

INSTRUCTION MANUAL

ARC FUSION SPLICER

FSM-20CSII

 **Fujikura**

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1. GENERAL

1.1 Outline of FSM-20CSII Optical Fiber Fusion Splicer

The FSM-20CSII Arc Fusion Splicer is used for splicing SM (Single Mode) optical fiber and MM (Multi Mode) optical fiber.

Mutual aligning of both SM and MM optical fibers is performed automatically by the image processing microcomputer built into the splicer.

The power source applicable for this system is AC85-265V (50/60Hz) or DC10-15V. The AC voltage selection is automatic.

The Type FSM-20CSII Arc Fusion Splicer is shown below.

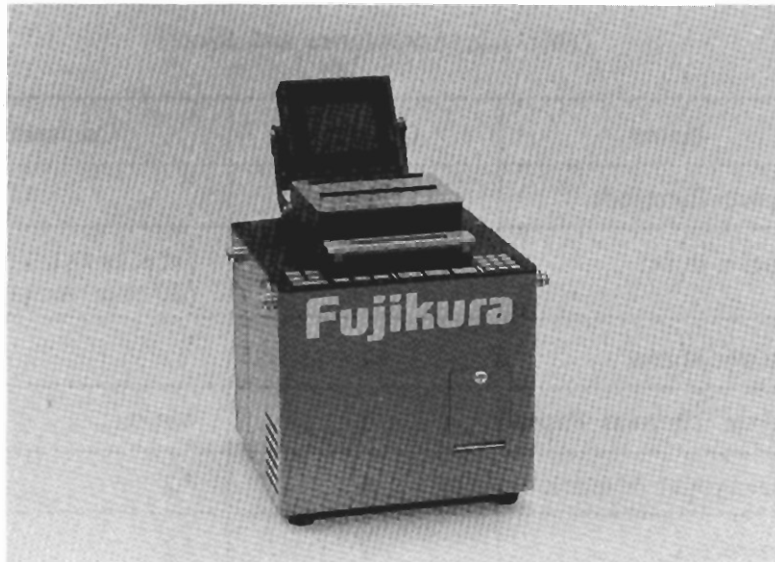


Fig.1.1 Type FSM-20CSII Arc Fusion Splicer

CAUTION

NEVER USE a cleaning spray on the machine. Spray that includes FREON gas causes abnormally strong discharges. This reduces the life time of the electrodes and may cause damage to the mirrors and lens.

1.2 Construction

The components comprising the FSM-20CSII Arc Fusion Splicer are shown in Table 1.1 and the accessories in Table 1.2 below.

Table 1.1 Components of FSM-20CSII Arc Fusion Splicer

No.	Name	Quantity
1	Arc Fusion Splicer Main Body	1
2	Power Cord (AC/DC)	1 pair
3	Carrying case	1

Table 1.2 Accessories and Spares

Name	Quantity	Comment
Spare Electrode	1 pair	
Spare Fuse	1 set	DC6.3A/AC3.15A *1 (20 mm long)
Spare Mirror	1	
Spare Thermal Paper	1	option
Hexagonal Wrench	1	*2
Tweezers	1	*2
Instruction Manual	1	

*1 AC250V 3.15A Time Lag Fuse (Slow-Blow).

*2 Used especially for "Up/Down" mirror replacement.

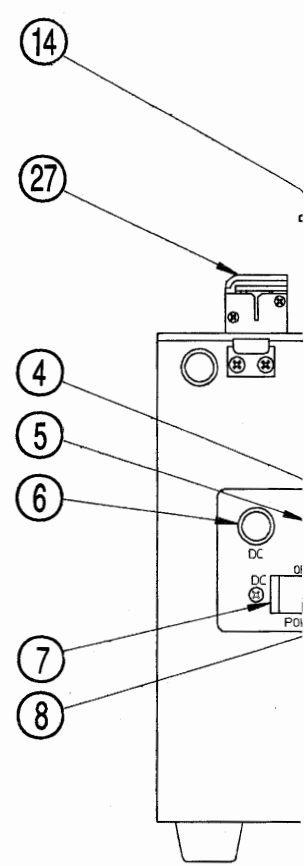
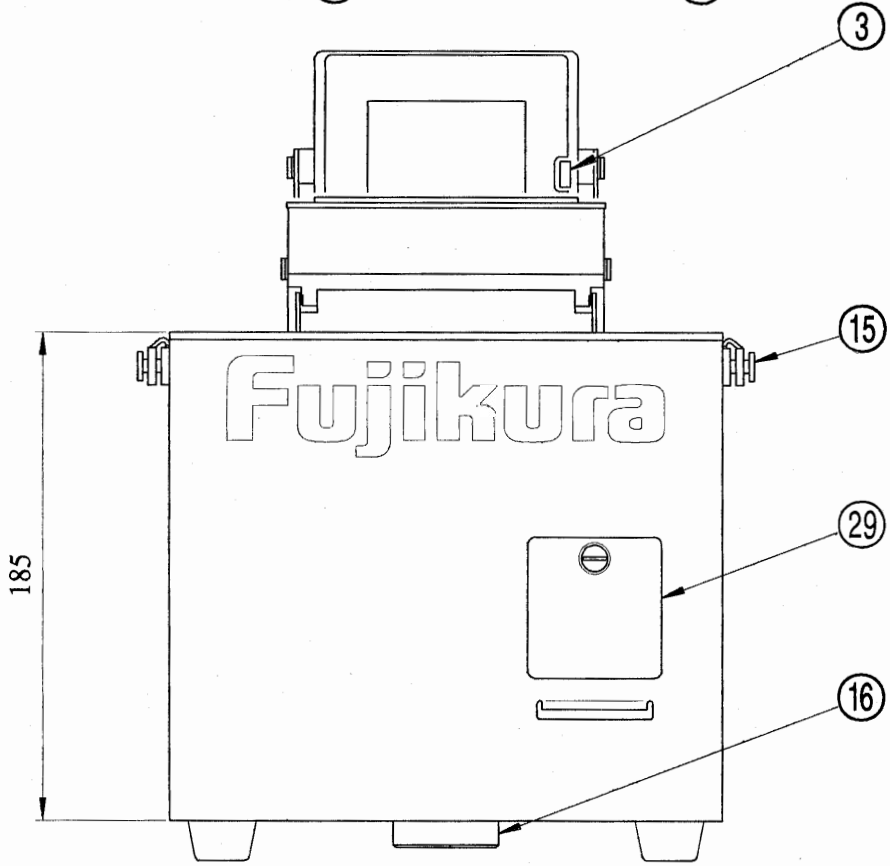
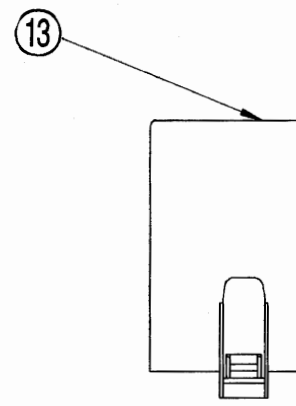
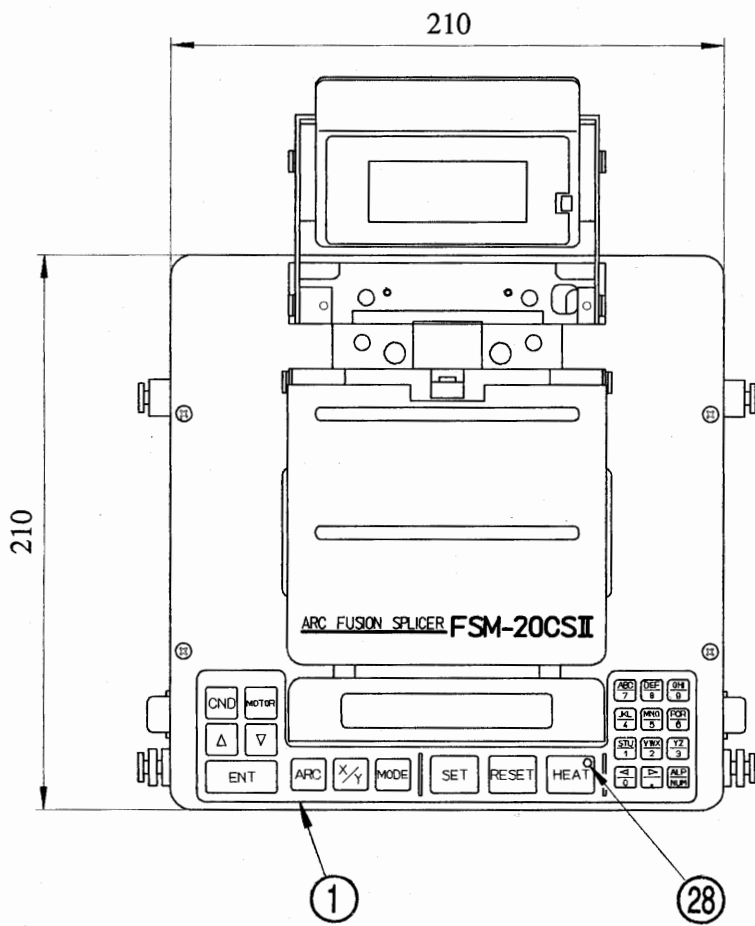
1.3 Parts and Functions

The following table gives descriptions of the parts and functions of the splicer. The locations of the items are given in Fig. 1.2.

Table 1.3 Items and Functions of Splicer

No.	Name	Function
①	Keyboard Panel	This is used to operate the splicer (See Section 2.1).
②	Monitor	Displays the fiber image, the operation state and estimated loss.
③	“Bright”	Adjusts the brightness of the LCD monitor.
④	Input Voltage Indicator	Indicates whether the input DC voltage is in the appropriate range. Green=good : Red=Too high or too low
⑤	AC Fuse Holder	3.15A fuse is used.
⑥	DC Fuse Holder	6.3A fuse is used.
⑦	POWER Switch	3 position switch. DC ON – OFF – AC ON.
⑧	DC IN Terminal	Connection for a DC power source, such as a battery. Turn the power switch to the DC-side.
⑨	SER.PORT Terminal	This terminal is used to input and output data when using a portable computer.
⑩	VIDEO OUT Terminal	This terminal is used to connect the video cord of an external monitor. Video signals are NTSC composite signals.
⑪	AC IN Terminal	This terminal is used for the AC power source (AC 85–265V, 50/60 Hz).
⑫	GND Terminal	This terminal may be used to ground the splicer.
⑬	Top Cover	This cover is used to protect the splicer when not in use.

No.	Name	Function
⑭	Wind Protector	Prevents abnormal arcing caused by the wind during discharge. By opening and closing the wind protector, the illumination lamp is turned off and on. When it is opened, the mirror is moved up to allow the fibers to be set. It also functions as a safety switch and prevents arc discharges while open.
⑮	Terminals for Working Table	These terminals are used to fix the working table (option).
⑯	Terminal for Tripod	This terminal is used to fix the splicer on the tripod (option).
⑰	Holder	The optical fiber sheath is set on this plate.
⑱	Optical Fiber Guide Unit (V-groove)	This guide unit is used to hold the optical fiber and to align the fiber pair to be spliced.
⑲	Discharge Electrodes	These discharge electrodes fuse the optical fiber pair to be spliced.
⑳	Illumination Lamp	This lamp is used to illuminate the optical fiber for the imaging system. When the wind protector is closed, the illumination is turned ON; when it is opened, the illumination is turned OFF.
㉑	Electrode Cover	Designed for the insulation of the high voltage electrode. DO NOT attempt arc discharges when the cover is disengaged for safety purposes.
㉒	Objective Lens	This lens is for magnification of the fiber image.
㉓	Fiber Clamp	This clamp is used to keep the optical fiber on the optical fiber guide unit.
㉔	Sheath Clamp	This clamp is used to hold the optical fiber sheath.
㉕	Mirror	This mirror is used to guide the illumination light to the objective lens to observe the fiber images. It can be set or reset (down or up).
㉖	Electrode Fixture	This secures the discharge electrode at the specified position.
㉗	Heater (option)	This is used to heat the heat-shrink sleeve.
㉘	Heat Indicator Lamp	Indicates that the heat-shrink sleeve is being heated.
㉙	Printer (option)	This is used to print splice data.



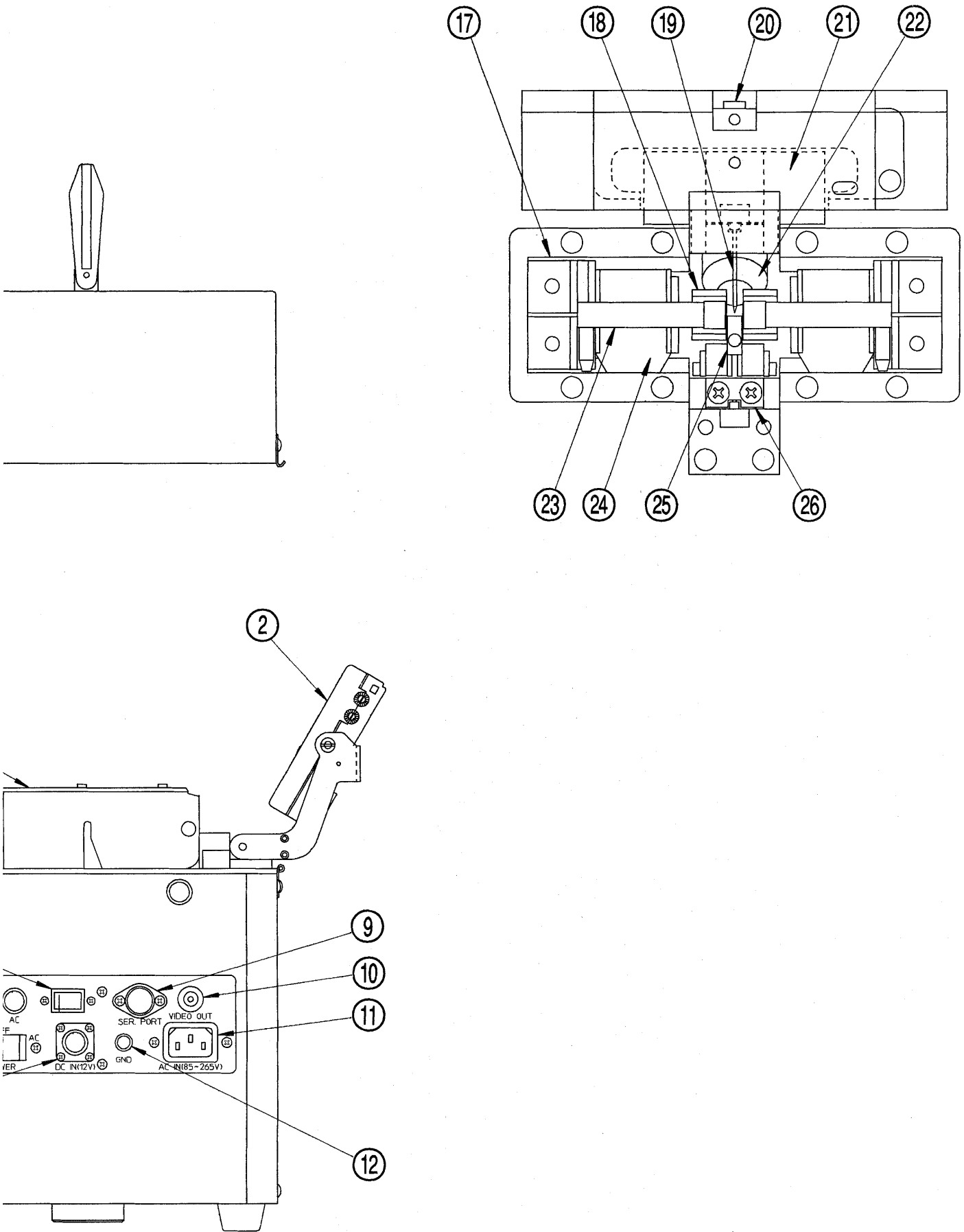


Fig. 1.2 FSM-20CSII Arc Fusion Splicer Main Body

2. OPERATION

2.1 Keyboard Panel

This section gives the key functions of the FSM-20CSII. Fig.2.1 shows the key layout on the top panel of the splicer. Table 2.1 shows their respective functions.

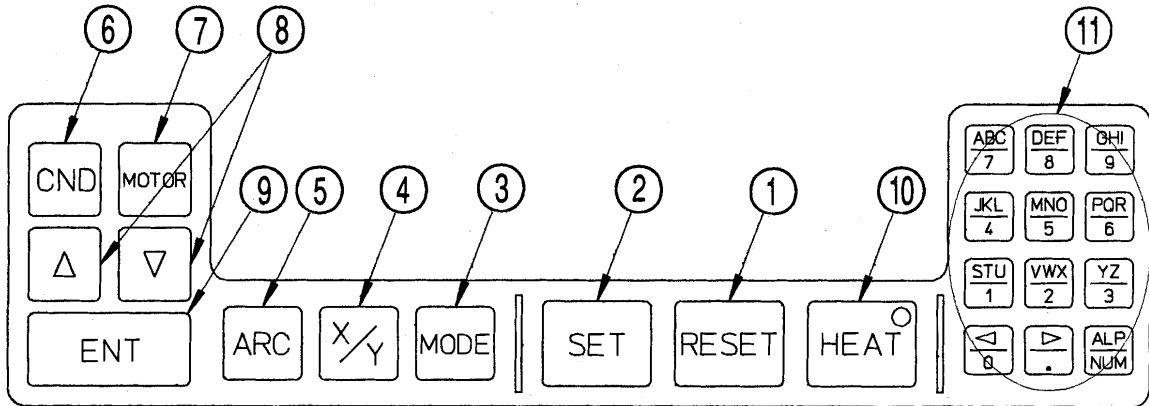


Fig. 2.1 Keyboard Layout

Table 2.1 Functions of Keys

No.	Name	Function
①	RESET Key	When the RESET switch is pressed, the system stops in any step of operation and the fibers move back to Z axis home position. The splicer accepts the RESET with a beeping sound and displays "RESET" on the monitor. After the reset operation is completed, "READY" is displayed on the monitor.
②	SET Key	This is used to initiate the gap setting of two fiber end faces and automatic alignment of the fibers. The instructions "GAP SET", "FIBER OK?" and "ALIGNING" are displayed on the monitor at each stage.

No.	Name	Function
③	MODE Key	<p>The FSM-20CSII can be preset to 20 different modes for various fibers (SM1 – SM10, MM1 – MM10). This key is used to select the mode.</p> <p>In SM mode, core axis alignment is performed automatically and in the MM mode, fiber axis alignment is performed.</p>
④	X/Y Key	<p>This is used for the automatic field change operation. When the X/Y key is pressed, the fiber image is changed from (X) to (Y) or (Y) to (X). If this is done after a gap set operation, the fibers are adjusted to the center of the monitor and focused automatically.</p>
⑤	ARC Key	<p>This is used to perform an arc but it will not function while the system is in its automatic splicing operation.</p> <p>No fiber stuffing occurs if this key is operated from the “READY” state or if an arc has already occurred. “**ARC**” is displayed on the monitor just before the discharge is produced.</p> <p>If gap setting has been done, loss estimation automatically follows the discharge operation. This function may be used to re-arc a splice after the automatic process has finished.</p>
⑥	CND Key	<p>This is used to select the menu options.</p>
⑦	MOTOR Key	<p>This is used for controlling the splicer motors manually.</p>
⑧	<p>△ (up) Key</p> <p>▽ (down) Key</p>	<p>These are used for moving the ‘*’ cursor wherever applicable in the menus and options.</p> <p>When manual motor control is selected, these keys act as “Backward” and “Forward” direction controls.</p>
⑨	ENT Key	<p>This is used to select a menu option for discharge conditions or select a motor control.</p>
⑩	HEAT Key	<p>This is used to start the heater process. The heat indicator lamp lights during heating.</p>
⑪	Condition/Comment Input Keys	<p>These are used for input of the operating parameters or the comments.</p>

2.1.1 Selecting Splice Mode

The FSM-20CSII can be preset for 20 different splicing modes (10 settings for SM fibers and 10 settings for MM fibers). This allows various fiber types to be spliced. Each mode consists of 6 parameters (ARC POWER, ARC TIME, FORWARD, PREFUSE, GAP, ECF). See Section 2.1.2. For SM1-SM10, core axis alignment and splice loss estimation are performed automatically. For MM1-MM10, fiber cladding alignment and splice loss estimation are performed automatically.

Operation

- (1) Make sure that the splicer is in its "READY" state or that the splicing sequence is paused or finished.
- (2) Press the MODE key. 10 splice modes are displayed on the monitor as shown in Fig. 2.2. The cursor "*" on the left side of the mode shows the present splice mode selected.
- (3) The cursor is moved up or down by the Δ (up) or ∇ (down) keys. Move it to the splice mode you wish to select.
- (4) If the ∇ (down) key is pressed when the cursor is beside SM10, then the MM modes are displayed as shown in Fig. 2.3.
- (5) To escape from this state, press any key except MODE, Δ (up) or ∇ (down) and Condition/Comment Input keys.

SPLICE MODE		
* SM1	FUJIKURA	125um
SM2	FUJIKURA	125um
SM3	FUJIKURA	125um
SM4	FUJIKURA	125um
SM5	FUJIKURA	125um
SM6	FUJIKURA	125um
SM7	FUJIKURA	125um
SM8	FUJIKURA	125um
SM9	FUJIKURA	125um
SM10	FUJIKURA	125um
READY	SM1	(X)

Fig. 2.2 Splice Modes for SM Fiber

SPLICE MODE		
* MM1	FUJIKURA	125um
MM2	FUJIKURA	125um
MM3	FUJIKURA	125um
MM4	FUJIKURA	125um
MM5	FUJIKURA	125um
MM6	FUJIKURA	125um
MM7	FUJIKURA	125um
MM8	FUJIKURA	125um
MM9	FUJIKURA	125um
MM10	FUJIKURA	125um
READY	MM1	(X)

Fig. 2.3 Splice Modes for MM Fiber

2.1.2 Changing Discharge Conditions

This section gives the procedures necessary to change the programme parameters (ARC POWER, ARC TIME, FORWARD, PREFUSE, GAP, ECF).

Note: Dip Switch 5 Bit 8 (DATA CHANGE PROTECT) must be OFF for this procedure. The splicer is shipped from the factory with this switch off.

Operation

- (1) Make sure that the splicer is in its "READY" state or that the splicing sequence is paused or finished.
- (2) Press the "CND" key. The menu is displayed on the monitor as shown in Fig. 2.4. The cursor '*' on the left hand side shows the function to be selected.
- (3) Move the cursor '*' to '2 CONDITION SET'
- (4) Press the "ENT" key. The current settings for the programmes are displayed on the monitor as shown in Fig. 2.5. The cursor '*' on the left hand side shows the selected parameter.
- (5) The cursor '*' is moved up or down by the Δ (up) or ∇ (down) key. Move it to the parameter you want to change.
- (6) The value of the selected parameter may be changed by pressing the Condition/Comment Input keys. (See 2.1.9)
- (7) To escape from this state, press any key except "CND", "ENT", Δ (up) or ∇ (down) and Condition Comment Input Keys.

Note: The FSM-20CSII has a sensor to measure the atmospheric pressure. When operating the splicer at a different altitude or under different weather conditions from which it was calibrated, the arc power is automatically adjusted to maintain splice quality.

If it is required to change the arc power for some other reason, see Appendices AP2.2 and AP7, set it using the above procedure. The new arc power becomes standard, again with automatic adjustment.

* 1 MEMORY DISPLAY
2 CONDITION SET
3 COMMENT SET
4 OPTION SET
5 CALENDAR SET
6 MEMORY CLEAR
READY SM1 (X)

Fig. 2.4 Menu Display

SM1 FUJIKURA 125um
* 1 ARC POWER 12
2 ARC TIME 2000msec
3 FORWARD 40msec
4 PREFUSE 180msec
5 GAP 8line
6 ECF 0.40
READY SM1 (X)

Fig. 2.5 Splicing Parameters

Table 2.2 Details of Splicing Parameters

Monitor display	Description	Step	Range
1 ARC POWER	Arc (discharge) power	1	0 – 31 *1
2 ARC TIME	Arc (discharge) time	0.1 sec	0 – 65 sec
3 FORWARD	Stuffing time during fusion splice	5 msec	0 – 1 sec
4 PREFUSE	Prefusion time during fusion splice	10 msec	0 – 1 sec
5 GAP	Gap between end faces of fiber	2 line	6 – 32 line *2
6 ECF	ECF factor	0.05	0 – 0.9 *3

*1 The discharge current is approximately $10.0+0.3 \times \text{DATA}$ (mA).

*2 1 line = 2 μm

*3 See Appendix AP6.

2.1.3 Setting Comments

When the "MODE" key is pressed, 10 splice modes and comments are displayed on the monitor as shown in Figs. 2.2 or 2.3. Move the cursor to the comment that is to be changed using the Δ (up) or ∇ (down) keys.

Note: Dip Switch 5 Bit 8 (DATA CHANGE PROTECT) must be OFF for this procedure. The splicer is shipped from the factory with this switch off.

Operation

- (1) Make sure that the splicer is in its "READY" state or that the splicing sequence is paused or finished.
- (2) Press the "CND" key. The menu is displayed on the monitor as shown in Fig. 2.4. The cursor '*' on the left hand side shows the programme to be selected.
- (3) Move the cursor '*' to '3 COMMENT SET'
- (4) Press the "ENT" key. The current comment for the programme is displayed on the monitor as shown in Fig. 2.6. The cursor '*' shows the selected character.
- (5) The cursor '*' is moved left or right by the \triangleleft (left) or \triangleright (right) key.
Move it to the character you want to change.
- (6) The character may now be changed by pressing the Condition/Comment Input keys or by pressing the Δ (up) or ∇ (down) key. (See 2.1.9)
- (7) To escape from this state, press any key except "CND", "ENT", Δ (up) or ∇ (down) and Condition/Comment Input keys.

2.1.4 Setting Optional Functions

This splicer has some optional functions, DATA DISPLAY, PAUSE, etc., as shown in Table 2.3. These are common to all splice programmes. To set these options, off or on, proceed as follows.

Note: Dip Switch 5 Bit 8 (DATA CHANGE PROTECT) must be OFF for this procedure. The splicer is shipped from the factory with this switch off.

Operation

- (1) Make sure that the splicer is in its "READY" state or that the splicing sequence is paused or finished.
- (2) Press the "CND" key. The menu is displayed on the monitor as shown in Fig. 2.4. The cursor '*' on the left hand side shows the programme to be selected.
- (3) Move the cursor '*' to '4 OPTION SET'
- (4) Press the "ENT" key. The current settings for the options are displayed on the monitor as shown in Fig. 2.7. The cursor '*' shows the selected option.
- (5) The cursor '*' is moved up or down by the Δ (up) or ∇ (down) key. Move it to the option you want to change.
- (6) Press the "ENT" key to turn ON or OFF.
- (7) To escape from this state, press any key except "CND", "ENT", Δ (up) or ∇ (down) and Condition/Comment Input keys.

SM1
FUJIKURA 125um
*

READY SM1 (X)

Fig. 2.6 Comment Display

OPTION SET

* 1 DATA DISPLAY OFF
2 PAUSE OFF
3 ECF ON
4 CLEANING ARC ON
5 CLEAVE ANGLE ON

READY SM1 (X)

Fig. 2.7 Optional Functions

Table 2.3 Details of Optional Functions

Monitor display	Description
DATA DISPLAY	Display data such as axis offset etc. on the monitor (See Appendix AP7).
PAUSE	Stop splice procedure after fibers are gapset (Press "SET" key to restart).
ECF	See Appendix AP6.
CLEANING ARC	A discharge is produced to remove dust on the fiber surface just after GAP SET has started.
CLEAVE ANGLE	The cleaved fiber end faces are checked and the cleaved angles are displayed on the monitor. ERROR 7 is displayed when either angle is more than 5 or 3 degrees. The threshold angle can be changed by Dip Switch 1 bit 6. (See Appendix AP1.)

2.1.5 Display of Stored Splice Data

This splicer stores 100 splice data points in the internal memory, and this data can be printed out by the optional printer.

Operation

- (1) Make sure that the splicer is in its "READY" state or that the splicing sequence is paused or finished.
- (2) Press the "CND" key. The menu is displayed on the monitor as shown in Fig. 2.4. The cursor '*' on the left hand side shows the programme to be selected.
- (3) Move the cursor '*' to '1 MEMORY DISPLAY'.
- (4) Press the "ENT" key. The current Memory No. and splice data is displayed on the monitor as shown in Fig. 2.8 (a).
- (5) The memory No. may be decreased or increased by pressing the \triangle (up) or ∇ (down) key and the splice data of the current Memory No. is displayed.
- (6) When you press the "ALP/NUM" key, the current Memory No. and splice data on the monitor are printed out by the printer. If the splicer does not have a printer, "ERROR 10 PRINTER ERROR" is displayed after about 5 seconds.
- (7) When you want to set a comment to the splice data, press the "ENT" key. The cursor '*' is displayed under the comment area as shown in Fig. 2.8 (b). Move the cursor '*' to the character you want to enter by the \triangleleft (left) or \triangleright (right) key. You can input characters by pressing the Condition/Comment Input keys or by pressing the \triangle (up) or ∇ (down) key. (See 2.1.9)
- (8) When you press the "ENT" key again, the cursor '*' vanishes and you can change the Memory No. again.
- (9) To escape from this state, press any key except "CND", "ENT", \triangle (up) or ∇ (down), and Condition/Comment Input keys.

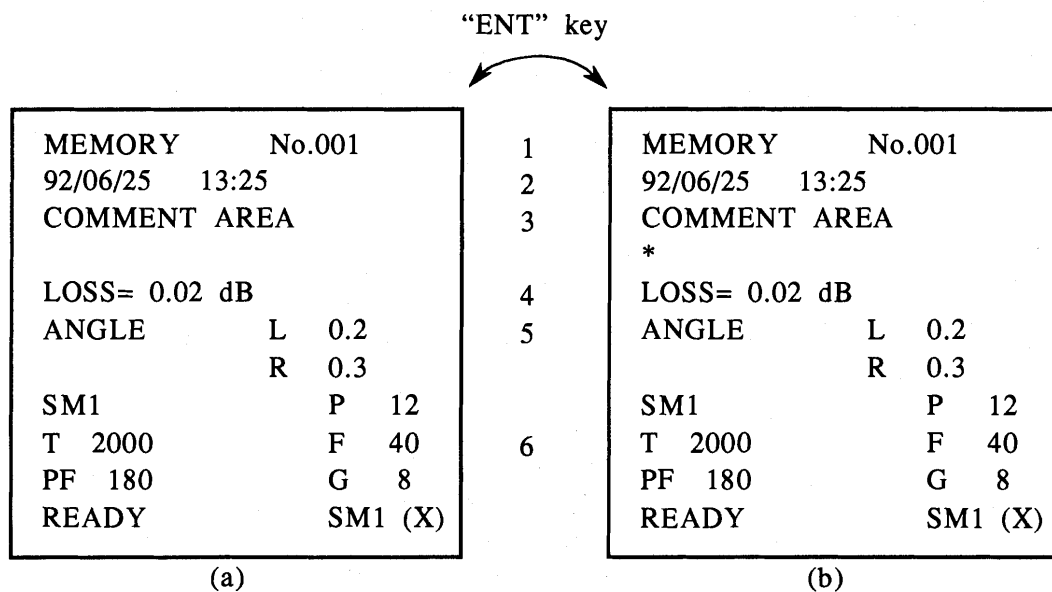


Fig.2.8 Memory Display

- Note:
1. The splice data is stored in the current Memory No. after splicing. Then Memory No. is changed to next number automatically.
 2. When the splice data is stored in Memory No.100, the next Memory No. turns to 001. The previous stored data in Memory No.001 is deleted.
 3. When you change the Memory No. by the former operation, the splicer starts storing data from last Memory No. you change.

1. Memory Number (from 001 to 100)
2. Date and Time when the splice is performed
3. Comment (manual input) MAX 14 characters
4. Estimated LOSS
5. Cleave Angle L: left, R: right
6. Splice Mode and Discharge Condition

P: ARC POWER, T: ARC TIME, F: FORWARD, PF: PREFUSE, G: GAP

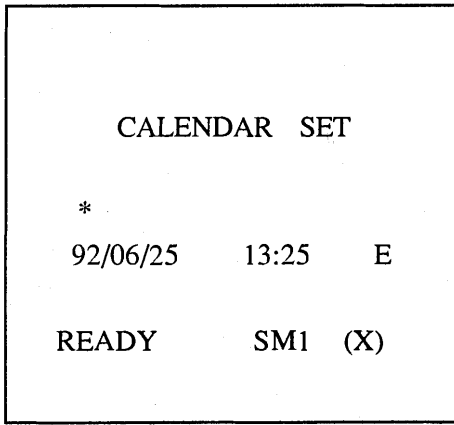
2.1.6 Changing Calendar

This splicer has an internal calendar. This section gives the procedures to change the calendar parameters (Year, Month, Day, Hour, Minute).

Operation

- (1) Make sure that the splicer is in its "READY" state or that the splicing sequence is paused or finished.
- (2) Press the "CND" key. The menu is displayed on the monitor as shown in Fig.2.4. The cursor '*' on the left hand side shows the programme to be selected.
- (3) Move the cursor '*' to '5 CALENDAR SET'.
- (4) Press the "ENT" key. The current date and time is displayed on the monitor as shown in Fig.2.9. The cursor '*' shows the selected parameter.
- (5) The cursor '*' is moved left or right by the \triangle (up) or ∇ (down) key. Move it to the parameter you want to change.
- (6) The parameter may now be changed by pressing the Condition/Comment Input keys. (See 2.1.9)
- (7) When you finish changing all parameters, move the cursor '*' at 'E', and press 'ENT' key at the same time to time signal. The calendar is changed to new date and time and the splicer returns to "READY" state.

Note: The current date and time is displayed in its "READY" state as shown in Fig.2.10.



Fi.2.9 Calendar Setting Mode

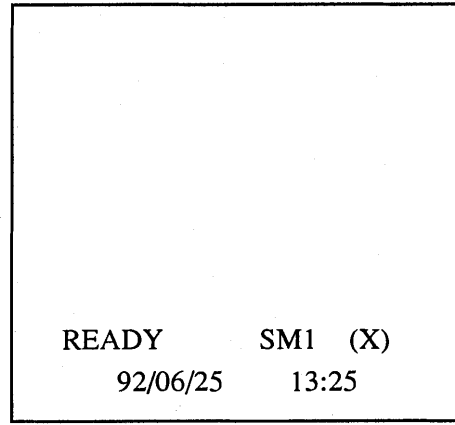


Fig.2.10 Display of Date and Time ("READY" state)

