

**Operating Manual
Fast Modulator VFM 60-25**

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Description

The fast diode current modulator VFM 60-25 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 20 MHz and currents up to 60 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.

Furthermore the modulator has a trigger input (TTL 3,5V) which acts at the high frequency input X2. This trigger input controls the current set point 1 signal.

A logic High-level at the trigger input puts through the current set point 1 signal to the modulator, a logic Low-level inhibits the current set point 1 signal.

In this way it is possible to generate fast and clean pulses by feeding in a DC voltage at the X2 input, even if the trigger signal has a bad waveform.

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. 5 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)
PI	Power Dissipation (W)

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For operating with CW current:

$$PI = (U_s - U_d) \times I_{dcw}$$

For operating with sinusoidal current:

$$PI = (U_s - U_d) \times (I_{dpeak} / 2)$$

For operating with rectangle current:

$$PI = (U_s - U_d) \times I_{dpeak} \times t_p \times f$$

For operating with sinusoidal current plus CW current:

$$PI = (U_s - U_d) \times ((I_{dpeak} / 2) + I_{dcw})$$

For operating with rectangle current plus CW current:

$$PI = (U_s - U_d) \times (I_{dpeak} \times t_p \times f + I_{dcw})$$

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:

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

Connect an oscilloscope at the X3 current monitor output, terminate the oscilloscope input with 50 Ohm.

Connect the supply voltage for the diode at X4- and X5+, take a power supply with an adjustable output voltage of approx. 0 V ... 5 V.

Connect the supply voltage (3 V ... 6 V) for the internal electronics at X4- and X1-8.

Feed in a TTL-square wave or a CMOS-square wave with a pulse length of approx. 5 µs and a repetition rate of approx. 100 Hz at X1-7 (CD-TRIGG).

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Feed in a positive DC-voltage of 500 mV (for an output current of 6 A) at X2 (CA-DCSP1).

Turn on the power supply for the internal electronics, the green LED must lit.

Turn on the power supply for the diode. Adjust 5 V.

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

The X3-signal must be a square wave with a pulse length of 5 μ s, a repetition rate of 100 Hz and an amplitude of 330mV.

If the X3-signal is ok, disable the modulator and turn off the power supplies.

Connect the diode and adjust the supply voltage for the diode to a voltage of approx. 5 V above the diode voltage.

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

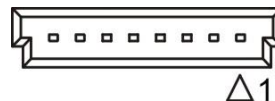
8-pole single row male connector

Manufacturer: ERNI Part number 214014

Mating plug:

8-pole single row female connector

Manufacturer: ERNI Part number 224396



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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
7	CD-TRIGG	Trigger
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

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 \varnothing 8 mm with female thread M4

Supply Voltage Minus for the laser diode

X5+

Connection bolt \varnothing 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 ... 60 A CW 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 ... 60 A CW 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 ... 220 mV (off-load voltage), output impedance 50 Ohm, reflects the actual diode current. 0 ... 220 mV corresponds to a diode current of 0 ... 60 A.

For maximum performance the coaxial cable should be terminated with 50 Ohm.

In this case 0 ... 110 mV corresponds to a diode current of 0 ... 60 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).

CD-TRIGG (X1-7)

Control Digital - Trigger

Digital TTL input, controls the current set point 1 signal at X2.

A logic High-level puts through the current set point 1 signal to the modulator, a logic Low-level inhibits the current set point 1 signal.

SD-READY (X1-6)

Status Digital - Ready

Digital TTL output, High if there are no errors.

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Specification

Supply voltage for the internal electronics	3 V ... 6 V DC
Supply current	1 A approx.
Supply voltage	1 ... 25 V
Supply current	60 A max
Diode voltage	0 ... 24 V
Diode current CW	0 ... 60 A
Diode current pulsed	0 ... 120 A
Frequency bandwidth	DC ... 20 MHz (CA-DCSP1)
Frequency bandwidth	DC ... 150 KHz (CA-DCSP2)
Rise time	28 ns
Fall time	32 ns
Accuracy	± 0.2 %
Linearity	± 0.2 %
Temperature stability	± 100 ppm / °C
Accuracy of SA-DCACT output	± 2 %
Power dissipation	30 W max. allowed
Cooling	required
Operating temperature range	0 ... +45 °C
Dimensions	95 x 61 x 20 mm
Weight	240 g
Part Number	10100375

Scope of Delivery

Fast Diode Current Modulator	Part Number 10100375
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

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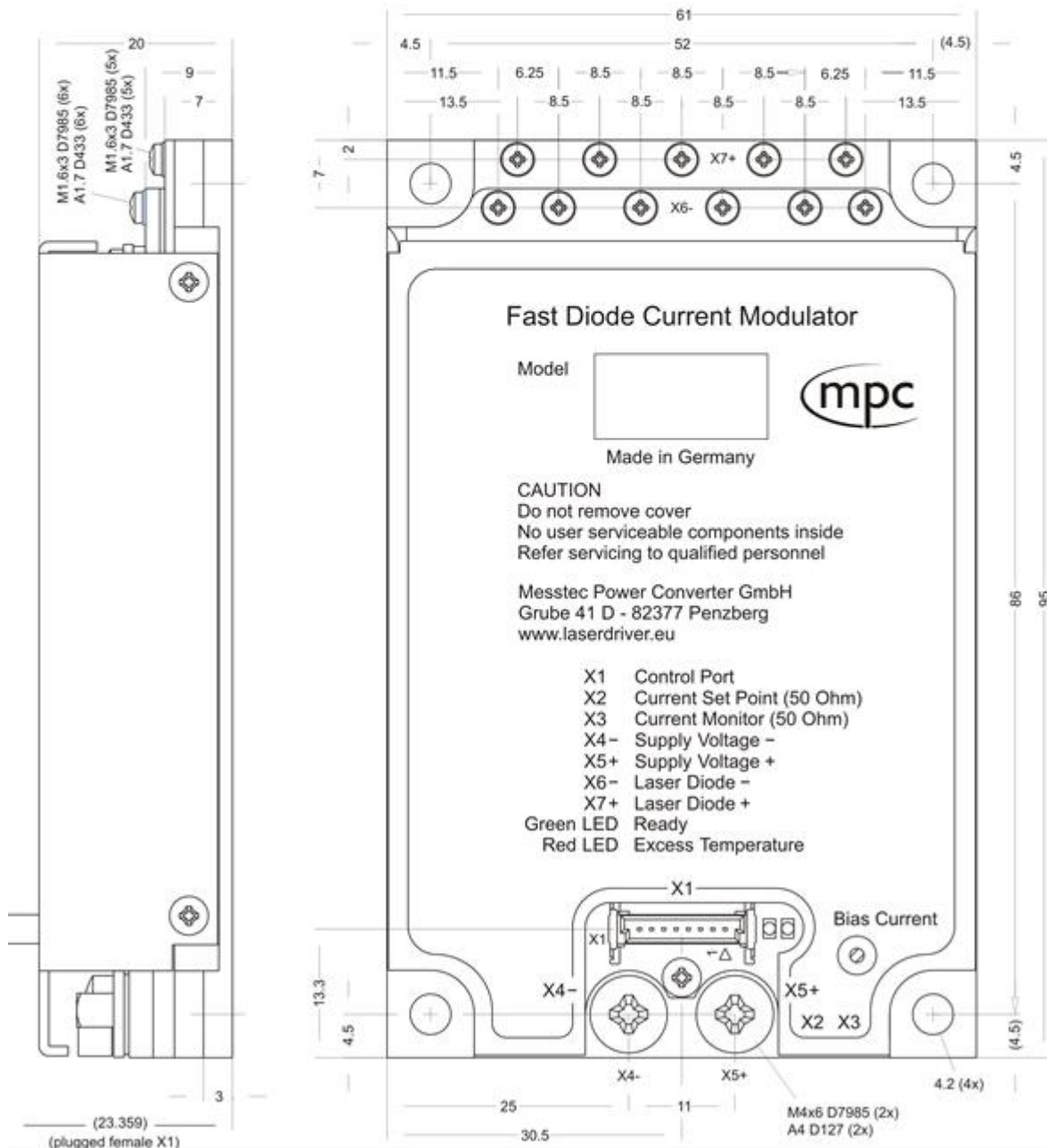
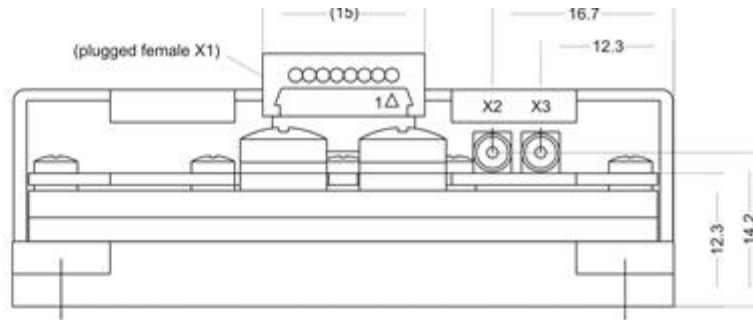
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Section Drawing

Dimensions (in mm)





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Technical subjects to change without notice.