

M9
FUSION SPLICER

User's Manual

Version:V0.01



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Preface

Thank you for choosing M9 Arc Fusion Splicer from INNO Instrument. M9 adopts innovative product design and exquisite manufacturing technology so as to deliver unprecedented splicing experience to customers.

The totally new technology greatly reduces splicing, and advanced estimation method and alignment technique ensure the accuracy of splice loss estimation. The simple-but-trendy product design, sophisticated internal structure and reliable durability make the splicer be suitable for any operating environment. Dynamic operation interface and automatic splice mode provide users great convenience. For more information of M9, please visit our official website at

www.innoinstrument.com



Standard accessory:
FH-40、FH-900、
FH-200/250S

This User Manual explains the use, performance characteristics, and cautions about M9 fusion splicer and how to install and operate it. The primary goal of this manual is to make the user as familiar with the splicer as possible.

Important!

INNO Instrument recommends all users to read this manual before operating M9 fusion splicer.

Chapter1 Technical Parameters

Applicable Fiber Type

- * SM(ITU-T G.652&T G.657)/MM(ITU-T G.651)/DS(ITU-T G.653)/NZDS (ITU-T G.655)
- * Applicable fiber count; Single core
- * Suitable indoor cable diameter: 0.25mm/0.9mm/2.0mm/2.4mm/3.0mm
- * Cladding diameter: 80 μ m-150 μ m

Splice Loss

Same fiber is spliced, measured by cut-back method relevant to ITU-T standard. The typical values of splice loss are:

- * SM:0.03dB
- * MM:0.02dB
- * DS:0.05dB
- * NZDS:0.05dB
- * G.657:0.03dB

Splice Mode

- * It can be preset 7 kinds of splice mode.
- * It can store 10000 records of the latest splice results.
- * Splice time: 12s

Heat Oven

- * 7 kinds of heat shrinking tubing: 10mm, 20mm, 30mm, 40mm, 50mm, 60mm, 80mm(thin sleeve)
- * Heating time: 20 to 900s optional.
- * Typical heating time: 20s.
- * Heating mode: 3 types of in-built heat modes available

Power Supply

- * Standard AC power voltage: AC 100 to 240V, 50 to 60Hz;
- * Standard DC power voltage: DC 9 to 14V
- * Power supplied by the Lithium battery: DC 11.1V, 3000mAh, Fully charged time is approximately 2 to 3 hours





Size and Weight

- * Size: 136H x 114W x 125D (including rubber bumper)
- * weight: 1.67kg (including battery) / 1.43kg (without battery)

Environmental Conditions

- * Operating conditions: altitude: 0 to 5000m, relative humidity: 0 to 95%, temperature: -10 to 50 °C , the maximum wind velocity: 15m / s;
- * Storage conditions: relative humidity: 0 to 95%, temperature: -20 to 60°C , battery: -20 to 30 °C for long-term storage

Other

- * Observation and display: Two cameras (orthogonally view), 4.3-inch color LCD display (There's high-strength and impact resistant protective layer on the surface of the LCD) .
- * 300X magnification, 400X partial magnification
- * Tension test: 1.96 to 2.25N.
- * Terminals: Mini USB

Battery precautions

- 1) Do not touch or hit battery with pointed or sharp items.
- 2) Do not transport or store the battery together with metals.
- 3) Do not throw, drop, impact, or bend battery, or any knock or stomp on the battery is forbidden.
- 4) Do not connect the anode and cathode terminals of the battery with metals such as electric wire for fear of short circuit trouble.
- 5) Do not allow battery' s anode or cathode terminal to touch with the aluminum layer of package made from aluminum laminated plastic film material for fear of short-circuit.
- 6) In no case the battery cell can be dismantled.
- 7) Do not immerse the battery into water or seawater, because the battery cell cannot bear moist environment.
- 8) Do not place or use the battery beside or near the heat source such as fire or heater.
- 9) Do not heat battery or throw it into water.
- 10) Do not directly solder the battery.
- 11) Do not charge battery near or beside the fire or in a very hot environment.
- 12) Do not place the battery into microwave oven or any high pressure vessel.
- 13) Do not allow the battery work or place it in hot temperatures such as in strong sunshine or hot environment in car for a long time, for fear that battery might be overheated, on fire, weakened functionally, or shortened in life.
- 14) Any usage of the damaged battery is forbidden. The battery should be kept away from fire source when electrolyte leakage occurs or the battery emits electrolyte smell for fear battery might catch on fire or explode.



Chapter 2 - Installation

Safety Warnings and Cautions

As M9 is designed for fusion splicing silica glass optical fibers, **it is very important that the splicer should not be used for any other purposes.** The splicer is a precision instrument and must be handled with caution. Therefore, you must read the following safety rules and general precautions in this manual regarding the use and handling of M9 at any time. Any behaviors that do not follow the warnings and cautions will break the safety standard about design, manufacture, and usage of the fusion splicer. INNO Instrument will not take the responsibility for those consequences caused by misuse!

Safety Warnings

- ① DO NOT use the splicer in places where there is a risk of explosion.
- ② DO NOT touch the electrodes when the splicer is switched on.



Note: The fusion splicer can only use the specified electrodes. Please choose the electrode replacement option on maintenance menu or turn off the power before you replace the electrode. Do not discharge the battery before you install a pair of electrodes.

- ③ DO NOT disassemble or modify any components of the splicer without approval, except for the permitted-to-disassemble / modify components or parts by users stated in this manual. Component replacement and its internal adjustment must be implemented by INNO or its authorized technicians or engineers.
 - ④ Handle the main supply cable carefully. Pull out the cable from the electrical socket by holding only the wall plug and not by pulling the cable. Always ensure this cable to be in good condition. Otherwise, there is a risk of fire or electrical shock.
 - ⑤ To prevent any fire or electrical shock, do not expose the splicer to rain or damp conditions.
 - ⑥ Safety glasses should always be worn during fiber preparation and splicing operation. Fiber fragments can be extremely dangerous if they come into contact with the eye, skin, or are ingested.
 - ⑦ Disconnect the AC power cord from the AC adapter inlet or the wall socket (outlet) immediately if user observes the following or if the splicer receives the following faults:
 - Fumes, bad smell, abnormal noise or over heat.
 - Liquid or other matter falls into cabinet
 - The splicer is damaged or dropped.
- If any of these faults occurs, please contact our service center immediately. Leaving the splicer in a damaged state without any prompt measures may cause equipment failure, electric shock, or fire and may result in injury or death.
- ⑧ Do not use compressed gas or canned air to clean the splicer. They may contain flammable materials that could ignite during the electrical discharge.
 - ⑨ Use the supplied AC power adapter of M9. Use of an improper cord or a damaged cord may cause fuming, electric shock, or equipment damage and may result in injury, death, or fire.
 - ⑩ Use the supplied AC power cord of M9. Do not place heavy objects on the AC power cord. Do not heat or modify the cord. Use of an improper cord or a damaged cord may cause fuming, electric shock, or equipment damage and may result in injury, death, or fire.





Maintenance and External Care Precautions

- ① Always avoid using hard objects to clean V-grooves and electrodes.
- ② Always avoid using acetone, thinner, benzol or alcohol when cleaning any part of the splicer, except for the places advised.
- ③ Use a dry cloth to remove dust and dirt from the splicer.
- ④ If the outside of the splicer is dirty, plunge a soft cloth into diluted neutral washing up liquid, wring out the cloth and clean. Dry the splicer with a dry cloth but DO NOT use furniture polish or other cleaning agents.
- ⑤ Always follow the maintenance instructions in this manual.

Transport and Storage Precautions

- ① When the splicer is moved from cold to warm environment, you should allow the splicer to warm up gradually. Otherwise, the condensation generated inside will bring harmful effects to the splicer.
- ② Pack the fusion splicer well for long time storage.
- ③ Keep the splicer clean and dry.
- ④ The splicer is precision adjusted and aligned. Always keep the splicer in its carrying case to protect from damage and dirt. Put cushion package outside the carrying case for long distance transportation.
- ⑤ Always avoid leaving the splicer in direct sunlight or expose to excessive heat.
- ⑥ DO NOT store the splicer in dusty or humid environment. This may result in electric shock, splicer malfunction or poor splicing performance.
- ⑦ Keep the humidity to a minimum level where the splicer is stored. The humidity must not exceed 95%.

Installation upon Delivery

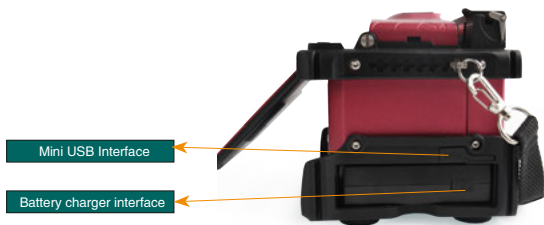
Important!
Please carefully follow the instructions below.

Unpacking the Splicer

Raise the handle upwards and with a firm grip, lifting the splicer upward and out of the carrying case. As shown below.



Overview of External Parts



Power Supply Method

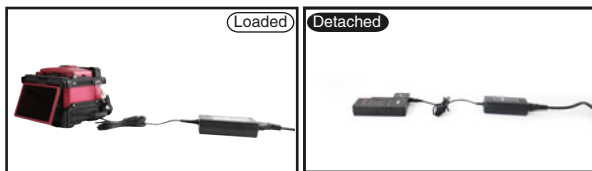
Loading or unloading Battery

1. Following is the way of installing a battery.



Charging

- * When power supply unit is loaded on M9 fusion splicer.
- * When power supply unit is detached from M9 fusion splicer.



During charging, the battery indicators will blink.

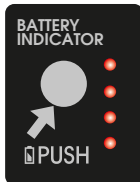
When battery charge completed, all of the indicators will be on steadily.

Note: 1. Before fusion splicing, please check if the remaining battery capacity is over 20% to prevent battery capacity damage. When fusion splicing or heating is needed but battery level is lower than 20%, please detach the battery but you can use power adapter to support operation. 2. The temperature of battery will increase during charging. So please do not charge for the adapter together with battery or charge when fusion splicer is still in the carrying case.

Battery Status

There are 2 ways for viewing battery level.

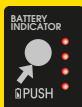
- ① If the battery is connected to the slicer, then battery level will be displayed on the upper right side of the screen.
- ② Battery level is indicated by battery LED indicator. You can press “PUSH” to view the battery level. As shown below:



When adapter is used for power supply, a power supply indicator will be displayed at the upper right side on the screen of fusion splicer. As shown below:



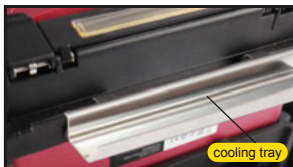
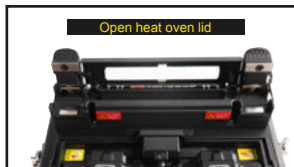
Battery Refresh Cycle



The battery should be refreshed or activated periodically for fear of aging caused by battery memory effect. The method is as follows:

Keep the splicer in power-on status to discharge until the splicer switched off automatically due to completely discharging. Then go on to charge until fully charging completes. Battery refreshing process completes.

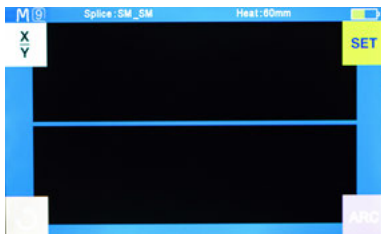
Heat Oven



Chapter 3 - Basic Operation

Turn On the Splicer

Press the “ON/OFF” button on the top left of the front operating panel of the splicer. The READY screen of working menu (workbench) will be displayed after startup, as shown in the following picture:



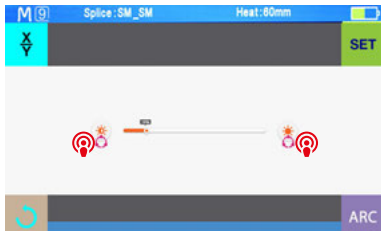
Adjust Monitor Angle

Adjust the monitor with a best angle for your convenient observation and operation



Adjust LCD Backlight Brightness

In the original operating interface (workbench), press the confirmation button then adjust LCD backlight brightness by tapping the two brightness icons on the LCD monitor, as the following picture shows:



Note: The LCD monitor is a precise instrument of the splicer and it is produced in the factory under strict quality control. But there may be dots of various colors on the screen. The brightness of the LCD monitor depends on the monitor angle. These symptoms are not defects of the LCD display but a natural phenomenon.

Preparing the Fiber

There are three basic preparatory steps to be completed before the fibers can be placed in the splicer.

1) Stripping

Remove the sleeve and retain at least 50mm length of coating of optical fiber (valid for both tight and loose tube optical fiber) with an appropriate stripper. Remove approximately 30 to 40mm length of primary coating with an appropriate stripper.

2) Clean bare fibers with lint-free cotton tissue soaked in Alcohol.

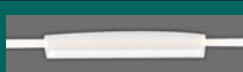
3) How to cleave the fiber

Cleave the fibers by using a high precision cleaving tool.

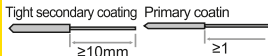
To ensure good splicing, you should cleave the fibers by using a high precision cleaver such as the cleaver of INNO V series and you should strictly control the cleaved length well, as shown in the following picture.



Note: always remember to slip a heat-shrinkable sleeve onto either end of the fibers at the beginning of each fiber preparations.



Examples of cleaving length



use blue V-grooves
 (Clamping on bare fiber)

Important!

You must ensure to keep the fibers clean:

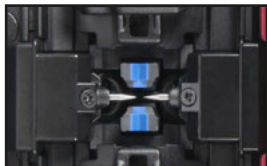
- Avoid putting them down on a dusty working surface
- Avoid waving them around in the air
- Check if the V-grooves are clean; if not, wipe them clean with cotton swab immersed into alcohol.
- Check whether the clamps are clean; if not, wipe them clean with cotton swab immersed into alcohol.

How to Make a Splice

Put the optical fiber in

- ① Open the safety shield.
- ② Raise the fiber clamps.
- ③ Position the fibers into V-grooves. Make sure the fiber ends are between the V-groove edges and the electrode tip.
- ④ Clamp the fiber in position by lowering both sets of fiber clamps.
- ⑤ Close the safety shield.

Note: Be careful not to slide the fibers along V-grooves. When fiber is placed into V-groove, the fiber end should exceed V-groove but it can't surpass the location of the electrode tips. (as the following picture shows)



Inspecting the Fibers

Before continuing with splicing, you should visually check the fibers in the monitor to make sure they are clean and well-cleaved.



Fibre ends visible on the monitor.



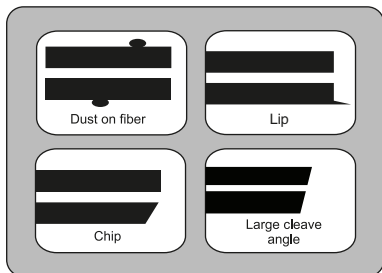
Fibre ends outside monitor.



Fibre ends above and below monitor, not possible to find automatically.



If any defect exists in the optical fiber, please take out the optical fiber carefully and prepare it again.



Note:The fibers are checked automatically when you press Splice button. The splicer automatically focuses the fibers and checks for damage or dust particles.

Splicing

- ① Select any desired splice mode.
- ② Splice the fibers by pressing: "SET" .



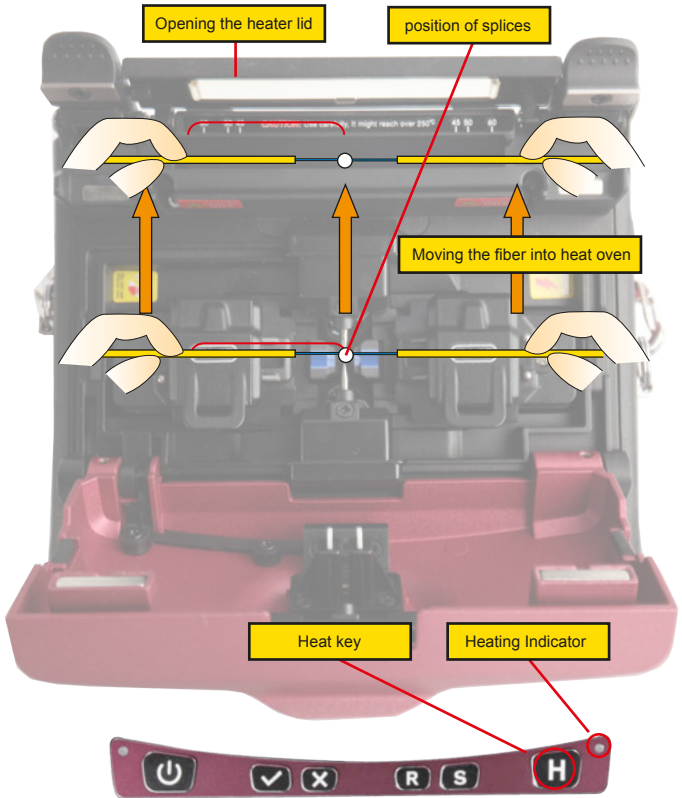
Note: The splicer always starts as "Auto mode" . The splicing starts once the safety shield is covered.

How to Protect the Splice

After splicing, press the key of "HEAT" to activate "shrink" process after you have put the optical fiber sleeved with a heat shrinkable sleeve into the heating oven, heating the heat shrinkable sleeve for purpose of strengthening and protecting the spliced joint.

Steps for Heating

- ① Open the heat oven lid
- ② Raise left and right fiber clamps on the splicer. Hold the heat-shrink tube, lift the spliced fibers and hold them taut, move the heat-shrink tube so that it is centered over the splice point.
- ③ Move both the fibers and the heat-shrink tube over to the heat oven and place them in the oven clamps.
- ④ Press the "HEAT" key to begin heating, when the heating process is finished, the heating indicator will be turned off automatically and accompanied by prompt sound of the buzzer.





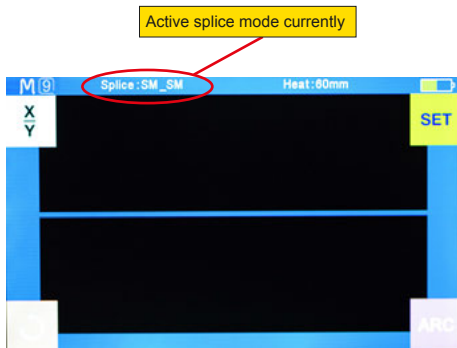
Chapter 4 Splice Mode

M9 fusion splicer has a concise and clear menu of splice mode, easy to be operated. Splice modes define arc currents, splice times as well as various parameters used when performing a splice. Therefore, it is essential to select the correct splice mode in accordance with the type of fiber you want to splice.

There is a numeric value of "pre-defined" splice modes for common fiber combinations. However, it is also easy to either modify new splice modes to further optimize the parameters for more unusual fiber combinations.

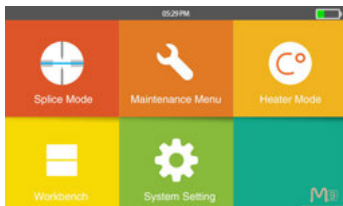
Displaying the Current Splice Mode

The active splice mode in progress at the moment is always displayed at the top of the screen (as the picture shows).

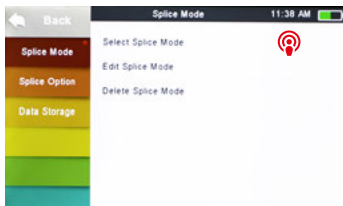


Selecting a Splice Mode

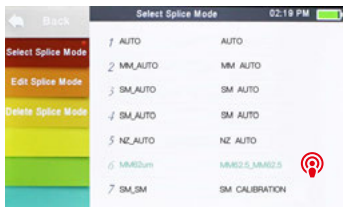
① Enter main menu.



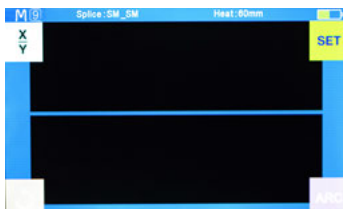
② Click “Splice Mode” for entry.



③ Click “Select Splice Mode” before you can select the splice mode that you need.



④ After viewing and selecting the splice mode, you can press the button of “Reset” to go back to initial interface.



Steps of Normal Splicing Program

This section explains the steps involved in automatic splicing process and describes how various program parameters are related to this process. The normal splicing process can be divided into two sections; pre-fusion and fusion.

Pre-Fusion

During pre-fusion, the splicer performs automatic alignment and focusing, where the fibers are subjected to a low pre-fusion current for cleaning purposes; a pre-fusion image is also taken. At this point, the user is informed of any problems recognized in the pre-fusion image, such as a poorly prepared fiber. The splicer will then issue a warning before the fibers are fused together.

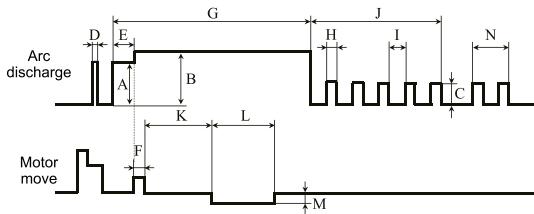
Fusion

During fusion, the fibers are joined together and subjected to five different currents as illustrated below. An important parameter, which changes during splicing, is the distance between the fibers. During Pre-fusion, the fibers are apart during Main Current phase, the fibers are pressed together.

Splicing Process

The most important splicing parameters are the discharge time and current intensity for each corresponding current phase, as shown below. In the next paragraph of "Splice Program Parameters, Normal Splicing Progress", we will illustrate in detail about the names and functions of those current phase, including their parameters, important to fusion splicing.

The following figure shows the discharge conditions (The relationship between the "discharge intensity" and "motor move"). We can change the splicing parameters listed below to change the discharge conditions. However, some parameters are inherent for the splice mode, so they cannot be changed.



- | | | | |
|---------------------------------------|------------------------------------|---------------|--------------------|
| A: Pre-fuse power | B: Arc power | C: Arc2 Power | D: Cleaning Arc |
| E: Pre-fuse Time | F: Forward Time related to Overlap | G: Arc1 time | |
| H: Arc2 ON time | I: Arc2 OFF | J: Arc2 time | K: Taper Wait Time |
| L: Taper Time related to Taper Length | M: Taper speed | N: Rearc Time | |

Diagram of electric discharge condition

Parameters for Normal Splicing Process

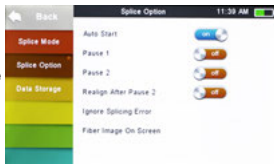
Parameter	Description
Template	A list of splice modes stored in the splicer database is displayed. Upon inputting the appropriate mode, the selected splice mode stored in database area is copied to a selected splice mode in user-programmable area.
Name	Title for a splice mode expressed in up to seven characters.
Note	Detailed explanation for a splice mode expressed in up to 15 characters. It is displayed at "Select splice mode" menu.
Align Type	Sets the aligning type for the fibers. "Core" : Aligns fibers by core position.
Arc adjust	Sets to adjust arc power according to the fibers' conditions.
Pull test	If "Pull test" is set to "ON", a pull-test is performed upon opening the wind protector after splicing or by pressing the SET key.
Loss estimate	Loss estimate (for the splicing point), which is computed by fusion splicer according to optical fiber image and different from true value, should be regarded as a reference. The algorithm is based on single mode fiber as model, using wavelength 1.31 μ m to perform. It provides a relatively good reference when in good splicing condition, but it is not a basis for project acceptance.
Minimum loss	This amount is added to the estimate splice loss originally calculated. When splicing specially or dissimilar fibers, a high actual splice loss may occur even with optimized arc conditions. To make the actual splice loss concur with the estimated splice loss, set the minimum value of estimate to the minimum optimized actual splice loss.
Loss Limit	An error message is displayed if the estimated splice loss exceeds the selected threshold (loss limit).
Core angle limit	An error message is displayed if the bend angle of the two fibers spliced exceeds the selected threshold (Core angle limit).
Cleave angle limit	An error message is displayed if the cleave angle of either the left or right fiber ends exceed the selected threshold (cleave limit).
Gap position	Set the relative position of the splicing location to the center of electrodes. The MFD values vary with different types of fibers. Splice loss may be reduced via shifting Gap Pos towards a fiber whose MFD is bigger than the other fiber MFD.

Parameter	Description
Gap	Set the end-face gap between the left and right fibers at the time of aligning and pre-fusion discharge.
Overlap	Sets the overlap amount of fibers at the fiber stuffing stage. Relatively small "Overlap" is recommended if "Pre-fuse power" is low, while relatively large "Overlap" is recommended if "Pre-fuse power" is high.
Cleaning Arc time	A cleaning arc burns out micro dust on the surface of the fiber with an arc discharge for a short period of time. The duration of the cleaning arc can be changed by this parameter.
Preheat Arc value	Set the power of the pre-fuse arc, which is an arc discharge occurring from the beginning until the fibers begin stuffing. If "Pre-fuse power" is set too low, axial offset may occur if cleaved angles are relatively poor. If "Pre-fuse power" is set too high, fiber end faces are fused excessively and splice loss gets worse.
Preheat Arc time	Sets the duration of the pre-fuse arc, which is arc discharge occurring from the beginning until the fiber begin stuffing. Longer "Pre-fuse time" is synonymous with higher "Pre-fuse power" .
Fuse Arc value	Set Arc discharging intensity.
Fuse Arc time	Set Arc discharging time.

Chapter 5 - Splice Option

Splice Mode Setting

Enter “Splice option” menu to select the options to change parameters.



Parameter	Description
Auto start	If “Auto start” is set to ON, splicing starts automatically as soon as the wind protector is closed. Fibers should be prepared and placed into the splicer in advance.
Pause 1	If “Pause 1” is set to ON, splicing operation pauses when fibers are forwarded to gap-set position. Cleave angles are displayed during the pause.
Pause 2	If “Pause 2” is set to ON, splicing operation pauses after fiber alignment is completed. With ECF “ON”, core-to-core alignment is made after this pause.
Realign after pause 2	If “pause 2” is operated for too long time, alignment performance may become invalid. If “Realign after pause 2” is set to ON, splicing restarts to align fibers after operated “Pause 2”. Setting “OFF” for “Realign after pause 2” will disable the “Realignment” to function. When axial displacement happens to the spliced fiber when “Pause 2” operated, “manual mode” is recommended for fusion splice, rather than “realignment” setting (which should be set as “OFF”).
	Ignore splice error
Cleave angle	Setting to OFF, make the splicer continue and complete a splice operation even if the message “Cleave angle over limit” occurs.
Core angle	Setting to OFF, make the splicer continue and complete a splice operation even if the message “Core angle over limit” occurs.
Loss	Setting to OFF, make the splicer continue and complete a splice operation even if the messages of “loss over limit”, “Core angle over limit”, “bubble”, “fat splicing point”, and “thin splicing point” occur.
Fat	
Thin	





Parameter	Description
Fiber Image on screen	
Pause1	Sets the method of displaying the fiber image on the screen during splicing operation. X : Enlarged display of X-axis image Y : Enlarged display of Y-axis image X/Y : Composite display vertically of X-axis and Y-axis images
Align	
Pause2	
Arc	
Estimate	
Gap set	

Chapter 6 - Heater Mode

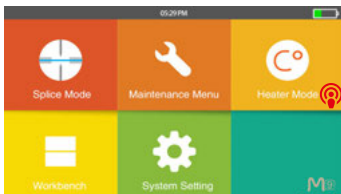
The INNO factory preset 3 kinds of mode, and the users can set the rest of the heating mode. Select the one best suited for the protection sleeve used.

Each sleeve-heating mode included in M9 is optimized for a certain type of protection sleeve. These modes can be found in the database area for reference. Copy the appropriate mode and paste it to the user-programmable area. The operator can edit the user-programmable modes

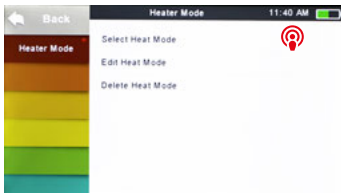
Parameter	Description
60mm	For standard protection sleeve of 60mm
40mm	For standard protection sleeve of 40mm.

Select Heat Mode

There is an access menu of "Heater Mode" after you have clicked "Heater Mode" in the main menu for fusion splice



① Tap "Heater mode" for entry.

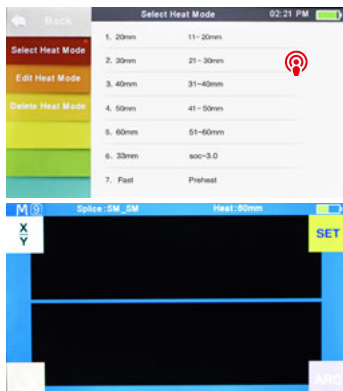


② Enter "Select Heat Mode" .



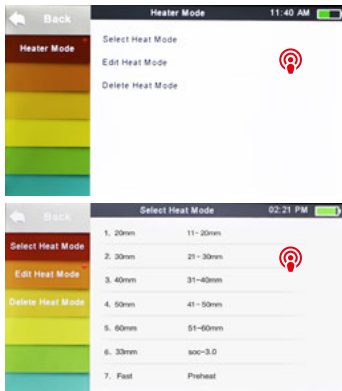
③ Select one of the heating modes that you need.

④ After viewing and selecting the heating mode, you can press the button of “Reset” to go back to initial interface.



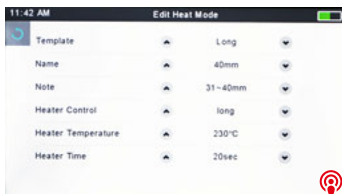
Editing Heater Mode

Sleeve-heating conditions stored in heating mode can be edited or changed.



① Enter “edit heat mode” menu via clicking “edit heat mode” in the interface of “Heater Mode” .

② Select one of the heating modes that you need to edit.



③ Finally, select the parameters to edit the heating mode as needed.

Delete Heat Mode

- ① Firstly enter "Heater mode" menu.
- ② Select "Delete heat mode" option.
- ③ Select a heating mode that you need to delete in the "Delete heat mode" menu.



Heater Mode Parameters

Parameter	Description
Template	Sets sleeve type. List of all heating modes are displayed. Select a mode in the list and this is copied to a user-programmable mode.
Name	Title for a heater mode expressed in some characters
note	Title of a heater mode that is displayed in the lower right part of the monitor during the splicing/heating process. Max number of characters used is 5.
Heater control	Sets the hot shrinkable protection sleeve's length. Long: protection sleeve over 30mm in length. Short: protection sleeve less than 30mm in length (30mm included).
Heater temperature	Sets heating temperature.
Heater time	Sets heating time from the beginning to the end.



Chapter 7 - Maintenance Menu

The splicer has a function to perform routine maintenance. This section describes how to use the maintenance menu.

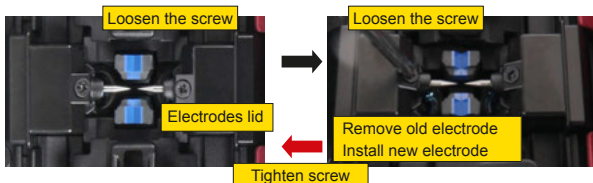
- ① Enter "Maintenance menu" interface.
- ② Select the functions that you need to perform in the "Maintenance menu" interface.

Replace Electrodes

Electrodes wear out with use and also must be cleaned periodically due to silica oxide buildup. It is recommended that the electrodes should be replaced after 4,500 arc discharges. When the number of arc discharges reaches a count of 4,500, a message prompting to replace the electrodes is displayed immediately after turning on the power. Long-term using the electrodes without a replacement will result in greater splice loss and reduced splice strength.

Replacement Procedure

- ① Function of "Replace Electrode" can be enabled under "Maintenance Menu".
- ② Replace old electrode.
 - I) Loosen screw located on electrode cover.
 - II) Take electrode out of electrode cover. (Electrode fits into electrode cover)



- ③ Clean the new electrodes with alcohol-impregnated clean gauze or lint-free tissue and install them in the splicer.

- I) Insert the electrode in the electrode cover.
- II) Place the electrode cover on the splicer and tighten screw.



Note: do not pull out wiring when replacing electrode.
Apply your fingers with strength that you can manage when tightening screw to fix electrode.

- ④ The INNO strongly recommends that you should stabilize the electrodes and do the discharge Diagnostic Test after replacing the electrodes (the details of operation will be described below); otherwise you cannot guarantee the good splice loss and splice strength.

Stabilize Electrodes

In the event of sudden change in environmental conditions, the arc power sometimes becomes unstable, resulting in higher splice loss. Especially when the splicer is moved from lower altitudes to higher altitudes, it takes time for the arc power to stabilize. In that case, stabilizing electrodes will expedite the process to set the arc power stable. And it needs many tests before the completion of stabilizing electrodes.

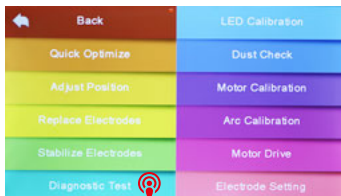
Operation Procedure

- ① Select "Stabilize Electrodes".
- ② Set prepared fibers on V-groove of the splicer for splicing.
- ③ Press "SET" key and the splicer begins to stabilize the electrodes automatically in the following ways:
 - * Repeat short arc discharge five times to measure the arc position.
 - * Splice optical fibers quickly.
 - * Perform 20-cycle continuous discharge to stabilize the electrodes.

Diagnostic Test

M9 fusion splicer has a built-in diagnostic test feature that allows the user to perform a simple one step evaluation of splicer performance covering several different critical variables. Perform this function in case of splicer operation trouble.

Operation Procedure



- ① Select "Diagnostic Test" in Maintenance Menu to enter "Diagnostic test" interface.

- ② The following checks will be made in the "Diagnostic Test".

	Check Item	Description
1	LED calibration	Measures and adjusts the brightness of the illumination LED.
2	Dust check	Checks the optical path for dust or dirt and judges whether they disturb fiber observation. If contamination exists, click "Back" key twice, then the dust location will be displayed.
3	Motor Calibration	Automatically calibrates 4 Motor Speed.
4	Arc Calibration	Automatically calibrates the arc power intensity factor and fiber splicing position.



Dust Check

The splicer observes fibers through image processing. Dust or contaminants on the optical fibers, cameras' lenses and wind protector mirrors will disturb normal observation of fibers and may result in improper splicing. This function checks the optical path for the presence or absence of contaminants and judges whether they cause trouble for fiber splicing.

Operation Procedure

- ① Select "Dust Check" in Maintenance Menu.
- ② If fibers are set in the splicer, remove them and press "SET" button again. The splicer begins the dust check.
- ③ Message of "Found Dust On The Lens" will appear on the screen if dust exists. Click "Back" key twice, then the dust location will be displayed. You need to clean the wind protector mirrors and objective lenses and operate "Dust Check" again till complete operation message shown.



Note: Even though you have cleaned the objective lenses, but if dirt or dust still remains, please contact your sales agency.

Motor Calibration

Motors are adjusted at the factory before shipping. However, settings can be changed in various reasons. This function automatically calibrates the speed of all 6 motors.

Operation Procedure

- ① Select [Motor Calibration] in [Maintenance Menu].
- ② Load prepared fibers in the splicer and press SET button.
- ③ Speeds for all motors are automatically calibrated. The message "Operation Completed" will be displayed if the operation is completed.



Note: * Perform this function when "Fat " or "Thin" error occurs, or fiber aligning or focusing takes too much time.

Arc Calibration

Atmospheric conditions such as temperature, humidity, and pressure are constantly changing, which creates variability in the arc temperature. This splicer is equipped with temperature and pressure sensors that are used in a constant feedback monitoring control system to regulate the arc power at a constant level.

However, changes in arc power due to electrode wear and glass adhesion cannot be corrected automatically. Also, the center position of arc discharge sometimes shifts to the left or to the right. In this case, the fiber splicing position has to be shifted in relation to the arc discharge center. It is necessary to perform an arc power calibration to eliminate those problems.



Note : * Performing Arc Calibration function changes the inner parameters of conditions; the electrical discharge intensity value will not be changed in the splice modes.

Operation Procedure

- ① After you have selected "Arc Calibration" in maintenance menu, an image of "Arc Calibration" will be displayed on the screen.
- ② Set prepared fibers on the splicer, press "SET" button to begin ARC Calibration.



Note: * Use standard SM, DS or MM fiber for arc calibration.
 * Ensure clean fibers for arc calibration. Dust on the fiber surface affects arc calibration.

- ③ After Arc calibration, 2 numeric values will be displayed on the screen. When values on the right side are up to 11 ± 2 , the splicer will prompt out message for completion, otherwise the fiber needs to be cleaved again for Arc discharge calibration till message for completion prompted out.

Electrode Setting

This function is used to set electrode. Electrodes are recommended to be replaced with new one every 4500 times' splicing operation to ensure splice quality.

- ① Enter into "maintenance menu" to select "electrode setting".
- ② Set electrode caution and electrode warning.

Parameter	Description
Electrode caution	When discharge count of electrode more than set count, message "caution! Replace electrodes" will prompt out as you start fusion splicer. The count' s parameter is recommended to be set as "4500" .
Electrode warning	When discharge count of electrode more than set count, message "warning! Replace electrodes" will prompt out as you start fusion splicer. The count' s parameter is recommended to be set as "5500" .

Update Software

- ① Select "update software" in the "system setting" interface.
- ② After you have clicked "OK", the splicer will automatically start the upgrade process, and the splicer will restart after the upgrade is complete.





Chapter 8 - Other Functions & Utilities

Data Storage

This splicer stores up to 10,000 splicing results. Contents of data stored are different depending on splicing mode.

Display Splice Record

Splicing results stored in the memory can be displayed. Enter "Data Storage" Menu and Select "Display Splice Record" to view.

Delete Splice Record

Splicing results can be cleared by part or whole.

- ① Select "Delete Splice Record", and then input specific number (begin-number and end-number) of splicing results to be cleared.
- ② Select "Reset Splice Record".

Cancel Data Storage

If you don't want to store the records, select "OFF" in the "Splice Data Save" option.

System Setting

Parameter	Description
Buzzer	Sets the sound volume of the buzzer.
Temperature Unit	Sets the unit of temperature.
Automatic heating	If select "On", when the fiber is placed into heat oven, which will automatically execute heating.
Language	Sets a language to be displayed on the screen.
Monitor position	Sets the operational direction of splicer. "Front" is for front monitor operation. "Rear" is for rear monitor operation. Refer to next page in detail.
Power Save Option	Sets the time of "Monitor Shut Down", time of "Splicer Shut Down" and LCD brightness.
Set Calendar	Sets the system time.
Password	Changes the password to access some menus as "Power on Option" and "Menu Lock". At the time of shipment from the factory, the password is set as "0000". If you have forgotten your password after you changed another one, contact the sales agency.

Monitor Position

The splicer is shipped from the factory with settings for the "Monitor Front" operation style. This can be changed to "Monitor Rear" operation style. When "Monitor Position" is changed, the direction of the four arrow keys is reversed.

Changing monitor position


- ① Enter "System Setting", then you can see the option of "Monitor Position".
- ② Change monitor angle as needed (front, or rear).



Power Save Option

This function is important for power conservation. If the power saving function is not set during battery pack use, the number of splice cycles will decrease.

- (1) Insert a power unit and turn on the splicer.
- (2) Select "Power Save Option" in "System Setting" menu.
- (3) Change value of "Monitor Shut Down" and "Splicer Shut Down"

Parameter	Description
Monitor Shut Down	To avoid power loss when battery is used, setting this function turns off the power supply to the LCD monitor if the splicer does not operate after a certain period of time. When the power supply for monitor turns off, the LED near the power key "  " blinks. Press any key to turn on the LCD monitor.
Splicer Shut Down	Automatically turns off the power supply of the splicer if it performs no operation for a long period of time. The function serves to prevent the battery capacity from running low.




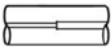

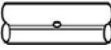



System Information

After selecting "System information", the following messages will be shown on the screen:


Parameter	Description
Machine Serial NO.	Display the fusion splicer' s serial number.
Software Version	Display the fusion splicer' s software version.
FPGA	Display FPGA' s version.
Total Arc Count	Display total arc discharge count.
Current Arc Count	Display arc discharge count after electrode change. The parameters will be zero cleared or reset after replacing electrodes.
Last Maintenance	Display maintenance date at last time.
Production Date	Display the date of production of the machine.

Appendix I

High Splice loss: Cause and remedy

Symptom	Name	Cause	Remedy
	Fiber core axial offset	There' s dust in V-grooves and fiber hammer	Clean the V-grooves and fiber hammer
	Fiber core angle error	There' s dust in V-grooves and fiber hammer	Clean the V-grooves and fiber hammer
		Bad fiber end-face quality	Check the cleaver
	Fiber core bending	Bad fiber end-face quality	Check the cleaver
		Pre-fuse power too low or pre-fuse time too short.	Increase [Pre-fuse Power] and/or[Pre-fuse Time].
	The mode field diameters mismatch	Arc power not adequate	Increase [Pre-fuse Power] and/or[Pre-fuse Time].
	Dust combustion	Bad fiber end-face quality	Check the cleaver
		Dust still present after cleaning fiber or cleaning arc.	Clean fiber thoroughly or increase[Cleaning Arc Time]
	Bubbles	Bad fiber end-face quality	Check the cleaver
		Pre-fuse power too low or pre-fuse time too short.	Increase [Pre-fuse Power] and/or[Pre-fuse Time].
	Separation	Fiber stuffing too small	Perform [Arc Calibration].
		Pre-fuse power too high or pre-fuse time too long.	Decrease [Pre-fuse Power] and/or [Pre-fuse Time].
	Fat	Fiber stuffing too much	Decrease [Overlap] and Perform [Arc Calibration].
	Thin	Arc power not adequate	Perform [Arc Calibration].
		Some arc parameters not adequate	Adjust [Pre-fuse Power], [Pre-fuse Time] or [Overlap]



	Splicing line	Some arc parameters not adequate	Adjust [Pre-fuse Power], [Pre-fuse Time] or [Overlap]
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Note :When different optical fibers (different diameters) or multi-mode fibers splicing, they will produce a vertical line which we call the "splicing lines" in a subsequent point, this does not affect splicing quality (splicing loss and splicing strength).

Appendix II

Error Message List

An error message may appear on the screen when using a splicer, the solution precisely as shown in the list below. If it is not possible to eliminate the problem, maybe some faults occur in the fusion splicer. Consult your sales agency.

Error Message	Cause	Solution
Left Fiber Place Error	The fiber end-face is placed on the electrode centerline, or beyond it.	Press the "RESET" button, and set the fiber end-face between the electrode centerline and the V-groove edge.
Right Fiber Place Error		
Press Motor Distance Over Limit	The fiber is not set correctly at the bottom of the V-groove. The fiber is not located in the Camera's field of view.	Press the "RESET" button; re-position the fiber again to seat it correctly at the bottom of the V-groove.
Press Motor Error	Motor might be damaged.	Consult your nearest sales agency.
Search Fiber End face Failed	The fiber is not set correctly at the bottom of the V-groove.	Press the "RESET" button; re-position the fiber again to seat it correctly at the bottom of the V-groove.
Arc Failure	Arc Discharge did not occur.	Assure the electrodes are in proper position; Replace the electrodes.
Align Motor Distance Over Limit	The fiber is not set correctly at the bottom of the V-groove.	Press the "RESET" button , re-position the fiber again to seat it correctly at the bottom of the V-groove.
Search Fiber Clad Failed	The fiber is not set correctly at the bottom of the V-groove.	Press the "RESET" button , re-position the fiber again to seat it correctly at the bottom of the V-groove.
Fiber Clad Gap Wrong	There's dust or dirt on the fiber surface	Prepare the fiber (stripping, cleaning, and cleaving) again.
Unknown Fiber Type	There's dust or dirt on the fiber surface	Prepare the fiber (stripping, cleaning, and cleaving) again.
	Mismatch Fibers	Use an appropriate splice mode other than AUTO splice mode to re-splice.
	Non-standard optical fibers	AUTO splice mode can only identify the standard fibers such as SM, MM, NZ.

Error Message	Cause	Solution
Fiber Clad Over Limit	The fiber is not located in the Camera's field of view.	Adjust the fiber position and do "motor calibration" for maintenance.
Focus Motor Home position Error	The fusion splicer is hit by force during splicing operation.	Carry out "motor calibration" for maintenance. If the problem still can't be solved, contact with agency.
Fiber End face Gap Wrong	Too much [Overlap] setting	Adjust or initialize [Overlap] setting.
	The motor is not calibrated	Do [Motor Calibration] maintenance.
Motor Distance Over Limit	The fiber is not set correctly at the bottom of the V-groove.	Press the "RESET" button, re-position the fiber again to seat it correctly at the bottom of the V-groove.
	There's dust or dirt on the fiber surface	Prepare the fiber (stripping, Cleaning and cleaving) again.
	There's dust or dirt on the fiber surface	Execute the [Dust Check] after cleaning the lenses and mirrors.
Fiber Mismatch	The fibers on the two sides are not the same	It may result in large splice loss if you continue to splice, Please use the proper splice mode corresponding to the fibers.
Cleave Angle Over Limit	Bad fiber end-face	Prepare the fiber (stripping, cleaning, and cleaving) again., Check the condition of the fiber cleaver. If the blade is worn, rotate the blade to a new position.
	[Cleave Limit] is set too low.	Increase the "Cleave Limit" to an adequate limit. (standard value: 3.0°)
Core Angle Over Limit	[Offset Limit] is set too low.	Increase the "Core Angle Limit" to an adequate limit. (standard value: 1.0°)
	Dust or dirt is on the V-groove or the clamp chip.	Clean the V-groove or the clamp chip, prepare and reposition the fiber again.
Fiber Axis Align Failed	Axial offset (>0.4um)	Prepare the fiber (stripping, cleaning, and cleaving) again.
	The motor is not calibrated	Do the "Motor Calibration" maintenance.

Error Message	Cause	Solution
Fiber is Dirty	There' s dust or dirt on the fiber surface	Prepare the fiber (stripping, cleaning, and cleaving) again.
	Dust or dirt is on the lens or LEDs	Execute the "Dust Check" . If dust or dirt exists, clean the lenses or LEDs
	"Cleaning Arc time" is too short	Set the "Cleaning Arc time" to 180ms
	Splice the fibers whose cores are difficult to find by the way of core alignment.	Splice the fibers whose cores are difficult to find by MM splice mode (cladding layer alignment).
Fat Splicing Point	Too much [Overlap] setting	Adjust or initialize "Overlap" setting.
	The motor is not calibrated.	Calibrate the arc power with the "Arc Calibration" function.
Thin Splicing Point	Inadequate arc power	Calibrate the arc power with the "Arc Calibration" function.
	Pre-fuse power or time is set too high	Adjust or initialize "Pre-fuse Power" or "Pre-fuse Time" settings.
	Insufficient "Overlap" setting	Adjust or initialize "Overlap" setting





Appendix III

Questions and Troubleshooting

The following gives the solution of some of the common problems for reference. If you cannot solve the problems, please contact the manufacturer directly.

1. Power does not turn off when press "ON/OFF" button.
 - ★ Press and hold the key "ON/OFF" until the LED flashes, release the button, and the splicer will be turned off.
2. Few splices can be made with a fully charged battery pack
 - ★ Enable it to conserve power usage.
 - ★ The battery power degrades due to memory effects and Long-term storage. Recharge the battery after a fully discharging.
 - ★ The battery pack has reached the end of its service life. Install a new battery pack.
 - ★ Don't use the battery at a low temperature.
3. Error message appears on monitor
 - ★ Refer to appendix 2.
4. High splice loss
 - ★ Clean the V-grooves, fiber clamps, wind protector LEDs, and objective lenses.
 - ★ Replace the electrodes.
 - ★ Refer to appendix 1.
 - ★ The splice loss varies according to the cleave angle, arc conditions and fiber cleanliness.
5. Monitor suddenly turned off
 - ★ when you enable the power saving function, the splicer will switch to the power saving state after an extended period of splicer inactivity. Press any key to return to the normal state.
6. Splicer power suddenly turned off
 - ★ when you enable the power saving function, the splicer will turn the splicer power off after an extended period of inactivity.
7. Mismatch between Estimated splice loss and Actual splice loss
 - ★ The estimated loss is a calculated loss, so it can be used for reference only.
 - ★ The optical components of the splicer may need to be cleaned.
8. Fiber protection sleeve does not shrink completely
 - ★ Extend the heating time.
9. Method to cancel heating process
 - ★ Press the "HEAT" button to cancel the heating process. And the LED will be turned off
10. Fiber protection sleeve adhered to heating plate after shrinking
 - ★ Use a cotton swab or a similar soft tip object to push and remove the sleeve.
11. Forgot passwords



- ★ Contact your nearest sales agency.
- 12. No arc power change after [Arc Calibration]
 - ★ An internal factor is calibrated and adjusted for the specific arc power selected. The displayed arc power in each splice mode does not change.
- 13. Forget to put the optical fiber during the process of maintenance function
 - ★ It is invalid to press the return key. You need to open the wind cover and put the prepared fibers and press the "SET" or "RESET" button to continue
- 14. Fail to upgrade
 - ★ When users use the "new" U-disk to upgrade, the splicer may not be able to correctly identify the upgrade program file; you need to reset the U-disk, and restart the splicer.
 - ★ Check whether the upgrade file name and the format are correct.
 - ★ If you cannot solve the problems, please contact the manufacturer directly.
- 15. Others
 - ★ Please refer to the training video in detail.



The End

Product specifications and models are subject to change without notice.