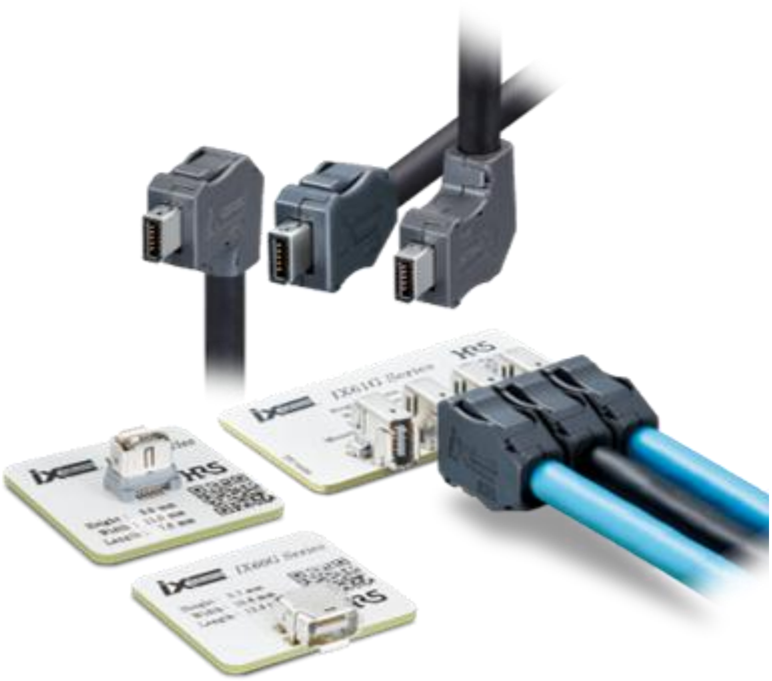
| NO. | ETAD-E3242-00 |
|---|---|

# IX series
# Design Guideline



# Contents

# 1 Introduction

## 1.1 Purpose

This guideline describes the precautions on equipment design and work to be taken in account, when using the IX series.
Please read this guideline before using the IX series.
Please be aware that the images on this document are a general representation of the product and they may differ from the specific product in use.
The guideline information is subject to change without prior notice.

# 2 Product Information

## 2.1 Basic Specification

〇Applicable standard : IEC 61076-3-124

〇UL/cUL certification : Receptacle and Plug

〇Current : 1.5A/pin（all pin）
3A/pin（pin No.1,2,6,7）

〇Voltage : AC 50V / DC 60V

〇Voltage proof : 500V DC（1min.）(altitude of 2000m or less.)

〇Mechanical operation(mating/unmating) : 5000times

〇Insertion and Withdrawal Forces : 25N Max.

〇Vibration, sinusoidal : 10-500Hz 0.35mm 50m/s2 , No electrical discontinuity of 1 μs.

〇Dry heat : +85℃ 500h（mated state）

〇Operating Temperature range : -40~+85℃

〇Storage Temperature range : -30~+60℃

For more information, please refer to the specification sheet for each product.。

2.2 Product Number Structure

○Receptacle

IX 61G # - A - 10 P (##)

① ② ③ ④ ⑤ ⑥ ⑩

| | | | |
|---|---|---|---|
| ①Series Name | IX Series | ④Mating Key/ Application | A : Type A/Ethernet Communication<br>B : Type B/Non-Ethernet Communication<br>C : Type C/Ethernet Communication |
| ②Mounting/ Assembly Method | 61G : Upright Right Angle SMT<br>60G : Horizontal Right Angle SMT<br>80G : Vertical SMT | ⑤Maximum Number of Usable Positions | 10 : 10 pos. |
| | | ⑥Contact Gender | P : Male Contact |
| ③Version | Blank : Ver.1<br>2 : Ver.2 | ⑩Plating Specification | Blank : Gold Plated<br>(01) : Palladium-Nickel Plated + Gold Plated |

○Plug

IX 40G # - A - 10 S - CV (7.0) (##)

① ② ③ ④ ⑤ ⑥ ⑦ ⑨ ⑩

| | | | |
|---|---|---|---|
| ①Series Name | IX Series | ⑤Maximum Number of Usable Positions | 10 : 10 pos.<br>8* : 8 pos. |
| ②Mounting/ Assembly Method | 40G : Hand Solder<br>30G : IDC<br>(26 to 28 AWG, Insulator Outer Diameter ø0.95 to 1.05mm)<br>31 : IDC<br>(24 to 25 AWG, Insulator Outer Diameter ø1.1 to 1.25mm)<br>32 : IDC (22 AWG, Insulator Outer Diameter ø1.4 to 1.6mm) | ⑥Contact Gender | S : Female Contact |
| ③Version | Blank : Ver.1<br>2 : Ver.2 | ⑦Plug Cover Cabling Direction | CV : Straight<br>CVL1 : Downward Cabling<br>CVL2 : Upward Cabling |
| ④Mating Key/ Application | A : Type A/Ethernet Communication<br>B : Type B/Non-Ethernet Communication<br>C : Type C/Ethernet Communication | ⑨Applicable Cable Diameter | (7.0) : Sheath Outer Diameter ø6.3 to 7.2mm |
| | | ⑩Plating Specification | Blank : Gold Plated<br>(01) : Palladium-Nickel Plated + Gold Plated |

* Contacts No.3 and 8 do not have a hole to pass the wire through the IDC guide.

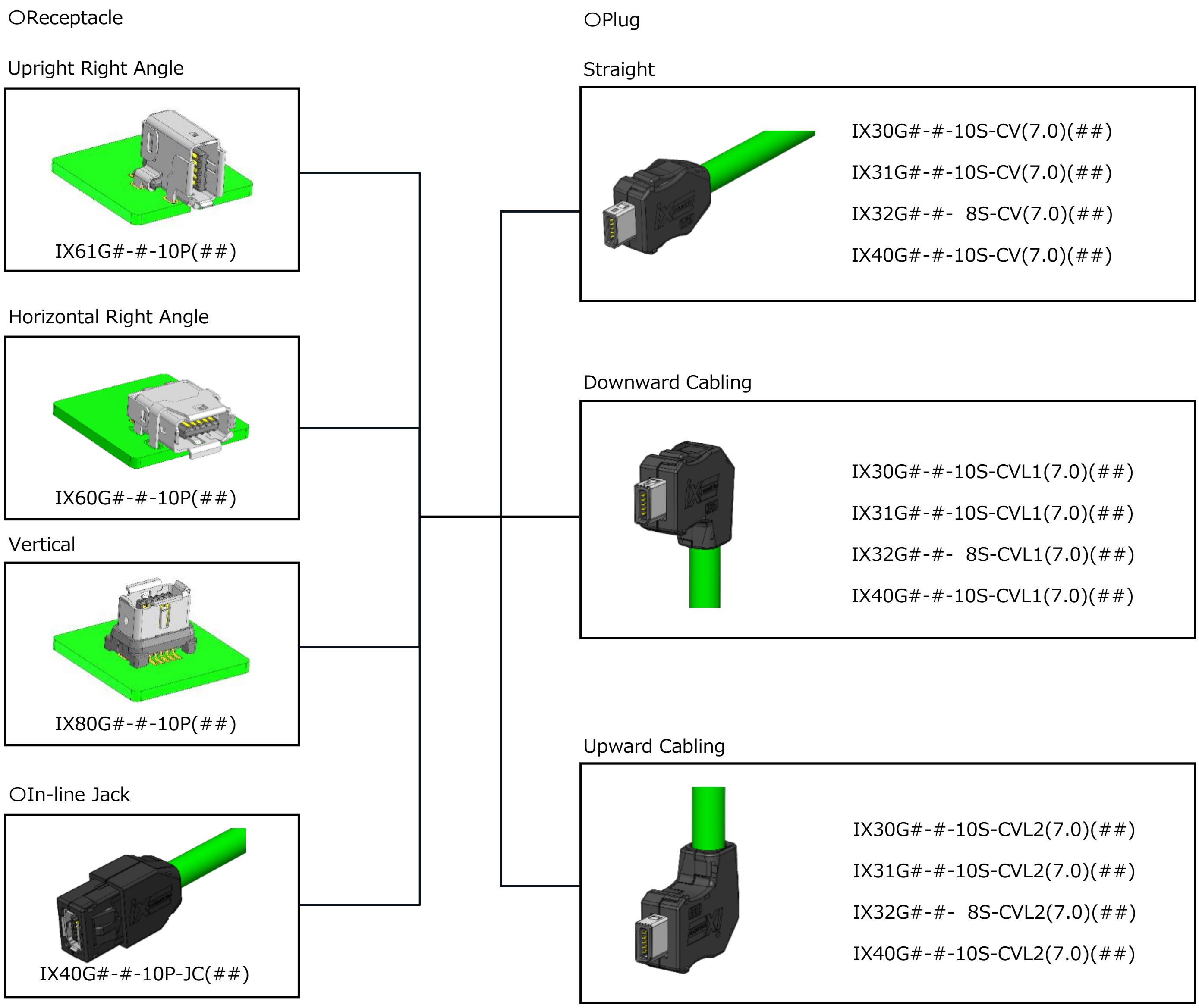
○In-line Jack

IX 40G - A - 10 P - JC (7.0)

① ② ④ ⑤ ⑥ ⑧ ⑨

| | | | |
|---|---|---|---|
| ①Series Name | IX Series | ⑤Maximum Number of Usable Positions | 10 : 10 pos. |
| ②Mounting/ Assembly Method | 40G : Hand Solder | ⑥Contact Gender | P : Male Contact |
| ④Mating Key/ Application | A : Type A/Ethernet Communication<br>B : Type B/Non-Ethernet Communication | ⑨Applicable Cable Diameter | (7.0) : Sheath Outer Diameter ø6.3 to 7.2mm |

## 2.3 Connector Mating Combination Diagram




(00) : Gold Plated 0.2µm

(01) : Palladium-Nickel Plated 0.75µm + Gold Plated 0.05µm

**※Use of Gold Plated and Palladium-Nickel + Gold Plated**

Palladium-Nickel + Gold Plating is lined up as an alternative to Gold Plating and has no difference in terms of basic performance.

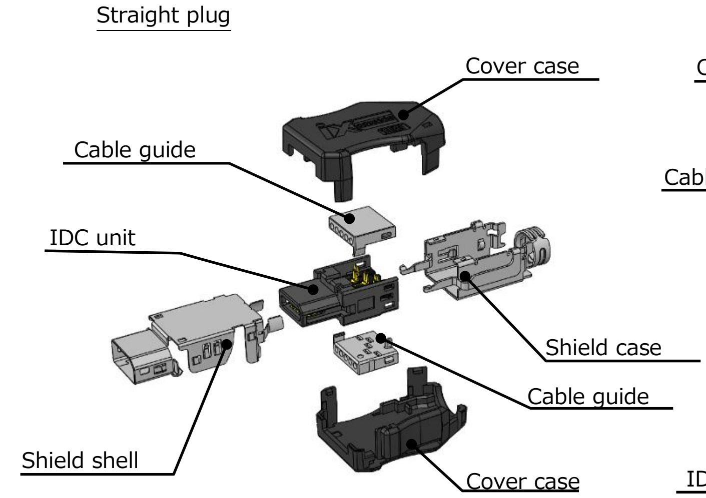
Palladium-Nickel + Gold Plating shall be selected, in case thick Gold Plating is required.

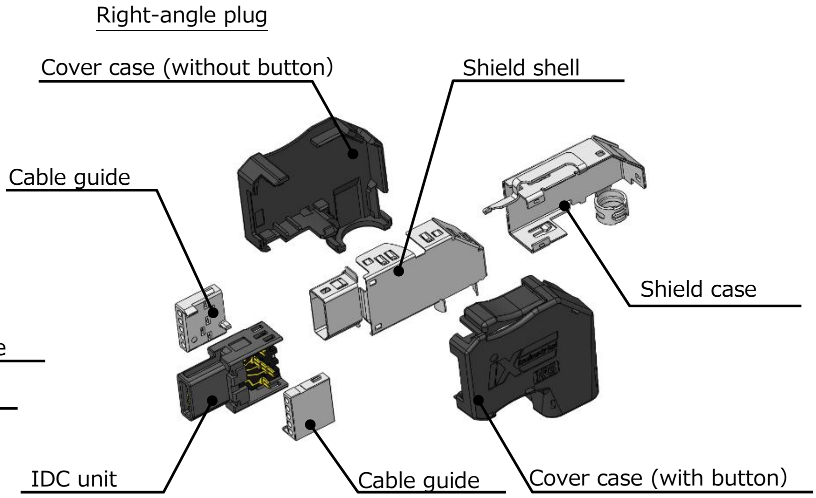
The use of different plating types in combination, is not recommended.

If a combination of different plating types is used, the maximum number of mating cycles will be 750 times.

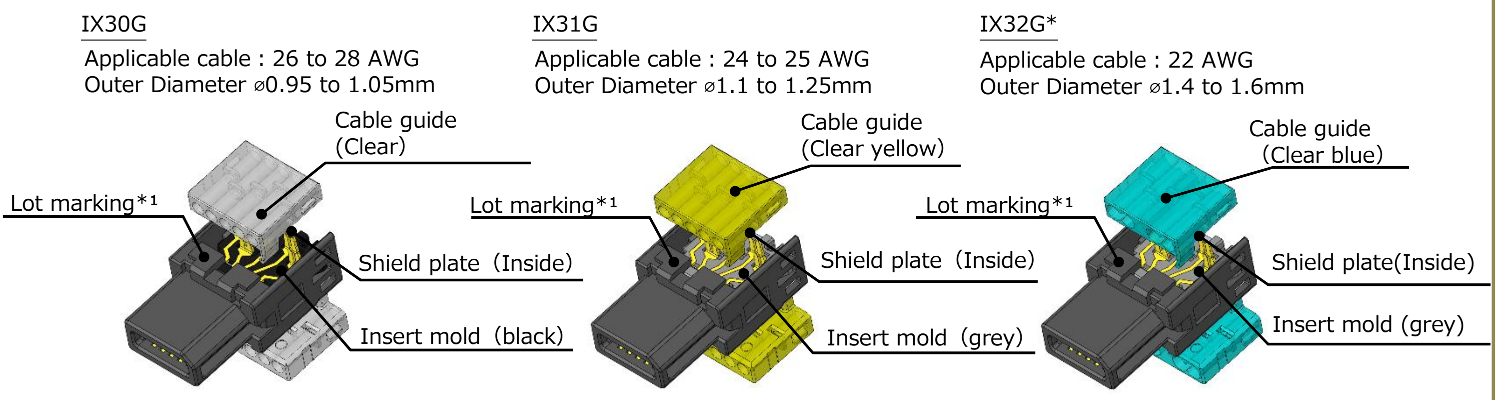
## 2.4 Component Designation

### ○Component Designation - Plug




IDC Unit

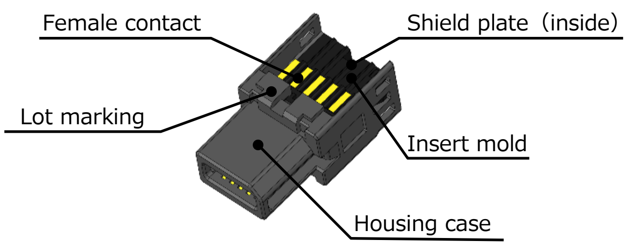



*Contacts No.3 and 8 do not have a hole to pass the wire through the IDC guide.

Solder Unit

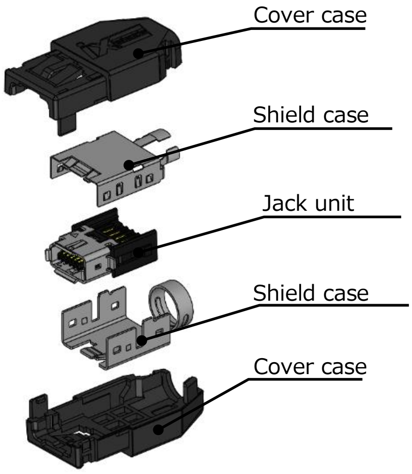
IX40G

Applicable cable : 22 to 28 AWG
Outer diameter ⌀1.55mm Max.*



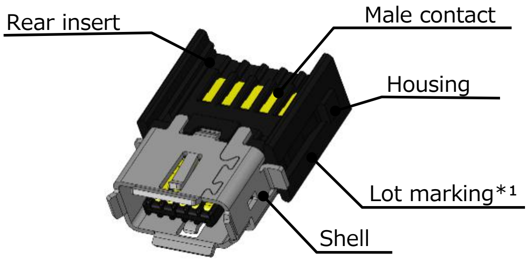

* In case of all terminal connections

## ○Component Designation - In-line jack




Jack unit

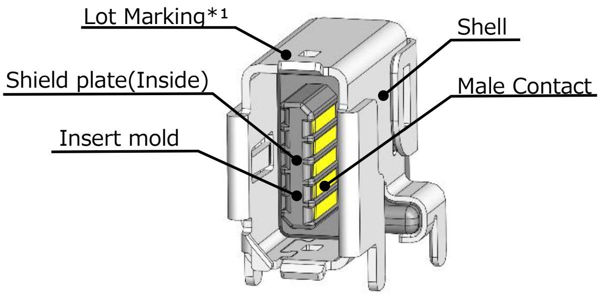
Applicable cable : 22 to 28 AWG
Outer diameter ⌀1.55mm Max.*



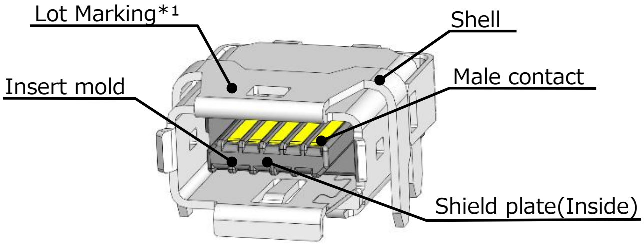

* For all terminal connections

## ○Component designation - Receptacle

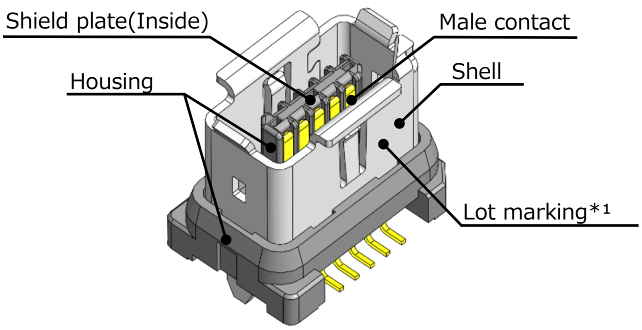
Upright Right Angle




Horizontal Right Angle

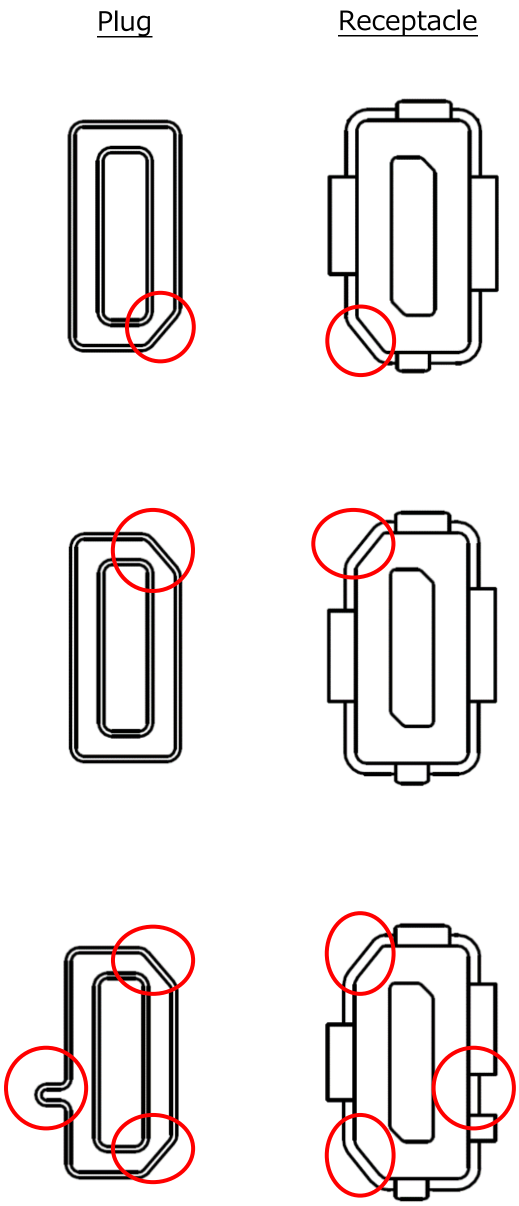



Vertical




*1Please refer to the technical specification ATAD-E2360 about Lot marking.

2.5 Keycode variation




Type A
Ethernet Communication

Type B
Non-Ethernet Communication

Type C
Ethernet Communication

Please be aware that the orientation of the mating key in relation to the PCB depends on the receptacle variant.
Please refer to the part 2D drawing or 3D model for further details.

## 2.6 Pin Assignment

When using A or C keys, the terminal arrangement on the table below shall be applied.
For the B key, any terminal arrangement can be implemented.

Receptacle

| Contact No. | Signal | |
|---|---|---|
| | 10/100 Mbit/s | 1/10 Gbit/s |
| 1 | TX+ | BI_DA+ |
| 2 | TX- | BI_DA- |
| 3 | N.C | GND |
| 4 | N.C | BI_DC+ |
| 5 | N.C | BI_DC- |
| 6 | RX+ | BI_DB+ |
| 7 | RX- | BI_DB- |
| 8 | N.C | GND |
| 9 | N.C | BI_DD+ |
| 10 | N.C | BI_DD- |

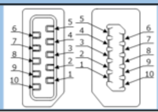
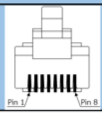
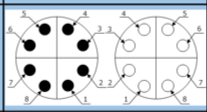
※When the terminal is used as 0 V or signal ground, it should be isolated from the shield (frame ground).

Plug

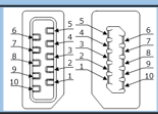
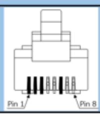
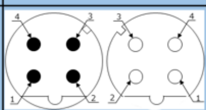
| Contact No. | Signal | |
|---|---|---|
| | 10/100 Mbit/s | 1/10 Gbit/s |
| 1 | TX+ | BI_DA+ |
| 2 | TX- | BI_DA- |
| 3 | N.C | N.C |
| 4 | N.C | BI_DC+ |
| 5 | N.C | BI_DC- |
| 6 | RX+ | BI_DB+ |
| 7 | RX- | BI_DB- |
| 8 | N.C | N.C |
| 9 | N.C | BI_DD+ |
| 10 | N.C | BI_DD- |

In case of change from RJ45/M12 to IX, please refer to the pin assignment correspondance on the table below.

1/10 Gbit/s

| ix Industrial | RJ45 | M12 X-coded | 1 GBASE-T<br>2.5 GBASE-T<br>5 GBASE-T<br>10 GBASE-T | EIA/TIA<br>T568 A | EIA/TIA<br>T568 B |
|---|---|---|---|---|---|
|  |  |  | | | |
| 1 | 1 | 1 | BI_DA+ | White/green | White/orange |
| 2 | 2 | 2 | BI_DA- | Green | Orange |
| 3 | - | - | GND | N.C | N.C |
| 4 | 4 | 8 | BI_DC+ | Blue | Blue |
| 5 | 5 | 7 | BI_DC- | White/blue | White/blue |
| 6 | 3 | 3 | BI_DB+ | White/orange | White/green |
| 7 | 6 | 4 | BI_DB- | Orange | Green |
| 8 | - | - | GND | N.C | N.C |
| 9 | 7 | 5 | BI_DD+ | White/brown | White/brown |
| 10 | 8 | 6 | BI_DD- | brown | brown |

10/100 Mbit/s

| ix Industrial | RJ45<br>4-pole | M12 D-coded<br>M8 D-coded | 10 BASE-T<br>100 BASE-T | ETHERNET/IP<br>(2 Pair) | PROFINET |
|---|---|---|---|---|---|
|  |  |  | | | |
| 1 | 1 | 1 | TX+ | White/orange | Yellow |
| 2 | 2 | 3 | TX- | Orange | Orange |
| 3 | - | - | N.C | N.C | N.C |
| 4 | - | - | N.C | N.C | N.C |
| 5 | - | - | N.C | N.C | N.C |
| 6 | 3 | 2 | RX+ | White/green | White |
| 7 | 6 | 4 | RX- | Green | Blue |
| 8 | - | - | N.C | N.C | N.C |
| 9 | - | - | N.C | N.C | N.C |
| 10 | - | - | N.C | N.C | N.C |

## 2.7 Accessories

### ○Receptacle Cap

| Product Name | HRS No. |
|---|---|
| IXG-10P-DC | CL0251-0097-0-00 |

If enclosure panels are to be installed on mating surfaces, please refer to Note 3 of EDC-395373-00-00 and consider the panel thickness and layout.
The cap can be easily removed by hooking the cap end with a fingernail or flat-blade screwdriver.

## 2.8 Fluke Adapter

A dedicated adaptor is available to perform wiring system certification testing using IX Industrial. To use this adapter, the DSX Cable Analyzer™ series from Fluke Networks is required.

| Product Name | HRS No. |
|---|---|
| DSX-CHA-5-IX-S | CL0251-1001-0-00 |

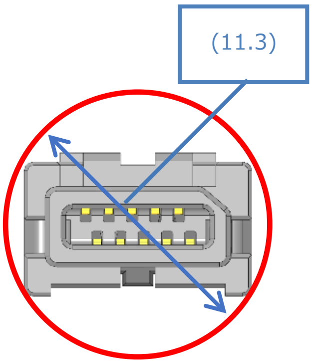
In the IX, the A key is specific for Ethernet communication and the B key is for non-Ethernet communication.
Therefore, only the A key is used as an adaptor.
There is no adaptor for the C key.
The adaptors are manufactured by Fluke Networks and can be provided by us and our distributors. These are sold in sets of two.
※For further information on adaptors and measurements, please contact Fluke Networks.

## 2.9 Diagonal dimensions of Plug and In-line jack

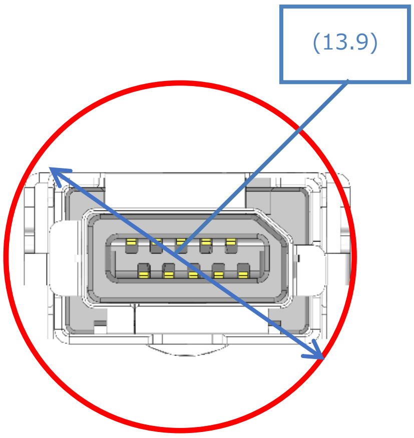
The diagram below shows the reference dimensions for three patterns of diagonal dimensions when viewed from the plug/relay jack mating surface. Please use these dimensions as a reference when inserting the jack into a narrow space such as inside of a robot arm.

○Plug

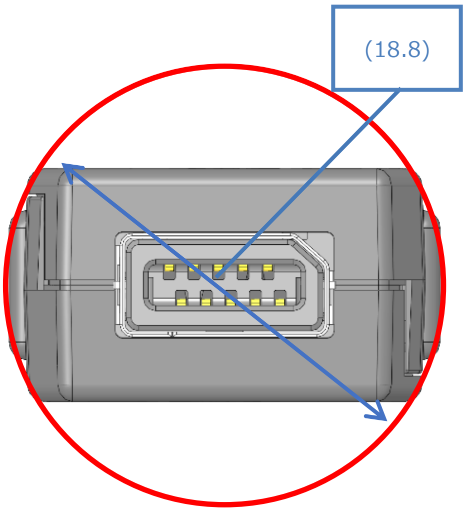
①Only IDC/Solder Unit




②After shield shell assembled

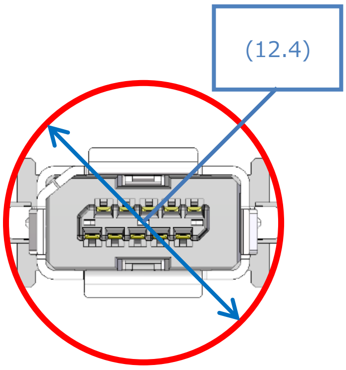



③After cover case assembled (Assembly completed)

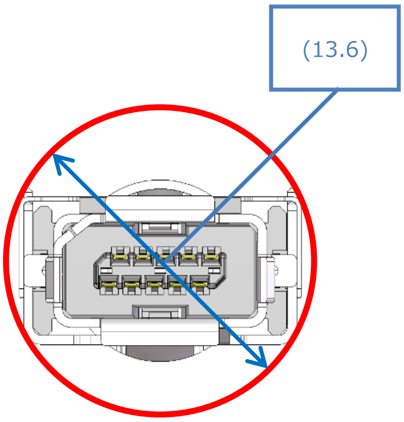



○In-line jack

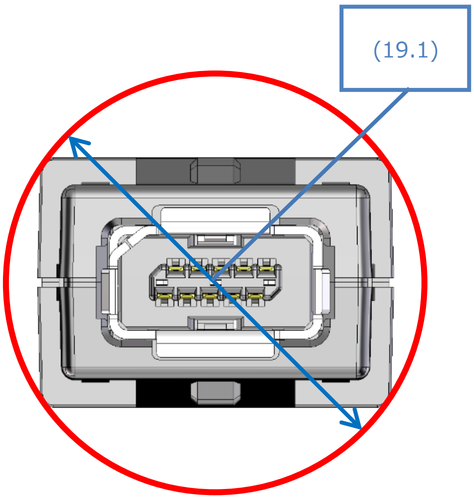
①Only jack unit




②After shield case assembled




③After cover case assembled (Assembly completed)



# 3 Applicable cables

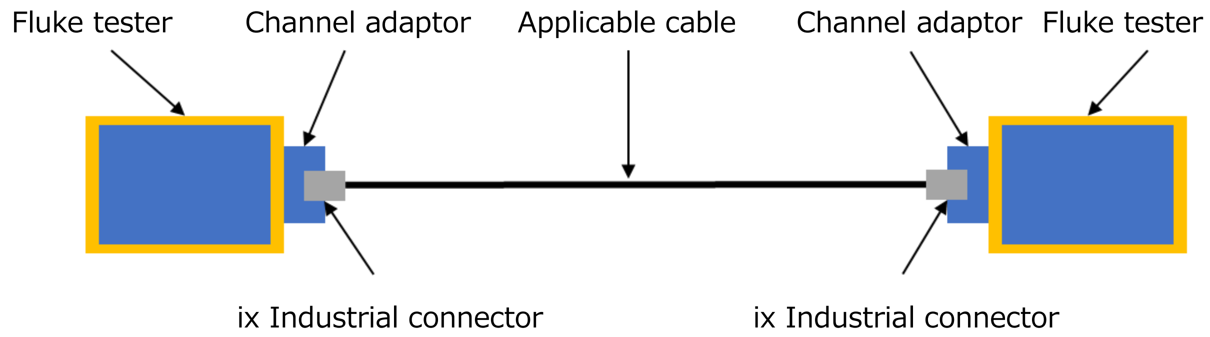
## 3.1 Applicable cables list

We carry out conformity assessments of cables with IX Industrial and publish a list of conformity cables on our website.
(https://www.hirose.com/product/jp/pr/ix_industrial/applicable_cable_list/)
Please contact the respective cable manufacturers for information on the production status of their cables.
※The cable size of the compatible plug is the recommended size.
※In consideration of actual use, compliance tests are carried out on harness products with 1 m and 5 m between the connectors.
All connectors used for evaluation are straight type A plugs.
The values are measured with IX plugs at both ends of the harnesses and do not represent the specific characteristics of the cables.
Test results are confirmed values, not guaranteed values.

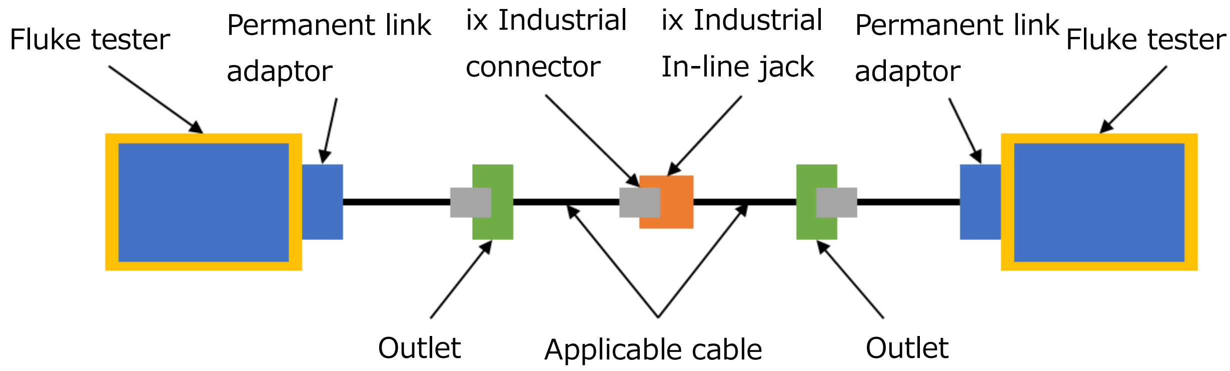
## 3.2 Methods for evaluating transmission characteristics in compliant cables.

Fluke testers are used to evaluate transmission characteristics, as shown in the diagram below.

○In case of Plug

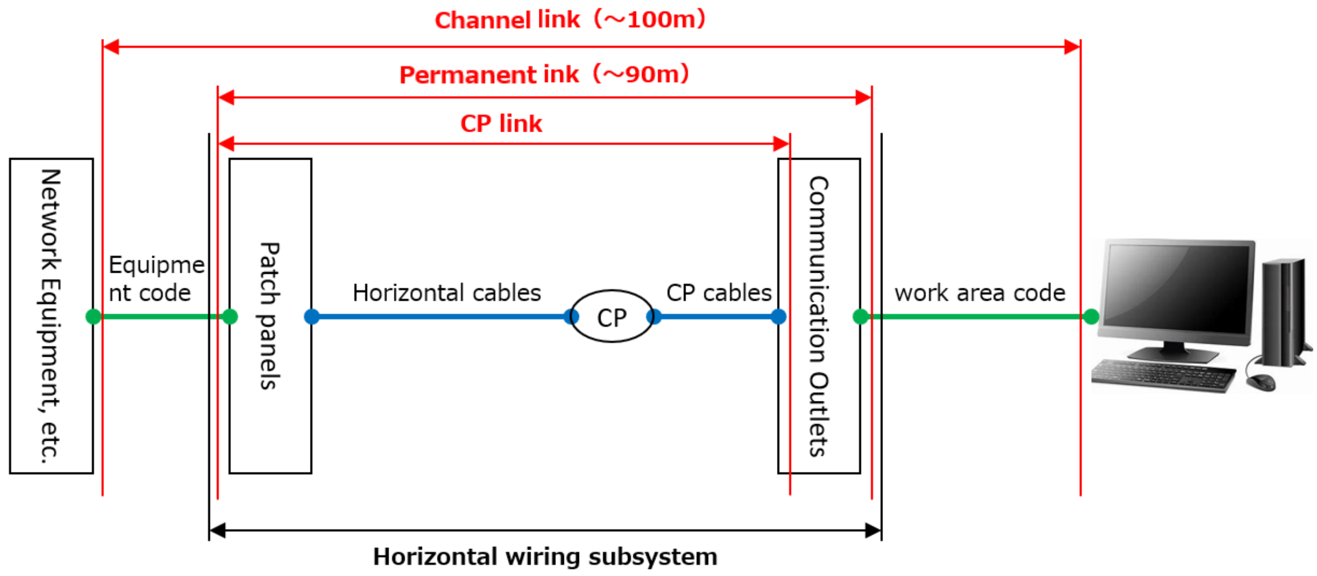



○In case of In-line jack



## 3.3 Channel and permanent link connections.

Horizontal wiring subsystems consist of floor wiring panels to communication outlets.
The performance of the horizontal wiring subsystem is specified for:
①Channel
②Permanent link
③CP link（similar to the performance standard values for ②Permanent link）




The physical length of the channel is supposed to be less than 100 m and the physical length of the permanent link is supposed to be less than 90 m.
Channels do not include connections at both ends, while permanent links include connections at both ends.

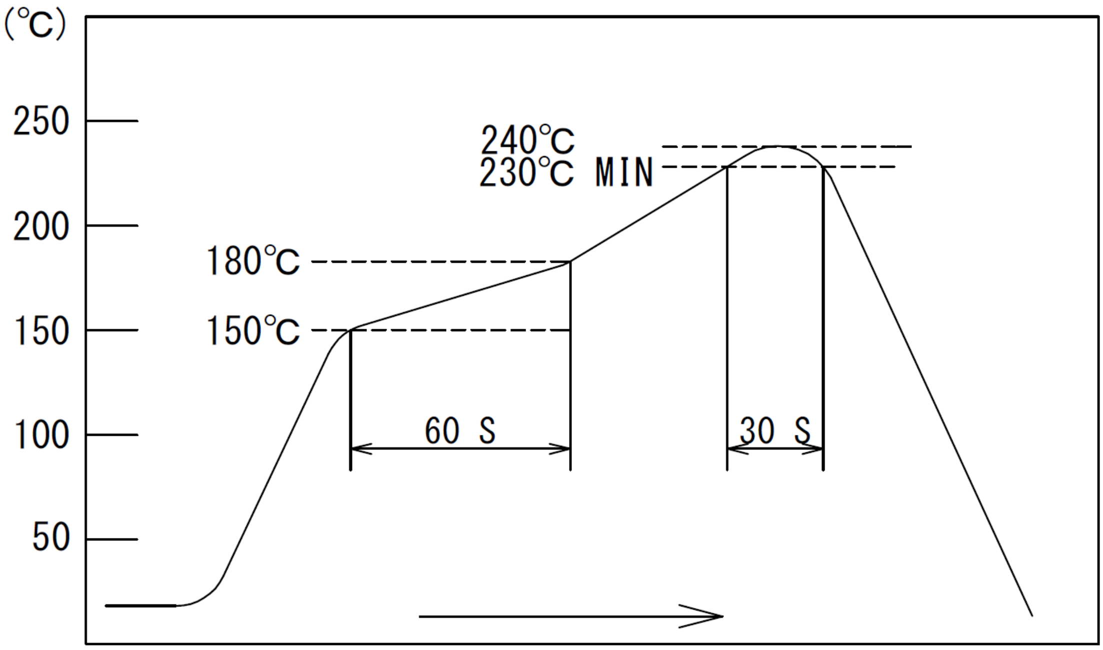
## 3.4 Requests for cable evaluation

Please contact our sales representatives through the cable purchasing channels.

# 4 Mounting/Soldering

## 4.1 Recommended reflow profile temperature

This temperature profile is for reference under the following conditions.
Please check the mounting conditions thoroughly before use, as they may vary depending on the type of solder paste, manufacturer, board size and other conditions such as mounting materials.

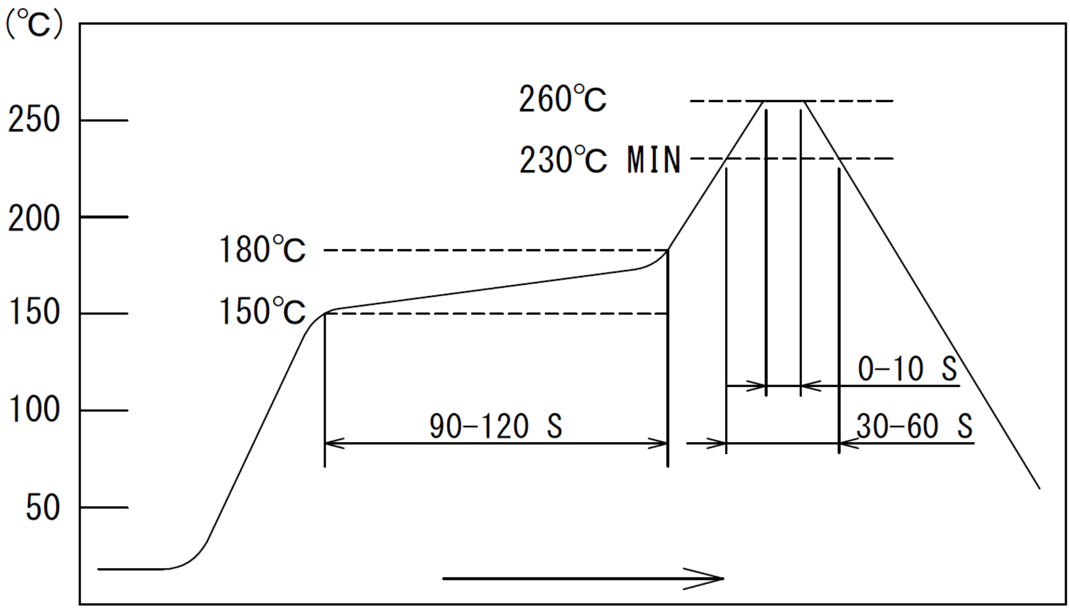



<Applicable conditions>

| | | |
|---|---|---|
| Temperature measurement point | : | Connector lead |
| Test PCB dimensions | : | 35×35×1.6 mm |
| Material | : | FR4 |
| Solder compositions | : | Sn96.5/Ag3.0/Cu0.5 |
| Flux content | : | 10.5～12.5 wt% |
| Metal mask thickness | : | 0.15 mm |
| Reflow cycles | : | 2 times Max |
| Reflow conditions | : | 230 ℃ Min、30 sec Max |
| Preheat conditions | : | 150～180 ℃、60 sec |

## 4.2 Resistance to soldering heat

This temperature profile is for reference under the following conditions.
Please check the mounting conditions thoroughly before use, as they may vary depending on the type of solder paste, manufacturer, board size and other conditions such as mounting materials.

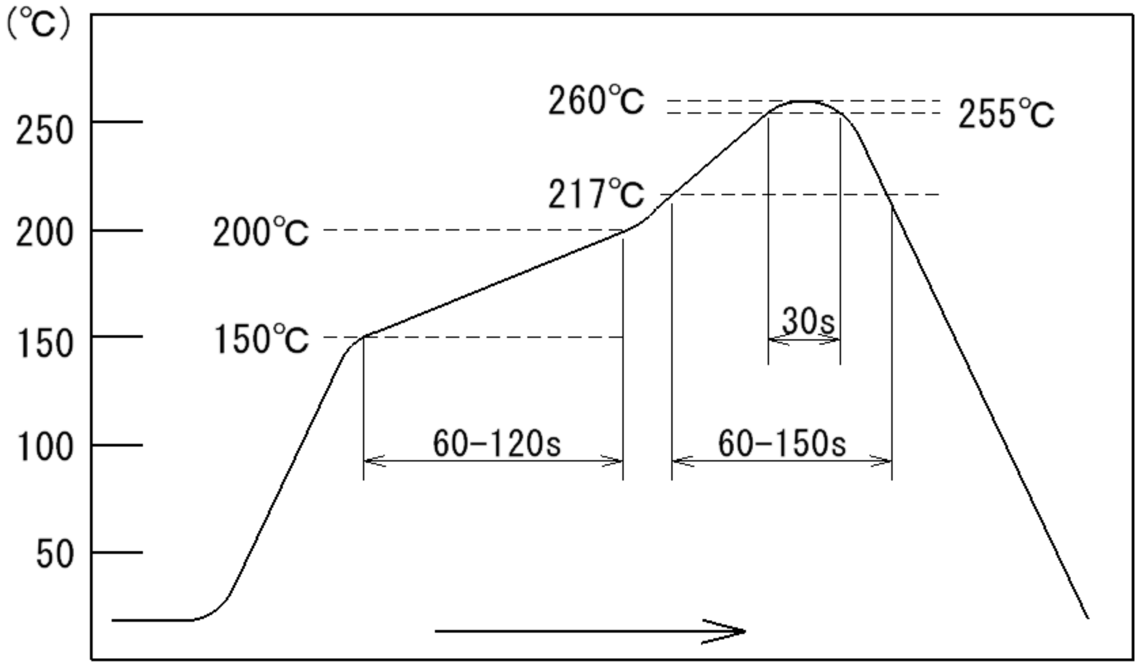



<Applicable conditions>

| | | |
|---|---|---|
| Temperature measurement point | : | Connector surface |
| Reflow cycles | : | 2 times Max |
| Reflow conditions | : | 230 ℃Max, 30 to 60 sec |
| Preheat conditions | : | 150 to 180 ℃, 90 to 120 sec |
| Peak temperature | : | 260℃, 0 to 10 sec |

○Reference reflow temperature profile IPC/JEDEC J-STD-020F conformity

Mounting is also possible at the following temperature profiles in accordance with IPC/JEDEC J-STD-020F.
Please note that conditions may vary depending on the type of solder paste, manufacturer, board size and other mounting materials, etc. Please check the mounting conditions thoroughly before use.



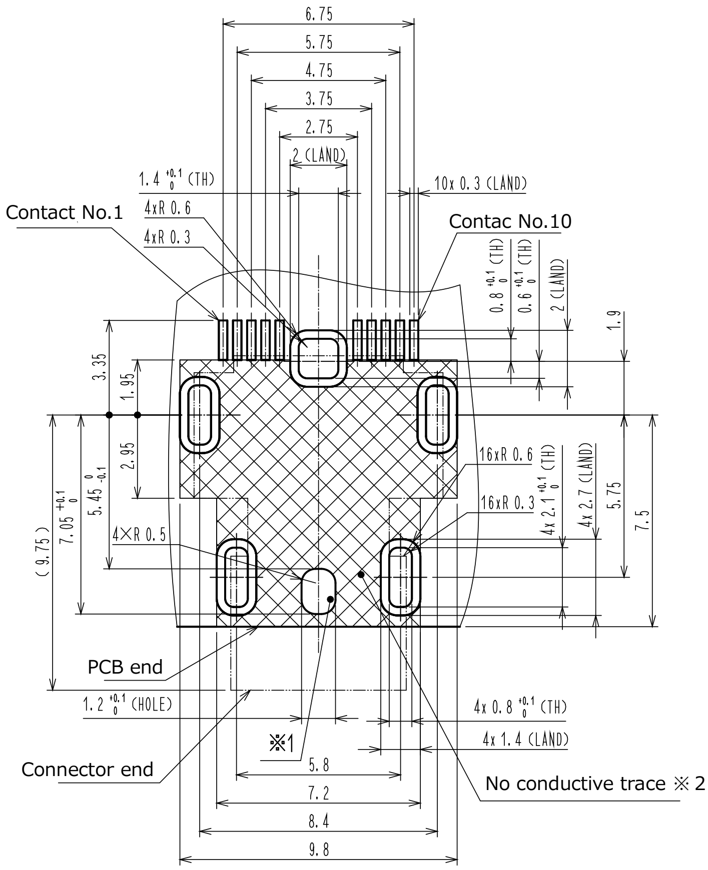

<Applicable conditions>

| | |
|---|---|
| Temperature measurement point | : Connector lead |
| Test PCB dimensions | : 35×35×1.6 mm |
| Material | : FR4 |
| Solder compositions | : Sn96.5/Ag3.0/Cu0.5 |
| Flux content | : 10.5～12.5 wt% |
| Metal mask thickness | : 0.15 mm |
| Reflow cycles | : 2 times Max |
| Reflow conditions | : 217℃ Min, 60 to 150 sec |
| Preheat conditions | : 150 to 200℃, 60 to 120 sec |
| Peak conditions | : 255℃ Min, 30 sec Max, 260℃ Max 10sec Max |

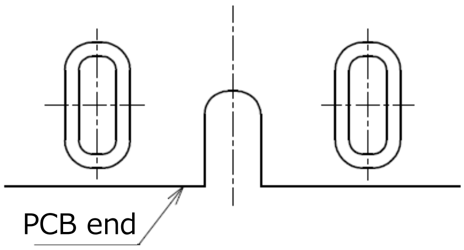
## 4.3 Reference PCB Layout

The recommended board thickness is **t=1.6 mm**.
When changing the board thickness, refer to section 4-5 "Solder filling characteristics" and consider the amount of solder in the dip.
Dimensional tolerances when not stated, is ±0.05.
When installing a signal ground, make sure that it is not connected to the frame ground.

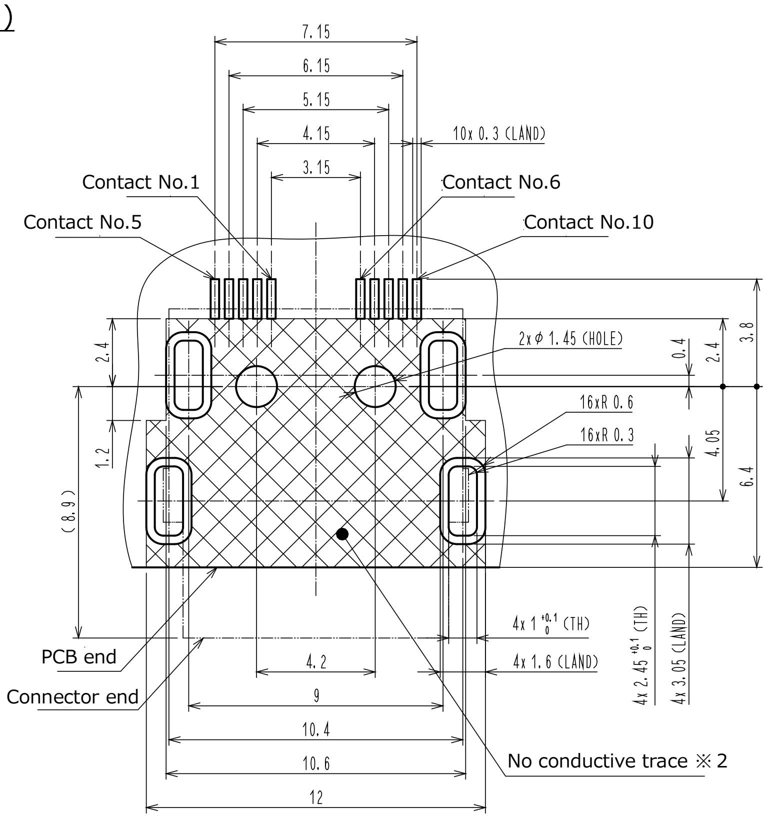
IX61G-#-10P(##)



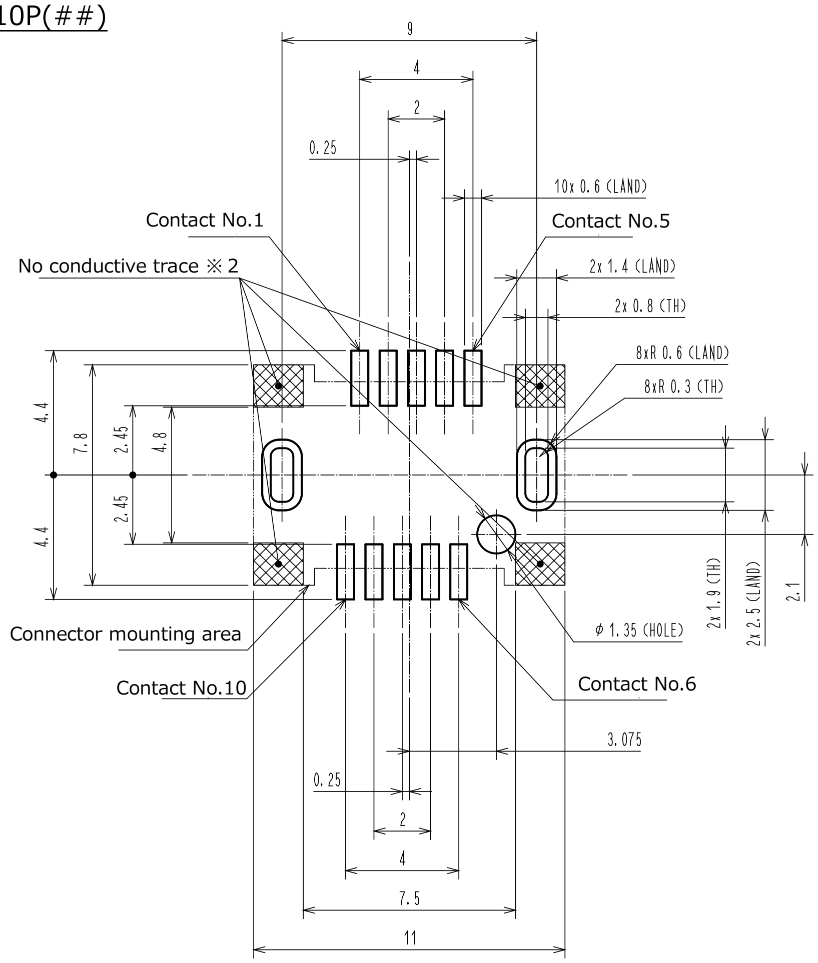

※1 In some situations and according to the board design, the locking feature of the plug may protrude from the bottom of the receptacle when mated.
In this case, a hole in the PCB is provided to prevent the locking feature from scratching the board.
It is also acceptable to use a notch shape as shown below.



IX60G-#-10P(##)




IX80G-#-10P(##)



※2 Pattern prohibited areas are defined for the following two reasons.

・**When a signal pattern is drawn, if there is an insulation breakdown or scraping of the coating, it will cause a short-circuit with the connector shell.**
However, this does not apply to the IX80G, which has no shell on the bottom.

・In this case, **if a pattern is placed, it may tilt the connector or cause mounting faults.**
**If a ground pattern is placed in a prohibited area, the connector will float by the amount of the pattern thickness and cause mounting faults.**
However, as this relates to the connector mounting surface, there will be no problem if a pattern is placed as an inner layer of a multi-layer board.

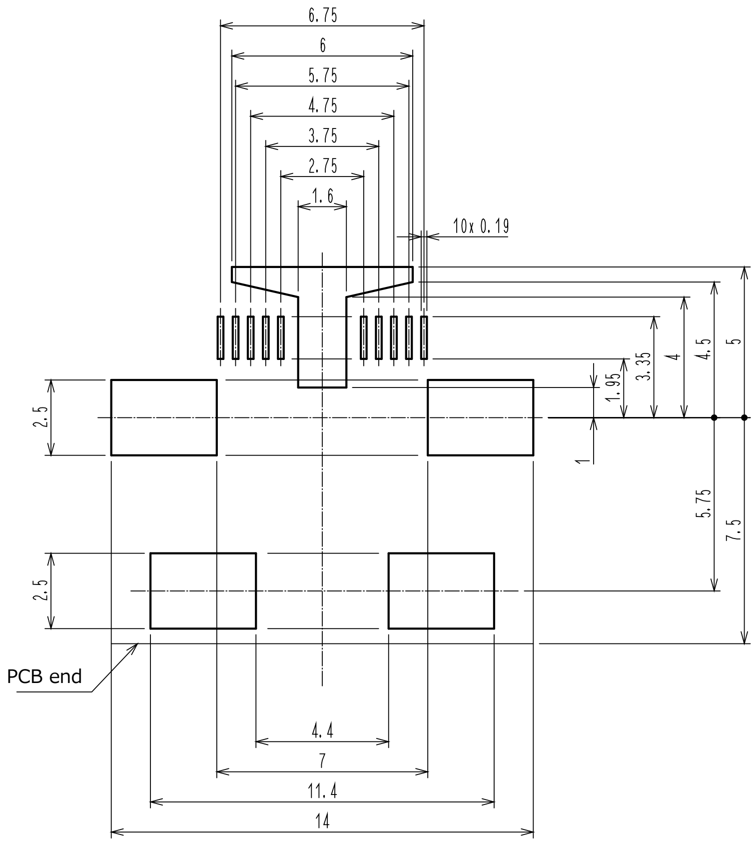
## 4.4 Metal Mask - Reference Layout

The recommended metal mask thickness is **t=0.15 mm**.
This layout is based on the following solder paste.
The amount of solder varies depending on the flux content of the solder paste.
In case other solder pastes are used, please adjust the layout based on the criteria described in section 4.5.
Dimensional tolerance when not mentioned shall be ±0.02mm.

◆ Used solder paste

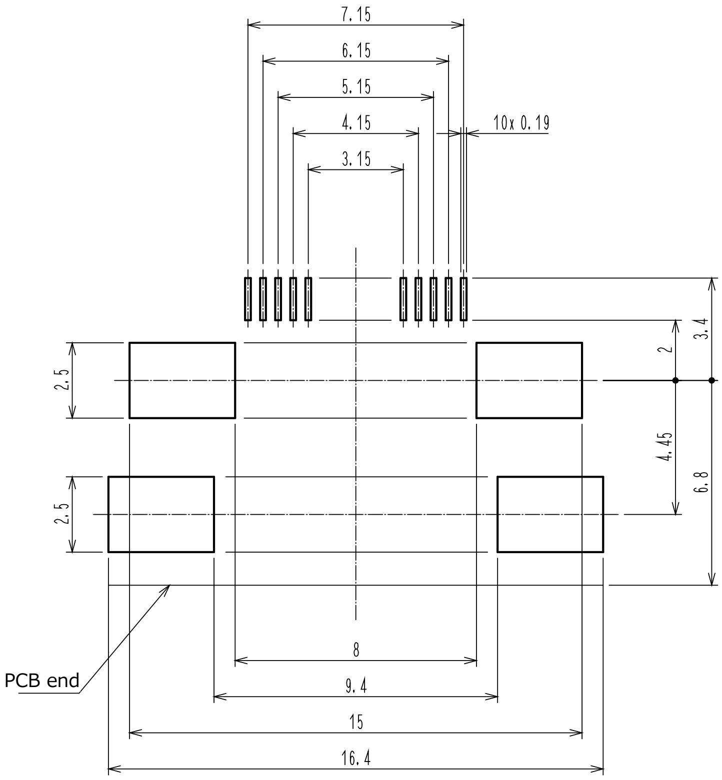
| | | |
|---|---|---|
| ･Manufacturer | : | Senju Metal Industry Co., Ltd. |
| ･Product name | : | M705-GRN360-K2-V |
| ･Solder component | : | Sn96.5/Ag3.0/Cu0.5 |
| ･Flux content | : | 10.5～12.5wt% |

IX61G-#-10P(##)

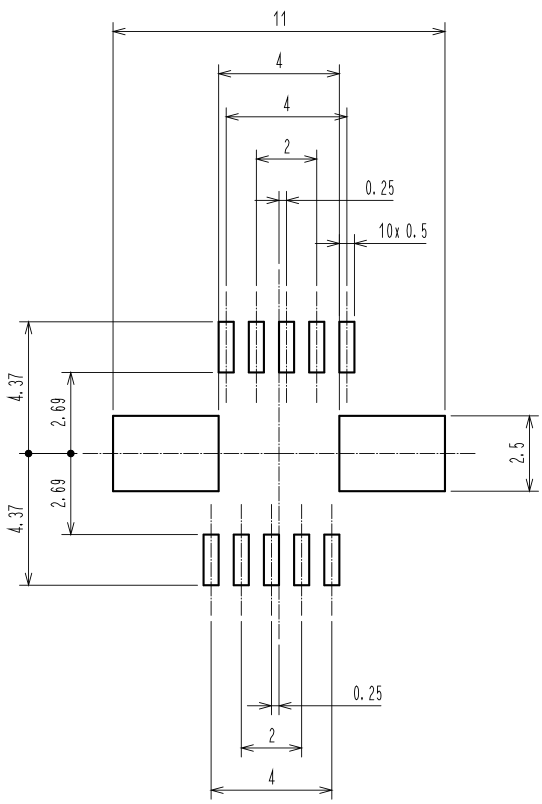



When mounting with a pitch of less than 14.5 mm in the IX61G, refer to ETAD-E3170-00.

IX60G-#-10P(##)

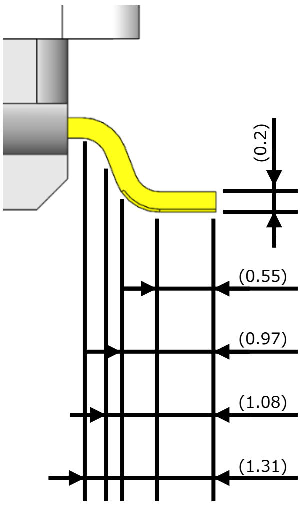



IX80G-#-10P(##)

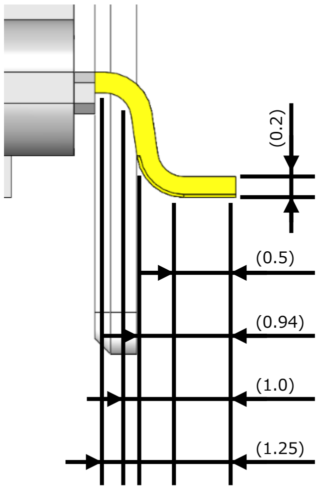


## 4.5 SMT leads - Dimensions

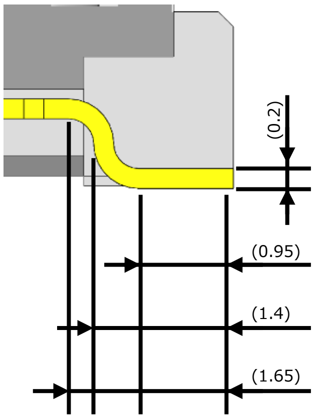
Please refer to the lead dimensions below, for each type receptacle.
All dimensions are for reference only.




IX60G
Straight area
0.55mm



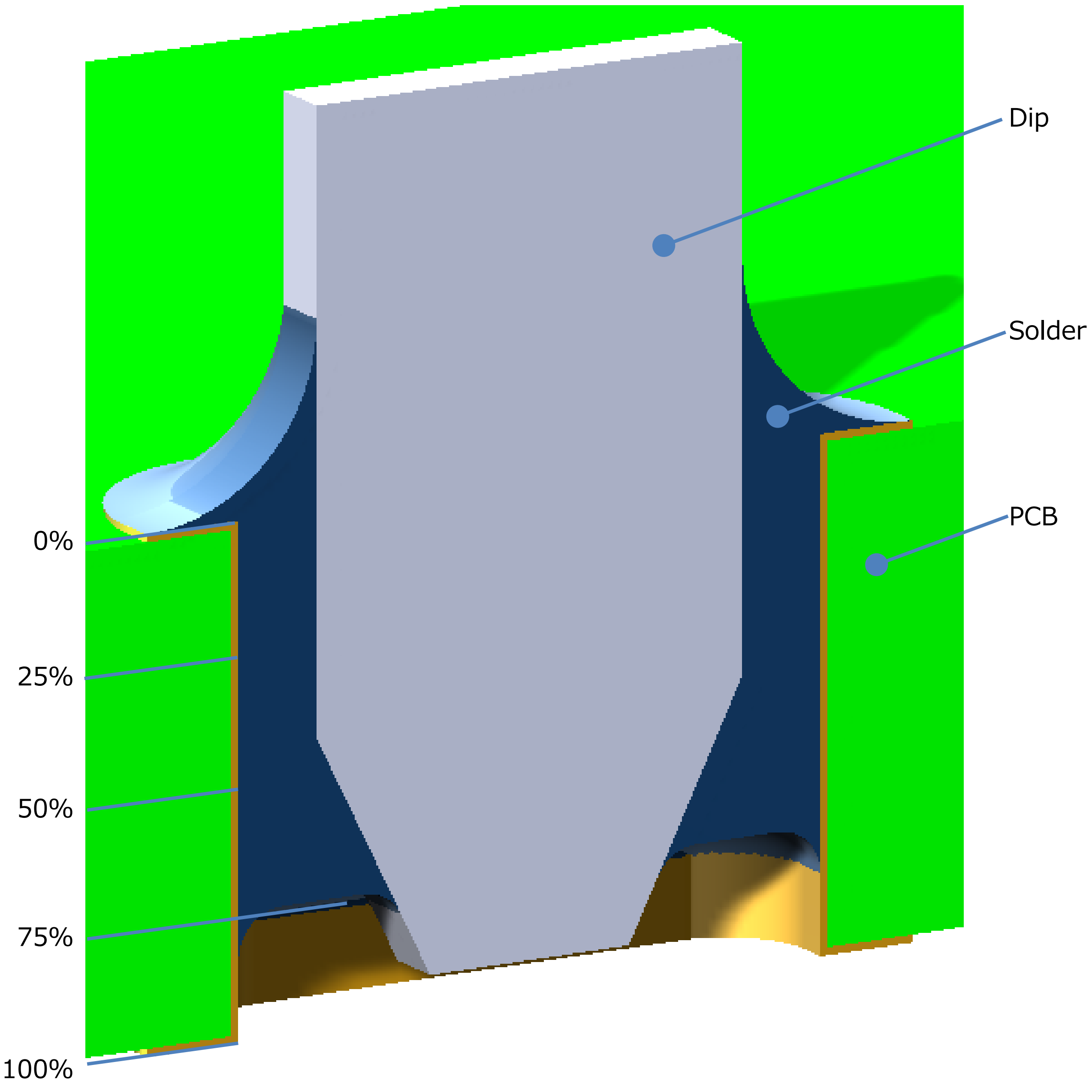

IX61G
Straight area
0.5mm




IX80G
Straight area
0.95mm

## 4.6 Solder filling characteristics

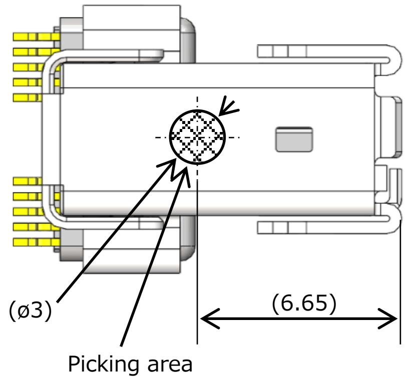
Our reference dimensional drawings for PCB and metal masks are designed to ensure that the solder fill in the dip area, is at least 75% of the board thickness, as described below.



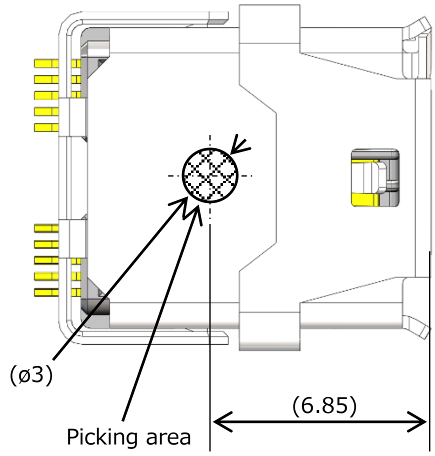
## 4.7 Picking area

The picking area is set as follows for automatic mounting.
Only the IX80G comes with an attached picking cap on the mating side.

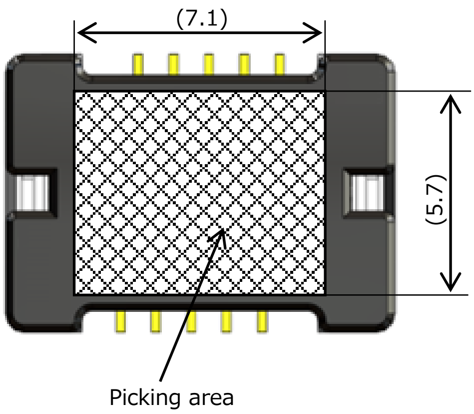
IX61G-#-10P(##)




IX60G-#-10P(##)



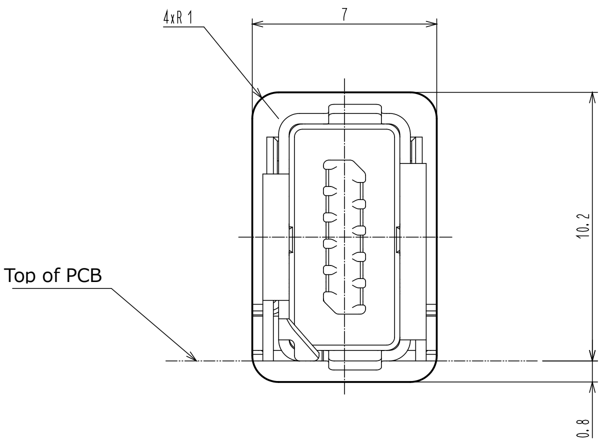

IX80G-#-10P(##)



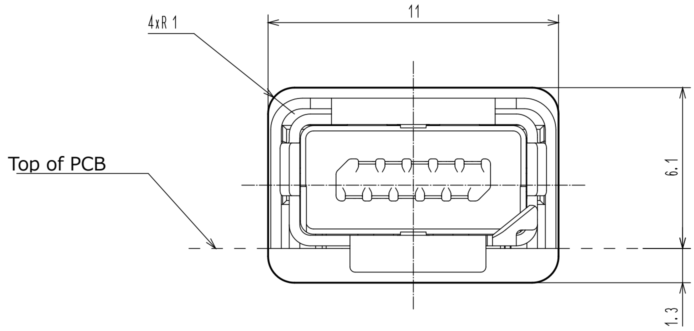
## 4.8 Panel Cutout - Reference dimensions

Refer to the diagrams below when drilling holes on the panel or creating the enclosure for receptacles or relay jacks.
In this case, please make sure that the receptacle opening and the panel surface are on the same side.
For right-angled types, check if the panel and board do not interfere with each other.

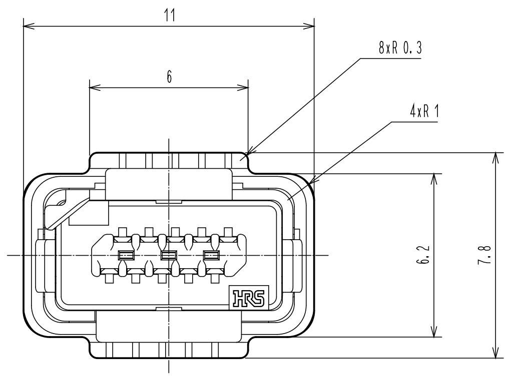
IX61G-#-10P(##)




IX60G-#-10P(##)

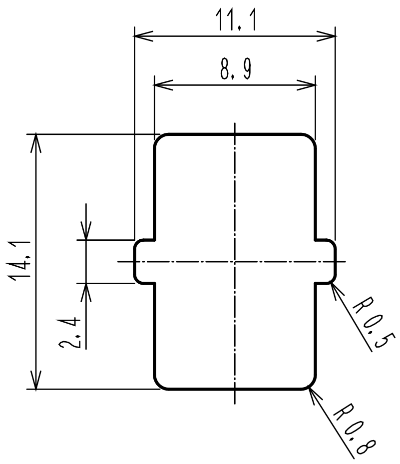



IX80G-#-10P(##)

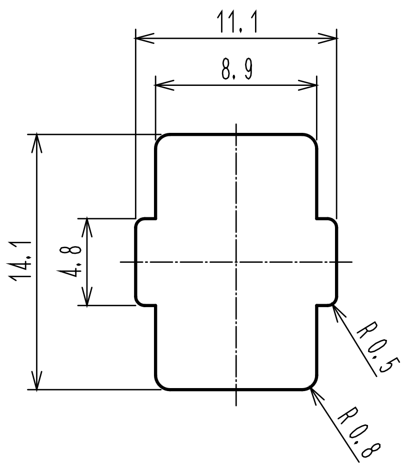


IX40G-#-10P-JC(##)

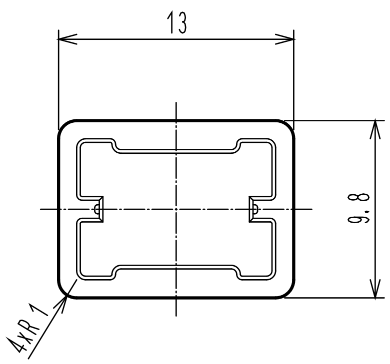
Panel Cutout 1.5mm




Panel Cutout 2.0mm




※When using a cap (IXG-10P-DC), the panel cut dimensions of the receptacle are as follows.

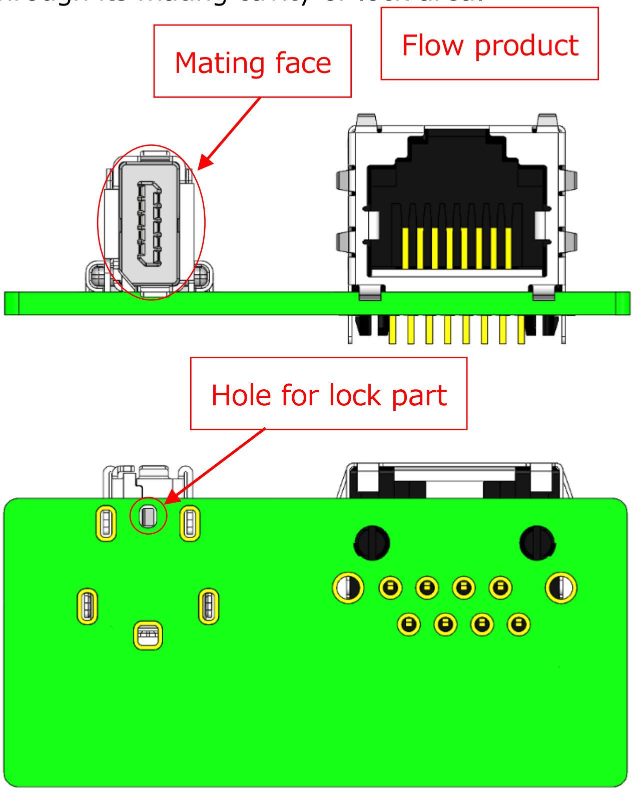


# 5 Using Precautions

## 5.1 Mounting

○Flux adhesion

Please take precautions to avoid flux from adhering to the terminal contacts, as this may cause contact failure. Particularly when flux is sprayed onto the DIP pins with a fluxer, it may infiltrate the connector through its mating cavity or lock area.




○Cleaning

Cleaning such as flux removal is not recommended, as flux and other residues from cleaning may cause contact defects.

○Acceptability of backside reflow

For IX61G* and IX60G*, there is a risk of connector drop when backside reflow is carried out without assistance.

When mounting on the backside, please consider the mounting order or use adhesives or jigs to prevent dropping.

※Verification results with our recommended board, recommended metal mask and solder paste.

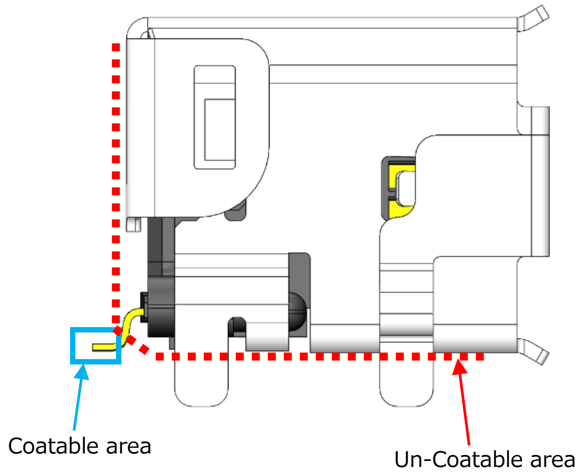
Please note that different results may be obtained depending on the customer's mounting environment.

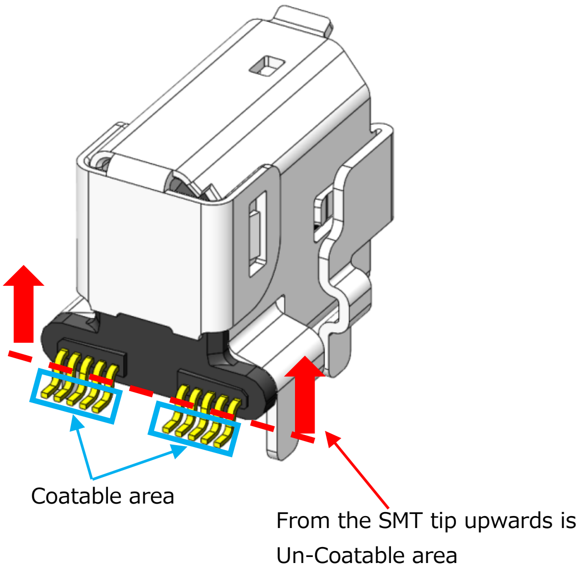
| Receptacle | Backside reflow possible/not possible |
|---|---|
| IX61G* | Not possible |
| IX60G* | Not possible |
| IX80G* | Possible |

○About moisture-proof insulating coatings

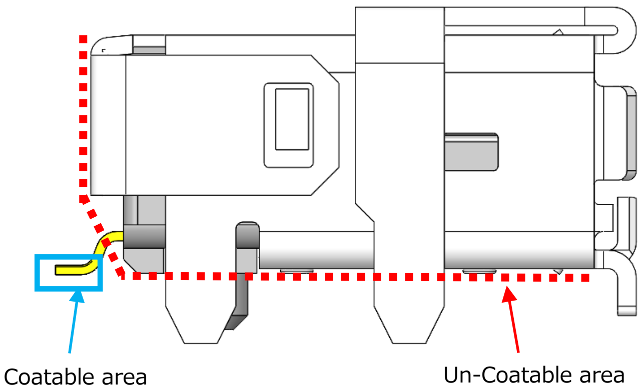
When using a moisture-proof coating agent, adjust the amount applied, e.g. apply it only to the terminal mounting area, and check if it does not infiltrate into the mating area.

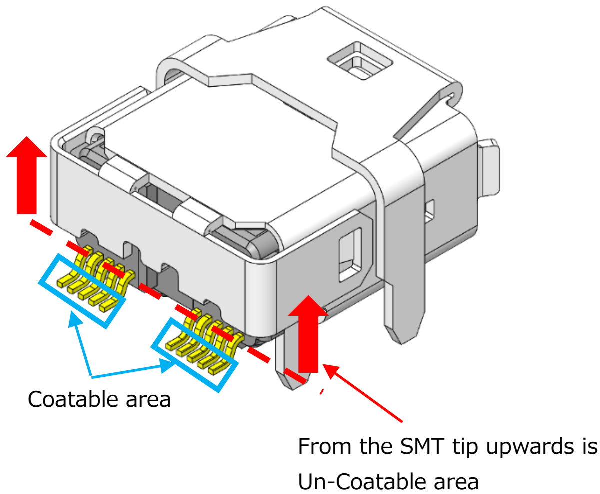
■IX61G*



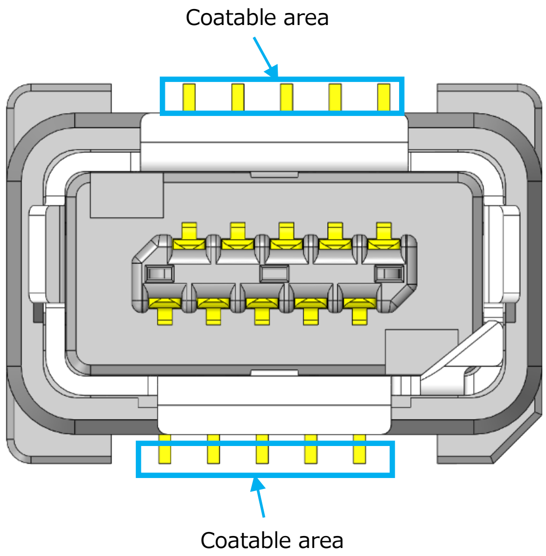



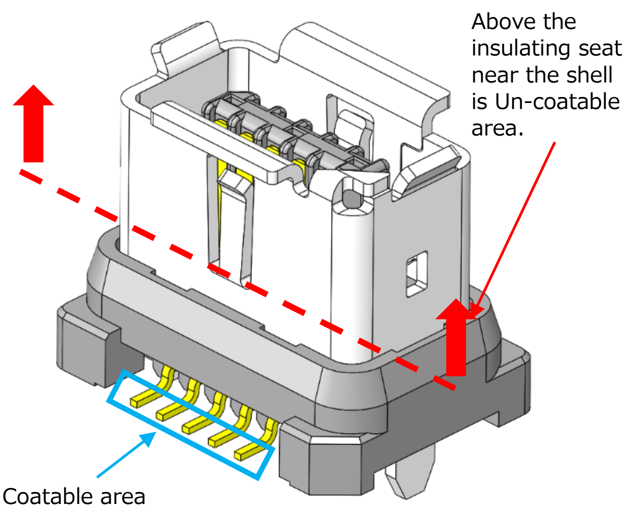

■IX60G*



■IX80G*




Caution : If the insulation coating material adheres to the shell, it may enter into the mating opening and cause continuity failures.

Caution : Excessive coating agent or soaking of the bottom of the connector, may cause it to infiltrate the mating area by capillary action.

○Resistance to hand soldering heat

| | |
|---|---|
| Soldering iron temperature | : 350 ℃ Max |
| Soldering time | : 3 sec Max |

These temperature conditions are for reference under the following application conditions. Please check the mounting conditions thoroughly before use as they may vary depending on the type of solder, manufacturer, board size and other mounting materials.

＜Applicable conditions＞

| | |
|---|---|
| Test PCB dimensions | : 35×35×1.6 mm |
| Material | : FR4 |
| Solder compositions | : Sn-3.0Ag-0.5Cu |
| Soldering area | : SMT, Dip |

※Hand soldering heat resistance in the state of reflow mounting on the board.

## 5.2 Plug

○Use without cover case

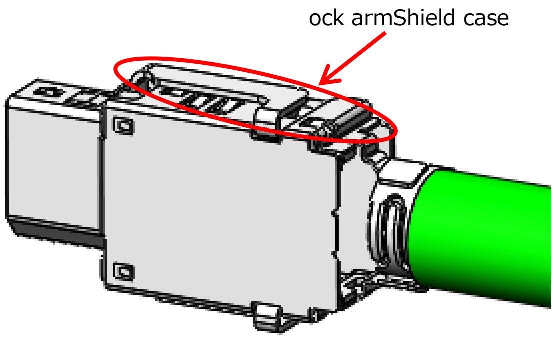
The use of the cover case attached to the plug is recommended.

However, in case of not using the cover case or overmolding, please ensure that it will not interfere with the locking spring and its function.

Without the cover case, the shielding case's fixing force may be reduced, and the shell edges may cause injury. Please consider these points carefully before use.

With cover case

Without cover case

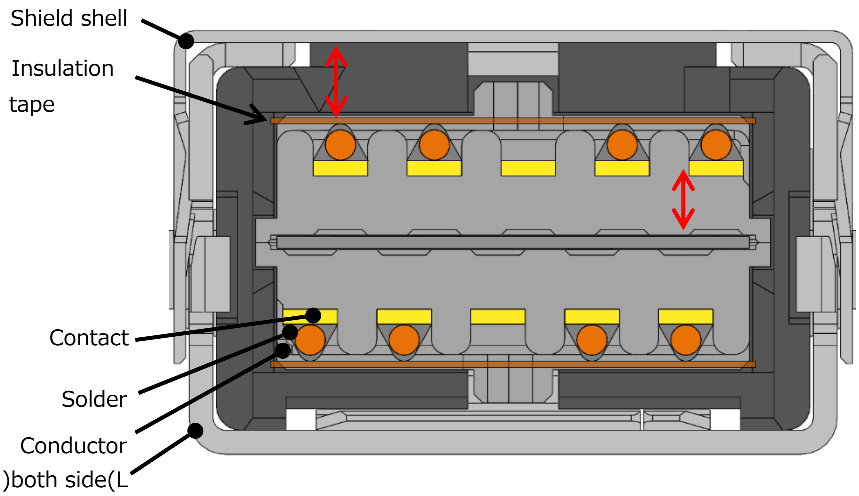


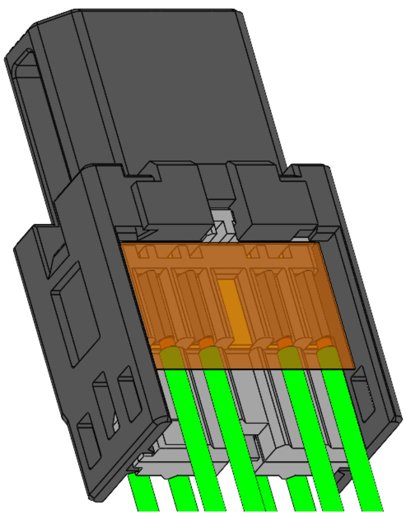

○Solder type wiring

High soldering height may cause a short circuit with the shield case or shield shell.

Please confirm the soldering range described in the wiring instructions or protect the soldered area with insulation tape.

If the outer diameter of the insulator exceeds ⌀1.55, soldering between adjacent terminals will become difficult.

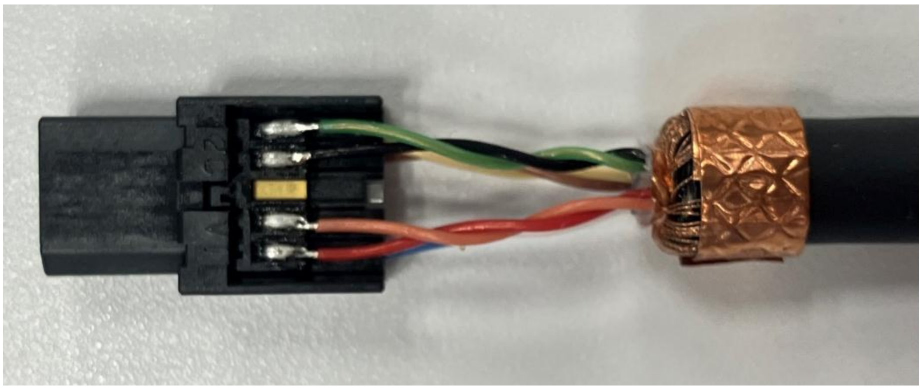


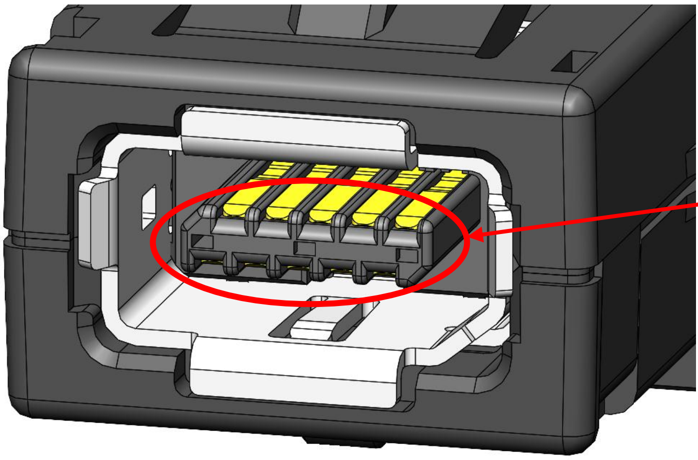
○Notes on assembly

To improve the transmission characteristics (NEXT), connect the twisted pair with as much twisted pair strands left as possible.

However, in the case of soldering types, depending on the material of the insulation coating, the twisted pairs may melt due to heat, resulting in a short circuit between twisted pairs. (Except in the case of twisted pair shields).



○Notes on pry insertion and extraction

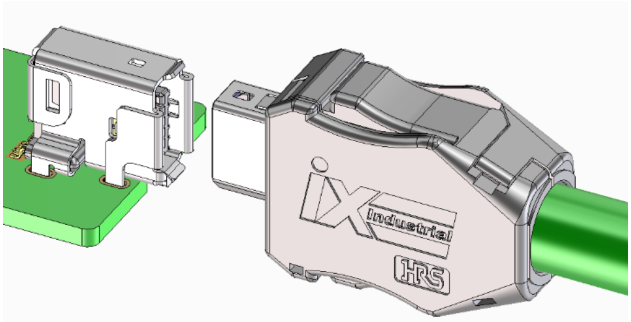


Note that if the Plug is inserted or removed with the plug pried against an IX series Receptacle or In-line jack, the edge of the central plastic part may be damaged.

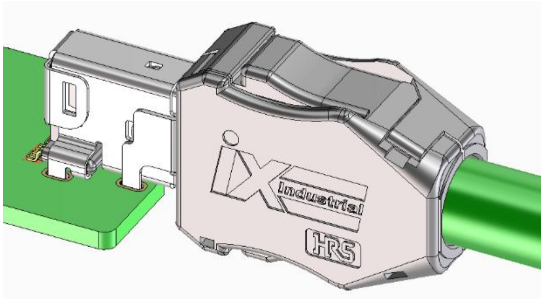
5.3 IP grade

The IP grade of the IX series is equivalent to IP2X on Un-mating conditions and IP4X on mating conditions.

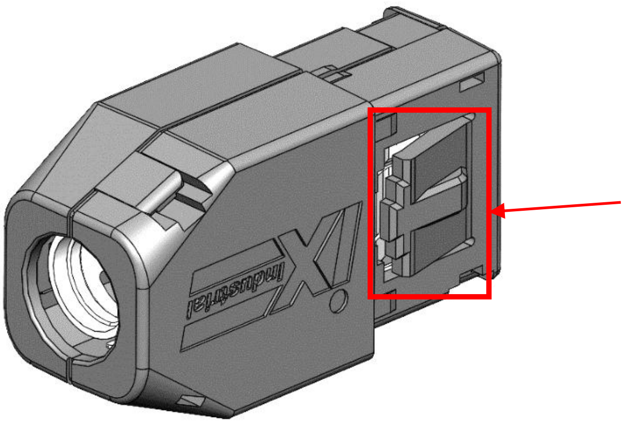
Equivalent to IP2X : Un-mating conditions



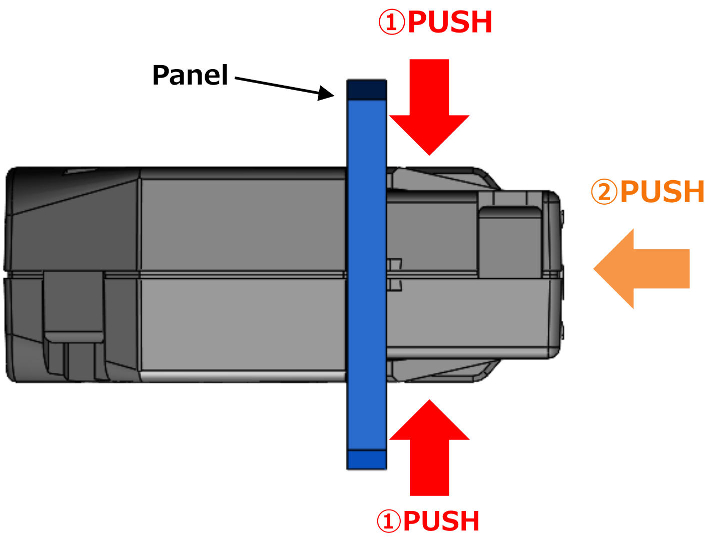

Equivalent to IP4X : Mating conditions



5.4 In-line jack How to remove it from the panel

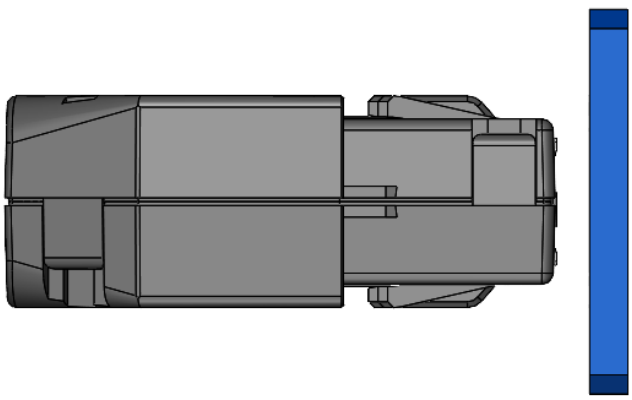


The IX relay jack has a locking spring on both sides of the cover case for fixing onto the panel. With this lock pressed down, the relay jack can be pulled out of the panel or pushed in for removal.




Step ①Push in the locking springs on both sides of the cover case with a general-purpose tool or similar to unlock them.

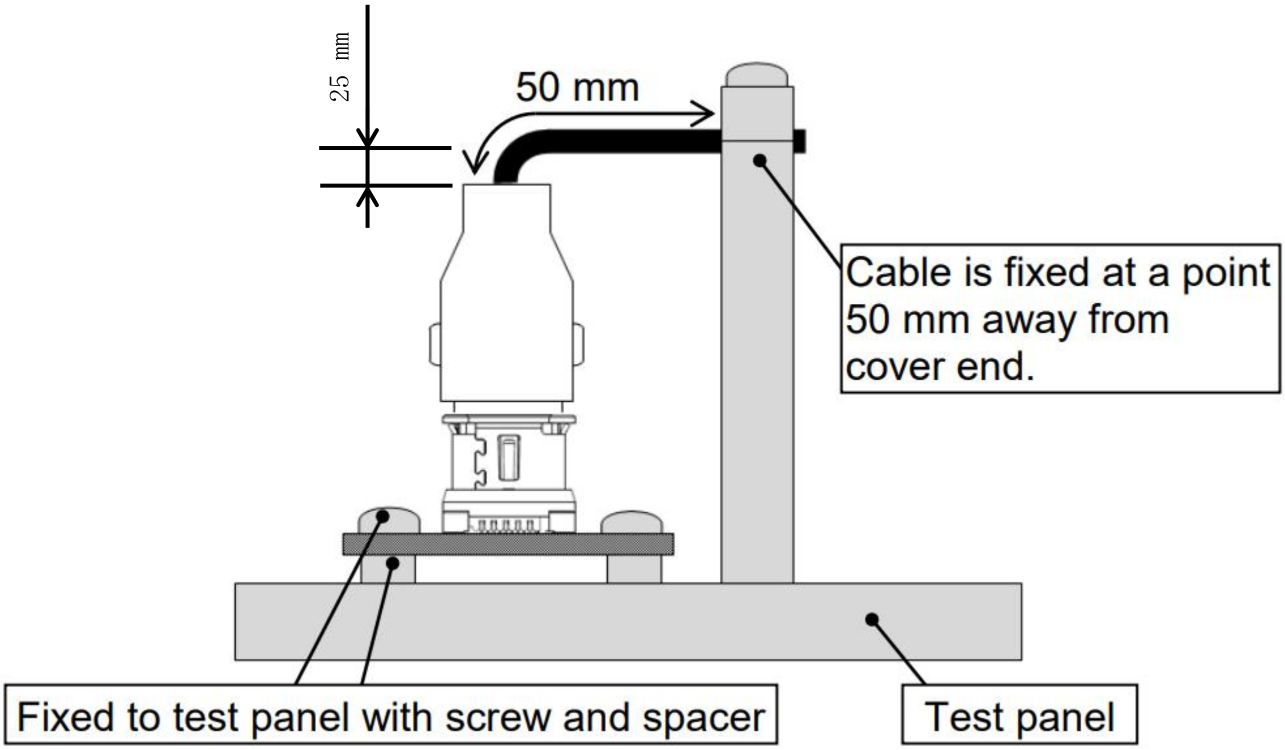
Step ② Push in or pull out the In-line jack body while holding the locking spring.

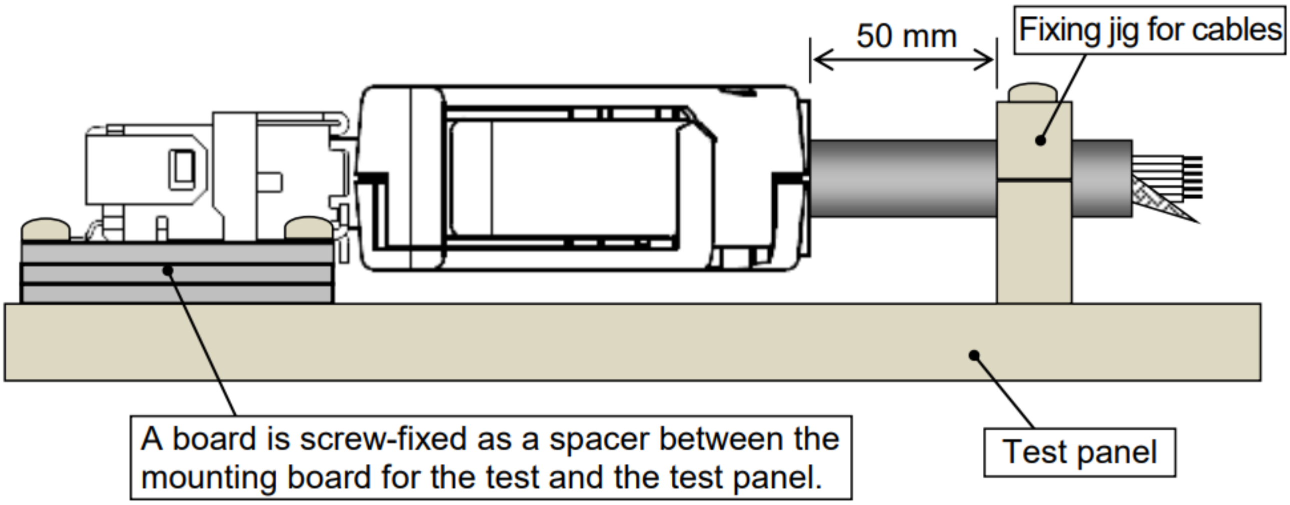


Complete

5.5 Vibration test

During our vibration tests, the cables are fixed at a distance of 50mm from the connector's cover end.



# 6 Compatibility

IX Series connectors comply with IEC 61076-3-124.
Connectors from other manufacturers that comply with IEC 61076-3-124 can be interchanged without any problems.
Performance other than interlocking compatibility are not guaranteed, even if other manufacturers' products comply with IEC 61076-3-124.

| | | |
|---|---|---|
| Written | MT.YASUDA | 20240610 |
| Charged | MT.YASUDA | 20240610 |
| Checked | KI.KAGOTANI | 20240612 |
| Approved | TU.TANIGUCHI | 20240612 |

Revision History

| Version No. | Description of revisions | Designed | Checked | Date |
|---|---|---|---|---|
| 0 | | | | |