USER APPLICATIONS

The PMD90 uses a serial interface with ASCII commands. All commands are in plain ASCII format and consist of one letter. Some commands also expect a number (in ASCII format) as parameter, terminated by a CR (hex 0D). Some commands read back one or more values. These values are also sent in ASCII format, terminated by a CR and preceded by the command letter.

Programs can use the USB driver to communicate with the unit. The baud rate at the RS232 interface of the BB-090 CPU is 57600, so the baud rate in the FTDI driver (for the FT232R USB-to-RS232 chip) must also be set to 57600. The D2XX drivers can be used for communication (please see FTDI manuals for more details on this). The vendor ID is 0x0403 and the product ID is 0x6001 (FTDI default PID). The USB driver can be configured to present a standard RS232 port (VCP option). Thereby, commands can be tested manually via any terminal program such as Windows Hyperterminal. The Virtual COM Port option is ON by default.

If a standard terminal program is used, it should preferably be set up for local echo and add LF to incoming CR. There is no way of cancelling an incorrect command. False commands will be ignored (<cr> is needed to end a false command). Any new command will be executed immediately. For example +100<cr>-100<cr> might not result in +-0 for the step counter.

In exploring different waveform settings and the I/O pins of the X3 port (pin 5..8), the program BB090.exe can be used instead of the PMD90 demo program. Note that the resulting speed is related to the cycle frequency rather than the microstep frequency. For instance, the Omega waveform at 1/4 resolution gives 512p per cycle. At 125 kHz microstepping (max BB-090 frequency) the cycle frequency will then be 244 Hz (multiply by cycle step length to get the speed). Please consult the TMCM-090 manual regarding waveforms and driver details.

Command examples

Using Hyperterminal (with local echo and Linefeed ON):

?BB-090 V2.0	// Typing "?", response was "BB-090 V2.0".
VV 898	// Typing "V", response was "V 898".
F99	// Setting microstep frequency to 250k/(99+1) = 2.5 kHz.
C33	// Setting wfm 3 res 3 (i.e. Omega564 at 2048p).
mm 3	// Typing "m", BB-090 confirmed wfm setting M3.
rr 3	// Typing "r", BB-090 confirmed resolution setting R3.
O0	// Setting Encoder =0.
EE 0	// Reading encoder =0.
z0	// Setting microstep counter=0.
+2048	// Running 2048 microsteps, in this case = 1 cycle.
EE -114	// Reading encoder = -114, i.e. -114*61.035 nm = -6958 nm
ZZ 2048	// Reading microstep counter = 2048.

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Piezo LEGS® driver unit PMD90

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PiezoMotor
Simplicity in motion

The Piezo LEGS® driver unit PMD90.

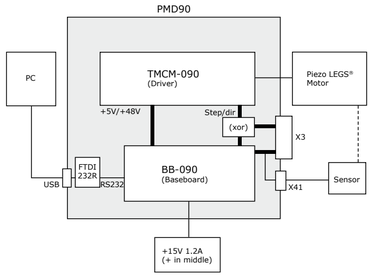
DRIVER DATA

This is a microstepping driver with up to 2048 microsteps per waveform cycle, giving 2-3 nm movement per microstep for a standard Piezo LEGS® motor. There are several waveforms (wfm) available, optimised for speed, resolution or force. Maximum speed is around 15 mm/s.

N.B. The unit can get rather hot after extensive driving, especially at the base of the box.

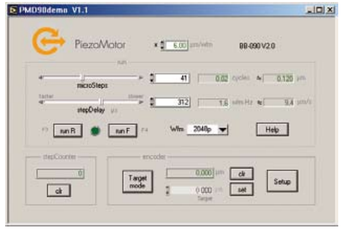
GETTING STARTED

1. Run *Install.exe* from CD to install software and USB driver.
2. Start the PMD90 demo program.
3. Connect motor and sensor (optional).
4. Connect USB cable and +15V power supply.
5. The program should detect the USB COM port after a while.



PMD90 DEMO PROGRAM

After connecting to the PMD90, the program shows the most important parameters for running the motor. The waveform setting defines the number of microsteps per cycle, and you can enter the expected movement per cycle in order to get a good estimate of the resulting motion.

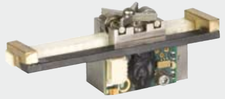


PMD90 demo program (a LabVIEW application).

If runR or runF is pressed, the motor will run the given number of microsteps with the chosen step delay. Selecting 0 microsteps is a special case in which the motion will continue until the run button is switched off manually. Since the actual cycle step length will depend on external force, a sensor is needed for accurate positioning control. Relying on step counting is normally not an option.

A help window can be activated by pressing the Help button. This will show additional information about objects on the screen when scrolled over.

A simple target mode is implemented in the demo program (requires a sensor).



Piezo LEGS® motor with high resolution magnetic encoder from Nanos Instruments GmBH. Resolution is 61 nm (500µm/8192).

Connecting a sensor

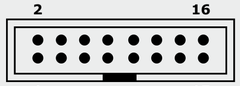
A quadrature encoder signal can be connected to the small 6-pin connector or the 2x8 pin port. Maximum counting frequency is 750 kHz. Pin numbering is indicated below.

1

Sensor port X41

1	Not connected
2-input	Sensor signal A+
3-input	Sensor signal B+
4-output	+5V max 200 mA
5	Gnd
6-input	Sensor Z index

Note: All X3 digital signals are 5V logic. Impuls have internal pull-up resistors.



I/O port X3

1-output	Connected to pin 14
2	Gnd
3-input	Analog ±10V
4-input	Analog 0…5V
5-output	Out0
6-input	In0_dir
7-input	In1
8-output	Out1
9-input	Analog_run
10-input	Dir_x
11-input	Step_x
12-input	Sensor Z index
13	Gnd
14-output	+5V max 200 mA
15-input	Sensor signal B+
16-input	Sensor signal A+

CLOSED LOOP CONTROL

A PC is needed to close the sensor feedback loop. The demo program has a simple go-to-target mode implemented in software. Alternatively, a motion controller with a step/direction interface can be connected to X3 pins 10, 11, 13. These signals bypass the control signals from BB-090 (signals are XORed together – please note that the external Dir_x signal gets inverted if the BB-090 last run was in the reverse direction). Maximum recommended external microstep frequency is 240 kHz. The resulting motor frequency depends on the number of microsteps per cycle (e.g. 470 Hz when using 512p at 240 kHz). Caution: For the lower resolution settings, the resulting cycle frequency can exceed motor specification.

If the motion controller has an analog output, it can use either pin 4 (0…5V) or pin 3 (±10V). Furthermore, pin 9 should be connected to Gnd in order to enable the analog interface, and the PMD90 will run the motor according to the analog voltage. Either pin 6 or 10 can be connected to Gnd in order to reverse the directions.

FURTHER INFO

Additional notes can be found in PMD90readme.txt.

The PMD90 unit is not intended for life support. The CD contains documentation, USB drivers and software. You are welcome to send your feedback to info@piezomotor.se.

The TMCM-090 is a Piezo LEGS® driver from Trinamic and is compatible with their motion control card series. They also have a useful discussion forum at www.trinamic.com.

Thank you for using motors from PiezoMotor.

List of commands

Command	Description
?	Report information string. Response: “BB-090 V2.0”<cr>
O<number><cr>	Set encoder position value
E	Report encoder position value. Response: E <number><cr>, where <number> is 32-bit integer. (-2147483648...2147483647)
M<number><cr>	Set waveform (<number> is 0..3). M3=Omega564 at 2048/1024/512/256p resolutions M2=Omega564 at 256/128/64/32p resolutions M1=Rhomb_speed at 256/128/64/32p resolutions M0=Rhomb_force at 256p/128p/64p/32p resolutions
m	Read waveform setting. Response: m <number><cr>
R<number><cr>	Set microstep resolution (<number> is 0…3). Note that R3=highest resolution (1/1) and R0=lowest resolution (1/8)
r	Report resolution setting. Response format: r <number><cr>
C<numb1><numb2><cr>	Set waveform and resolution in one command, where <numb1> is waveform and <numb2> is resolution.
F<number><cr>	Set the microstep frequency for run commands. This is not directly the frequency, but a frequency divider. Microstep Freq = 250 kHz /(<number>+1), where <number> is 1..65535.
+<number><cr>	Run <number> steps in positive direction
-<number><cr>	Run <number> steps in negative direction
S	Stop driving
Z	Report microstep counter (produced by the run commands). Response: Z <number><cr>
z<number><cr>	Set step counter to a new value
I	Report inputs (X3 pin 6, 7). Response: I<number><cr>
X<number><cr>	Set outputs (X3 pin 5, 8) (<number> is 0..3 where Bit 0 = output 0, Bit 1 = output 1)
W	Write current wfm and resolution settings to permanent memory. Current settings will be default at power ON.
P	Report value of the X3 analogue input pin 3 (±10V) or pin 4 (0...5V). Response: P<number><cr>, where <number> is 0…1023.
V	Report voltage of the internal step-up regulator. Response: V<number><cr>, where <number> is 0…1023. (1023=55V)
A	Report all inputs. Response: P<numb>, V<numb>,E<numb>,I<numb><cr>
*	Motor status. Returns 1 when running, 0 when standing.
<unknown cmd><cr>	Unknown commands are ignored. Must be terminated with <cr>