deltarobot Message Format

Specification v1.0

Table of Contents

Lucas Pires Camargo
EMB5613 – Projeto Integrado de Sistemas Embarcados
Prof. Diego Santos Greff

Introduction

This document defines the message formats used by deltarobot. They are to be used in the implementation of both the firmware and the accompanying software interface.

For more information on the nature of the project and the robot itself, please refer to the full report.

Purpose

The project aims for making the platform fully operational, which means giving the user means of controlling the platform position. This could be accomplished with an interface on the controller device itself, but we figure it is better (and more simply) done by use of a personal computer connected to the platform. This makes possible the use of an user interface with interactive 3D graphics, the creation of a software library for integration into other applications, path drawing, etc.

However, to accomplish this, there must be a standardized way for the controller to talk to a personal computer. Therefore, it was decided that a simple protocol would have to be defined.

Definitions

In this specification, "Controller" means the device that operates the motors of the parallel actuators, reads sensor inputs, and executes the control loop. "Interface", "Interface software", or "Computer" refers to the computer that is communicating with the Controller, monitoring its status, and defining its goal positions.

An "Opcode" is be understood as "Operation code". Different Opcodes describe the various functionalites of the protocol in compartmentalized commands.

About this specification

This document is organized as follows:

- Section "Connection and Transmission" gives an overview on the physical link layer.

- Section "Message Frame Structure" defines the basic structure of a command.

- Section "Opcodes" defines commands, their requirements and outcomes.

- Section "Implementation Notes" gives further details in regards to implementation and noteworthy behaviors.

Connection and Transmission

The Controller is to be connected to the Computer by means of a serial port device. This device has to be configured as follows:

- Baud rate: 115200 baud

- Data bits: 8 bits

- Stop bits: 1 bit

- Parity bits: (none)

- Hardware flow control: (disabled)

Furthermore, a "serial port", this can mean a physical, standard RS-232 connection, or a connection emulated in software or in hardware. A valid implementation is a USB connection through which a serial data stream is sent, and that the Computer can recognize as such. This has to translate into a COM port or TTY device file ("/dev/ttyS?", "/dev/ttyUSB?") in the operating system of the Computer, to which the Interface Software connects.

Message Frame Structure

Commands, status information, and control information are organized into frames. A frame is a validated sequence of bytes structured as follows:

Start-of-Frame	Length	Opcode	Data	Checksum	Terminator
'$' (ASCII)	Size in bytes (whole frame)	"What the frame is"	Opcode-dependant	(Mod-sum of frame bytes)	':' (ASCII)
1 byte	1 byte	1 byte	(length – 5) bytes	1 byte	1 byte

TODO: descrição de cada campo passo-a-passo do negócio

Checksum Calculation

TODO: descrever como é calculado o checksum

TODO: adicionar exemplo

Notes

There is no message resend requests.

Incomplete or corrupted packets are lost.

If an ACK is times out an operation can be repeated depending on the opcode

Opcodes

This section describes each opcode in detail. However, for the purpose of an overview, a complete list is given beforehand. The opcodes are divided in three categories: "common" opcodes that can be sent in both directions, "down" opcodes that only make sense from Computer to Controller, and "up" opcodes that only apply in the Controller to Computer direction.

Following the lists of opcodes, there is a section explaining each opcode in detail.

List of Common Opcodes

- Acknowledge – 0x41 – ASCII 'A'
- No-Acknowledge – 0x4E – ASCII 'N'

List of Down Opcodes

- Homing Request – 0x48 – ASCII 'H'
- Status Request – 0x53 – ASCII 'S'
- Move Request – 0x4D – ASCII 'M'
- Cancel Request – 0x43 – ASCII 'C'

List of Up Opcodes

- Homing Finished – 0x68 – ASCII 'h'
- Status Report – 0x73 – ASCII 's'
- Move Finished – 0x6D – ASCII 'm'
- General Error – 0x65 – ASCII 'e'