

INSTRUCTION MANUAL

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ARC FUSION SPLICER  
FOR  
POLARIZATION MAINTAINING  
OPTICAL FIBER

FSM-20PMII  
(Type-T)

# 1. GENERAL

**The FSM-20PMII ARC Fusion Splicer (type-T) is designed to splice optical glass fiber for telecommunications. The features are described below:**

- Polarization maintaining optical fiber (PM), normal single-mode fiber(SM) and multi-mode fiber(MM) are applicable for splicing.
- The Splicer performs fiber gap setting, core/cladding alignment and splice automatically by image processing by an internal microprocessor.
- Both PAS and RIDS can be used for Fujikura PANDA fiber and 3M Tiger fiber. Only RIDS can be used for other kinds of PM fiber.
  - PANDA : Polarization Maintaining and Absorption Reducing Fiber
  - PAS : Profile Alignment System
  - RIDS : Remote Injection and Detection System
- A core alignment method is used for the SM fiber. A cladding alignment method is used for the MM fiber.
- The FSM-20PMII has a pressure sensor to adjust discharge power automatically when there is a change in altitude or atmospheric pressure.
- The Splicer is powered by AC 100-240V 50-60Hz (Max.3A.)
- Proper cleave length is 10mm-16mm for  $\phi$ 0.22mm and  $\phi$ 0.25mm coated fiber, and 16mm only for  $\phi$ 0.4mm and  $\phi$ 0.9mm coated fiber.

Fiber cladding diameter	$\phi$ 80-125um		
Fiber coating diameter	$\phi$ 0.22-0.25mm	$\phi$ 0.4mm	$\phi$ 0.9mm
Coating Material	UV curable material	UV curable material	Nylon
Cleave length	10-16mm	16mm	

## **2. CONSTRUCTION**

## 2.1 Components

The components comprising the FSM-20PMII are shown in Table 2.1 and 2.2.

Table 2.1 Components of the FSM-20PMII

Name	Quantity
Splicer Main Body	1pc
Controller	1pc
Fiber Guide	2pcs
AC Power Cord for Splicer	1pc
Monitor Extinction Cord	1pc
DC Power Cord of Controller	1pc
Control Cord of Controller	1pc
Carrying Case	1pc

Table 2.2 Attached Accessories of the FSM-20PMII

Name	Quantity	Note
φ0.2 Sheath V-groove	1pair	For 0.22-0.25mm coating fiber Installed on the splicer
φ0.2 Sheath Clamp	1pair	For 0.22-0.25mm coating fiber Installed on the splicer
φ0.4 Sheath V-groove	1pair	For 0.4mm coating fiber Kept in Parts box
φ0.4 Sheath Clamp	1pair	For 0.4mm coating fiber Kept in Parts box
φ0.9 Sheath V-groove	1pair	For 0.9mm coating fiber Kept in Parts box
φ0.9 Sheath Clamp	1pair	For 0.9mm coating fiber Kept in Parts box
Spare Electrodes	1pair	Model : ELCT1-25
Spare Mirror	1pc	Model : UDM-01
Spare Fuses	1pc	3.15A Time Lag Type for Splicer
	1pc	0.5A for Controller
Hexagonal Wrench	1pc	Use for the mirror, the sheath V-groove and sheath clamp replacement. Used for changing the fiber clamp strength.
Tweezers	1pc	
Instruction manual	1pc	-

## 2.2 Optional Accessories

The optional accessories are available shown in Table 2.3.

Table 2.3 Optional Accessories of the FSM-20PMII

Name	Model	Note
Bar Clamp	PT-05	For 0.22mm-0.9mm coating fiber
Side Mounted Tray	WT-PM2	-
Tripod Adapter	TRA-01	-

## 2.3 Other Accessories

Other accessories are available shown in Table 2.4.

Table 2.4 Other accessories of the FSM-20PMII

Name	Model	Note
Fiber Cleaver	CT-03/04/07/ CT-103/104/107 CT-84 (For 80um diameter fiber)	
Jacket stripper	JS-01	For 0.9mm coating fiber
Primary coat stripper	PS-02	For 0.25mm coating fiber
Tube heater	SH-7	
Splice protector	FP-03, FP-03(40mm)	

## 2.4 Input Power Voltage Range

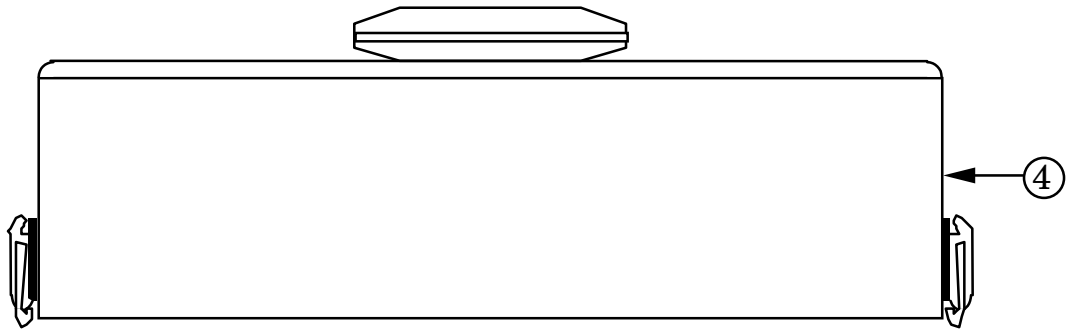
Input power voltage range is shown in Table 2.5.

Table 2.5 Input power voltage

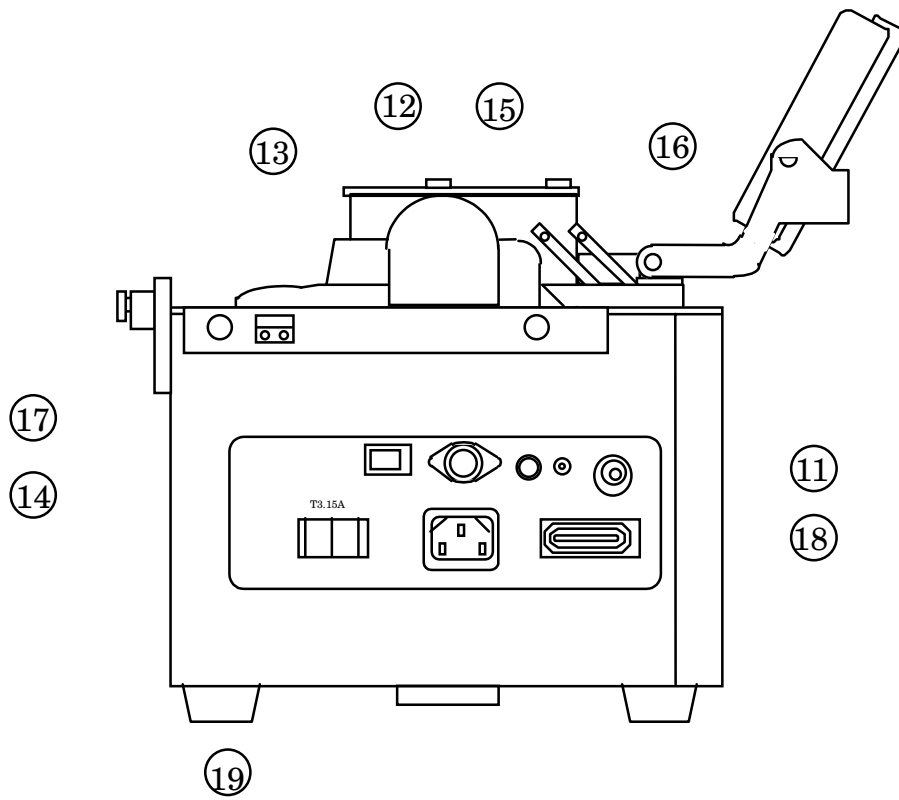
Input voltage range	AC 100-240V
Frequency range	50-60Hz
Max input current	3.0A

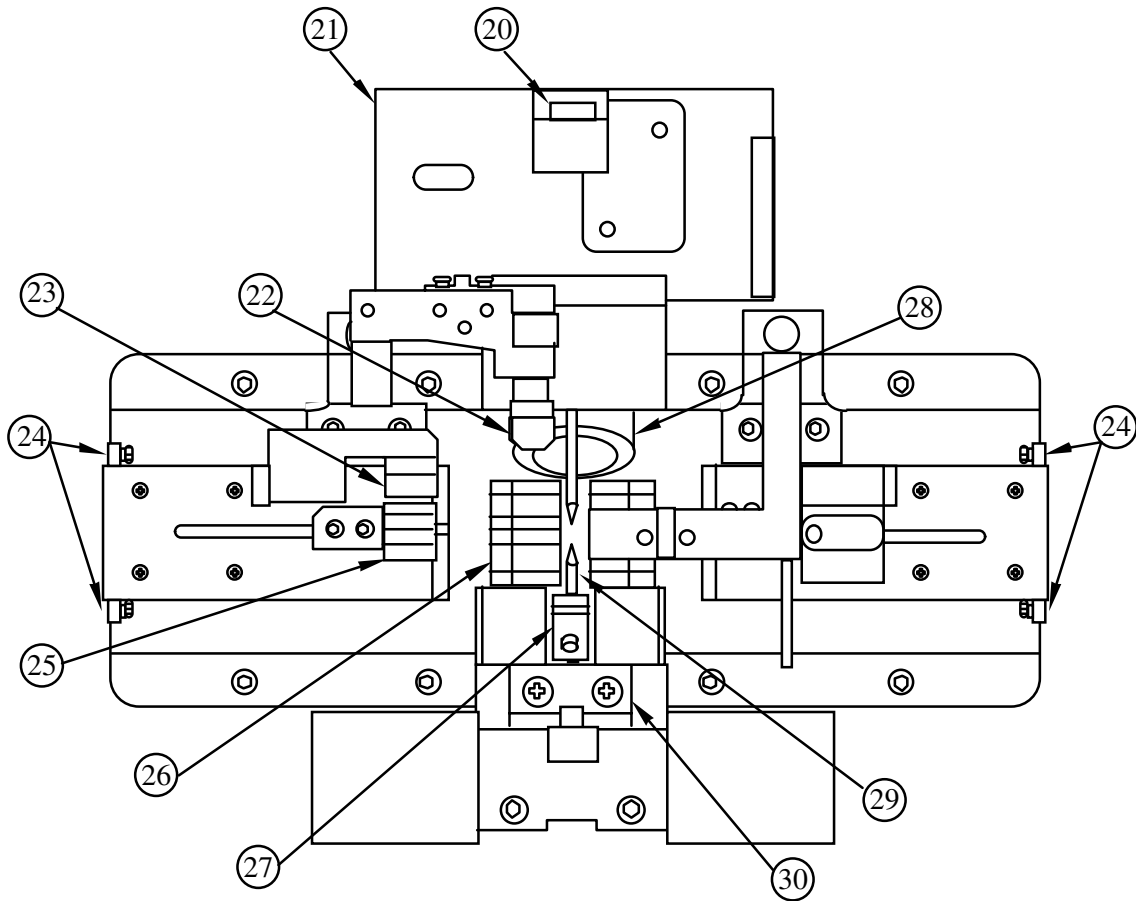
# **3. DESCRIPTION of PRODUCTS**

### 3.1 Main body







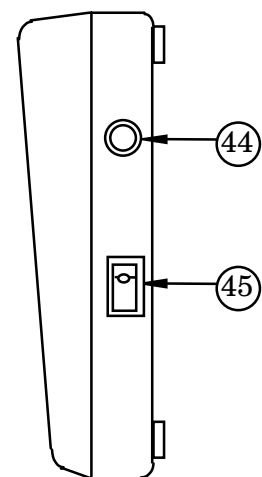
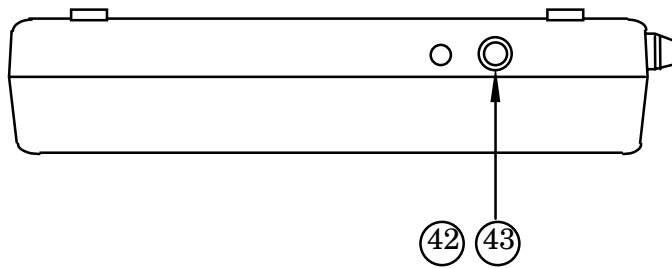


**Figure Top View of the V-Groove Area**

No.	Name	Function
20	LED Lamp	To illuminate the fibers for image processing. When the wind protector is closed, the illumination is turned ON, when it is opened, the illumination is turned OFF.
21	Electrode Cover	Designed to protect the electrode (anode) during operation.
22	Fiber Clamp	Used to secure the optical fiber in the V-groove. Fiber Clamp strength have to be adjusted for fiber diameter. See section 7.5.
23	Sheath Clamp	Keeps the fiber in the sheath V-groove by clamping the fiber coating, and can be changed to accommodate.
24	Sheath Clamp Release Lever	Pull this lever to release sheath clamp. See section 4.2.5 and section 4.2.8.
25	Sheath V-groove	Used to hold the optical fiber. It is necessary to exchange the sheath V-groove for sheath coating diameters. See section 8.2.1.
26	Optical Fiber V-groove	To align the fibers by precise movement.
27	Up/Down Mirror	To observe the fiber from X and Y views.

28	Objective Lens	Magnifies the fiber image.
29	Discharge Electrode	Used to produce the arc discharge for fiber splicing.
30	Electrode Fixture	Used to align and secure the electrodes in the correct position.

### 3.2 Control Box



34	Motor Indicator	The lamps of the indicator display the selected motor by the motor by the "Motor select" key.
35	MODE Key	To change the splice mode to P1, P2, P3, SM or MM. The mode indicator displays the splice mode according to this key.
36	X / Y	Changes the focus from the X view to the Y view, or the Y view to the X view. If this is done after a gap set operation, the fiber are adjusted to the center of the monitor and focused automatically.
37	RESET Key	Used for the reset operation. When RESET key is pressed, the system stop at any step of operation and the fibers move back to Z-axis home position. Splicer performs the RESET with a beep sound and displays "RESET" during the reset operation. After the reset operation is completed, "READY" is displayed on the monitor.
38	ARC	Performs the arc discharge when "READY," "PAUSE" (after gap setting) and "FINISHED" (after splicing) messages are displayed on the screen. In the "PAUSE" state, the splicer performs the arc discharge as well as the fiber stuffing when the "ARC" key is pressed. If the splice mode is SM, the loss estimation automatically follows the discharge operation. Only the arc discharge occurs if the "ARC" key is pressed in the "READY" state. In the "FINISHED" state, pressing the "ARC" key results in the rearc.
39	SET	To start the splicing operation, or to go through to the "PAUSE" state.
40	Motor Direction Key	During manual motor control, these arrows serve as the "Backward" and "Forward" keys to operate the motors.
41	Condition Input key	Used for entering numeral to parameters.
42	DC IN Power terminal	Used to connect the control cord from the DC OUT Power terminal of the splicer main body to the control box.
43	SER. PORT Terminal	Used to connect the control cord from the SER. PORT terminal of the splicer main body to the control box.
44	DC Fuse Holder	The DC 0.5A fuse is used.
45	Power Switch	Used to turn on and off the control box.

### 3.3 Fiber Guide

The fiber guide is an accessory to support the optical fiber as it rotates. The fiber guide fits into the fiber guide stand on the side of the splicer.

When using side mounted tray is used, the fiber guide fits into the side mounted tray. See section 7.1.

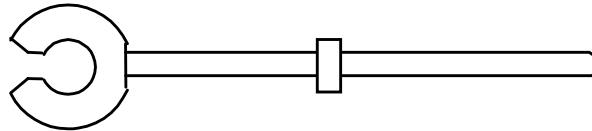
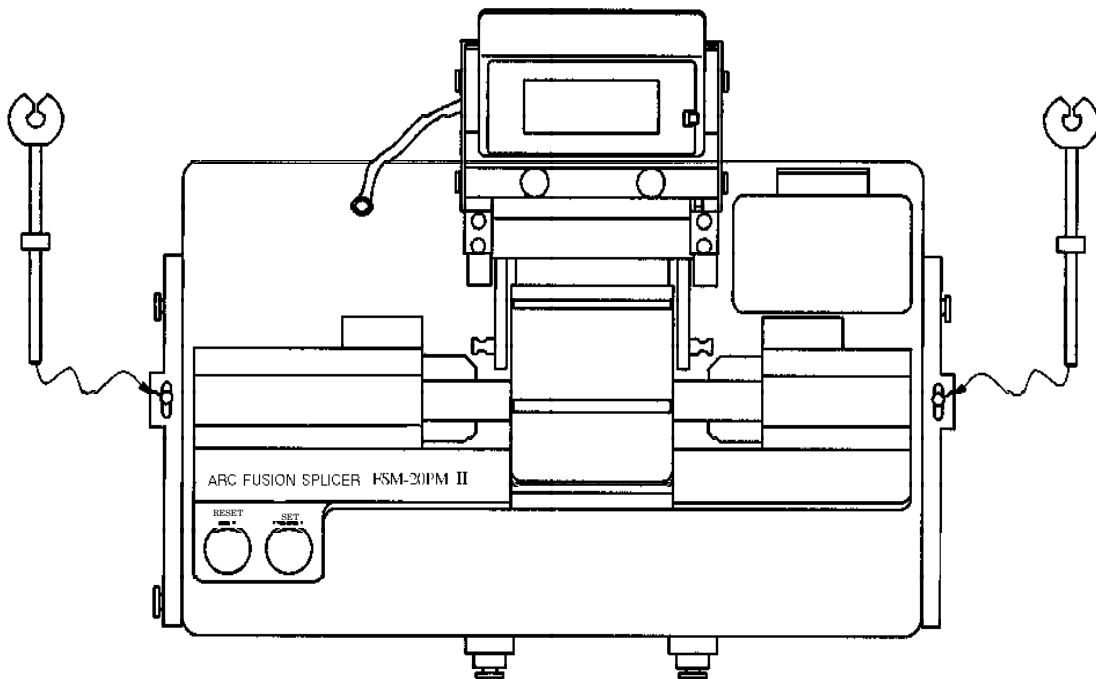


Figure Fiber guide



# 4. OPERATION



## WARNING



(1) This equipment is designed for splicing the optical glass fiber for telecommunication. Do not attempt to splice any other types of fibers or any other materials.



(2) Safety glasses should always be worn during the fiber preparation and the splicing process. A glass fiber fragment can be extremely dangerous if it comes into contact with the eye, skin, or is ingested.



(3) Use only the power cord attached. An improper power cord may cause fire and/or equipment damage.



(4) The appliance inlet is used to disconnect the power cord when using the equipment. Be sure to position the equipment so that it is easy to disconnect the power cord.



(5) If the side ventilation holes are covered, high temperature inside the equipment may result in damage. Confirm the clearance of 2 inches between the ventilation holes and wall when placing the equipment.



(6) Check the AC or DC power source before turning on the equipment. Proper power source is AC100-240V, 50-60Hz (Max.3A). Using power source out of the proper range can cause personal injury and/or equipment damage.



(7) When using an AC power generator, check AC output voltage with a tester which can measure AC voltage. The AC output voltage from the generator must be within AC100-240V, 50-60Hz. Generating wrong high voltage above the specification is a common fault. Measuring the AC output voltage is necessary before every use.



(8) Never operate the equipment in an environment where flammable liquids, or vapor exists. Extremely dangerous fire and explosion may be resulted in with the splicer's electrical arc under such an environment.



(9) During arc discharge, the electrodes generate very high voltage. The following measures will prevent personal injury and/or equipment damage from the high electrical voltage.

-Make sure no water or liquid is present on the equipment.

-Never touch the electrodes.

-Before operation, connect the equipment to the electrical ground (earth).

-When using an AC power source, use the AC power cord attached. It connects to electrical ground through the third pin of the AC plug.

-Make sure the power switch is off when the power cord is plugged in or out.

-Turn the power switch off and disconnect the power cord before the electrodes, the fuse or the up/down mirror is replaced.



## CAUTION



(1) Keep the splicer free from sand or dust. Never clean the V-groove with a hard material or rough object. Doing so will damage the surface, and degrade the performance.



(2) Precise adjustment and alignment have been made to all parts of this splicer before shipping. Do not loosen any screws or make any modifications to the splicer other than electrodes, up/down mirror and fuse replacements. If you encounter some problem with the splicer, please contact a sales agent.



(3) The equipment must not be placed on an unstable place. In case the equipment falls to the ground, it may cause personal injury and/or damage the equipment.

# Hear is Flowchart page 1

# Hear is Flowchart page 2

## 4.2 Splicing procedure

### 4.2.1 Connecting of Power Cord

1. Confirm that the Power Switch is OFF

Confirm the power switch is OFF before connecting the AC Power Cord.

2. Connecting the AC Power Cord

Plug the AC power cord into the AC power terminal.

Connect DC OUT power terminal of the splicer and DC IN power terminal of the control box with DC power cord.

Connect SER.PORT terminal of the splicer and SER.PORT terminal of the control box with control Cord.

### 4.2.2 Power ON/OFF Procedure

#### 4.2.2.1 Power ON Method

1. Remove the blue Z-unit stopper

Remove the blue Z-unit stopper form the splicer.

2. Check Input Voltage

Input voltage must be AC100-240V 50-60Hz (Max.3A.). Check the voltage fluctuation and the power factor when an AC power generator supplies AC power to the splicer.

3. Turn ON the Power Switch of the splicer

Turn ON the power switch of the splicer.

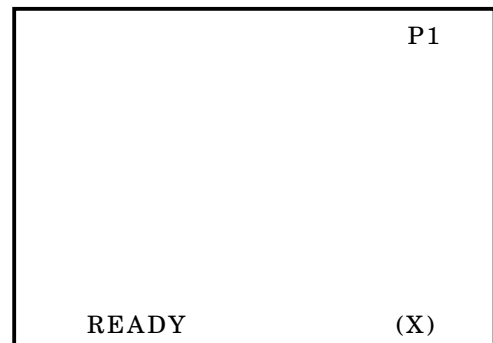
4. Check the Input Voltage Indicator and message of the monitor

- (1) Input Voltage Indicator

A needle of the voltage indicator should point to the green range in the AC power.

- (2) Message of the Monitor

"READY" message appears after a self-diagnostic test. (Display 1)

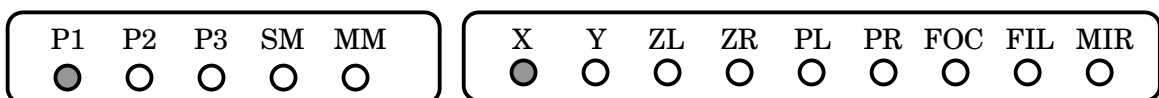


Display 1

5. Turn ON the Power Switch of the Control Box

Turn ON the power switch of the Control Box.

The LED lump on the Control Box lit up and indicate splice mode and selected motor.



#### 4.2.2.2 Power Off Method

1. Press the "RESET" key.
2. Open the wind protector.
3. Turn OFF the power switch of the splicer.
4. Close the wind protector, and install the Z-unit stopper.
5. Attach the top cover of the splicer.
6. Turn OFF the power switch of the control box.

[NOTE] To protect up/down mirror damaged by the electrodes, please open the wind protector before turning OFF the power switch of the splicer.

#### 4.2.3 Splice Mode Selection

The FSM-20PMII type-T has 9 splice modes for PM fiber (P1-\*\*, P2-\*\*, P3 mode,) 1 splice mode for SM fiber (SM mode,) and 1 splice mode for MM fiber (MM mode.)

Each mode has independent discharge conditions.

The splice mode now in use is displayed on the monitor and indicated by the MODE indicator on the control box.

Mode	Fiber Type (L) – (R)	$\theta$ Axis Aligning	XY Axis Aligning
P1-PP	PANDA-PANDA	PAS	PAS
P1-PT	PANDA-Tiger	PAS	PAS
P1-TP	Tiger-PANDA	PAS	PAS
P1-TT	Tiger-Tiger	PAS	PAS
P2-PP	PANDA-PANDA	PAS	RIDS
P2-PT	PANDA-Tiger	PAS	RIDS
P2-TP	Tiger-PANDA	PAS	RIDS
P2-TT	Tiger-Tiger	PAS	RIDS
P3	All types of PM fiber	RIDS	RIDS
SM	SMF-SMF	-	PAS (Core Axis Aligning)
MM	MMF-MMF	-	PAS (Clad Axis Aligning)

PAS : Profile Alignment System (Observing Fiber Image)

RIDS: Remote Injection and Detection System

(Power Level Monitoring System)

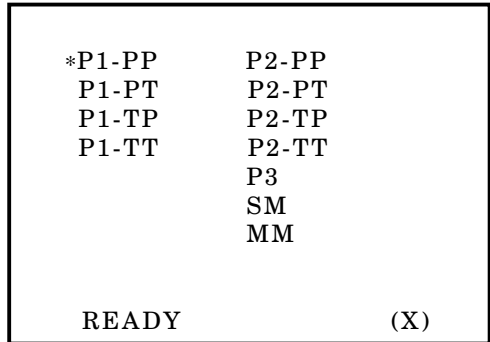
1. Display "READY" message

Ensure "READY" message is on the monitor.

2. Select Splice Mode

Push MODE key on the control box, and select Splice Mode according to the fiber type. Make sure Splice Mode displayed on the monitor. Splice Mode is toggled as below by pressing "MODE" key of the control box. (display2)

P1-PP → P1-PT → P1-TP → P1-TT →  
P2-PP → P2-PT → P2-TP → P2-TT →  
P3 → SM → MM → P1-PP → ---



Display 2

#### 4.2.4 Preparation of the Fiber Ends

Proper preparation of the fiber ends is necessary before splicing. This operation includes stripping, cleaning and cleaving processes.

As the fiber ends condition before splicing affects the quality of splice directly, refer to the following instructions carefully.

[NOTE] The FSM-20PMII can splice only single fibers. In a case of ribbon fiber, divide the ribbon fiber into single fibers.

1. Threading the Fiber through Splice Protector

When a splice protector is used to protect the complete splice, threading the fiber on one side through the splice protector is required in advance (before preparation of the fiber ends). If the splice protector is installed after preparation of the fiber ends, the fiber would be contaminated, and splice result would be bad.

[NOTE] The tube heater SH-7 and the splice protector are optional accessories.

2. Removing the Coating

Remove the coating with an approved fiber coating stripping tool.

3. Cleaning of the Fiber

Wipe the bare fiber several times with a clean lint free tissue dampened with alcohol.

#### 4. Cleaving the Fiber

Cleave the fiber with a precise optical fiber cleaver. The cleaved length must be 10mm-16mm for 0.22 and 0.25mm coated fiber, and 16mm only for 0.4mm and 0.9mm coated fiber.

[NOTE] The splice loss may increase if the condition of the cleaver is not good.

[NOTE] Do not touch the bare fiber. Handle it carefully because it would be easily damaged.

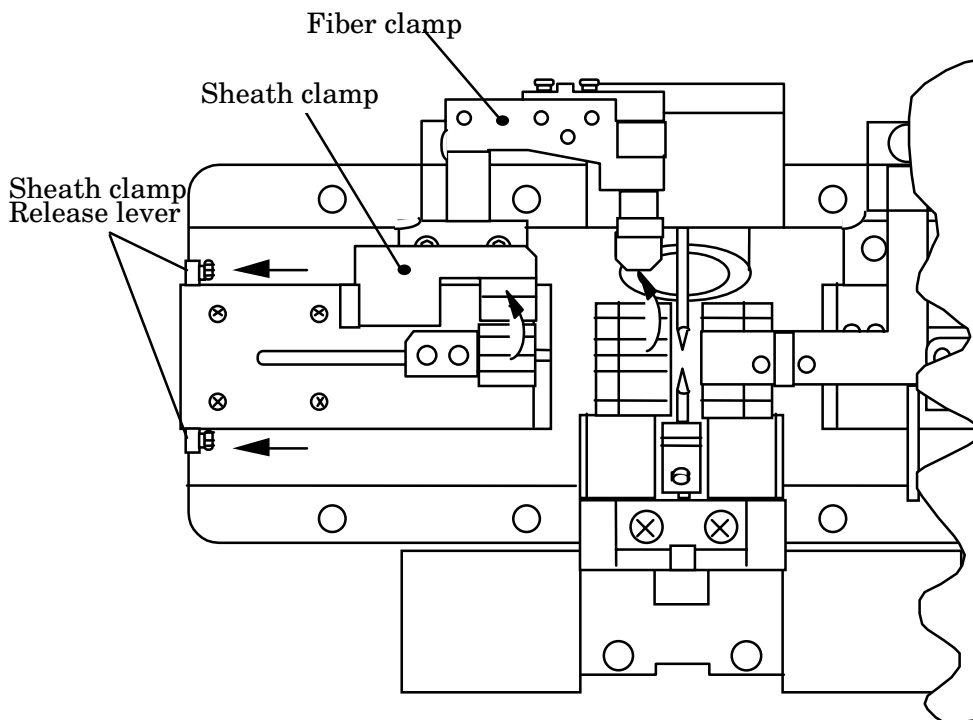
#### 4.2.5. Setting of Fibers

Set the prepared fibers onto the splicer as below.

1. Open the Wind Protector

2. Open the fiber clamps and the sheath clamps

Open the left and right fiber clamps first, then open left and right sheath clamps with sheath clamp release lever.

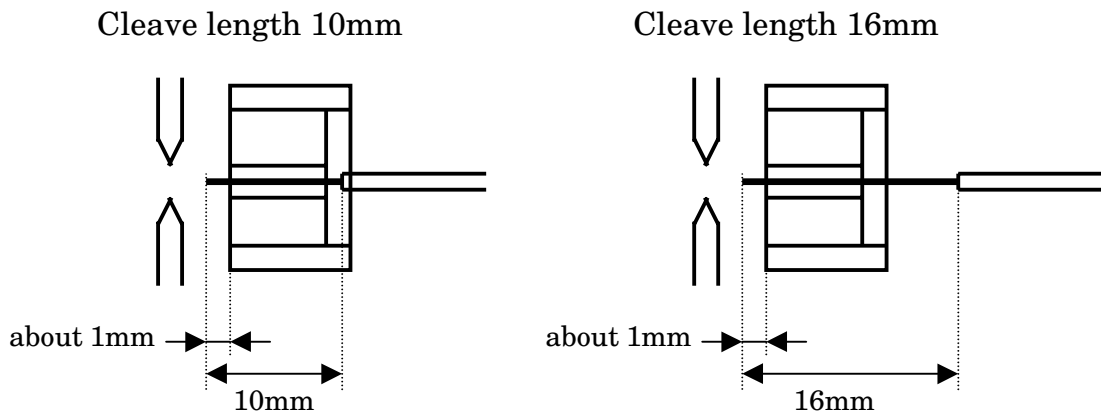


3. Set the Fiber onto the V-grooves and close the sheath clamps

(1) Set a fiber onto the V-groove so that sheath edge is put at the proper

position on the sheath clamp. While setting the fiber, be careful that the fiber end doesn't touch the V-groove surface or any other surface or object (such as the up/down mirror). Fiber end must not be contaminated.

- (2) Close the sheath clamp while holding the fiber, and ensure that the fiber is touching on the bottom of the V-groove. If the fiber does not touch on the bottom, set the fiber onto proper place again.



[NOTE] In case that the fiber has a bend, it is easy to set the bent fiber properly on the bottom of the V-groove by turning the bending direction of the fiber down.

- (3) Set the another side fiber by the procedure above.
- (4) Close both left and right fiber clamps gently.

#### 4. Close the Wind Protector

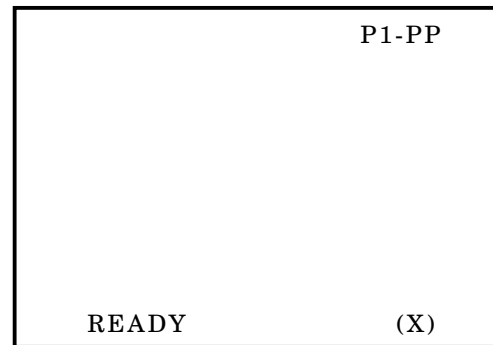
The illumination lamp lights.

## 4.2.6 Automatic Splicing Procedure

The automatic splice procedure is described as below.

### 1. Confirmation of the "READY" message

Check "READY" message is displayed on the monitor (Display 1). Press the "RESET" key to enter the "READY" state if the "READY" message is not displayed.



Display 1

### 2. Initial Gap Setting, Cleaning Arc and Cleave Angle Check

Press the "SET" key to start splicing process.

#### (1) Starting the Initial Gap Setting

At first, the splicer move forward. (Display 2).

#### (2) Cleaning Arc

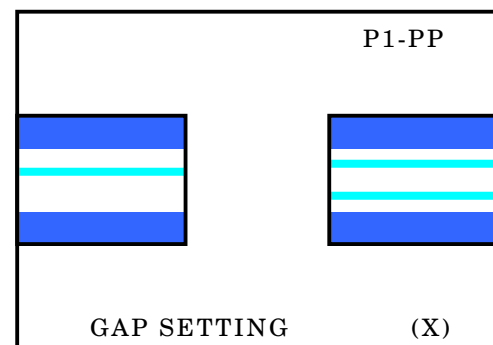
During the fiber forward motion, a short Arc occurs to clean the fiber surface.

#### (3) Initial Gap Setting

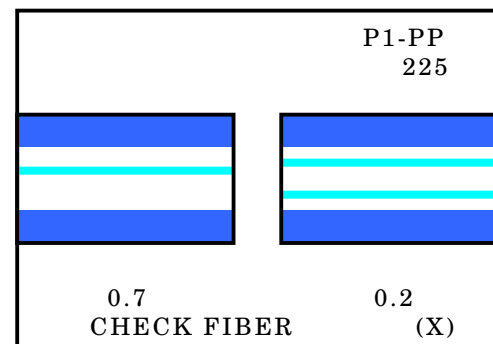
The proper gap between fiber ends is set.

#### (4) Cleave Angle Check

After the gap setting, the cleave angle is measured and displayed on the monitor. (Display 3)



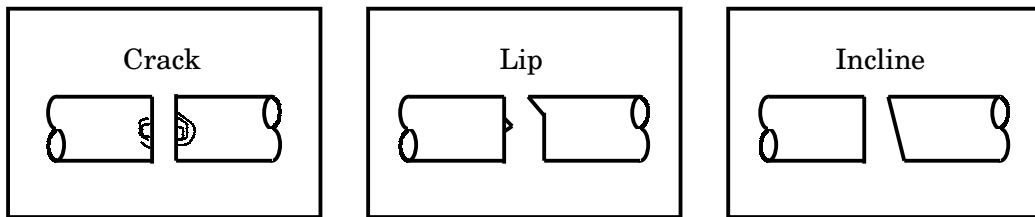
Display 2



Display 3

[NOTE] The splicer will be in a PAUSE state after gap setting if "PAUSE1" is "ON" in the "CONDITION SET." menu. In the pause state. "CHECK FIBER" message appears on the monitor. (Display 3)  
(Concerning "PAUSE1" function, see Section 5.2.)

[NOTE] Observe and check the fiber ends on the monitor with your eyes. In case the fiber ends are bad as shown in figure below, press the "RESET" key to cancel the splice. Then prepare the fiber ends again, i.e., stripping, cleaning and cleaving.



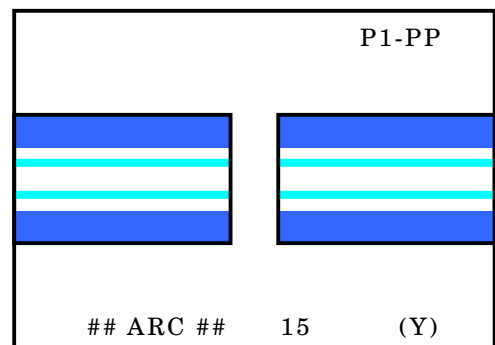
[NOTE] The splicer may not detect the dust on the fiber surface sometimes. If there is visible dust, press the "RESET" key to cancel the splice, then prepare the fiber ends again, i.e., stripping, cleaning and cleaving. The dust may cause high splice loss.

[NOTE] When the "RESET" key is pressed during splice process, the fiber image of next splice may not correctly focused or positioned on the monitor. In such case, please make Focus or Field motors move with control box.

### 3. Automatic Alignment (Core, Clad, or $\theta$ axis)

Press "SET" key to start splice process again when the splicer is PAUSE state ("PAUSE1"). Alignment procedures of splice modes are different. See Section 4.3.

[NOTE] Fiber image seems different by each fiber type or alignment procedures. Specially Tiger fiber image during  $\theta$  axis alignment seems out of focus.

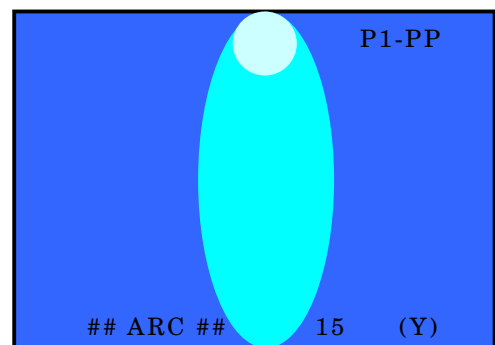


Display 4

### 4. Arc Fusion Splicing

Press "SET" key to start splice process again when the splicer is PAUSE state ("PAUSE2").

- (1) Both fibers move toward each other again. The splicer sets a narrow gap between the fiber ends. The width of the narrow gap is the same as the "GAP" value of the "CONDITION SET." menu (Display 4).

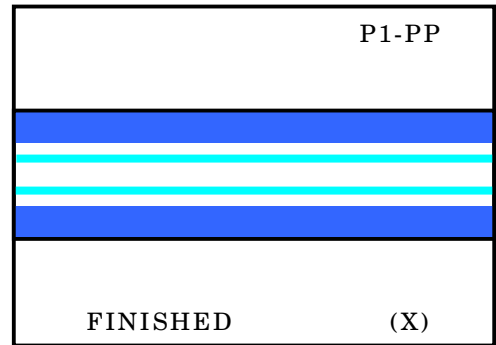


Display 5

(2) The splicer begins high voltage ARC fusion, and stuffs the left fiber towards the right fiber. (Display 5)

[NOTE] The ARC POWER is automatically compensated for atmospheric pressure.

(3) "FINISHED" message is displayed on the monitor (Display 6).



Display 6

5. Observe the splice point visually

Observe the splice point visually. The splicer cannot always detect every splice defect. If any of the following problems as shown in figure are present, take the appropriate measure by referring to the table below.

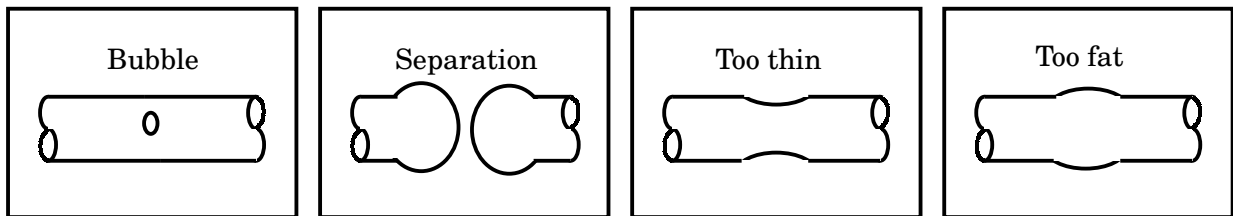


Table : Treatment of Defective Spliced Results

PROBLEM	CAUSE	MEASURE
Bubble	Bad fiber end	Prepare the fiber end again or check the fiber cleaver.
	Chipping the edge of fiber end	
	Dust on the fiber end	Prepare the fiber end again.
	Short prefuse time	Adjust the prefuse time. Refer to section 5.1.
Separation	Lack of stuff amount	Carry out the 'STUFF CHECK' command to check it. Refer to section 5.1.1 and 6.2.3.
	Strong ARC POWER	Reduce the ARC POWER. Refer to section 5.1.1.
	Long prefuse time	Adjust the ARC POWER. Refer to section 5.1.1.
Too thin	Lack of stuff amount	Carry out the 'STUFF CHECK' command to check it. Refer to section 5.1.1 and 6.2.3.
	Strong ARC POWER	Reduce the ARC POWER. Refer to section 5.1.1.
Too fat	Large stuff amount	Carry out the 'STUFF CHECK' command to check it. Refer to section 5.1.1 and 6.2.3.

#### 4.2.7 REARC

In a case that the splice loss is higher than acceptable value, REARC may improve the splice loss.

##### 1. REARC

Press the "ARC" key to perform REARC after "FINISHED" message is displayed on the monitor. The splicer generates an ARC discharge again (Display 7).

#### 4.2.8 Remove the spliced fiber

Remove the spliced fiber from the splicer. When you are using the bar clamp, see section 7.1.2.

##### 1. Release the sheath clamp

Pull the sheath clamp release lever.

[NOTE] Do not press the "RESET" key before releasing the sheath clamp. The spliced fiber may get damage if PL or PR motor move.

Sheath clamp

3. Remove the spliced fiber

(1) Open the wind protector.

(2) Open the sheath clamps

(3) Open the fiber clamps.

(4) Then remove the spliced fiber carefully from the V-groove.

### **4.3 Alignment process of each splice mode**

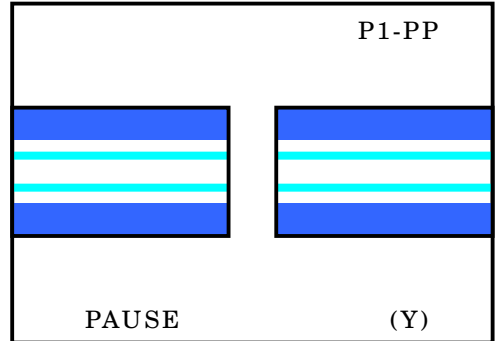
#### **4.3.1 P1-\*\* mode (P1-PP, P1-PT, P1-TP, P1-TT)**

Both XY-axis alignment and  $\theta$  axis alignment are performed by PAS in the case of P1

(4) Press the "SET" key if the splicer is in a PAUSE state. The splicer aligns the cladding in both X and Y fields again. (Display 3)

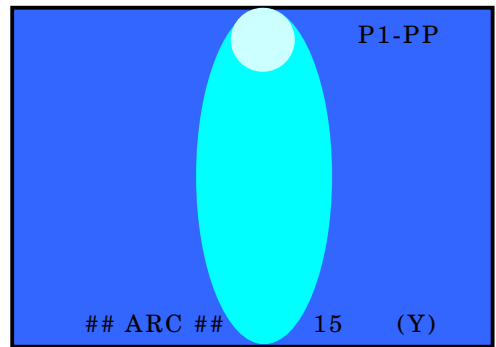
(5) The splicer will be in a PAUSE state after all alignments are finished. (Display 4)

[NOTE] In (3) and (5) process, the splicer will be in a PAUSE state if "PAUSE2" is "ON" in the "OPTION SET" menu. The splicer displays "PAUSE" message on the monitor during PAUSE state. (Display 4) Refer to section 5.2.



Display 4

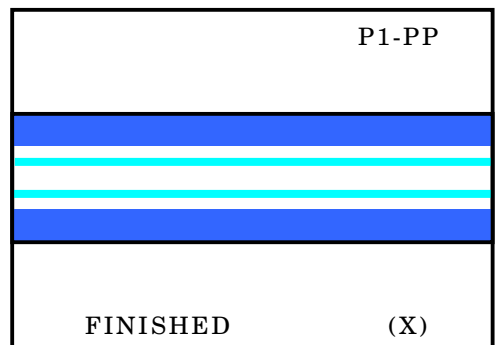
(5) Press the "SET" key to start splice process again if the splicer in PAUSE state ("PAUSE2"). Both fibers move toward each other again. The splicer sets a narrow gap between the fiber ends.



Display 5

(6) The splicer begins high voltage ARC fusion, and stuffs the left fiber forward the right fiber. (Display 5)

(7) "FINISHED" message is displayed on the monitor after ARC fusion splicing. (Display 6)



Display 6

5. Observe the splice point visually

Observe the splice point visually. Refer to section 4.2.6.

6. Remove the spliced fiber

Remove the spliced fiber carefully. Refer to section 4.2.8.

### 4.3.2 P2-\*\* mode (P2-PP, P2-PT, P2-TP, P2-TT)

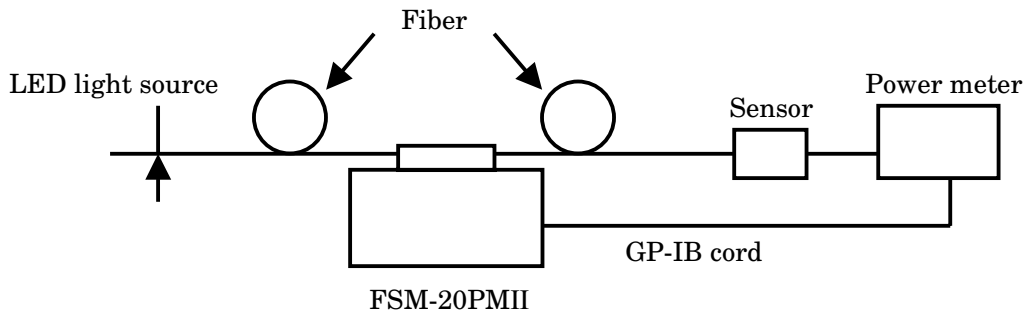
In the case of P2-\*\* mode, XY-axis alignments is performed by RIDS and  $\theta$ -axis alignments is performed by PAS.

RIDS: Remote Injection and detection system. A power meter and a light source are needed.

PAS: Profile Alignment System

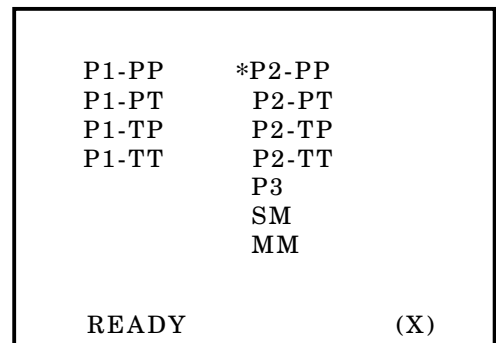
#### 1. Connection of the Measuring System

A power meter and a light source are needed for this alignment method. A power meter must be Anritsu ML93B or ML9001A. Sensor for the power meter must be Anritsu MA9612A for ML9001A. (ML910B is not acceptable.) Set the address switch of the power meter to "TALK ONLY". Standard connection is shown below figure. GP-IB cord connects the splicer and the power meter. The plug of the GP-IB cord must be connected firmly and the screws must be tightened.



#### 2. Splice Mode Selection

- (1) Ensure the splicer is "READY" state.
- (2) Select splice mode by pressing "MODE" key on the control box. Ensure that splice mode is suitable for the fiber type. (Display 1)



Display 1

#### 3. Fiber Setting

See the section 4.2.5.

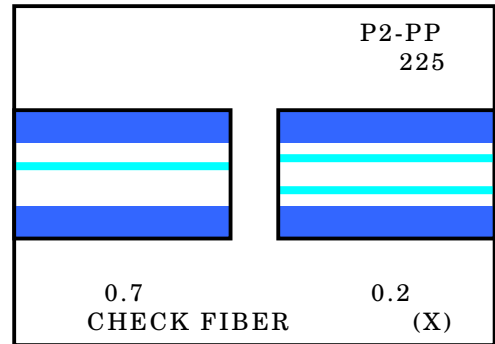
Ensure that both left and right fibers are suitable for the splice mode.

4. Press the "SET" key

The splicer operates cleaning ARC, initial gap setting and cleave angle check. "CHECK FIBER" message is displayed if "PAUSE1" is "ON" in the "OPTION SET." menu.

(Display 2)

[NOTE] The Cladding axial offset value is display if "DATA" is "ON" of the "OPTION SET." menu. Refer to Section 5.2.



Display 2

5. Automatic Splicing Procedure

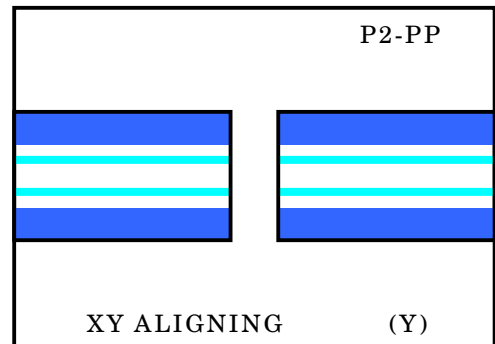
(1) Press the "SET" key to start splice process again if the splicer in PAUSE state ("PAUSE1").

(2) The splicer aligns the clad in both X and Y field, and displays "XY ALIGNING" message.

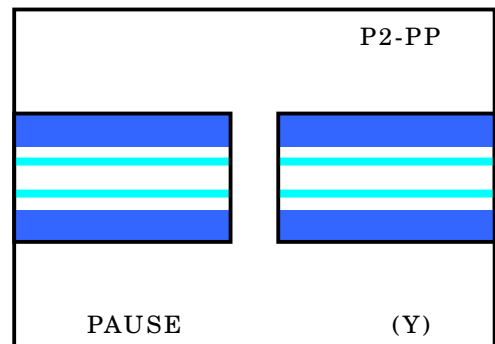
(3) The splicer aligns  $\theta$  axis, and displays "PM ALIGNING" message. The splicer beeps 3 times after  $\theta$  axis alignment is finished, and will be in a PAUSE state if "PAUSE2" is ON.

(4) Press the "SET" key if the splicer is in a PAUSE state. The splicer aligns the cores by RIDS. (Display 3)

(5) The splicer will be in a PAUSE state after all alignments are finished. (Display 4)



Display 3



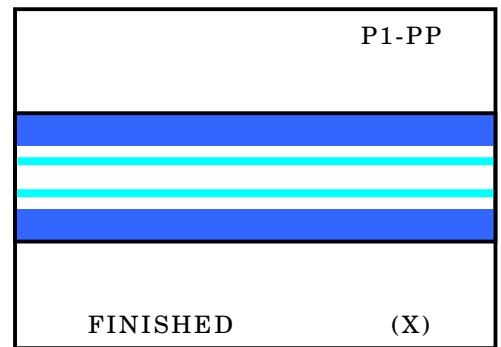
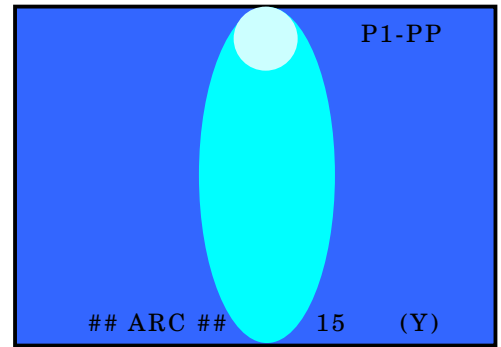
Display 4

[NOTE] In (3) and (5) process, the splicer will be in a PAUSE state if "PAUSE2" is "ON" of the "OPTION SET" menu. The splicer displays "PAUSE" message on the monitor during PAUSE state. (Display 4) Refer to section 5.2.

(6) Press the "SET" key to start splice process again if the splicer in PAUSE state ("PAUSE2"). Both fibers move toward each other again. The splicer sets a narrow gap between the fiber ends.

(7) The splicer begins high voltage ARC fusion, and stuffs the left fiber forward the right fiber. (Display 5)

(8) "FINISHED" message is displayed on the monitor after ARC fusion splicing. (Display 6)



6. Observe the splice point visually

Observe the splice point visually. Refer to section 4.2.6.

7. Remove the spliced fiber

Remove the spliced fiber carefully. Refer to section 4.2.8.

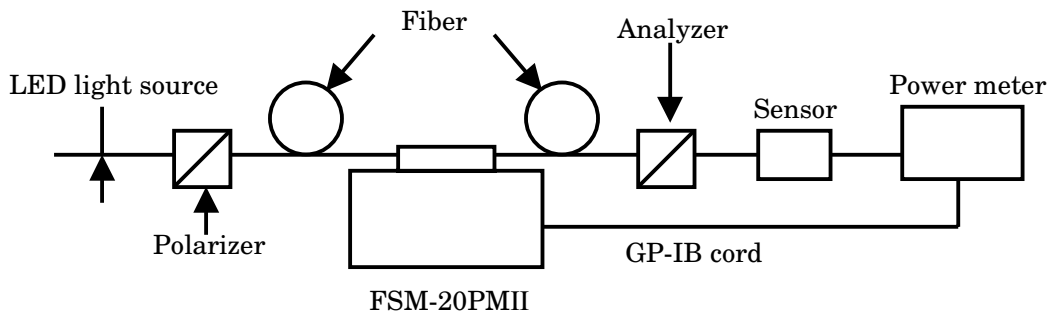
### 4.3.3 P3 mode

In the case of P3 mode, both XY-axis alignment and  $\theta$ -axis alignment are performed by RIDS.

RIDS: Remote Injection and detection system. A power meter and a light source are needed.

#### 1. Connection of the Measuring System

A power meter and a light source are needed for this alignment method. A power meter must be Anritsu ML93B or ML9001A. Sensor for the power meter must be Anritsu MA9612A for ML9001A. (ML910B is not acceptable.) Set the address switch of the power meter to "TALK ONLY". Standard connection is showed below figure. GP-IB cord connects the splicer and the power meter. The plug of the GP-IB cord must be connected firmly and the screws must be tightened.



#### 2. Splice Mode Selection

- (1) Ensure the splicer is "READY" state.
- (2) Select splice mode by pressing "MODE" key on the control box. Ensure that splice mode is suitable for the fiber type. (Display 1)

P1-PP	P2-PP
P1-PT	P2-PT
P1-TP	P2-TP
P1-TT	P2-TT
	*P3
	SM
	MM
READY	(X)

#### 3. Select PMALIN MAX or MIN

Select "PMALIN MAX" or "PMALIN MIN" of the "CONDITION SET" menu. Refer to section 5.1.2

Display 1

#### 4. PAUSE must be ON

"PAUSE1" and "PAUSE2" of the "CONDITION SET" menu must be ON.

## 5. Fiber Setting

See the section 4.2.5.

## 6. Press the "SET" key

The splicer operates cleaning ARC, initial gap setting and cleave angle check. "CHECK FIBER" message is displayed if "PAUSE1" is "ON" of the "OPTION SET." menu.

(Display 2)

[NOTE] The Cladding axial offset value is display if "DATA" is "ON" of the "OPTION SET." menu. Refer to Section 5.2.

## 7. PL and PR motor moving

Rotate PL and PR motor by manual motor operation, so that left fiber image and right fiber image become similar. (Display 3)

## 8. Adjust the polarizer and the analyzer

(1) In the case of "PMALIN MAX"

Adjust the polarizer and the analyzer, so that the value of the power meter becomes maximum.

(2) In the case of "PMALIN MAX"

Adjust the polarizer and the analyzer, so that the value on the power meter becomes minimum.

## 9. Press the "SET" key

(1) At first, the splicer aligns the cladding in both X and Y fields and displays "XY ALIGNING" message. (Display 4)

(2) The splicer aligns the

(3) Then the splicer beeps 3 times after  $\theta$  axis alignment is finished and displays a "SET PM UNIT" message on the monitor. (Display 6)

10. Adjustment of the analyzer

(1) In the case of " PMALIN MAX"  
Adjustment of the analyzer is not needed.  
Go to next step.

(2) In the case of " PMALIN MIX"  
Rotate the analyzer about 90 degrees, so that the value of the power meter becomes maximum.

11. Press the "SET" key

(1) Press the "SET" key. The splicer aligns the core by RIDS.  
(2) The splicer will be in a pause state after alignment is done. (Display 7)

12. Press the "SET" key

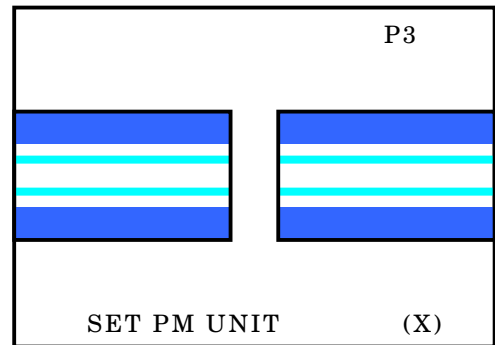
(1) Press the "SET" key again. Both fibers move toward each other again. The splicer sets a narrow gap between the fiber ends.  
(2) The splicer begins high voltage ARC fusion, and stuffs the left fiber forward the right fiber. (Display 8)  
(3) "FINISHED" message is displayed on the monitor after ARC fusion splicing. (Display 9)

13. Observe the splice point visually

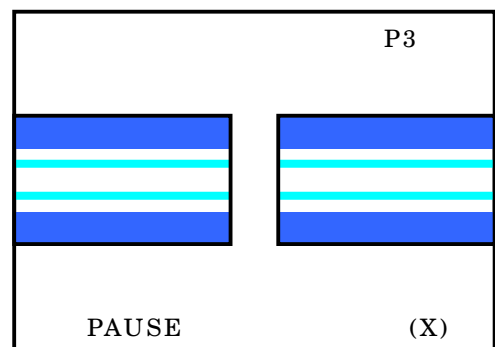
Observe the splice point visually. Refer to section 4.2.6.

14. Remove the spliced fiber

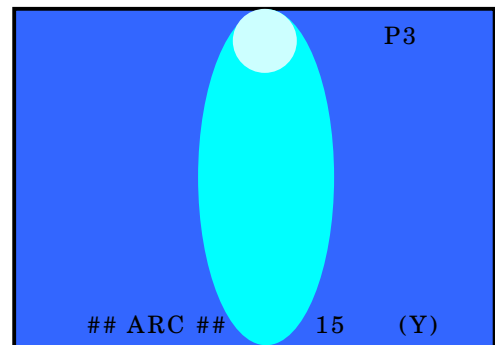
Remove the spliced fiber carefully. Refer to section 4.2.8.



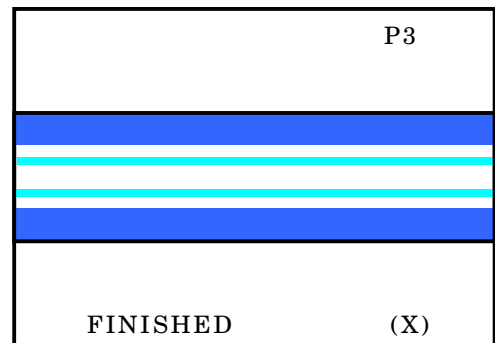
Display 6



Display 7



Display 8



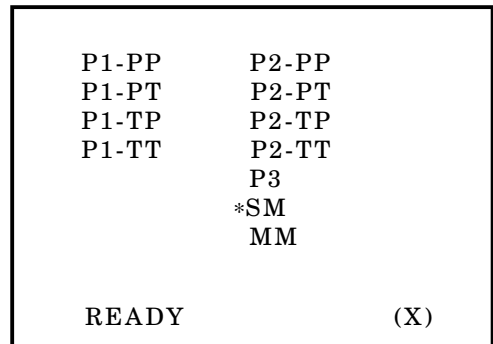
Display 9

### 4.3.4 SM mode

XY-axis alignment is performed by PAS in the case of SM mode. (PAS: Profile Alignment System)

#### 1. Splice Mode Selection

- (1) Ensure the splicer is "READY" state.
- (2) Select splice mode by pressing "MODE" key on the control box. (Display 1)



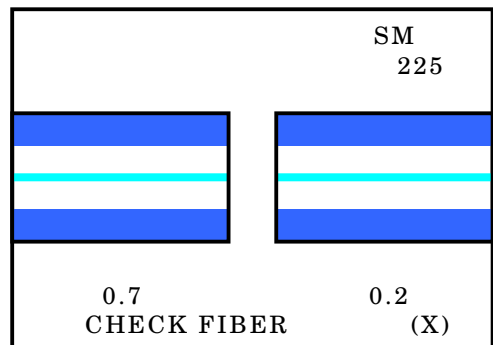
Display 1

#### 2. Fiber Setting

See the section 4.2.5.

#### 3. Press the "SET" key

The splicer operates cleaning ARC, initial gap setting and cleave angle check. "CHECK FIBER" message is displayed if "PAUSE1" is "ON" of the "OPTION SET." menu. (Display 2)

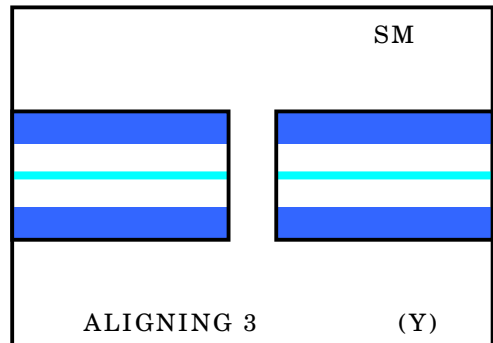


Display 2

#### 4. Automatic Splicing Procedure

- (1) Press the "SET" key to start splice process again if the splicer in PAUSE state ("PAUSE1").
- (2) At first the splicer aligns the clad. And next the splicer aligns core. (Display 3) Detail of each step is shown in the following table.

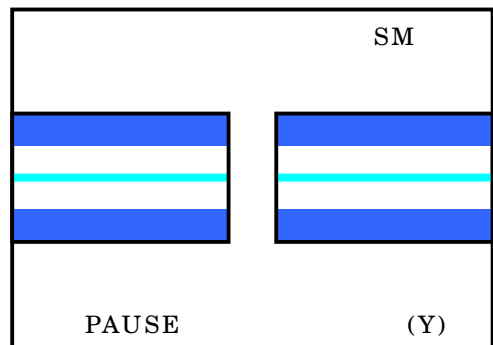
Message	Steps
ALIGNING 1	Clad aligning in X field Focus aligning in X field
ALIGNING 2	Core aligning in X field
ALIGNING 3	Core aligning in Y field



Display 3

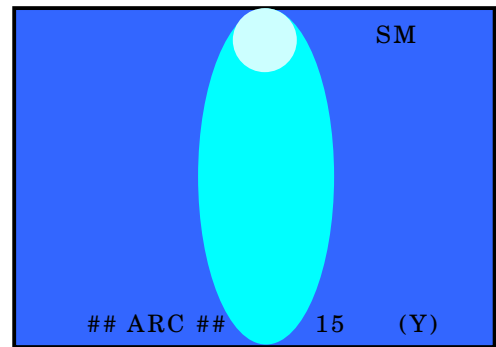
- (3) The splicer will be in a PAUSE state after all alignments are finished. (Display 4)

[NOTE] The splicer will be in a PAUSE state if "PAUSE2" is "ON" of the "OPTION SET" menu. The splicer displays "PAUSE" message on the monitor during PAUSE state. (Display 4) Refer to section 5.2.



Display 4

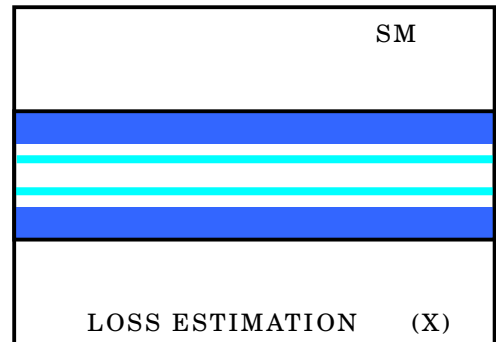
(4) Press the "SET" key to start splice process again if the splicer in PAUSE state ("PAUSE2"). Both fibers move toward each other again. The splicer sets a narrow gap between the fiber ends.



Display 5

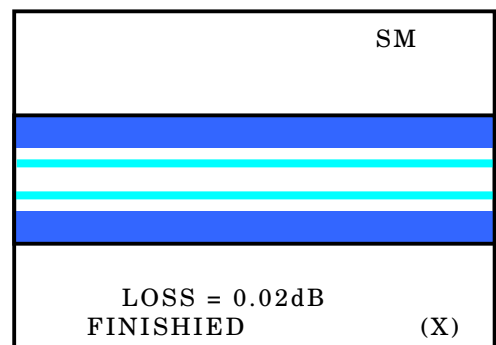
(5) The splicer begins high voltage ARC fusion, and stuffs the left fiber forward the right fiber. (Display 5)

(6) After the arc fusion splicing, the splicer measures the core axial offset value, and observes the splicing point. (Display 6)



Display 6

(7) After the arc fusion splicing, "FINISHED" message and the estimated splice loss are displayed on the monitor. (Display 7)



Display 7

5. Observe the splice point visually

Observe the splice point visually. Refer to section 4.2.6.

6. Remove the spliced fiber

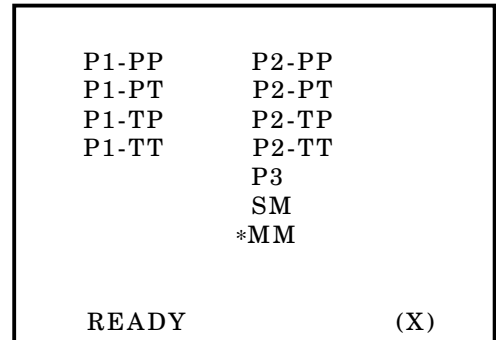
Remove the spliced fiber carefully. Refer to section 4.2.8.

#### 4.3.4 MM mode

XY-axis alignment is performed by PAS in the case of MM mode. (PAS: Profile Alignment System)

##### 1. Splice Mode Selection

- (1) Ensure the splicer is "READY" state.
- (2) Select splice mode by pressing "MODE" key on the control box. (Display 1)



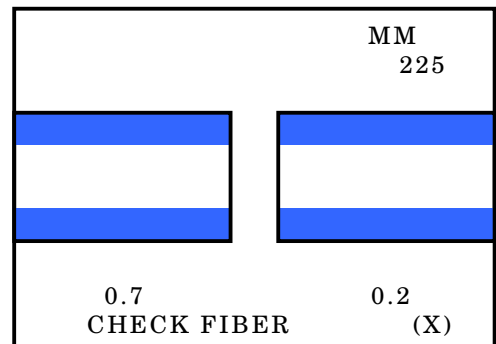
Display 1

##### 2. Fiber Setting

See the section 4.2.5.

##### 3. Press the "SET" key

The splicer operates cleaning ARC, initial gap setting and cleave angle check. "CHECK FIBER" message is displayed if "PAUSE1" is "ON" of the "OPTION SET." menu. (Display 2)



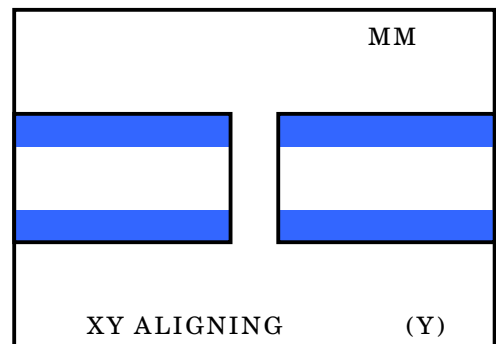
Display 2

##### 4. Automatic Splicing Procedure

(1) Press the "SET" key to start splice process again if the splicer in PAUSE state ("PAUSE1").

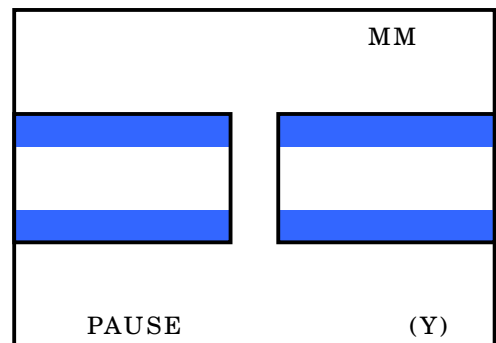
(2) The splicer aligns the clad in both X and Y fields. (Display 3)

(3) The splicer will be in a PAUSE state after all alignments are finished. (Display 4)



Display 3

[NOTE] The splicer will be in a PAUSE state if "PAUSE2" is "ON" of the "OPTION SET" menu. The splicer displays "PAUSE" message on the monitor during PAUSE state. (Display 4) Refer to section 5.2.

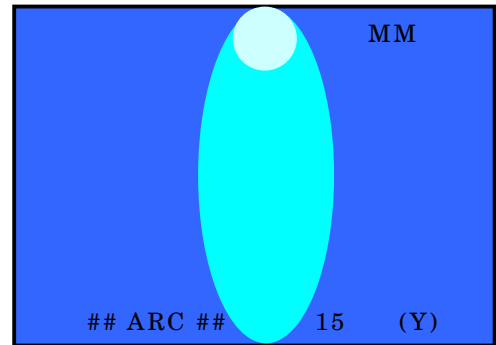


Display 4

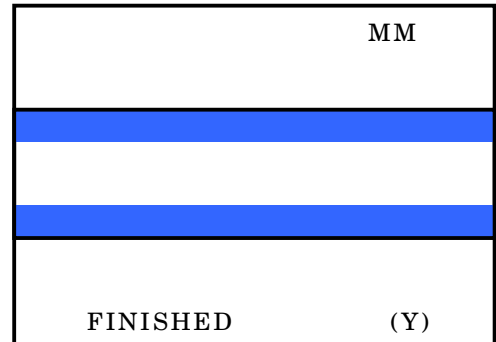
(4) Press the "SET" key to start splice process again if the splicer in PAUSE state ("PAUSE2"). Both fibers move toward each other again. The splicer sets a narrow gap between the fiber ends.

(5) The splicer begins high voltage ARC fusion, and stuffs the left fiber forward the right fiber. (Display 5)

(6) "FINISHED" message is displayed on the monitor after ARC fusion splicing. (Display 6)



Display 5



Display 6

5. Observe the splice point visually

Observe the splice point visually. Refer to section 4.2.6.

6. Remove the spliced fiber

Remove the spliced fiber carefully. Refer to section 4.2.8.

# 5. MENU COMMANDS

This splicer maintains conditions and splice data results in a non-volatile memory. Functions used for settings and maintenance are also maintained.

## 5.1 Optional Function Setting

This splicer maintains conditions and splice data results in a non-volatile memory. Functions used for settings and maintenance are also maintained.

### 1. Splice Mode Selection

Ensure the splicer is in the "READY" state.

### 2. Press the "CONDITION" key

The discharge conditions of the current splice mode are displayed on the monitor by pressing the "CONDITION" key on the control box.

The parameters of the condition are a little different with each splice mode.

P1 mode

CONDITION SET		P1-**
* ARCPWR	12	
ARCTIME	3000(msec)	
FORWARD	40(msec)	
PREFUSE	180(msec)	
GAP	8	
ECF	NONE	
ANGLE	0	
READY		(X)

P2 mode

CONDITION SET		P2-**
* ARCPWR	12	
ARCTIME	2000(msec)	
FORWARD	40(msec)	
PREFUSE	180(msec)	
GAP	8	
ECF	0.40	
ANGLE	0	
READY		(X)

P3 mode

CONDITION SET		P3
* ARCPWR	12	
ARCTIME	2000(msec)	
FORWARD	40(msec)	
PREFUSE	180(msec)	
GAP	8	
ECF	0.40	
ANGLE	0	
PMALIN	MIN	
READY		(X)

SM mode

CONDITION SET		SM
* ARCPWR	12	
ARCTIME	2000(msec)	
FORWARD	40(msec)	
PREFUSE	180(msec)	
GAP	8	
ECF	0.40	
READY		(X)

MM mode

CONDITION SET		MM
* ARCPWR	12	
ARCTIME	3000(msec)	
FORWARD	40(msec)	
PREFUSE	300(msec)	
GAP	8	
ECF	NONE	
READY		(X)

Details of each parameter are shown below.

Parameter	Explanation
ARCPER	This parameter determines discharge current by bit unit. The possible range is 0 – 31 bit. The discharge current is approximately $10.0+0.3*DATA(mA)$ .
ARCTIME	Arc discharge time
FORWARD	Movement time of the left fiber during Arc discharge. If fiber stuff amount is not suitable, adjust this parameter.
PREFUSE	Heating time before stuffing. The fiber end surfaces must be slightly melted by preheating before stuffing. It is not needed to change this parameter usually. But if bubble often happens after splicing, changing PREFUSE may efficient.
GAP	The distance between both fiber ends just before the arc discharge. “Line” is the unit of the “GAP” value. One line is approximately 2um. It is not needed to change this parameter usually.
ECF	“ECF” is the acronym for Eccentricity Current Factor. It is not needed to change this parameter usually.
ANGLE	The rotational angle after $\theta$ axis alignment of the PM fiber. Unit is degree. The left fiber rotates by this amount after $\theta$ axis alignment.
PMALIN	Method for aligning PM fiber in P3 mode. It determines $\theta$ axis alignment is performed by MAX method or MIN method.  In the case of MIN aligning, $\theta$ axis alignment is done so that power meter reading should be minimum. It means the polarization axis of the polarizer and the analyzer are set 90 degrees difference. MIN method enables high precision aligning when measurement system has large dynamic range.  In the case of MAX aligning, $\theta$ axis alignment is done so that power meter reading should be maximum. It means the polarization axis of the polarizer and the analyzer are matched. MAX method is effective when measurement system doesn't have large dynamic range.

[NOTE] The discharge current is automatically compensated for atmospheric pressure.

### 5.1.1 Arc Parameter

#### 1. Select the Parameter

Move the "\*" symbol next to the parameter to be changed with "CONDITION" key. (Display 1)

#### 2. Change the Value

Press a Condition Input key on the control box to input new value.

Concerning the ranges and steps of each parameter, refer to the table, which follows.

#### 3. Store the Changed Value

Press the "ENT" key to store the changed value to the internal memory. (Display 2)

CONDITION SET	P3
ARCPWR	12
*ARCTIME	2000(msec)
FORWARD	40(msec)
PREFUSE	180(msec)
GAP	8
ECF	NONE
ANGLE	0
PMALIN	MAX
READY	(X)

Display 1

CONDITION SET	P3
ARCPWR	12
*ARCTIME	2800(msec)
FORWARD	40(msec)
PREFUSE	180(msec)
GAP	8
ECF	NONE
ANGLE	0
PMALIN	MAX
READY	(X)

Display 2

Parameter	Minimum	Maximum	Step	Unit
ARCPER	0	31	1	bit
ARCTIME	0	65000	1	msec
FORWARD	0	1000	1	msec
PREFUSE	0	1000	1	msec
GAP	0	32	2	Line
ECF	0	0.99	0.01	-
ANGLE	0	360	1	deg
PMALIN	MIN or MAX		-	-

### 5.1.2 PMALIN MIN or MAX

#### 1. Select "PMALIN

Move the "\*" symbol next to "PMALIN" with "CONDITION" key.  
(Display 1)

#### 2. SELECT "MIN" or "MAX"

##### (1) To select "MIN"

Press "0" key, and next press "ENT" key on the control box.

##### (2) To select "MAX"

Press "1" key, and next press "ENT" key on the control box. (Display 2)

CONDITION SET	P3
ARCPWR	12
ARCTIME	2000(msec)
FORWARD	40(msec)
PREFUSE	180(msec)
GAP	8
ECF	NONE
ANGLE	0
*PMALIN	MIX
READY	(X)

Display 1

CONDITION SET	P3
ARCPWR	12
ARCTIME	2000(msec)
FORWARD	40(msec)
PREFUSE	180(msec)
GAP	8
ECF	NONE
ANGLE	0
*PMALIN	MAX
READY	(X)

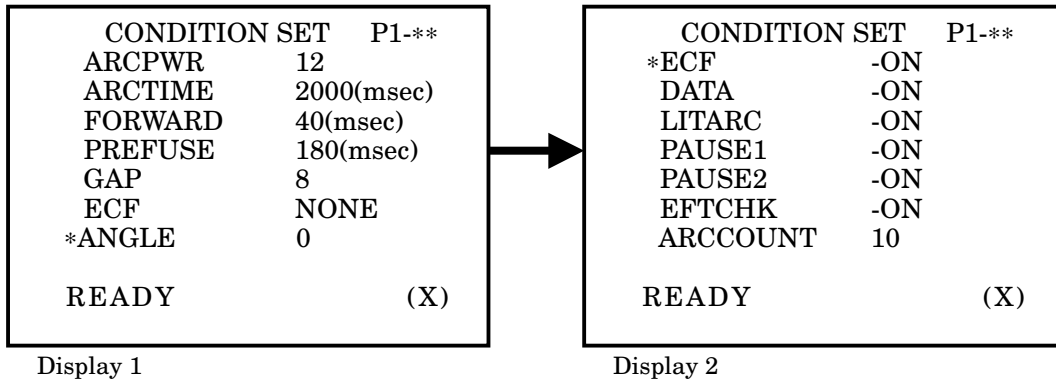
Display 2

## 5.2 Option Set Setting

### 1. Select the "Condition Set"

The discharge conditions are displayed on the monitor by pressing the CONDITION key. Move the "\*" symbol to the bottom parameter and press the CONDITION key again.

"OPTION SET" menu is displayed on the monitor. "OPTION SET" functions are common to all splice modes.



Function	Meaning
ECF	ECF function works at the core axis aligning. Refer to section 7.4.
DATA	Displays axis offset data on the monitor during XY axis alignment. Refer to 7.3.
LITARC	A sort Arc discharge occurs to clean the fiber surfaces during the initial gap setting.
PAUSE1	The splicer pause after the initial gap setting. Cleave angles and "CHECK FIBER" message are displayed on the monitor.
PAUSE2	The splicer pause after aligning. Cleave angles, axial offset value and "PAUSE" message are displayed on the monitor.
EFTCHK	Cleave angles are displayed on the monitor. If cleave angle is too big, "ERROR 7" is displayed on the monitor.
ARCCOUNT	The number of Arcs. Check this number before changing electrodes.

## 2. Select the Parameter

Move the "\*" symbol next to the parameter to be changed with the "CONDITION" key.  
(Display 1)

CONDITION SET	P1-**
ECF	-ON
DATA	-ON
LITARC	-ON
*PAUSE1	-ON
PAUSE2	-ON
EFTCHK	-ON
ARCCOUNT	10
READY	(X)

Display 1

## 3. Select ON or OFF

### (1) Select ON

Press "1" key, and next press "ENT" key on the control box.

### (2) Select OFF

Press "0" key, and next press "ENT" key on the control box. (Display 2)

CONDITION SET	P1-**
ECF	-ON
DATA	-ON
LITARC	-ON
*PAUSE1	-OFF
PAUSE2	-ON
EFTCHK	-ON
ARCCOUNT	10
READY	(X)

Display 2

## 4. Arc Count Clear

Move the "\*" symbol next to the "ARC COUNT" with the "CONDITION" key.  
(Display 3)

Press "0" key, and next press "ENT" key on the control box. (Display 4)

CONDITION SET	P1-**
ECF	-ON
DATA	-ON
LITARC	-ON
PAUSE1	-ON
PAUSE2	-ON
EFTCHK	-ON
*ARCCOUNT	10
READY	(X)

Display 3

CONDITION SET	P1-**
ECF	-ON
DATA	-ON
LITARC	-ON
PAUSE1	-ON
PAUSE2	-ON
EFTCHK	-ON
*ARCCOUNT	0
READY	(X)

Display 4

### 5.3 Manual Motor Operation

The splicer has 9 independent motors, these can be manually operated when the splicer is in PAUSE state. (ex. READY, CHECK FIBER S/R, PAUSE)

Fibers can be aligned with this manual motor operation at PAUSE1 or PAUSE2. The motor indicator on the control box displays the selected motor. Select the motor with the motor select keys on the control box.

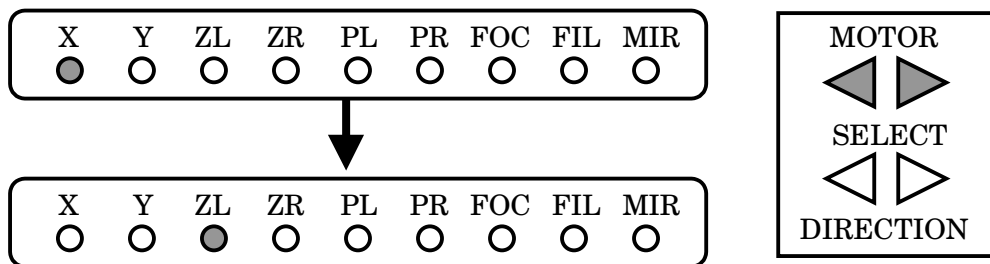
The motor can be operated with the motor direction keys on the control box. The motor moves while the key is pressed, and stops by releasing the key. Moving direction of each motor is shown in the following table.

Motor Indicator	Motor	Motor Direction Key	
		Left	Right
X	X	The right fiber moves upward on X field.	The right fiber moves downward on X field.
Y	Y	The left fiber moves upward on Y field.	The left fiber moves downward on Y field.
ZL	ZL	The left fiber moves backward.	The left fiber moves forward.
ZR	ZR	The right fiber moves backward.	The right fiber moves forward.
PL	$\theta$ Axis left	The left fiber rotates backward. (PLR)	The left fiber rotates forward. (PLF)
PR	$\theta$ Axis right	The right fiber rotates backward. (PRR)	The right fiber rotates forward. (PRF)
FOC	FOCUS	The objective lens moves away form the fiber. (FAR)	The objective lens approaches the fiber. (NEAR)
FLE	FIELD	The fiber moves upward. (UP)	The fiber moves downward. (DOWN)
MIR	UP/DOWN MIRROR	Mirror moves to another side. (UP or DOWN)	Mirror moves to another side. (UP or DOWN)

[NOTE]  $\theta$  axis motor cannot move when the wind protector is open.

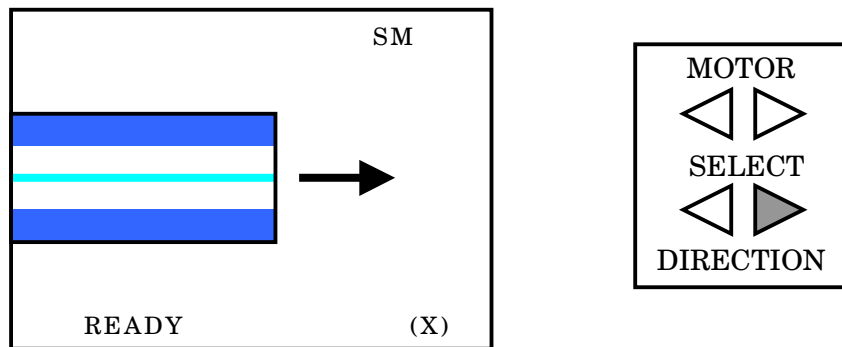
## 1. Select the Motor

Select the motor to move with the Motor select key.



## 2. Manual Operation

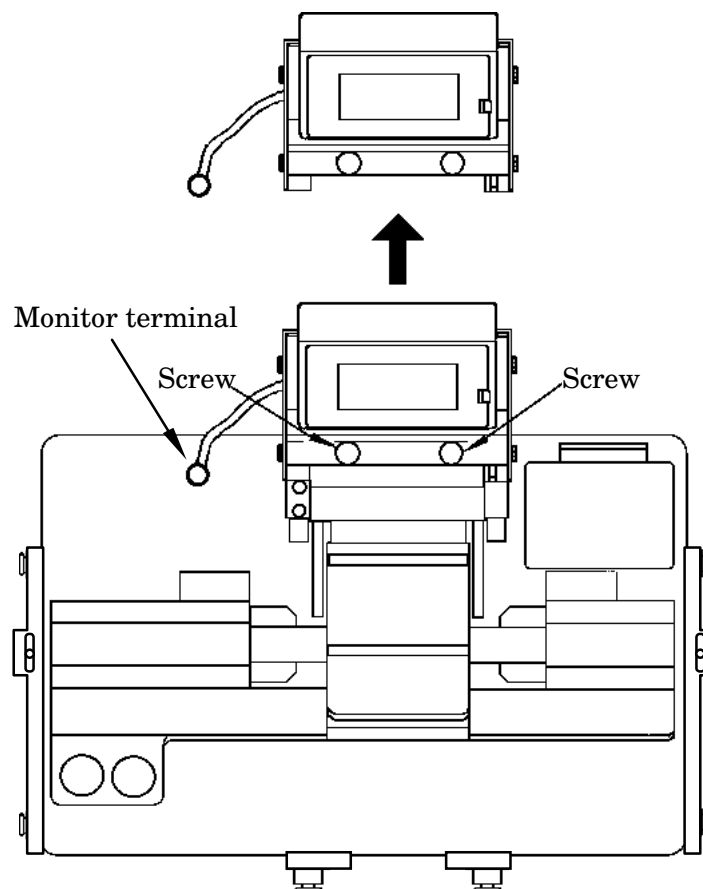
Press the motor direction key to move the motor. During pressing the motor direction key, the motor continues moving. When pressure is released, the motor stops moving.



## 5.4 Releasing Monitor

The LCD monitor on the splicer can be detached from the splicer. The following shows how to detach the monitor.

1. Turn off the power switch.
2. Detach the monitor terminal on the splicer.
3. Loosen two screws behind the wind protector and remove the monitor.
4. Connect the monitor extension cord between the monitor and the monitor terminal on the splicer.
5. Place the monitor beside the splicer.



# 6. DIP SWITCH FUNCTIONS

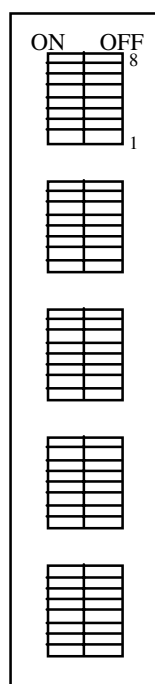


## WARNING

Safety glasses should always be worn during the fiber preparation and the splicing process. A glass fiber fragment can be extremely dangerous if it comes into contact with the eye, skin, or is ingested.

### 6.1 Dip Switch Functions

The splicer has five dip switches. The location and their functions are shown below.



## Dip Switch Functions

Switch No.		Bit	Function
Dip SW 1	LSB	1	Field change before aligning
		2	Discharge in X field view
		3	Not used
		4	ECF Aligning (usually must be ON)
		5	1.55um dispersion shifted fiber loss estimation
	MSB	6-8	Adjusted by each splicer. Never change these bits.
Dip SW 2		1	Adjusted by each splicer. Never change these bits.
		2	Loss estimation in P1-**, P2-**, P3,MM mode
		3-8	Adjusted by each splicer. Never change these bits.
Dip SW 3		1	Maintenance mode
		2-8	Adjusted by each splicer. Never change these bits.
Dip SW 4		1-8	Adjusted by each splicer. Never change these bits.
Dip SW 5		1-8	Adjusted by each splicer. Never change these bits.

### (1) Field Change before Aligning [Dip switch 1 Bit 1]

**OFF:** If gap set starts in X field, the splicer checks cleaved angle only in the X field, and starts alignment in the X field. Then field changes from X to Y, and cleaved angle in the Y field is checked. Cleaved angle of the Y field is checked after alignment in the X field is done.

If gap set starts in Y field, the cleaved angle in both Y and X field before alignment.

**ON:** If gap set starts in X field, the splicer checks cleaved angle both X and Y field. Then alignment starts.

If gap set starts in Y field, procedure is the same as “OFF”.

### (2) Discharge in X Field View [Dip Switch 1 Bit 2]

**OFF:** The splicer discharges in the field which alignment is finished.

**ON:** The splicer discharges in X field always so that discharge is visible.

(When discharge is done in Y field, discharge is not visible.)

### (3) ECF Aligning [Dip Switch 1 Bit 4]

**OFF:** Not ECF Aligning

**ON:** ECF Aligning in the case of SM, P2-\*\* and P3 mode

Refer to Section 7.4.

### (4) 1550nm Dispersion Shifted Fiber Loss Estimation [Dip Switch 1 Bit 5]

This function works in SM mode only.

OFF: Estimated splice loss is for 1300nm wavelength SM fiber.

"1.3um LOSS EST." is displayed during the reset operation.

ON: Estimated splice loss is for 1550nm wavelength DS fiber.

"1.55um LOSS EST." is displayed during the RESET operation.

(5) Loss Estimation in P1-\*\*, P2-\*\*, P3 and MM Mode [Dip Switch 2 Bit 2]

This function works in P1-\*\*, P2-\*\*, P3 and MM mode.

OFF: The splicer does not estimate splice loss.

ON: The splicer estimates the splice loss with clad axis offset.

## 6.2 Maintenance Mode

### 6.2.1 Select the Maintenance Mode

1. Confirmation of the "READY" state

Ensure that the "READY" message is displayed. Press the "RESET" key to enter the "READY" state if the "READY" message is not displayed.

2. Select the Maintenance Mode

(1) Turn Dip SW 3 bit 1 ON. The maintenance mode menu is displayed.

"\*" symbol shows the selected function. (Display 1)

(2) Move "\*" to the required function with the "CONDITION" key.

(3) To escape from the maintenance mode, turn Dip SW 3 bit 1 OFF.

MAINTENANCE MODE	SM
*1 XY RESET	
2 STUFF MEASURE	
3 ELECTRODE	
4 CENTER SHIFT	
5 TFFMXY	2500
6 TFMXY	1200
7 TFFMYX	2400
8 TFMXYX	1250
READY	(X)

Display 1

### 6.2.2 XY RESET

This function is used to move X and Y motors to their home positions.

1. Select the "XY RESET"

Move the "\*" symbol next to "XY RESET" with "CONDITION" key. Then press the "SET" key.

2. XY Reset

"X, Y RESET wait 2 minute" message is displayed. Wait until this message disappears.

### 6.2.3 Stuff Measure

This function measures the stuffing amount of left hand side fiber. The left fiber automatically stuffs towards the right fiber during discharge. The stuff amount is very important for splice quality.

#### 1. Selection of "STUFF MEASURE"

Display "Maintenance Mode" menu and move "\*" symbol next to the "STUFF MEASURE"

#### 2. Execution of the "STUFF MEASURE"

Set both left and right fibers onto the V-grooves before starting this function. The fiber ends must be cleaved precisely.

Then press the "SET" key. The splicer checks stuff amount automatically.

#### 3. Stuff Check Process

The splicer automatically proceeds with the following steps.

##### (1) Gap setting and Cleaning Arc

Both fibers move forward and a cleaning Arc occurs. Then both fibers stop when distance between the fiber ends be proper.

##### (2) Stuffing and measurement

The right fiber moves backward, and the left fiber stuffs forward. Then the splicer measures and displays the stuff amount of the left fiber.

##### (3) Calculate average

In order to eliminate the effect of any variability of the stuff amount, perform this function at least 5 times, and calculate average of the results. Acceptable stuff amount is from 26um to 32um.

##### (4) Adjustment of Stuff Amount

If stuff amount is not acceptable, please increase or decrease "FORWARD" time. Concerning adjustment of the "FORWARD" parameter, refer to Section 5.1.1.

##### (5) Quit from the Stuff Check Function

Press the "RESET" key.

### 6.2.4 ELECTRODE

This function is used to adjust the gap set position. This function is only for trained personnel.

### 6.2.5 CENTER SHIFT

This function is used to adjust the relationship of X field gap set position and Y field gap set position. This function is only for trained personnel.

### 6.2.6 TFFMXY, TFMXY, TFFMYX, TFMXY

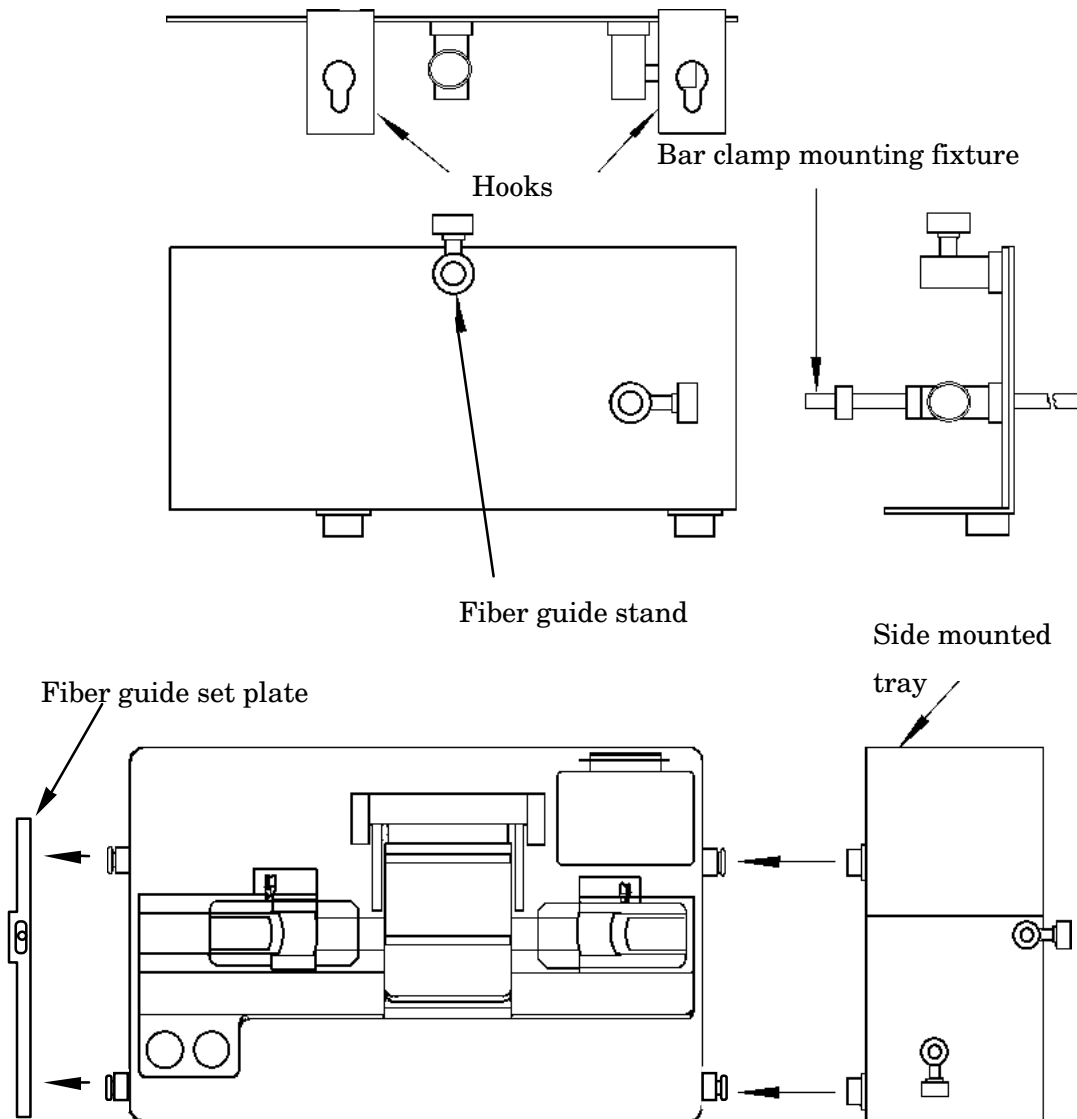
These parameters show the moving time of FOCUS and FIELD motors during field exchange. This function is only for trained person.

# 7. OHTERS

## 7.1 Side Mounted Tray and Bar Clamp (OPTIONS)

### 7.1.1 Side Mounted Tray

The side mounted tray has hooks to attach to the hanger on the splicer main body. The side mounted tray includes a mounting fixture for the bar clamp and a mounting fixture for the fiber guide. The following figure shows the side mounted tray.

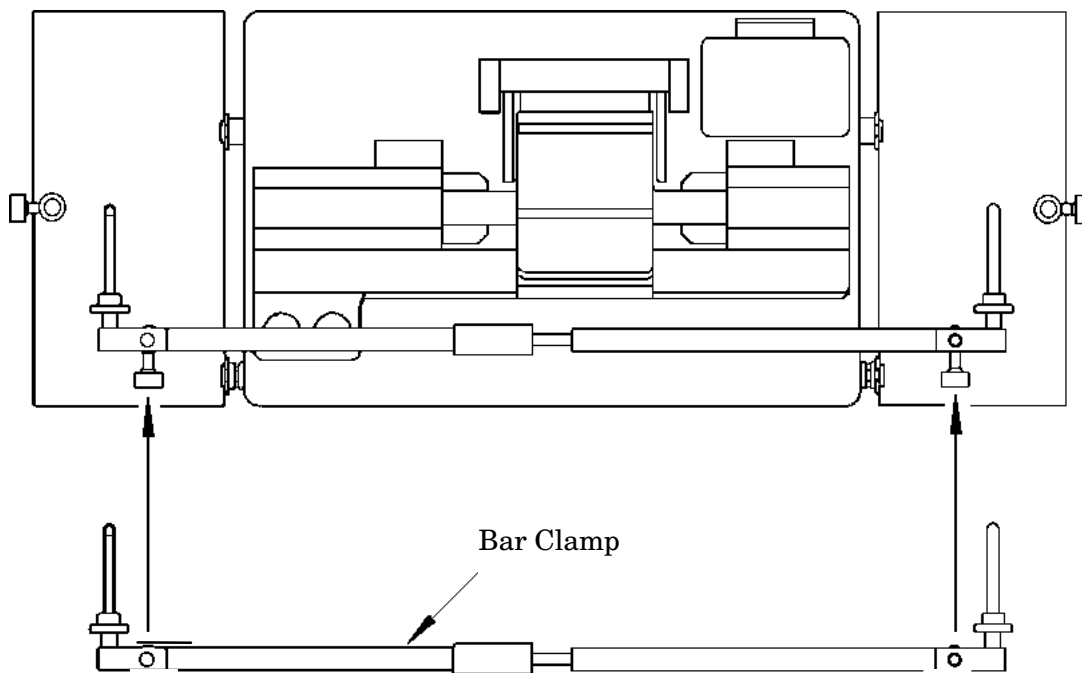


## 7.1.2 Bar Clamp

The bar clamp prevents the optical fiber from twisting when removing the fiber after splicing.

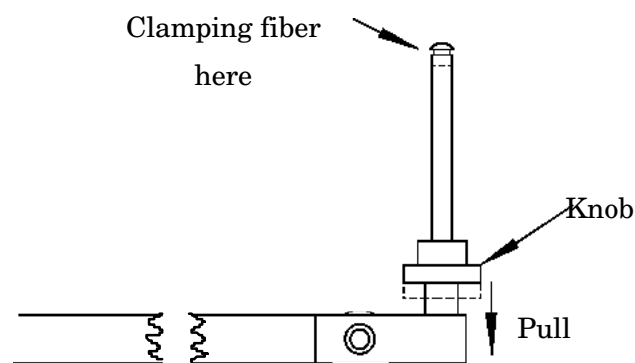
### 1. Fit up the Bar Clamp

Fit up the bar clamp to bar clamp mounting on the side mounted tray. The bar clamp and side mounted tray are options.



### 2. Nip the fiber

Pull the knob of the bar clamp and nip the optical fibers.



3. Release the sheath clamp

Pull the sheath clamp release lever.

[NOTE] Do not press the "RESET" key, while sheath clamp is not released.

## 7.2 Adjustment of ARC Power

- (1) Select "SM" mode.
- (2) Select DATA-ON to display data during splicing.

		SM	
<u>A</u>		<u>E</u>	
<u>B</u>		<u>F</u>	
<u>C</u>		<u>G</u>	
<u>D</u>		<u>H</u>	
<u>a1</u>	<u>a2</u>	<u>a3</u>	<u>a4</u>
<u>b1</u>	<u>b2</u>	<u>b3</u>	<u>b4</u>
LOSS = 0.02dB			
FINISHED		(X)	

Display 1

- A : Core axis offset after aligned in (Y) [ line ]
- B : Core axis offset after aligned in (X) [ line ]
- C : Core axis offset after spliced in (Y) [ line ]
- D : Core axis offset after spliced in (X) [ line ]
- E : Fiber axis offset after aligned in (Y) [ line ]
- F : Fiber axis offset after aligned in (X) [ line ]
- G : Fiber axis offset after spliced in (X) [ line ]
- H : Fiber axis offset after spliced in (Y) [ line ]
- a1-a4 : Eccentricity on each inspection point of left fiber [ line ]
- b1-b4 : Eccentricity on each inspection point of right fiber [ line ]
- 1 [ line ] = about 0.6 um

(3) Prepare an optical fiber that has large core/cladding eccentricity.

(4) Discharge power is appropriate if the difference between E and G and the difference between F and H are within 1 line after splicing.

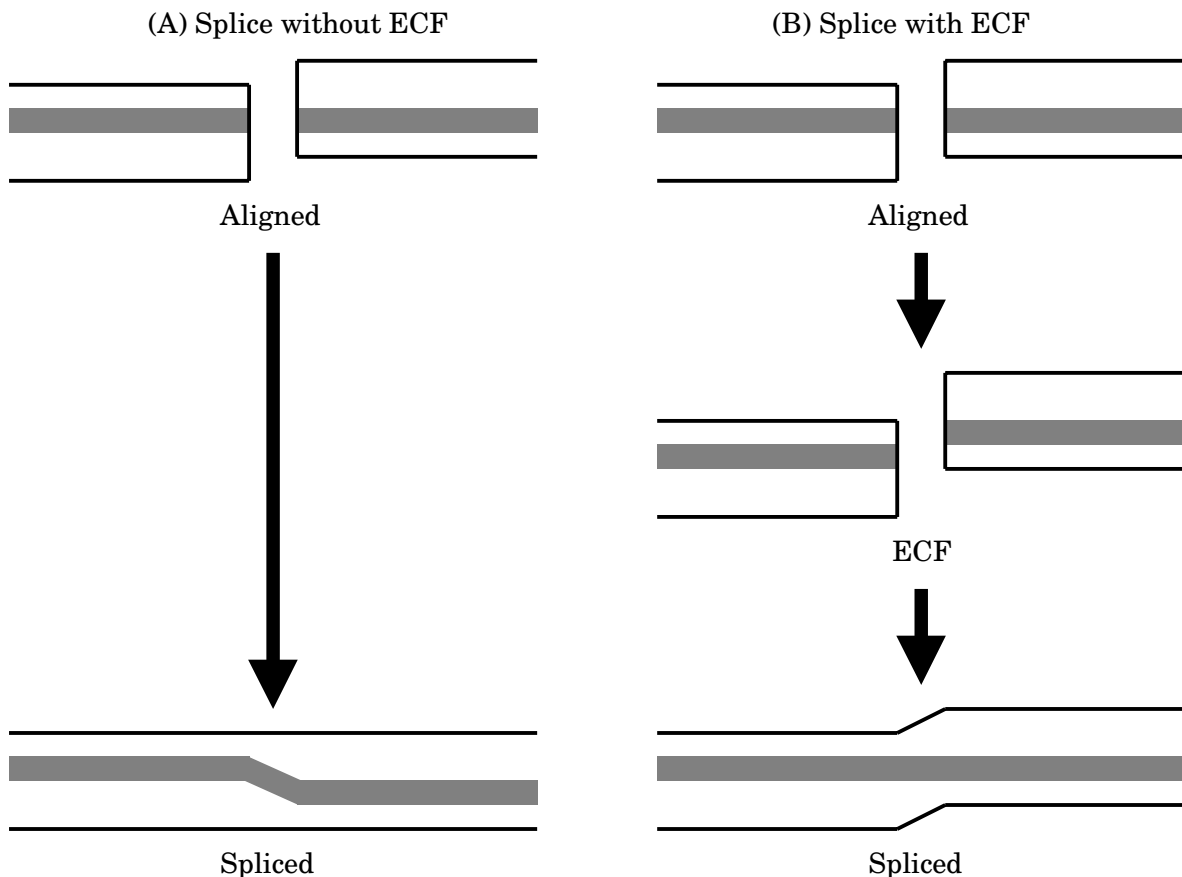
Discharge power is too weak if  $|G| > |E|$  and  $|H| > |F|$

Discharge power is too strong if  $|G| < |E|$  and  $|H| < |F|$

### 7.3 ECF (Eccentricity Correction Function)

When optical fibers are spliced, surface tension of the molten glass tends to draw the cladding into alignment. If core eccentricity is present, the splicer core alignment process (before the splice) will align the fiber cores. Because of the eccentricity, the cladding will therefore be miss aligned. The surface tension of the molten glass during the fusion arc will tend to draw the cladding into self-alignment, causing the loss of core alignment, and high splice loss, as in (A) below.

To compensate for this tendency, this splicer is provided with the Eccentricity Correction Function (ECF). With the use of the ECF function, the splicer calculates the amount of cladding self-alignment motion which will occur due to surface tension. The splicer therefore corrects for the surface tension by applying an intentional core offset during the alignment process. The intentional core offset will be eliminated by the surface tension motion effect, resulting in perfect core alignment at the end of the fusion arc, as shown in (B) below.



## 7.4 ECF Aligning Mode and Two Step Aligning Mode

This splicer can splice SM fiber with low splice loss by adopting ECF, regardless of the core eccentricity. (refer to section 7.3.) There are two ECF modes as follows.

### 1. Two Step Aligning Mode

The fiber core is aligned first and then the fiber axis is offset according to the required ECF factor. This is called "Two Step Aligning Mode".

### 2. ECF Aligning Mode

The fiber axis is directly aligned to the best position including the ECF offset. Standard setting for this splicer is ECF aligning mode.

### 3. Mode Selection

Two Step Aligning Mode : Dip Switch 1 Bit 4 OFF

ECF Aligning Mode : Dip Switch 1 Bit 4 ON

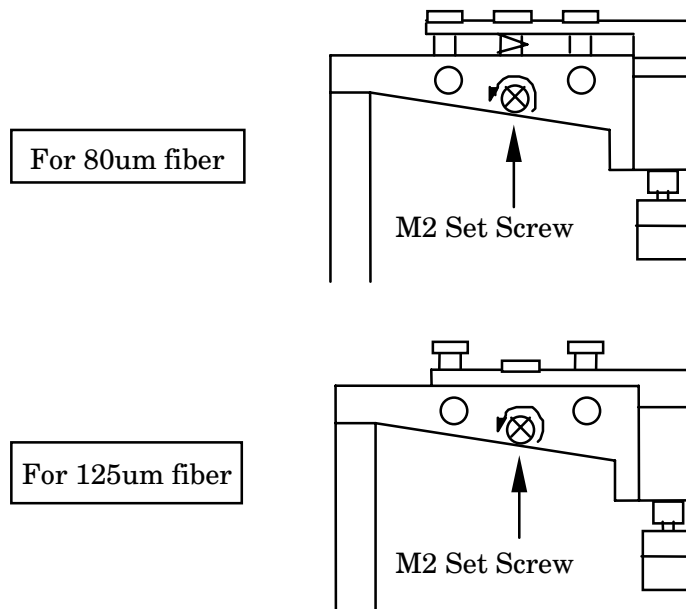
### 4. Data Display on the Monitor

Offset data displayed on the monitor is not affected by ECF.

When ECF is OFF, the splicer works without ECF. "ECF ALIGNING" message is displayed on the monitor during the RESET operation when "ECF Aligning Mode" is selected.

## 7.5 Adjustment of the Fiber Clamp Strength

This splicer is basically adjusted for 125um fibers. To splice 80um fibers, loosen the M2 set screw to reduce the fiber clamp strength. Then tighten the M2 set screw. To return to the fiber clamp strength for 125um fibers, loosen the M2 set screw, press the spring plate down and tighten the M2 set screw.



The ARC conditions for 80um fibers are approximately

ARCPWR : 8  
PREFUSE : 100 [msec]  
GAP : 6

Other discharge conditions are the same as 125um fibers.

# 8. MAINTENANCE



## WARNING



During arc discharge, the electrodes generate very high voltage. The following prevents form personal injury and/or equipment damage caused by the high electrical voltage.

- Make sure no water or liquid is present on the equipment.
- Never touch the electrodes.
- Before operation, connect the equipment to the electrical ground (earth).
- When using an AC power source, use the AC power cord attached. It connects to electrical ground through the third pin of the AC plug.
- Make sure the power switch is off when the power cord is plugged in or out.
- Turn the power switch off and disconnect the power cord before the electrodes, the fuse or the up/down mirror is replaced.



Dangerous electrical voltages are present inside this equipment. Failure to maintain the equipment properly may result in personal injury and/or equipment damage.



## CAUTION



Set the electrodes into the correct position during replacement. Failure to place the new electrodes into the proper position may results in abnormal discharge, and damage to the equipment.



Always replace the electrodes as a pair.



Use only alcohol to clean the objective lens, mirrors, v-groove, sheath clamp, fiber clamp, LCD monitor and body. Any other chemicals may cause blurring, discoloration or deterioration.



Keep the equipment free from sand or dust. Never clean the v-groove with a hard material or rough object. Doing so will damage the surface, and degrade the performance.



Precise adjustment and alignments have been made to all parts of this equipment before shipping. Do not loosen any screws or make any modifications to the equipment other than electrodes, up/down mirror and fuse replacements. If you encounter some problem with the equipment, please contact a sales agency.

This equipment consists of very precise parts and a high resolution image processing unit in order to observe and align the fiber cores precisely. Dust and dirt on the mechanical and optical parts may affect the splicing quality dramatically. To maintain the best operating condition, daily or period maintenance is very important.

## 8.1 Cleaning

### 8.1.1 Cleaning of V-groove

#### 1. Turn the Splicer OFF

(1) Open the wind protector to raise the up/down mirror to the up position.

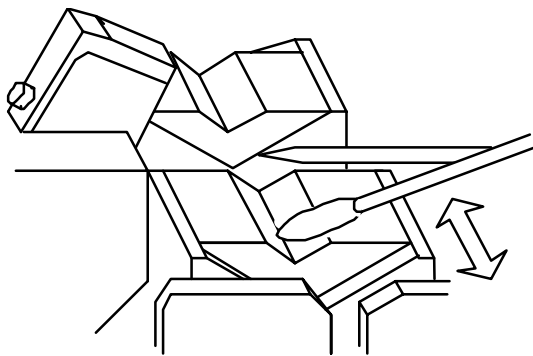
(2) Turn the splicer OFF and raise the fiber clamps.

[NOTE] The alcohol must be 99% or greater in purity. Low purity alcohol causes dirt, impurities, or residue to remain in the v-groove.

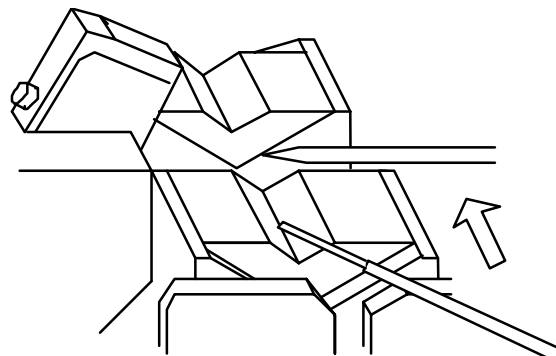
#### 2. Clean the V-groove

(1) Wipe the V-groove with cotton swab dampened alcohol.

(2) An alternate procedure is to scrape the bottom of the V-groove with the end face of a cleaved fiber as shown below.



Clean with cotton swab



Clean with a cleaved fiber

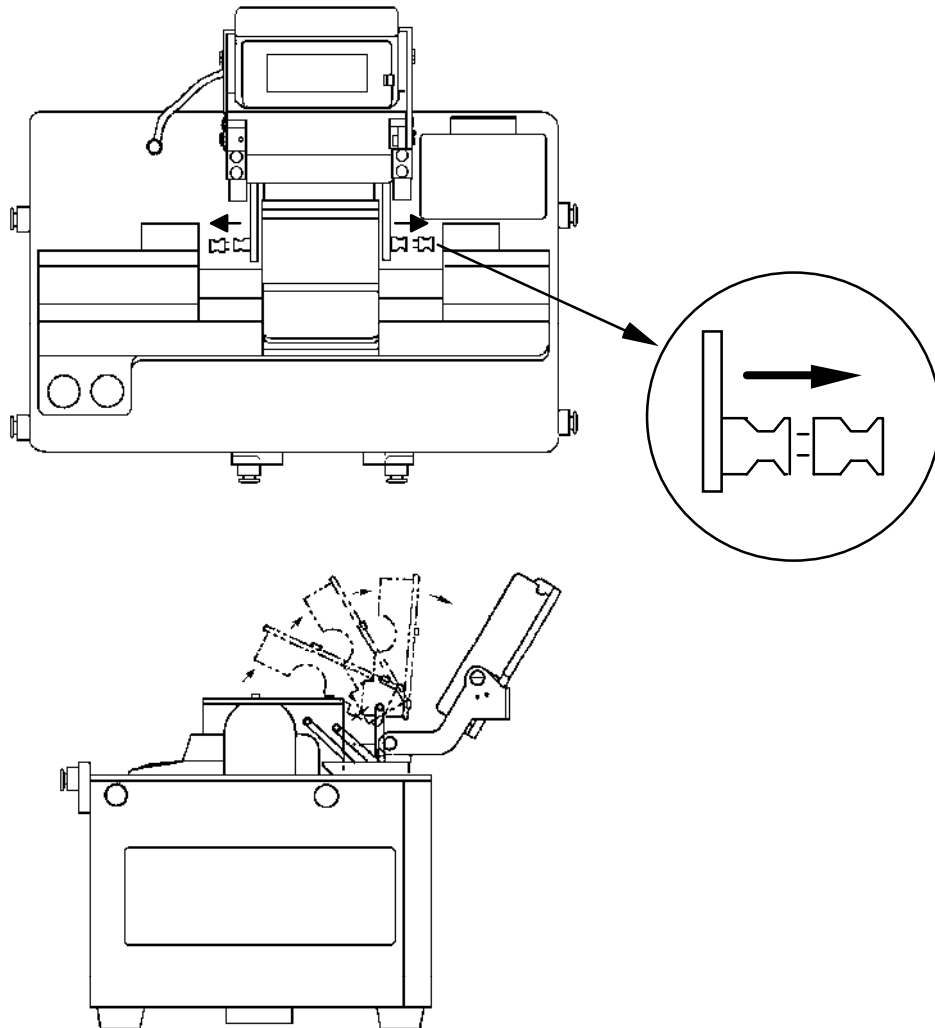
## 8.1.2 Cleaning of Objective Lens

### 1. Turn the Splicer OFF

- (1) Open the wind protector to raise the up/down mirror to the up position.
- (2) Turn the splicer OFF and raise the fiber clamps.

### 2. Open the wind protector.

Detach the wind protector handles, and open the wind protector fully.



### 3. Sliding the Positive Electrode

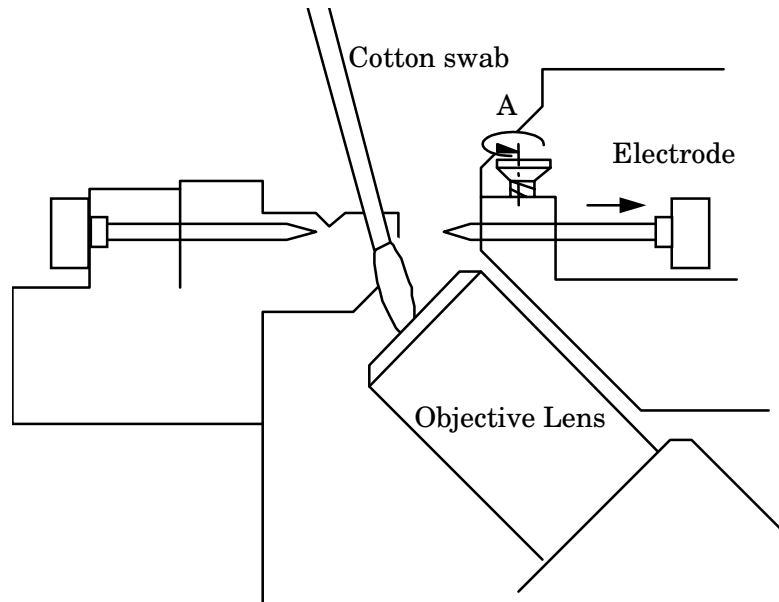
- (1) Remove the electrode cover.
- (2) Loose two screws (A) which secures the electrode fixture. Slide the positive electrode backward to expose the objective lens.

[NOTE] Just loosen the two screws, and do not remove the v-groove fixture or the screws.

#### 4. Wiping the Objective Lens

- (1) Examine the surface of the objective lens. If there is any large visible dirt or dust particles, blow these off with an air bulb.

[NOTE] Never use a canned air type cleaner to remove the dust.



- (2) Wipe the objective lens with a cotton swab dampened with alcohol on one end. Use the dry end of the swab to wipe away any remaining alcohol residue.

[NOTE] The alcohol must be 99% or greater in purity. Low purity alcohol causes dirt, impurities, or residue on the objective lens.

#### 5. Setting the Electrode in Place

- (1) Push the electrode back into proper position on the v-groove of the electrode base, and gently tighten the two screws. Be careful not to over-tighten the screws.

[NOTE] When tightening the two mounting screws (A), continue to push the electrode flange against the electrode base. Failure to secure the electrode in the proper position will result in abnormal arc discharge.

- (2) Attach the electrode cover.
- (3) Close the fiber clamps and the wind protector.

## 6. Examination

- (1) Turn ON the splicer and ensure that there is no dust or dirt on the monitor screen.
- (2) Press the "ARC" key several times to check the arc discharge.

## 8.1.3 Cleaning of Mirrors

This splicer is equipped with two mirrors:

- (1) The up/down mirror
- (2) The mirror inside the wind protector

Dirt or dust on the mirrors interfaces the fiber image. Keep the mirrors clean by referring to the following procedures.

### 1. Turning the Splicer OFF

- (1) Open the wind protector to raise the up/down mirror to the up position.
- (2) Turn the splicer OFF and raise the fiber clamps.

### 2. Open the Wind Protector

### 3. Cleaning the Mirrors

- (1) Check the surface of the mirrors. If there is any large visible dirt or dust particles, blow these off with an air bulb.

[NOTE] Never use a canned air type cleaner to remove the dust.

- (2) Wipe the mirror with a cotton swab dampened with alcohol on one end. Use the dry end of the swab to wipe away any remaining alcohol residue.

[NOTE] The alcohol must be 99% or greater in purity. Low purity alcohol causes dirt, impurities, or residue on the mirrors.

- (3) Inspect and clean the mirror surface again if there is any dirt or dust remaining.
- (4) Close the wind protector.

## 4. Examination

Turn on the power switch and make sure there is no dust or dirt on the monitor.

#### 8.1.4. Cleaning of Fiber Clamp and Sheath Clamp

##### 1. Fiber Clamps

(1) Raise the fiber clamps.

(2) Wipe the fiber clamps with a cotton swab dampened with alcohol.

##### 2. Sheath Clamps

(1) Raise the sheath clamps.

(2) Wipe the sheath clamps with a cotton swab dampened with alcohol.

[NOTE] The alcohol must be 99% or greater in purity. Low purity alcohol causes dirt, impurities, or residue to remain on the fiber clamps or sheath clamps.

## 8.2 Replacement of Expendable Items

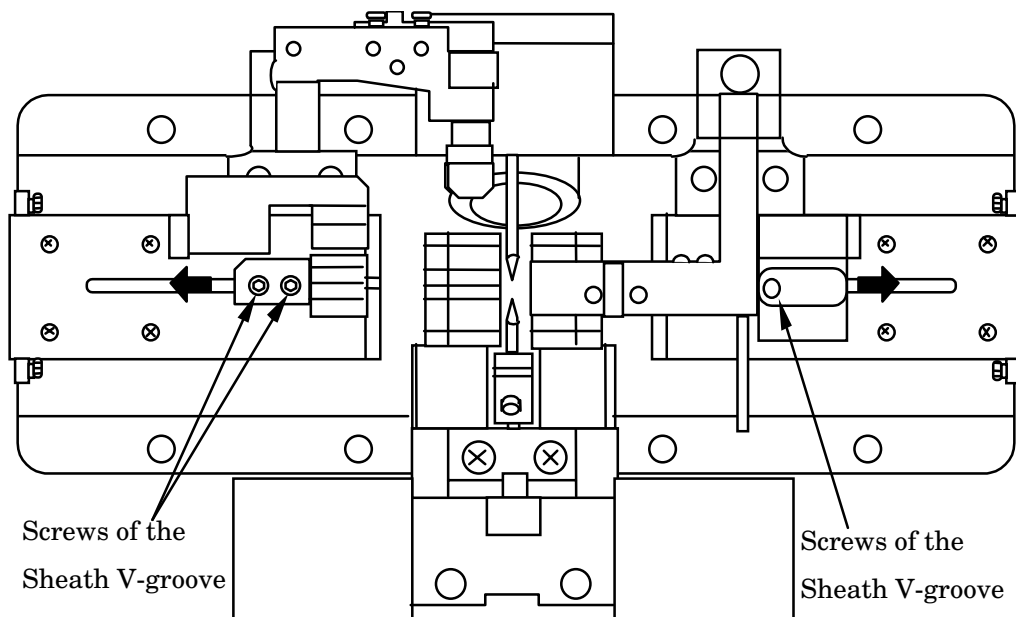
### 8.2.1 Exchange of Sheath V-groove and Sheath Clamp

This splicer is adjusted for 0.25mm coated fibers. To splice other diameter coated fibers, it is necessary to exchange the sheath V-groove and the sheath clamp.

- (1) Loosen the screws of the sheath V-grooves and the sheath clamps. Then remove the sheath V-grooves and the sheath clamps.
- (2) Look at the marks under the sheath V-grooves and the marks over the sheath clamps, insert them into each position correctly. The meaning of each mark is listed below.
- (3) Install the sheath V-grooves and the sheath clamps, pushing them in the direction of the lower figure.

Meaning of mark written on sheath V-grooves or sheath clamps

Mark	Side	Fiber coating diameter
2L	Left	0.22mm-0.25mm
2R	Right	0.22mm-0.25mm
4L	Left	0.4mm
4R	Right	0.4mm
9L	Left	0.9mm
9R	Right	0.9mm



## 8.2.2 Replacement of Electrodes

The electrodes are worn slightly by each arc discharge, and the tip shape will gradually become spherical. In such a case, high splice loss, abnormal discharge or fiber separation may occur. Replace the electrodes as a pair if the number of arc discharges exceeds 1000.

The following describes the replacement procedure.

### 1. Turn the Power switch OFF

- (1) Open the wind protector to raise the up/down mirror to the up position.
- (2) Turn the power switch off.

### 2. Open the wind protector.

Detach the wind protector handles, and open the wind protector fully.  
Refer to section 8.1.2.

### 3. Replacing the Electrode

See the next figure.

- (1) Remove the electrode cover.
- (2) Loosen four screws (A) which secures the electrode fixtures. Then remove the old electrodes.

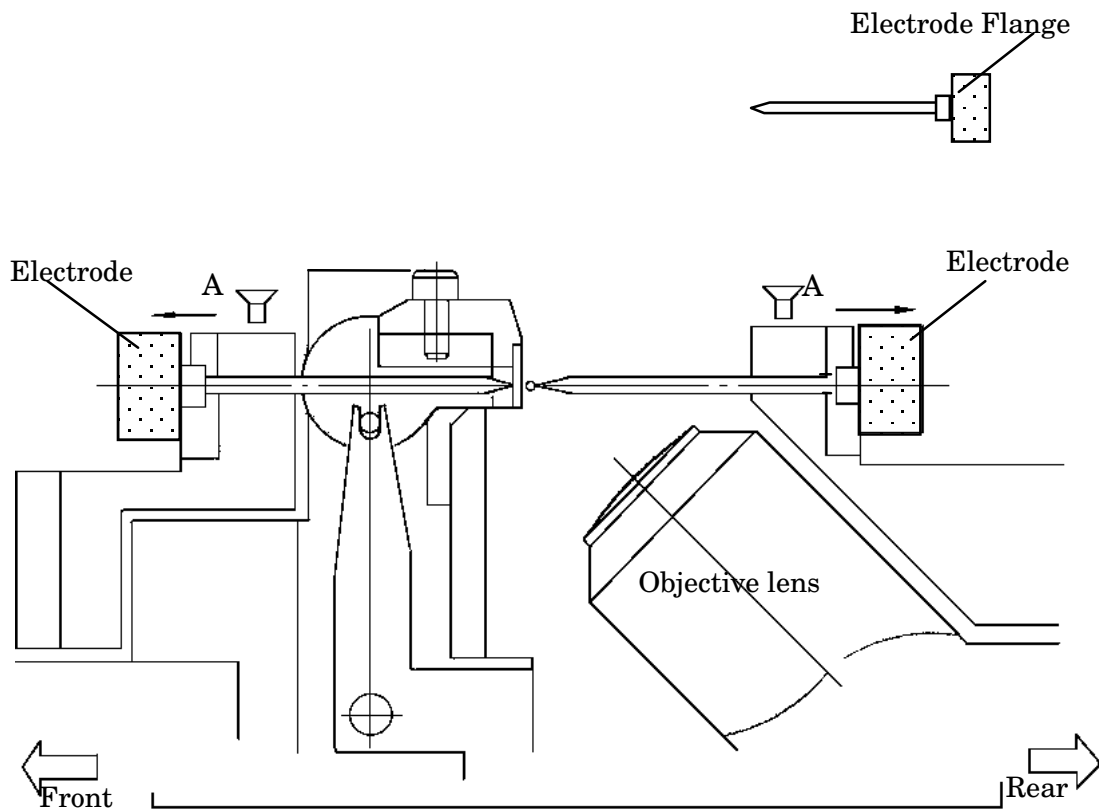
[NOTE] Just loosen the four screws, and do not remove the v-groove fixtures or the screws.

- (3) Clean the new electrodes with alcohol to remove the oil on the surface.
- (4) Insert the new electrodes into proper position in the v-groove of the electrode base, and gently tighten the four screws. Be careful not to over-tighten the screws.

[NOTE] While tightening the electrode mounting screws (A), push the flange of the rear electrode all the way forward against the electrode base, and push the flange of the front electrode all the way to the rear against the front electrode base. Failure to secure the electrodes in the proper position will result in abnormal arc discharge.

[NOTE] Be careful to ensure that the tips of the new electrodes are not damaged or bent, and do not contact or touch any part of the splicer.

- (5) Attach the electrode cover.
- (6) Close the wind protector.
- (7) Turn the splicer on.



#### 4. Resetting the Arc Count

Reset the arc count to zero. For details of this operation, refer to the Arc Count Clear Function of the maintenance menu, section 5.2.

#### 5. Examination

- (1) Turn the power switch on, and make sure that there is no dust or dirt on the monitor screen.
- (2) Press the "ARC" key several times to check the arc discharge.

### 8.2.3 Replacement of Up/Down Mirror

The up/down mirror should be replaced when non-removable dirt, a crack, a pit, or a broken point is observed. The splicer may not work properly if such defects are present.

#### 1. Turn the power switch OFF

- (1) Close the wind protector to lower the mirror to the down position.
- (2) Turn the power switch off.

#### 2. Open the wind protector.

Detach the wind protector handles, and open the wind protector fully.  
Refer to section 8.1.2.

#### 3. Sliding the Electrode Back

See the next figure.

- (1) Remove the electrode cover.
- (2) Loosen the four screws (D) which secure the electrode fixtures. Slide both of the electrodes backwards, away from the up/down mirror.

[NOTE] Just loosen the four screws, and do not remove the v-groove fixtures or the screws.

#### 4. Installing the New Mirror

- (1) Loosen the up/down mirror mounting screw (A) by using the hexagonal wrench included with the splicer. Remove the screw and the old defective mirror.
- (2) Set the new up/down mirror (B) onto the mirror base (C).
- (3) Tighten the screw (A) while pushing the mirror in the direction indicated by the arrow marked (E).

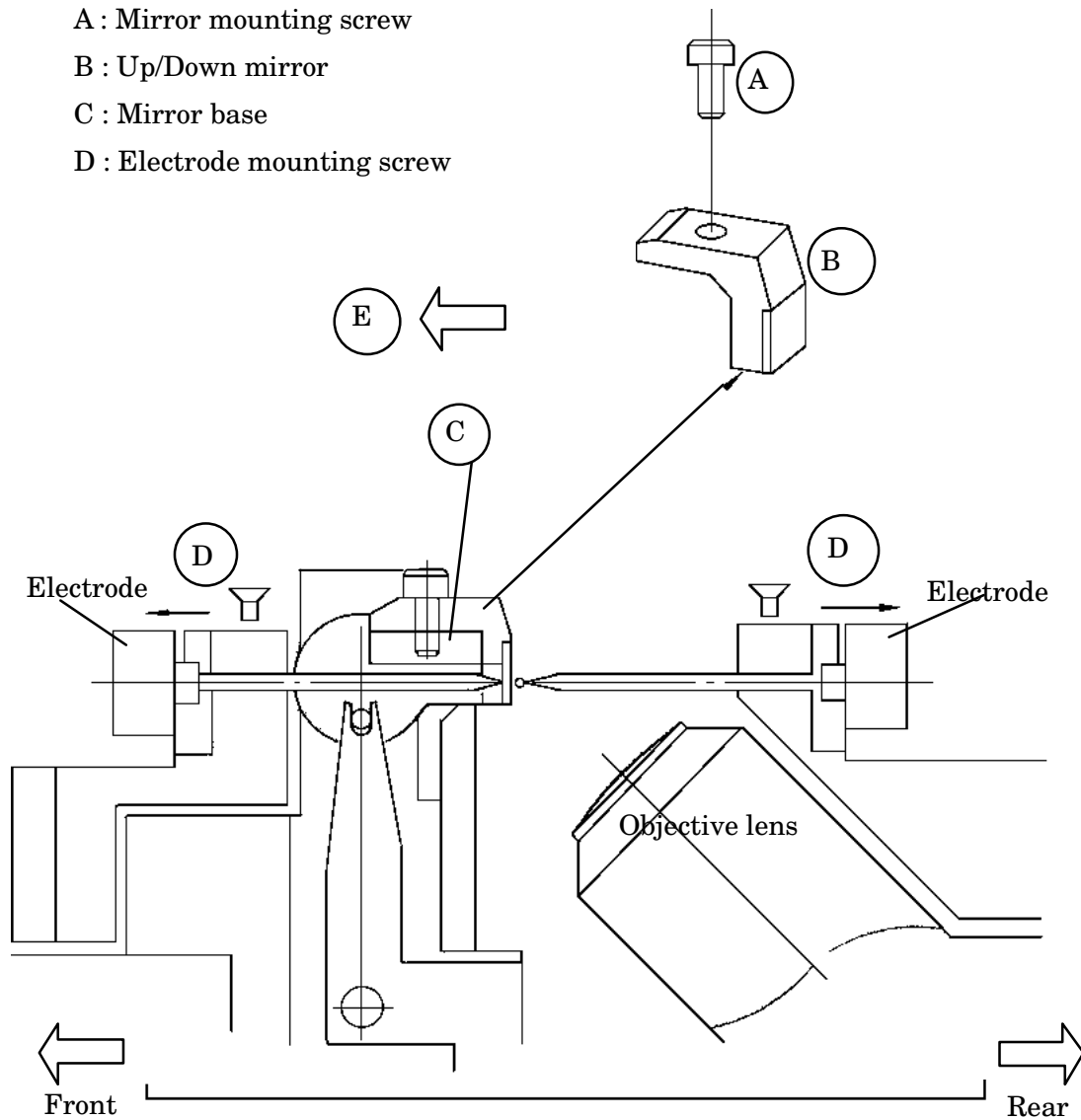
#### 5. Setting the electrode into place

- (1) Push the electrodes back into proper position on the v-groove of the electrode base, and gently tighten the four screws. Be careful not to over-tighten the screws.

[NOTE] While tightening the electrode mounting screws (D), push the flange of the rear electrode all the way forward against the electrode base, and push the flange of the front electrode all the way to the rear against the front electrode base. Failure to secure the electrodes in the proper position will result in abnormal arc discharge.

- (2) Attach the electrode cover.
- (3) Close the wind protector.
- (4) Turn the power switch on and press the "ARC" key several times to check the arc discharge.

- A : Mirror mounting screw
- B : Up/Down mirror
- C : Mirror base
- D : Electrode mounting screw



## 8.2.4 Replacement of Fuse of the splicer

### 1. Turning the Power Switch OFF

- (1) Turn the power switch off.
- (2) Remove the power cord from the socket on the side panel of the splicer.

### 2. Replacement of the Fuse

- (1) Open a cap of the fuse holder.
- (2) Install a 3.15A time lag fuse (20mm long). This fuse is for splicer.
- (3) Close the cap of the fuse holder.

[NOTE] Fuse for splicer and for control box is not the same. Be careful not to insert the wrong fuse.

### 3. Turn the Power Switch ON

- (1) Install the power cord.
- (2) Press the power switch toward the AC side, depending on which power source will be used.

[NOTE] If the fuse blows again, consult the sales agency. This could be an indication of an internal electrical short circuit, or some other problems.

## 8.2.5 Replacement of Fuse of the Control Box

### 1. Turning the Power Switch of the Control Box OFF

- (1) Turn the power switch of the control box off.
- (2) Remove the DC power cord from the DC IN terminal of the control box.
- (3) Remove the control cord from the SER-PORT terminal of the control box.

### 2. Replacement of the Fuse

- (1) Open a cap of the fuse holder.
- (2) Install a 0.5A fuse (20mm long). This fuse is for control box.
- (4) Close the cap of the fuse holder.

[NOTE] Fuse for splicer and for the control box is not the same. Be careful not to insert the wrong fuse.

### 3. Turn ON the Power Switch

- (1) Install DC power cord and control cord.
- (2) Turn ON the power switch of the control box.
- (3) Make sure one of the mode LEDs and one of the motor LEDs light.

[NOTE] If the fuse blows again, consult the sales agency. This could be an indication of an internal electrical short circuit, or some other problems.

# 9. TROUBLE SHOOTING

## 9.1 Motor Over Run

If a motor drives to the limit point, an alarm message appears on the monitor with eight beeps, and returns to the home position.

Message	Reason	Remedy
OVER RUN XF XR YF YR	-There is substantial dust on the V-groove. -The fiber is detached from the V-groove. -The primary coating of the fiber is not completely removed.	Clean the V-groove according to 8.1.1. Place the fiber again into the V-groove. Cleave the fiber again and repeat the entire procedure.
OVER RUN FOCUS NEAR FOCUS FAR FIELD UP FIELD DOWN	-The fiber is not set properly before automatic splicing.	The FOCUS motor and the FIELD motor will recover to their proper position automatically as soon as the "OVER RUN" error occurs. Place the fiber again on the V-groove.
OVER RUN ZLF ZLR	-The fiber is cleaved too short in length. -The fiber is detached from the V-groove.	Cleave the fiber to its proper length. *1 Place the fiber again into the V-groove.
OVER RUN ZLR ZLF	-The fiber moves to the back limit during manual operation	The splicer automatically returns to the "READY".
OVER RUN PLF PLR PRF PRR	$\theta$ axis moves to the forward limit or the back limit.	Place the fiber again on the V-groove. Clean the mirrors and objective lens. Make sure the fiber is clean.

\*1 : The cleave length must be 10mm-16mm for 0.22 and 0.25mm coated fiber, and 16mm only for 0.4mm and 0.9mm coated fiber.

## 9.2 Error Messages

If any error message is displayed on the monitor, press the "RESET" key. And refer to the following table showing possible causes and remedies.

Message	Reason	Remedy
ERROR 1 GAP SET ERROR	Gap set is not correctly.	Set the fiber again on the proper place.
ERROR 2 SET ERROR	Cleave length is too long.	Strip, clean, cleave and set the fiber again.
	Lens or mirror is dirty.	Clean the objective lens, the up/down mirror and the wind protector mirror.
	Electrode image is on the monitor.	Move field motor by manual operation so that electrode image doesn't appear on the monitor.
ERROR 3 TOO DARK	The wind protector is open.	Close the wind protector completely.
	Lens or mirror is dirty.	Clean the objective lens, the up/down mirror and the wind protector mirror.
	Up/down mirror doesn't move.	Consult the sales agency.
	Insufficient illumination	Consult the sales agency.
ERROR 4 FOCUS ERROR	FOCUS or FIELD position is not proper.	Consult the sales agency.
ERROR 5 DIRTY FIBER OR MIRROR	Fiber, lens or mirror is dirty.	Strip, clean, cleave and set the fiber again. Clean the objective lens, the up/down mirror and the wind protector mirror.
	The wind protector mirror angle is wrong	Consult the sales agency.
	Attempting to splice non corresponded PM fiber	Fiber with other than depressed index circular stress rods may require P3 mode splicing.
ERROR 6 FIELD EXCHANGE ERROR	Automatic field exchange operation doesn't work well.	Consult the sales agency.
ERROR 7 BAD CLEAVE	Cleave angle is larger than threshold.	Strip, clean, cleave and set the fiber again. Check the cleaver.
ERROR 8 MIRROR TROUBLE	Mirror motor doesn't work properly.	Consult the sales agency.
ERROR 9 ZL/ZR TROUBLE	ZL or ZR motor doesn't work properly.	Consult the sales agency.
ERROR 10 PL/PR TROUBLE	PL or PR motor doesn't work properly.	Consult the sales agency.

Message	Reason	Remedy
ERROR 11 UNDER RANGE	Detected level of power meter is too small.	In the case of P2 or P3 mode, the power of the incident light is under the detectable level of the power meter. Check fibers and connection. Set fiber again if the offset of fiber axis is large.
ERROR 12 GPIB INACTIBE	Power meter is not active.	In the case of P2 or P3 mode, the power meter is not active or GP-IB cord is not connected properly in the automatic aligning sequence. Check the power meter is on and GP-IB connection. Check the address switch of the power meter is TALK ONLY.
ERROR 13 LEVEL UNCHANGED	The level of power meter doesn't change.	X, Y, PL or PR motor doesn't move normally. Consult the sales agency or factory.
ERROR 14 COVER OPEN	Wind protector is open during PL or PR motor moving.	Close the wind protector and press RESET key.

**10. GUARANTEE  
and  
CONTACT ADDRESS**

## **10. Guarantee and Contact Address**

### **10.1 Guarantee**

#### **1. Guarantee period and limits**

In case that the splicer gets out of order within one year from the date of delivery, it will be repaired free of charge. However, warranty repair does not apply to the following cases regardless of the guarantee period:

- (1) Trouble or damage due to natural disaster.
- (2) Trouble or damage due to abnormal voltage supply.
- (3) Trouble or damage due to mishandling.
- (4) Trouble or damage due to handling in disregard of the operating procedures or instructions described in the instruction manual.
- (5) Consumables

#### **2. In case sending the tube heater back**

Please consult the nearest sales agency.

#### **3. Necessary information for the repair**

Attach papers to the splicer in order to inform us of details as described below.

- (1) Your full name, section, division, company, address, phone number and fax number.
- (2) Model name and serial number of the splicer.
- (3) Encountered Trouble
  - What is the symptom, and when did it happen?
  - What is the present state?etc.

#### **4. Transportation when sending the tube heater**

As the splicer is a high-precision machine, use the attached carrying case without fail for transportation, and storage in order to protect it against humidity, vibration and shock. When you request the nearest sales agency to have the tube heater repair, please send it together with its accessories.

## 10.2 Contact Address

Inquiries concerning this product should be made to the nearest sales agency or one of the following:

**Fujikura Europe Ltd.**

C51 Barwell Business Park Leatherhead Road, Chessington,  
Surrey KT9 2NY England

Tel. +44-20-8240-2000 (Service: +44-20-8240-2020)

Fax. +44-20-8240-2010 (Service: +44-20-8240-2029)

**Alcoa Fujikura Ltd.**

150 Ridgeview Circle Duncan, SOUTH CAROLINA 29334 U.S.A.

Tel. +1-800-AFL-FIBER

Fax. +1-864-433-5560

P.O.Box 3127 Spartanburg, SC 29304-3127

**Fujikura Asia Ltd.**

460 Alexandra Road #22-01 PSA Building Singapore 119963

Tel. +65-2711312

Fax. +65-2780965

**Fujikura Ltd. Export Department**

1-5-1 Kiba, Koto-ku, Tokyo 135-8512 Japan

Tel. +81-3-5606-1164

Fax. +81-3-5606-1534

----- End of Document -----

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**Read this instruction manual carefully before operating the equipment.  
Keep this instruction manual carefully.**

## 1. Warning and Cautions for Safe Operation

Thank you for purchasing Fujikura ARC Fusion Splicer. This instruction manual also includes safety requirements.

- Read this manual carefully before operating the ARC Fusion Splicer.
- Keep this manual carefully.

Fujikura Ltd. accepts no responsibility for personal injury or physical loss including equipment damage resulting from improper use or modification.

### Alert Symbol

This instruction manual indicates warnings and cautions by using alert symbols. It is important to understand these mean.



#### WARNING

There is a possibility of personal death or serious injury resulting from improper use by ignoring this indication.



#### CAUTION

There is a possibility of personal injury or physical loss resulting from improper use by ignoring this indication.

### Example of Alert Symbol



△ Symbol means “Pay Attention.”

The left symbol indicates “Pay attention to explosion.”



⊘ Symbol means “Must not do.”

The left symbol indicates “You must not disassemble.”



● Symbol means “Must do.”

The left symbol indicates “You must disconnect the AC power cord from the wall socket or the appliance inlet.”



## WARNING



(1) Do not attempt to use or operate this equipment before reading this instruction manual. Read and follow the all safety instructions and cautions contained in the manual.



(2) This equipment is designed for splicing the optical glass fiber for telecommunication. Do not attempt to splice any other types of fibers or any other materials.



(3) Safety glasses should always be worn during the fiber preparation and the splicing process. A glass fiber fragment can be extremely dangerous if it comes into contact with the eye, skin, or is ingested.



(4) Use only the power cord attached. An improper power cord may cause fire and/or equipment damage.



(5) The appliance inlet is used to disconnect the power cord when using the equipment. Be sure to position the equipment so that it is easy to disconnect the power cord.



(6) If the side ventilation holes are covered, high temperature inside the equipment may result in damage. Confirm the clearance of 2 inches between the ventilation holes and wall when placing the equipment.



(7) Check the AC or DC power source before turning on the equipment. Proper power source is AC100-240V, 50-60Hz (Max.3A). Using power source out of the proper range may cause personal injury and/or equipment damage.



(8) When using an AC power generator, check AC output voltage with a tester which can measure AC voltage. The AC output voltage from the generator must be within AC100-240V, 50-60Hz. Generating wrong high voltage over the specification is a common fault. Measuring the AC output voltage is necessary before every use.



(9) Do not remove or bypass any electrical or mechanical devices (e.g., a fuse or safety switch) incorporated into the design and manufacturing of this equipment.






(10) Never operate the equipment in an environment where flammable liquids, or vapor exists. Extremely dangerous fire and explosion may be resulted in with the splicer's electrical arc under such an environment.












(11) Spilled solvent or alcohol causes a fire hazard.



(12) Never use a canned air type cleaner to remove dust, or to clean the equipment. The electrical arc may ignite some remaining gas mixture.

	<p>(13) During arc discharge, the electrodes generate very high voltage. The following prevents form personal injury and/or equipment damage caused by the high electrical voltage.</p> <ul style="list-style-type: none"> <li>-Make sure no water or liquid is present on the equipment.</li> <li>-Never touch the electrodes.</li> <li>-Before operation, connect the equipment to the electrical ground (earth).</li> <li>-When using an AC power source, use the AC power cord attached. It connects to electrical ground through the third pin of the AC plug.</li> <li>-Make sure the power switch is off when the power cord is plugged in or out.</li> <li>-Turn the power switch off and disconnect the power cord before the electrodes, the fuse or the up/down mirror is replaced.</li> </ul>
	<p>(14) Dangerous electrical voltages are present inside this equipment. Failure to maintain the equipment properly may result in personal injury and/or equipment damage.</p>
	<p>(15)When carrying the carrying case using the shoulder belt, check the belt and hook for damage beforehand. Carrying the case with a damaged belt will cause the belt to break or come off and result in personal injury or equipment damage.</p>

 <b>CAUTION</b>	
	<p>(1) Attach the top cover to the equipment during the transportation.</p>
	<p>(2) Use carrying case and Z-unit stopper to transport and store the equipment. These will protect the equipment from damage, vibration, shock and moisture during storage and transportation.</p>
	<p>(3) The fiber setting position on the sheath clamp depends on the fiber cleaved length. Set the fibers correctly by referring to the label inside the wind protector. This equipment may not achieve optimum performance if the fiber setting position is incorrect.</p>
	<p>(4) Set the electrodes into the correct position during replacement. Failure to place the new electrodes into the proper position may results in abnormal discharge, and damage to the equipment.</p>
	<p>(5) Always replace the electrodes as a pair.</p>
	<p>(6) Use only alcohol to clean the objective lens, mirrors, v-groove, sheath clamp, fiber clamp, LCD monitor and body. Any other chemicals may cause blurring, discoloration or deterioration.</p>
	<p>(7) Keep the equipment free from sand or dust. Never clean the v-groove with a hard material or rough object. Doing so will damage the surface, and degrade the performance.</p>
	<p>(8) Precise adjustment and alignments have been made to all parts of this equipment before shipping. Do not loosen any screws or make any modifications to the equipment other than electrodes, up/down mirror and fuse replacements. If you encounter some problem with the equipment, please contact a sales agency.</p>



(9) Do not store in any area where extreme heat and humidity are present. Do not use with the condensing on the any devices. It may damage the equipment.



(10) This equipment requires no lubrication. Oil will degrade the performance and damage the equipment.



(11) The equipment must not be placed on an unstable place. In case the equipment falls to the ground, it may cause personal injury and/or equipment damage.