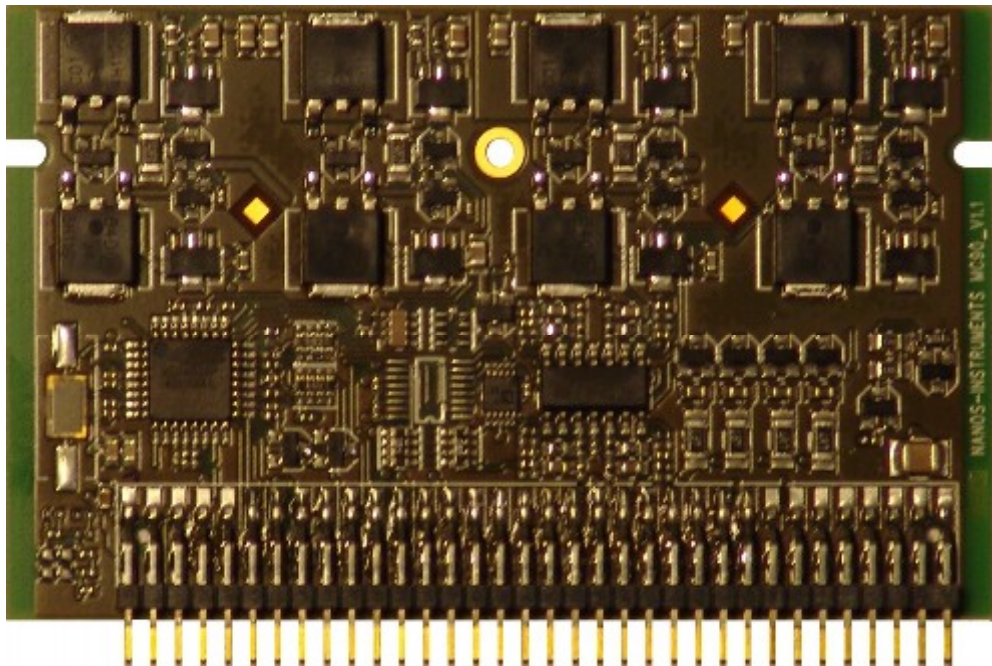


MC-90 driver LEGS-Drive® serie Manual

**Piezo motor driver stage designed
for Piezolegs motors
with step/direction or +/- 10V interface**

The MC-090 is a compact piezo motor driver module for high precision and highly dynamic piezo axis. It is specially designed for the LEGS-Drive® Serie from Piezomotor AB Uppsala. You can drive the LL10; LT20/40/80; LTC20/40/300/450, LS10/15; LR10/50/80 LW20



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1) Features

It is an analog power stage with step/ dir and an analog servo voltage interface

The resolution is going down to 4nm (11 bit resolution/ periode from firmwareversion 0.7)
or

The resolution is going down to 1nm. (13 bit resolution/ periode from firmwareversion 0.8)

Driving frequenz is up to 3khz

Step/ dir frequency is up to 500kHz. Waveform update is 90kHz

The Power supply is 5V+/-5% max 50mA and 48V +/-5% max 0,2 to 1A for the driver.

An optional drivervolatge is 30-70V (please ask if necessary)

It has an enable function to reduce power and heat.

It has a parking funktion.

LED red shows an overheat at the amplifirer.

LED green shows that the Powerstage is on. Otherwise it is parked.

Space is 80*50* 5,3mm³

Thermal back site, designed for up to 50W heat transport (with mounted heatsink)

RoHS Compliant

Low EME design for ease of use

68 pin connector (Samtec MMT-134-02-S-DH-K)

A horizontal connector is possible (please ask if necessary)

Socket board connector: Samtec MMS-134-02-L-DV straight

Fischer Elektronik BLY4-068 right angle

Firmwareversion 9 in test:

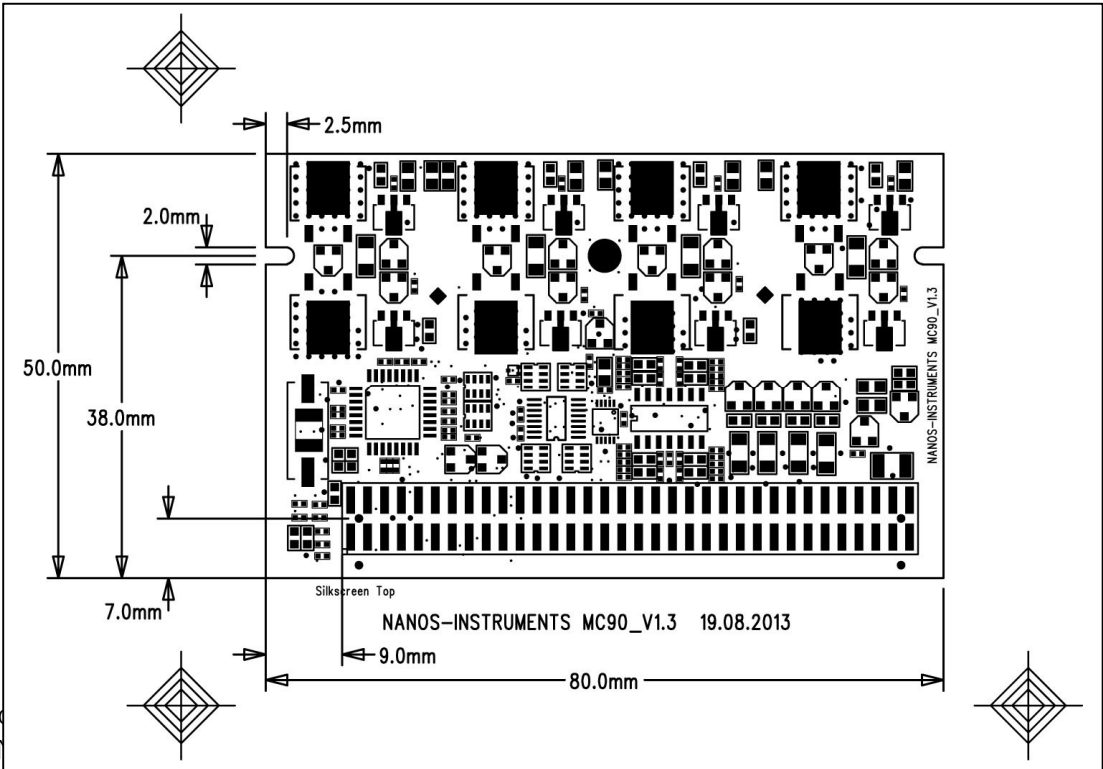
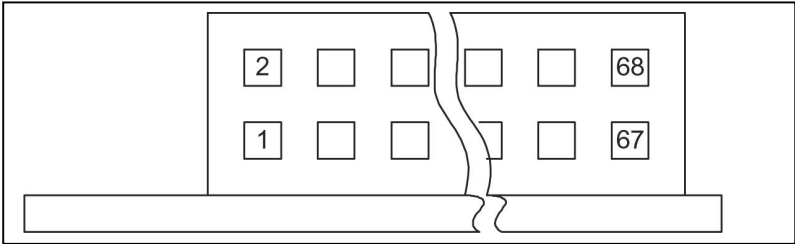
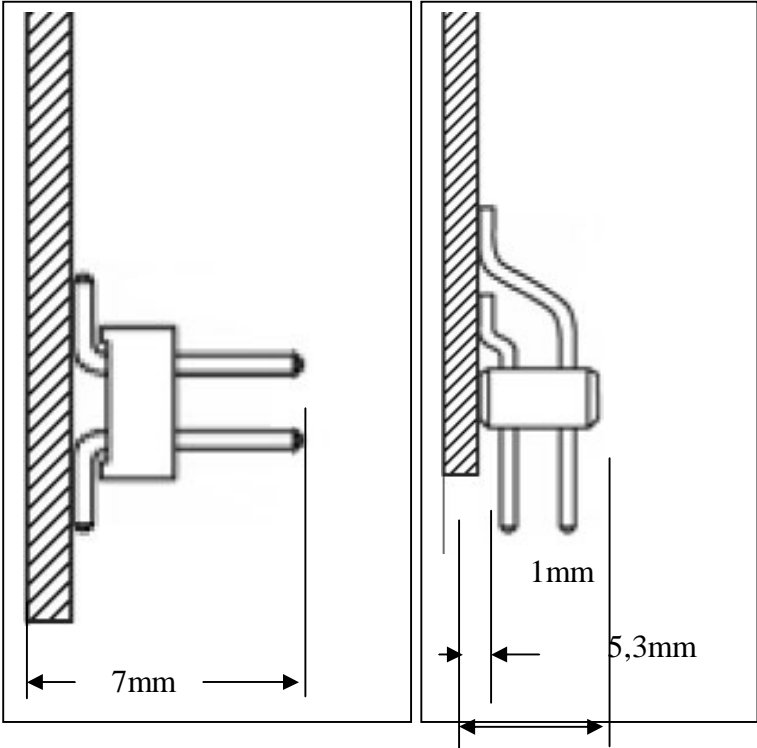
+/- 10V servo voltage interface is working from this version

2) Life support policy

NANOS-Instrumentsl GmbH does not authorize or warrant any of its products for use in life support systems, without the specific written consent of NANO-Instrumentsl GmbH

Life support systems are equipment intended to support or sustain life, and whose failure to perform, when properly used in accordance with instructions provided, can be reasonably expected to result in personal injury or death.

3) Mechanical Dimension



4) Pinning

Pin	Number	Funktion
+5V	1 (3 is not connectet anymore)	5V logic power supply input. use a precise and stable regulator if possible. If the servo input is used → 5V +/-1%
GND	2, 4, 6, 8, 10,61, 62	Digital and motor GND
VM/ VM/option	5,7 (9 is not connectet anymore)	Motor supply voltage 48V +/-5% (option 70-30V with variable input and motor voltage)
Step_ENN	11	Digital out: 1 when ready to run, 0 when parked or overheat
SCK	12	Digital In: Serial clock for SPI operation. Do not connect in step/direction mode.
SCSN	13	Digital In: Serial chip select for SPI operation. Do not connect in step/direction mode.
SDO	14	Digital Out: Serial data output for SPI operation. Do not connect in step/direction mode
USER0*	15	Digital In. 1= servo voltage enabled; 0 or open disabled
SDI	16	Digital In: Serial data input for SPI operation. Do not connect in step/direction mode.
NRESET	17	Digital In: Module reset – leave open for normal operation
STEP	18	Digital In. Step input
USER1*	19	Digital In. 1 = high resoulution 0 = standard resolution.
DIR	20	Digital In: Direction input
USER2	21	to be defind / OEM use
MODE0	22	Digital In: Selection of wave form in Step/Direction mode
USER3	23	to be defind / OEM use
MODE1	24	Digital In: Selection of wave form in Step/Direction mode
RES0	25	Digital In: microstep resolution 0
RES1	26	Digital In: microstep resolution 1
MODE2	27	Digital In: Selection of operation mode: tie to GND for servo voltage mode, 1 for Step /Dir mode
N_STAGE	28	Digital In. Disable Powerstage and parking. 0= enable
V_Servo*	31	Analog In: +/- 10V
MOT4	37, 38, 39, 40	Motor phase 4 output
MOT3	41, 42, 43, 44	Motor phase 3 output
MOT2	49,50,51,52	Motor phase 2 output
MOT1	53,54,55,56	Motor phase 1 output

* available in Firmwareversion 0.9

5) Operational Ratings

The operational ratings show the intended / the characteristic range for the values and should be used as design values. In no case shall the maximum values be exceeded.

Symbol	Parameter	Min	Typ	Max	Unit
VM	power supply voltage for operation	45,6	48	70	V
VM option	Variable power supply with variable motor voltage	30	48	70	V
+5V	Voltage for logic and analog input If the servo input is used → 5V +/-1%	4,5	5	5,5	V
Vservo	Voltage for +/-10V input	-15	+/- 10	+15	V
I	Motor current (RMS) ; take care of the driver heat and transport the heat. It is depending of the motor capacity, the driving frequency and the voltage.	0	0,2	0,5 1 short	A A for 3 sec
I + 5	Power supply current +5V		0,05		A
I STB	Standby power supply VS	0	0,05		A
fStep	Step frequency (input)			500	kHz
th	Step pulse high time	100			ns
TS2D	Direction change to step delay(direction setup time)	2			µs
TENV	Environment temperatur	-25		80	°C

6) Power supply requirements

The motor supply voltage of the MC-090 is 48V DC +/-5% max 0,2 to 1A for the driver. The module is not protected against wrong polarity. Also a +5VDC supply for module functionality is needed (use +/-2% or better tolerance regulator if possible, max. 50mA). Please use all listed pins for the power supply inputs and ground in parallel.

Note:

At switching on the capacitors (together 10µF) at 5V and 2µF at VM will be loaded within 10-20µs with a higher current. This depends on the current of the Powersupply.

If 5V is first at the board the driver will be enabled by the µController after 70ms.

When the VM voltage will be later switched on the µcontroller will do an reset and start new.

7) Motor connection

This module is special designed for Piezolegs motors. Different motor types could have different capacity. The powerlost in the driver is depending on the driving full wave frequency, the VM voltage and the motor capacity.

8) Step/Dir or servo voltage mod operation

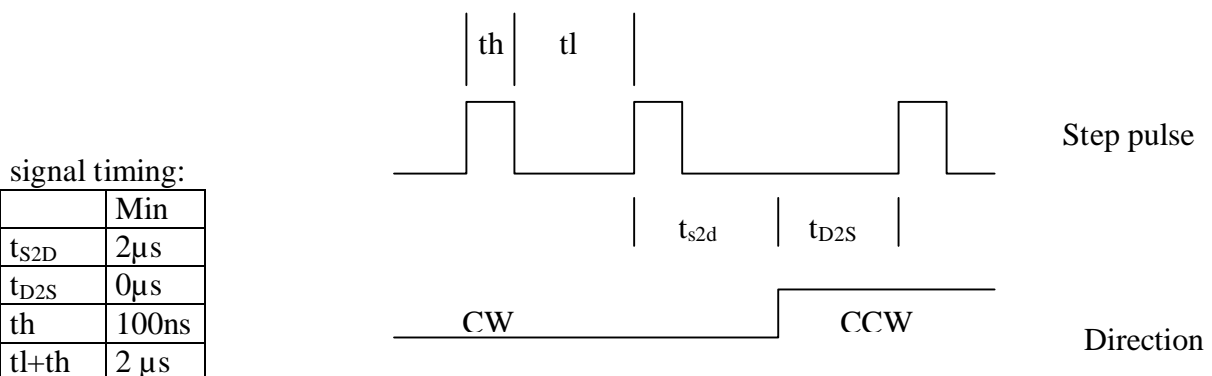
In Step/Direction mode the full capabilities of the module can be used, e.g. different waveforms and highest step resolution. However, the motor velocity which can be achieved depends on the mode, because the clock frequency which can be accepted by the module is quite limited.

To use the Step / Direction interface connect the inputs as follows:

Signal name	Pin number	connection
MODE2	27	Digital In. When this pin is low, the motor will be parked and SPI is set to slave (or unused). When pin is set high, SPI is set to master and the motor is unparked/powerd up.
STEP_ENN	11	Digital out: 1 when ready to run, 0 when parked or overheat
USER0	15	Digital In. 1= servo voltage enabled; 0 or open disabled
STEP	18	Digital In. Step input
USER1	19	Digital In. 1 = high resolution 0 = standard resolution.
DIR	20	Digital In: Direction input
MODE0	22	Digital In: Selection of wave form in Step/Direction mode
MODE1	24	Digital In: Selection of wave form in Step/Direction mode
RES0	25	Digital In: Selection of step/direction microstep resolution
RES1	26	Digital In: Selection of step/direction microstep resolution
N_STAGE	28	Digital In. Disable Powerstage 0 or open = enable
Vservo	31	Analog In. +/- 10 V. servo voltage

Note: Pins 12, 13, 14 and 16 must not be connected in this mode!

Pin 15/19/31 (USER0/USER1/ V_{servo}) is at Firmware 0.9 available.



9) Resolution and Waveform settings

The different waveforms and resolutions stored in the internal ROM are selected by digital inputs. MODE0 and MODE1 set the waveforms and RES0 and RES1 the microstep resolutions. Please be careful not to exceed the maximum allowed motor velocity in these modes, in order not to damage the motor and heat disatation of the driver board.

Wave Mode	Microstep resolution	MODE1	MODE0	RES1	RES0	USER1	USER0	firmware	Note
Delta	2048	1	1	1	1	x	x	0.7	1
Delta	1024	1	1	1	0	x	x	0.7	1
Delta	512	1	1	0	1	x	x	0.7	1
Delta	256	1	1	0	0	x	x	0.7	1
Delta	256	1	0	1	1	x	x	0.7	1
Delta	128	1	0	1	0	x	x	0.7	1
Delta	64	1	0	0	1	x	x	0.7	1
Delta	32	1	0	0	0	x	x	0.7	1
Rhomb	2048	0	1	1	1	x	x	0.7	2
Rhomb	1024	0	1	1	0	x	x	0.7	2
Rhomb	512	0	1	0	1	x	x	0.7	2
Rhomb	256	0	1	0	0	x	x	0.7	2
Rhomb_F	256	0	0	1	1	x	x	0.7	3
Rhomb_F	128	0	0	1	0	x	x	0.7	3
Rhomb_F	64	0	0	0	1	x	x	0.7	3
Rhomb_F	32	0	0	0	0	x	x	0.7	3
Delta	8192	0	1	1	1	x	x	0.8	4
Delta	8192	0	1	1	0	x	x	0.8	5
Delta	8192	0	1	0	1	x	x	0.8	1
Delta	4096	0	1	0	0	x	x	0.8	1
Delta	2048	1	1	1	1	0	1	0.9	1
Delta	1024	1	1	1	0	0	1	0.9	1
Delta	512	1	1	0	1	0	1	0.9	1
Delta	256	1	1	0	0	0	1	0.9	1
Delta	256	1	0	1	1	0	1	0.9	1
Delta	128	1	0	1	0	0	1	0.9	1
Delta	64	1	0	0	1	0	1	0.9	1
Delta	32	1	0	0	0	0	1	0.9	1
Rhomb	2048	0	1	1	1	0	1	0.9	2
Rhomb	1024	0	1	1	0	0	1	0.9	2
Rhomb	512	0	1	0	1	0	1	0.9	2
Rhomb	256	0	1	0	0	0	1	0.9	2
Rhomb_F	256	0	0	1	1	0	1	0.9	3
Rhomb_F	128	0	0	1	0	0	1	0.9	3
Rhomb_F	64	0	0	0	1	0	1	0.9	3
Rhomb_F	32	0	0	0	0	0	1	0.9	3
Delta	8192	0	1	1	1	1	1	0.9	4
Delta	8192	0	1	1	0	1	1	0.9	5
Delta	8192	0	1	0	1	1	1	0.9	1
Delta	4096	0	1	0	0	1	1	0.9	1

Notes:

- 1) Strong linear motion.

- 2) Faster than Delta for light load. Also good for rotating motors.
- 3) This waveform is considered obsolete. Use Delta instead.
- 4) Stepping on every 4th pulse. (32768/4)
- 5) Stepping on every 2nd pulse.(16384/2)

TMCM090 replacement (no SPI)

Wave Mode	Microstep resolution	RES1	RES0	MODE1	MODE0	firmware	Note
Delta	2048	1	1	1	1	1.0	
Delta	1024	1	0	1	1	1.0	
Delta	512	0	1	1	1	1.0	
Delta	256	0	0	1	1	1.0	
Sin1S85	512	1	1	1	0	1.0	
Sin1S85	256	1	0	1	0	1.0	
Sin1S85	128	0	1	1	0	1.0	
Sin1S85	64	0	0	1	0	1.0	
Rhomb	2048	1	1	0	1	1.0	
Rhomb	1024	1	0	0	1	1.0	
Rhomb	512	0	1	0	1	1.0	
Rhomb	256	0	0	0	1	1.0	
Rhomb_F	256	1	1	0	0	1.0	
Rhomb_F	128	1	0	0	0	1.0	
Rhomb_F	64	0	1	0	0	1.0	
Rhomb_F	32	0	0	0	0	1.0	

A change of waveform and resolution can be done at every point. It may take up to 14 μ s to set, during which time the driver may continue to use the old parameters

10 Revision

10.1) Dokumenten Revision

Version	Comment	Description
0	internal Release	not to give out

10.2) Hardware Revision

Version	Comment	Description
1.10	internal Release	desing only
1.12	1.2013	changing in the resisto at the powerstage. refvoltage
1.13	9.2013	changing connector j200, R200/2001/203/203/216/R1

10.3) Firmware Revision

Version	Comment	Description
0.1	internal Release	desing only
0.6	released version	until 03.2013
0.7	released version	fast 11 Bit resolution, overheat signal Standard version
0.8	special version	13Bit resolution, available on request.
0.9	beta version	analog servo voltage control
1.0	TMCM090	Replacement for TMCM090