

# EBU Technical Recommendation R100-1999

## Connectors for camera cables with fibre optical transmission



| <i>EBU Committee</i> | <i>First Issued</i> | <i>Revised</i> | <i>Re-issued</i> |
|----------------------|---------------------|----------------|------------------|
| PMC                  | 1999                |                |                  |

Keywords: **Cameras, digital processing, fibre optical transmission**

The EBU has considered that:

- modern CCD broadcast cameras employ digital video processing in the camera head;
- camera cables of the triax type that are currently in use can only carry digital signals over a maximum length of approximately 300m;
- new or refurbished television production studios/OB vans are normally equipped with digital installations;
- broadcasters may wish to avoid the use of analogue video signal transmission over the camera cable in an otherwise digital production environment;
- manufacturers of broadcast cameras now offer, as an option, camera cables with fibre optic transmission of the digital video signals;
- the connectors in use on fibre optical camera cables are of a type that has been standardised by national standards organisations;

The EBU recommends that:

- EBU Members who wish to use camera cables with fibre optic transmission of the digital signals between the camera heads and the Camera Control Units (CCU), should use the cable connectors described in Annex 1<sup>1</sup>.

### Bibliography

- [1] ARIB Technical Report BTA S-1005B: **Interconnection for HDTV studio equipment** (in Japanese)
- [2] SMPTE Standard, SMPTE 304M: **Broadcast cameras – Hybrid Electrical and Fiber-Optic Connector**
- [3] IEC 60068-2-3: **Environmental testing - Part 2: Tests. Test Ca: Damp heat, steady state**

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<sup>1</sup> Suitable connectors, type 3K.93C, are available from Lemo SA, Case postale 194, CH-1024, Ecublens, Switzerland

## ANNEX 1

# Connectors for camera cables with fibre optical transmission

### 1. Introduction

The connectors described in this annex have been specified since 1997 by the Association of Radio Industries and Businesses (ARIB) in Japan [1] and are standardised by the SMPTE [2].

This connector is mainly intended for use in broadcast television and video equipment, particularly for the interconnection of camera head and Camera Control Unit (CCU). It is a hybrid connector with two optical and four electrical contacts. The optical fibres in the cable must be single-mode (SM) fibres.

### 2. Specifications

#### 2.1. Structural requirements

The connector system consists of a plug-and-jack arrangement with push-pull self-latching for quick and easy mating. There are two fibre optic contacts in each connector with ceramic ferrules having spherical ends to ensure high performance. The alignment mechanism consists of a split sleeve contained in the contacts on the plug.

These connectors are available in panel mounting and cable mounting versions of both plugs and jacks. Care should be taken that the contacts carrying power cannot be accidentally touched when cables are being routinely connected.

Suitable protection caps, that prevent contamination of the fibre optical parts in particular, should be used on all contact configurations.

#### 2.2. General specifications

|              |  |
|--------------|--|
| Temperature: | -40° C, +80° C   |
| Humidity:    | 90-95% relative humidity at 40° C +/-2 for 96 hours<br>(according to IEC 60068-2-3)[3] |
| Durability:  | 10 000 cycles  |

#### 2.3. Electrical specifications

##### 2.3.1. Power contacts

|                     |                                     |
|---------------------|-------------------------------------|
| Number of contacts: | 2                                   |
| Voltage:            | 600 V rms (maximum working voltage) |
| Current:            | 10 A (maximum working current)      |

##### 2.3.2. Low voltage/signal contacts

|                     |   |
|---------------------|---|
| Number of contacts: | 2   |
| Voltage:            | 42 V rms or 60 V DC (maximum working voltage) |
| Current:            | 3 A (maximum working current)                 |

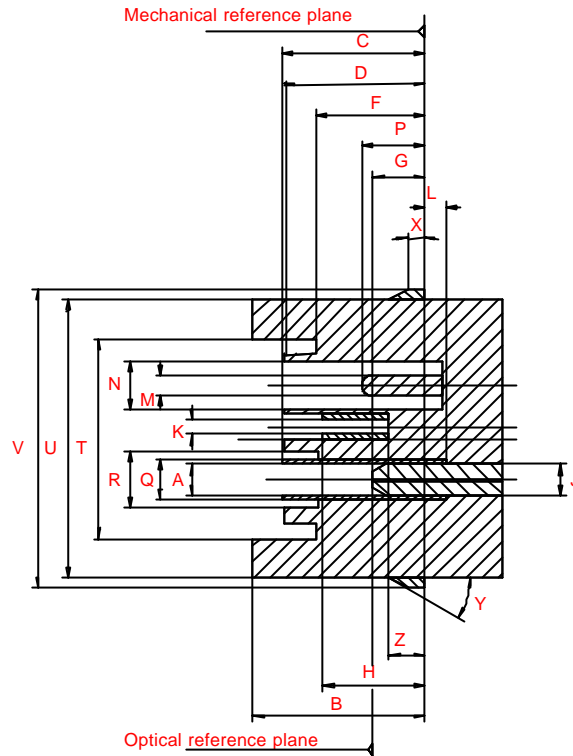
#### 2.4. Optical specifications

|                            |  |
|----------------------------|--|
| Number of fibre contacts:  | 2  |
| Fibre core/cladding diam.: | 9/125µm, single mode (SM) fibre  |
| Insertion loss:            | less than 0.5dB at 1300 nm <sup>2</sup>  |
| Return loss:               | better than -45dB (machine polishing);<br>alternatively better than -28dB (hand polishing) |

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<sup>2</sup> Tested at 1300nm in accordance with IEC 874-1 method 7

**2.5. Mechanical dimensions and configurations**

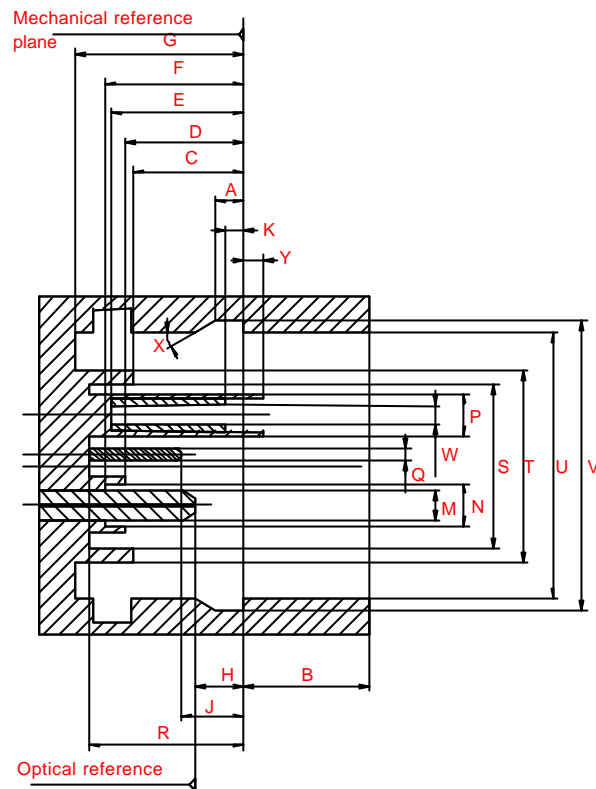


**Fig. 1 Plug mating interface**

**Table 1 - Plug mating dimensions**

| Dimension | Specification (mm) |         |         | Description   |
|-----------|--------------------|---------|---------|---|
|           | Minimum            | Nominal | Maximum |   |
| A         | /                  | /       | ø2.000  | Split sleeve inside diameter                            |
| B         | /                  | /       | 11.25   | Connector shell to reference plane                      |
| C         | /                  | /       | 10.17   | Split sleeve to reference plane                         |
| D         | /                  | /       | 9.4     | Insert dimension  |
| F         | /                  | /       | 7.15    | Insert dimension  |
| G         | /                  | 3.33    | /       | Optical to mechanical reference plane <sup>1)</sup>     |
| H         | /                  | /       | 8.9     | Low-voltage contact location                            |
| J         | ø1.999             | /       | ø2      | Diameter of optical ferrule                             |
| K         | ø0.88              | /       | ø0.885  | Low-voltage contact inside diameter                     |
| L         | 1.3                | /       | /       | Split sleeve  |
| M         | ø1.27              | /       | ø1.3    | Auxiliary electrical contact outside diameter           |
| N         | ø3.05              | /       | /       | Insert inside diameter for auxiliary electrical contact |
| P         | /                  | /       | 4.3     | Auxiliary electrical contact location                   |
| Q         | /                  | /       | ø3      | Split sleeve outside diameter                           |
| R         | ø4.48              | /       | /       | Insert dimension  |
| T         | ø12.97             | /       | /       | Shell inside diameter                                   |
| U         | /                  | /       | ø18     | Shell outside diameter                                  |
| V         | /                  | /       | ø19.6   | Latch outside diameter                                  |
| X         | /                  | /       | 1.2     | Latch dimension   |
| Y         | /                  | 30°     | /       | Latch dimension   |
| Z         | /                  | /       | 2.4     | Low-voltage contact depth                               |

1) Nominal location of spring-loaded optical ferrule when subject to a load force of 3N to 8N. Spring loading optional on plug optical contacts.

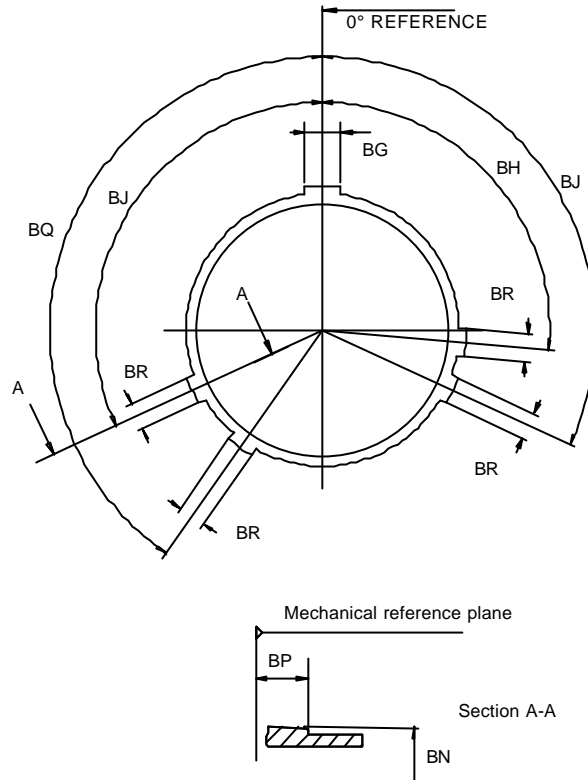


**Fig. 2 Jack mating interface**

**Table 2 - Jack mating dimensions**

| Dimensions | Specifications (mm) |         |         | Description   |
|------------|---------------------|---------|---------|---|
|            | Minimum             | Nominal | Maximum |   |
| A          | 2.05                | /       | /       | Latch groove dimension                              |
| B          | /                   | /       | 8.55    | Groove location                                     |
| C          | 7.35                | /       | /       | Insert dimension                                    |
| D          | 7.73                | /       | /       | Insert dimension                                    |
| E          | 7.7                 | /       | /       | Auxiliary electrical contact depth                  |
| F          | 10.27               | /       | /       | Insert dimension                                    |
| G          | 11.35               | /       | /       | Shell depth   |
| H          | /                   | 3.33    | /       | Optical to mechanical reference plane <sup>1)</sup> |
| J          | 2.97                | /       | /       | Low-voltage contact location                        |
| K          | /                   | /       | 0.05    | Auxiliary electrical contact location               |
| M          | ∅1.999              | /       | ∅2      | Diameter of optical ferrule                         |
| N          | ∅3.2                | /       | /       | Insert inside dimension                             |
| P          | /                   | /       | ∅2.95   | Insert dimension                                    |
| Q          | ∅0.87               | /       | ∅0.9    | Low-voltage contact outside diameter                |
| R          | 10.33               | /       | /       | Insert location                                     |
| S          | ∅11.05              | /       | /       | Inside outside diameter                             |
| T          | /                   | /       | ∅12.95  | Shell dimension                                     |
| U          | ∅18.1               | /       | /       | Shell inside diameter                               |
| V          | ∅19.7               | /       | /       | Latch groove diameter                               |
| W          | ∅1.28               | /       | ∅1.285  | Auxiliary electrical contact inside diameter        |
| X          | /                   | 30°     | /       | Latch dimension                                     |
| Y          | /                   | /       | 1.07    | Insert dimension                                    |

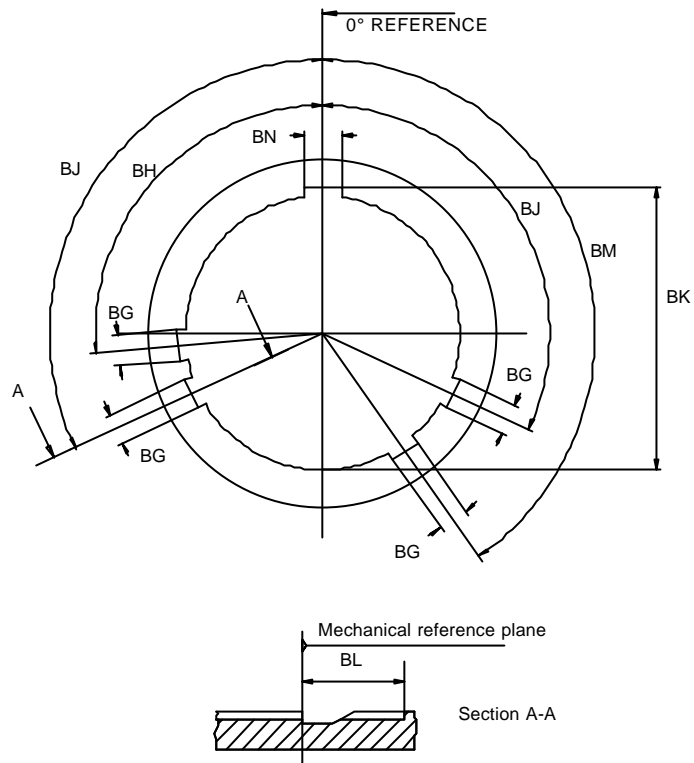
1) Nominal location of spring-loaded optical ferrule when subject to a load force of 3N to 8N.



**Fig. 3 Plug key arrangement**

**Table 3 - Plug key dimensions**

| Dimensions | Specifications (mm) |         |         |
|------------|---------------------|---------|---------|
|            | Minimum             | Nominal | Maximum |
| BG         | /                   | /       | 2.43    |
| BH         | /                   | 95°     | /       |
| BJ         | /                   | 115°    | /       |
| BN         | /                   | /       | ø19     |
| BP         | /                   | /       | 3.5     |
| BQ         | /                   | 145°    | /       |
| BR         | /                   | /       | 1.83    |



**Fig. 4: Jack key arrangement**

**Table 4: Jack key dimensions**

| Dimensions | Specifications (mm) |         |         |
|------------|---------------------|---------|---------|
|            | Minimum             | Nominal | Maximum |
| BG         | 2.02                | /       | /       |
| BH         | /                   | 95°     | /       |
| BJ         | /                   | 115°    | /       |
| BK         | 18.55               |         | /       |
| BL         | 5.35                | /       | /       |
| BM         | /                   | 145°    | /       |
| BN         | 2.52                | /       | /       |

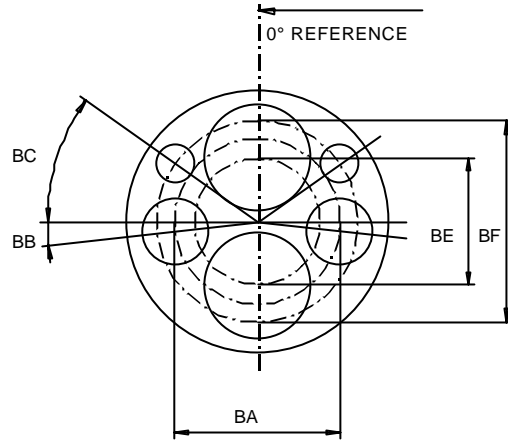


Fig. 5: Plug contact arrangements

Table 5 - Plug contact dimensions

| Dimensions | Specifications (mm) |         |         | Description                  |
|------------|---------------------|---------|---------|------------------------------|
|            | Minimum             | Nominal | Maximum |                              |
| BA         | ø6.895              | /       | ø6.905  | Auxiliary electrical contact |
| BB         | 6°25'               | /       | 6°35'   |                              |
| BC         | 34°56'              | /       | 35°4'   |                              |
| BE         | ø5.295              | /       | ø5.305  | Fibre-optic contact          |
| BF         | ø8.395              | /       | ø8.405  | Low-voltage contact          |

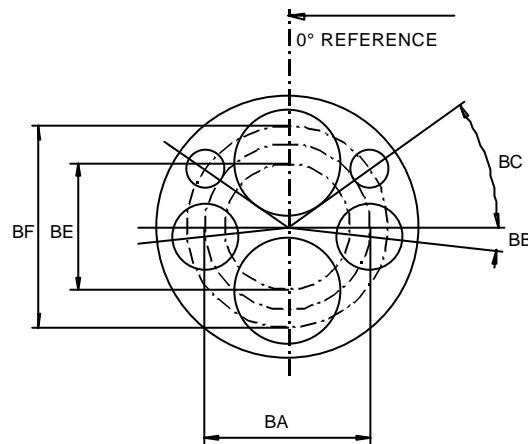


Fig 6: Jack contact arrangement

Table 6 - Jack contact dimensions

| Dimensions | Specifications (mm) |         |         | Description                  |
|------------|---------------------|---------|---------|------------------------------|
|            | Minimum             | Nominal | Maximum |                              |
| BA         | ø6.895              | /       | ø6.905  | Auxiliary electrical contact |
| BB         | 6°25'               | /       | 6°35'   |                              |
| BC         | 34°56'              | /       | 35°4'   |                              |
| BE         | ø5.295              | /       | ø5.305  | Fibre-optic contact          |
| BF         | ø8.395              | /       | ø8.405  | Low-voltage contact          |