Assisted Electrical Rotary Joint

User Manual

Version 1.0.2

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1

Overview

1.1 Assisted Electrical Rotary Joint

(a) *Connections* (b) *Stator (black) and Rotor (yellow)*

Figure 1.1: *Assisted Electric Rotary Joint*

The Doric *Assisted Electrical Rotary Joint* is used to transmit electrical signal from a moving sample to a fixed recording system. It consists of high precision ball bearings, a slip ring to transmit signal, and a small motor to assist rotation. This allows effectively frictionless rotation of the rotary joint. The device can be separated into 3 elements (Fig. **??**):

- The **USB Mini-B 5V Port** (Fig. 1.1a) is used to connect the rotary joint power supply.
- The **Output/Input Electric Receptacles** (Fig. 1.1a) are used to connect electrical cables to the Output/Input of the rotary joint. The device uses Male Harwin (12 contacts) or Female HDMI (Microscope or Blackrock 2 configuration) electrical connectors.
- The **Ground** (Fig. 1.1a) is a #2-56 threaded hole that can be used to electrically ground the rotary joint to an exterior object.
- The **Torque Sensor** (Fig. 1.1a) is used by the rotary joint to detect when cables are turning.
- The **Stator** (Fig. 1.1b) contains all the fixed input ports, as well as the power supply port described here.
- The **Rotor** (Fig. 1.1b) contains all the rotary output ports.

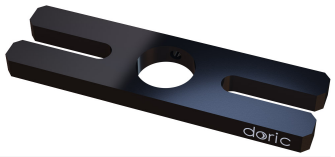
This is a device intended for fundamental research, especially good for lightweight animals like mice.

The electrical signal is transmitted through 2 possible types of connectors: Male Harwin (12 contacts) or Female HDMI (*Doric Lenses Fluorescence Microscope* and *Blackrock Micro* compatible pinouts available). The central clearance hole is used in cases where optical signal is required. It allows for passage of one or two optical fibers with M3 or ferrule/sleeve connectors.

1.2 Assisted Electrical Rotary Joint Holders

The rotary joint can be used in two possible holders which both come standard. The first, the *Holder_ARJ* (Fig. 1.1) can take the rotary joint alone for experiments requiring only electrical signals. The second, *Holder_AERJ* (Fig. 1.1), can also hold an optical rotary joint allowing optical and electrical transmission. These include 1x1, 1x2 and 1x4 fiber-optic rotary joints . The rotary joint also comes standard with a *Holder_FRJ_small* and a *Holder_FRJ_large* to allow the integration of a fiber-optic rotary joint into the *Holder_AERJ*.

Table 1.1: *Assisted Electrical Rotary Joint Holders*

Holder_ARJ	
Holder_AERJ	
Holder_FRJ_small	
Holder_FRJ_large	

1.3 Rotary Joint Harwin 12/Omnetics PZN12 Adapter Kit

To integrate the rotary joint within electrophysiology systems that use **Omnetics PZN-12 connectors**, an adapter kit can be provided. These elements allow a Harwin-connectorized rotary joint to serve as a rotary joint for Omnetics connectorized systems. The adapter system is composed of the following elements.

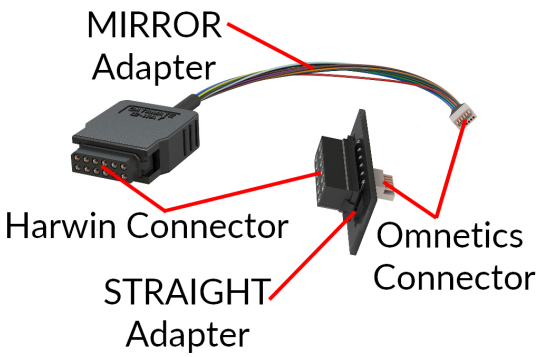


Figure 1.2: *Harwin-Omnetics Adapters and Parts*

- The **MIRROR Adapter** is a cable with a **Female Harwin 12-pin connector** on one side and a **Omnetics PZN12 connector** on the other. To use, simply insert the Female Harwin connector in the Male Harwin connector on the **Stator** side of the rotary joint. The pinout inside this adapter is mirrored to take into account the connector mirroring in a **Omnetics PZN12/Omnetics PZN12** cable.
- The **STRAIGHT Adapter** is a simple **Female Harwin 12-pin connector**/**Omnetics PZN12 connector** adapter. To use, simply insert the Female Harwin connector in the Male Harwin connector on the **Rotor** side of the rotary joint.

Figure 1.3: *Adapters Connected to AHRJ (example), STRAIGHT on Rotor (yellow) and MIRROR on Stator (black)*

For the assisted rotation to function, connect the 5V mini USB-B power supply to the port shown in Figure 1.1a.

2.1 Electrical Rotary Joint Installation

2.1.1 Holder_ARJ

The *Holder_ARJ* is used during experiments requiring only electrical signals. The rotary joint is held in place by gravity, and must be placed vertically (Fig. 2.1).

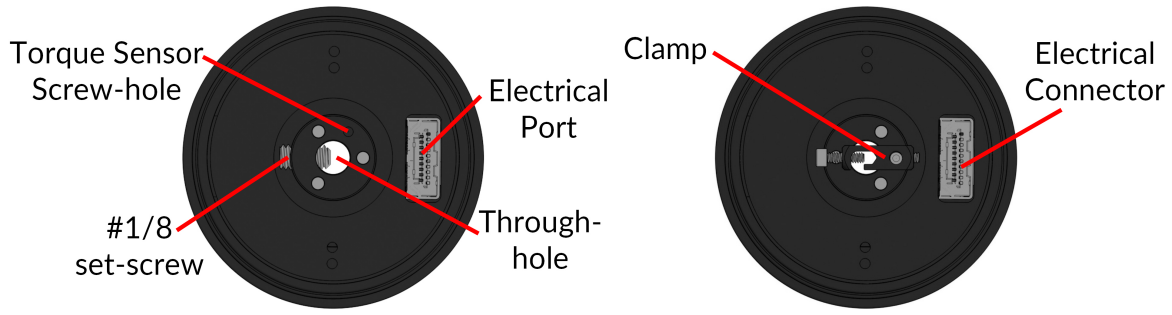
Figure 2.1: *Installation of the AERJ in the Holder_ARJ*

2.1.2 Electrical Cable Configuration

The signal input/output is ensured using a HARWIN (12-pin) (Table 3.1) or HDMI (12-pin) connector (see HDMI connector pinouts, Table 3.3). The number of electrical contacts does not necessarily equal the number of recording channels.
Note: Ensure that the electrical connectors are free of dust using an air duster before installing the cables. If using optical fibers and a fiber-optic rotary joint, clean the connector end tips of the patch cords before connecting them. When not in use, install plastic caps on connectors for protection and cleanliness.

2.2 Ground

Secure a #2-56 screw into the **Ground** hole. Bend an electrical wire around the screw, and connect the cable to an outside ground. This can reduce electrical noise when used in high-sensitivity applications.

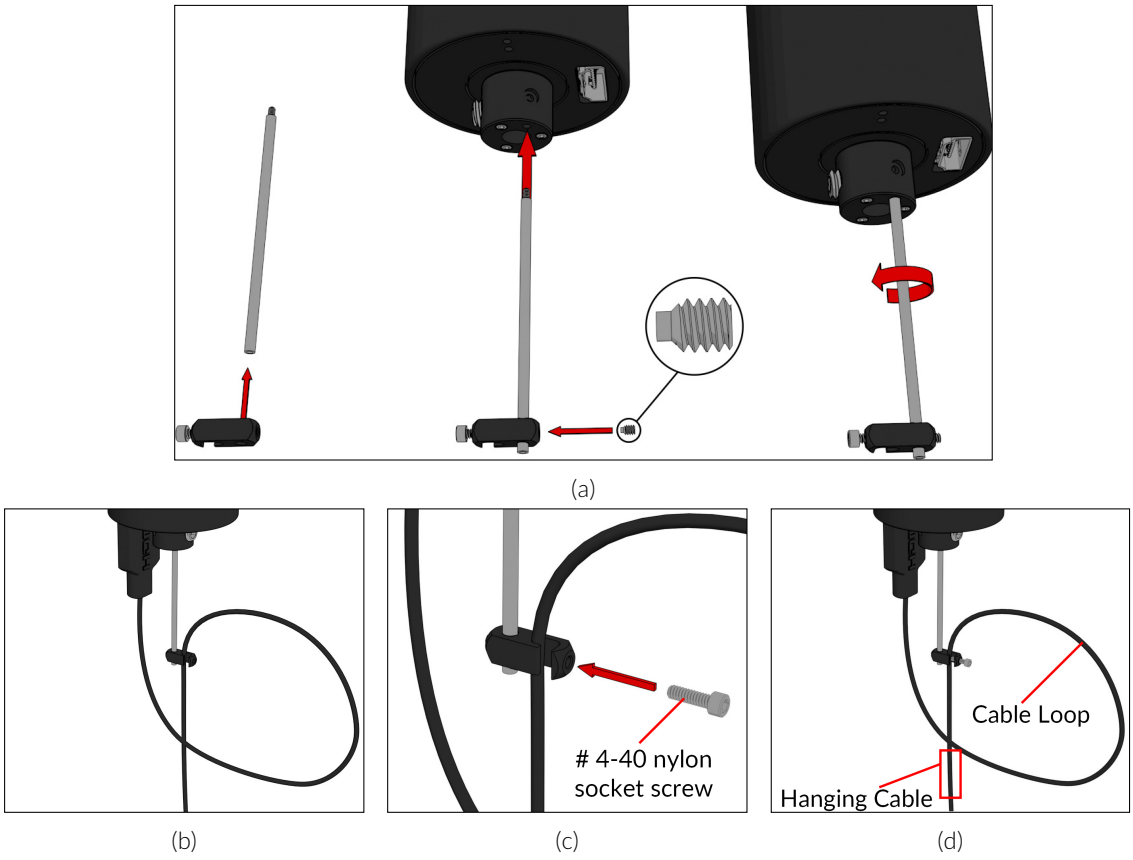


(a) *Assisted Electrical Rotary Joint Underside* (b) *Clamp Orientation*

Figure 2.2: *Assisted Electric Rotary Joint Underside*

2.2.1 Torque Sensor Installation

The **Torque Sensor** is necessary to the effective operation of the *Assisted Electrical Rotary Joint* when the rotary joint is used for electrophysiology only. It acts as a cable holder to allow a good rotation with the weight of the electrical cable. To install the **Torque Rod** and the electrical cable, follow this procedure. These steps must be performed before connecting the rotary joint to an experimental subject.



(a)

(b) (c) (d)

Figure 2.3: *AERJ Toque Rod Placement*

1. Add the black cable clamp to the end of the **Torque Rod**. Secure the clamp to the rod using a # 4-40 screw (Fig. 2.3a).
2. Connect the **Torque Rod** with a # 0-80 set-screw into the small screw-hole on the **Torque Sensor** (See Fig. 2.2a for location).

3. Remove the **1/8 hex set-screw** (Fig. 2.2a).
4. Install the *ARJ_Holder*. For proper function of the rotary joint, the holder **MUST BE LEVEL**.
5. Place the rotary joint in the holder. The weight of the clamp alone should not move the rotor; if so, check the **Level** of the holder. Ensure approximately 10 cm of clearance around the **Torque Sensor**.
6. Delicately move the **Torque Sensor** left and right. The **Torque Sensor** will hit two **Sensors**, that activate the rotary joint's assist function while powered. If you move the **Torque Sensor** less delicately, the rotor can be rotated.
7. Move the **Torque Sensor** to be between the two **Sensors**, a position called **Center** (Fig. 2.4). Adjust the clamp orientation at center so the length of the **Clamp** is perpendicular to the length of the **Electrical Connector** (Fig. 2.2b).
8. Connect the rotary **Electrical Connector** to the rotary joint.
9. Loop the cable (**Cable Loop**, Fig. 2.3b) into the clamp, and secure it in place using the *# 4-40 nylon socket screw* (Fig. 2.3c).
10. Because of its weight, the **Cable Loop** will move the **Torque Sensor** off-center. The loop's orientation must be adjusted so the **Torque Sensor** is centered on its own.
    a) Adjust the **Cable Loop** orientation by slightly unscrewing the *nylon socket screw*, rotating the **Hanging Cable** (Fig. 2.3d) using thumb and forefinger, then tightening the screw when in position.
    b) Identify the **Extremes** of the **Cable Loop** orientation. Adjust the loop so the **Torque Sensor** rests on one sensor, then the other.
    c) Adjust the orientation of the **Cable Loop** to be between the **Extremes**.
    d) Check the distance between this new **Center** and the two sensors.
        i. If the distance from **Center** to **Sensor** appears equal on both sides, go to step **10.e**.
        ii. If the distance **Center** to **Sensor** appears unequal, go back to step **10.c**.
    e) Connect the power supply to the rotary joint.
        i. If the rotary joint starts spinning uncontrollably, disconnect the power supply.
            A. Check if the holder is level. If not, return to step **4**.
            B. Check the **Center**. If the **Torque Sensor** is not properly centered, return to step **10.c**. If the *nylon socket screw* is not well secured, the **Cable Loop** can easily move and de-center the **Torque Sensor**.
        ii. If the rotary joint stays motionless, gently grasp the **Hanging Cable** with thumb and forefinger, rotating the **Hanging Cable** clockwise and counter-clockwise.
            A. If the assist function activates as the **Hanging Cable** is turned, doing small, slow movements, go to step **10.f**.
            B. If the rotary joint starts spinning uncontrollably, return to step **10.e.i**.
            C. If the rotary joint spins rapidly, making large movements for small movements of the **Hanging Cable**, the **Torque Sensor** is almost centered. Return to step **10.d**.
            D. If the rotary joint moves correctly in one direction but does not move in the other, check the clearance of the rotary joint. If the *1/8 hex set-screw* is still in place, it can easily hit the **Electrical Connector**, stopping movement in one direction. Objects that block the **Cable Loop** can cause similar problems. Return to step **10.e.ii**.
    f) Once the rotary joint moves properly for small **Hanging Cable** rotations, ensure all screws are well secured.
    g) Test the rotary joint using large, quick rotations of the **Hanging Cable**.
        i. If the rotary joint starts spinning uncontrollably, return to step **10.e.i**.
        ii. If the rotary joint now only spins in large, fast movements, even when the rotation of the **Hanging Cable** is minimal, return to step **10.d**.
11. Once the movement correspondence is adequate, the rotary joint is well aligned. This process must be repeated if the rotary joint is uninstalled, or if the movements no longer correspond.

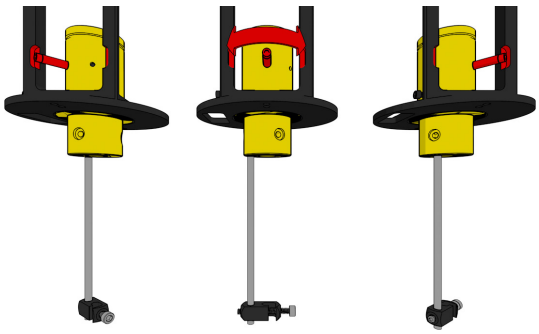


Figure 2.4: *Torque Sensor Mechanism, in **Left**, **Center** and **Right** Positions*

2.3 Electrical + Optical Rotary Joint Installation

2.3.1 Holder_AERJ

The Holder_AERJ allows the electrical rotary joint to be used with fiber-optic rotary joints. The following section explains how to install the rotary joints in the specialized holder dedicated to that use.

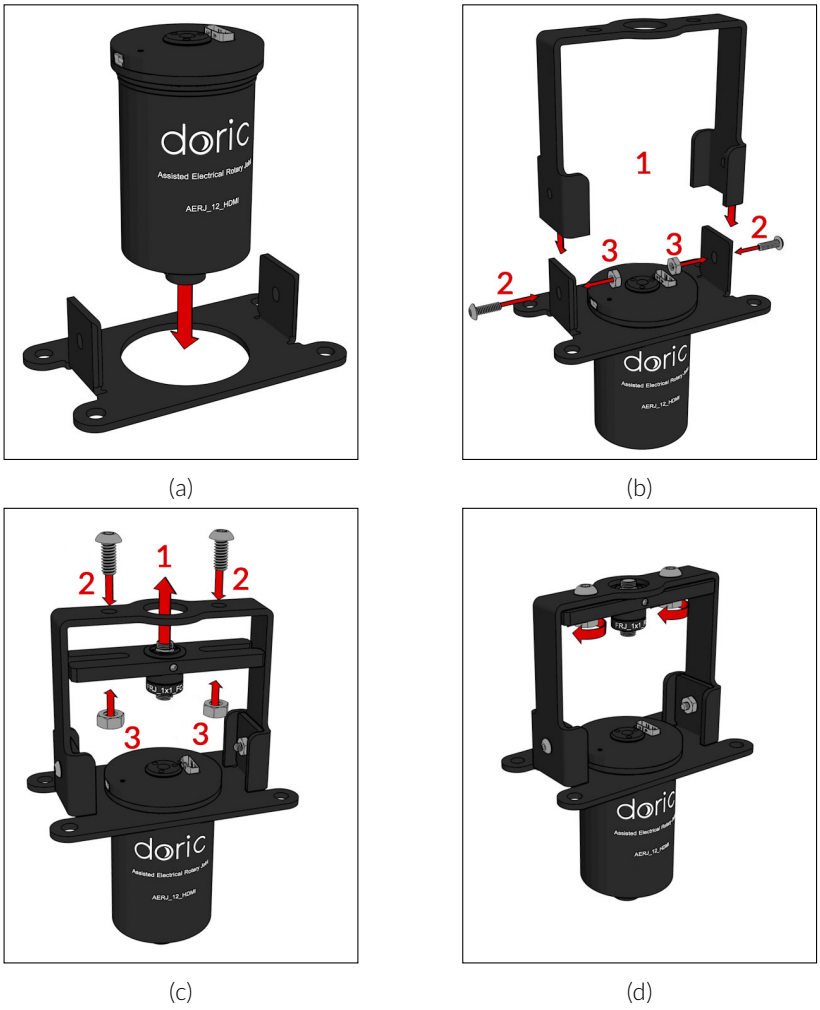
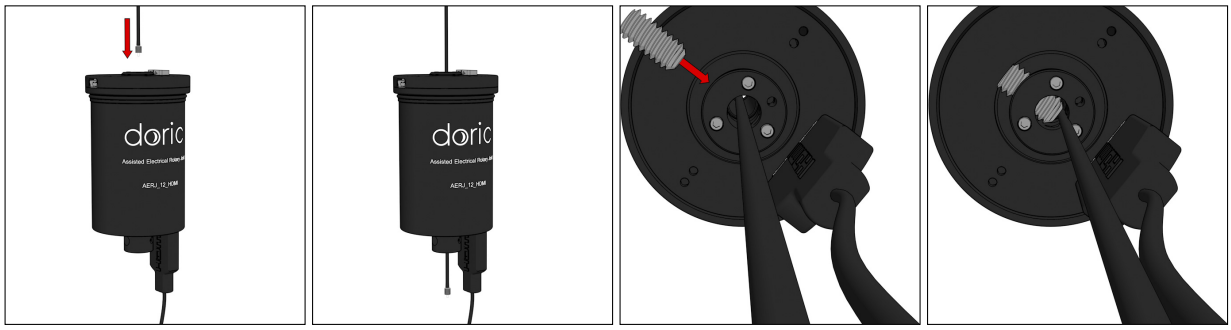


Figure 2.5: *Installation of the rotary joints in the Holder_AERJ*

1. If the *Holder_AERJ* is used, first install the AERJ in the *Holder_AERJ* base (Fig. 2.5a). The rotary joint is held in place by gravity, and must be placed vertically.
2. Assemble the *Holder_AERJ* base with the *Holder_AERJ* frame. Deposit the frame on the base (1). Secure the frame to the holder base using #8-32 (or M4) screws (2) and nuts (3) (Fig. 2.5b).
3. Take the rotary joint assembly, placing it under the *Holder_AERJ* frame so the fiber connector passes through the hole (1). Using 1/4 (or M6) screws (2) and nuts (3) (Fig. 2.5c), secure the holder to the frame (Fig. 2.5d).
    - If the *1x1 Fiber-optic Rotary Joint* is used, secure it into the *Holder_FRJ_small*, using the directives in the *1x1 Fiber-Optic Rotary Joint User Manual*.
    - If the *1x2 Fiber-optic Rotary Joint* is used, secure it into the *Holder_FRJ_large*, using the directives in the *1x2 Fiber-Optic Rotary Joint User Manual*.
    - The final result with a 1x1 Fiber-optic Rotary Joint is shown in Figures 2.6a and 2.8. The final result with a 1x2 Fiber-optic Rotary Joint is shown in Figure 2.6b.

(a) *AERJ and FRJ 1x1 Setup* (b) *AERJ and FRJ 1x2 Setup*

Figure 2.6: *Assisted Electrical Rotary Joint combined setups*



(a) (b) (c) (d)

Figure 2.7: *AERJ Sensor Cable Placement*

2.3.2 Optical Cable Configuration

Figure 2.8: *AERJ and FRJ 1x1 Setup with cables*

When the Assisted Electrical Rotary Joint is used in combination with a fiber-optic rotary joint, the optical and the electrical cables attached together provide sufficient torque to activate the assisted rotation. In this case, the rod of the **Torque Sensor** is not necessary for proper assisted rotation. If using no **Torque Rod** (Fig. 2.3), follow this installation procedure.

1. Connect the signal patch cord to the fixed connector of the optical rotary joint.
2. Install the *AERJ_Holder* as shown in section 2.3.1.
3. Select the subject patch cord(s) for usage.
    - If using a *FRJ 1x1*, a **FC/M3** or **FC/Ferrule-sleeve** patch cord must be used. Only these connectors are sufficiently small to pass in the **Through-hole**.
    - If using a *FRJ 1x2*, a **FC/Ferrule-sleeve** patch cord must be used. Only the ferrule connectors are small enough to allow 2 to pass in the **Through-hole**.
4. Connect the subject patch cord(s) **FC connector** to the rotary connector. Follow the directions in the user manual of the rotary joint.
5. Pass the patch cords through the **Through-hole** (Fig. 2.2a, 2.7a and 2.7b). Only **M3** or **Ferrule-sleeve** connectors are small enough to pass through.
6. Using a 1/8 hex screwdriver, secure the fiber with the set-screw (Fig. 2.7c and 2.7d).
7. Attach the optical fiber and electrical cable together at a distance of more than 5 cm from the rotary joint. This transfers torque to the rotary joint.
    - When attaching the **HDMI cable** and **Patch cords**, bend the **HDMI cable** and allow the fiber to stay straight; this will allow better torque transmission.
    - The **HDMI cable** and **Patch cords** can be held together with tape or twist-ties. If using tape, fold the tips of the length of tape so it may be easily removed. Using any cutting implement to remove the tape can easily damage the fiber and cable.
    - Attaching the cable and fiber at multiple points along the length will allow better torque transmission.
    - The length of cable exiting the rotary joint should typically be near 20 cm (Fig. 2.8).

3

Specifications

Table 3.1: *Harwin Electrical Connector Configuration*

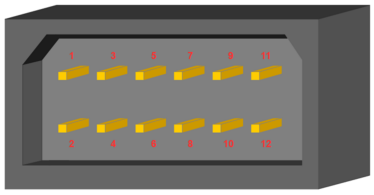
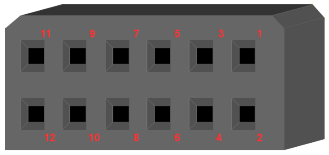
Male (on rotary joint)	Female (on adapter)
	

Table 3.2: *HDMI Electrical Connector Configuration*

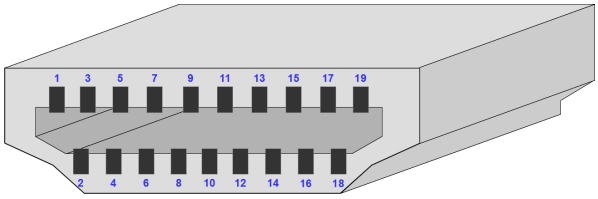
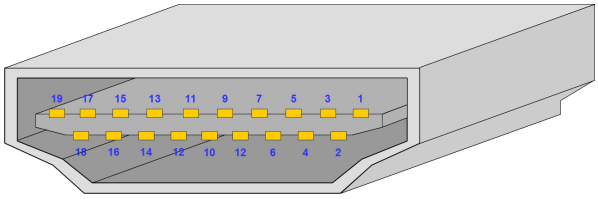
Male (on cable)	Female (on rotary joint)
	

Table 3.3: *HDMI Electrical Connector Pinouts*

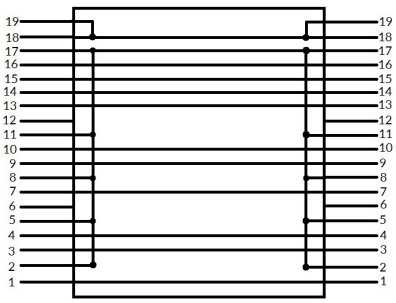
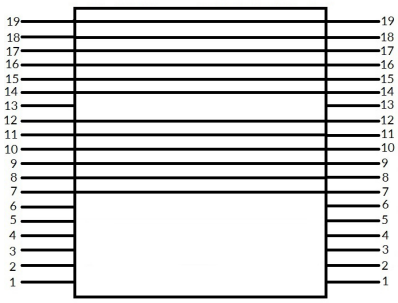
HDMI Microscope	HDMI Blackrock 2
	

Table 3.4: *General Specifications*

SPECIFICATIONS	VALUE
Number of contacts	12
Contact Material	Gold
HDMI connector pinout type	Microscope, Blackrock 2 (Female)
Harwin connector type	Datamate L-Tek serie, 2 mm (Male) pitch, 12 contacts, 2 rows
Maximum current	2 A per contact
Contact resistance	<500 mΩ
Resistance variation during rotation (constant rotation)	<100 mΩ @ 5 VDC
Start up torque	<20 µN·m
Rotation speed	up to 300 rpm
Outer diameter	50.8/55.6 mm
Through-hole diameter	6 mm
Length	82.6 mm
Mass	201 g

Table 3.5: *Recommended Environmental Specifications*

DESCRIPTION	OPERATION	STORAGE
Use	Indoor	Indoor
Temperature	0-40 ° C	0-40 ° C
Humidity	40-60% RH, non condensing	40-60% RH, non condensing

4

Support

4.1 Maintenance

The product does not require any maintenance. Do not open the enclosure. Contact Doric Lenses for return instructions if the unit does not work properly and needs to be repaired.

4.2 Warranty

This product is under warranty for a period of 12 months. Contact Doric Lenses for return instructions. This warranty will not be applicable if the unit is damaged or needs to be repaired as a result of improper use or operation outside the conditions stated in this manual. For more information, see our Website.

4.3 Contact us

For any questions or comments, do not hesitate to contact us by:

Phone 1-418-877-5600

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