Operating Instructions
*mini*MASS™ Fusion Splicer Series 5000
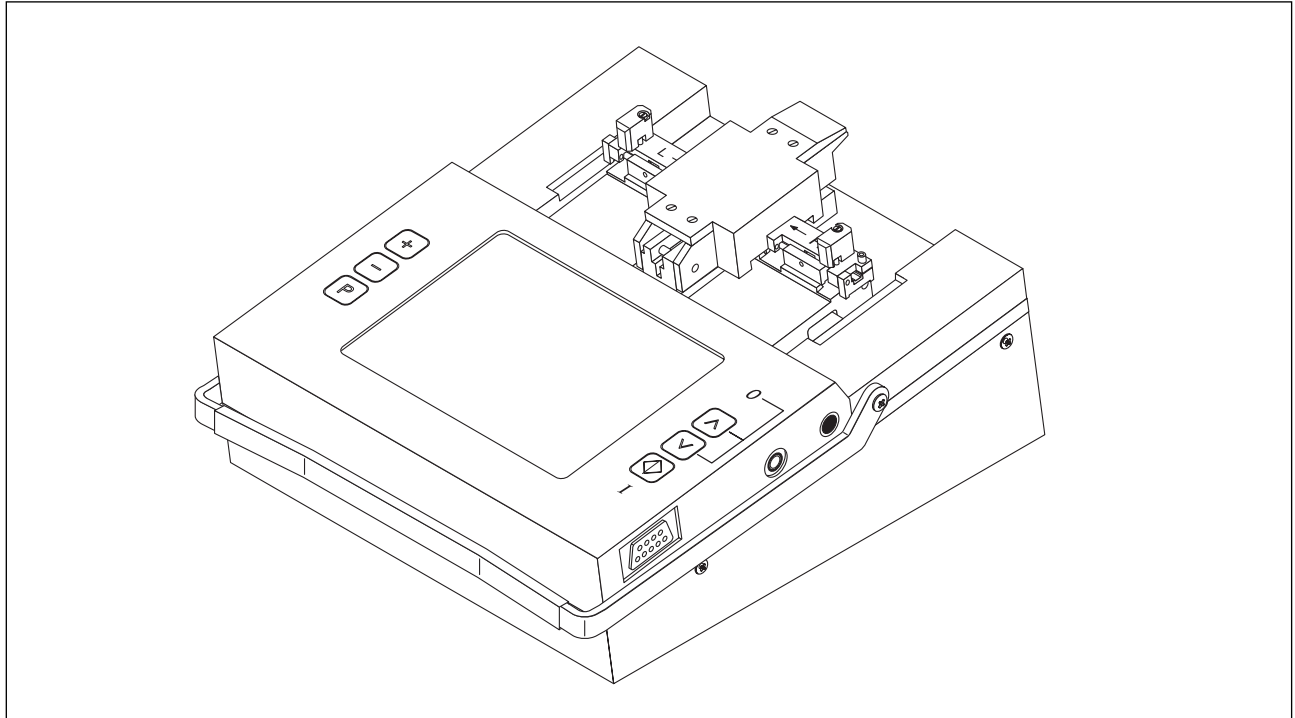
SIECOR®

Contents

Important:

Please read these operating instructions carefully to ensure that your fusion splicer functions perfectly to your full expectations. Carry out the necessary service and maintenance work on your fusion splicer regularly with the help of this manual. You should exercise the greatest care in order to prevent damage.

If you have any queries whatsoever, please contact the service center responsible where there are trained experts who know the equipment best.

Improper and inadequate maintenance can impair the operating characteristics of your fusion splicer.

The warranty obligations of the manufacturer of the fusion splicer are null and void in the event of tampering by unauthorized persons.

NOTE	For reasons of clarity, these operating instructions do not provide detailed information for all versions of the product and cannot, therefore, take every possible installation, operation or maintenance situation into account. If you require further information, or if particular problems arise which are not covered in enough detail in the operating instructions, do not hesitate to contact the Siecor Splice Equipment Service department for the necessary information.
	We should also like to point out that the content of these operating instructions does not form part of a previous or existing agreement, commitment or legal relationship, nor is it intended to modify any such arrangement. All obligations on the part of Siecor arise exclusively from the relevant sales contract which also contains the only valid and comprehensive warranty conditions. The operating instructions neither extend nor limit the contractual warranty conditions.

Warranty Information

The Siecor MiniMass Fusion Splicer is warranted against defects in material and workmanship for a period of one year from date of shipment. Any MiniMass found to be defective during the warranty period may be returned, transportation prepaid, to the factory for repair without charge.

This warranty does not apply to units which have been repaired or altered by an unauthorized person, or which have been subject to misuse, negligence or accident. This warranty does not apply the those components considered consummables: cleaver blades, electrodes, of v-grooves.

A complete explanation of Siecor corporation´s warranties, and terms and conditions of sale may be found on the reverse side of Siecor´s Quotations, Order Acknowledgement and/or invoice forms and only the Warranty appearing thereon is to be considered Siecor´s Warranty.

All inquiries regarding repairs or replacement parts should be directed to the Customer Service Department, SIECOR CORPORATION, 489 Siecor Park, Hickory, NC 28603-0489; (800) SIECOR-1. This will assure you the fastest possible service. See the maintenance section in this manuel.

Addresses

If your fusion splicer needs servicing, send it to:

Siecor
Splice Equipment Lab
800 17th Sr, NW
Hickory, NC 28601

Tel. (704) 327-

Please inform Siecor before you send your fusion splicer to the service center.

If you have any technical questions or questions about our training program, please contact:

Siecor
P.O. Box 489
Hickory, NC 28603

Tel. (800) 743-2671
Fax (704) 327-5973

Definition of Terminology used in Warnings

The list below defines the terms used in the warning notices:

Danger
In these operating instructions and the warning notices on the products themselves, this term means that death, serious injury or severe property damage <u>will</u> result if the relevant precautions are not observed.

Warning
In these operating instructions and the warning notices on the products themselves, this term means that death, serious injury or severe property damage <u>may</u> result if the relevant precautions are not observed.

Caution
In these operating instructions and the warning notices on the products themselves, this term means that slight injury or damage may result if the relevant precautions are not observed.

Note
In these operating instructions, this term indicates important information about the product or the relevant part of the operating instructions to which particular attention must be paid.

Qualified Personnel
In these operating instructions and the warning notices on the products themselves, the term qualified personnel means persons who are familiar with commissioning, operating and maintaining electrical equipment, and who are suitably qualified for the work they perform.

DANGER	When electrical equipment is in operation, certain parts of such equipment are bound to reach hazardous voltage levels. If the warning notices are not observed, serious injuries or damage may occur. Only suitably qualified personnel should work on this equipment or in its vicinity. Operating personnel must be fully familiar with all the warnings and maintenance procedures covered in these operating instructions. The trouble-free and safe operation of this equipment requires that proper arrangements are made for its shipping, correct storage, set-up and assembly, as well as careful use and maintenance.

Password Request

Activating pass-word request	The fusion splicer must be open in order to activate or deactivate password request.

DANGER	The fusion splicer or electrically operated accessories must not be opened except by suit-ably qualified personnel. Switch off fusion splicer and disconnect from the power supply (power supply plug and 12V lead)!

Two cross-recess screws are located on the left of the housing and two on the right. These must be removed in order to open the housing. The PC board which is now visible contains a switch with which password request can be activated or deactivated (switch position "OFF": request is deactivated).
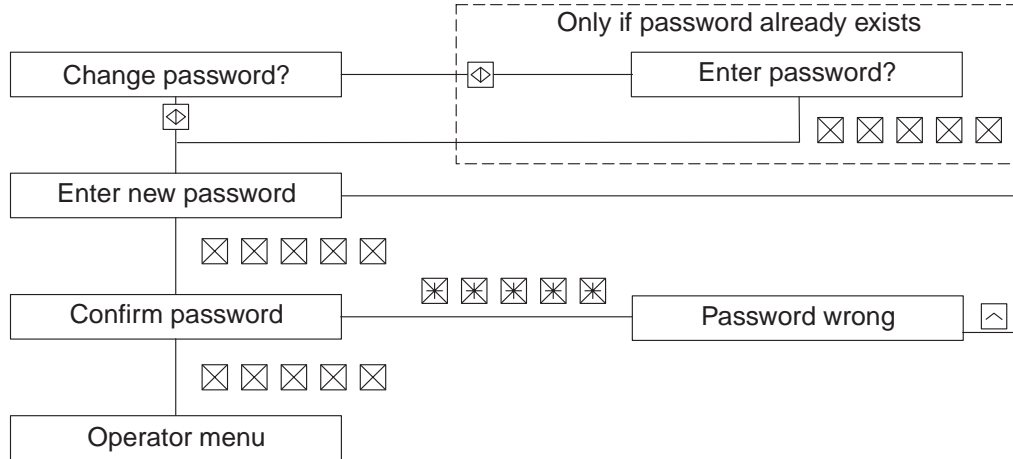
If password request is deactivated, the stored password is deleted when the fusion splicer is switched on again. However, if you subsequently reactivate password request without switching the fusion splicer on and off previously, the old password is retained.

No password is stored when request is reactivated. A new password must therefore be defined first.

Entering the password	A password consists of an arbitrary sequence of five input keys. If you try to change a parameter when password request is activated, the message "Enter password" appears. If an incorrect password is entered, the parameter change is rejected. This also applies to a change of password, i.e. a new password cannot be defined unless the current password is known. To redefine the password, activate the parameters menu, select the parameter "Password" and proceed according to the following flow chart.

```
                                         ┌─────────────────────────────────────────────────────────┐
                                         │                Only if password already exists           │
                                         │                                                           │
┌───────────────────────┐     ┌───┐      │   ┌───────────────────────┐                               │
│   Change password?    │─────│◇│──────┼───│   Enter password?      │                               │
└───────────────────────┘     └───┘      │   └───────────────────────┘                               │
         ┌───┐                           │                    ⊠ ⊠ ⊠ ⊠ ⊠                              │
         │◇│                             │                                                           │
         └───┘─────────────────────────────────────────────────────                                │
                                         └─────────────────────────────────────────────────────────┘
┌───────────────────────┐
│   Enter new password  │─────────────────────────────────────────────────────┐
└───────────────────────┘                                                      │
         ⊠ ⊠ ⊠ ⊠ ⊠                                                            │
                              ⊠ ⊠ ⊠ ⊠ ⊠                                       │
┌───────────────────────┐                         ┌───────────────────────┐  ┌───┐
│   Confirm password    │─────────────────────────│   Password wrong      │──│⌃│
└───────────────────────┘                         └───────────────────────┘  └───┘
         ⊠ ⊠ ⊠ ⊠ ⊠

┌───────────────────────┐
│   Operator menu       │
└───────────────────────┘
```

1 MiniMass Fusion Splicer, Overview

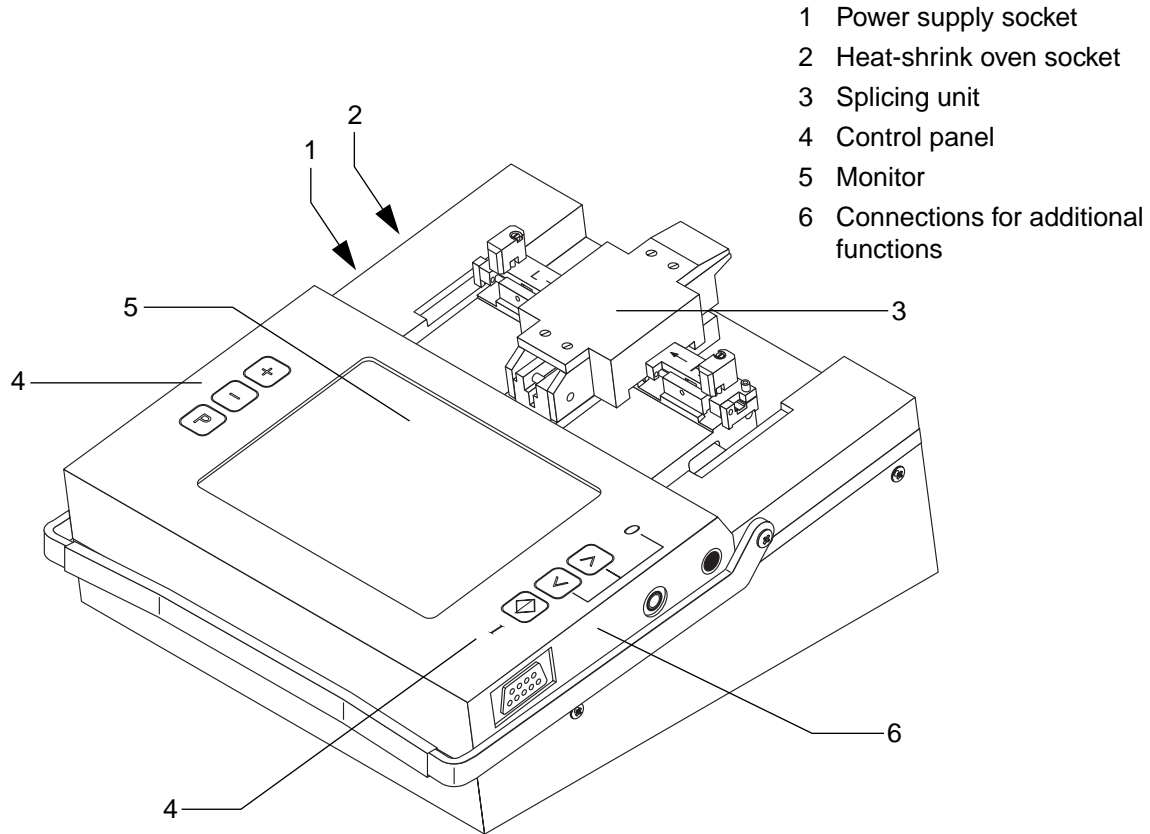## Contents   Page

General

The MiniMass Fusion Splicer is used for reliable, low-loss joining of optical fibers. It is designed for all commonly used single-mode and multimode fibers with a standard glass diameter of 125 μm. Both single fibers and fiber ribbons with up to 12 fibers can be processed.
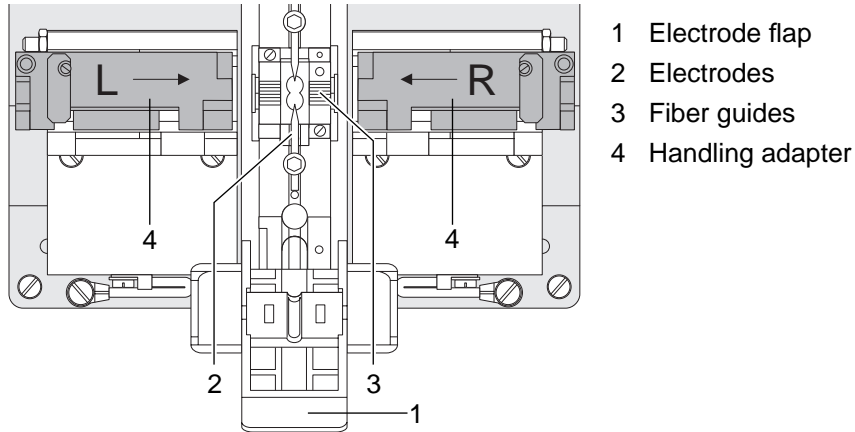
Automatic Fiber Positioning

Fully automatic positioning of fibers in the Z axis using L-PAS ensures uniformly good splicing results regardless of the operator.

L-PAS video image evalution

The L-PAS (**L**ens **P**rofile **A**lignment **S**ystem) employs two CCD cameras to detect the position of the fiber ends in the X, Y and Z axes with high precision. In addition, the L- PAS computes splice loss.

Equipment Overview

1 Power supply socket
2 Heat-shrink oven socket
3 Splicing unit
4 Control panel
5 Monitor
6 Connections for additional functions

Splicing unit

1 Electrode flap
2 Electrodes
3 Fiber guides
4 Handling adapter

Monitor	The LCD monitor displays two views of the fibers (allows for switching between X and Y axes).
NOTE	The fiber shown on the bottom of the screen is the fiber which is at the top of the handling adapter (1st fiber).

Control Panel   The control panel consists of 6 keys with the following functions:

⬦   Enter key: the indicated operation is executed, or the previously entered value is acknowl-
edged. Switches splicer on.

∧   Scroll back: the indicated operation is not executed.
Press ∨ simultaneously to switch off.

∨   Scroll forward: the indicated operation is skipped.

P   Call-up / exit parameters menu.

+   Increase indicated value. Fibers are displayed on the monitor in X axis.

−   Decrease indicated value. Fibers are displayed on the monitor in Y axis.

Connections for additional functions

1   2
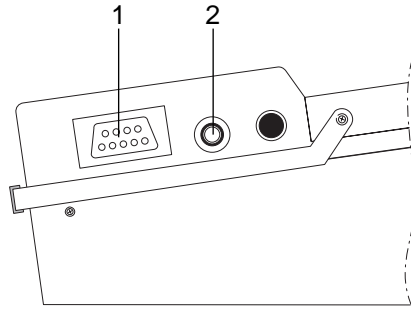
1 Serial interface
2 Video output

Serial interface   You can output the splicing parameters or the contents of the splice memory to a printer or a computer via the serial interface (see »Printer cable« on page 4-15).

Video output   You can connect a standard European monitor (CCIR, 625 lines) with an input impedance of 75 Ω or higher. Use an ordinary coaxial cable with cinch plug to this end.

Technical Data

Fiber prerequisites:	Glass diameter: 125 μm Coating diameter: 250, 500, 900 μm
Fiber viewing:	LCD Monitor
Magnification:	approx. 25
Fiber positioning:	Fully automatic in Z axis
Mean splice loss for identical standard single-mode fibers:	typ. < 0.08 dB for 12 x ribbon typ. < 0.05 dB for single fibers
Tensile test:	Automatic / off
Number of splice programs:	8 for single-mode fibers 2 for multimode fibers
Video output:	CCIR output (75 Ω)
Working temperature:	-5˚C to 45˚C
Storage temperature:	-20˚C to 70˚C
Dimensions (L x W x H):	208 x 185 x 100 mm
Weight:	2.5 kg

2　Preparations

Contents   Page

Placing the Splicer into Operation

| WARNING | To ensure the equipment operates safely, it must be assembled and put into operation by qualified personnel in the proper manner and with due regard for the warning notices in these operatinginstructions. Non-observance may lead to death, serious injury or considerable property damage. |

AC power connection
- Connect the splicing unit to the power supply (see operating instructions for the power supply or the rechargeable battery module).

Switching on the fusion splicer
- Press the ⊕ key.
- After powering up, the software version installed to the splicer is displayed on the monitor and a self-test is performed. If the electrode flap is closed, the electrodes are cleaned automatically by burning them off.

| DANGER | Before switching on, make certain that both electrodes are inserted correctly. Never switch on the splicer without the electrodes, otherwise the splicer will be damaged! |

- The screen shows the selected altitude above sea level.
- The positioning slides are then moved automatically to the insertion position.
- In battery mode, the charge level of the battery is indicated as a percentage.
  If the charge level is too low for operating the splicer, the message "battery empty" appears on the monitor and the splicer switches off automatically. In this case charge the battery (see operating instructions for the rechargeable battery module).

NOTE	You should only operaste the splicer with the battery if the battery charge level exceeds 30%. Never stow away the splicer with the battery discharged. Recharge the battery at the end of each working day.

NOTE	The splicer switches off automatically in the AC power and the battery mode if no key has been activated for a certain time. Press the ⏻ key in order to switch the splicer back on again. The switch off time for battery operation can be changed in the parameters menu (see page 3-10).

Checking the Electrodes

NOTE	Make sure that no fiber is inserted. Make sure that the electrodes have been properly seated, i.e. that they have been inserted into the holder as far as they will go and the screws are tightened.

- Start the fusion process (see section 4).

The electrodes are fully functional if

- they are not whitened or distorted,
- no loud hissing noises can be heard during fusion and
- the arc is uniform.

Electrodes which are not functioning properly should be cleaned or replaced (see »Cleaning / replacing the electrodes« on page 6-19).

Preparing the Optic Fibers

| NOTE	Minimal splice losses can only be achieved if the fiber ends are prepared carefully.

Preparing the fibers includes the following steps:

- Where necessary, pushing splice protection onto a fiber end (e.g. heat-shrink protection)
- Stripping the coating
- Cleaning the fibers
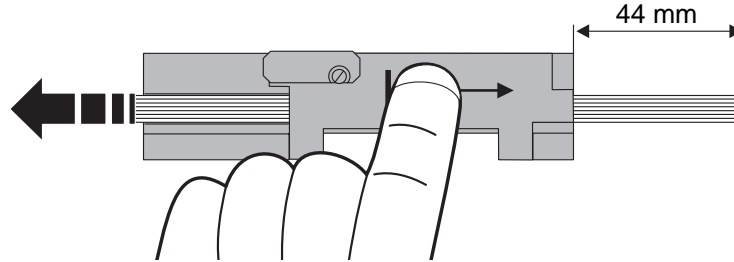- Cleaving the fibers
- Assessing the fiber end faces (monitor)

Inserting fibers into the handling adapter

- Make sure that you are using the correct handling adapters for the respective fibers. Move the locking lever to its horizontal position and open up the handling adapter.
- Now lay the fiber from the fiber ribbon between the supports of the handling adapter so that the end protrudes at least 50 mm.


50 mm

A   Coated fibers

A
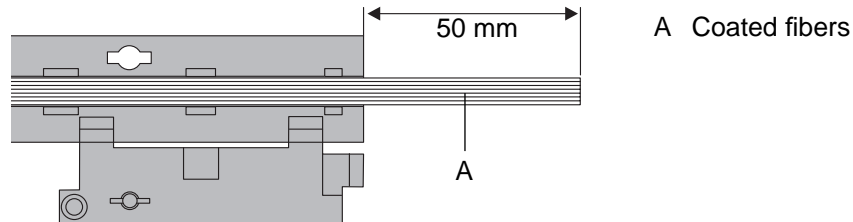
- Close up the handling adapter but do not lock the locking lever yet.

- Hold the flap gently closed with your finger and pull the fiber carefully in the direction indicated by the arrow until the end of the fiber is still protruding by about 44 mm. Move the locking lever into the vertical position.

Stripping the coating

Remove the coating from the end of the fiber as shown in the following diagram. Please refer to the operating instructions for your stripper and cleaver (required stripping length).
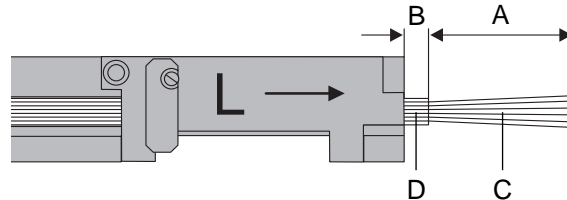
A Stripping length
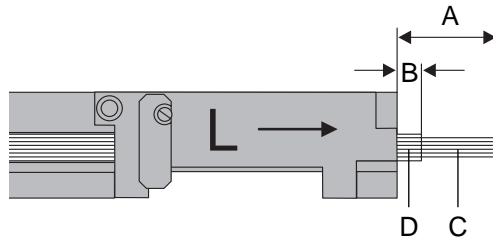
B 4 mm ±0.2

C Uncoated fibers

D Coating

Cleaning   Clean the fiber ends after stripping (coating and uncoated fiber) with a lint-free paper cloth soaked in alcohol.

DANGER   There is a risk of fire if solvents are spilled.

Cleaving   -   Use a cleaver to cut the fiber ribbon to the following length:

A   Cleave length (13 mm)

B   4 mm ±0.2

C   Uncoated fibers

D   Coating

Inserting the Fibers

- Open the electrode flap (1) with the fusion splicer switched on.
- Insert both handling adapters (2) with fiber ribbons correctly inserted and cleaved. Single fibers can be inserted into groove 6 or 7.

NOTE   Ensure that the fiber ribbons have been cleaved to the correct length. Otherwise the fiber ends may be damaged or positioner travel may be insufficient.
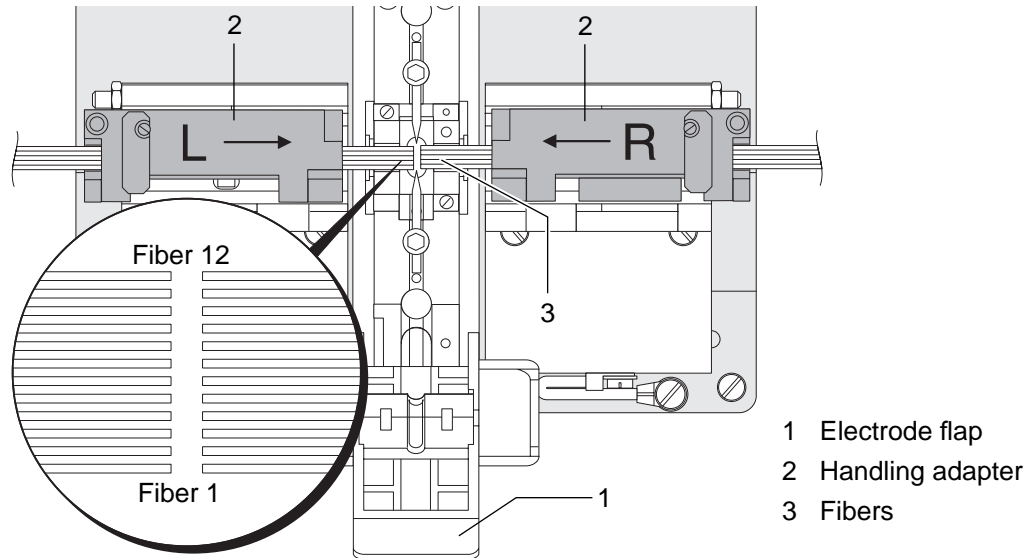
Fiber 12

Fiber 1

1 Electrode flap

2 Handling adapter

3 Fibers

- Now close the electrode flap (1).

Setting Monitor Brightness

NOTE   Monitor brightness can only be changed in the main menu.
The first time the ⊞ or ⊟ key is pressed, the monitor may switch from X view to Y view (or vice versa).

- Press the ⊞ or the ⊟ key until the desired brightness is obtained.

  Increase monitor brightness with the ⊞ key.

  Decrease monitor brightness with the ⊟ key.

Checking Fiber End Faces

NOTE	Good splice results can only be obtained with good end face quality.

After you have inserted the fibers into the splicer, select the menu item "Man. pos." or "Automatic". The fiber ends are moved to the center of the monitor.

The fiber ends must be:

bad   good

- Clean
- Free of protrusions and indentations
- Flat
- and square in relation to the fiber axis
- same fiber lengths for all fibers.
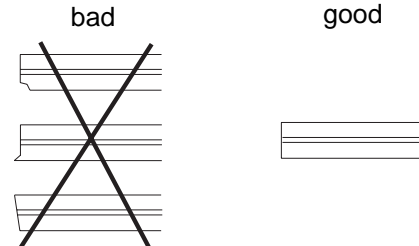
- If the quality of the end face is poor, the fiber ribbon must be prepared again.

NOTE	If you are in the "Automatic" mode and notice poor end face quality, you can abort positioning by pressing the [∧] key.

3   Parameters and Programs

Contents   Page

Parameters Menu

General In the parameters menu, the parameters can be matched to the fiber type used. The parameters menu is subdivided into "Options/Language", "Program selection" and "Data output".

```
options / language

» fusion parameters
  » singlemode fiber   1
    multimode fiber    1

data output
```

Determining the optimum parameters
- Use the default parameters for your initial attempts.
- If the results are not satisfactory, see »Adjusting the Splice Parameters« on page 3-15.

Call-Up   Pressing the $\boxed{\text{P}}$ key allows you to access the parameters menu with the electrode flap closed. Press the $\boxed{\text{P}}$ key in the parameters menu to return to normal operator control (main menu).

$\boxed{\text{P}}$ Enter / exit parameters menu.

$\boxed{\Diamond}$ Save value.

$\boxed{\wedge}$ Scroll back or go to previous line.

$\boxed{\vee}$ Scroll forward or go to next line.

$\boxed{+}$ Increase value.

$\boxed{-}$ Decrease value.

Selecting Parameters

NOTE	Good splice results can only be obtained with well prepared fiber ends, correct parameter settings and properly functioning electrodes.

General	The fusion splicer allows all programs and parameter sets to be protected against unauthorized access by means of a password. More detailed information about this can be found on the red page "Password request".

NOTE	If a fiber count other than the currently selected count is required, the corresponding program should be selected rather than changing the fiber count in the current program.

Resetting the parameters	The parameters of all the programs are reset to their default values by pressing and holding the [P] key and the [⏻] key simultaneously for about 1 s at switch-on.

NOTE	This is only possible if the password is not activated.

Default parameters for single-mode fibers

	Program							
	1	2	3	4	5	6	7	8
Fiber count:	12	10	8	6	4	2	1	12 Ti
Fiber gap (µm):	10.0	10.0	10.0	10.0	8.0	8.0	8.0	10.0
Auto feed (µm):	27.0	27.0	27.0	25.0	18.0	16.0	14.0	27.0
Cleaning current (mA):	30.0	29.2	28.3	27.5	26.7	25.8	25.0	30.0
Cleaning time (s):	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Pre-fusion current (mA):	28.0	26.4	24.8	23.3	21.7	20.1	18.5	28.0
Pre-fusion time (s):	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.4
Fusion current (mA):	32.5	30.3	28.2	26.0	23.8	21.7	19.5	32.5
Fusion time (s):	12.0	12.0	10.0	10.0	6.0	6.0	6.0	12.0
max. XY offset (µm):	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
max. Z tolerance (µm):	20.0	20.0	20.0	15.0	15.0	15.0	10.0	15.0
Tensile test:	yes	yes	yes	yes	yes	yes	yes	yes

The parameter values have been optimized during final testing of the splicer and may therefore be slightly different than those shown above.

Default parameters for multi-mode fibers

	Program	
	1	2
Fiber count:	12	1
Fiber gap (µm):	10.0	10.0
Auto-feed (µm):	27.0	14.0
Cleaning current (mA):	30.0	25.0
Cleaning time (s):	0.1	0.1
Pre-fusion current (mA):	25.4	16.0
Pre-fusion time (s):	1.3	0.6
Fusion current (mA):	30.0	18.0
Fusion time (s):	16.0	8.0
max. XY offset (µm):	7.0	7.0
max. Z tolerance (µm):	20.0	10.0
Tensile test:	yes	yes

The parameter values have been optimized during final testing of the splicer and may therefore be slightly different than those shown above.

Language Selection

- Change to the parameters menu with the P key.
- Select the line "Options/language" with the ∧ key.
- Press the ⬦ key.
- Press the ∨ key to select the menu item "Language".
- Select the desired language with + or − and acknowledge with the ⬦ key.

D	German
GB	English
F	French
E	Spanish
I	Italian
NL	Dutch
POR	Portuguese

DK	Danish
H	Hungarian
PL	Polish
CZ	Czech
中	Chinese
GUS	Russian
IRA	Farsi

Available languages depend upon the software version installed.

Program Overview

```
┌─────────────────────────┐        ┌─────────────────────────┐
│ Options / language      │───────▶│ Options / language      │
│ > Program selection     │        │ > Common parameters     │
│    > Single-mode fibers │        │ > Language D            │
│    > Multimode fibers   │        │ > Heatshrink oven       │
│ > Data output           │        │ > Service data          │
└─────────────────────────┘        └─────────────────────────┘

                                   ┌─────────────────────────┐
                                ──▶│ SM video # page #       │
                                   │ ...                     │
                                   └─────────────────────────┘

                                   ┌─────────────────────────┐
                                ──▶│ MM video # page #       │
                                   │ ...                     │
                                   └─────────────────────────┘

                                   ┌─────────────────────────┐
                                ──▶│ Data output             │
                                   │ Baud rate        9600   │
                                   │ Splice memory           │
                                   │   Print          no     │
                                   │ Splicing parameters     │
                                   │   Print          yes    │
                                   └─────────────────────────┘
```
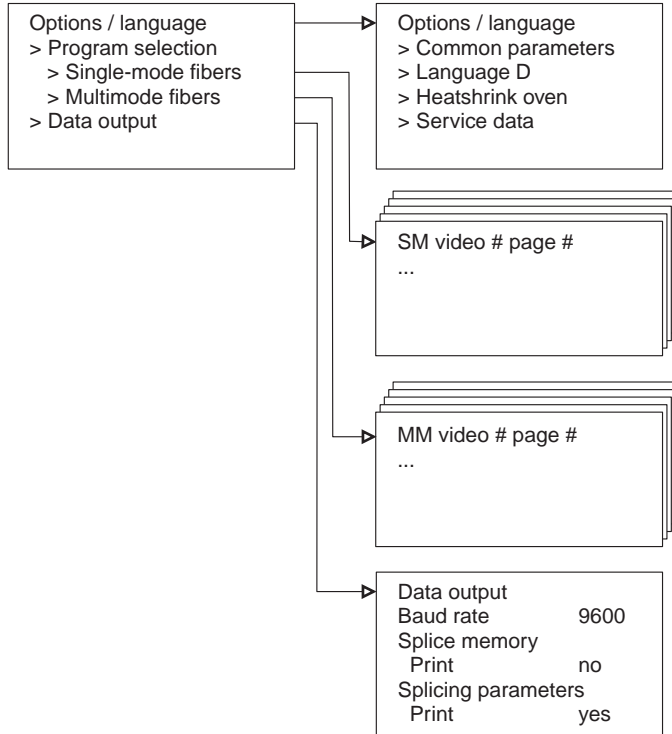
Parameter Descriptions

"Program selection (single-mode/multimode)" menu
Menu call-up: → Parameter menu → Program selection (single-mode/multimode fibers) → Program selection.

There are various sets of parameters available for each program type. These can be matched individually in each case for a particular fiber type.

Parameter	Effect	Setting Range
Fiber count	Number of fibers in the fiber ribbon used	1 to 12
Fiber-gap	Distance between fiber ends before splicing	8.0 to 20.0 µm in 0.5 µm steps
Auto-feed	Pushing fiber ends together beyond touching	0.0 to 45.0 µm in 0.5 µm steps
Cleaning current	Temperature of the arc during cleaning	10.0 to 49.0 mA
Cleaning time	Ignition time during cleaning	0.0 to 0.3 s
Pre-fusion current	Temperature of the arc during prefusion	12.0 to 49.0 mA
Pre-fusion time	Time between ignition of arc and starting total feed	0.0 to 1.0 s
Fusion current	Temperature of the arc during main fusion	12.0 to 49.0 mA
Fusion time	Ignition time during main fusion	0.0 to 20.0 s

Parameter	Effect	Setting Range
Max. XY offset	Input of maximum permissible offset of the fibers to be spliced in X and Y axes without a message appearing at the monitor.	0.0 to 15.0 µm
Max. Z tolerance	Input of maximum permissible distance between the fibers to be spliced in Z axis without a message appearing at the monitor.	8.0 to 20.0 µm in 0.5 µm steps
Tensile test	The tensile strength of the fiber ribbon is checked after the fusion process.	yes / no

"Common parameters" menu

Menu call-up: –› Parameters menu –› Options/Language –› Common parameters.

Parameter	Effect	Setting Range
Code:	Disable parameter sets	-
Splice memory:	Store max. 231 splice loss values (for single fibers)	Off/auto/manual/delete
Cont. detection	Detect contamination and dust	On/off
Battery disconnection time:	Duration of device disconnection in battery mode	2 to 60 min

Parameter	Effect	Setting Range
Altitude above sea-level:	See »Air pressure or altitude« on page 3-15.	0 to 3500 m in 10 m steps

"Language" Menu Menu call-up: → Parameter menu → Options/Language –› Language.

Parameter	Effect	Parameter
Language:	Language seledction, see »Language Selection« on page 3-8.	Language:

"Heat-shrink oven" menu Menu call-up: → Parameter menu → Options/Language → Heat-shrink oven.

Parameter	Effect	Setting range
Heat-shrink parameters internal:	The shrinking time and temperature selected on the fusion splicer are used.	-
Shrinking time:	-	10 to 250 s, in 10 s steps
Temperature:	-	80 to 150 ˚C

Parameter	Effect	Setting range
Heat-shrink parameters external:	The shrinking time and temperature set on the splicer are used.	-

"Service data" menu

Menu call-up: → Parameter menu → Options/Language → Service data.

Parameter	Effect	Display/setting range
Operating hours:	Total number of operating hours.	-
Splices:	Total number of splices.	-
Interval for electrode		
- cleaning:	Number of splices before reminder is given to clean electrodes.	50 to 700, in steps of 10
counter = XXX reset	Resets "Cleaning electrode" counter reading to 0.	yes / no
- replacement:	Number of splices before reminder is given to replace electrodes	700 to 7000, in steps of 100
counter = XXX reset	Resets "Replace electrode" counter reading to 0	Yes/no

Current optimi-zation menu Menu call-up: –› Parameter menu–› Options/language –› Current optimization.

Parameter	Effect	Display/setting range
Current optimization:	See »Current optimization« on page 3-16.	-

"Data output" menu Menu call-up: → Parameter menu → Data output.

Parameter	Effect	Setting range
Baud rate:	Data transfer rate at the RS232 interface	150/300/600/1200/ 2400/4800/9600 and 19200 baud
Print splice memory	For "yes" the splice data is output at the interface	yes/no
Print splice parameters	For "yes" the current splice parameters are output at the interface	yes / no

Adjusting the Splice Parameters

Using the default parameters

The default parameters (see »Default parameters for single-mode fibers« on page 3-6 and see »Default parameters for multimode fibers« on page 3-7) are selected such that they can be used for all common fiber types.

Adjustment of the parameters is required under extreme ambient conditions, for example if:

- special fiber types with widely divergent fiber characteristics are used.
- the ambient temperature is considerably higher or lower than 22 ˚C.

Air pressure or altitude

The default parameters apply for an altitude of 550 m above sea level. to achieve uniformly good splice results, the height setting must correspond to actual altitude ± 100 m (see »"Common parameters" menu« on page 3-11).

Temperature

The default parameters apply for an ambient temperature of 22˚C. If the ambient temperature differs considerably from this value, the cleaning current, pre-fusion current and fusion current must be adjusted.

Above 22˚C: current must be *reduced* by 0.4 mA per 10˚C.
Below 22˚C: current must be *increased* by 0.4 mA per 10˚C.

Matching to special fiber types

If you wish to splice special fiber types you should start first of all with the default parameters. If you do not achieve good results, the parameters must be optimized as described on the following pages.

Current optimization

Current optimization provides a simple method of optimizing pre-fusion current and fusion current under currently prevailing conditions.

Check the following points before undertaking current optimization:

- Are the default parameters being used?
- Are the electrodes in good condition?
- Is the height above sea level set correctly?
- Has the correct fiber count been selected?

Procedure

- Change to the parameters menu.
- From the "Options/language" menu, chose the "current optimization" item. The screen displays the message "please insert fibers".
- Now insert the fibers as you would for a splicing operation and press the ⬦ key.
- The monitor displays the "Current optimization" and "Please open electrode flap" messages inone after the other.
- Open the electrode flap.
- Close the electrode flap again as soon as the "Please close the electrode flap" message is displayed.
- The existing fusion current and the new fusion current are displayed at the monitor. Pressing the ⬦ key replaces the previous fusion current with the new fusion current.

4   Splicing

Contents   Page

General

NOTE	Ensure that all preparations for splicing have been performed correctly and completely. Otherwise perform the necessary preparations on the splicer and optical fibers (see sections 2 and 3).

Selecting the Fusion Program

The various splicing programs and parameter sets are listed in section »3 Parameters and Programs«. With this information available to you, you should now be able to specify and activate the required program.

Now activate the required program in the parameters menu and return with the $\boxed{P}$ key.

Fusion program groups

The splicer features the following program groups:

1. Single-mode fibers (SM Video) with 8 parameter sets

2. Multimode fibers (MM Video) with 2 parameters sets

The parameters of each of the parameter sets can be set individually.
For fiber ribbons with 12 titanium, 12, 10, 8, 6, 4 and 2 fibers, and for single fibers, there are already default parameters set. These can be adapted to other fiber counts if required.

Selecting the Splicing Sequence

Each splicing sequence consists of:

- Cleaning (with the arc)
- Positioning (Z-axis)
- Contamination checking (if selected in "common parameters")
- Offset measurement
- Fusion, with feed in Z direction
- Splice assessment (only in automatic splicing mode)

You can run the splicing sequence in any of the following modes:

Automatic

You will normally use the fully automatic splicing sequence. The selected fusion program runs automatically. If the fiber ends are still not clean with the arc, they must be stripped and cleaved again.
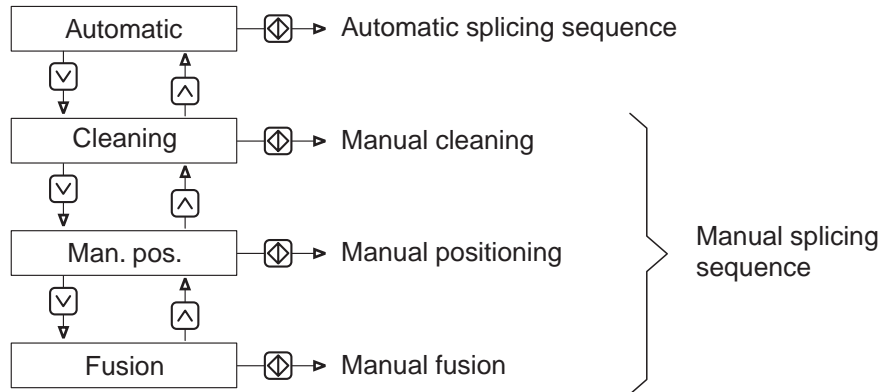
Manual fiber positioning

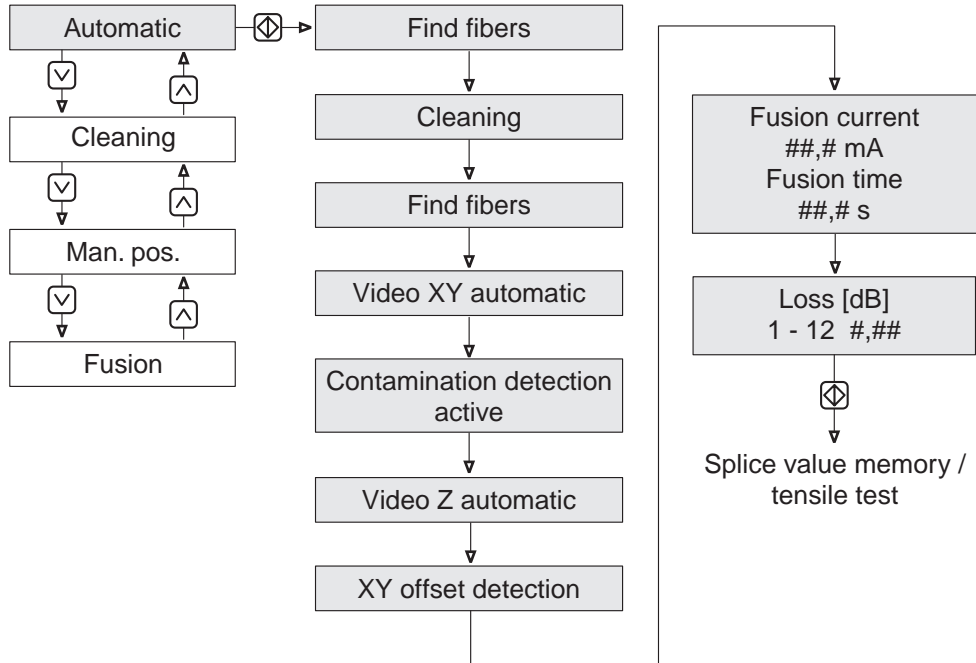With manual splicing, all operations are initiated separately.
The fiber ends must be positioned using the ⊕ and ⊖ keys so that the distance between the fiber ends is approximately equivalent to the fiber gap value set in the parameters menu.
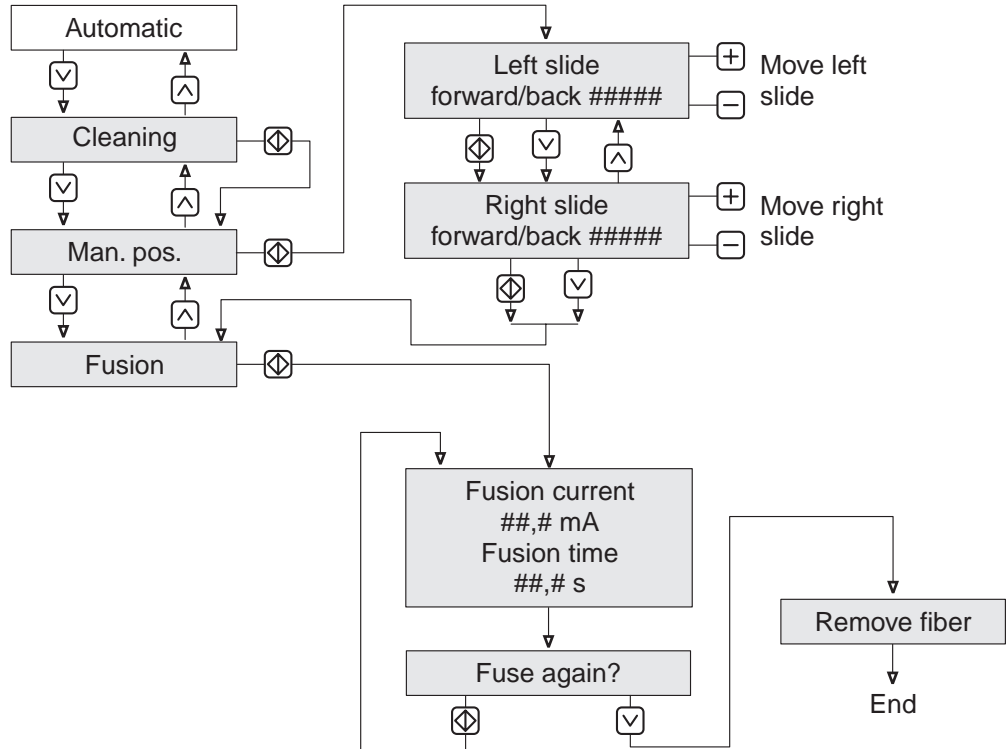
**Flow chart:
Selecting the
splicing
sequence**

```
┌─────────────────┐
│    Automatic    │──�◆──▶  Automatic splicing sequence
└─────────────────┘
  ▼⌄      ⌃▲
┌─────────────────┐
│    Cleaning     │──◆──▶  Manual cleaning
└─────────────────┘
  ▼⌄      ⌃▲
┌─────────────────┐                                    ⎫
│    Man. pos.    │──◆──▶  Manual positioning          ⎬  Manual splicing
└─────────────────┘                                    ⎪  sequence
  ▼⌄      ⌃▲                                            ⎪
┌─────────────────┐                                    ⎪
│     Fusion      │──◆──▶  Manual fusion               ⎭
└─────────────────┘
```

Automatic splicing sequence

Automatic → ⟐ → Find fibers

Automatic ⌄ ⌃ Cleaning

Cleaning ⌄ ⌃ Man. pos.

Man. pos. ⌄ ⌃ Fusion

Find fibers
↓
Cleaning
↓
Find fibers
↓
Video XY automatic
↓
Contamination detection active
↓
Video Z automatic
↓
XY offset detection

Fusion current
##,# mA
Fusion time
##,# s
↓
Loss [dB]
1 - 12 #,##
↓ ⟐
Splice value memory /
tensile test

**Manual
splicing
sequence**

Splice memory, tensile test

Automatic splicing sequence

Splice memory "Auto."
Tensile test "Yes"

Splice memory "Auto"
Tensile test "No"

Tensile test active

Tensile test ended

Remove fiber

End

Splice memory "Manual"
Tensile test "Yes"

Automatic splicing
sequence

Splice memory "Manual"
Tensile test "No"

Tensile test
active

Tensile test
ended

◇

Mean loss
#,## dB
Save splice data?

Splice loss
is not saved   ∧

◇   Splice loss
is saved

Remove fiber

End

Positioning

During the positioning operation, all automatic programs assess the end face quality and perform a fiber offset measurement.

Assessing the end face quality If the video system detects dirt or end angle errors totalling more than 5˚ (sum of angles between the individual fibers), the following message appears at the monitor.

```
y-axis

fiber 5
cleave angle
26.5 °

fusing?
```
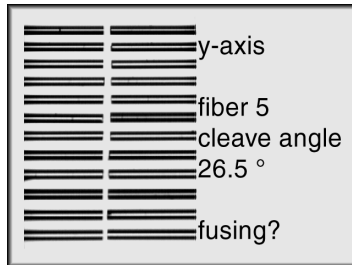
NOTE	Only correct end faces guarantee good splices.

Measuring the fiber offset

If the fiber offset is greater than the value selected in the parameters menu, the following message appears at the screen.

```
x/y offset
too big!
continue [✥]
show offset
     with[v]
  abort[^]
```
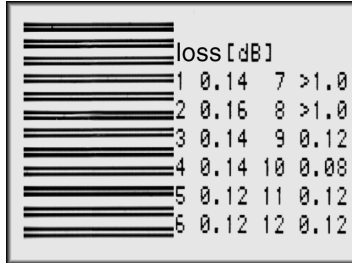
Assessing the Splice and Repeat Fusion

Visual splice assessment

The fiber cladding has a smooth surface if the splice is good. However, the cores are not visible on the monitor. The light strip in the middle of the fiber is the result of light reflecting from the fiber surface. The illustration below shows a good splice.

```
x-axis

remove
fibers
```
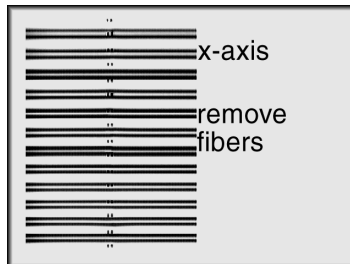
Automatic splice assessment

The finished splice is analyzed in the automatic mode. The splice is examined first for enlargements or constrictions as well as homogeneity and offset. If at one or more fibers has a loss of > 1.0 dB, the following menu is displayed:

- After the ◇ key is pressed, the monitor displays the message "Fuse again?". You can fuse again by pressing the ◇ key.

If the splice appears to be good, splice loss is calculated and displayed in dB. Splice loss assessment provides accurate results if the following requirements have been fulfilled:

• The fusion parameters must be set correctly.

• The fibers must be of good quality in terms of the eccentricity of the core relative to the outer contour.

Section 6 provides examples of poor splices, the possible causes and relevant corrective measures.

Fuse again   Repeat fusion is used to optimize the parameters and to enhance the splicing results if the selected fusion time was too short, or if fusion current was too low.

-    When key $\boxed{\wedge}$ is pressed, the question "Fuse?" or "Fuse again" appears on the display. This allows you to perform repeat fusion, i.e. to re-ignite the arc. After that the splice loss obtained is displayed again.

Tensile Test

The splicer allows for testing the tensile strength of the splice.

Activating the   You can switch the tensile test on and off in the parameters menu, see »"Program selec-
tensile test   tion (single-mode/multimode)" menu« on page 3-10. If the tensile test is switched on, the message "Tensile test active" appears after the end of the fusion process.

After completion of the tensile test "Tensile test completed" is displayed.

-    When the $\boxed{\oplus}$ key is pressed, "Remove fibers" is displayed at the monitor.

Splice Memory

Activating the splice memory

The splice memory can be activated under "Options" in the parameters menu. Up to 231 results (for of single fibers) can be stored and printed out via the RS 232c serial interface. You can also upload the results to a computer for further processing using a standard terminal program.

Displaying the splice memory at the monitor

If you "page" through the splicing sequence by repeatedly depressing the ⌄ key, the contents of the splice memory will be displayed at the monitor.

You can scroll backwards and forwards within the memory with the + and − keys.

Deleting values

-   Use the + and − keys to select the splice value to be deleted.
-   Press the ⌄ key. A prompt asking you if you really want to delete this value is displayed.
-   Acknowledge the deletion.

Leaving the memory display

•   By pressing the ⌄ key, you return to the operator menu.

Printing out the splice values

The printer and splicer used must be set to the same data transmission format (see »"Data output" menu« on page 3-14).

The splicer's serial interface works with the XON/OFF protocol. Data transmission is performed asynchronously with a start bit, eight data bits and one stop bit. The parity bit is not used. The baud rate of the splicer can be set to any one of the following values:
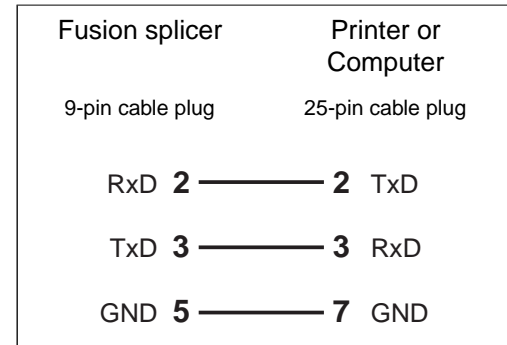
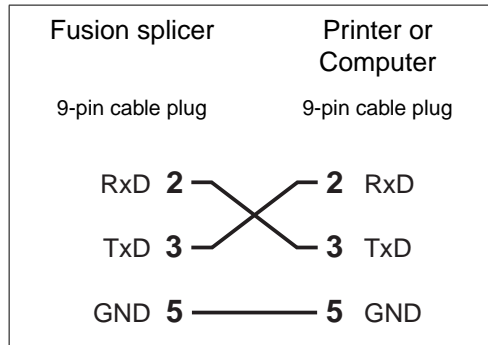19200, 9600, 4800, 2400, 1200, 600, 300 and 150 Baud

The settings are changed with the ⊞ and ⊟ keys. The value is acknowledged with the ⬦ key.

```
     data output

baud rate          9600
splice memory
  printing          no
fusion parameters
  printing          no
```

Printer cable   RSS 232c cables are commercially available as "computer to computer" connector cables. The cable used must include the following connections:

Fusion splicer	Printer or Computer		Fusion splicer	Printer or Computer
9-pin cable plug	9-pin cable plug		9-pin cable plug	25-pin cable plug
RxD **2**	**2** RxD		RxD **2** ——— **2** TxD	
TxD **3**	**3** TxD		TxD **3** ——— **3** RxD	
GND **5** ——— **5** GND			GND **5** ——— **7** GND	

Removing the Splice

- Open the electrode flap.
- Open fiber holder and remove the fiber ribbon.
- Remove fiber holder and close the electrode flap.

NOTE	5 seconds after the electrode flap is opened, the slide returns to the insertion position.

The fusion splicer is once again ready for use.

Splice Protection

The fiber coating at the splicing point was removed in order to splice the fibers. This section of the fiber must be protected after splicing by using a heat-shrink splice protector. This splice protector gives the splice mechanical strength and prevents possible damage during subsequent handling.

A heat-shrink oven is available as an accessory (see section »Appendix A: Accessories«).

5 Ending Operation

Contents   Page

Switching the Fusion Splicer Off

- Ensure that no more fiber ribbons are inserted.
- Press keys ⌃ and ⌄ simultaneously.

  The slides are then moved automatically to the transport position. The fusion splicer switches off as soon as this occurs.

WARNING	Always switch the splicer off via the control panel. If you only pull out the power supply plug, the slides are not moved to the transport position. This could result in damage to the splicer during transport.

Packing Away Accessories

- Pull the AC power cable out of the power supply socket.
- Remove any dirt or fiber remnants.
- Close the electrode flap.
- Pack any cables, tools and accessories into the fusion splicer case (see operating instructions for fusion splicer case).

6   Troubleshooting and Maintenance

Contents   Page

Basic Procedure

Proceed as follows if the fusion splicer malfunctions or if error messages are displayed:

- In the case of error messages which occur once only, repeat the action in question. For example, if the error message "Bad end faces" occurs, strip and cleave the fibers again.
- If the same problem occurs repeatedly, make absolutely certain that you are handling the fibers and operating the splicer as described in the operating instructions.
- If you are unable to ascertain the cause of the error or if the error is repeated, the following subsection provides you with the possible causes of numerous problems and the measures you should adopt to remedy them.
- A number of the remedies set forth below require utmost care, and should only be performed by qualified personnel in a clean working environment.
- Under no circumstances should you attempt to perform repair work which, according to the table, may only be carried out at the service center. Forward the defective splicer along with the completed "Repair Instructions for Splicer" form to your authorized service center.

NOTE   The manufacturer assumes no liability for damage as a result of the following work being performed incorrectly.

NOTE   Error messages displayed at the monitor are also indicated by a beep tone!

Error Messages at the Monitor

The following pages contain explanations of the *error messages displayed at the monitor* together with notes on remedying the errors. The error messages are arranged in the order of the operations during which they might occur.

Note that a number of error messages can have different causes and symptoms and may therefore be listed more than once in the following pages.

Error messages when powering up

Error message	Possible cause	Remedy
Self test *Error 1*	Defective RAM	Switch off the splicer and switch it back on again. If the error is repeated, the splicer must be sent to the service center for repair. Notify the service center of the error number displayed.
Error 2	Defective Visual storage	
Error 3	Defective RAM and visual storage	
Error4	Digitizing defective	
Reference switch *left error* *right error*	Left and/or right-hand reference switch has not been actuated. Switch is defective or slide does not move.	Press the ⊕ key. If the error still occurs after this, the splicer must be sent to the service center for repair.

Error message	Possible cause	Remedy
Battery charge status Battery empty! The splicer switches off	The power supply unit is not connected to the battery - AC power operation is not possible.	Check whether the power supply unit, battery and splicer are connected properly.
	The power supply unit is not functioning. The battery is not being charged. The display appears even though the splicer is being powered from the AC power supply.	Check the AC power supply.
	The battery is defective but AC power operation is possible.	Replace the battery.

Error message	Possible cause	Remedy
Error messages during fiber location and positioning		
Z-distance too wide or fibers not detected	Fibers wrongly inserted, wrong number of fibers or wrong cleave length.	Insert the fibers correctly, see »Inserting the Fibers« on page 2-7. The fibers must be in the center between the electrodes when the fiber holding flaps are closed.
	No fibers present.	Insert fibers.
Fiber input error	The fiber end could not be found during fiber positioning. The fibers overlap too much or are too long or are cut to very different lengths.	Insert the fibers correctly, see »Inserting the Fibers« on page 2-7.
Insert fibers	No fibers were inserted into the unit	Insert fibers
Left fiber missing or Right fiber missing	No fibers were inserted on the relevant side.	Insert fibers on the relevant side.

Error message	Possible cause	Remedy
Fiber # not detected or *Fiber ends not detected* or *Left fiber ends not detected* or *Right fiber ends not detected*	Dirty optical system.	Remove dirt and coating residues from the protective disks of the optical system (see »Maintenance and Care« on page 6-16).
	Condensation on optical system. The fiber appearance displayed is unclear in one or two axes.	Prevent condensation by placing the splicer prior to use in a room that is not too cold. Leave the electrode flap open for as short a time as possible during fusion.
	Fiber end is no longer detected as such by the video system, i.e. the fiber is either extremely dirty or extremely poorly cleaved.	Clean fiber or prepare fiber again.
Not all fibers detected *Fiber count incorrect*	The fiber count of the ribbon does not agree with the count set in the parameter menu	Change fiber count in parameter menu

Error message	Possible cause	Remedy
Fiber offset error The fiber offset is clearly visible before starting of the positioning.	Fiber dirty or positioned wrongly.	Check whether the fiber is clean and correctly inserted in the guide. If necessary, prepare the fiber again and insert correctly.
	Fiber guides dirty or damaged.	Clean the guides as described further on.
Fiber left *bad cleavage* or *Fiber right* *bad cleavage* or *Fiber # end face angle* or *Fiber # dirty* *or damaged*	The video system has detected that the total end face angle exceeds 5˚ or that the end face is dirty.	Determine which fiber end is faulty at the monitor. Prepare fibers again.
Video digitizer error	Video system electronics not functioning.	Switch off the splicer and switch it back on again. If the error occurs again, the splicer must be repaired at the service center.

	Error message	Possible cause	Remedy
Error messages during splice analysis	*Fiber not detected*	Dirty optical system.	Remove dirt and coating residues from the protective disks of the optical system (see »Maintenance and Care« on page 6-16).
		Condensation on optical system. The fiber appearance displayed is unclear in one or two axes.	Prevent condensation by placing the splicer prior to use in a room that is not too cold and leave the electrode flap open for as short a time as possible during the fusion process.
		Fiber end is no longer detected as such by the video system (fibers burnt or bubble formation).	Repeat splice.

	Error message	Possible cause	Remedy
	Bad splice - fuse again? The actual splice loss can still be OK under some circumstances	Wrong splicing parameters.	Reduce the pre-fusion current or pre-fusion time. The time must not be set too low (de-error setting: 0.25 s).
		Dirt in the optical system.	Check the monitor picture for visible signs of dirt with no fibers inserted. Remove dirt and coating residues from the protective disk of the optical system (see »Cleaning / replacing the protective discs« on page 6-16).
Error messages relating to the splice memory	*No data available*	The splice memory is empty.	Ensure that the splice memory is activated in the parameters. In order to store an indicated loss value, you must confirm the *manual splice memory* each time with ⊕.

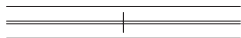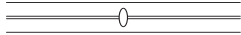| Error message	Possible cause	Remedy
Error messages during printing — *Printer not ready!*	The printer connected to the serial interface transmits incorrect control characters.	Check the baud rate set at the printer and splicer. Make sure that the printer you are using supports the XON/XOFF protocol and the data format (8 data bits, 1 stop bit, no parity).

Other Errors

The following table describes corrective measures for eliminating errors which do not generate error messages at the monitor.

Symptom	Possible cause	Remedy
Battery mode not possible; AC mode functioning.	The battery is missing or is not connected, or the battery fuse is defective.	Check that the battery has been fitted correctly and that the battery fuse is OK Install and correctly connect the battery and/or replace the fuse. If the error is repeated, the splicer must be sent to the service center for testing.
Arc flickers or hisses.	Electrodes dirty or eroded.	Clean or replace electrodes.
The fiber does not melt during the fusion process but buckles instead. The splice point barely lights up during splicing.	Fusion current too low	Set correct fusion current.
The arc is not ignited.	Fusion generator is defective.	Service center.

Symptom	Possible cause	Remedy
The fiber buckles at the start of the fusion process.	The prefusion time is too short or the prefusion current too low.	Correct the pre-fusion parameters. You can use the de-error values as a starting point.
Fibers burn away.	Prefusion current or prefusion time too high.	Set the parameters (see section 3). Try using the de-error parameters if necessary.
	Autofeed too small.	
	Fusion current far too high.	
	Defective Z-piezo	Service center.
Charging indicator not lit.	No AC power supply.	Connect the power supply unit to the socket.
	Power supply unit defective	Service center

Symptom	Possible cause	Remedy
Constriction	Dirty electrodes. The arc burns irregularly.	Clean electrodes.
	Fusion current too high.	Reduce in steps of 0.2 to 0.3 mA.
	Overfeed too small.	Increase in steps of 1 μm
	Prefusion time too long.	Use standard value — change only in exceptional cases. Reduce in steps of 0.05 s.
	Prefusion current too high.	Use standard value — change only in exceptional cases. Reduce in steps of 0.1 mA
	Z-gap too wide.	Reduce Z-gap in steps of 0.5 μm (do not set below 3 μm).
Enlargement	Overfeed too large.	Reduce in steps of 1 μm.

Symptom	Possible cause	Remedy
Not fused through	Fusion current too low.	Increase in steps of 0.2 to 0.3 mA.
	Prefusion time too short.	Use standard value — change only in exceptional cases. Increase in steps of 0.05 s.
Bubble or inclusion	Dirty end faces before splicing.	Clean end faces before fusion! Possibly increase cleaning current by 0.2 to 0.3 mA or increase cleaning time by 0.1 s.
	Bad cleavage.	Check cleavage quality before fusion.
	Fusion current too high.	Reduce prefusion and fusion currents.
	Prefusion time/current too low.	Increase prefusion time in steps of 0.1 s.

Symptom	Possible cause	Remedy
Matchheads	Electrodes dirty, arc burns irregularly.	Clean electrodes.
	Fusion current is far too high.	Reduce in steps of 0.5 to 1.0 mA.
	Prefusion time is far too long.	Set standard value 0.20.
	Prefusion current is far too high.	Use standard value.
	Autofeed too small.	Increase autofeed in steps of 1 µm.

Maintenance and Care

The splicer must be cleaned regularly and kept clean at all times.

Clean the following parts at the end of every working day or more often if required:

- the fiber guides
- the electrodes
- the fiber cleaver
- glass prisms, LEDs and clamps in the electrode flap (lint-free cloth)


WARNING   Do not clean the splicer with chemical solvents, use pure alcohol only.

Cleaning / replacing the protective discs

The protective disks for the optical system are located vertically under the electrode tips and must be kept free from dirt and fiber and coating residues at all times. Clean the protective disks using the following procedure:

- Disconnect the splicer from the power supply.
- Remove the electrodes, see »Cleaning / replacing the electrodes« on page 6-19
- Lose the fixing screws (5) from the fiber guide body.
- Loosen the clamping screw (1) by about 3 turns using a screw driver (2.3 wide).
- Extract the fiber guide (2) using tweezers.
- Take out the protective disks (4) using tweezers.
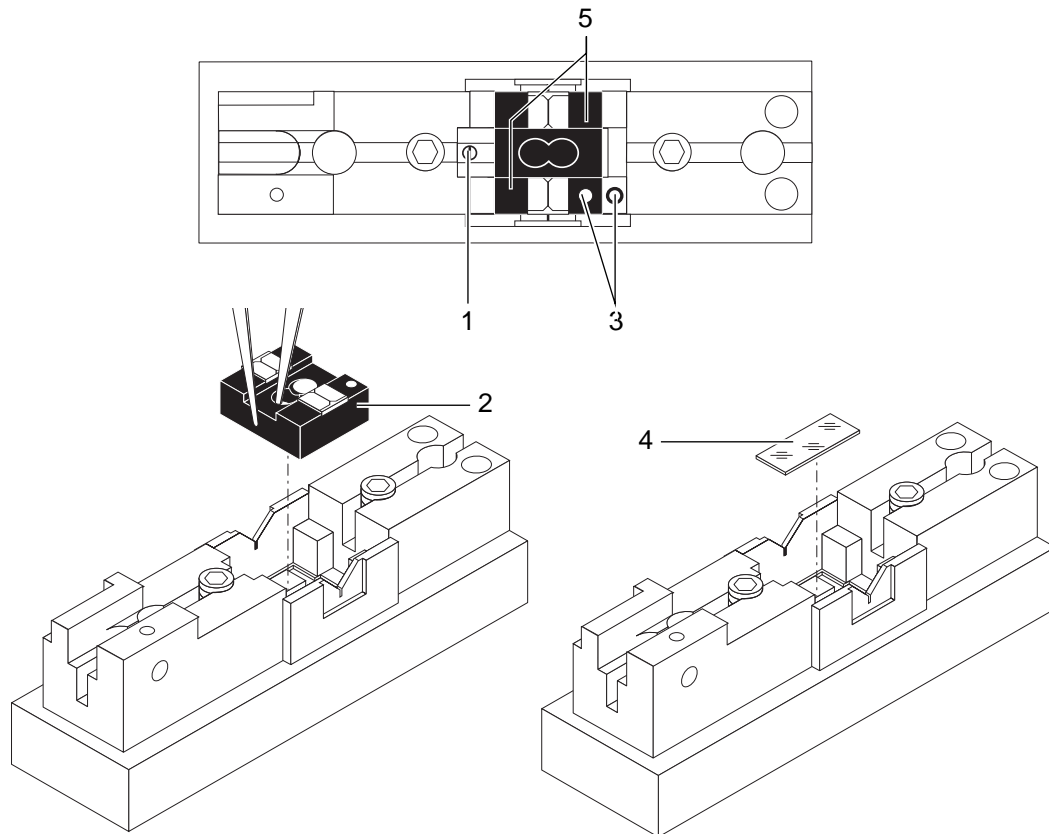
- Clean the protective disk (4) with a chamois. If it is more heavily contaminated, clean it with alcohol or replace it with a new disk if necessary (see »Accessories / spare parts« on page A-2).
- Put the protective disk back in using tweezers.

NOTE	When inserting the disk ensure that it locates in the cutout provided. Ensure that the bottom of the disk (on the achromatic lenses) is clean!

- Insert the fiber guide using tweezers. Ensure that it locates correctly and that it is clean, the two markings (3) must be opposite one another.
- Now tighten the clamping screw (1) using a maximum torque of 0.1 Nm.
- Fix the fiber guide body with the fixing screws.
- Electrodes: replace (see »Cleaning / replacing the electrodes« on page 6-19)

Changing the battery fuse
The battery fuse is located in a fuse holder on the outside of the battery. Replace this fuse only with a fuse of the same rating and type after having eliminated the cause of the error.

Cleaning the fiber guides
The fiber guides require cleaning if there appears to be a marked offset between the fibers on insertion.

Clean the fiber guides by blowing them out with compressed clean air and reduce pressure. Obstinate dirt can be removed carefully using a wooden toothpick with its tip slightly moistened in alcohol.

DANGER	After cleaning there must be no alcohol left in the vicinity of the electrodes!

| WARNING	Never use hard objects to clean the fiber guides!

Cleaning / replacing the electrodes

The electrodes become dirty through the fusion process. When they become very dirty they no longer function properly. The electrodes are working properly:

- if the arc burns regularly
- and no hissing sounds are to be heard during the fusion process.

Replacing the electrodes

- Open the electrode flap.
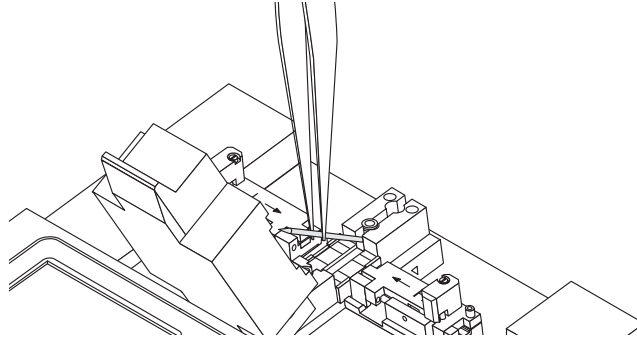
- Loosen the bolt with the special Allen wrench, size 3 (approx. one half turn).
- Pull off the electrode.
- Push the new electrode into the holder up to the stud.
- Clamp the electrode with the Allen screw.

CAUTION   Only use the special wrench supplied in the tool set.

- Change the second electrode in the same way.

Mechanical cleaning	If the electrodes still do not function properly after they have been burned clean, clean them mechanically. Use only the electrode cleaning tool and the emery cloth included with the tool kit for mechanical cleaning.
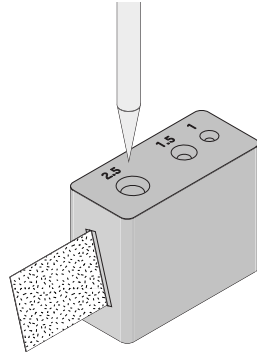
- Place a piece of emery cloth (with the *rough* side up) into the slot at the electrode cleaning tool.
- Remove the electrodes (see »Replacing the electrodes« on page 6-19).
- Insert the electrode into the cleaning tool and turn it carefully several times.
- Do not touch the tips of the electrodes with your fingers after cleaning.
- Clean the second electrode in the same way.
- If cleaning is unsuccessful, or the electrodes are excessively eroded, they must be replaced. Use original electrodes only.

CAUTION	Don't forget to reinstall and tighten the electrodes. Performing fusion without electrodes in place will damage the splicer!

7 Supplements / Changes / Notices

Appendix A: Accessories

In order to assure that the technical documentation for accessories purchased subsequent to the MiniMass Fusion Splicer are always readily available, we recommend attaching it to the end of this section.

Contents   Page

Order Numbers

Accessories / spare parts

Designation	Ordering number	Explanation
Handler for 2 ribbon	Handler-02	1 set = 2 handlers
Handler for 4 ribbon	Handler-04	1 set = 2 handlers
Handler for 6 ribbon	Handler-06	1 set = 2 handlers
Handler for 8 ribbon	Handler-08	1 set = 2 handlers
Handler for 12 ribbon	Handler-12 / 3.10	1 set = 2 handlers (standard)
Handler for 12 ribbon	Handler-12 / 3.15	1 set = 2 handlers
Handler for 12 ribbon	Handler-12 / 3.18	1 set = 2 handlers
Handler for single fiber handler 250 μm	Handler-250	1 set = 2 handlers
Handler for single fiber handler 125/900 μm	Handler-900	1 set = 2 handlers
Standalone battery case	X75-002-01	Tilting battery case attaches to bottom of splicer. Hold 2 camcorder batteries. Capacity: 15 splices / 2 batts

Accessories / spare parts

Designation	Ordering number	Explanation
Universal splice tray	2806127-01	For standard splice trays
Heat-shrink oven	X75-004	Time and temperature adjustable, for heat-shrink splice protectors
Work light	X75-006	Work light for X7... or M90 series 3000 splicer, 6 pin plug
Flexpack workstation case	X75-001	For holding all X7... splicers, incl. power supply unit, 6.5 A hr battery, and cables
Connecting cable	2809023-01	For connecting power supply unit and splicer, length approx. 2m
Attachment power supply unit, battery charger	X75-???	12V, 100W, for all X7... splicers (large screen)
Thermal stripping tool	2814003-01	Heated stripping tool needed to remove coating from ribbons
Ribbon cleaver	FBC-012	Ribbon cleaver for standard fibers
Replacement cleaver blade	FBC-012-01	Ribbon cleaver for standard and Titan fibers

Spare parts

Designation	Ordering number	Explanation
Electrodes	MM-026	1 set = 2 electrodes.
Electrode cleaning tool	2806042-01	Plastic tool wich holds fine abrasive paper.
Protective lens	2809040-1	Protective lens above camera lenses.

Expendable materials / Splice organization

Designation	Ordering number	Explanation
12 fiber heat shrink splice protection	2806031-012	Pack of 25
Single fiber heat shrink splice protection	2806031-01	Pack of 50