FRACARRO

Splicer FST-V6 / FST-V6S
Optical Fusion Splicer Code 287617 / 287008

CE

OPERATING INSTRUCTIONS

UK CA CE

SAFETY WARNING

The product must only be installed by qualified persons, according to the local safety standards and regulations. Fracarro Radioindustrie is free from all civil and criminal responsibilities due to breaches of the current legislation derived from the improper use of the product by the installer, user or third parties. The product must be used in full compliance with the instructions given in this manual in order to protect the operator against all possible injuries and the product from being damaged.

The splicer is designed for splicing silicon glass fibers and cannot be used for other purposes. It is a precision instrument that must be handled with great care and comply with the following safety rules and regulations.

Do not open the product container, dangerous voltage parts can be accessible when opening the packaging.

Installation warnings

- The product must not be exposed to any dripping or splashing and thus it should be installed indoors and in a dry location.
- Never touch the electrode bar when the power is on.
- Wear protective glasses as when preparing the fiber, otherwise there is a risk of damage to the eyes and skin.
- Humidity and condensation could damage the product. In case of condensation, wait until the product is dry before using it.
- Handle the product carefully. Impacts can damage the product.
- Leave enough space around the product to ensure sufficient ventilation.
- Excessive temperatures and/or an overheating may affect the performance and the life of the product.
- Please do not disassemble any part of the splicer.
- When replacing batteries, to avoid device damage caused by electrostatic discharge, do not touch the electronic components directly with your hand.
- Use only batteries supplied by the manufacturer. Improper use of power supply may cause fire, electric shock and/or equipment damage, personal injury or death.
- Use only the adapter supplied by the manufacturer. Do not put heavy objects on the battery charging cable, do not heat or change the cable. Improper or broken cable may cause fire, electric shock, equipment damage, personal injury or death.
- When working with the optical connectors, always check that the lasers of any optical transmitters connected to it are turned off.

General warnings

Please remove the battery when any of the following occurs:
- Smoke, odor, abnormal noise or heating, liquid and/or foreign matter enters the inside of the splicer, damaged or broken machine.
- If any of the above problems or malfunctions occur, contact the service center immediately. Failure to take these measures in time may result in total breakdown of the machine or cause fire, personal injury or death.
- In the event of a malfunctioning, do not try to fix the product as the guarantee would be invalidated.
- **Caution: Only professional electrodes can be used. If replacing the electrode, turn off the power first, select the option in system maintenance. Discharging operation is not allowed before the paired electrodes are mounted.**

Although the information given in this manual has been prepared carefully and thoughtfully, Fracarro Radioindustrie S.r.l. reserves the right to modify it without notice and to improve and/or modify the product described in this manual. See the website www.fracarro.com to have information relevant to the technical support and product guarantee.

Battery Precautions

- It is recommended to remove the battery when the splicer is not used for more than 1 month.
- Do not charge or discharge for a long time at low or high temperature, so as not to reduce the battery life.
- Avoid short-circuiting the positive and negative of the battery with the aluminum packaging.
- Do not disassemble the battery or throw it into fire, as it may explode.
- Batteries are consumables and have a certain lifespan. When checking the battery pack level, if all the lights are on, but the battery life is short, replace the battery.
- After completing the battery charging by the adapter, disconnect the power supply immediately, a long period of charging at full power will damage the battery or cause accidents.
- If the electrolyte leaks and contacts the skin or other parts of the body, wash it with water immediately. If the electrolyte comes into contact with the eyes, it should be washed immediately with water and then go to the nearest hospital.

Cleaning

Check and clean the V-groove (the place where the fiber is placed), avoid touching the V-groove and electrode with hard objects. Use a dry cloth to wipe off dust and dirt from the splicer. If the splicer is dirty, avoid using acetone and paint thinner to clean any part of the splicer, instead you can use a soft cloth with a neutral detergent.

COMPLIANCE WITH EUROPEAN DIRECTIVES

The full text of the EU declaration of conformity is available on the following website ce.fracarro.com

PRODUCT DESCRIPTION

Thank you for choosing this product, The following manual will introduce the features and instructions.
Adopting innovative design and refined manufacturing technology, this splicer will bring you an unprecedented splicing experience. The latest technology greatly reduces splicing and heating time: micron-level precision parallel clamping, high-precision spindle alignment and advanced technology, ensure the accuracy of splicing loss estimation. The refined design with a sturdy protective shell can adapt to harsh environments.
The touch screen application with fully automatic splicing procedures will bring great convenience to users.
Below is an overview of the splicer and its function keys.
Note: All the functions of the physical keys can also be used via the touch screen (virtual keys)

On/Off button ————>
Turns on/off

Arrow keys ————>
To move between
the options

Cancel button ———— >
To cancel a choice

<———— Steady blue LED / Flashing blue LED
instrument on / instrument in standby

< — Menu button
Opens the menu

< — Confirm button
To confirm a choice

Red led ———— >
Active heating

X/Y button ——— >
Change the image
between the axes

SET button ———— >
Starts the welding procedure

< — Heat button
Activate the oven heating for the sheath

< — Arc button / Reset Button
Produces welding / Stops operation and returns to start

TECHNICAL SPECIFICATIONS

FST-V6 and FST-V6S		
Fracarro Code		287617 and 287008
Dimensions W x D x H		170 x 130 x 170 (excluding rubber protection) 170 x 140 x 178 (including rubber protection)
Weight	Kg	2,233 (with battery) / 1,853 (without battery)
Number of fibers		Single
Usable Fibers		ITU-T G.651, ITU-T G.652, ITU-T G.653, ITU-T G.655 e ITU-T G.657
Fiber Cable Compatibility		0.25 - 3.0 mm / Indoor cable
Cutting measures		Diameter 0.125 - 1 mm / Lenght 8 - 16 mm
Coating diameter	µm	80 - 150
Junction mode		41 preset modes, max 100 available
Heating mode		5 preset modes (20/30/40/50/60 mm), max 100 available
Typical splice loss		SM:0.02 dB / MM:0.01 dB / DS:0.04 dB NZDS:0.04 dB / G.657:0.02 dB (ITU-T Standard)
Return Loss		≤ 60 dB
Lighting		3 white LEDs
Junction time		Quick mode: 6s
Estimation of splice loss		Available
Heat shrink tubing lenght		20 - 60 mm
Warm-up time		Quick time: 13s, typical time: 30s
Results memory		20000 recordings & 200 images
Tension test		1.96 - 2.25 N
Operating conditions		Altitude: 0 - 5000 m above sea level 96% relative humidity, -10 a +50°C Max wind 15 m/s
Storage conditions		0 a 95% relative humidity, -40 a +80°C
Display touch screen		5" high resolution color display 90° bi-directional view
Fiber view and magnification		X,Y,XY,X/Y: magnification 500x
Power supply		Input 100-240 V AC, output 12-15 V DC
N° of junctions / battery-powered heating		Battery capacity 5200 mAh, about 250 operations (junction and heating)
Operating methods		Buttons / Touch Screen
Automatic calibration		Automatic arc calibration based on air pressure and temperature
Electrode life		5000 arc
Connector		Mini USB 2.0

BASIC OPERATIONS

Battery change and charging

The removal and insertion of the battery is shown below:
- Press the release button to remove the battery

Release button

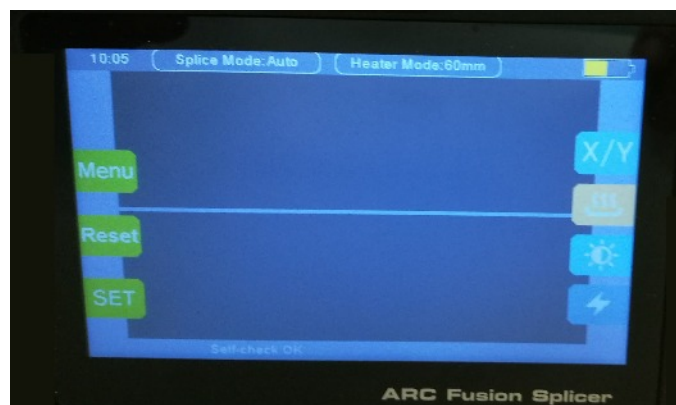- Insert in the direction of the arrow

- Battery charging

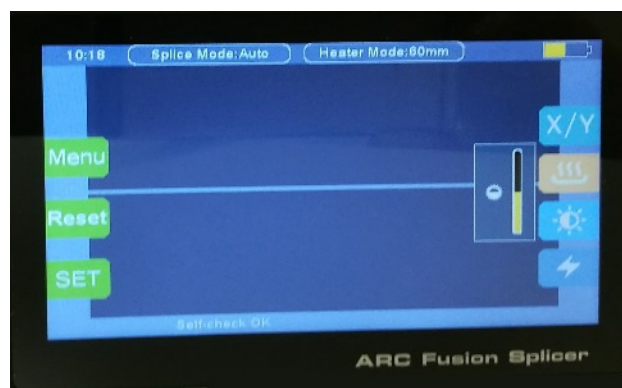Charge the battery

Turning on

Press the power button and wait until the system starts as shown in the photo below

Adjust the display for the best screen angle

Adjust the brightness of the LCD backlight with the dedicated button (Sun)

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Fiber preparation steps

There are some steps to prepare the fibers before splicing:
- Protective sheath: Remember to insert the heat shrink tubing which will serve to protect the fiber once it is soldered
- Stripping: Remove the coating leaving about 50mm. Do this with the appropriate tool, the length should be at least 30~40mm.
- Cleaning: To clean the fiber, use a cotton cloth or paper soaked in pure alcohol of 99% or higher only.
- Fiber cutting: Cut the fiber with the appropriate tool, it is recommended to use a high-precision cutting machine. To ensure the quality of the splicing, it is necessary to use a fiber cutter and strictly control the cutting length.
- **Important!** Make sure that the bare optical fiber and its surface coating are not stained.
- Check that the soldering area is clean, if not, it must be cleaned with an alcohol swab.

Automatic Fiber Optic Inspection

After positioning the fiber, visually check on the display whether the position of the 2 terminals is correct or not, the terminals must be within the visible area and on the same line, below you can see some incorrect positioning.
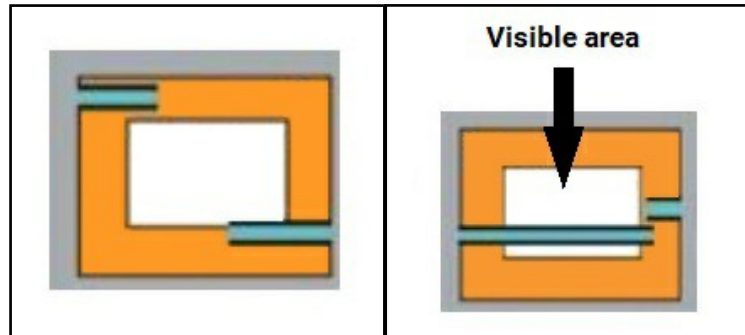
When the terminals are aligned and within the visible area, the splicer starts and the alignment will take place.

Then, a series of checks are carried out such as the splice angle and the quality of the cutting surface. The buzzer will emit an alarm if the cutting angle is greater than the limit value or if there are imperfections on the cutting surface and on the display you can see the type of problem, see image below.

Wrong cutting angle | Broken fiber | Poorly cut fiber | Dirty fiber
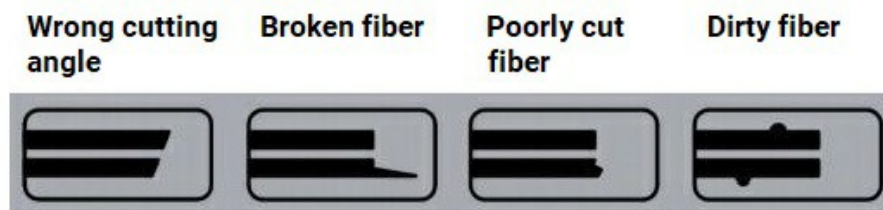
Splicing procedure

1. Turn on the splicer, if splicing single mode fiber (ITU-T.G. 652), SM mode is suggested.
2. Confirm the splicing and heating mode, when splicing different types of fibers, automatic mode is suggested. The splicing speed will be slower.
3. Clean the fiber and heat shrink tubing.
4. Insert the fiber into the heat shrink tubing.
5. Make sure the debris and/or dirt are cleaned. Protect the cut fiber end from contact with hard objects.

6. Place the fiber between the V-groove and the two electrodes, do not exceed the electrodes.

7. Close the protective cover, the automatic splicing starts, you can see the splicing in progress on the LCD display.
8. Remove the spliced fiber, center the protective sheath and insert everything into the oven, turn on the oven with the appropriate button (red LED on), heating starts automatically when the cover is closed.
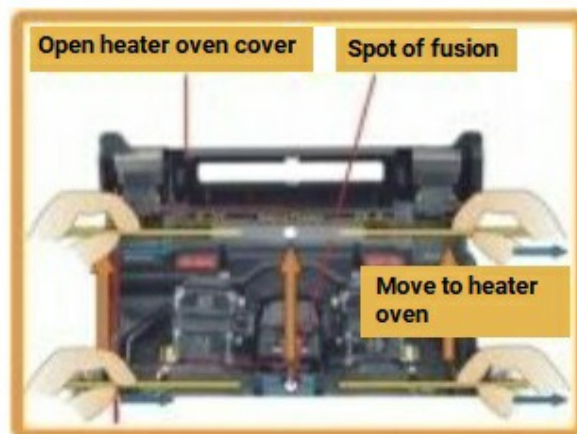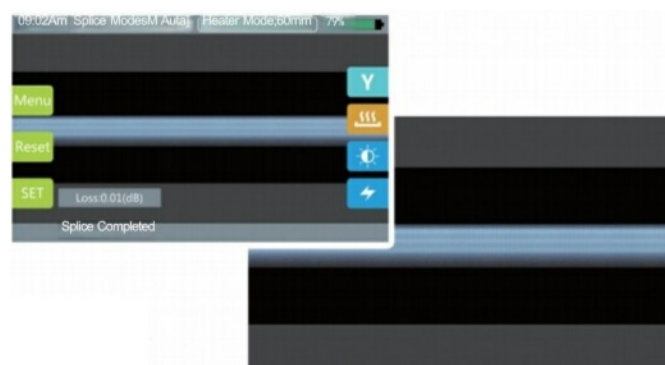

9. Operation completed.

Attention: when the splice loss or the altitude change are high, it is necessary to perform the electrode and arc calibration.

Zoom function

After the joint, you can double-click on the display to zoom in on the welding point and check its quality.

Splicing mode

The menu is concise and easy to use, each splicing mode defines the splicing current, time and other important parameters.
It is essential to select the right splicing mode. There is a default value for the commonly used fusion model. This makes it easier to change the splicing mode and optimize the parameters for uncommonly used fibers.

Displaying the current splice mode

The current splicing mode will be shown on the top of the operation interface, see the picture below.

Selecting the splicing mode

Select **Menu**, then **Splice Menu** and select the mode.
Once selected (written in yellow), you can make different choices:
  ● If the parameters are already ok with the Select button I confirm the chosen mode
  ● If I want to modify some parameters I press the Edit button**
  ● If I want to delete a mode I press the Delete button, after confirmation, the mode is deleted.

** in Edit mode I can change all the parameters involved and save the configuration with the Confirm button.

If I want to create a new mode, I use the arrows to scroll to the last saved mode and find the item Add New…, after selecting it it suggests using one of the existing models.
At this point I can modify all the parameters and also give a name to the mode I am creating so as to identify it more easily.

Parameter	Description
Name	Name of the splice mode, no more than 8 characters
Note	Detailed explanation of the mode, visible in the choice menu
Pull Test	Enable or disable the traction test
Loss Estimate	Enable or disable loss estimation
Cleave Angle Limit	Sets the maximum angle allowed for cutting the fiber, if beyond this it generates an error
Gap	The distance between the 2 ends of the fiber to be spliced
Overlap	Sets the size of the fiber overlap
Clean Arc Value	Arch cleaning percentage
Clean Arc Time	Arc cleaning time in ms
PreArc Value	Percentage value before the arc
PreArc Time	Time in ms before the arc
Splice Arc Value	Percentage of the splice arc
Splice Arc Time	Arc time in ms
Motor Speed	Engine speed

Splice options

Select **Menu**, therefore **Splice Option** and I can decide which options to activate.

Parameter	Description
Auto Start	Enable or disable automatic splicing start (just close the lid)
Pause 1	When enabled, splicing starts when the fiber is in the correct position and the user can see the cutting angle.
Pause 2	If enabled, the splicing starts after the alignment is complete.
Align Again	Allows automatic re-alignment
Ignore Error	Ignore the errors and continue with the junction
Pull Test	Enable or disable the traction test

Heating mode

Select *Menu*, therefore *Heater Menu* and select the desired mode.
Once selected (written in yellow), you can make different choices:
- If the parameters are already ok, with the Select button I confirm the chosen mode
- If I want to modify some parameters, I press the Edit button**
- If I want to delete a mode, I press the Delete button, after confirmation, the mode is deleted.

** in Edit mode I can change all the parameters involved and save the configuration with the Confirm button.
If I want to create a new mode, with the arrows I scroll to the last stored mode and find the Add New… item, after selecting it it suggests using one of the existing models.
At this point I can modify all the parameters and also give a name to the mode I am creating so as to identify it more easily.

Parameter	Description
Description	Name assigned to the heating mode
Type	Select full (heats everything) or part (heats only a part)
Temperature	Select the heating temperature
Time	Select the heating time

System maintenance

Select *Menu*, therefore *Maintain.*
- Brightness Test
  - Automatic brightness test
- Dust Check
  - Automatic test for dust presence, if present the problem is shown on the monitor, once cleaned, repeat the test until the test is ok. If the problem remains contact the seller.
- Arc Adjust
  - The atmospheric conditions such as temperature, humidity and pressure are constantly changing. This also changes the discharge temperature. The splicer is equipped with temperature and pressure sensors that provide feedback to the control system to adjust the discharge intensity to keep it stable. Automatic calibration is not suitable for the changes caused by motor wear and fiber waste, and the discharge position sometimes shifts left or right. In this condition, the fiber will be shifted from the discharge center, ARC calibration is needed
- Electrode Stabilize
  - When the environmental conditions change, the discharge may become unstable, this will increase the junction loss, especially when the altitude changes, it takes time to stabilize the discharge. In this condition, electrode stabilization should be performed several times until the stabilization appears finished.
- Motor Calibration
  - This function automatically calibrates the speed of the motors.

With the use of the splicer, oxide will form on the electrodes, which must be cleaned regularly. The splice loss will increase and the splice strength will be reduced. Set a reminder when the electrode has been used for 2000 times. When the threshold of 3000 times is exceeded, there will be a reminder when turning on the splicer.

To replace the electrodes, select **Menu,** select the button **Maintain,** select the button **Electrode Set,** therefore press the button **Replace.**

The splicer will turn off and you can proceed with the physical replacement of the electrodes as described below:

- Open the windshield
- Loosen the screw on the electrode
- Remove the old electrode. **Caution!!!** Do not pull out the wiring.
- Clean the new electrode with a clean swab or dust-free cloth soaked in alcohol
- Install it on the splicer
- Place the electrode cover and tighten the screws.
- Proceed in the same way for the other electrode.
- It is strongly recommended that after replacing the electrode, perform the stabilization and calibration procedure, otherwise the leakage and splice strength cannot be guaranteed.

Recording storage

Up to 20000 splicing results can be stored. Depending on the different splicing modes, the storage contents are different.

To access the records, select **Menu**, therefore **Splice History.**

Here you can see the recordings **Show Record,** delete recordings **Clear Record** and enable or disable automatic recording.

- If I select **Show Record** I see all the recordings with the parameters based on the mode used. With the keys **Prev** and **Next** I scroll through all the stored recordings.
- If i select **Clear Record,** It asks me for the password (default 000000) and all recordings are deleted.
- To enable or disable recordings use the button **Save Record.**

System settings

To access the system settings, select *Menu*, therefore *Function Set.*
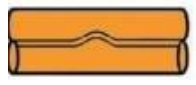
- If I select *System* I have these functions:
  - Buzzer: enable or disable the buzzer
  - Temperature Unit: choose whether °C or °F
  - Auto Heater: enable or disable the automatic start of the oven
  - 24 Hour Format: Set the time format to 24 or 12
  - Set Password: enable or disable the password
- If I select *Language*, I decide in which language to use the tool
- If I select *Calendar* I have these options to set:
  - Year: set the year
  - Month: set the month
  - Day: set the day
  - Hour: set the hour
  - Minute: set the minutes
  - SET: confirm the settings made
- If I select *Password*, I'm going to set the password for the tool
- If I select *Others* I have these options to set:
  - Electrode Hint Value: set after how many electrode shocks to suggest the change
  - Electrode Warn Value: set after how many electrode shocks to activate the warning message **Caution for electrode wear**
  - Auto Power Off LCD: set after how many seconds of inactivity the display should turn off
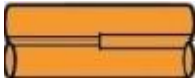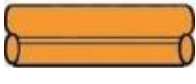 - Auto Power Off: set after how many minutes of inactivity the instrument turns off
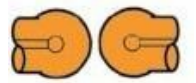
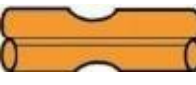## System information

To access system information, select *Menu*, therefore *System Info*

- If I select *System Info* I have these indications:
  - Version: I see the software version
  - Arc Info: I see the info regarding the number of discharges
  - Serial N°:   I see the serial number of the splicer
- If I select *Parameter* I see some data of the splicer, in this screen I have the possibility to restore the initial settings by pressing the button *Restore to Factory*

Excessive splice loss and solutions

Image	Definition	Reason	Solution
	Axial deviation of the fiber core	dust on the V-groove or fiber terminal	Clean the V-groove or fiber terminal
	Fiber core angle error	▪ dust on the V-groove or fiber terminal ▪ poor quality of the fiber terminal	▪ Clean the V-groove or fiber terminal ▪ Check the fiber cutter
	Fiber core bending	▪ poor quality of the fiber terminal ▪ weak discharge or too short discharge time	▪ Check the fiber cutter ▪ increase the force or time of discharge

	diameter mismatch	discharge power too low	increase the power or time of the discharge
	dust combustion	● poor quality of the fiber terminal ● the dust has not been cleaned or the cleaning was cancelled	● check the cutter ● clean the fiber or increase the cleanliness
	bubbles	● poor quality of the fiber terminal ● discharge power too low	● check the cutter ● increase the power or time of the discharge
	Separation of fibers	● the fiber thrust is too low ● too much power or too long discharge time	● perform arc calibration ● reduce the power or time of the discharge
	Too often	the fiber thrust is excessive	reduce overlap and perform arc calibration
	Too thin	● discharge power too low ● incorrect discharge parameters	● increase the power or time of the discharge ● increase overlap
	Joint line	some discharge parameters are incorrect	● adjust the power or time of the discharge ● increase overlap

Attention: When joining different types of fibers (different diameter) or multimode fibers, sometimes there may be a vertical line at the splice point, it is called splice line, it does not affect the splice quality (splice loss and splice strength).

Common Mistakes and Solutions

When using the fusion splicer, if any error messages appear, please refer to the following suggestions. If the errors still cannot be resolved, please contact your distributor for assistance.

Error Message	Reason	Solution
Left / right fiber place error	The end of the fiber is positioned on or beyond the centerline of the electrode	Press RESET and place the fiber between the center line of the electrode and the edge of the V-groove
Pushing motor surpass limit	The fiber is not positioned correctly at the bottom of the V-groove	Press RESET and position the fiber correctly
Fiber end face not touch	● Overlay is set too low ● The engine is not calibrated	● adjust the overlap parameter ● calibrate the engine

Fiber tracking failed	● the fiber is not positioned correctly in the V-groove ● the fiber is not in the camera's field of view ● the cut length (bare fiber part) is too short	● press RESET and place the fiber correctly in the V-groove ● check the position of the fiber ● check the length
Cleave angle abnormal	● poor quality of the fiber end ● the angle limit is too low	● prepare the fiber again if the problem persists, check the blade, if the blade is a worm screw, rotate the blade ● set the angle limit to a correct value (standard 3.0°)
Core angle abnormal	● the "Core angle limit" parameter is set too low ● there is dirt on the V-groove or fiber terminal	● set the "Core angle limit" parameter to an appropriate value (standard 1,0°) ● clean the V-groove and the fiber end, otherwise re-prepare the fiber and put it back
Fiber is dirty	● dust or dirt on the fiber terminal ● dust or dirt on the objective lens ● discharge time is too short	● prepare the fiber again ● clean the lens and perform dust check ● set the discharge time to 180 ms

Common Problems and Solutions

For user's reference in case of problems, solutions to some common malfunctions are listed below. If the problems persist, please contact your local agent.

Problem	Solution
By pressing the ON/OFF button it is not possible to turn the machine on/off	● press and hold the ON/OFF button until the LED flashes ● release the button, the splicer is now switched off
With the battery charged it is not possible to make many joints	● when the memory effect occurs, when the battery is low or after a long period of inactivity, the battery should be completely discharged, then recharged ● low battery, replace the battery ● you are using the splicer at too low temperatures
The splice loss is high	● clean the V-groove and fiber end ● replace the electrodes and re-calibrate them ● fiber cutting angle, discharge and fiber cleaning can affect the splice loss
The display suddenly turns off	If there is no operation, the display will automatically turn off in 180 seconds (user can change this time) to save battery consumption. When the display turns off, the LED next to the "on/off" button will flash, the screen can be turned on again by pressing any button
The splicer suddenly shuts down	The splicer automatically switches off when the set time expires without any operation being performed (default 30 minutes)

Fiber identification errors in AUTO mode	AUTO mode is only for standard SM, MM, NZ optical fibers When joining special fibers, AUTO mode may not recognize them correctly
Estimated loss is different from actual loss	• Estimated loss is provided for reference only • Optical components must be cleaned
Heat shrink tubing does not shrink completely	Extend the warm-up time
How to cancel the heating	If the user wants to finish heating, he/she should press the HEAT button, then the LED will turn off
The heat shrink tubing is stuck in the oven after heating	Remove the heat shrink tubing with a thin cotton ball
Forgot your password	Contact the agent or distributor
After the discharge calibration, the discharge intensity did not change	Discharge calibration changes internal condition parameters, not discharge force
Forgot to place the fiber when it is needed for maintenance	Press the "Back" button does not work, open the wind cover and insert the cut fiber into the splicer, close the cover, finally press the SET button to continue

USER'S INFORMATION Disposal of Old Electrical & Electronic Equipment (applicable in the European Union and other European countries with separate collection system)	
	This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. The recycling of materials will help to conserve natural resources. For more detailed information about recycling of this product, please contact your local city office, your household waste disposal service or the shop where you purchased the product.