Fast Diode Current Modulator FM 10-25
Part Number 10100330
Operating Manual

English Edition

Description

The fast diode current modulator FM 10-25 is a linear modulator with improved properties for driving arbitrary current waveforms into into high voltage laser diodes.Current waveforms can be CW, pulsed, modulated or mixed with frequencies up to 20 MHz and currents up to 20 A.

For achieving maximum performance it is required to mount the modulator as close as possible at the laser diodes 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 it with low inductance as close as possible 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 setpoint, a high frequency input (50 Ohm input impedance) with a bandwidth of 20 MHz and a low frequency input with a bandwidth of 100 KHz. Both inputs cover the full current range.
Additionally there is a 10 turns potentiometer for generating a CW-current (bias current).
All set points are added and form the effective current set point.
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. 2 V ... 5 V above the diode voltage.

Simple formulas for calculating power dissipation:

U_s	Supply Voltage (V)
U_d	Diode Voltage (V)
I_{dcw}	Diode Current CW (A)
I_{dpeak}	Diode Current peak value (A) (für sinusoidal and rectangle currents)
t_p	Pulse Duration (s)
f	Pulse Frequency (Hz)
P_l	Power Dissipation (W)

For operating with CW current:
$P_l = (U_s - U_d) \times I_{dcw}$

For operating with sinusoidal current:
$P_l = (U_s - U_d) \times (I_{dpeak} / 2)$

For operating with rectangle current:
$P_l = (U_s - U_d) \times I_{dpeak} \times t_p \times f$

For operating with sinusoidal current plus CW current:
$P_l = (U_s - U_d) \times ((I_{dpeak} / 2) + I_{dcw}))$

For operating with rectangle current plus CW current:
$P_l = (U_s - U_d) \times (I_{dpeak} \times t_p \times f + I_{dcw})$

Calculating power dissipation with arbitrary current waveforms is rather 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) to 70 °C (3.5 V) are still not critical.

Current Limit
The modulator has a diode current limit mechanism which has a response time of approximately 600 µs. If the maximum allowed current is exceeded for more than 600 µs, the modulator will be switched off and remains in an off state.
The response time of 600 µs allows driving currents which are much higher than the specified CW current. Thus care must be taken to prevent laser diodes from damage.

General Instructions
Never run a negative current set point (effective current set point), this may lead to an overshoot if you alter the negativ 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 voltage or undefined signals if you change ranges, this may damage diodes.

If you are not sure what will happen, 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 … 25 V. Adjust 0 V.
Connect the supply voltage (3 V … 6 V) for the internal electronics at X4- and X1-8.

Feed in a square wave with a pulse length of approx. 5 µs, a repetition rate of approx. 100 Hz and an amplitude of +500 mV(for 10 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 (0 V).

Enable the modulator.
Adjust the voltage of the power supply for the diode to approx. 2 V … 3 V and watch the X3 current monitor output.
The X3-signal must be a square wave with a pulse length of 5 µs, a repetition rate of 100 Hz and an amplitude of 50 mV.

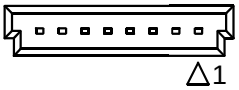
If the X3-signal is ok (no overshoot or ringing), disable the modulator and turn off the power supplies.
Connect the diode and adjust the supply voltage for the diode to a voltage of 2 V … 3 V above the diode voltage. Be aware of the maximum allowed power dissipation of the modulator.

Adjustment elements
10 turns potentiometer for a CW current set point (bias current)
The potentiomter covers the full current range.

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		
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		
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 ∅ 8 mm with female thread M4
Supply Voltage Minus

X5+
Connection bolt ∅ 8 mm with female thread M4
Supply Voltage Plus

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: 3 V ... 6 V
Supply current: 300 mA 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 10 A.

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 10 A.

Diode Current Set Point 1, Diode Current Set Point 2 and the current value of the bias current potentiometer are added internally and form the effective current set point.
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 ... 10 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 ... 10 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 - Enabel
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.

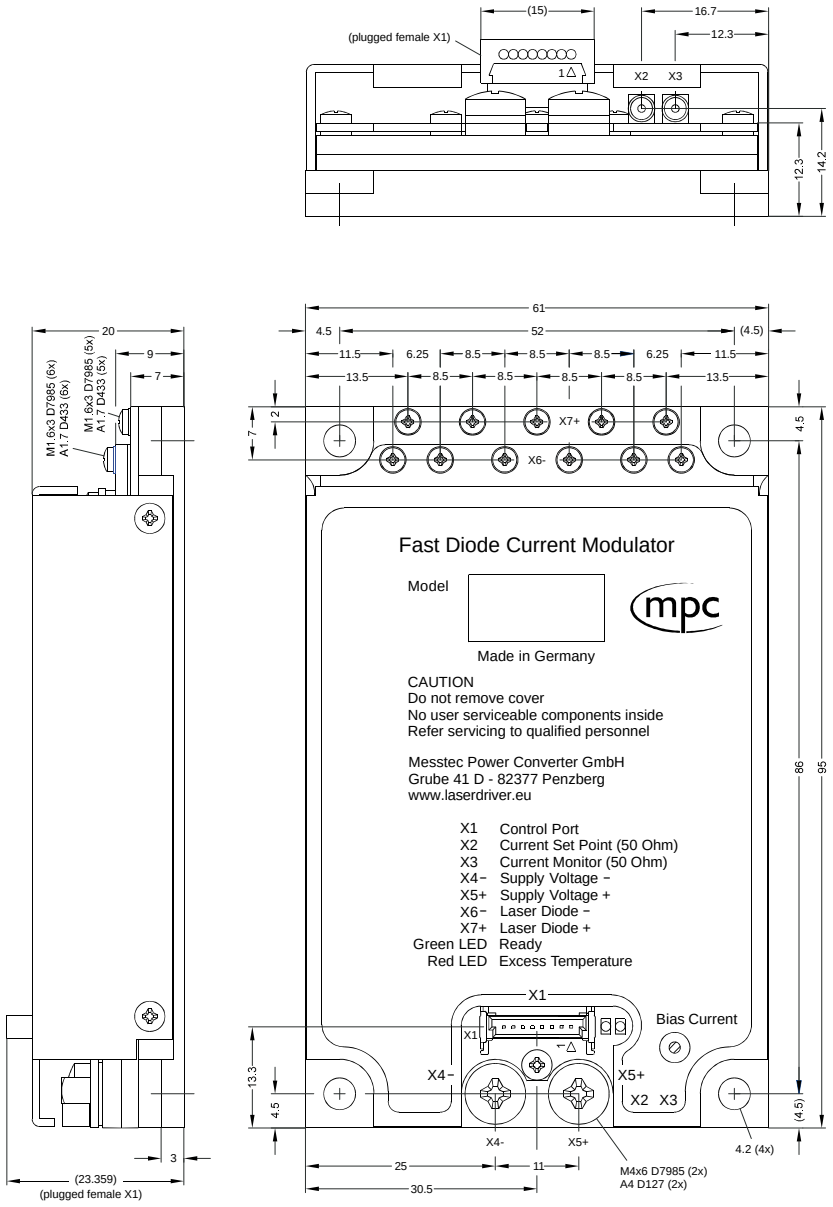
Specification

Supply voltage for the internal electronics	3 ... 6 V
Supply current	300 mA
Supply voltage for the diode	1 ... 25 V
Supply current	10 A max
Diode voltage	0 ... 24 V
Diode current CW	0 ... 10 A
Diode current pulsed	0 ... 20 A (50 % duty cycle)
Frequency bandwidth	DC ... 20 MHz (CA-DCSP1)
Frequency bandwidth	DC ... 100 KHz (CA-DCSP2)
Rise time	16 ns
Fall time	9 ns
Accuracy	± 0.2 %
Linearity	± 0.2 %
Temperature stability	± 100 ppm / °C
Current Limit	10 A, not adjustable, response time 600 µs
Accuracy of SA-DCACT output	± 2 %
Power dissipation allowed	30 W max
Cooling	required
Operating temperature range	0 ... +45 °C
Dimensions	95 x 61 x 20 mm
Weight	250 g
Part Number	10100330

Scope of delivery:

Fast Diode Current Modulator	Part Number 10100330
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

Dimensions (in mm)



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