Fiber or Fiber-cord Identification Technique for Long-wavelength-band Communication Light

Yuji Aoyagi and Hajime Yamamoto†

Abstract

We have developed a small, lightweight, high-quality optical fiber ID tester with reduced insertion loss. It can identify any optical fiber currently in use, including ones used in long-wavelength-band optical communication and ones in optical fiber cords used in central offices or indoor locations.

1. Background

The paradigm shift of telecommunications to IP-based equipment and the rise in popularity of NTT's B-FLET'S Internet access service have led to strong demand to convert access-side line equipment from metallic to optical cables. This has resulted in the optical fiber ID tester becoming a very important tool for correctly identifying a particular optical fiber among the many fibers in a cable or cord. When engineers are installing and maintaining optical fiber communication networks they often cut or connect the wrong fibers. Correct identification would avoid this major problem. Optical fibers are normally identified using the method shown in **Fig. 1**. This method can identify fibers while they are in use, so there is no need to interrupt service to the user. At the central office, identification light is injected into the target fiber. This light has a different wavelength from the communication light carrying the data signal. The ID tester bends the optical fiber cable, which contains many fibers, and the photodetector placed at the center of the bent part detects the 270-Hz modulated identification light leaking from the bent fiber. This enables the engineer to identify which fiber is carrying the identification light.

Existing techniques work well for fibers using communication wavelengths of 1.3 and 1.55 µm. However, in the long-wavelength band (such as the L band (1.565 to 1.625 µm) used for wavelength division multiplexing) they cannot avoid disturbing the communication signal by introducing insertion loss. And they cannot be used for optical fiber cords in a central office, because they have thick sheaths, so little light leaks out. Moreover, although they can identify a specific fiber, they cannot judge which is the upstream or downstream side of the optical path (i.e., in which direction the light beam is propagating). This judgment is becoming increasingly important as the number of optical fiber types increases. To satisfy these requirements, we have developed a small, lightweight, high-quality optical fiber ID tester that has lower insertion loss for long-wavelength-band communication light and can identify optical fiber cords.

† NTT Access Network Service Systems Laboratories
Tsukuba-shi, 305-0805 Japan
E-mail: hajime-y@ansl.ntt.co.jp

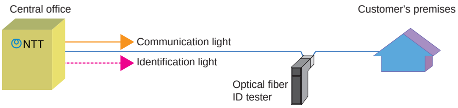


Fig. 1. Optical fiber identification.

It expands the applicable area of optical fiber identification techniques (**Fig. 2**).

2. Development goals

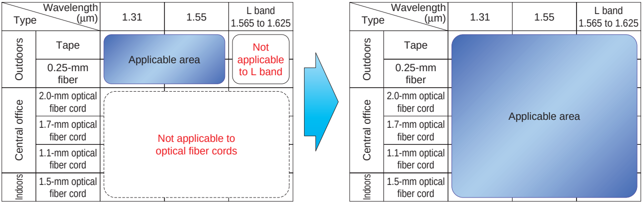
1) Reduce the insertion loss of long-wavelength-band communication light
2) Identify optical fiber cords
3) Reduce the size and weight of the tester to improve its ease of use
4) Judge the upstream and downstream sides of the optical path

3. Product outline

In the conventional tester, the bend is symmetrical, so the communication light suffers a large insertion loss in the section after the photodetector (**Fig. 3(a)**). Since this section does not contribute to the detection of the identification light, we reduced the bend here to reduce the insertion loss without reducing the intensity of identification light available for detection (**Fig. 3(b)**). This asymmetrical bend has the added advantage of creating a difference in the amount of light that leaks out when the identification light is incident from the left and right sides. Thus, by comparing the magnitudes of these two detected light levels, we can easily judge the propagation direction of the identification light.

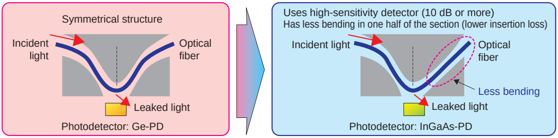
To enable the tester to handle optical fiber cords, we changed the photodetector from the conventional single-element (Ge) photodiode to a three-element (InGaAs) photodiode. This increased the detection sensitivity so we can either detect identification light leaking out of thick-sheathed fiber cords (which was not possible before) or reduce the insertion loss of the communication light by reducing the intensity of the injected identification light. In addition, since the bender's groove suits the largest diameter (2.0 mm) optical fiber cord cross-section, we were able to make a single head that can handle four types of low-insertion-loss optical fiber cords: 1.1, 1.5, 1.7, and 2.0 mm.

The new optical fiber ID tester is compared with a



(a) Conventional products (b) New product

Fig. 2. Expanding the applicable area of optical fiber identification techniques.



(a) Conventional products (b) New product

Fig. 3. Shape of bend applied to the optical fiber.

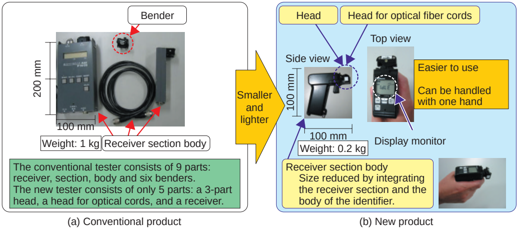


Fig. 4. Comparison of conventional and new optical fiber ID testers.

conventional one in **Fig. 4**. It incorporates a power meter, so by simply replacing the head part, an engineer can measure the communication light level and the optical loss using the same unit as for identifying optical fibers. The new tester's compact and integrated structure makes it smaller and lighter and provides greater ease of use at a lower cost.

4. Future plans

We intend to continue developing optical fiber identification techniques while determining actual needs in field tests and feeding back the results to improve the utility and ease of use of the product.

Yuji Aoyagi
Research Engineer, NTT Access Network Service Systems Laboratories.
He joined NTT in 1992. Recently, he has been engaged in the development of systems for optical fiber distribution and management, and fiber maintenance.

Hajime Yamamoto
NTT Access Network Service Systems Laboratories.
He joined NTT in 1996. Recently, he has been engaged in optical fiber cable development and fiber maintenance.