Operating Manual
Fast Diode Current Modulator MCM 30-25-U with USB Interface
10100557

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Index of contents **Page**

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Description

The fast diode current modulator MCM 30-25-U 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 80 kHz and currents up to 30 A for CW and 60 A for short pulses at diode voltages up to 22.5 V.
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 for example using twisted wires. Conventional wires for connecting are not allowed, this will decrease performance significantly and may lead to an unstable operating.
An onboard pulse generator in combination with an external trigger input and a DC voltage at the X2 input generate fast and clean pulses, even if the trigger signal has a bad waveform.
Via a USB interface, the modulator can be configured, controlled and monitored.
The modulator is small and compact and it is designed for mounting with low inductance at 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, one input with 50 Ohm input impedance and a second input with high impedance. Both inputs cover the full current range.
Additionally a bias current (CW-current) can be generated via software.
All set points are added and form the effective current set point.

Power dissipation

Dynamic performance of the modulator normally increases with supply voltage, however the electrical power dissipation increases with supply voltage too.
A good compromise is to choose a supply voltage of approx. 2 V above the diode voltage for CW operation and 3 V … 8 V above diode voltage for fast pulsed or modulated operating.

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) x Idcw

For operating with sinusoidal current:
Pl = (Us - Ud) x (Idpeak / 2)

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

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

For operating with rectangle current plus CW current:
Pl = (Us - Ud) x (Idpeak x tp x 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 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.

Specification

Supply voltage	3.5 V ... 24.5 V *
Supply current	31 A max
Diode voltage	1 V ... 22.5 V
Diode current CW	0 ... 30 A
Diode current pulsed	0 ... 60 A (for short pulses)
Output power	690 W max
Frequency bandwidth	DC ... 80 kHz (CA-DCSP1)
Frequency bandwidth	DC ... 80 kHz (CA-DCSP2)
Rise time	6 µs
Fall time	6 µs
Power dissipation	90 W max. allowed
Cooling	required
Operating temperature range	0 ... +45 °C
Dimensions	87 x 72 x 41 mm
Weight	220 g

* Recommended supply voltage:

CW operation:	2 V above diode voltage
Pulsed and modulated operation:	3 V – 8 V above diode voltage

Final values have to be tested during setup

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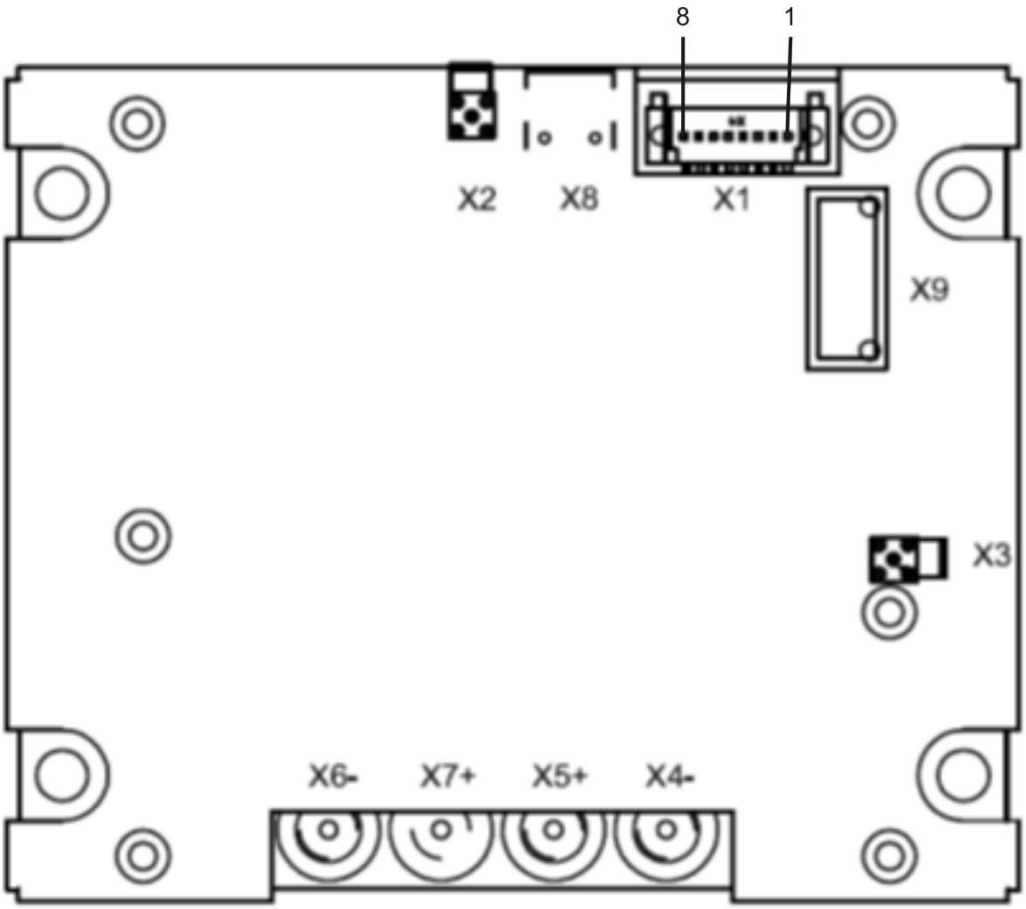
Indicator elements

Red and green LED for indicating data transfer between control software CSMCM and modulator.

Connectors



X1	8-pole single row male connector for control signals, status signals and Ground
X2	female coaxial jack MMCX for current set point 1
X3	female coaxial jack MMCX for actual current (current monitor)
X4-	connection bolt ø 7 mm with female thread M4 for Supply Voltage Minus
X5+	connection bolt ø 7 mm with female thread M4 for Supply Voltage Plus
X6-	connection bolt ø 7 mm with female thread M4 for laser diode cathode
X7+	connection bolt ø 7 mm with female thread M4 for laser diode anode
X8	Serial Interface 1
X9	Serial Interface 2

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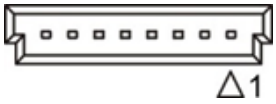
X1 Control Port

8-pole single row male connector
Manufacturer: ERNI Part number 214014
Mating plug:
8-pole single row female connector
Manufacturer: ERNI Part number 224396



Signals and data at the interfaces

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 for digital signals
2	CA-DCSP2	Diode Current Set Point 2
3	CD-ENABLE	Enable
4	CD-RESET	Reset
7	CD-TRIGG	Trigger
8	GND	Signal Ground for analogue signals
Outputs Control Port X1		
Pin	Name	Function
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 ø 7 mm with female thread M 4
Supply Voltage Minus

X5+

Connection bolt ø 7 mm with female thread M 4
Supply Voltage Plus

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X6-
Connection bolt ø 7 mm with female thread M 4
Laser Diode Cathode

X7+
Connection bolt ø 7 mm with female thread M 4
Laser Diode Anode

X8
Serial Interface 1
USB Interface Mini B
Option: RS 232 via RS 232 interface cable (Part number 10385263)

X9
Serial Interface 2

Signal Description

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 … 30 A
0 … 1000 mV corresponds to a diode current of 0 … 60 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 0 … 30 A

Diode Current Set Point 1, Diode Current Set Point 2 and the current value of the bias current are added internally and build the effective current set point.

SA-DCACT (X3)
Status Analog - Diode Current Actual
Analog output 0 … 2500 mV (off-load voltage), reflects the actual diode current
0 … 2500 mV corresponds to a diode current of 0 ... 30 A CW current
0 … 5000 mV corresponds to a diode current of 0 ... 60 A pulsed current

SA-TEMP (X1-5)
Status Analog - Temperature
Reflects the actual temperature of the modulator
1863.9 mV corresponds to 0 °C, 919 mV corresponds to +80 °C.

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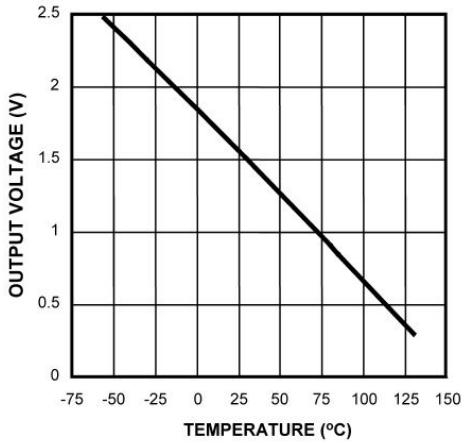
Output Voltage vs Temperature



Temperature (T)	Typical V_O
130°C	303 mV
100°C	675 mV
80°C	919 mV
30°C	1515 mV
25°C	1574 mV
0°C	1863.9 mV
–30°C	2205 mV
–40°C	2318 mV
–55°C	2485 mV

CD-ENABLE (X1-3)
Control Digital - Enable
Digital TTL input, High if left open.
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 Diode Current Set Point 1 signal at X2.
A logic High-level puts through the Diode Current Set Point 1 signal to the modulator,
a logic Low-level inhibits the Diode Current Set Point 1 signal.

SD-READY (X1-6)
Status Digital - Ready
Digital open collector output, High if there are no errors.

Onboard Pulse Generator
The internal pulse generator acts on the Diode Current Setpoint 1 input CA-DCSP 1 (X2).
The pulse duration as well as the pulse pause can be adjusted in the range of 1.055 µs … 4394.71 µs.
(Currently the minimum is set to 15 µs)
More details and information can be found in the manual for the control software CSMCM.

Control Software CSMCM
The control software CSMCM is used to configure, operate and monitor the MCM modulator.
Please contact our technical support for the manual.

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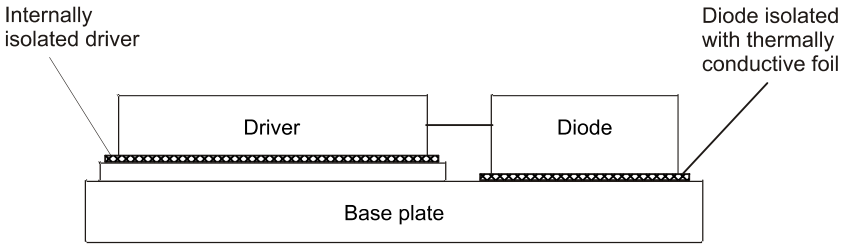
Serial Interfaces

Please contact our technical support for a detailed description of the serial interface, the DLL interface RS 232 and the DLL interface USB.

Initial Setup

Mount the modulator at a air- or water-cooled base plate.

Mount the diode in isolation directly next to the modulator at the base plate.



To avoid ground shifting, separate the analog ground and the digital ground.

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

Connect an oscilloscope at SA-DCACT (X3).

Connect the power supply, connect Plus to X5+ and Minus to X4-.

Turn on the power supply and adjust its output voltage to 10 V.

Connect the modulator to a PC, a notebook or a tablet, see separate operating manual for the control software CSMCM.

Enable the modulator by connecting X1-3 to X1-1.Set the BIAS current to 3 A via control software and observe the SA-DCACT (X3) on the oscilloscope.

Its value must be 250 mV, corresponding to 3 A.

Set the BIAS current to zero via control software.

Disable the modulator.

Connect an adjustable DC power supply to CA-DCSP2 (X1-2).

Enable the modulator.

Apply 500 mV to the CA-DCSP2 (X1-2) and observe the SA-DCACT (X3) on the oscilloscope.

Its value must be 250 mV, corresponding to 3 A.

Disable the modulator.

Disconnect CA-DCSP2 (X1-2).

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Connect an adjustable DC power supply to CA-DCSP1 (X2).
Enable the modulator.
Apply 50 mV to the CA-DCSP1 (X2).
Set the CD-TRIGG (X1-7) to High and observe the SA-DCACT (X3) on the oscilloscope.
Its value must be 250 mV, corresponding to 3 A.
Disable the modulator.

Apply 100 mV to the CA-DCSP1 (X2).
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 CD-TRIGG (X1-7).
Enable the modulator and observe the SA-DCACT (X3) on the oscilloscope.
The SA-DCACT (X3) signal must be a square wave with a pulse length of 5 µs, a repetition rate of 100 Hz and an amplitude of 500 mV, corresponding to 6 A.
Disable the modulator.
Turn off the power supply.
Disconnect CA-DCSP1 (X2).
Disconnect CD-TRIGG (X1-7).
Remove the shortcircuit at the output of the modulator.

Connect the diode to the modulator, use striplines or short twisted leads.
Adjust the output voltage of the power supply according to the diode voltage.
Recommended values are approx. 2 V above diode voltage for CW operation and approx. 3 V … 8 V above diode voltage for pulsed or mixed signal operating.
The optimal supply voltage for the best dynamic behavior must be determined during setup with a diode.
Turn on the power supply.
Apply signals to CA-DCSP1 (X2), to CD-TRIGG (X1-7) and / or to CA-DCSP2 (X1-2) according to your requirements and set BIAS current if necessary.
Enable the modulator and run the system.
Pay attention to the maximum diode current and the maximum allowable power dissipation of the modulator!

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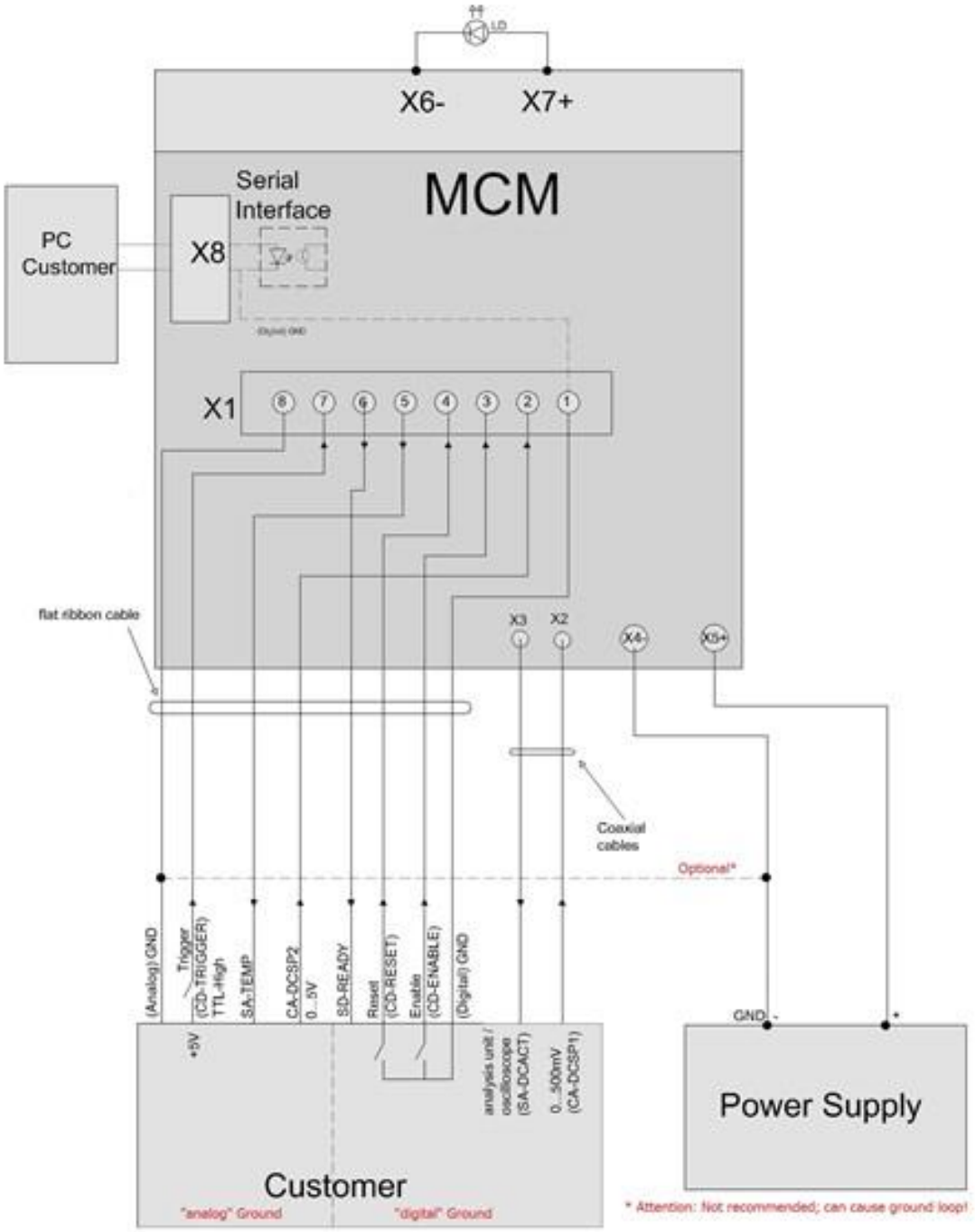
Wiring Diagram



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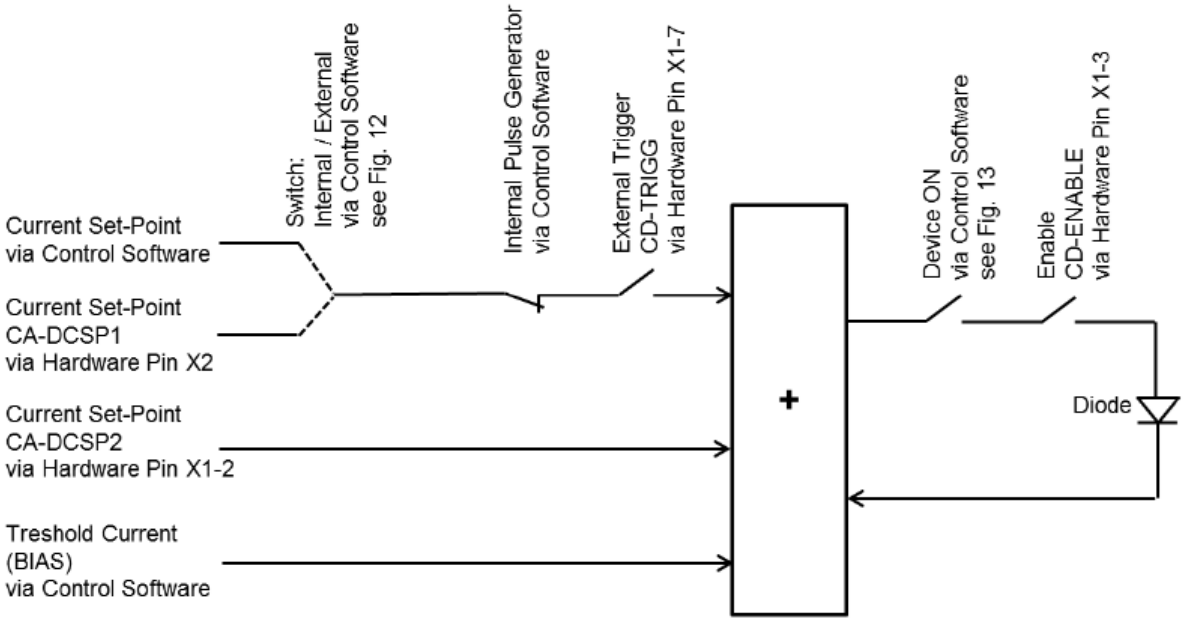
Functional Diagram

The following diagram shows the multi-functional combination of control functions realized with hardware signals and software control including the use of the internal pulse generator and the external trigger input.



Scope of Delivery

Fast Diode Current Modulator	Part Number 10100557
8-pole single row female connector (ERNI)	Part Number 10883510

Accessories

Buffer Capacitor	Part Number 10231091
Ribbon cable 8pole with ERNI plug 1 m	Part Number 10385370
Ribbon cable 8pole with ERNI plug 3 m	Part Number 10385371
USB Interface Cable	Part Number 10385120
RS-232 Interface Cable	Part Number 10385263
RS-232 / USB 2.0 Adapter	Part Number 10385264
Coaxial cable with MMCX plug and BNC plug 0,5 m	Part Number 10385372
Coaxial cable with MMCX plug and BNC plug 1 m	Part Number 10385373
Coaxial cable with MMCX plug and BNC plug 2 m	Part Number 10385374
Coaxial cable with MMCX plug and BNC plug 3 m	Part Number 10385375
Coaxial cable with MMCX plugs on both sides 0,5 m	Part Number 10385376
Coaxial cable with MMCX plugs on both sides 1 m	Part Number 10385377
Coaxial cable with MMCX plugs on both sides 2 m	Part Number 10385378
Coaxial cable with MMCX plugs on both sides 3 m	Part Number 10385379

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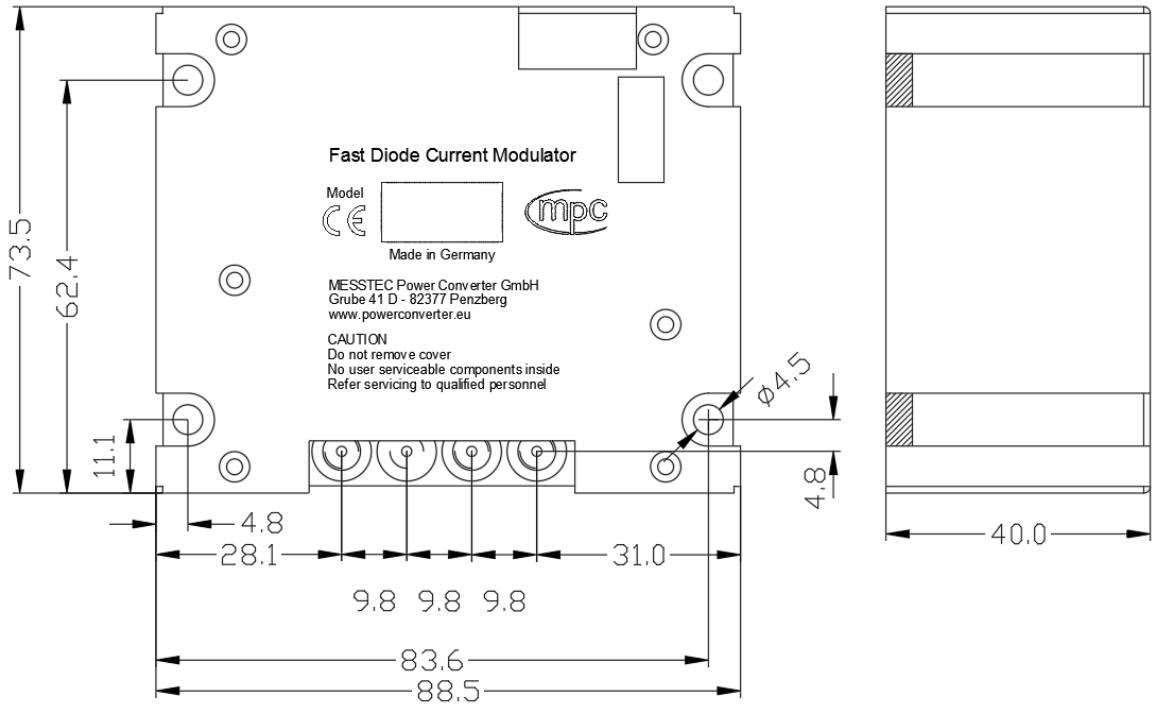
Dimensioned drawing (mm)



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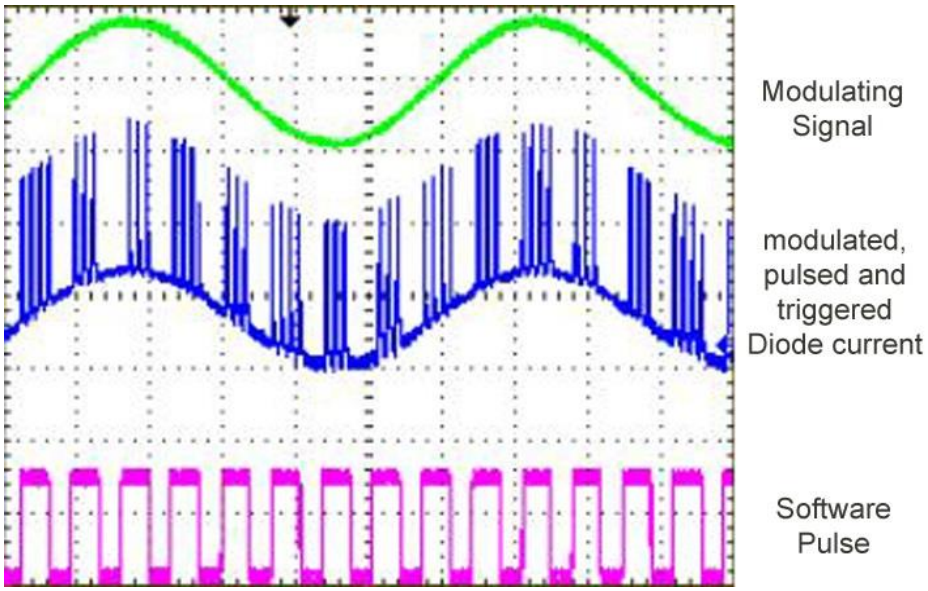
Sample current waveforms



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Technical subjects to change without notice