ESD-Protective Multi-fiber Optic Connector Cleaner 「One-Click® Cleaner MPO ESD」

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Optical connectors, which are essential components in the construction of optical networks, require cleaning prior to connection as a standard procedure to prevent degradation of communication quality caused by contamination or foreign substances. In recent years, with the growing demand for data centers, damage due to static electricity has become a critical issue in optical transceivers and related devices, electrostatic discharge protected particularly leading to performance deterioration of optical modules and failures in optical links. In response to these challenges, we have developed the "One-Click® Cleaner MPO ESD", the ESD-protective multi-fiber optical connector cleaner designed for use in electrostatic discharge protected areas (EPAs). This paper reports on the features of this product.

1. Introduction

Optical connectors, essential components in optical networks, are known to cause deterioration in optical connection characteristics and degradation of communication quality when contamination or foreign substances are present on the connector end face [1)2)3)]. Additionally, the International Electrotechnical Commission (IEC) has established visual inspection standards for optical connector end face [4)], and cleaning the end face prior to connection is recognized as a standard procedure. Our company has previously commercialized various optical connector cleaners that enable simple and reliable cleaning irrespective of the operator's skill level [5)]. In recent years, with the expansion of new and additional data centers, there has been progress in increasing the mounting density of servers and storage systems to improve efficiency and capacity. In electronic devices such as optical transceivers equipped with optical connectors used for this purpose, not only failures of optical links caused by contamination or damage to optical ports but also performance degradation of optical modules due to electrostatic discharge have become significant concerns, making electrostatic countermeasures for tools increasingly important. Against this background, our company developed the "One-Click® Cleaner MPO ESD," the ESD-protective multi-fiber optical connector cleaner compliant with the international standard IEC 61340-5-1 [6)7)], enabling its use in EPAs. This paper reports on the structure and various characteristics of the developed multi-fiber optical connector cleaner.

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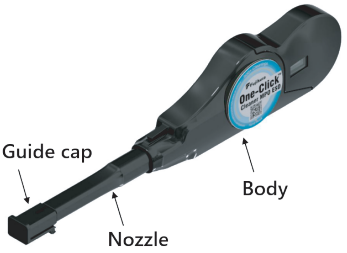
2. Structure

The specifications of the developed product are shown in Table 1. The cleaning method employed by this product is described below.

2.1 Cleaning Method

The developed product incorporates a dedicated cleaning cloth, which moves synchronously with the action of pushing the main body toward the optical connectors to be cleaned. The cleaning cloth at the nozzle tip moves across the optical connector end face to perform wiping cleaning. Additionally, the cleaning cloth is pressed against the optical connector end face with a constant pressure by a tip component, enabling stable wiping removal of oils and dust adhering to the connector end face, regardless of the operator's skill level (Fig. 1).

Table 1. Specifications.

	ESD-Protective Multi-fiber Optic Connector Cleaner
Appearance	
Product Name	One-Click® Cleaner MPO ESD
Size	W19 ×H43.5 ×L194 mm
Applicable Connecter	12/24 c MPO (SM/MM)
Polishing Type	PC, APC
Cleaning frequency	≥ 500 times
Surface resistance	$< 1 \times 10^{12}$ Ω
Charge decay	< 2 s

Abbreviations, Acronyms, and Terms.

MT ferrule—Mechanically Transferable Ferrule
A resin-molded part with high-precision holes for fiber alignment to connect multiple optical fibers all at once.

MPO—Multifiber Push-On
A multi-fiber push-pull type optical connector designed to connect multiple optical fibers with a single connector.

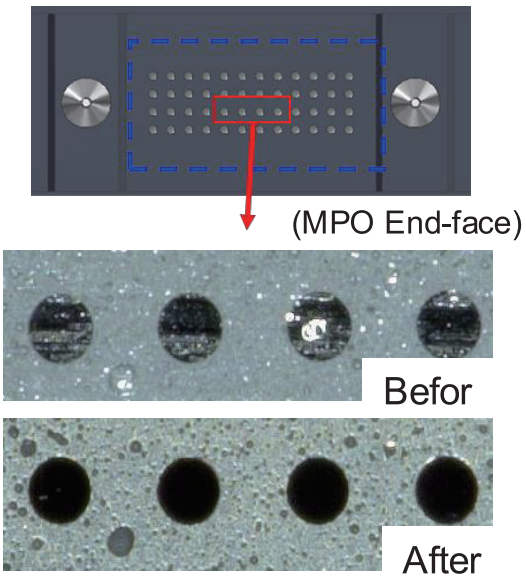


Fig. 1. Example of cleaning the end face.

2.2 Applicable Connectors

The developed product can clean the ferrule end face of 12-fiber and 24-fiber MPO connectors standardized by IEC. It supports both PC polished and APC polished ferrule end face. When cleaning the plug side of an MPO connector, attaching a guide cap for plug cleaning to the nozzle tip enables cleaning operations similar to those performed for ferrule cleaning inside an adapter (Fig. 2).

3. Characteristics of the Developed Product

The electrical specifications of the developed product refer to the requirements for ESD control items listed in the international standard IEC 61340-5-1. The results of the electrical characteristic evaluations of the developed product are shown below.

3.1 Surface Resistivity

Figure 3 shows a schematic diagram of the surface resistivity measurement method for the developed product, and Table 2 presents the evaluation results. The maximum measured value was 2 × 108 Ω, confirming compliance with the requirements of IEC 61340-5-1. Since static electricity attracts dust and fine foreign substances, the low surface resistivity of the developed product suppresses static electricity buildup. As a result, adhesion of foreign substances is reduced, maintaining the cleanliness of the tool itself and preventing re-adhesion of foreign substances from the tool onto the optical connectors.

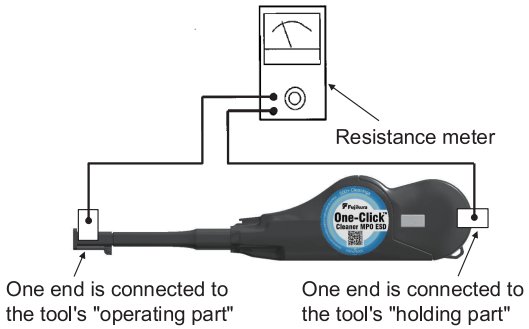


Fig. 3. Measurement method of surface resistance [7].

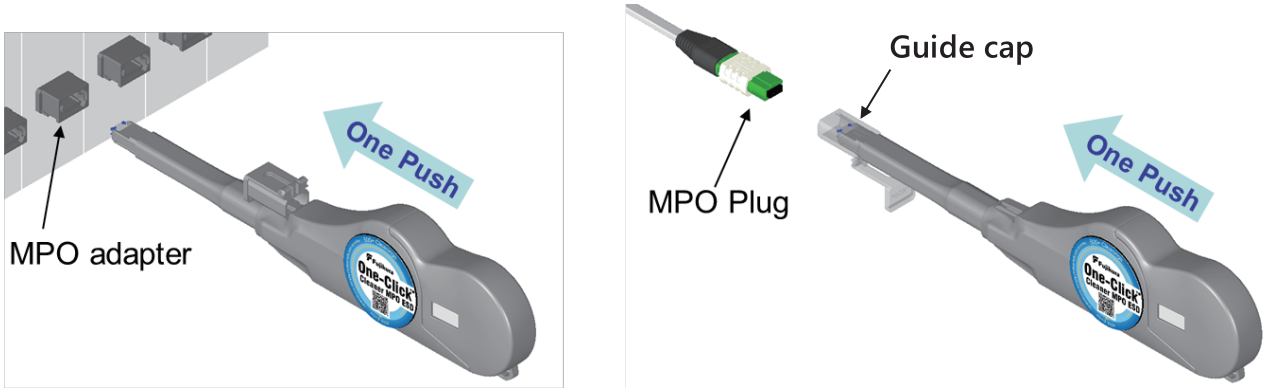


Fig. 2. Cleaning for MPO adapter and MPO plug.

Table. 2. Surface resistance measurement results.

Number of measurements	Surface resistance[Ω]
1	1×10^{7}
2	4×10^{7}
3	1×10^{7}
4	4×10^{7}
5	7×10^{6}
6	2×10^{8}
7	8×10^{7}
8	2×10^{7}
9	9×10^{7}
10	2×10^{7}
Max value	2×10^{8}

3.2 Charge Decay

Figure 4 shows a schematic diagram of the charge decay time measurement method for the developed product, and Table 3 presents the evaluation results. The decay time from 1000 V to 100 V was confirmed to be a maximum of 0.5 seconds, meeting the specified requirement. The developed product has a structure that allows instantaneous dissipation of electric charge, thereby preventing damage to precision equipment caused by electrostatic discharge.

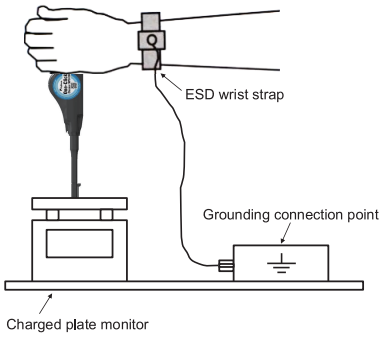


Fig. 4. Measurement method of charge decay time [7].

Table. 3. Charge decay time measurement results.

Number of measurements	Charge decay time [s]
1	0.2
2	0.1
3	0.3
4	0.1
5	0.2
6	0.3
7	0.4
8	0.5
9	0.4
10	0.4
Max value	0.5

4. Conclusion

This report has confirmed that the developed electrostatic-protective multi-fiber optical connector cleaner meets the requirements specified in the international standard IEC 61340-5-1. The use of this product can improve optical connection quality, thereby enabling stable communication performance. Moving forward, we will continue to develop products that contribute to improving the reliability of optical networks and contribute to improved work efficiency in optical communication construction and the construction of high-quality optical network infrastructure.

References

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