

TOSLINE-S20

Active Star Coupler(ASC25)

Instruction Manual

REQUIREMENTS

- Keep this instruction manual where it can be easily referred to by users and those responsible for the equipment.
- Read this instruction manual carefully before using the equipment.
- After this instruction manual has been read, keep it beside the equipment.

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TOSHIBA CORPORATION

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1. Introduction

The brochure is an instruction manual for Active Star Coupler (ASC25) which is a modified version of general use Active Star Coupler (ASC22). The Active Star Coupler (ASC25) is specially designed to connect TOSLINE-S20 data communication network with a station provided with F07 Type Optical Connector, such as TOSVERT- μ /S250W/W Drive Station.

Instruction manuals for other TOSLINE-S20 components are listed below. System designers, device designers, and maintenance personnel using a TOSLINE-S20 network should refer to these manuals for information about how these components can be used in a TOSLINE-S20 network.

- T2/T3 stations 6F3B0354
- SIF (Serial Interface) station 6F3B0352
- VME Bus station 6F3B0353
- Loader software S-LS 6F3B0351
- PLC-5 station 6F3B0355
- Loader software S-LS (for windows) 6F3B0357

2. Overview

The Active Star Coupler is used for distributing fiber optic signals in a TOSLINE-S20 network.

The TOSLINE-S20 is a Bus-style transmission system. If the power is off in one of the stations on this bus, communication is not possible before or after that station.

To prevent this from happening, an Active Star Coupler can be used.

If the Active Star Coupler is used, a station that is off will have no effect on the rest of the transmission system. The Optical Connector Board of the Active Star Coupler has ten ports (CH1 through CH10), in which CH1 and CH10 adopt FC Type connector same to the general version of Active Star Coupler (ASC22). Other ports, CH2 through CH9, adopt the JIS-F07 Type connectors which are mounted to TOSVERT- μ /S250W/W drive station, etc.

Appearance of the Active Star Coupler is shown below.

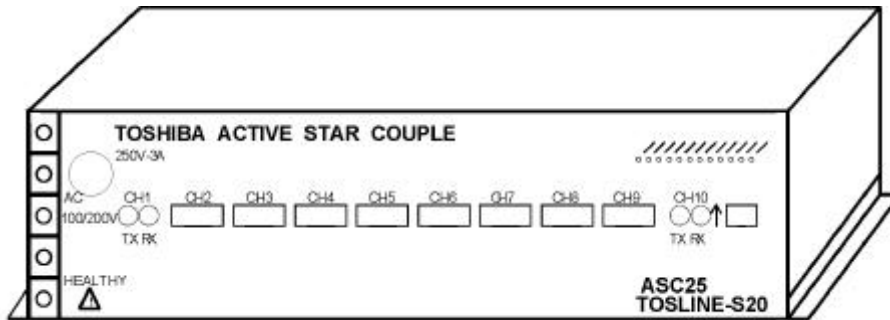


Figure 2.1

3. System Configurations

Adoption of the Active Star Coupler provides a system configuration illustrated below.

(1) Basic configuration

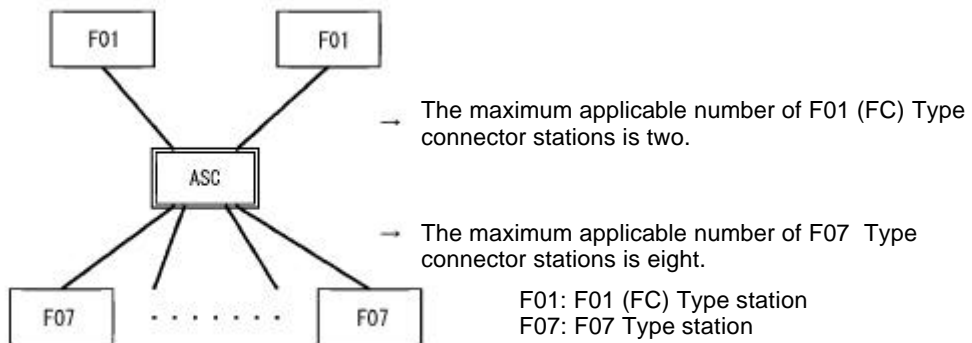


Figure 3.1

(2) Active Star Coupler daisy-chain connection

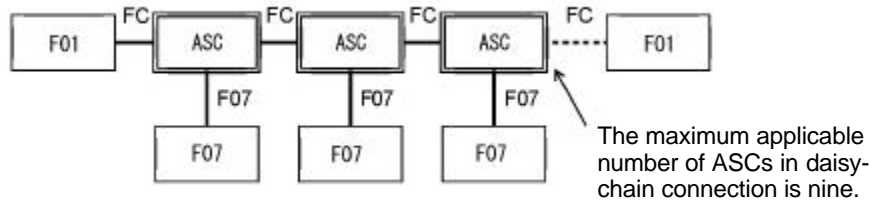


Figure 3.2

4. Outline of Functions

(1) Basic functions

When the Active Star Coupler receives a signal from one channel among ten of them, it transmits this signal (unchanged) from its remaining nine ports.

The drawing given below illustrates the case that data input from Port 1, and the data are output from ports 2 through 10.

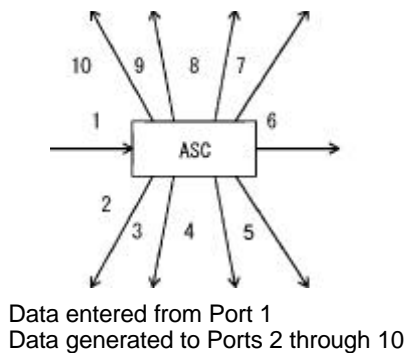


Figure 4.1

(2) Function of preventive measures to single-wire breaking

The function is effective to CH1 and CH10. Able/Disable of the function is selected by a switch.

In the case that the function is brought into "Able" mode, the transmission on TX side is stopped about 400 ms after the detection of wire breaking at RX side.

* On using the function, refer to 8.(1) "Precautions on the Preventive Measures to Single-Wire Breaking".

(3) Function of status display

Since the conditions of power source and of transmission are confirmed by the turning ON/OFF of the respective LEDs, the function is useful in case of accident occurrence.

For detail of the display, refer to 6.5 "LED Display".

(4) Function of optical level identification

Manipulation of switch makes the optical module output continuously illuminate. The function is useful to check the optical level at terminals during the cable laying work.

For detail of the switch setting, refer to "6.4 Function setting switches".

(5) Function of automatic test operation

The function is used in quality control in the production and test processes. During normal operation, turn the switch to "OFF" position.

For detail of switch setting, refer to "6.4 Function setting switches".

5. Specifications

The section describes the specifications of the Active Star Coupler.

(1) General specifications

General specifications of Active Star Coupler are given below.

Item		Specification	
Power Supply	Voltage	Rating	100/110 V AC, 50/60 Hz 200/220 V AC, 50/60 Hz
		Fluctuation range	85 to 132 V AC, 47 to 66 Hz 170 to 250 V AC, 47 to 66 Hz
	Power consumption		about 10 VA
	Retentive power interruption		Resuming to normal operation within 10 ms
	Insulation rating		1500 V AC for 1 minute
	Fuse rating		250V-3A
Environment	Temperature	Operating temperature	0 to +55°C (unit ambient temperature)
		Storage temperature	-20 to +75°C (unit ambient temperature)
	Humidity		20 to 90% RH, no condensation
	Vibration		Conforming to JIS C0911 • Power OFF, Frequency 16.7 Hz, Displacement 3 mm
	Atmosphere		Free from corrosive gas
	Dust		Not more than 1 mg/m ³
Ground		Grounding resistance 100 or less	
External dimensions		390 (W) × 200 (D) × 70 (H) mm	
Weight		approximately 3.0 kg	
Cooling		Natural air cooling	
Installation position		Horizontal (unacceptable of upside down or vertical position)	

Table 5.1

(2) Functional specifications

The functional specifications of the Active Star Coupler are listed below.

Item	Description	
Number of connectable stations	Max. 10	
Applied optical fiber	for FC Type connector	Silica glass optical fiber cable (JIS C6820) GI 50/125 μm (core dia./clad dia.)
	for F07 Type connector	H-PCF (hard clad silica glass core fiber) cable SI Model 200/230μm (core dia./clad dia.)
Transmission distance	Station to Star Coupler : Max. 1 km Star Coupler to Star Coupler : Max. 1 km Total system : Max. 10 km	
Number of daisy-chain connection of Star Couplers	Max. 9	
Connectable apparatus	TOSLINE-S20 fiber optic network stations.	
HEALTHY contact (Relay contact)	"ON" during normal operation Contact rating Voltage: 250 V AC Current: max. 1 A Voltage: 24 V DC Current: max. 1 A Voltage: 5 V AC/DC Current: min. 10 mA	

Table 5.2

6. Hardware

The section describes the hardware of Active Star Coupler.

6.1 Product construction

- (1) Active Star Coupler main unit (1 unit)

Pet Name : ASC25

Product Code : SASC25*US

Target apparatus for connection : TOSLINE-S20 fiber optic network stations.

(Various kinds of stations, ASC22, ASC25)

- (2) Fuse (2 pieces)

Rating: 250 V AC, 3 A

(One is attached to the apparatus, the other is for spare.)

- (3) L-shape bracket (2 units)

(Both are attached to the apparatus on shipment.)

6.2 External dimensions

External dimensions

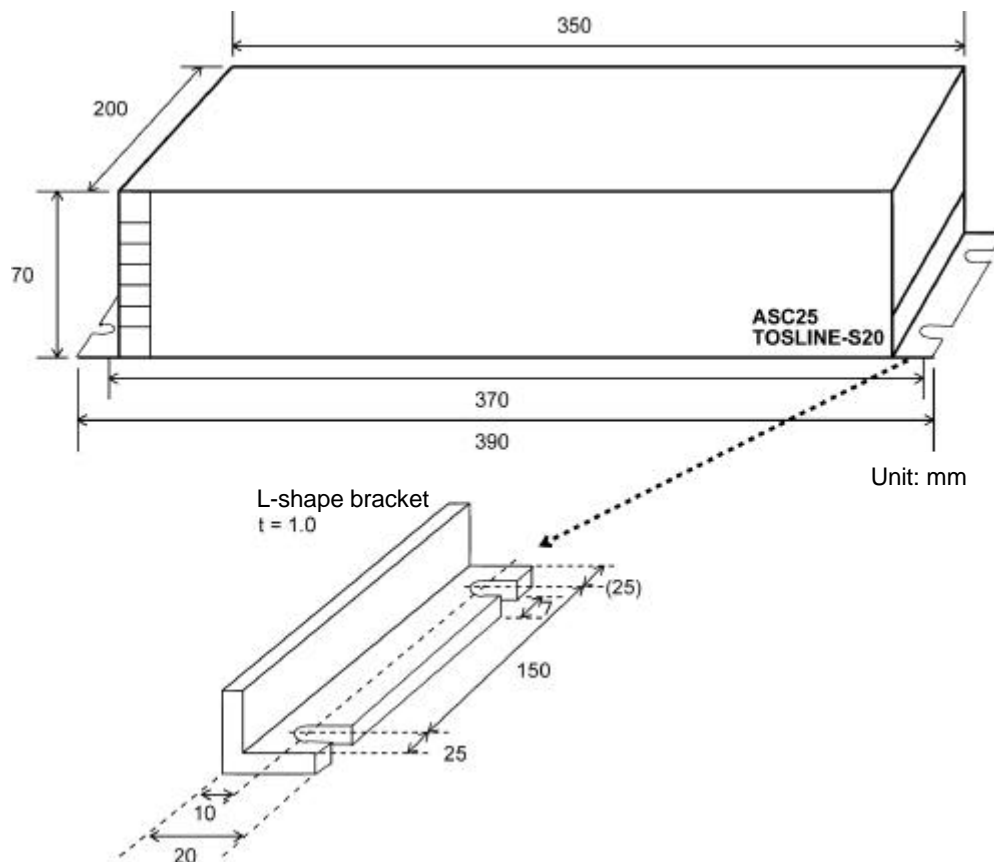


Figure 6.1

6.3 Component identification

Names of the components of Active Star Coupler are given below.

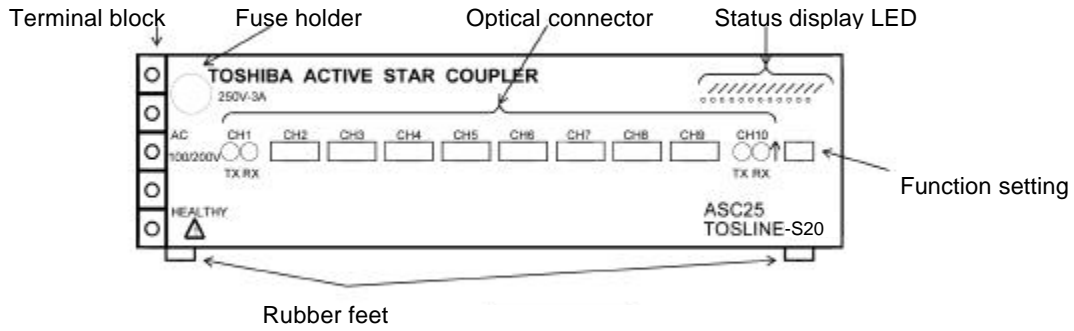


Figure 6.2 Front view of the unit

Name	Use
Status display LED (TX1 to 10, POWER, COMM)	Display of operational state
Terminal block	Power supply and Relay contact output
Fuse holder	Protection of power supply
Optical connector (CH1 to 10)	Fiber optic connection
Function setting switch	Setting/releasing function

Table 6.1 Uses of components shown on the front face of the unit

6.4 Function setting switch

Arrangement and names of function setting switches are given below.

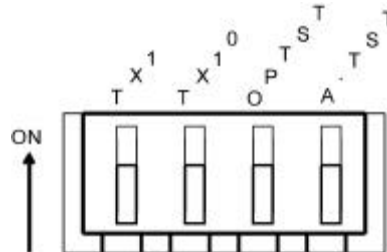


Figure 6.3

Name	Description	Use
TX1	Setting the function of preventive measures to single-wire breaking	Preventive measures to single-wire breaking
TX10	Setting the function of preventive measures to single-wire breaking	Preventive measures to single-wire breaking
OPTST	Setting the function for determining optical power	Optical power determination
A.TST	Setting the function for automatic testing	Quality assurance test

Table 6.2

(1) Setting switch "TX1"

Turn the switch to "ON" position, and the function of preventive measures to single-wire breaking of CH1 is actuated. In the case that, when the function is in "ON" mode, the RX signal of CH1 cannot be detected during a period of about 400 ms, the transmission of TX signal from CH1 is stopped.

On the port which entered the stop transmission, when the switch is turned to "OFF" position after the circuit operation is resumed, the transmission is reactivated on receiving signals from other port. When the switch is turned to "ON" position again, the function is also reactivated.

When the function is in "OFF" mode, TX continues to transmit signals even if RX signal cannot be detected.

(2) Setting switch "TX10"

Turn the switch to "ON" position, and the function of preventive measures to single-wire breaking of CH10 is actuated. In the case that, when the function is in "ON" mode, the RX signal of CH10 cannot be detected during a period of about 400 ms, the transmission of TX signal from CH10 is stopped.

On the port which entered the stop transmission, when the switch is turned to "OFF" position after the circuit operation is resumed, the transmission is reactivated on receiving signals from other port. When the switch is turned to "ON" position again, the function is also reactivated.

When the function is in "OFF" mode, TX continues to transmit signals even if RX signal cannot be detected.

* For TX2 through TX9, the ASC25 side does not have the function because the preventive measures are provided to the connected device side.

(3) Setting switch "OPTST"

Turn the switch to "ON" position, and the output side of the whole optical modules is kept to illuminate continuously. Thus, the optical power can be determined. During the optical fiber cable laying work, check that the satisfaction of the level requirements at terminals of optical fiber cables, as needed, using the function. (Refer to page 30.)

Turn the switch to "OFF" position, and the mode returns to normal operation mode.

(4) Setting switch "A.TST"

The switch is a function switch used in the product inspection of Active Star Coupler before shipment.

When the Active Star Coupler is used, confirm that the switch is in "OFF" position.

Although no mechanical failure occurs when the switch is in "ON" position, the apparatus cannot be operated in normal state.

*

Inquiry relating to (4) is not accepted.
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6.5 LED display

Status display LEDs are found on the front panel of the unit of Active Star Coupler. Through these LEDs, the operating status of Active Star Coupler is identified.

(1) Display and name of LED

Arrangement and names of LEDs on the front panel of ASC25 are shown below.

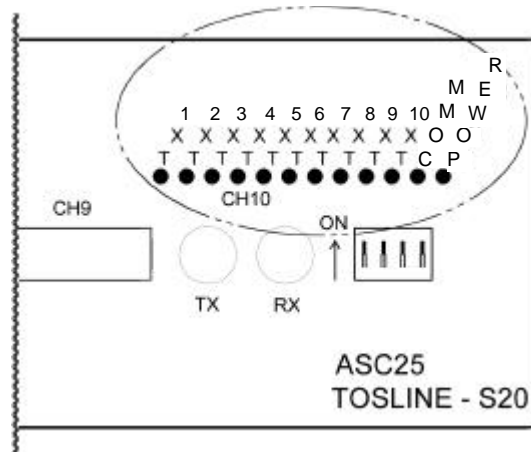


Figure 6.4

(2) Description

Description of LEDs is given below.

Name of LED	Description
POWER	Normal/Abnormal of power supply to the Active Star Coupler are displayed. Turned ON : Normal Turned OFF : Abnormal ○: State of absence of power supply ○: State of fuse blown
COMM	Indicating the power source "ON" of Active Star Coupler and the acceptance of data from station. Turned ON : Normal Turned OFF : Abnormal ○: Power source of Active Star Coupler is "OFF". ○: Power source of whole stations is "OFF". ○: Transmission cables from whole stations are broken. ○: No station is connected.
TX1 - 10	Indicating transmission mode on each port. Turned ON : Transmitting Turned OFF : Not-transmitting

Table 6.3

6.6 Optical connector

For the transmission cables of the Active Star Coupler, the optical fiber cables (cords) are used.

(1) Position and name of optical connector

The Active Star Coupler has ten optical connector connection ports, CH1 through CH10. They are positioned on the front panel of the unit: CH1 and CH10 are FC Type connectors, and CH2 through CH9 are F07 Type connectors.

(2) Connection cable

- for FC Type: (CH1 and CH10)

Optical fiber cable: Silica Glass GI optical fiber cable (core diameter 50 μm , clad diameter 125 μm)

- for F07 Type: (CH2 through CH9)

Optical fiber cable: H-PCF (hard clad Silica Glass SI optical fiber cable (core diameter 200 μm , clad diameter 230 μm)

(3) Connection of cables

Connection is made between FC Type connector and FC Type connector, and between F07 Type connector and F07 Type connector.

For more detail, refer to "9. Installation and wiring".

(Note) Since all ports have no priority among them, arbitrary one may be used. Nevertheless, when the daisy-chain connection between ASC25s is done, use CH1 and CH10 (FC Type). (Although CH2 through CH9 can establish the daisy-chain connection between ASC25s without raising functional problems, the FC Type connector has a function of preventive means to single-wire breaking and is able to function the preventive means to single-wire breaking between ASC25s, so that we recommend the use of CH1 and CH10.

6.7 Terminal block

(1) Power supply

Connect the power supply cables to the power source terminal block (M3.5 screws) of ASC25 using appropriate crimping terminals. Insufficient connection may damage the terminal block. Do not supply the power source to other users via the power source terminal block.

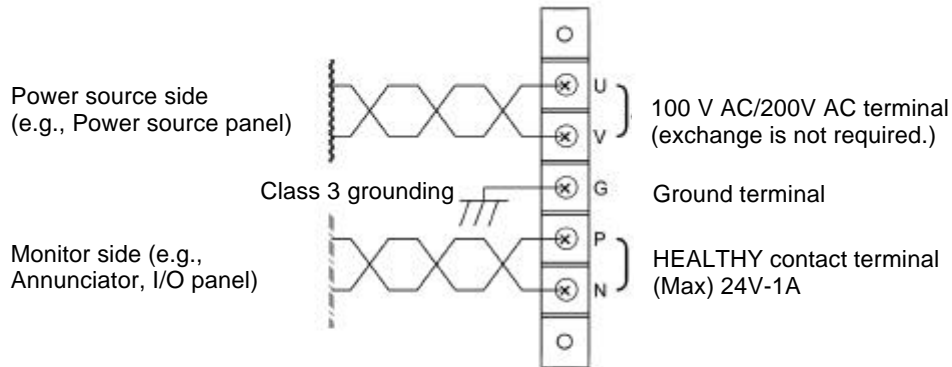


Figure 6.5 Connection of cables

(2) HEALTHY contact

HEALTHY contact indicates abnormal state of power source and communication. The following is the conditions of HEALTHY contact.

HEALTHY contact	Condition of HEALTHY contact actuation
Close	Power supply is normal, and any one of 10 ports is in normal operation.
Open	Power source is in "OFF" mode, or no port is connected.

Table 6.4 Condition of HEALTHY contact

Rating of HEALTHY contact

Voltage		Current
DC	24V	1A (Max)
AC	250V	1A (Max)
AC/DC	5V	10mA (Min)

Table 6.5

6.8 Fuse holder

When power source is connected, and the POWER lamp of LED is not turned ON, fuse may be blown. In that case, cut OFF the power supply, and replace the fuse in the fuse holder at front panel of the Active Star Coupler. Then turn the power source switch to "ON" position, again.

Fuse rating:..... 250 V-3 A

7. Start up and Power down methods

7.1 Start up method

- (1) Connect power supply cables to individual stations which are connected to the Active Star Coupler.
- (2) Connect the connecting station with the Active Star Coupler, or an Active Star Coupler with another Active Star Coupler (in the case of daisy-chain connection), using respective transmission cables.
- (3) Set the operational mode switch.
- (4) Supply power to the Active Star Coupler and to each station.
(Note) Either of the two may be actuated first.
- (5) Begin the transmission to each station. (Refer to the instruction manual for respective stations.)
- (6) Through the above-given steps, the Active Star Coupler begins its operation.

7.2 Power down method

- (1) Cut off the power supply to the Active Star Coupler and to each station.
(Note) Either of the two may be cut off first.

8. Precautions on using Active Star Coupler

(1) Precautions on the function of preventive means to single-wire breaking

Observe the following-listed cautions on using the function of preventive mean to single-wire breaking.


- Even if the function is set, it is not actuated for about 10 seconds after power "ON".
- In the case that the power is "ON" while the function was not set, when the function is set in that state, (or when the switch is turned to "ON" position), the function is not actuated for about 10 seconds after the switch is turned "ON", and after that, the function is actuated.
- In the case that ASC25s are connected in daisy-chain, (in the case of CH1 and CH10 are used), the actuation of the function that brings the resume operation between ASC25s becomes troublesome. Accordingly, in normal operation, we recommend to not use the function. Nevertheless, for a special case (e.g., the system operation is required to continue even under wire-breaking between ASC25s), the function may be actuated based on the judgment during system design.

(2) General precautions for the Active Star Coupler

- Do not remove the unit cover.
- On using the optical fiber cables, care should be paid not to contaminate the edge faces of the optical connectors. Since the optical parts have finely finished structures, care should be given not to apply shock and unnecessary force to the parts. For handling and cleaning of optical parts, refer to the "Installation and wiring" of the instruction manual.
- Optical connectors of ports not in operation shall be provided with respective covers.



The mark indicates "DANGER". The label is attached to the portions that may induce injury.

The precautions on the places around the terminal block with the  mark are the following.

- The protective cover on the terminal block at front face of the unit has sharp corners. Special care should be paid for handling the cover.
- During power acceptance to the Active Star Coupler, skin contact to the terminals on the terminal block may induce electrical shock. Therefore, the protective cover shall be firmly attached. During power acceptance to the Active Star Coupler, do not touch the terminals.

9. Installation and Wiring

9.1 Method for mounting the main unit

The Active Star Coupler may be installed within a cubicle, on a table, or onto a panel.

(1) Installation in a cubicle

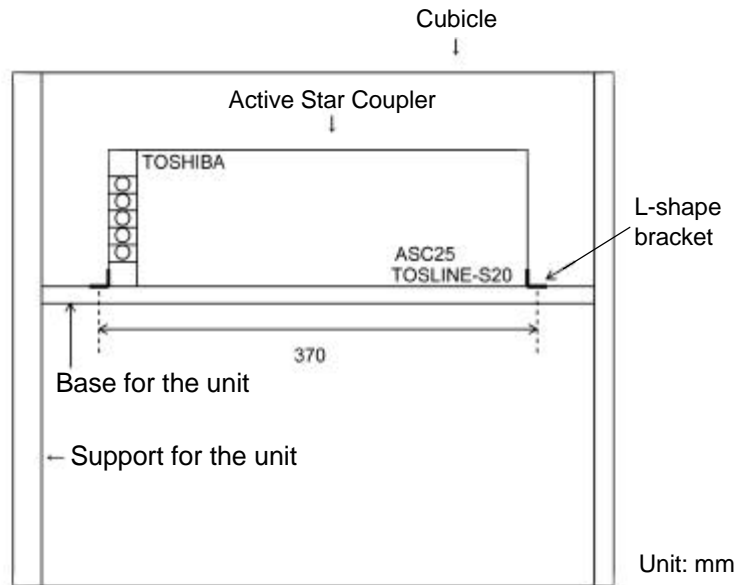


Figure 9.1 Installation of Active Star Coupler in a cubicle

Using L-shape brackets and M5 screws (12 to 20 mm in length), mount the Active Star Coupler main unit to the base for the unit.

In that case, remove the rubber feet at the bottom of the Active Star Coupler. The L-shape brackets have already been attached to the main unit of Active Star Coupler.

(2) Installation on a table

For the case of installation of Active Star Coupler on a table, place the Active Star Coupler on the table. The Active Star Coupler is equipped with rubber feet at the bottom. If the attached L-shape bracket is unwanted, remove them by detaching the screws at the sides of the main unit. After removing the L-shape brackets, retighten the once detached screws.

(Note) Do not stack the Active Star Couplers because the Coupler is not designed to have strength bearing that weight.

(3) Mounting Active Star Coupler onto a panel

For panel mounting of the Active Star Coupler, horizontal mount shall be applied using the L-shape brackets. Do not mount the Active Star Coupler upside down or vertical position.

When the mounting of the Active Star Coupler is made by using the L-shape brackets, remove the rubber feet at bottom of the main body.

Mounting position is illustrated below.

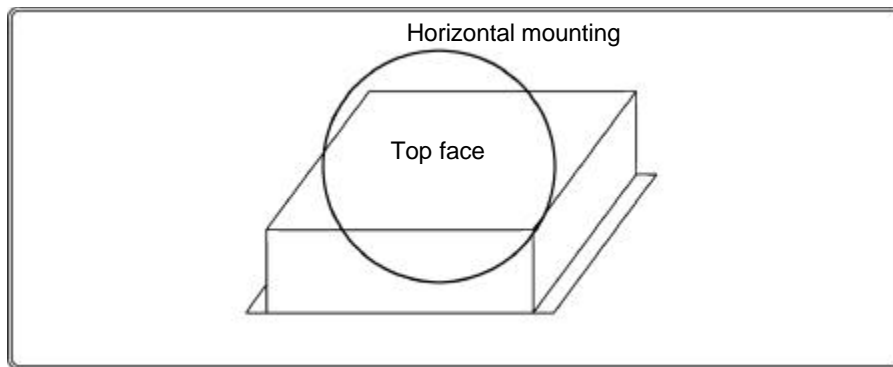


Figure 9.2 Recommended mounting position

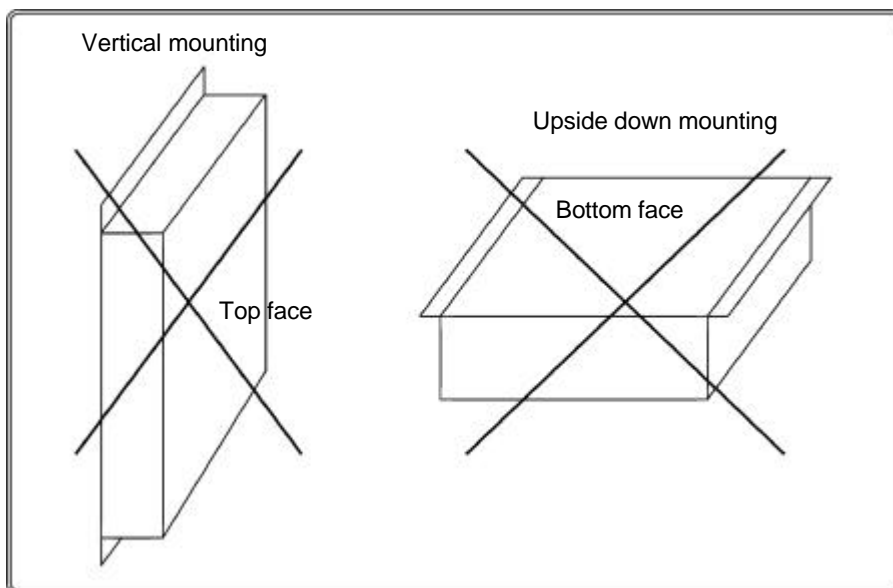


Figure 9.3 Forbidden mounting position

9.2 Connection of optical fiber cables (cords)

Connection is made between FC Type connectors, or between F07 Type connectors. For the case of CH1 and CH10, the connectors are FC Type, so that a transmission connector (TX) of the Active Star Coupler shall be connected to the FC Type receiving connector (OR) on the target station, and that a receiving connector (RX) of the Active Star Coupler shall be connected to the FC Type transmission connector (OT) on the target station, using respective optical cables.

For the connection between Active Star Couplers, a transmission connector (TX) of an Active Star Coupler shall be connected to a receiving connector (RX) of another Active Star Coupler, further a receiving connector (RX) of an Active Star Coupler shall be connected to a transmission connector (TX) of another Active Star Coupler, using respective optical cables.

(Notes)

- At Active Star Coupler side, arbitrary port among CH1 through CH10 may be selected. (TX and RX of CH1 and CH10 are in a pair form.)
- To the optical transmission/receiving sections (ports) which are not connected with cables shall be applied with black caps to avoid incoming ambient natural lights. Unnecessary lights may induce error-functioning.

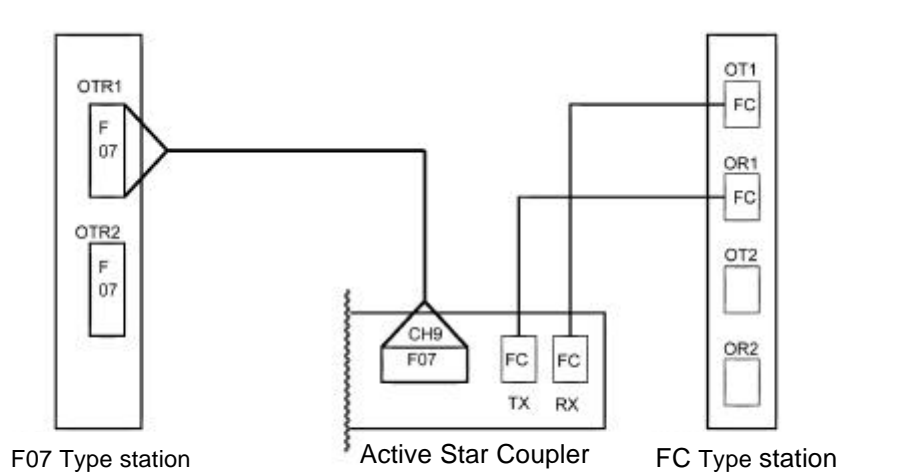


Figure 9.4 Method for connecting an Active Star Coupler with stations

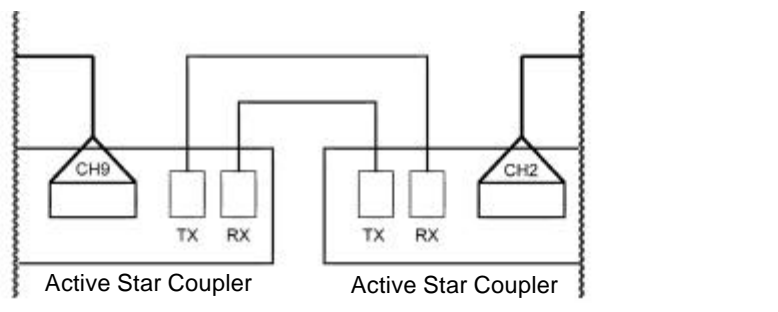


Figure 9.5 Method for connecting Active Star Couplers

9.3 Optical parts

(1) Optical fiber cable

For the optical parts of FC Type, refer to the "T2/T3 stations of the instruction manual (6F3B0354)". The following is the description on optical parts of F07 Type.

As the optical fiber cable, use H-PCF (Hard Plastic Clad silica glass optical Fiber) cable that satisfies the following-given requirements.

Environmental condition		Optical fiber core wire		
Temperature	-20°C to +70	Core	Outer diameter	200 ± 5μm
Humidity	95%RH (60°C)		Material	Silica glass
Cable characteristics		Clad	Outer diameter	230 (+0, -10) μm
			Material	Fluoroacrylate resin
		Housing	Outer diameter	500 ± 100μm
			Material	Fluororesin
Allowable tension (max.)	not more than 75 kg	Nominal NA		0.40
Allowable bending radius (min.)	not less than 50 mm	Wavelength		810nm
Outer diameter	10.0 ± 1.0mm	Transmission loss (max.)		7.0dB/Km
Weight	100kg/Km	Transmission band width (max.)		14MHz · Km

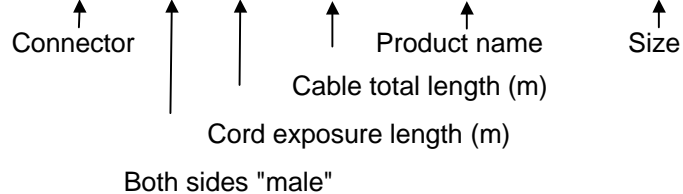
Table 9.1 Characteristics of optical fiber cable

We recommend the use of a short wave service H-PCF cable that is described below.

Manufacturer: Sumitomo Electric Industries, Ltd.

Agency: Takachiho Electric Co., Ltd.

Product identification: 2001H - MM - □□ / □□□□ 2 - C - LAP 2XCCV - HC - 20/07



(2) Optical fiber cord

Any type of optical fiber cords may be applicable if only they have the transmission characteristics of optical fiber cable, given above, and they are connectable with F07 Type connector, further they have the following-listed mechanical strength characteristics.

Outer diameter (mm)	2.2 ± 0.2 × 4.4 ± 0.4mm
Weight (kg/km)	8
Allowable tension (kg)	max. 25
Allowable bending radius (mm)	min. 50

Table 9.2

That type of cord is used for connecting transmission modules inside of panel and for connecting an optical fiber cable with a transmission module. We recommend the use of a H-PCF cord that is described below.

Manufacturer: Sumitomo Electric Industries, Ltd.

Agency: Takachiho Electric Co., Ltd.

Model:

(A) Optical fiber cord with connector on one end. (□□ denotes cord length.)

2001H-M-□□□□ DCV-HC-20/07

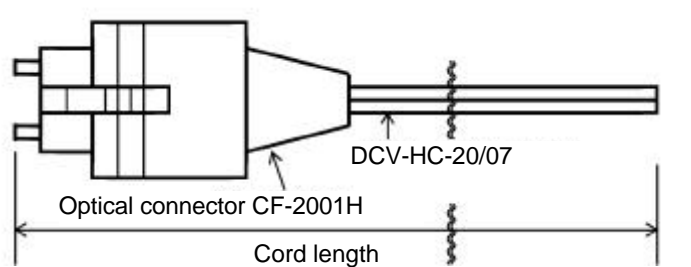


Figure 9.6

(B) Optical fiber cord with connector on both ends. (□□ denotes cord length.)

2001H-MM-□□□□ DCV-HC-20/07

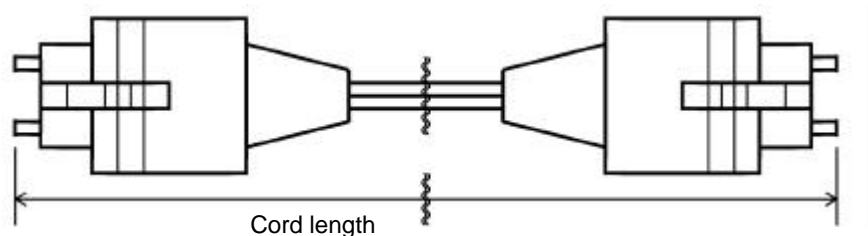


Figure 9.7

(3) List of optics-related parts

Name	Model, Rating	Use
Optical fiber cable (Standard optical fiber cable)	2001H-MM■■/□□□□ 2-C-LAP 2XCCV-HC-20/07	(Main line cable) (□□ denotes cable total length.) (■■ denotes exposed cord length.)
Optical fiber cable with optical connector (Standard optical fiber cord)	2001H-M-□□□□ DCV-HC-20/07 2001H-MM-□□□□ DCV-HC-20/07	(Cord with connector on one end) (□□ denotes cord length.) (Cord with connector on both ends) (□□ denotes cord length.)
Aligner (In-line adapter)	IAT-4000	(Connection of optical connectors)

Table 9.3

9.4 Precautions on handling optical fiber and optical connector

Since optical fibers are finely finished parts and are made of glass, handling of them shall be done with special care emphasizing the following.

- (1) Do not damage and contaminate the edge faces of optical connector. Damage or attached dust on the edge of optical connector increase the connection loss. If the edge of optical connector is contaminated, remove the contaminants from the edge.

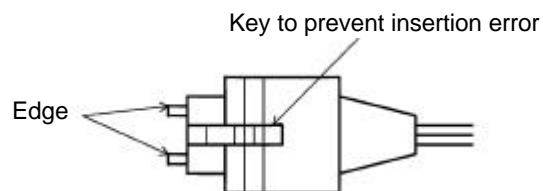


Figure 9.8 Edge position of F07 Type connector

- (2) For connecting an optical connector and an optical fiber, align the key seats, and insert the connector until "click" sound is generated. Since the optical fiber has only 200 μm in diameter, accurate insertion is necessary to avoid increase in connection loss.
- (3) To the optical transmission/receiving sections of the connector not in use, a black cap shall be applied to avoid incoming ambient natural lights. Unnecessary lights may induce error-functioning.
- (4) Do not forcefully bend an optical fiber cord.
Allowable bending radius of optical fiber cord is 50 mm or more.
- (5) Do not strongly pull an optical fiber cord.
Allowable tensile force of optical fiber is 25 kg. The allowable tensile force at the attaching section with an optical connector is about 2 kg. Special care should be paid on applying tension to the optical fiber cord.
* The figure with underline is applied to a temporary tension, and shall not be applied to sustained tension mode.
- (6) Do not excessively tighten an optical fiber cord.
On clamping an optical fiber cord, do not apply excessively large compressive force. Generally, the resistance to compressive force of optical fiber cord is about 100 kg/50 mm.
* The figure with underline is applied to a temporary compressive force, and shall not be applied to sustained compression mode.
- (7) On wiring an optical fiber cord, apply clamp to avoid direct self-weight of the cord onto the connector section.
Allowable weight applied to the connection section with an optical connector is 200 kg.

9.5 Method of F07 optical connector assembly

Assembly work of optical connector shall conform to the following-given steps.
For detail, refer to the instruction manual attached to the assembly tools.

Precautions of optical connector assembly work

On assembling an optical connector, observe the following-listed precautions.

- Prepare exclusive-use assembling tools for processing optical connector.
- A simple training is necessary for the understanding of the use of the exclusive-use assembling tools and for the assembling method of optical connector.

For detail, inquire to the cable manufacturer.

Recommended optical connector assembling tools

Manufacturer: Sumitomo Electric Industries, Ltd.

Agency: Takachiho Electric Co., Ltd.

Model of optical connector assembling tools: CAK-1062

- (1) Cut off about 110 to 150 mm of the edge portion of the optical fiber cable using a cutter knife or other means, and inserts the optical fiber through the cord bush.

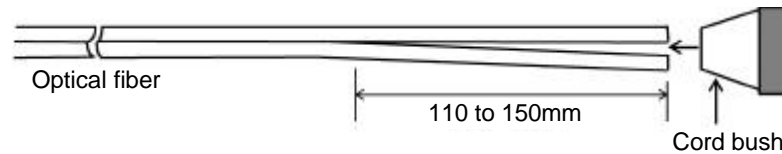


Figure 9.9 Fiber cut off

- (2) Using a jacket remover (use the hole at 2.2 side of label indication), remove the housing to about 45 mm in length. At that moment, the step between two housings shall be within 1 mm.



Figure 9.10 Removal of housing

- (3) Fold the tension member, and insert the collar through the jacket of optical fiber core wire until the collar went under the cord housing. The collar shall be exposed from the edge of housing removal by 1 mm or less.

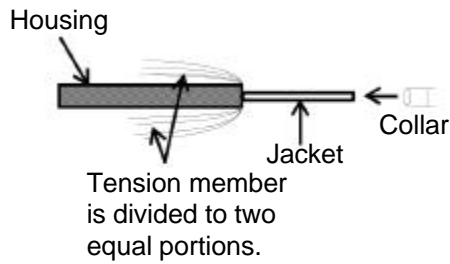


Figure 9.11 Collar insertion

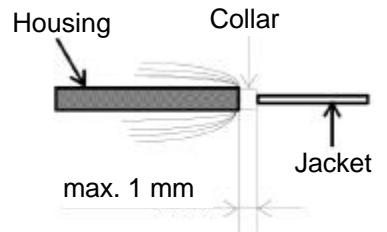


Figure 9.12 Protrusion of collar

- (4) Using the jacket remover (use the hole at 0.5 side of label indication), remove the cover (semi-transparent) of core wire of the optical fiber.

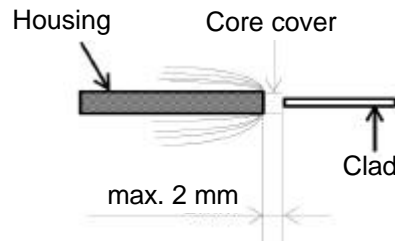


Figure 9.13 Residual length of core cover

Caution

To remove the core cover (0.5 mm in diameter, semi-transparent), if the knife edge of jacket remover is damaged or if mal-manipulation of the knife is occurred, the clad (0.23 mm in diameter, transparent) of the optical fiber may be damaged (becoming cloudy in the surface). The clad of H-PCF optical fiber is an important section that protects the Silica glass core and that assures high strength and high reliability of the optical fiber. Accordingly, damaged surface of the optical fiber may result in break of fiber at that portion in the succeeding process or during the manipulation of connector. Therefore, the clad shall be confirmed to have no damage on the surface by giving inspection described below before entering succeeding step, independent of presence/absence of cloudiness.

- (5) Cut off the tension member by 5 to 6 mm using scissors, and bring a spring on through the optical fiber cord.
- (6) Insert the optical fiber through a ferrule.

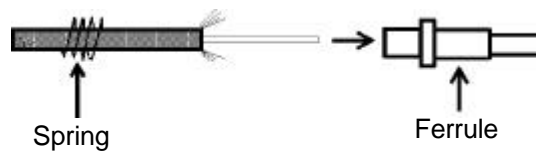


Figure 9.14 Insertion of ferrule

Note: Assure that the optical fiber is inserted into the ferrule until either the tension member is folded to protrude to outside the ferrule by 1 to 2 mm, or the tension member enters the ferrule by about 1 mm.

- (7) Using a crimping tool, fix the ferrule and the optical fiber. The work shall be done with special care for the position of ferrule and the groove of the tool.
- (8) Using an optical fiber cutter, cut off the protruded portion of the optical fiber at the tip of ferrule. On cutting the optical fiber, debris of the optical fiber may be attached to the cutting edge of the fiber cutter due to static electricity. Check the debris on the cutting edge before and after the cutting work. If the debris of optical fiber remained on the cutter knife edge, remove the debris with tweezers or other means.

- (9) Assemble the optical connector. On assembling the optical connector, care should be given not to mix the transmission side ferrule and the receiving side ferrule.

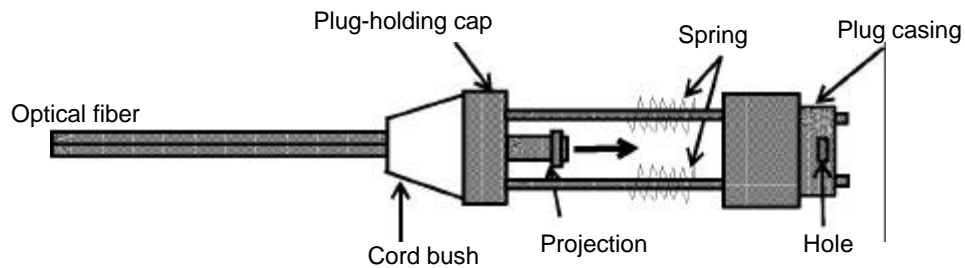


Figure 9.15 Optical connector assembly

- (10) Confirm the quantity of light using a light power tester or other means

Recommended optical power meter

Manufacturer: Hactronics Co., Ltd.

Agency: Hakuto Co., Ltd.

Model:	{	photom 205	(light power meter)
		photom 310-081CF	(light source unit)
		photom 180-HTL	(F07 Type connector adapter)

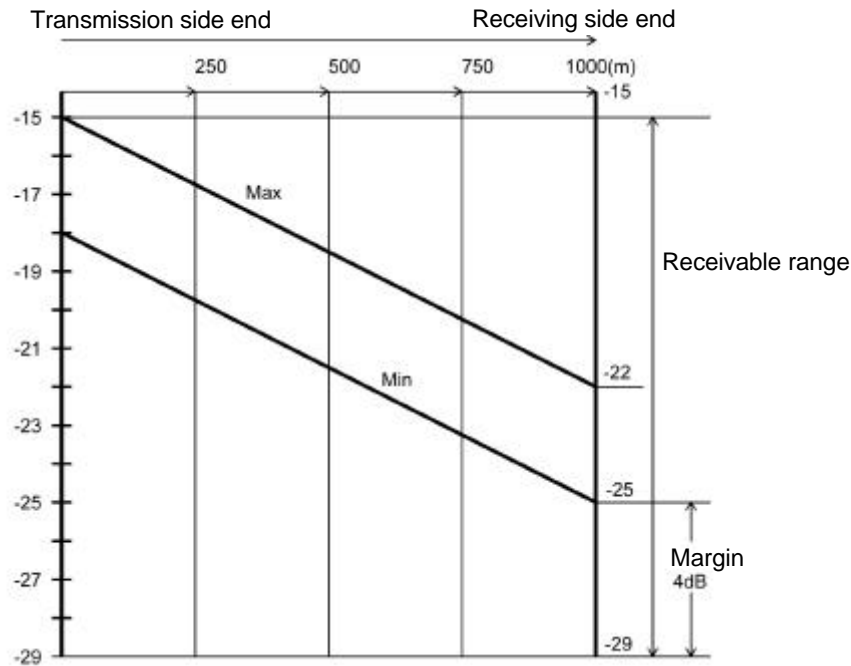
9.6 Procedure of design for laying optical fiber cables

For the use of TOSLINE-S20 optical fiber cable system, following-listed items shall be observed to lay cables/codes.

- (1) Precautions of optical fiber cable system design
 - (A) Formulation of FC Type optical level diagram
 - For FC Type, refer to the "T2/T3 stations instruction manual (6F3B0354)".
 - (B) Formulation of F07 Type optical fiber diagram

On designing an optical system, formulate the optical level diagram and confirm that the light power has sufficient margin in advance. The following is an example of transmission/receiving side level diagram. The example shows that the receiving side receives up to -29 dBm of light power. Nevertheless, the receiving side is designed to be capable of min. -25 dBm of light power taking into account of a margin. The level diagram given below does not consider the presence of aligner at intermediate position.

If an intermediate aligner exists, a corresponding light loss shall be added. Generally, that kind of loss is 2 dBm with an aligner. However, calculation shall be done after inquiry to the manufacturer, (use the worst case values.)



- Applied optical cable gives 6 dB/km of transmission loss, (under the use of H-PCF).
- Connector connection loss is 1 dB/both ends, (2 dB/both ends for non-polishing case).

At 7 dB of loss (the worst case), 1 km of transmission is possible with a margin of 4 dB.

Figure 9.16 Example of level diagram of an optical fiber cable system

(2) Selection of terminal treatment

For selecting wiring cable and cord, the following-described precautions shall be observed.

• Wiring within cubicle

For the case of intra-cubicle wiring with several meters of length, cords are convenient.

Since, however, cords are weak in mechanical strength, the cords shall be fixed at about two meters of intervals to avoid free-moving of the cords and to avoid direct application of self-weight onto a connector.

Use of plurality of aligners increases the connection loss and causes troubles. The number of aligners shall be minimized. And, if the aligners are used, secure a margin on the light level diagram.

• Wiring outside cubicle

For the case of outside cubicle wiring, we recommend to use cables in view of durability. The cable shall be a cord-integrated cable. On laying the cables at site, attach optical connectors to the cables referring to "9.5 Method of optical connector assembly" and the technical documents issued by the optical cable manufacturer.

9.7 Precautions on ordering cables/cords

On ordering the cables and cords, the following-listed precautions shall be observed.

- Cables and cords applied shall be those specified in the instruction manual.
- When the cable contractor is named, and when the cables specified in the instruction manual cannot be adopted, use the cables having the same characteristics with those specified in the instruction manual. In that case, particularly the following-listed characteristics shall be checked.

Core diameter/Clad diameter, Transmission band, Applied wavelength, Aperture rate, Attenuation
--

* If the judgement is difficult to give, please contact our section in charge of the matter.

- Cable contractors shall be unified. For example, separate the cable contractor and the connector-mounting contractor should be avoided because there is no responsible contractor on accident.
- Delivery of optical fiber cables take a time compared with ordinary wire cables. Therefore, order shall be made with a sufficient margin of time.

9.8 Precautions on laying cables

For handling optical connectors and cords, refer to the "7.4 Precautions on handling optical fiber and connector" of the instruction manual.

(1) Precautions on laying cables

- For the case of cable with connector, the front end cord and optical connector portions shall be carefully prepared not to apply direct force to the portions.
- Cables shall be laid in straight pattern as far as possible.

(2) Check of transmission loss

To monitor the connection condition of aligner after wired and to detect abnormality in transmission loss caused from contamination on the connector edge faces, light power shall be measured. The determination of the light power is done as follows.

Devices to be prepared

Light power meter 2 units (one shall have a reference light emission function)

Reference single-core cord 2 cords (each having a length of about 1 meters)

(A) Check of light power meter

One of the two light power meters shall be used as the light source, and the two shall be connected as shown in the figure below, thus confirm the light emission power.

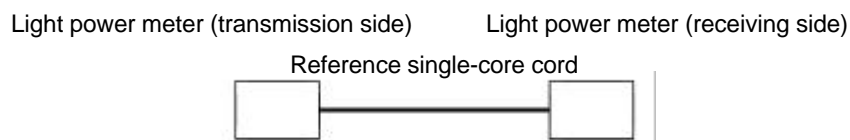


Figure 9.17 Measurement of light emission power

Two reference cords shall be used to determine the light emission power.

Two cords for checking confirm that the reference cord is in normal state. Normally, both cords give similar results.

(B) Determination of transmission loss in actual optical transmission line

The above-described power meters shall be placed at both ends of the optical transmission line to determine the transmission loss. The difference between the value observed at that moment at receiving side and the value observed at receiving side with the reference cord becomes the transmission loss in actual transmission line.

$$\text{Transmission loss in actual transmission line} = (\text{Observed value with the reference cord}) - (\text{Observed value in the transmission line})$$

The transmission loss in the transmission line is the sum of the transmission loss across the optical fiber and the connection loss of aligner.

(C) Comparison with level diagram

Comparing with the level diagram which was prepared during design stage, if the transmission loss of the transmission line is abnormally large, the portion structuring the transmission line should be abnormal. Thus, the inspection shall be given to individual sections.

(3) Check on system up

At the point of system up, check on the LED display status at each station to judge the performance of normal transmission. For the meaning of display, refer to the instruction manuals of individual stations.