



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