SMPTE REGISTERED DISCLOSURE DOCUMENT

RDD 16-2008

for Television —
Broadcast Cameras — Hybrid Electrical and Fiber-Optic Ball-Lock Connector Type-OPS

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This document is NOT a Standard, Recommended Practice or Engineering Guideline, and does NOT imply a finding or representation of the Society.

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All other inquiries in respect of this document, including inquiries as to intellectual property requirements that may be attached to use of the disclosed technology, should be addressed to the proponent identified below.

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Overview

This Registered Disclosure Document (RDD) describes a connector intended for use connecting a broadcast camera to its camera control unit (CCU). This connector has been used in heavy-duty environments at broadcasting facilities in Japan, other Asian countries and Central America. However, this connector has not been used in the United States of America yet. When this connector starts to be used in the United States of America in the future, the proponent will consider submitting it to SMPTE for formal standardization.

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1 Scope

This document describes a connector primarily intended for use in television broadcasting and video equipment, such as camera head to camera control-unit connections. It defines hybrid connectors, which contain a combination of electrical contacts and fiber-optic contacts for single-mode fibers. This document also contains nominal dimensions, which ensure nondestructive mating of the electrical and optical interfaces, and functional operability of the electrical interface. Functional operability of the optical interface is dependent upon fiber preparation and termination and is, therefore, not guaranteed by this document.

In addition, this connector has three following characteristics in structure.

a) Ball-lock mechanism:

If metal residue or small particles of dust contaminate the end face of the fiber, the optical power may decrease, and the risk of a communication error increase. The Ball-lock mechanism used is intended to decrease the occurrence of metal residue created by connecting or disconnecting.

b) Position with Shell-key guide groove and Optical ferrule with regard to *Jack connector:*

The Shell-key guide groove is located on the outside of the jack connector so that if metal residue is created by the mating process, there is very low probability of it contamination the optical ferrule which is covered by Shell. (As shown in Figure 2)

c) Protective mechanism for waterproof with regard to *Plug connector*

The Waterproofing plane is located inside the extremities of the outer shell, so that it is protected in the event that the connector is dropped in an unmated condition. (As shown in Figure 1)

The connector described in this document is intended for use primarily with the hybrid fiber optic camera cable described in SMPTE 311M; however, this connector may be used independently to meet other requirements.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified the order of precedence of the types of normative information in this document shall be as follows. Normative prose shall be the authoritative definition. Tables shall be next, followed by formal languages, then figures, and then any other language forms.

3 Normative Reference

The following standard contains provisions which, through reference in this text, constitute provisions of this registered disclosure document. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this registered disclosure document are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below.

SMPTE 311M-2003, Television — Hybrid Electrical and Fiber-Optic Camera Cable

4 Connector Specifications

4.1 Structural Requirements

The connector system shall consist of a plug-and-jack arrangement. It shall feature a push-pull quick connect/disconnect coupling mechanism by metal ball.

Each connector shall contain two fiber-optic contacts, with cylindrical spherical butting ferrules. The ferrules shall be ceramic and the optical alignment mechanism shall be a ceramic split sleeve contained in the contacts on the plug. Appropriate dust caps for all connector configurations shall be used as protection against contamination during unmated situations.

4.2 Contact Requirements

The connectors shall house two fiber-optic contacts, four electrical contacts.

4.3 Classifications

Connectors covered by this part shall be classified as:

- Name: Hybrid Ball-lock connector Type-OPS (Optical Push-pull connector by Spherical metal ball)
- Coupling: Push pull by metal ball
- Configurations:
    - Cable plug (to mate with connector on camera) color ring: green
    - Cable jack (to mate with base station) color ring: black
    - Jack, panel mount (installed on camera)
    - Plug, panel mount (installed on base station)
    - Cable jack, panel mount (installed on patch panels)
    - Cable plug, panel mount (installed on studio wall boxes / OB vans)

Note: Other styles of connector with other back-end mounting arrangements are available and are fully intermateable with the variants above.

4.4 Field serviceability

The connectors shall be designed to permit field termination, replacement, and repair by trained personnel, using assembly instructions supplied by the connector manufacturer, and with the appropriate tooling.

5 Mechanical interface dimensions

5.1 Mating interface dimensions

The mating interface dimensions for each connector configuration (plug and jack) shall be in accordance with Figures 1 and 2 and Tables 1 and 2. All dimensions are metric.

5.2 Shell-Key

The connectors shall have polarization keys in accordance with Figures 3 and 4 and Tables 3 and 4.

5.3 Insulator-Key

The connectors shall have an insulator key to maintain the correct performance in accordance with Figures 5 and 6 and Tables 5 and 6.

5.4 Contact arrangements

The contacts shall be located in accordance with Figures 5, 6, and 7 and Tables 5, 6, and 7.

6 Performance

The connectors shall meet the following minimum requirements:

- Optical:
  - Wavelength: 1250 nm – 1625nm
  - Insertion loss: 0.5 dB maximum
  - Return loss: Better than – 45 dB
- Electrical:
  - Voltage: 600 V ac
  - Current: 10 A
- Environmental:
  - Temperature: –40°C to +75°C
  - Humidity: 0 % to 95% RH (at +40°C)

Note: The degree of waterproofing is left for manufacturing implementation.

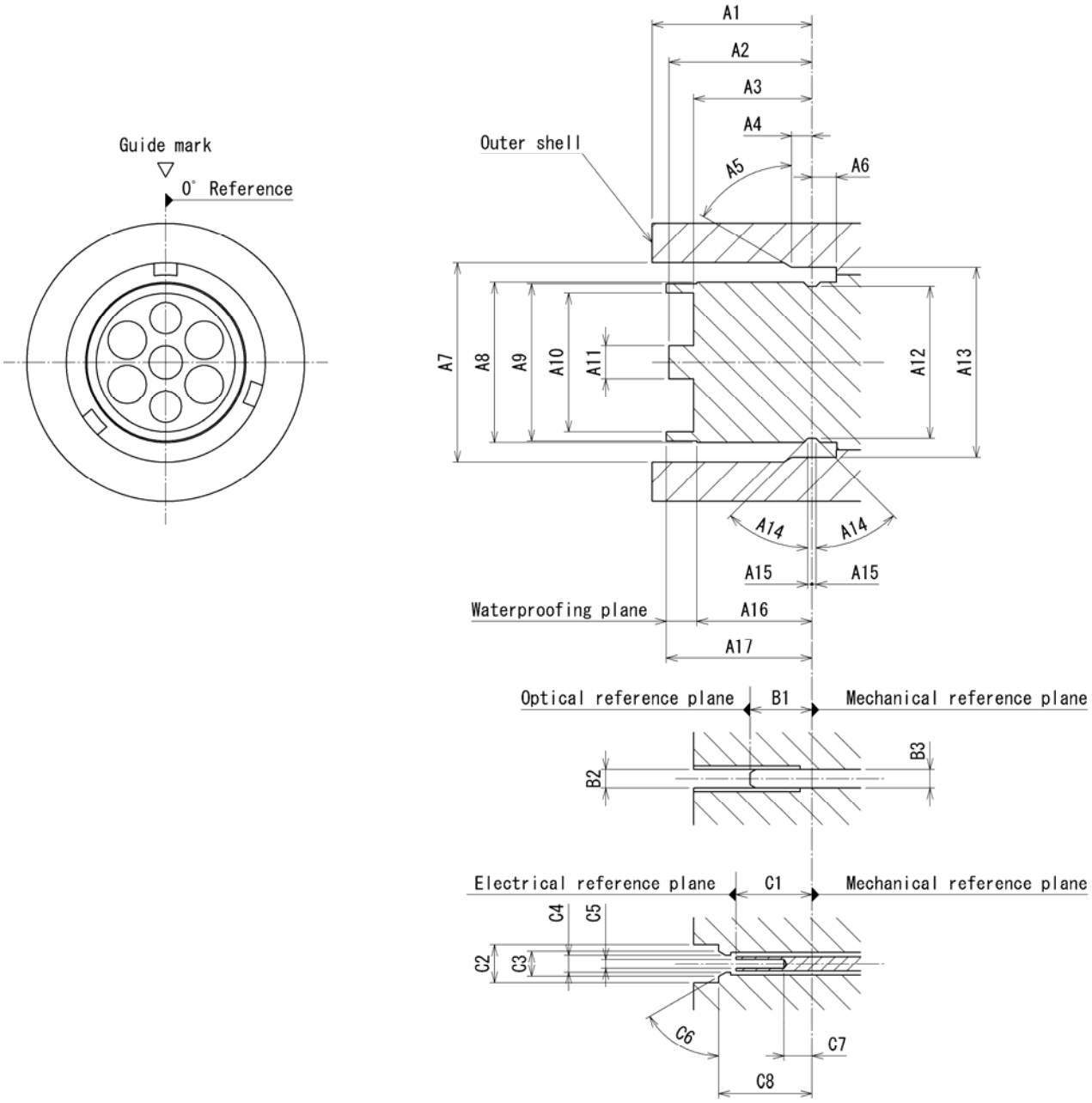


Figure 1 – Plug mating interface

Table 1 – Plug mating dimensions

Position	Dimensions (mm)	Description
A1	17.0	Outer shell to reference plane
A2	15.5	
A3	12.8	Insulator to reference plane
A4	2.0	
A5	60°	
A6	3.0	
A7	φ21.45	Outer shell inside diameter
A8	φ17.33	Inner shell outside diameter
A9	φ16.99	Waterproofing plane
A10	φ15.02	Inner shell inside diameter
A11	φ3.7	
A12	φ16.43	Groove for locking the Ball
A13	φ20.53	Holding the Ball
A14	45°	Two places
A15	0.47	Groove for locking the Ball / Two places
A16	12.5	
A17	15.71	The top is used as Ground.
B1	7.0	Optical to mechanical reference plane
B2	(φ1.98)	Split sleeve inside diameter
B3	φ1.998	Diameter of optical ferrule
C1	7.8	Electrical to mechanical reference plane
C2	φ4.1	Insulator inside diameter for electrical contact
C3	φ2.77	
C4	φ1.87	
C5	(φ1.4)	Connection with B2 (Figure 2) electrically
C6	60°	
C7	3.0	
C8	9.8	Insulator location

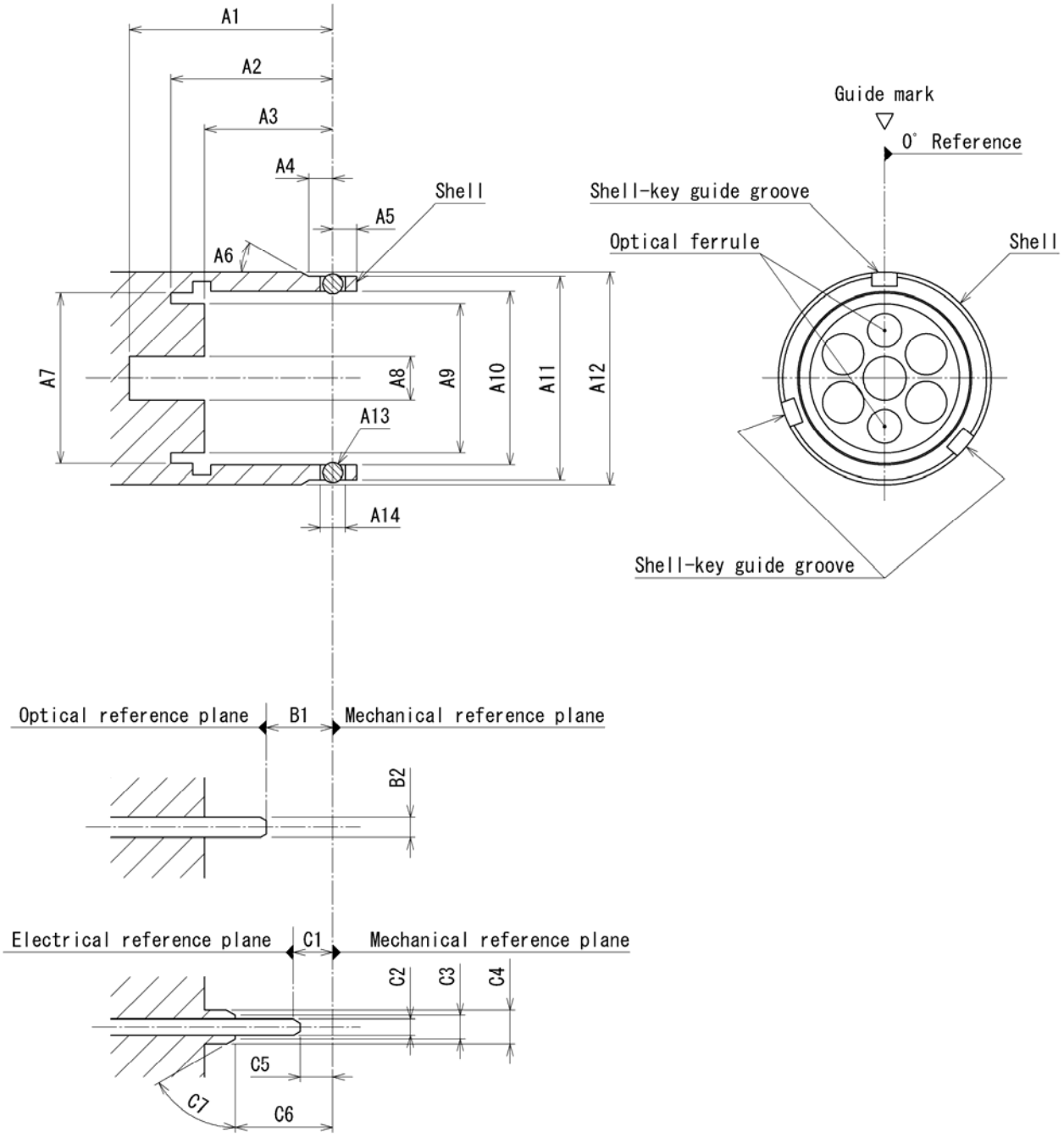


Figure 2 – Jack mating interface

Table 2 – Jack mating dimensions

Position	Dimensions (mm)	Description
A1	21.0	
A2	14.5	Connection with A17 (Figure 1) electrically
A3	12.8	Insulator to reference plane
A4	2.45	
A5	2.42	
A6	30°	
A7	φ17.15	
A8	φ4.33	
A9	φ14.95	Insulator outside diameter
A10	φ17.43	Shell inside diameter
A11	φ20.35	
A12	φ21.25	Shell outside diameter
A13	φ2.0	Ball diameter / 6 pcs
A14	φ2.13	Ball holding space / 6 pcs
B1	6.1	Optical to mechanical reference plane
B2	φ1.998	Diameter of optical ferrule
C1	4.3	Electrical to mechanical reference plane
C2	φ1.58	Electrical contact outside diameter
C3	φ2.35	
C4	φ3.38	Insulator outside diameter for electrical contact
C5	3.1	The top of Electrical contact
C6	9.9	Insulator location
C7	60°	

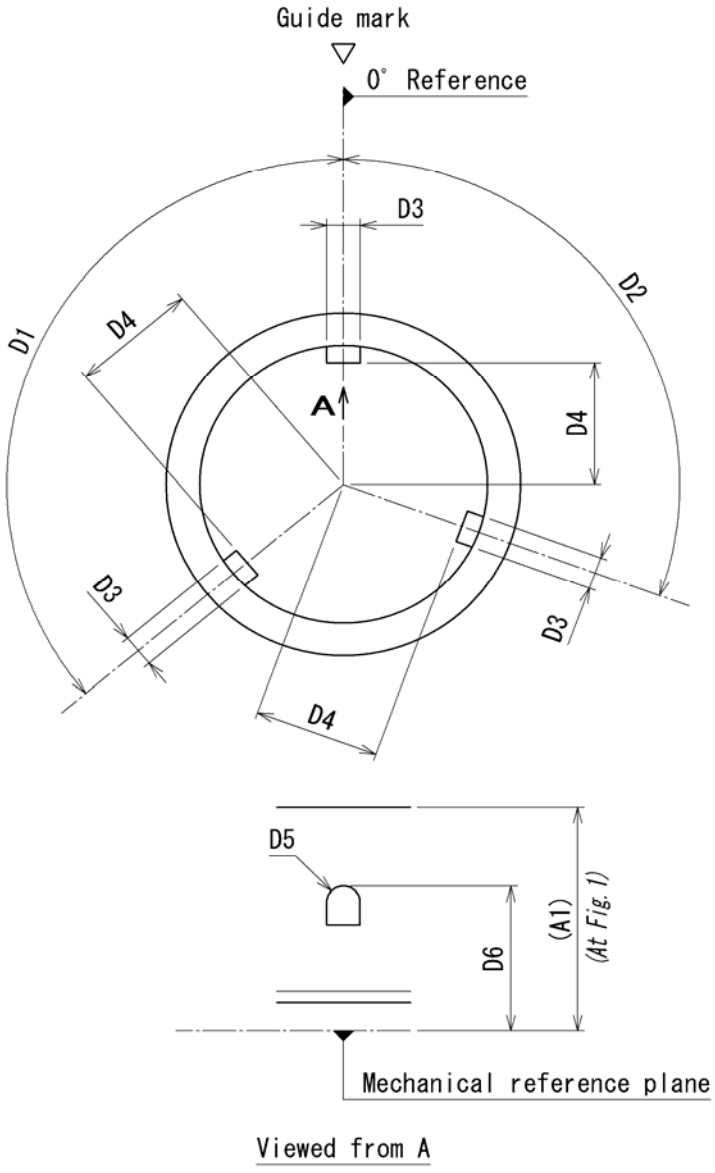


Figure 3 – Plug key arrangement

Table 3 – Plug key dimensions

Position	Dimensions (mm)	Description
D1	130°	Shell-Key
D2	110°	Shell-Key
D3	2.5	Width of Shell-Key / 3 pcs
D4	9.5	Height of Shell-Key / 3 pcs
D5	R1.25	Shell-Key / 3 pcs
D6	11.0	Depth of Shell-Key / 3 pcs

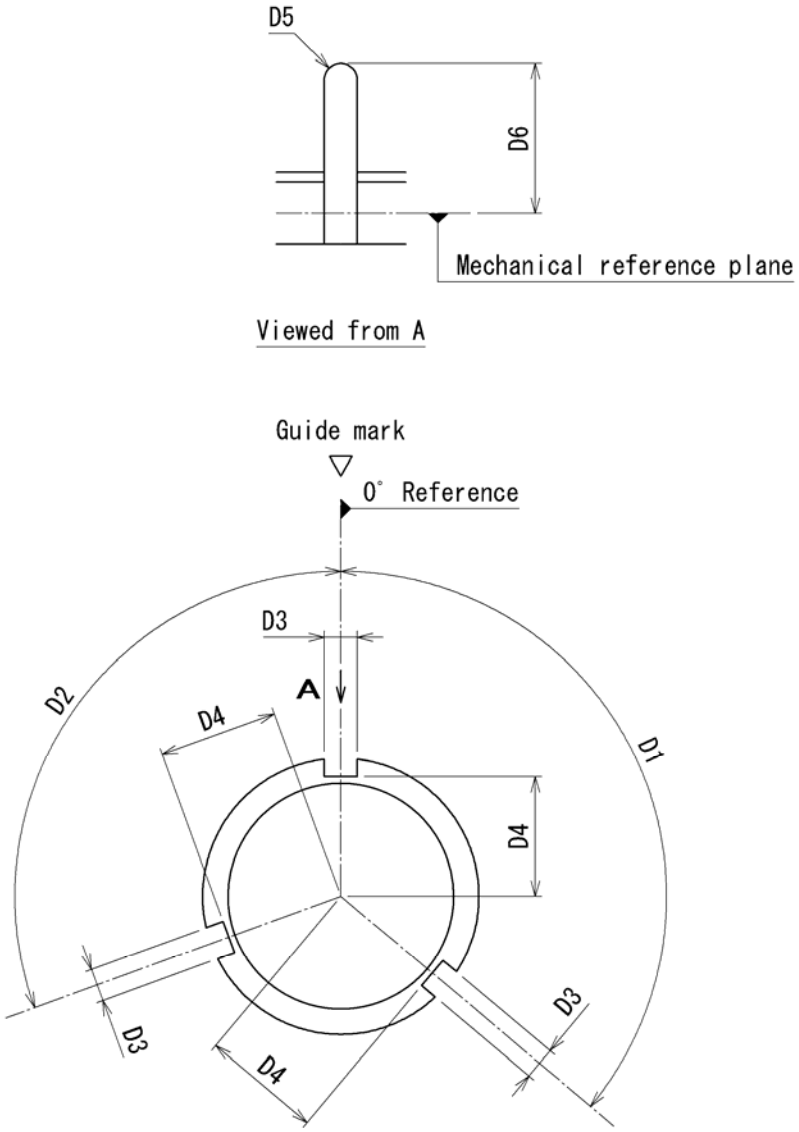
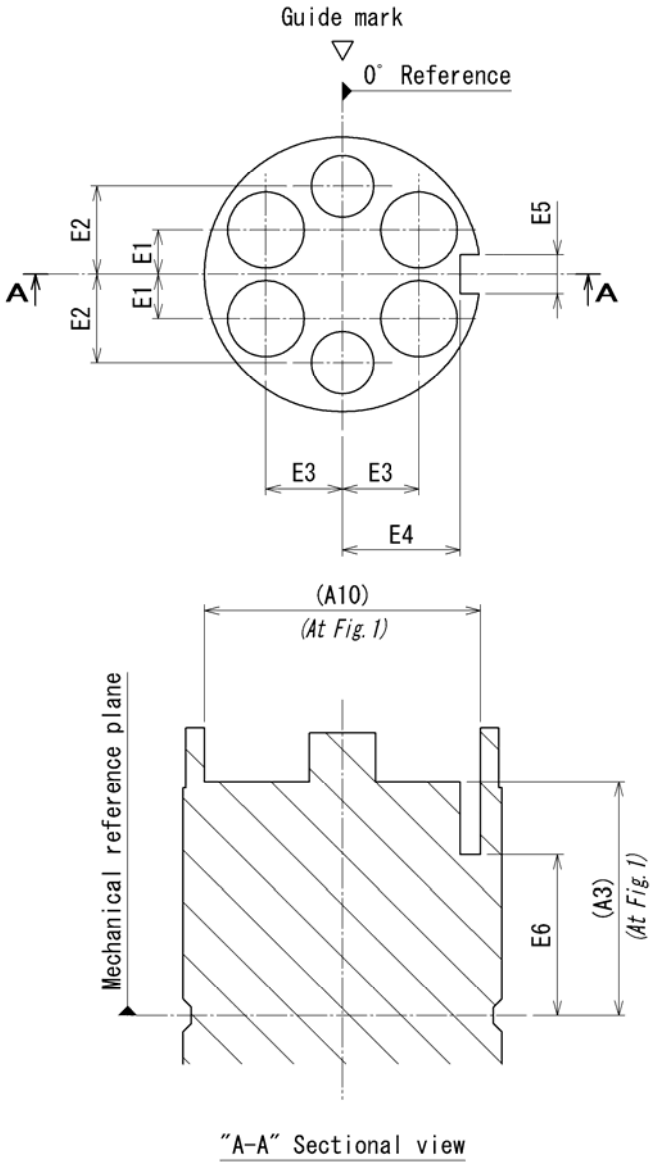


Figure 4 – Jack key arrangement

Table 4 – Jack key dimensions

Position	Dimensions (mm)	Description
D1	130°	Shell-Key groove
D2	110°	Shell-Key groove
D3	2.6	Width of Shell-Key groove / 3 pcs
D4	9.3	Height of Shell-Key groove / 3 pcs
D5	R1.3	Shell-Key groove / 3 pcs
D6	11.5	Depth of Shell-Key groove / 3 pcs

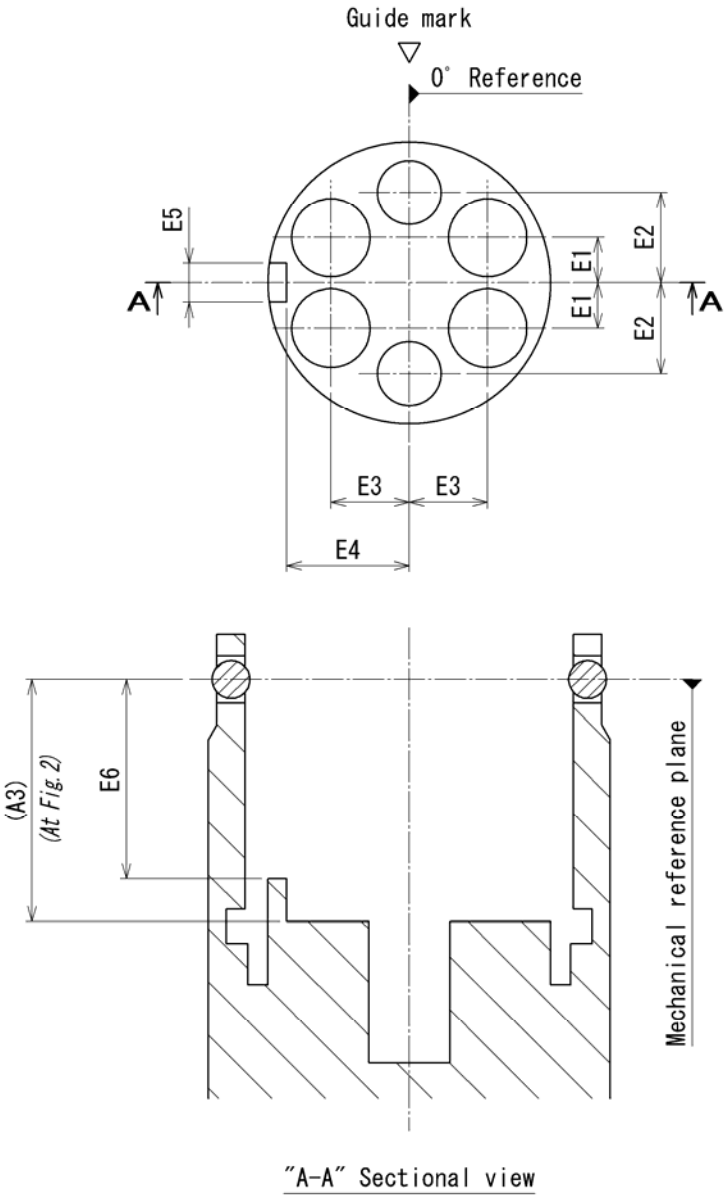


NOTE – Figure viewed from front face.

Figure 5 – Plug contact arrangement

Table 5 – Plug contact dimensions

Position	Dimensions	Description
E1	2.4	Electrical contact
E2	4.8	Fiber-optic contact
E3	4.16	Electrical contact
E4	6.5	Height of Insulator-Key groove
E5	2.1	Width of Insulator-Key groove
E6	0.5	Depth of Insulator-Key groove

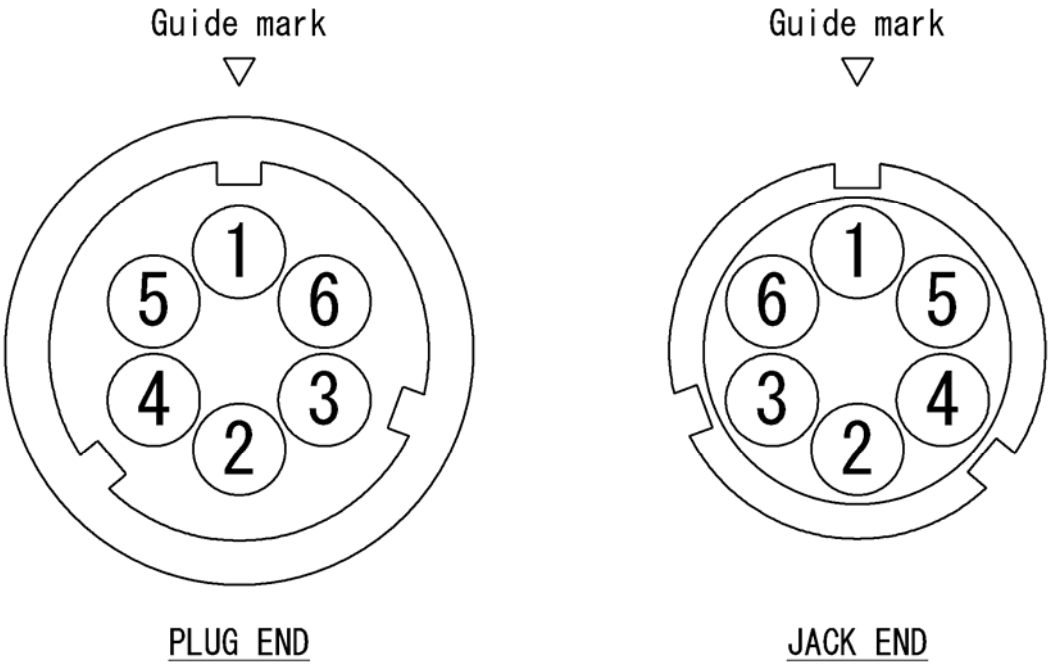


NOTE – Figure viewed from front face.

Figure 6 – Jack contact arrangement

Table 6 – Jack contact dimensions

Position	Dimensions (mm)	Description
E1	2.4	Electrical contact
E2	4.8	Fiber-optic contact
E3	4.16	Electrical contact
E4	6.5	Height of Insulator-Key
E5	2.05	Width of Insulator-Key
E6	11	Depth of Insulator-Key



NOTE – Figure viewed from front face.

Figure 7 – Pinout wiring number

Table 7 – Pinout wiring diagrams

Contact No.	Wire type (Color)	Description
1	Optical fiber (Blue)	From Camera to Base station
2	Optical fiber (Yellow)	From Base station to Camera
3	Low voltage electrical wire (Gray)	Hot
4	Low voltage electrical wire (Red)	Cold
5	Auxiliary electrical wire (Black)	Hot
6	Auxiliary electrical wire (White)	Cold