PoKeys Pulse engine documentation
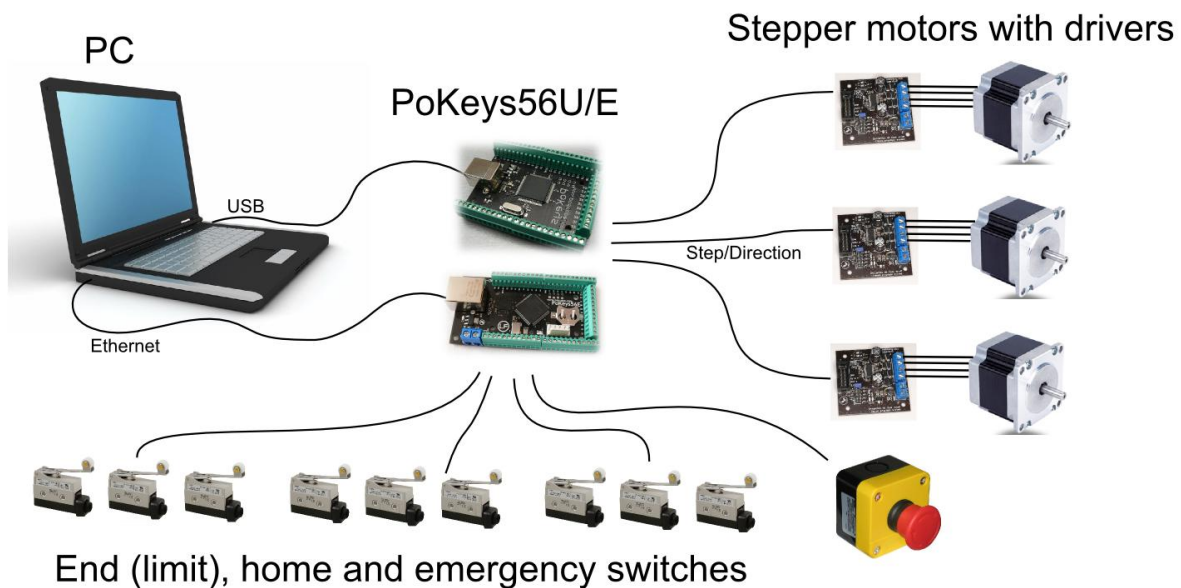
SAFETY INFORMATION

This product is intended for integration by the user into a computer numerical control (CNC) machine. It is the user's responsibility to assess the overall system design and address all safety considerations that affect the users and equipment. The user assumes all responsibility for system design, including compliance with regulatory standards and codes issued by the applicable entities. PoLabs do not make any claims as to the suitability of this equipment for the user's application. Serious personal injury or equipment damage can occur from the improper integration, installation or operation of this product.

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Description

PoKeys Pulse engine (available on PoKeys56U and PoKeys56E devices) enables the control of up to three stepper motors. PoKeys Pulse engine can work in standalone (rapid positioning and speed control mode, homing, jogging via kbd48CNC keyboard) or in slave mode (under the command of the PC application). For each stepper motor, two end (or limit) switches and one home switch are supported and can be configured by the software. PoKeys Pulse engine also supports a dedicated emergency switch input, which stops the pulse generation.

Operating principles

PoKeys Pulse engine divides the operation in 1 millisecond time slots, during which the pulse frequency is held constant, and supports the generation of up to 25 pulses per 1 millisecond time slot (which equates to 25 kHz maximum pulse frequency supported).

At each time slot beginning, the limit and home switches are read and evaluated. If emergency switch or any limit switch is activated (enabled in the configuration) and the switch is tripped, the pulse engine is put into STOP mode and no more pulses are generated (with hard-stop mechanism). However, when in standalone jogging mode, the limit switches are ignored. If STOP condition is not met, the Pulse engine uses the data in the slot buffer to set the pulse frequency in the next time step.

The slot buffer is 128-slots deep buffer that holds pulse frequencies for each axis, giving a 128 millisecond buffered motion period. Each slot entry in the buffer holds 3 bytes (1 byte per axis) and each axis entry uses 7-bits for pulse frequency and MSB bit for the direction signal (if MSB bit is set, the direction output is activated).

Fill buffer command is used to transfer the data to the slot buffer. Application that uses the fill buffer command should send as much time slot data as possible. PoKeys Pulse engine will then return the number of accepted time slots. This omits the need of additional query on the buffer free space in PoKeys Pulse engine buffer. Application should only then increase the 'read pointer' based on the

number of accepted slots. Additionally, fill buffer command returns a number of parameters of the pulse engine (position, engine state, state of limit and home switches and states of each axis).

Modes of operation

- **Stopped**: the pulse engine does not generate any pulses.
- **Error**: the pulse engine encountered an error (e.g. limit switch was activated).
- **Homing**: homing mode is activated. In this mode, one or more axes can be homed. The selected axis (or axes) move in negative direction at 10% the maximum speed until the home switch is tripped. Then, the direction is changed to positive and speed decreased to 1% of the maximum speed. When the switch is tripped, the internal position counter is reset and the axis is commanded to stop. This operation does not include moving back to position 0! The state of homing procedure is reflected in axes states.
- **Jogging**: each axis can be moved in jogging mode. Jogging mode also overrides the limit switches. Only set_speed internal controller is functional in this mode with speed limited by the axis parameters.
- **Buffer**: the internal controller is disabled and the slots are fed direclty from a slot buffer, which must be constantly filled by the external application.
- **Internal**: the internal controller supports two modes:
    - internal position control: moves the axis to the desired position, following the limitations set by the axis parameters,
    - internal speed control: moves the axis at the desired speed, following the limitations set by the axis parameters.

Both internal modes and buffer mode utilize the internal buffer for operation. Therefore the fluctuations in the free space of the slot buffer can be observed in this modes. Before utilizing the buffer mode after internal controller mode, external application must either wait 10 ms for the buffer to clear or clear the buffer using the clear buffer command.

Axis parameters

Internal mode uses the following axis parameters of motion:

- Maximum speed: maximum frequency of pulses (in pulses/s)
- Acceleration: maximum acceleration (in pulses/s^2)
- Deceleration: maximum deceleration (in pulses/s^2)
- Limit and home switches configuration: each of the 6 limit and 3 home switch inputs can be enabled or disabled
- Direction change configuration: direction can be changed separately for each of the axes
- Homing direction configuration: direction of homing can be changed separately for each of the axes
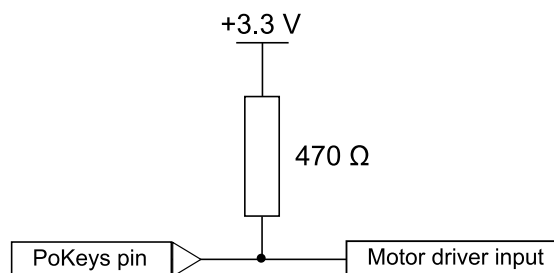
PoKeys device pins in use

Pin	Function
32	Limit+ switch – x
33	Limit+ switch – y
34	Limit+ switch – z
35	Limit- switch – x
36	Limit- switch – y
37	Limit- switch – z
38	Direction output – x
39	Direction output – y
40	Direction output – z
46 !	Step output – x
48 !	Step output – y **(external 470 Ω pull-up resistor needed)**
49 !	Step output – z **(external 470 Ω pull-up resistor needed)**
47	Home switch – x
50	Home switch – y
51	Home switch – z
52	Emergency switch input

Remarks:

- **Watch for pin 47! It is used for home switch input and not for step output!**
- **All switch inputs expect normally closed (NC) switches and must be connected between specified PoKeys input pin and ground.**
- **Emergency switch must be connected in such way so that it cuts the power supply to the motors when the switch is activated.**

External pull-up resistor wiring for pins 48 and 49

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