Description

The fast diode current modulator MSM 100-25 is a linear modulator with improved properties for driving arbitrary current waveforms into laser diodes. Current waveforms can be CW, pulsed, modulated or mixed with frequencies up to 100 kHz and currents up to 100 A.

For achieving maximum performance it is required to mount the modulator as close as possible at the laser diode and to connect it with low inductance. Conventional wires for connecting are not allowed, this will decrease performance significantly and may lead to an unstable operating.

The modulator is small and compact and it is designed for mounting with low inductance at the laser diodes or for integrating it in laser diode modules. Ask our support for more information and for important hints.

The modulator has two analogue inputs for the current set point, a high frequency input (50 Ohm input impedance) and a low frequency input. Both inputs cover the full current range. Additionally there is a 10 turn potentiometer for generating a CW-current (bias current). All set points are added and form the effective current set point.

The user needs to make sure that the maximum current will not be exceeded!

A set point with a negative sign acts subtracting.

Power dissipation

Dynamic performance of the modulator normally increase with supply voltage, however the electrical power dissipation increase with supply voltage too.

A good compromise is to choose a supply voltage of approx. 1 V above the diode voltage.

Simple formulas for calculating power dissipation:

Us	Supply Voltage (V)
Ud	Diode Voltage (V)
Idcw	Diode Current CW (A)
Idpeak	Diode Current peak value (A) (for sinusoidal and rectangle currents)
tp	Pulse Duration (s)
f	Pulse Frequency (Hz)
Pl	Power Dissipation (W)

For operating with CW current:

$Pl = (Us - Ud) \times Idcw$

For operating with sinusoidal current:

$Pl = (Us - Ud) \times (Idpeak / 2)$

For operating with rectangle current:
$Pl = (Us - Ud) \times Idpeak \times tp \times f$

For operating with sinusoidal current plus CW current:
$Pl = (Us - Ud) \times ((Idpeak / 2) + Idcw))$

For operating with rectangle current plus CW current:
$Pl = (Us - Ud) \times (Idpeak \times tp \times f + Idcw)$

The calculating of power dissipation with arbitrary current waveforms is difficult, therefore a good method for estimating power dissipation is to measure the temperature of the modulator.
The modulator has a precise temperature measurement system inside.
The SA-TEMP output reflects the actual temperature in the range of 0 °C … +80 °C.
Values of 60 °C (3 V) are still not critical.

General Instructions
Never run a negative current set point (effective current set point), this may lead to an overshoot if you alter the negative current set point to a positive current set point.
If you use a pulse signal generator or a function generator for the current set point, always disconnect it before you change any ranges. Some generators create high voltages or undefined signals if you change ranges, this may damage diodes and the modulator.

Starting Up
We recommend the following procedure for starting up:

Step 1: Precautionary Measures
Avoid personal static charge!
Switch off all power supplies for the laser driver

Step 2: Preparation
Remove short circuit cable at X4- and X5.
For further steps also see wiring diagrams below.

Disconnect the diode and short-circuit the output of the modulator:
connect X6- to X7+ via a short thin metal sheet or clamp.

For types FM xx-25 and FM xx-50:
Connect the supply voltage (3 V … 6 V, preferred 5V) for the internal electronics at X1-1 (GND) and X1-8 (SVI+).
For types FM xx-06:
An additional power supply for internal electronics is not needed.

Connect an oscilloscope at the X3 (SA-DCACT) current monitor output, terminate the oscilloscope input with 50 Ohm.

Connect the power supply for the diode at X4- (GND) and X5+.

Check correct cabling!

Step 3: Pre-Testing
For types FM xx-25 and FM xx-50:
Turn on the power supply for the internal electronics, the green LED must lit.

For all types FM:
Turn on the power supply for the diode.
Adjust voltage according to operating manual (recommended operating voltage, max. 6V), the green LED must lit

Enable the modulator (connect X1-3 to Ground) and watch the X3 current monitor output.

For all following steps:
Be aware of maximum diode current and maximum allowed power dissipation!
See specifications for modulator and diode.

Turn the BIAS Current potentiometer 1 turn clockwise. You must see 1/10 of the maximum current value on the oscilloscope (DC current).

Turn back the BIAS Current potentiometer counter-clockwise to position "Zero".

Connect X2 (CA-DCSP1) with adjustable DC power supply or function generator.
Supply X2 with 50mV DC.
You must see 1/10 of the maximum current value on the oscilloscope (DC current).
Disconnect X2.

Connect X1-2 (CA-DCSP2) with adjustable DC power supply or function generator.

Supply X1-2 with 500mV DC.

You must see 1/10 of the maximum current value on the oscilloscope (DC current).

Disconnect X1-2.

Switch off all power supplies and function generator.

Step 4: Commissioning

If the X3-signal is correct, disable the modulator (X1-3).

Remove the short-circuit at X6 - X7 and connect the diode.

Adjust the supply voltage for the diode according to recommended operating diode voltages.

For types FM xx-25 and FM xx-50:

Switch on the supply voltage (3 V … 6 V, preferred 5V) for the internal electronics at
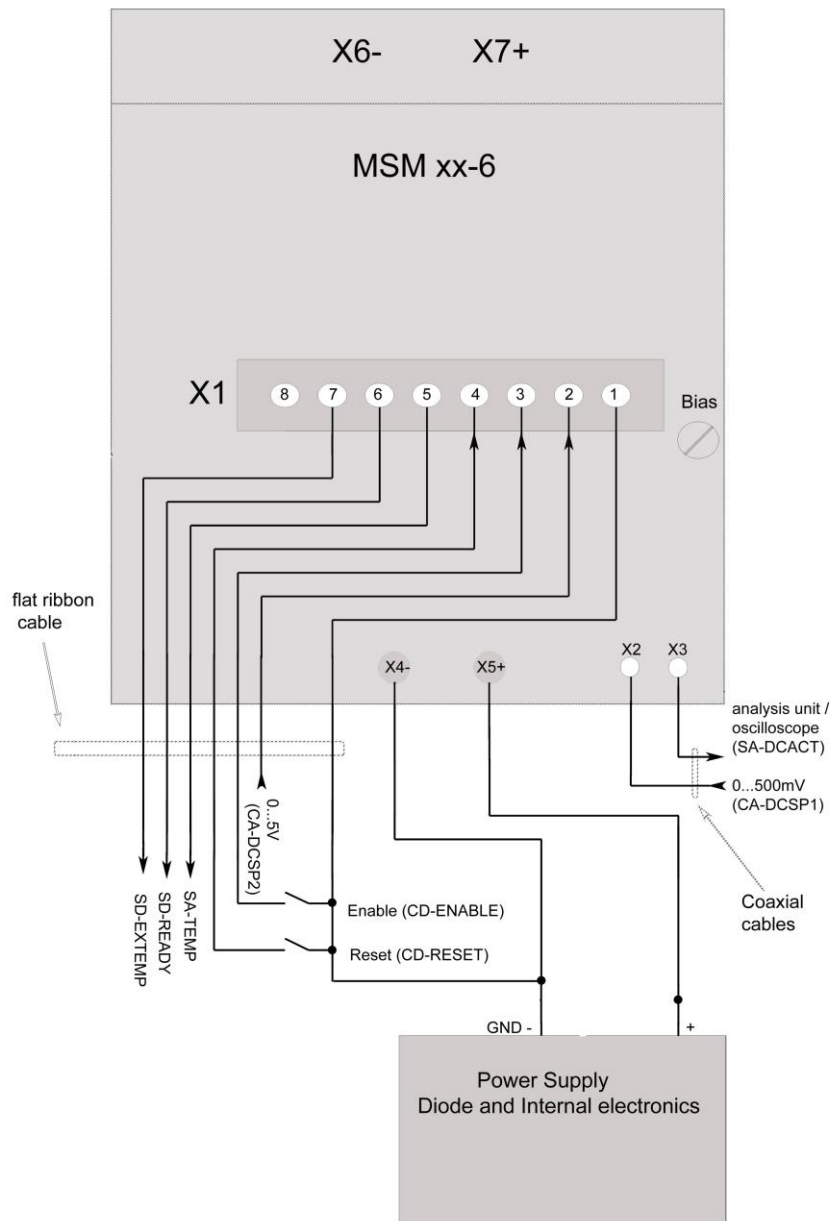X1-1 (GND) and X1-8 (SVI+).

Enable the laser driver at X1-3.

Adjust set points via BIAS current potentiometer, analog input X2 and / or analog input X1-2.

Be aware of the maximum diode current!

Be aware of the maximum allowed power dissipation of the modulator!
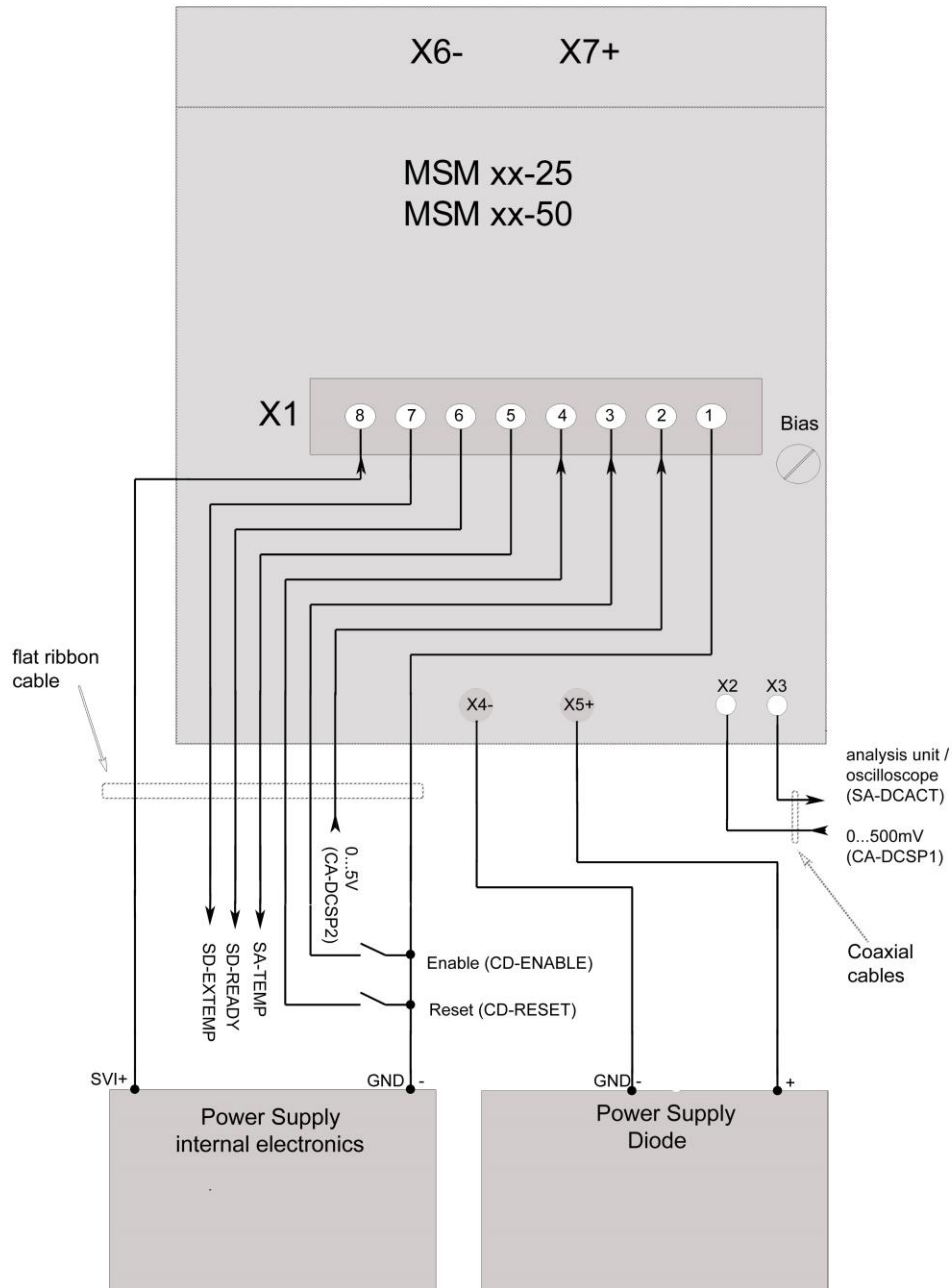
Adjustment elements

10 turns potentiometer for a CW current set point (bias current)

The potentiometer covers the full current range.

Turn clockwise for increasing current.

Indicator elements

Green LED for indicating status Ready

Red LED for indicating status Excess Temperature

Connectors

X1   8-pole single row male connector for control signals, status signals and supply voltage for the internal electronics

X2   female coaxial jack MMCX for current set point 1

X3   female coaxial jack MMCX for actual current (current monitor)

X4-   connection bolt & 8 mm with female thread M4 for Supply Voltage Minus

X5+   connection bolt & 8 mm with female thread M4 for Supply Voltage Plus

X6-   connection plate with six female thread M1.6 for laser diode cathode

X7+   connection plate with five female thread M1.6 for laser diode anode
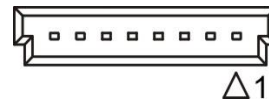

X1 Control Port

8-pole single row male connector

Manufacturer: ERNI Part number 214014

Mating plug:

8-pole single row female connector

Manufacturer: ERNI Part number 224396

CA=Control Data Analog
CD=Control Data Digital
SA=Status Data Analog
SD=Status Data Digital

Inputs Control Port X1		
Pin	Name	Function
1	GND	Signal Ground
2	CA-DCSP2	Diode Current Set Point 2
3	CD-ENABLE	Enable
4	CD-RESET	Reset
8	SVI+	Supply Voltage for the Internal Electronics

Outputs Control Port X1		
Pin	Name	Function
1	GND	Signal Ground
5	SA-TEMP	Temperature
6	SD-READY	Ready
7	SD-EXTEMP	Excess Temperature

X2 Control Port
Female coaxial jack MMCX
CA-DCSP1
Diode Current Set Point 1

X3 Current Monitor Port
Female coaxial jack MMCX
SA-DCACT
Diode Current Actual

X4-
Connection bolt ø 8 mm with female thread M4
Supply Voltage Minus for the laser diode

X5+
Connection bolt ø 8 mm with female thread M4
Supply Voltage Plus for the laser diode

X6-
Connection plate with six female thread M1.6, Laser Diode Cathode

X7+
Connection plate with five female thread M1.6, Laser Diode Anode

Signal Description

SVI+
Supply voltage for the internal electronics
Required supply voltage: 3V ... 6 V
Supply current: 1 A approx.
Plus must be connected at X1-8, Minus at X4-.

CA-DCSP1 (X2)
Control Analog - Diode Current Set Point 1
Analog input 0 … 500 mV, input impedance 50 Ohm
0 … 500 mV corresponds to a diode current of 0 … 100 A CW operation.
0 … 1000 mV corresponds to a diode current of 0 … 200 A pulsed operation.
Max power dissipation must be considered!

CA-DCSP2 (X1-2)
Control Analog - Diode Current Set Point 2
Analog input 0 … 5 V, input impedance 10 kOhm
0 … 5 V corresponds to a diode current of 0 … 100 A CW operation.
0 … 10 V corresponds to a diode current of 0 … 200 A pulsed operation.
Max power dissipation must be considered!

Diode Current Set Point 1, Diode Current Set Point 2 and the current value of the bias current potentiometer are added internally and build the effective current set point. The user needs to make sure that the maximum current will not be exceeded!
A current set point with negative sign acts subtracting.

SA-DCACT (X3)
Status Analog - Diode Current Actual
Analog output 0 … 100 mV (off-load voltage), output impedance 50 Ohm, reflects the actual diode current. 0 … 100 mV corresponds to a diode current of 0 ... 100 A.
For maximum performance the coaxial cable should be terminated with 50 Ohm.
In this case 0 … 50 mV corresponds to a diode current of 0 ... 100 A.

SA-TEMP (X1-5)
Status Analog - Temperature
Analog output 0 … 4 V, reflects the actual temperature of the modulator.
0 V corresponds to 0 °C, 4 V corresponds to +80 °C.

CD-ENABLE (X1-3)
Control Digital - Enable
Digital TTL input, High if left open.
A Low-Signal or pulling the input to GND enables diode current.

CD-RESET (X1-4)

Control Digital - Reset

Digital TTL input, High if left open.

A Low-Signal or pulling the input to GND resets the modulator if there was an error (maximum allowed current exceeded or excessive temperature).

SD-READY (X1-6)

Status Digital - Ready

Digital TTL output, High if there are no errors.

SD-EXTEMP (X1-7)

Status Digital - Excess Temperature

Digital TTL output, High if the temperature of the modulator has exceeded 80 °C.

The modulator will be switched off and remains in an off state.

SD-READY signal goes Low, the green Ready-LED goes out and the red

Excess Temperature-LED lits.

Specification

Supply voltage for the internal electronics	3 V ... 6 V DC
Supply current	300 mA approx.
Supply voltage	1 ... 25 V
Supply current	100 A max
Diode voltage	0 ... 24 V
Diode current CW	0 ... 100 A
Diode current pulsed	0 ... 200 A
Frequency bandwidth	DC ... 100 kHz (CA-DCSP1)
Frequency bandwidth	DC ... 100 KHz (CA-DCSP2)
Rise time	5 µs
Fall time	7 µs
Accuracy	± 0.2 %
Linearity	± 0.2 %
Temperature stability	± 100 ppm / °C
Accuracy of SA-DCACT output	± 2 %
Power dissipation	150 W max. allowed
Cooling	required
Operating temperature range	0 ... +45 °C
Dimensions	95 x 61 x 20 mm
Weight	240 g
Part Number	10100458

Scope of Delivery

Fast Diode Current Modulator	Part Number 10100458
8-pole single row female connector	Part Number 10883510
2 pcs screw M4x6 DIN 7985	Part Number 10701642
11 pcs screw M1.6x3 DIN 7985	Part Number 10701609
11 pcs washer A1.7 DIN 433	Part Number 10705300

Section Drawing

Dimensions (in mm)
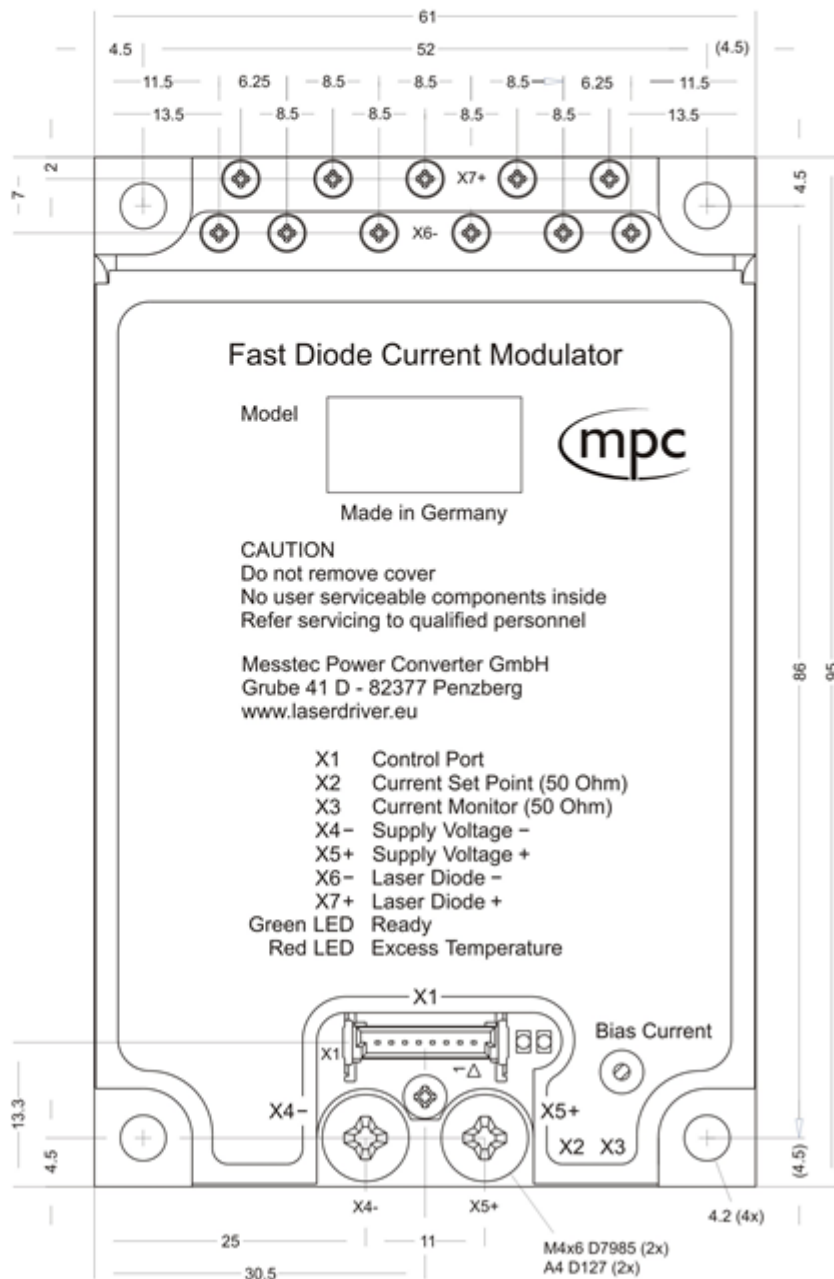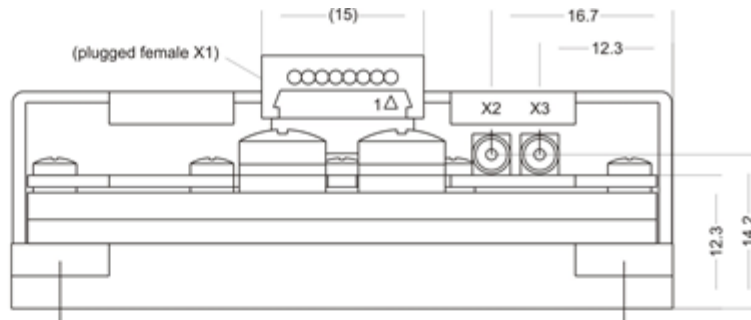
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Technical subjects to change without notice.