TECHNICAL MANUAL

PYCO

Pyramid control

SUMMARY

This document describes the procedures for programming/updating the microcontroller firmware and the system configuration of the PYCO pyramid controller.

Change history

Rev	Date	Changes	Page	From
A	2016-11-22	First edition	-	MB

Referenced documents

#	Doc.#	Rev	Type	Publisher	Title
1					

Table of contents

List of figures

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List of tables

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List of open points

1 Acronyms

The following acronyms have been used in this document:

Acronyms	Meaning
DC	Direct Current
ESD	Electro-Static Discharge
IC	Integrated Circuit
SMD	Surface Mounted Device
HD-SDI	High Definition - Serial Digital Interface
mS	Milli-Second
PCB	Printed Circuit Board
PoSDI	Power over SDI
PWM	Pulse Width Modulation
RS-232	Single-Ended Serial Communication Protocol
RS-422	Differential Serial Communication Protocol
RS-485	Differential Serial Multipoint Communication Protocol
SDI	Serial Digital Interface
TBD	To Be Determined
uC	Micro-Controller
uS	Micro-Second
V	Volts
CANBus	Controller Area Network
VGA	Video Graphics Array
DVI	Digital Visual Interface
PCB	Printed Circuit Board

2 Introduction

2.1 System overview

The system described here is a digital control system consisting of the following components (see Fig. 1):

1. 80 MHz ARM Cortex-M4 microprocessor
2. Two-line dot-matrix display NHD-0216K3Z-NSW-BBW-V3
3. Endless rotary push encoder
4. UART-RF radio module HM-TRP
5. SD card slot
6. USB2.0 interface
7. Sound card with VS1003 audio codec
8. Real-time clock (incl. temperature sensor) DS3231
9. EEPROM 32KByte
10. 8-channel relay board (230VAC 10A)
11. Infrared motion sensor HCSR501

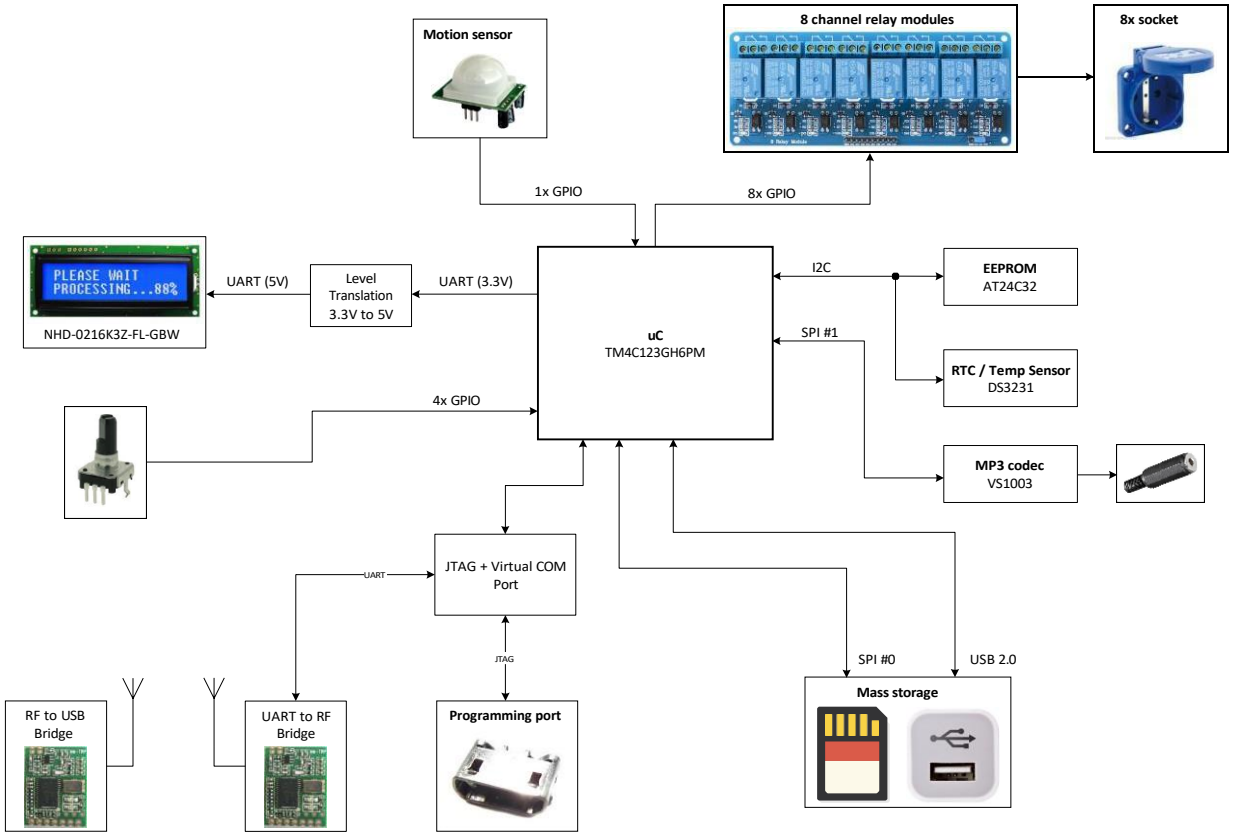


Fig. 1 - Overall system overview

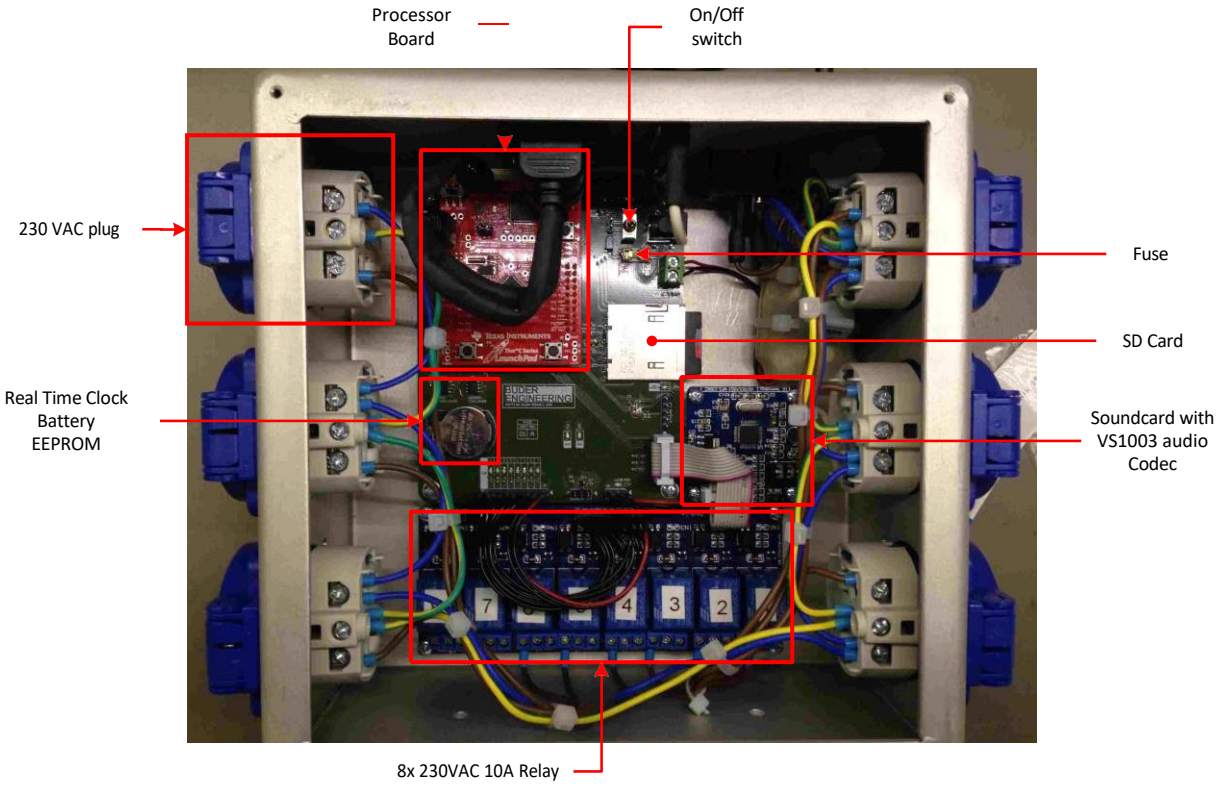


Fig. 2 - Definition of the components

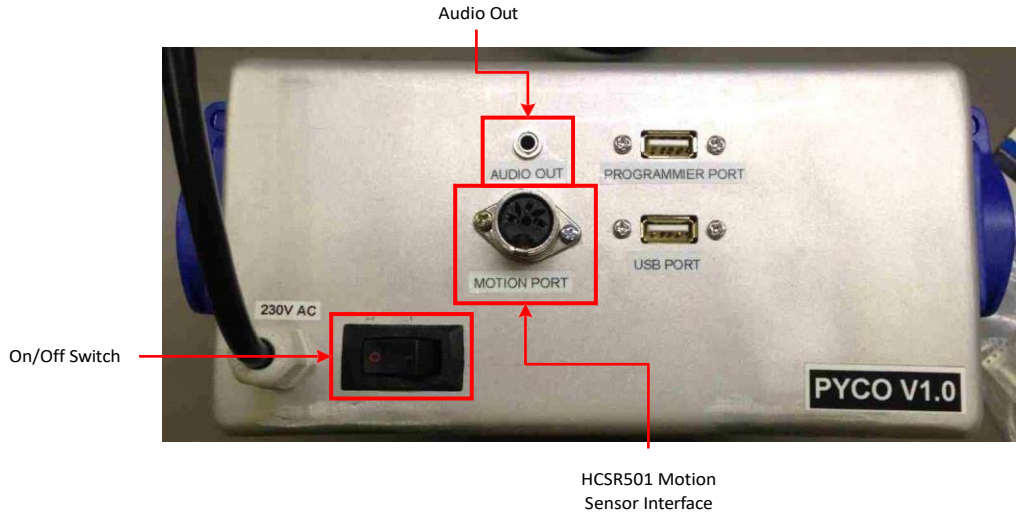


Fig. 3 - Definition of the interfaces

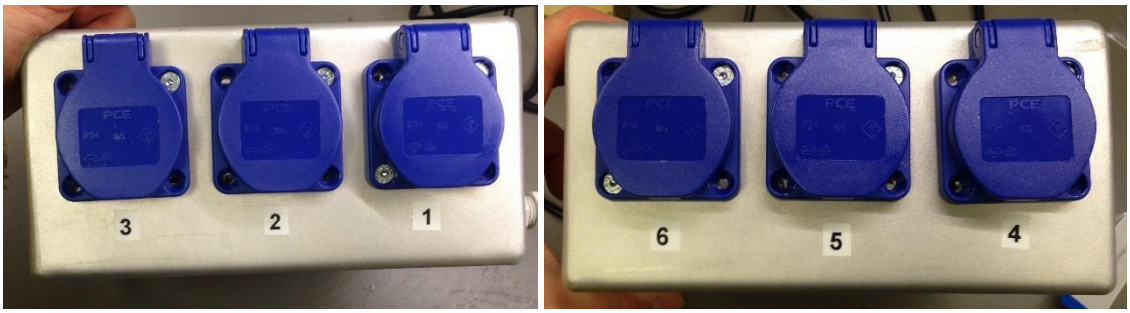


Fig. 4 - 230V AC earthed sockets

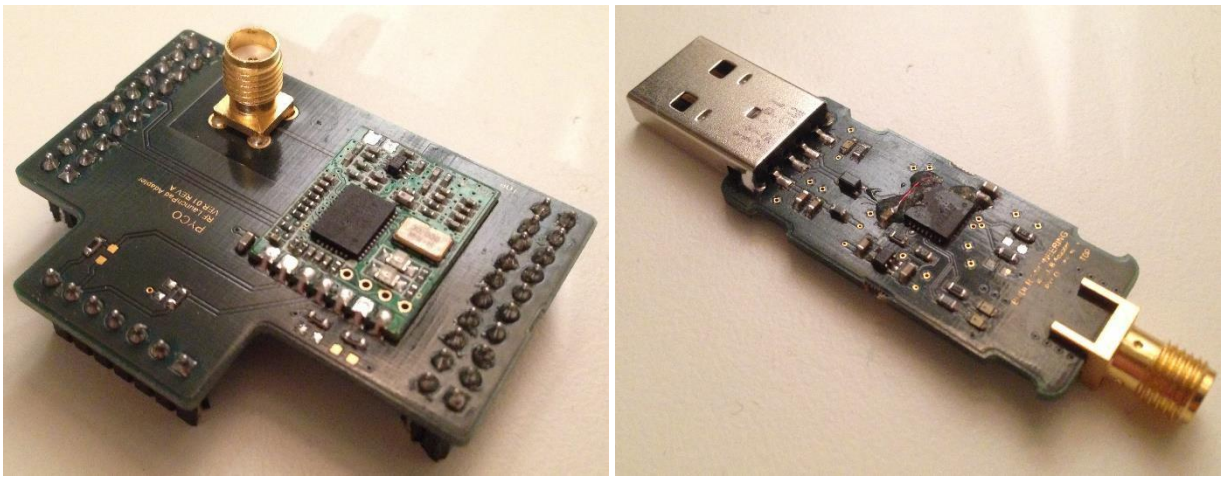


Fig. 5 - Radio module, Left: Processor side, Right: USB stick for connection to PC

2.2 Scope of functions

2.2.1 Real-time and temperature measurement

The present system has a DS3231 real-time clock IC. This is able to output the current date, the current time and the ambient temperature.

Date format : `<weekday> <day> <month> <year>`

Time format : `<hour> <minute> <second>`

Temperature Format : `<##.##>`

```
/> z -a
--------------------------------
 24.11.16 23:57:22  23.00 Grad
--------------------------------
```

Fig. 6 - Console output of the real-time clock

```
/> aa

+-----------------------------------------------------------------------------------------------------------------------+
|                                                    AUFGABENLISTE                                                      |
+-----------------------------------------------------------------------------------------------------------------------+
|  Nr.  |  Id  |  Startzeit  |  Stopzeit  |  Aktivzeit  |  Bewegung  |  Audio  |  Aktor  | Ch 1 | Ch 2 | Ch 3 | Ch 4 | Ch 5 | Ch 6 |
+-----------------------------------------------------------------------------------------------------------------------+
|  01   |  01  |    20:58    |    23:08   |    05:30    |     X      |    X    |    X    |   X  |   X  |   -  |   -  |   -  |   -  |
|  02   |  02  |    23:08    |    23:09   |    05:00    |     -      |    X    |    X    |   -  |   -  |   -  |   X  |   -  |   -  |
|  03   |  03  |    23:10    |    23:12   |    05:00    |     -      |    X    |    X    |   -  |   -  |   X  |   -  |   X  |   -  |
+-----------------------------------------------------------------------------------------------------------------------+
```

Fig. 7 - Task list

3 System configuration

3.1 Communication

The system configuration is done using the supplied USB wireless adapter. This, when used on a Windows system, emulates a serial interface (COM port) and can be used in conjunction with a console programme (Putty, hTerm, ...) to configure the system at hand. The following parameters are set for communication:

Baud rate : 9600
Stopbit : 1
Parity : none
CTS : none

The parameters to be set are exemplified by the hTerm programme in Fig. 8.

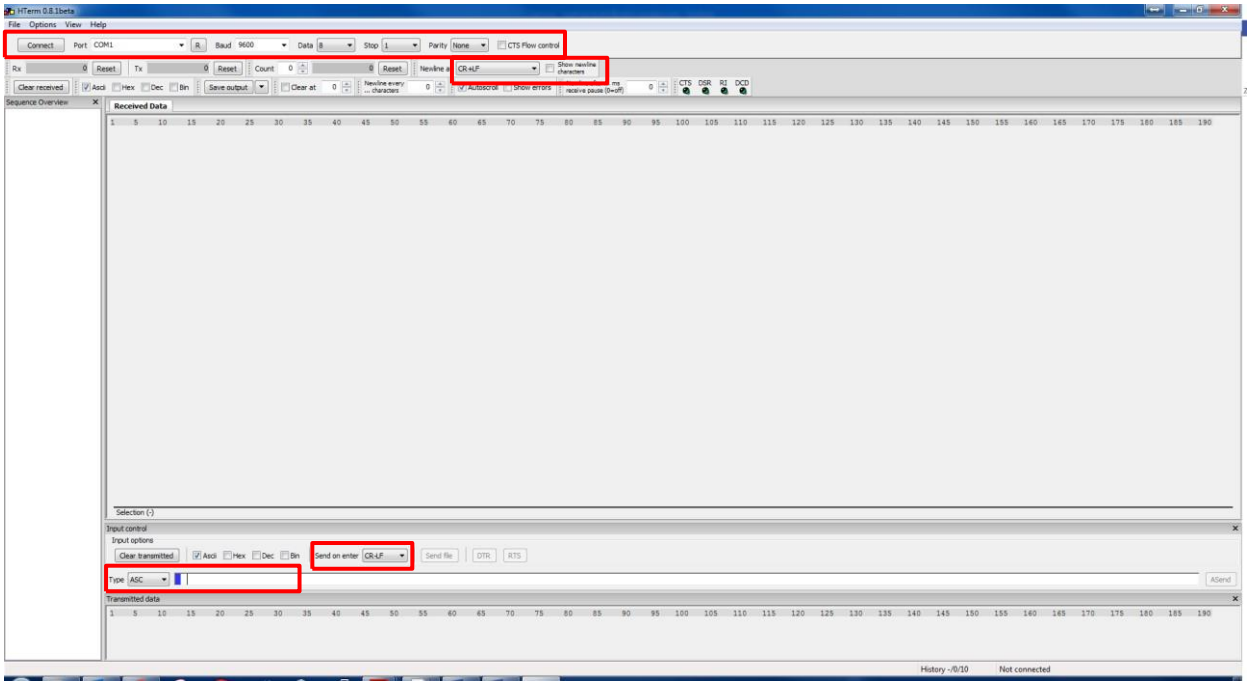


Fig. 8 - Example of communication parameters in HTerm

3.2 Configuration

3.2.1 Task management

Task management can be controlled with the following four commands:

3.2.1.1 *Show tasks*

Lists all existing tasks in a table.

```
aa<No parameters>
```

3.2.1.2 *Add task*

Adds a task and then lists all existing tasks in a table.

```
ah<No parameters>
```

3.2.1.3 Remove task

Deletes an existing task and then lists all existing tasks in a table.

`ae<Tasks Id>`	Task number	1 - 25

3.2.1.4 Edit task

Processes an existing task with the functions listed below and then lists all existing tasks in a table.

`ab -a <tasks Id>`			Task number	1 - 15
	`-sah`	`<starting hours>`	Starting hour	0 - 23
	`-sam`	`<start minute>`	Start minute	0 - 59
	`-soh`	`<stop hour>`	Stop hour	0 - 23
	`-som`	`<stop minute>`	Stop minute	0 - 59
	`-akm`	`<Active minute>`	Active minute	0 - 59
	`-aks`	`<active second>`	Active second	0 - 59
	`-b`	`<switch>`	Motion sensor	0: Off, 1: On
	`-au`	`<switch>`	Audio playback	0: Off, 1: On
	`-act`	`<switch>`	Actuator usage	0: Off, 1: On
	`-ak`	`<channel>`	Actuator channel	1 - 8

3.2.2 System parameters

The editing of the system parameters can be controlled with the following 2 commands:

3.2.2.1 Display system parameters

Lists all system parameters in a table.

`sa<No parameters>`

3.2.2.2 Edit system parameters

Edits the system parameters with the functions listed below and then lists all parameters in a table.

`from`	`-m`	`<switch>`	Mode	0: Auto, 1: Manuel
	`-v`	`<volume>`	Standard volume	0 - 100
	`-ebz`	`<time>`	Standard fade-in/fade-out time	0 - 60 s
	`-dc`	`<contrast>`	Standard display contrast	1 - 50
	`-db`	`<brightness>`	Standard display brightness	1 - 8
	`-atm`	`<time>`	Standard active second	0 - 59
	`-ats`	`<time>`	Standard active minute	0 - 59
	`-bvz`	`<time>`	Standard motion delay	0: Off, 1: On

3.2.3 Audio

Audio playback can be controlled with the following 6 commands:

3.2.3.1 *Start audio playback*

Starts audio playback by specifying a file path (absolute path) to a valid audio file (.wav, .mp3). If the current playback was paused by the command `pause`, it can be continued by executing `play`. In this case, **no** parameter is necessary.

```
play <audioteipath>
```

3.2.3.2 *Pause audio playback*

Pauses the current audio playback.

```
pause <No parameters>
```

3.2.3.3 *Stop audio playback*

Stops the current audio playback.

```
stop <No parameters>
```

3.2.3.4 *Set volume*

Adjusts the playback volume.

`lst <volume>`	Playback volume	0 - 100

3.2.3.5 *Show volume*

Fades in the volume of the current audio playback. The fade-in ends when the current volume is reached.

`einlb <time>`	Fade-in time (seconds)	0 - 60

3.2.3.6 *Hide volume*

Hides the volume of the current audio playback.

`offlb <time>`	Fade out time (seconds)	0 - 60

3.2.4 File system

The file system can be controlled with the following 6 commands:

3.2.4.1 *List the contents of the storage medium*

Lists the entire content of the storage medium. This includes the name, properties and size of the respective file.

```
ls<No parameter>
```

3.2.4.2 *Change directory*

Switches to the specified directory.

`cd <directory>`	To directory to be changed
`cd .. <No parameters>`	Switches to the previous directory

3.2.4.3 *Working directory*

Shows the current working directory

```
pwd<No parameter>
```

3.2.4.4 *Read file content*

Reads the content of the specified file and outputs it.

`cat <file>`	File to be read

3.2.4.5 *Delete file / folder*

Deletes the specified file / folder(s).

`rm <file/folder>`	File / folder to be deleted

3.2.4.6 *Index data*

Indexes all existing data on the data carrier (max. number: 150). Order, hidden and system files are ignored.

```
Index <No parameters>
```

3.2.5 Real-time clock

The real-time clock can be controlled with the following command:

3.2.5.1 *Edit date and time*

Edits the date / time and displays the result afterwards.

`z`	`-?`		Displays all real-time clock commands	
	`-a`		Shows the current date, Time and temperature on	
	`-wt`	`<day of the week>`	Sets the day of the week	Mon, Tue, Wed, Thu, Fri, Sat, Sun
	`-dd`	`<tag>`	Sets the day	1 - 31
	`-mm`	`<month>`	Sets the month	1 - 12
	`-yy`	`<year>`	Sets the year	0 - 99
	`-h`	`<hour>`	Sets the hour	0 - 23
	`-m`	`<minute>`	Sets the minute	0 - 59
	`-s`	`<second>`	Sets the second	0 - 59

3.2.6 Display

The display can be controlled with the following commands:

3.2.6.1 *Contrast*

Changes the display contrast

`disp -c`	`<contrast>`	Contrast value	1 - 50

3.2.6.2 *Brightness*

Changes the display brightness

`disp -b`	`<brightness>`	Brightness value	1 - 8

3.2.7 Actuator

3.2.7.1 *Activate*

Activates the specified actuator channel.

`rly -at <channel>` Actuator channel1 - 8

3.2.7.2 *Deactivate*

Deactivates the specified actuator channel.

`rly -from <channel>` Actuator channel1 - 8

3.2.7.3 *Enable All*

Activates all actuator channels.

`rly -allan<no parameter>`

3.2.7.4 *Disable All*

Deactivates all actuator channels.

`rly -alloff<no parameter>`

3.2.8 Other

3.2.8.1 *All commands*

Shows a list of all commands.

`? <No parameters>`

3.2.8.2 *Delete console content*

Deletes the entire content of the console / terminal.

`cls<No parameters>`

3.2.8.3 *Saves task list*

Saves the current task list in the file `task.cfg`

`spa<No parameters>`

3.2.8.4 *Saves system parameters*

Saves the current system parameters in file `system.cfg`

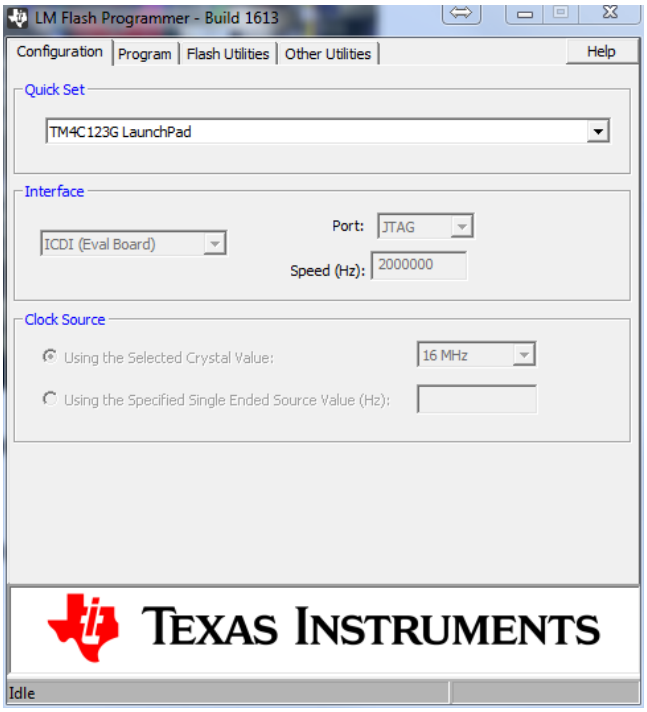
`sps<no parameters>`

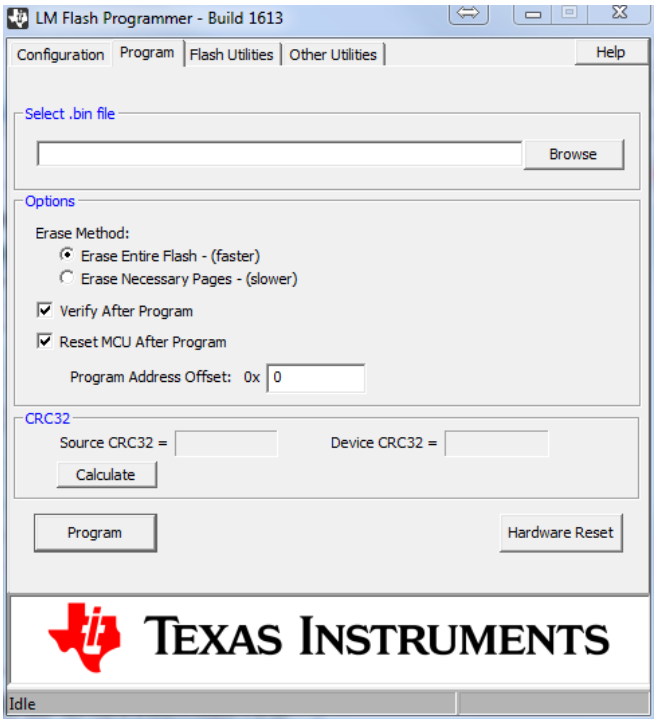
3.2.8.5 *Loading task and system parameters*

Loads task and system parameters from the `system.cfg` and `task.cfg` files.

`lad<No parameters>.`

4 Firmware programming




LM Flash Programmer - Build 1613
Configuration
Program
Flash Utilities
Other Utilities
Help
Select .bin file
Browse
Options
Erase Method:
Erase Entire Flash - (faster)
Erase Necessary Pages - (slower)
Verify After Program
Reset MCU After Program
Program Address Offset: 0x 0
CRC32
Source CRC32 =
Device CRC32 =
Calculate
Program
Hardware Reset
TEXAS INSTRUMENTS
Idle