

Stepper Motor Control – Installation & Configuration

User Manual

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Confidentiality

This document is classified as a public document. As such, it or parts thereof are openly accessible to anyone listed in the Audience section, either in electronic or in any other form.

Scope

This is installation & configuration manual for stepper motor control software.

Audience

Audience are all users of stepper motor control software.

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1. Installation

1.1. File system



In this document we assume the installation of various parts of the stepper motor control software is done as described in this chapter. However since everything is configurable the installation can also be done in a different way and is up to the FAIR to decide where certain parts of the software/configuration will reside.

Stepper Motor Control software is installed in the following directories on M-Box:

- /opt/slits/conf – configuration files
- /opt/slits/driver – system driver as shared library
- /opt/slits/lcmonitor – access control monitor
- /opt/slits/server – local control server
- /opt/slits/lcd – LCD control
- /opt/slits/log – log directory
- /opt/slits/pmac – PMAC software and PMAC utility programs

1.2. PMAC



When performing this steps make sure that any other software is NOT communicating with PMAC (e.g. FESA, DevAcc, LCD control, Local control server or lcMonitor) since this might confuse the PMAC controller. Easiest way is to kill all processes that could communicate with PMAC.

The following steps are to be performed for PMAC controller:

1. Download default configuration to PMAC:

```
./sendfile default-conf-3-3-2006.CFG
```

2. Download PMAC software for generic slits:

```
./sendfile genericSlits.pmac
```

Make sure to download correct version of PMAC software for generic slits. The version is hardcoded at the top of generated file genericSlits.pmac as follows:

```
;
```



```
; Version  
;  
P33 = 17
```

In this case the version is 17.

1.2.1. Performing backup of software on PMAC



When performing this step make sure that any other software is NOT communicating with PMAC (e.g. FESA, DevAcc, LCD control, Local control server or IcMonitor) since this might confuse the PMAC controller. Easiest way is to kill all processes that could communicate with PMAC.

To perform backup use the following command:

```
./upload -a backup.txt
```

Where backup.txt is the name of the file where backup is to be saved.

1.3. System Driver

System driver is compiled as shared library used by other programs and therefore does not have any special installation instructions. Configuration is explained in chapter 2.1.

1.4. Access Control Monitor

Access control monitor is compiled as executable and it has to have access to system driver in order to run. Configuration is explained in chapter 2.2.

1.5. LCD Control

LCD control monitor is compiled as executable and it has to have access to system driver in order to run. Configuration is explained in chapter 2.3.

1.6. Local Control Server

Local Control Server is compiled as executable and it has to have access to system driver in order to run. Configuration is explained in chapter 2.4.

2. Configuration

2.1. System Driver

System driver is deployed as shared library and is used by other artifacts of the stepper motor control software.



System data file and PMAC properties file should not be changed by the users.

System driver configuration is defined in 3 files:

- System data file

This file contains system configuration (e.g. number and type of the motors and motor pairs). It is used to generate PMAC software (e.g. genericsSlits.pmac) and is used by system driver to create internal structures (e.g. number of motors in the system). Here number of motors does not mean number of connected motors but number of motors supported by the motion controller i.e. 8. This file should not be changed by the users.

- PMAC properties file

This file contains PMAC configuration setup and commands that needs to be executed to drive single motor or pair of motors, to stop single motor or pair of motors etc. This file needs to be changed only if basic system reconfiguration is done e.g. reconfiguration of motor channels on the PMAC level. It is generated and it should not be changed by the users.

- Motor and motor pair properties file

This file contains all motor settings that can be changed by the user (e.g. drive direction, default velocity, default acceleration ...) using local control GUI. This file is used by system driver during initialization or on user request via local control GUI. When motors settings are saved on the motor controller this is the file where the values are saved to.

The following is example format of the motor and motor pair properties file

```
motor1.motorName=motor1
motor1.motorNumber=1
motor1.limitsEnabled=1
motor1.maxPosition=100
motor1.minPosition=-100
motor1.maxOffset=0.5
motor1.minOffset=0.5
motor1.encoderType=1
motor1.mountingOrientation=1
motor1.installationOrientation=1
motor1.potentiometerLength=400
motor1.driveDirection=1
motor1.pulseWidth=5.9
motor1.pulsePolarity=1
motor1.offset=0
motor1.stepsPerMillimeter=200
```



```
motor1.positionFactor=1
motor1.velocity=3
motor1.accelerationTime=0.2
motor1.partOfPair=1
motor1.SSIResolution=1024
motor1.SSIMillimetersPerRevolution=5
motor1.referenceVoltageTolerance=20
motor1.positionTolerance=0.01

slit1.enabled=1
slit1.middleSwitchEnabled=1
slit1.minimumSpacing=5
```

Below each of the properties for motor and motor pairs are explained:

- motorName – display name of motor
- motorNumber – number of the motor
- limitsEnabled
 - enabled (1) – if hard limits are enabled
 - disabled (0) - if hard limits are disabled
- maxPosition – max position for the motor in mm
- minPosition – min position for the motor in mm
- maxOffset – offset in mm to be added to maxPosition
- minOffset – offset in mm to be added to minPosition
- encoderType
 - potentiometer (1) – if encoder is potentiometer
 - ssi (2) – if encoder is SSI
 - pmac (3) – if pmac is used as readback meaning no encoder is mounted to the motor
- mountingOrientation
 - right/up (-1) – if motor is right/up
 - left/down (1) – if motor is left/down
- installationOrientation (currently only for informative purposes)
 - horizontal (1) – if installation is horizontal
 - vertical (-1) – if installation is vertical
- potentiometerLength – potentiometer length in mm.
- driveDirection – direction of driving
 - clockwise (1) – if drive direction is clockwise



- anticlockwise (0) – if drive direction is anticlockwise
- pulseWidth – pulse width in usec
- pulsePolarity – polarity of pulses
 - positive (1) – if polarity is positive
 - negative (0) – if polarity is negative
- offset – in mm (used in calculating position value from potentiometer)
- stepsPerMillimeter – motor steps to mm conversion (Steps/EGU)
- positionFactor – use to compensate for voltage drops on potentiometer or for asymmetrical installed potentiometer
- velocity – motor velocity in mm/s
- accelerationTime – acceleration time in s
- partOfPair
 - 1 - if motor is part of pair
 - 0 – if motor is not part of pair
- SSIResolution – resolution of one revolution of SSI encoder (number of values / revolution)
- SSIMilimeterPerRevolution – number of mm per one revolution of SSI encoder in mm/revolution
- referenceVoltageTolerance – tolerance of the potentiometer voltage in mV
- potentiometerReference – potentiometer reference readback in volts

The following properties can be set for each motor pair:

- enabled
 - 1 - pair enabled
 - 0 – pair not enabled
- middleSwitchEnabled
 - enabled (1) – minimum spacing is not checked by the driver
 - disabled (0) – minimum spacing is checked by the driver
- minimumSpacing – minimum space between motors in mm used by software

2.2. Access Control Monitor

Access control monitor can be started with access control monitor configuration file as startup parameter as shown below

```
./lcMonitor -c /opt/slits/conf/lcMonitor.ini
```

If no parameter is defined then default location of configuration file is used (/opt/slits/conf/lcMonitor.ini). If file does not exist the default values for properties are used which are described below.

This local control server configuration file is java style properties file with the following properties:

- configDirectory – configuration file directory, default value is /opt/slits/conf
- configurationFile – system driver configuration file, default value is data.txt
- propertiesFile – system driver properties file, default value is properties.ini
- pmacPropertiesFile – system driver pmac properties file, default value is pmacProperties.ini
- logFile – name of the log file, default value is /opt/slits/log/lcMonitor.log
- fallbackTimeout – timeout of the fallback from local control to remote control, default value is 300s.

2.3. LCD Control

LCD control can be started with access control monitor configuration file as startup parameter as shown below

```
./lcd -c /opt/slits/conf/lcd.ini
```

If no parameter is defined then default location of configuration file is used (/opt/slits/conf/lcd.ini). If file does not exist the default values for properties are used which are described below.

This local control server configuration file is java style properties file with the following properties:

- configDirectory – configuration file directory, default value is /opt/slits/conf
- configurationFile – system driver configuration file, default value is data.txt
- propertiesFile – system driver properties file, default value is properties.ini
- pmacPropertiesFile – system driver pmac properties file, default value is pmacProperties.ini
- logFile – name of the log file, default value is /opt/slits/log/lcd.log
- serialPortFile – device file for serial communication with LCD. Default value is /dev/ttyS1
- unitName – name of the M-Box that will be displayed on LCD. Default value is unknown.

2.4. Local Control Server

Local control server can be started with local control server configuration file as startup parameter as shown below:

```
./server -c /opt/slits/conf/localServer.ini
```

If no parameter is defined then default location of configuration file is used (/opt/slits/conf/localServer.ini). If file does not exist the default values for properties are used which are described below.

This local control server configuration file is java style properties file with the following properties:

- configDirectory – configuration file directory, default value is /opt/slits/conf
- configurationFile – system driver configuration file, default value is data.txt
- propertiesFile – system driver properties file, default value is properties.ini
- pmacPropertiesFile – system driver pmac properties file, default value is pmacProperties.ini
- logFile – name of the log file, default value is /opt/slits/log/localServer.log
- port – port at which local control should listen to incoming connections, default value is 7001



3. Boot Procedure

The following has to be performed during boot procedure:

1. Configuration of serial driver used to communicate with potentiometer or SSI encoder
2. Setup of the FESA or DevAcc environment
3. Second network interface configuration (IP = 192.6.94.1, netmask = 255.255.255.0) used to communicate with PMAC
4. Start of the motion control software in this order (pause of 10s between each step is needed in order to prevent any errors from concurrent access to the equipment):
 - a. Access Control Monitor
 - b. Local Control Server
 - c. LCD Control
 - d. FESA or DevAcc software



