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FSP-100

Optical Fiber Fusion Splicer

User Manual

Ningbo Youxin Optic-Electronic Technology Co.,LTD

Warning (ignore the warning, non-proper use of fusion splicer could lead to fatal and serious injury)

1. The input voltage of this model of Fusion Splicer is definite; please do not use the voltage outside the scope. Please use the correct AC and DC power supply.
2. When the fusion splicer comes across the following failures, please immediately remove the AC adaptor power cord from the power supply input and turn off the fusion splicer, otherwise will lead to the incapable of the repairing and even will cause personal injury, death and fire.
 - ★ Smoke, smell, noise or heat anomaly
 - ★ Liquid or foreign matter enters the interior of the machine
 - ★ Broken or damaged machines
3. This model of fusion splicer does not have the need to maintain internal components, dismantling of fusion splicer and power modules is prohibited; any mistake in maintenance will lead to the machine beyond repair even causing bodily harm.
4. This model of fusion splicer has strictly limitation to the power supply module used.
5. The fusion splicer is prohibited to be used under the environment with the inflammable liquid or flammable gas; otherwise will lead to fire, explosion and other serious consequences.

Notes:

1. This model of fusion splicer is used for the fusion of quartz glass fiber; please do not use this machine for other usages. Please read this manual carefully before using.
2. Please do not deposit fusion splicer under the environment with high temperature or humidity.
3. If the fusion splicer is used in the environment with lots of dust, it should avoid dust as far as possible.
4. When the fusion splicer moves from the low-temperature environment to high-temperature environment, heating process must be ensured as possible to eliminate condensation.
5. In order to maintain fusion splicer's performance, recommend to do complete machine maintenance once a year.
6. The fusion splicer has been precision calibrated, please try to avoid strong vibration, and impact, and use dedicated box for transportation and storage.
 - The fusion splicer must be repaired and debugged by specialized technical personnel, for the appeared problems, please contact the manufacturers in a timely manner.

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1 General information

This manual contains complete performance and operation for FUSION SPLICER. FUSION SPLICER uses the high-speed image process technology and special exact orientation technology, so that the whole process of fiber's fusion can be finished in 9 seconds automatically. LCD monitor makes each process of fiber fusion clear. Because of small bulk, light weight and AC、DC power supply, it is the same with the project and maintenance of telecommunications, cable TV, railway, petrochemistry, electric power, army, police and scientific research organizations.

1.1 Applicable range

SM (Single-mode), MM (Multi-mode) silex-fiber
125 μ m outer diameter (standard)
0.2~1.5mm outer coating diameter
Fiber cleaved length: 16mm (standard)

1.2 Specifications:

- Screen: 5 inches color LCD Monitor
- Display: Display X and Y axis simultaneously
- Environment: Temperature: -10~50°C
Storage: -40~60°C
Humidity: <95%RH (without dew)
Storage humidity: no dew
- Average fusion loss: 0.02dB (SMF), 0.01dB (MMF)
- Average fusion time: 9secs. (standard SM)
- Average heat time: 30 secs. (Setting heat time optionally)
- Fusion program: 12(templet),188(user)
- Internal light(setting fiber at night)
- Internal heater
- Setting the parameters: Testing end-face angle, Push distance, Pre-fusion current, Pre-fusion time, Fusion current, Fusion time etc.
- Power supply(average): Alternating Current: 100-240V 50Hz / 60Hz 30W
Direct Current: 13.5V/5A/ 25W
- Fusion results storage: 5000
- Inner Li-ion battery and AC adaptor
- Appearance: 150mm (length) x150mm (width) x160mm (height)
- Weight: 3.52 Kg (with battery module)

2 Terms about FUSION SPLICER

During operating the fusion splicer by menu, you will find some terms, the meanings are as follows:

- Heat time: Fusion splicer sets up heat time. (Unit: 30 Seconds)
- Surface angle: Allowed maximum cleaved slope angle when fusion splicer checking the end-face.
- Push: Process that electromotor drives fiber to move forward during splicing.
- Push speed: The electromotor controls delay of unit during arc splicing, while push speed slower, the moving speed of fiber becomes faster.
- Pre-fusion: Process that fusion splicer arcs little current while doesn't push fiber during splicing.
- Fusion: Process that fusion splicer arcs proper current and pushes fiber during splicing.
- Fusion push: The quantity of pushing fiber during splicing.
- Gap: Space between left and right fibers' end-face that set up by fusion splicer before splicing.
- Calibration: Process that fusion splicer adjusts the warp between left and right fiber to make them are collinear during splicing.
- Test: fusion splicer arcs to revise arc position and arc current automatically.
- Cleaning electrode: Part high temperature gasifies the impurity on electrode's surface during arc.
- Arc position: The opposite position between arc and fiber during arcing. (Eyeballing optionally)
- Adjusting system parameters: Zero to inner parameters of machine. You needn't operate it usually.

3 Main body and accessories

Following are main body and accessories: Fittings No.1~6 are admeasured to users with main body; Options No.7~13 are sell to user's base requirement.

Table 1

S/N	Description	Model No.	Qty.	Remark
1	Fusion splicer	fusion splicer	1	Main body
2	Power supply modules	01-26L7	1	Accessories
3	Carrying case	04-26C (with belt)	1	Accessories
4	Spare electrodes	09-26C	1	Accessories
5	Cooling tray			Accessories
6	AC power cord			Accessories
7	Power adaptor			Accessories
8	Cleaning Brush			Accessories
9	Plastic nipper			Accessories
10	Screen cover			Accessories
11	User manual CD		1	Accessories
12	Packing List		1	Accessories
13	Certificate and Test report		1	Accessories
14	Warranty Card		1	Accessories

4. Panel and side elevation

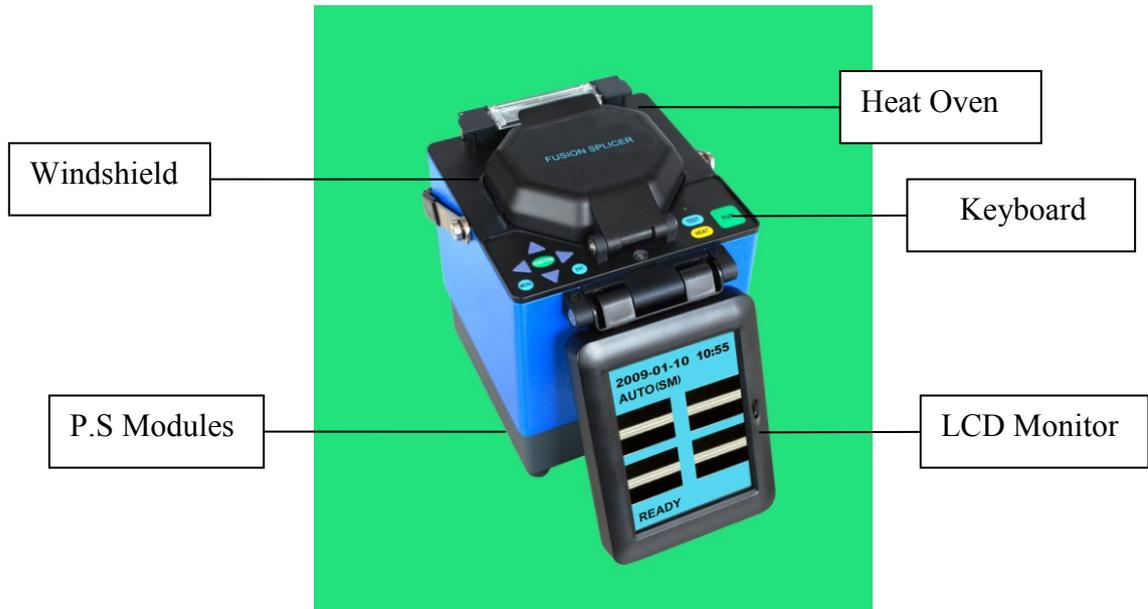


Figure 1: The sketch map of main body's panel



Figure 2: Side-View of Main Body

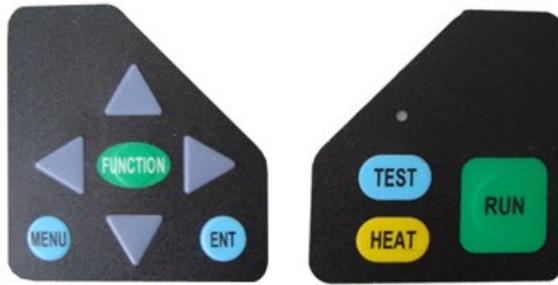


Figure 3: Left and Right keyboards

The keyboard's multi-functions are manual /Auto /parameter menu.
 Explanations as below:

Keys	Manual mode	Auto mode	Parameter menu mode
◀	Scroll left	Invalid	Low parameter or move cursor
▶	Scroll right	Invalid	Add parameter or move cursor
▲	Scroll up	Invalid	Add parameter or move cursor
▼	Scroll down	Invalid	Low parameter or move cursor
FUNCTION	Shift left/right fiber driving	Invalid	Invalid
MENU	Enter/Exit menu	Enter/Exit menu	Enter/Exit menu
ENT	Invalid	Invalid	Confirm efficient selection
HEAT	Heat protection sleeves	Heat protection sleeves	Heat protection sleeves
TEST	Invalid	Test arc	Invalid
RUN	Invalid	Enter "Continue" and pause, press Start to splicing	Invalid

6 Fiber's fusion flow

6.1 Start and stop

Fusion splicer can be supplied by outer battery, inner PS modules or AC adaptor.

Use AC adaptor or outer battery, please connect PS output with "DC 13.5V/5A", turn switch to "DC" to start machine.

- 1) Connect AC PS to power supply, insert DC PS to power supply modules where writes POWER INPUT and switch to "ON " to start to work.
- 2) Use KL-01-26L7 , please turn switch to "ON" to start machine. Use KL-01-26L7, Fusion Splicer can be supplied by inner battery or AC PS line connect to 220V PS; Use KL-01-26AC PS modules, Fusion Splicer only can be supplied by AC PS line connect to 220V power supply.
- 3) Turn switch to "OFF" to stop work.

● Notice:

Please charge the inner battery in time when use KL-01-26L7 PS modules. Power specifications of the inner battery: DC 13.5V/5A. And please consult Addenda D Introduction of power supply modules.

6.2 Preparation before fusion

6.2.1 Checking electrode

- 1> Make sure no fiber; electrodes are loaded well.
- 2> Connect with power then start machine, initialize the fusion splicer.
- 3> Observe arc electrodes; make sure that no obvious damage on electrode's top.
- 4> Close wind shield
- 5> Arc to check state of electrode's top, as following measures:
 - a> Press "MENU" to enter the first class menu.
 - b> Press "▲" or "▼" to make cursor "→" to point to "Maintenance".
 - c> Press "ENT" to enter the menu of maintenance.
 - d> Press "▲" or "▼" to make cursor "→" to point to "clean electrode", then press "ENT" to make fusion splicer to arc.
 - e> Confirm normal; then press "MENU" to exit menu in turn.

5> Electrode aging: If you do not use the machine for long time, in order to assure splicing quality, please operate "electrode aging" before the first splice, operate process is similar to process "clean electrode". "electrode aging" will arc electrode 20 times to clear the layer of oxide on electrode

6.2.2 Fixing splice protection sleeve

To protect joint after fusion, you should enclose the fiber into the splice protection sleeve. Please consult figures 4 (a).

● Notice:

- 1> Make sure that there's no dirt in the splice protection sleeve and surface of fiber has been cleaned before fixing.
- 2> Make sure that fiber is in the splice protection sleeve.
- 3> To avoid influencing fusion's target, please cut the otiose part if the inside core's length is longer than the sleeve's coat.

6.2.3 Making fiber's end-surface

- 1> Strips cover about 30mm~40mm with fiber coat stripper and clean the dirt of bare fiber with alcohol tampons. Please consult figure4 (b).
- 2> Cut the bare fiber with fiber cleaver and hold it about 16mm as figure4 (c) shows.

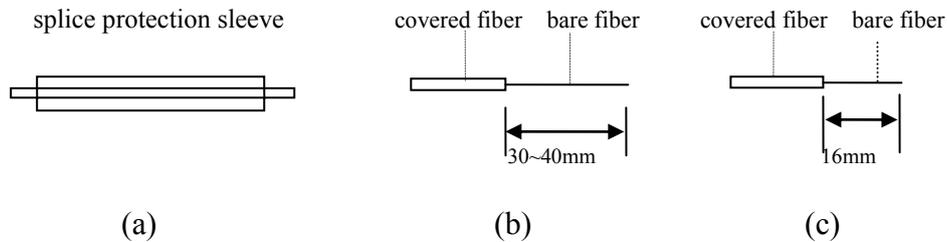


Figure 3

6.2.4 Side elevation of cleaved fiber's end-face

The quality of fiber's end-surface is of influence to fusion loss; you should try to make end-face flatly, and the inclination between end-surface and section should be less than 1°. The figure5(a) is finer end-surface for fusion while (b) ~ (f) are unqualified and need to remade.

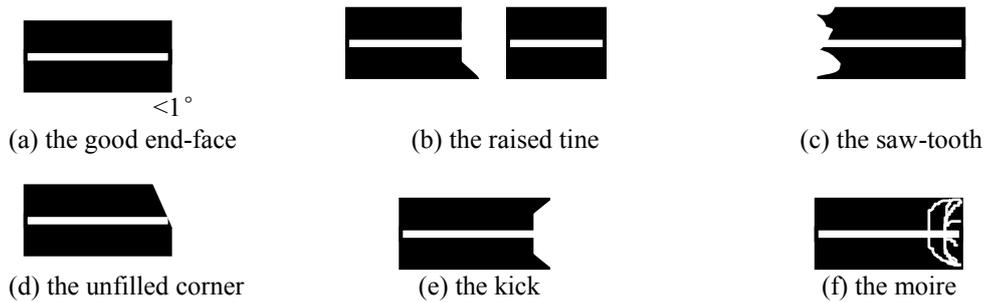


Figure 4 fiber's end-face

6.3 Fusion

6.3.1 Selecting proper fusion program

Change arc program and parameter to obtain the best fusion result due to different environment and different kinds of fibers (consult 8.2, 8.3, and 8.4).

6.3.2 Loading fiber

- 1> Open the wind cap to reposit the fiber holder; "Load fiber" is displayed on the screen.
- 2> Open the fiber holder separately, Load cleaved fiber into V-groove, and the end-surface couldn't touch the bottom of V-groove, consult figure 6(a)、(b).

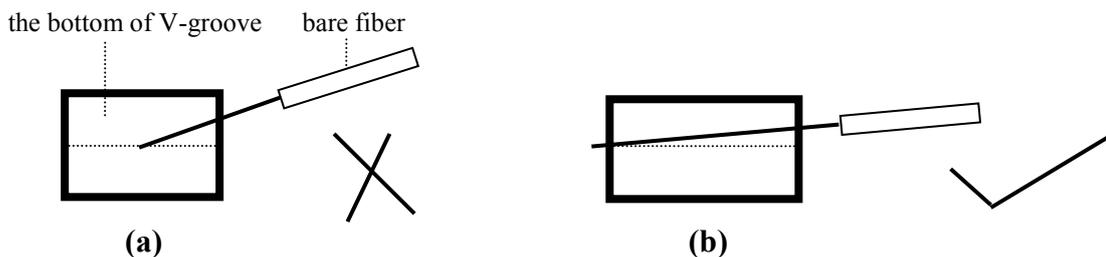


Figure 5

- 3> Put down fiber holder and windshield to finish loading. Then figure 7 should be displayed on screen. The distance between two fibers must less than radius of fiber. If the distance exceed adjust arrange, KL-280 doesn't splice, then you should load fiber over again and clean V-groove. (Consult 10.4)

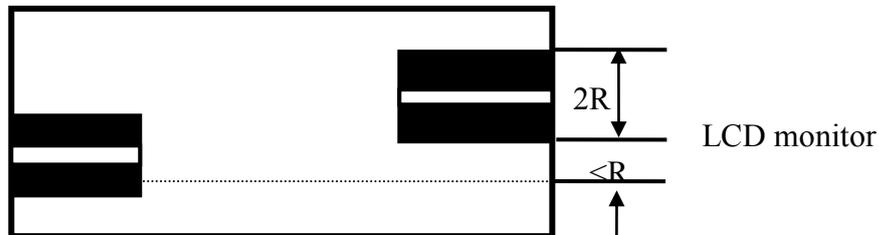


Figure 6 (fiber of X axis and Y axis)

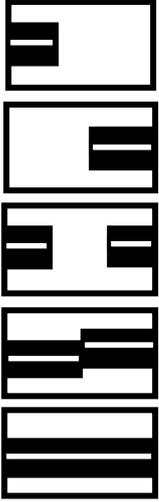
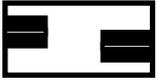
6.3.3 Fusion instance and measure

Table 2 is the possible phenomena that appeared after pressing “RUN” or “TEST”.

If the phenomena don't exist, please consult <Addenda A>.

- ☆ Notice: 1> To guarantee fusion target, please setting value of “Setting end-surface” about 6.
- 2>Make sure that electrode is fixed well before splicing.
- 3>Make sure that electrode is well and there's no obvious injury on electrode's top.
- 4>Best to test arc each time before splicing.2 times.

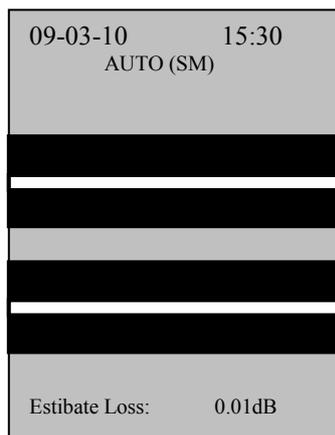
Table 2

Graphic (X axis or Y axis)	Message	Reason	Measure
	Reload the fiber	1. The bare fiber is cleaved too long or too short.	1. Reload fiber. 2. Recut fiber. 3. Clean the lens.
	Bad left fiber or bad right fiber	Bad end-surface's quality.	1. Remake the end-surface. 2. Reset end-surface's angle
	The picture is clear in only one direction or picture are unclear in two directions.	1. There is dust in V-groove. 2. There is dust on bare fiber.	1. Clean V-groove. 2. Clean bare fiber 3. Reload fiber

6.3.4 Auto fusion and estimating loss

The steps of auto-fusion are as follows:

- 1) Check and confirm the right option of "fusion fiber".
- 2) Consult 6.2.4 and make the end-surface of fiber.
- 3) Open the windshield and fiber holder to load fiber.
- 4) Close the windshield, then press "RUN", KL-280 begin to work automatically: clean fibers automatically, check end-surface, setup gap, adjust fiber's core, arc splice, estimate loss and display loss on screen.



5) If “Not qualified end-surface” or “Reload fiber” is displayed, KL-280 will stop working. Please remake fiber’s end-surface or refer table 2. (Consult 6.2.4 and 6.2.5)

- ☆ Notice: 1> Please do not press “HEAT” after you press “RUN” and when machine in status of auto splice, otherwise will have error.
 2> Fusion splicer will estimate loss one time only after splicing automatically.
 3> Only the electrode is well, arc parameter is optimized, fiber character is identical, then fusion loss is of reference.
 4> Best to arc test before splicing.

6.3.5 Splicing partial core fiber

If loss is unsteady during splicing, the measures are as follows:

- 1> Check whether the arc is steady and whether the parameter is proper.
- 2> If opposite position is steady and the parameter is proper, maybe fiber’s core is partial. The solution is minish the value of “fusion time” and “fusion push”.
- 3> If method<2> is useless, to obtain best loss, you must mark direction angle on the fiber to test fiber’s fusion.

6.3.6 Evaluating fusion quality

Fusion quality is judged by estimating loss, fusion shape and fusion process. Only combine them together, and then the evaluation is external.

- 1> If fusion process is steady and the spliced fiber’s shape as follows as Table 3, then the fusion status is well.

Table 3

	Fiber’s cord is accord with shape
	Spot or abrasion, be care of cleaning and cleaving end-surface
 white line	Because of optics, there’s no effect to joint
	Different eccentricity between two fibers
	Different external diameter between two fibers

2>If the spliced fiber’s shapes are as follows as Table 4, you must splice over again even the loss value is very low.

Table 4

Shape	Reason	Measure
  bubble	1. There is dust on the end-face 2. Dew 3. Bad fiber's end-surface 4. Too small arc current	1. Remake end-surface. 2. Adjust program or current. (Optimization of arc parameter)
  broken thin diameter	1. Too large arc current 2. Too small push speed 3. Little fusion push 4. Feed blocked	1. Adjust program or current parameter. 2. Clean V-groove. (Optimization of arc parameter)
 black line	Notice: Black line will appear on fiber's joint with fluorine, it has no effect to transport characteristic.	Press "RUN" to arc again and observe.

6.4 Tension test

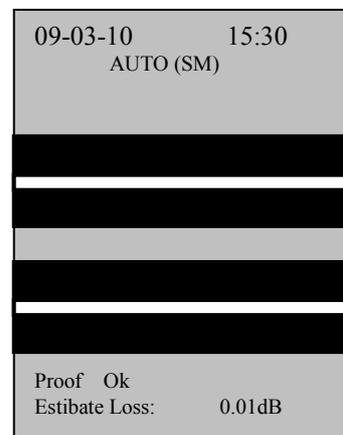
KL series fusion splicers supply the function of tension test.

If you need this function, when you enter into "MENU", please open this function, and after each splicing, machine will do tension test.

After you start the machine, the screen displays as left picture:

You can base need to select "if test tension", then operate. After splicing the screen displays as right picture. Press "ENT" to make KL-260C to test tension automatically.

If you don't want to test tension, then press "RESET" to reset system after taking out spliced fiber or do not select "Test tension".



6.5 Protection of fusion point

6.5.1 Taking out spliced fiber

Raise windshield and fiber-collect in turn, take out spliced fiber, do not touch electrode.

6.5.2 Moving splice protection sleeve

Move splice protection sleeve that covered around fiber to joint, make sure that length of two fiber's coat is equal in splice protection sleeve. Consult figure 8(a).

6.5.3 Heating splice protection sleeve

Working mode	Automation or manual optionally
Maintenance	Enter the next maintenance menu

7.1 Heating time

The setting range of heating time is 1-60s, step-size is 1S. If heat time is 4, actual heat time is 4S. Press “HEAT” to turn on the light, then the heater begins to work; heater will stop working if time is up. But if the temperature were the highest value, it would keep the temperature regularly.

- Remark: Press “HEAT” to stop heating. Next heat time counts from zero.

7.2 Setting end-surface

Setting end-surface stands for the maximum cleaved angle under auto work mode. Its setting range is 1~16, step-size is 0.5~**8.0°**, it is 6 (3.0°) usually. If the fiber’s cleaved angle is unqualified, the splicer will stop working and demand to do over the end-face.

7.3 Tension Test

You can select TENSION TEST start or close, “1” means open this function, “2” means close this function. When tension test opened, machine will do this function automatically after each splicing.

7.4 Splicing fiber and fusion program

The two parameters can concert each other. You can select 20 kinds different fusion program (SMF: 100 MMF: 100).

7.4.1 Splicing fiber

Figure 1 stands for selecting SM fiber and figure 2 stands for selecting MM fiber.

7.4.2 Fusion program

It stands for the adopted fusion program currently. The program number is 1~100, inside it is divided to SM1~100 and MM1~100. No.1~No.5 are set by factory; you can set program from No.6~No.100 freely. But KL-280 will adjust No.6 program after fusion testing automatically, and setup the No.6 program, please consult 8.3-arc test. Press “ENT” to enter the program setting menu after selecting program number as right picture.

Cursor “→” point to the optional or modifiable content, press “▲” or “▼” to move the cursor; The next line’s number is value of the item, press “◀” or “▶” to modify; The modification quantity in the bottom of menu stands for the change quantity of increase/decrease key, you can press “AUTO” to select among “1,10,100”;

Press “ENT” to confirm or enter next menu;

Press “MENU” to exit current menu.

- Remark: You must press “ENT” to confirm after modifying the value.

The explanations of parameters are as follows:

2008-10-10	10:55
PREARC POWER (0.1mA)	60
PREARC TIME (10mS)	11
ARC POWER (0.1mA)	90
ARC TIME (0.1S)	15
FORWARD SPEED (1ms)	5
FORWARD (1μm)	11

7.4.2.1 Pre-fusion current and Pre-fusion time

After setting gap and adjusting, KL-280 agains to work. In the process, the fusion

splicer will pre-manage the fiber. The range of pre-fusion current is 0.1~24mA, step-size is 0.1mA; the range of pre-fusion time is 10~1000 mS, step-size is 10mS.

7.4.2.2 Fusion current and fusion time

It is the current value and arc time. The range of fusion current is 0.1~24mA, step-size is 0.1mA; the range of pre-fusion time is 0.1~10S, step-size is 0.1S. (The value of current can be tested automatically base on the arc testing)

7.4.2.3 Push speed and fusion push

KL-280 will wrap part fiber in the process of fusion, these two parameters decide speed of fiber and quantity of wrap. The range of push speed is 1~30mS, step-size is 1mS; the range of fusion push is 1~100μm, step-size is 1μm.

7.5 Working mode

The manual/Auto mode is optional. "1" is Auto mode and "2" is manual mode.

7.6 Maintenance

Cursor "→" point to "Maintenance", press "ENT" to enter maintenance menu. It contains daily maintenance and part accessorial content as right picture. Cursor "→" stands for current selection; Press "▲" or "▼" to move cursor;

Press "ENT" to confirm; press "MENU" to exit current menu.

7.6.1 Cleaning electrode and electrode aging

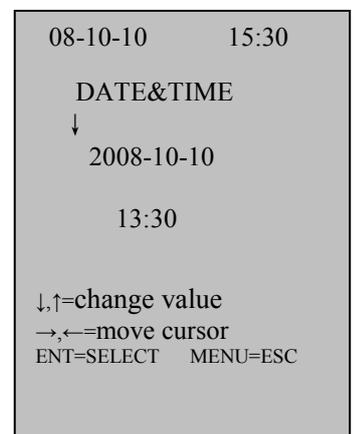
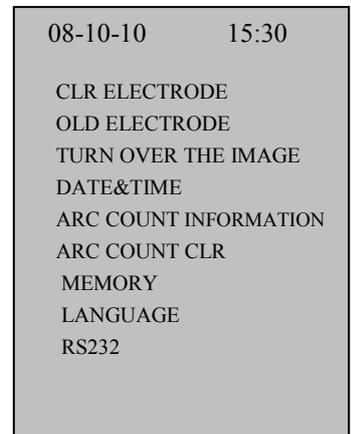
The two functions will produce high-pressure arc. Please consult 10.2.

7.6.2 Image turn over

- 1) press "◀" or "▶" to fix on "image turn over", press "ENT", buzzer bleat 6 times, then image will be turned over
- 2) press "MENU" twice to quit image turn over
- 3) user can choose the direction of image by step 1 and 2.

7.6.3 Time/date

After enforcing the function, menu will appear as right picture, and then you can modify date and time of KL-280 cursor "↓" point to modifiable content, press "◀" or "▶" to move cursor; Press "▲" or "▼" to modify; Press "ENT" to confirm modify and exit current function. Press "MENU" to exit.



7.6.4 Arc record

When machine open this function, the right menu will appeared, so you can check arc amount.

7.6.5 Zero to take count of arc

When you replace with new electrode, you an carry “ Zero to take Count of arc”, press “ENT” to confirm zero and press “MENU” To exit.

7.6.6 Splicing record

Splicing time and loss will be shown in this function, (consult the Picture on the right. Fusion Splicer can keeps 5000 records, the number of latest record is 0001, until the oldest number 5000. Press “▲” or “▼” to turn page,press “MENU” to exit.

	08-10-10	15:30
0001	2008-10-10	10:21
	Loss:	0.01dB
0002	2008-10-10	10:23
	Loss:	0.02dB
0003	2008-10-10	10:25
	Loss:	0.01dB
0004	2008-10-10	10:28
	Loss:	0.01dB
↓ ↑ (P00004) ↑		
↓ =N. page ↑ =L. page		
MENU=esc		

7.6.7 Languages

To choose the language of menu.

8 Selecting fusion programer

8.1 Overview of fusion program

Fusion splicer has 200 kinds of fusion program (100 kinds for SM, 100 kinds for MM).

- 1> Factory setup program No.1~No.5.
- 2> Users setup program No.7~No.100.
- 3> Program No.6 is saved program after test the current is suitable.
- 4> You should select proper fusion program base actual splice fiber(SM or MM).

8.2 Selecting fusion program

Fusion Splicer provides function to correct arc current automatically, to satisfy different requirement; you can select different fusion parameters. The operations are as follows:

- 1> Press “MENU” to enter the first class menu;
- 2> Press “▲” or “▼” to make cursor “→” point to “Fusion fiber”.
- 3> Press “◀” or “▶” to select the value of “Fusion fiber”.
- 4> Press “▲” or “▼” to make cursor “→” point to “Fusion program”.
- 5> Press “◀” or “▶” to select needed arc program.
- 6> Press “MENU” to enter program parameter menu.
- 7> Press “▲” or “▼” to make cursor “→” point to modifiable parameter
- 8> Press “◀” or “▶” to increase or decrease the quantity of selected parameter.
- 9> Press “ENT” to save program parameter after confirming.
- 10> Press “MENU” to exit menu in turn.

● Notice:

- 1) Press “AUTO” to modify step-size among “1”, “10”, “100” under two class menu.
- 2) You can only modify arc program No.6~No.100, but can refer to program No.1~No.5.

8.3 Arc test

The field conditions (such as fiber, altitude, climate, electrode status, etc.) are influential to splice loss. To get low loss, Fusion Splicer provides test function to modify

arc current automatically. Operations are as follows:

- 1> Press “MENU” to enter the first class menu.
 - 2> Press “▲” or “▼” to make cursor “→” point to “working modo”.
 - 3> Press “◀” or “▶” to select the value of “working mode” to 1.
 - 4> Press “▲” or “▼” to make cursor “→” point to “Fusion fiber”.
 - 5> Press “◀” or “▶” to select the value of “Fusion fiber” to 1 or 2.
 - 6> Press “▲” or “▼” to make cursor “→” point to “Fusion program”.
 - 7> Press “◀” or “▶” to select needed arc program.
 - 8> Press “ENT” to enter program parameter menu.
 - 9> Check whether fusion parameter is reasonable (consult program No.1~No.5. Notice: fusion current’s range is 10~16mA). Following methods can modify current parameter:
 - a> Press “▲” or “▼” to make cursor “→” point to modifiable parameter.
 - b> Press “◀” or “▶” to increase or decrease the quantity of selected parameter.
 - c> After confirming, press “ENT” to save arc parameter.
 - d> Press “MENU” to exit menu in turn.
 - 10> Select two pieces of fiber to be spliced and make end-surface.
 - 11> Raise the windshield and the fiber holder in turn.
 - 12> Load two pieces of fiber into worktable and close windshield.
 - 13> Press “TEST” in auto working mode, KL-280 will check the quality of fiber’s end-surface, gap, calibrate cursorily, arc automatically, and then correct value of arc current.
 - 14> If “Too large fusion current” or “Too small fusion current” is displayed on the screen, please repeat step 10~13 until “Right fusion current” is displayed. So test is finished, and arc program will be rectified to be arc program No.6.
- Notice:
 - 1) The selected fiber must be accord with actual fiber. Best to arc test before splicing.
 - 2) Arc test will correct arc position and arc current, so it is normal if gap position changed after test.
 - 3) During the process of arc test, if “Proper fusion current” is not be displayed on screen, please do not enter the parameter menu of the arc program.
 - 4) During the process of arc test, if “Right fusion current” doesn’t be displayed, to avoid useless current, do not enter splice program parameter menu.
 - 5) During the process of arc test, “Right fusion current” has definite range; you can select proper arc current base on actual demand.
 - 6) Arc test is efficient only when electrode is well, so you must check electrode at first. (Consult 6.2.1)
 - 7) The value of “Fusion program” after arc test mustn’t be the best arc parameter due to consider the factor of “current” only.
 - 8) **when pressing "test" button to make splicer arcing for testing, in order to avoid causing errors, don't press "heat" button.**

8.4 Optimization of arc parameter

Those factory-set arc parameters can satisfy splicing of standard fiber basically. But in order to obtain the best efficiency, it is necessary to optimize arc parameter.

8.4.1 Optimization of SM fiber arc parameter

You need some instruments to test fiber's loss, for example: lamp-house, OTDR. The process of optimization of arc parameter is same as process of fusion, you can use instrument to test loss and change arc parameter properly, until loss is of coherence and is the smallest. The general principles of optimization of arc parameter are:

- 1> Increase of current will get similar effect with extending time in definite range.
- 2> "Pre-fusion current" mustn't be bigger than "Fusion current".
- 3> Do not modify value of "Fusion push".
- 4> Best to change value of "Push speed" after selecting current usually.

● Notice:

- 1> Optimization of arc parameter is effective only when arc electrode is well.
- 2> Fusion loss displayed on screen is of reference only when arc parameter is well and spliced fibers' physical parameter is accordant.

8.4.2 Optimization of MM fiber arc parameter

Optimization of MM fiber arc parameter is different with SM fiber. The relation between selection of MM fiber arc parameter and fusion loss is undemanding. If process of splicing is smooth and splice spot is symmetrical, then loss is satisfied, and you needn't to test fusion loss.

Following are general principles of optimization of arc parameter when splicing MM fiber:

- 1> The value of "Pre-fusion current" mustn't be bigger than the value of "Fusion current".
- 2> The value of "Pre-fusion time" must bigger than splicing SM fiber.

The possible questions and measures are as follows:

- 1> There is bubble when splicing.

Solution: Increase value of "Pre-fusion time", then try to decrease value of "Fusion current" if it is insufficient.

- 2> Fusion is insufficient and the light string is broken in the center of fiber.

Solution: Increase value of "Fusion time" or decrease value of "Fusion current".

- 3> Fiber's splicing spot becomes smaller.

Solution: Try to decrease value of "Pre-fusion current" or value of "Fusion current".

Notice:

MM fiber fusion program uses special arc mode. It is normal that screen menu shakes or you can hear "pa pa" when splicing.

9. Setting working mode and parameter

9.1 Setting working mode

The working mode of Fusion Splicer are automatic operation and manual operation. The operations are as follows:

- 1> Press "MENU" to enter the first class menu;
- 2> Press "▲" or "▼" to make cursor"→" point to working mode to be selected;
- 3> Press "◀" or "▶" to select working mode;
- 4> Press "ENT" to confirm;
- 5> Press "MENU" to exit the first class menu, then working mode will be displayed on the screen.

● Notice:

- 1) Auto operation and manual operation can't be mixed.
- 2) Best to press "RUN" to setting gap when it's manual operation.
- 3) The fusion splicer won't estimate loss when it's manual operation.

9.2 Setting working parameter

Working parameters of Fusion Splicer include heating time, surface-angle, tension test, etc.

The operations are as follows:

- 1> Press “MENU” to enter the first class menu;
- 2> Press “▲” or “▼” to make cursor “→” point to working parameter to be selected.
- 3> Press “◀” or “▶” to select needed working parameter.
- 4> Press “ENT” to confirm.
- 5> Press “MENU” to exit the first order menu.

● Notice:

- 1) The value of “Setting end-face” should be 6 usually under the premise of fusion automatically.
- 2) You can adjust “Heating time” freely, the heating control of KL-280 very flexible, it can be controlled by keyboard or reckon through time.
- 3) “Fusion fiber” must be accord with actual spliced fiber.

10. Maintenance

10.1 Replacing the electrode

Firstly make sure fusion splicer is turned off, the take off protective cover of electrode room, loosen the screw and take out up-electrode. Then take out down-electrode in the same way. The installation’s order of new electrode is opposite to strip. Gap between two tops of electrode should be within 2.6 ± 0.2 mm and they should be symmetrical to fibers. Usually, do not adjust electrode, and to avoid damage of electrode do not touch the electrode’s top in the whole process, prevent electrode dropping into the machine. After replacing electrode, you should aging electrode, test the current until it is steady and do the arc test , after “Current is OK” is showed 3 times, user can continue to splice, steps are as following:

Press “MENU” to enter first class menu,

- 1) Press “▲” or “▼” to make cursor to “Maintenance ”
- 2) Press “ENT” to enter it
- 3) Press “▲” or “▼” to make cursor to “electrode aging”
- 4) Press “ENT” to achieve arcing, arcing count is shown at the bottom of displayed, 20 times of arcing is shown in one time of “Electrode aging”, after buzzer bleats twice, electrode aging is finished. User can know the electrode situation according to steady of image and sound.

● Notice:

- 1) Shut off the power of machine before replacing electrode.
- 2) Make sure that arc parameter had been setup efficiently in the arc process before testing the arc current.

10.2 Maintenance of electrode

After extended use, the top of electrode will produce dust; dust will make arc unsmooth. When “hiss” sounds, you should clean electrode. Best to clean electrode timely as following operations:

- 1> Open the machine ;
- 2> Clean electrode’s top tenderly with alcohol tampons;
- 3> Press “MENU” to enter the first class menu;
- 4> Press “▲” or “▼” to make cursor “→” point to “Maintenance”;

- 5> Press “ENT” to enter maintenance menu;
- 6> Press “▲” or “▼” to make cursor “→” point to “CLR Electrode”;
- 7> Press “ENT” to make machine arc automatically, do those two or three times. To stabilize arc current and clean electrode, the high temperature will boil off the impurity on the electrode, until arc is stable and the sound of “hiss” disappear.
- 8> Press “MENU” to exit menu in turn.

● Notice:

- 1) Because top of electrode is very weak, to avoid damage of electrode and unstable arc, do not touch it by hard things.
- 2) During the process of maintenance, to avoid damage of instrument, do not arc large current for a long time.

10.3 Cleaning V-groove

The driving range of adjusting core’s direction is only a little micron, fiber’s picture will departure normal position and couldn’t level if any things exists. You should clean the V-groove timely as following operations:

- 1> Open the windshield;
- 2> Open the fiber holder and fiber clamp;
- 3> Using the special tool to push several times at the same direction.

☆ Notice:

To avoid damage of V-groove and instrument, do not clean V-groove with hard thing(knife) and energize on it.

10.4 Cleaning lens of microscope

Fusion splicer adopts the working mode of disposal pictures. It is necessary to keep the lens of microscope cleaning. The operations are as follows:

- 1> Open the windshield, under the electrode you will find two lens.
- 2> If any thing exists on lens, dispose it with proper instrument. To avoid of damage, do not touch lens with hard thing.
- 3> Wipe lens with a cotton swab soaked with absolute alcohol or air pouch.
- 4> Wipe lens tenderly with dry cotton swab until it is clean.

10.5 Maintenance

This company guarantees to keep fusion splicer in good repair. Do not open box to repair if any failure exists. To resolve questions in time, please contact with our technology department at once.

11 Notice

11.1 Shipping and storing

- 1> Fusion splicer is an exact instrument; it must be transported with special encasement.
- 2> Do not put fusion splicer in too hot environment.
- 3> Do not make it dew when storing.

11.2 Operating instructions

- 1> Fusion splicer can only splice silica fiber.
- 2> To avoid of too high voltage, do not open windshield and touch electrode.
- 3> Do not touch electrode with hard thing when cleaning.
- 4> Do not touch V-groove with hard thing when cleaning.
- 5> Do not use KL-280 fusion splicer in flammable and explosive environment.
- 6> Although normal working life of electrode is 3000 times, do not replace electrode easily if arc is stable.
- 7> Best to clean electrode about two or three times before splicing, and do the arc test.

● Notice:

Because of the vulnerability, the electrode is not in the range of repair.

12 Addenda A Operating Fusion Splicer skillfully

This addendum can help you to resolve some questions by yourself.

- 1> The screen is dark after starting machine.

Solutions:

- 1) Check whether the electrical outlet is inserted.
- 2) Check whether the voltage of P.S. is too low.
- 3) Check electric quantity of battery and charge battery in time.

- 2> “Exhausted Battery” is displayed on the bottom of screen after starting Fusion Splicer and buzzer works continually.

Solutions:

- 1) If use battery, charge in time or replace the power supply.

- 3> The fiber can be reset as normal, but when setting gap, fiber is immovable on the screen and “Setting gap” is displayed on the screen.

Solutions:

- 1) Raise the windshield, left and right clamps. The checking steps as follows:
- 2) Check whether broken fiber exists.
- 3) Check whether cleaved length is too short.
- 4) Check whether fiber matches with V-groove.
- 5) Check whether fiber is tail fiber.

- 4> The fiber can be reset as normal, but when setting gap, fiber moves backwards continually, “Setting gap” and “Reload fiber” are displayed on screen.

Solutions:

Maybe there is too much dust on the lens of microscope, clean the aclinic and upright lens with cotton swab until dust disappears, then try again.

- 5> The fiber can be reset as normal, but when setting gap, “Setting gap” is

displayed on screen and after a while “Reload fiber” is displayed on screen.

Solutions:

- 1) Raise the windshield, left and right clamps. The checking steps as follows:
- 2) Check whether broken fiber exists.
- 3) Check whether cleaved length is too short.
- 4) Check whether fiber matches with V-groove.

6> When calibrating automatically, fiber moves up and down, the screen’s display stops at “Adjust core”.

Solutions:

- 1) Check whether the position warp between X and Y directions’ surface is less than 1cm. (screen displays size) If not, return KL-280 factory to fix, otherwise operating as follows:
- 2) Check whether bare fiber is clean.
- 3) Clean the dust of V-groove.

7>The fiber can be reset as normal, but when setting gap, “Setting gap” is displayed on screen and after a while “Bad left fiber’s surface” is displayed.

Solutions:

- 1) Observe fiber picture in screen, if the quality of left fiber’s surface is bad, you can remake surface and try again.
- 2) Observe fiber picture in screen, if the quality of left fiber’s surface is good, maybe the value of “Setting surface” is too small, if you want to keep on working you can increase it.
- 3) After “Bad left fiber’s surface” is displayed, the screen becomes dark; Make sure that windshield is covered well. Raise windshield, check whether the pipe is dent, and then manage it.

8> The fiber can be reset as normal, but the time of auto-fusion is too long.

Solutions: Enter the menu of arc parameter; check whether the setup is efficient.

9>During arc test, the position of fiber’s gap leans to one side of screen.

Solutions: When the machine tests the arc, it will adjust the position of current and arc. If the arc on the apparent of electrode were asymmetric, the arc position would change. If the change was not too much, you can ignore it, otherwise please manage it:

- 1) Enter the menu of maintenance, and then operate “Clean the electrode” several times.

10> When arc splicing, do not use the program (1~5).

Solutions: Because of electrode’s aging, big change takes place in opposite position between fiber and arc or operating environment.

- 1) The condition of electrode’s aging.
Operate “Clean the electrode” if the top of electrode is well.
Replace electrode if the top of electrode is bad. (Consult 10<Maintenance>)

2) Big change takes place in operation environment. Operations are as follows:

- 1> Do arc test until “Moderate current” is displayed three to five times.

- 2> Enter splice program the menu of arc parameter, and check the value of arc current.
 - 3> translation motion (decrease or increase) current (premelting current, splicing current).
 - 4> Press “ENT” to save after confirming.
 - 5> Press “MENU” to exit menu.
- 11> When splicing the MM fiber, there is bubble in the process of arc.
Solutions: The difference between fiber’s core and envelope’s refractive index is too big. Operations as follows:
- 1> Consult MM fiber’s arc program set by factory (the value of “Fusion program” is less than 5) and confirm.
 - 2> Do arc test until “Moderate current” is displayed three times.
 - 3> Splice MM fiber; if there is bubble then modify arc parameter.
Operations are as follows:
 - 1) Enter the menu of arc parameter.
 - 2) Increase 1 step size(10m/s)to the value of “Pre-fusion time”.
 - 3) Splice fiber; increase the value of “Pre-fusion time” until no bubble.
 - 4) Decrease the value of “Pre-fusion current” if no bubble and fiber thins.

13 Addenda B Explanations about arc test

It is necessary to select proper arc fusion program if you want to obtain low fusion loss. Fusion splicer can modify arc current and arc position automatically.

Basic theory:

The gap position of fiber’s surface before arc is L0 and L1,

The gap position of fiber’s surface after arc is L2 and L3. The formula is as follows:

$$\Delta L = (L3-L2) - (L1-L0)$$

Base on the value of “ ΔL ”, you can modify the quality of arc current.

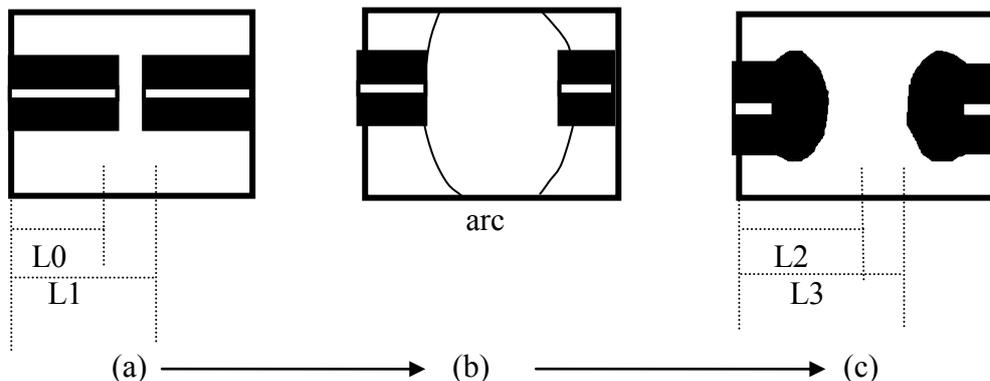
The shrinking value of left fiber “ ΔL ” is gotten from following formula:

$$\Delta L1 = L2 - L0$$

The shrinking value of right fiber “ ΔL ” is gotten from following formula:

$$\Delta L2 = L3 - L1$$

Base on the value of $\Delta L1$ and $\Delta L2$, you can modify gap position to fit the change of arc position.



arc test chart

Notice: Arc tests just only change current of arc parameter; you should optimize the arc parameter.

14 Addenda C Unusual condition, confirmation and solution

Unusual condition, confirmation and solution			
Unusual condition	The possible problem	Solution	Remark
1) After opening the machine, the screen doesn't have light; After opening the windshield, the light is off (the machine doesn't have reaction)	1. The power socket is not be put well or P.S. is damage 2. The P.S. switch didn't work well. 3. There is short circuit or fault in the machine. 4. When using the battery, voltage is low or polarity is opposite.	1. Confirm P.S. output voltage is about DC 12~13V. Check whether polarity is opposite and manage it. 2. Check whether there is something in the machine, then restart. If it doesn't work, please contact us.	All problems are caused by inner circuit fault probably. If you couldn't solve the problems, please sent it to us with detailed explanation.

2) After closing the windshield, the image of fiber is dim.	The windshield is not pressed well or the fiber didn't come into the V-groove.	1. Reload fiber. 2. Clean V-groove.	
3) When pressing "RUN" to setting gap, fiber moved from front to behind Then "Reload fiber" is displayed.	1. The length of cutting fiber is wrong. 2. The fiber holder doesn't work well	1. The length of cutting fiber should be 16mm. 2. Push the fiber holder and check whether there is fault in it , then confirm its position and manage it.	
4). When pressing "RUN" to setting gap, fiber moved to behind, then "Reload fiber" is displayed or fiber moved from left to right , occasionally it can splice.	1. There is dust on the lens or the light. 2. There is dust on reflector.	Clean lens and two Lights with cotton. If it doesn't work, contact us.	

<p>5) Press “RUN”, Fiber image of one Side moved vertically, and could not splice.</p>	<p>1. There is dust in the V-groove, which leads to the position of fiber is too higher than another side. 2. There is dust on lens, light or reflector</p>	<p>1. Wipe V-groove at single direction with tool several times. 2. Clean lens, prism and two lights with clean cotton several times. 3. If it doesn't work, contact us.</p>	
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<p>6) After splicing, displayed big loss or failed splicing.</p>	<p>1. The fiber is dirty, the end-face is unqualified, or there is fault in the cleaver. 2. There is dust on the lens, light or reflector.</p>	<p>1. Adjust fiber cleaver, make qualified fiber end-face. 2. Clean the lens, reflector and two lights with clean cotton several times. 3. If it doesn't work, contact us.</p>	<p>All problems are caused by inner circuit fault probably. If you couldn't solve the problems, please sent it to us with detailed explanation.</p>
<p>7) Always display bad fiber end-face of one side.</p>	<p>1. The value of “Setting end-face” is too small. 2. There is dust on the Lens, lights or reflector.. 3. The light is dim. 4. There is dust in V-groove or fiber isn't put properly.</p>	<p>Enter the menu; add the value of “Setting end-face”. Clean the lens, the light and the reflector, clean the V-groove and try again. . If it doesn't work, contact us.</p>	
<p>8) The value of tested current is too big or too small.</p>	<p>1. The value of “fusion current” are too large or too small. 2. Too much sediment on the electrode. 3. The relative position between fiber and arc has changed. 4. The storage battery doesn't work well. 5. The environment has changed.</p>	<p>1. Enter the menu and clean electrode several times. 2. Or select “electrodes aging” and check whether the arc is steady. Then select Program 3 to test arc again. 3. Test the current until it is proper. 4. If it doesn't work, contact us.</p>	

<p>9) The image position of end-face gap leans to one side of screen. (The function can follow the arc position automatically, if too much, please adjust it.</p>	<ol style="list-style-type: none"> 1. Too much sediment on the electrode. 2. Electrode deflects because of concussion. 3. The lens leans to unusual position. 4. When testing current, open the windshield too early or touch one side fiber, this is because of wrong judgment of arc position. 	<ol style="list-style-type: none"> 1. Enter the menu and clean electrode several times. 2. Close machine and restart after several minutes, then do arc test at least three times. 3. If deflection isn't too much, do not adjust it. 4. Contact us due to special condition. 	
<p>10) After cleaning V-groove, fiber can't be put in it well and the image is unclear.</p>	<ol style="list-style-type: none"> 1. The groove on the fiber holder and V-groove don't lie in same line or same flat. 2. The tail fiber can not be pressed tightly. 	<ol style="list-style-type: none"> 1. Open the board, push the groove toward to near V-groove, check whether the two grooves lie in same line and same flat, then manage it. 2. Reload fiber. 3. If it doesn't work, contact us. 	<p>All problems are caused by inner circuit fault probably. If you couldn't solve the problems, please sent it to us with detailed explanation.</p>
<p>11) Normal setting gap and calibration, but electrode doesn't arc during the fusion.</p>	<ol style="list-style-type: none"> 1. Set the current parameter to zero or select the program without setting parameter. 2. The storage battery doesn't work well. 3. When press the "RUN" and the machine is in mode of auto splice, "HEAT" is pressed by mistake. 	<ol style="list-style-type: none"> 1. Enter the menu, check whether the parameter setting is normal, if not, change it to normal parameter. If this doesn't work, please send it to us to change the battery. 2. Change the battery 3. Don't press "HEAT" when the "START" is pressed and the machine is in mode of auto splice. 	
<p>12) There is spark in the electrode room or electrode arcs to near metal.</p>	<ol style="list-style-type: none"> 1. The environment is too damp. 2. Electrode is loose or deformed. 	<ol style="list-style-type: none"> 1. Change to dry environment. 2. Open windshield to check electrode is loose or deformed. If it doesn't work, contact us. 	

<p>13) Normal “RUN”, setting gap and calibration, but splicing is abnormal.</p>	<ol style="list-style-type: none"> 1. Regard “TEST” as fusion key wrongly. 2. Too large current. 3. The value of pushing is too small or is zero because of too high push speed. 4. The board is not put well. 5. On the right is bad tail fiber. 	<ol style="list-style-type: none"> 1. Confirm the fiber is in good condition. 2. Enter the menu to check parameter setting and set the proper parameter. 3. Do art test until current is proper. Reload fiber, press “RUN” to check the fusion. If it doesn’t work, contact us. 	
<p>14) Normal splicing. But the value of fusion loss is too large and fusion is failing.</p>	<ol style="list-style-type: none"> 1. Check whether there is fault in system or there is dust on the lens or lights or reflector. 2. The value of “Setting end-face” is too large. 3. Open the windshield before the test. 	<ol style="list-style-type: none"> 1. Wipe the lens, reflector and two lights; decrease the parameter of “Setting end-face”. 2. Do arc test until the current is proper, and then slice the fiber. If it doesn’t work, contact us. 	<p>All problems are caused by inner circuit fault probably. If you couldn’t solve the problems, please sent it to us with detailed explanation.</p>
<p>15) There is bubble on the spliced fiber or the fiber becomes coarse or tenuous.</p>	<ol style="list-style-type: none"> 1. The end-face of fiber is unqualified or there is dust on it. 2. The setting of program parameter is wrong. 	<p>Make sure that the end-face is good. Test current until it is proper then try again. If it doesn’t work, change the value of “Pre-fusion current, time” or “Fusion push”</p>	
<p>16) The splicing index is too large. (actual measure)</p>	<ol style="list-style-type: none"> 1. There is dust in V-groove, 2. Improper current 3. The fiber is not aligned. 4. The electrode doesn’t work well. 5. Improper setting of program parameter. 6. Unqualified end-face. The cleaver is not good. 7. Special fiber. 8. Bad environment. 	<ol style="list-style-type: none"> 1. Clean the V-groove, lens or electrode. 2. Select proper program to arc. 3. Adjust the cleaver. 4. If the splicing index is too large, change the value of “Pre-fusion current” or “Fusion push”, find proper program. 5. Make sure that the wind power is proper. 	

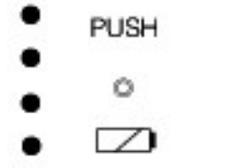
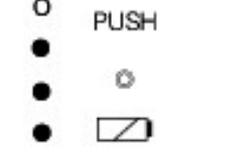
<p>17) 1>The heat LED doesn't work, but it can heat; or the index light, buzzer and heater don't work 2> The heat LED and buzzer work well, but the heater doesn't work.</p>	<ol style="list-style-type: none"> The heat key is damaged. The heat key is stuck by something hard. 	<ol style="list-style-type: none"> Press "Heat" several times, If it doesn't work, contact us. 	<p>All problems are caused by inner circuit fault probably. If you couldn't solve the problems, please sent it to us with detailed explanation.</p>
<p>18).Can't achieve arc in fusion and current test or something wrong happen.</p>	<ol style="list-style-type: none"> When press the "RUN" and the machine is in mode of auto splice," HEAT" is pressed by mistake. When press "TEST" and the machine is in arc test, "HEAT" is pressed by mistake. 	<ol style="list-style-type: none"> Don't press "HEAT" when pressing the "RUN" and the machine is in mode of auto splice. Don't press "HEAT" when pressing "TEST" and the machine is in arc test. 	

15 Addenda E Introduction of power supply modules

KL-01-26L7 PS modules has inner Lithium battery, 11.1V 6.6Ah. It is fixed on the bottom of machine with four screws and easy to replace with special design.

1) Check electric quantity of battery and charging mode explanation:

A. Press "PUSH" to show electric quantity when machine is off. More green lights on the left side show more electric quantity. The red light stands for charging. Please refer to following table:

 <p>Battery power $\geq 80\%$ Battery voltage $\geq 12.2V$</p>	 <p>Battery power $\geq 60\%$ Battery voltage $\geq 11.8V$</p>	 <p>Battery power $\geq 40\%$ Battery voltage $\geq 11.4V$</p>	 <p>Battery power $\geq 15\%$ Battery voltage $\geq 11.0V$</p>	 <p>Battery power $\geq 10\%$ Battery voltage $\geq 11.0V$</p>
<p>Electric quantity 100%</p>	<p>Electric quantity 90%</p>	<p>Electric quantity 60%</p>	<p>Electric quantity 30%</p>	<p>Electric quantity <10%</p>

Voltage $\geq 12.5V$	Voltage 12.1V	Voltage 11.8V	Voltage 11.5V	Voltage $< 11.5V$
● Green light or red light open		○ Green light or red light off		

B. When being charging, 4 light on the left of power module are in red, it represent the voltage, not the electric quantity.

2) Charge the battery:

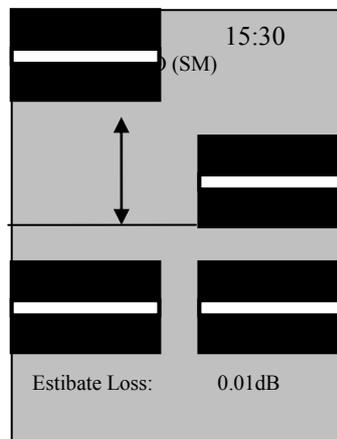
Battery is being charged when AC/DC adapter (13.5V /5A) is inserted no matter how much is the quantity of battery. Duration of charging is between 3 hours 40 minutes and 40 minutes, depending on the quantity of battery, red lights indicate being charging, green lights indicate ending of charging.

3) Notice:

- A. Please check the electric quantity before using machine and charge in time.
- B. Putting the battery in hot environment or into fire is prohibited.
- C. Please do not charge the battery in low environment to avoid reduce the working life.
- D. Taking down the battery is prohibited.
- E. Battery is expendable; please replace it with the type of battery appointed by our company when the machine could not work with green lights on.
- F. Please charge the battery in time when you could not start the machine or machine warns. As shown in photo.

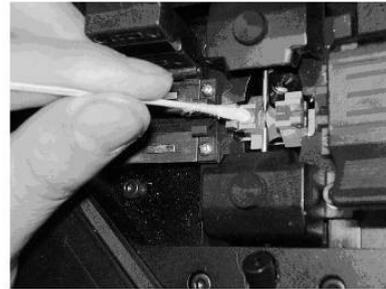
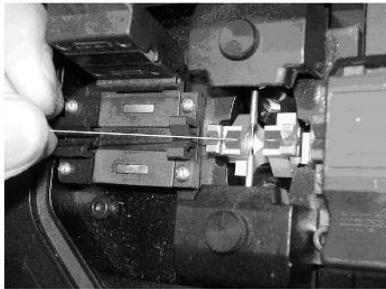
16 Addenda E Cleaning of V- groove and Fiber optical

1. Set gap, when two fibers are not vertically aimed, machine shows “ set fiber again” or “ R&L BAD CLEAVE” (as the photo)

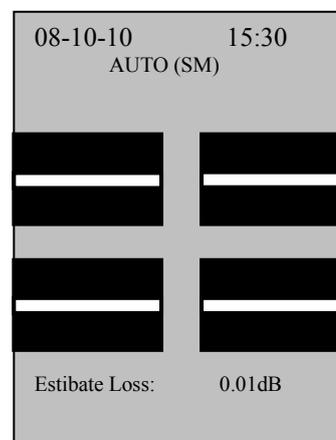
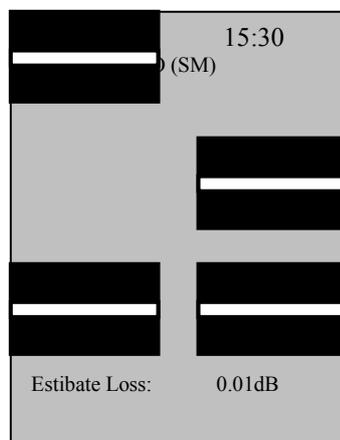


2. Check and clean V-groove for the first time

Please be careful and don't push hard while cleaning V-groove. Use cotton swab dipped by alcohol to brush slightly, use fiber end to clean the dust and make sure there is enough light. Clean the dust from V-groove so that machine work correctly. Check according priority: bending of fiber, press board of fiber. Make sure the restrict groove and V-groove of the big board is in one line, make sure there is no dust in V-groove.



3. If fibers are still not in the right place, enter “ Manual mode” and press ▲ or ▼ to align them, then set to “auto mode” again. Make sure the movement of fiber and key-press is in the same direction.



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