Bus solution for «insert name»

Norwegian University of Science and Technology
Department of Engineering Cybernetics Trondheim

Author:

Kjell Rohde

12. Jan 2007

Contents

Chapter 1

Introduction

This document will look at different solutions for the choice of bus systems on the satellite. One of the main goals for the satellite project group is that every subsystem designed should be module based, i.e any new type of sensor or payload can be added with minimal reconfiguration of the satelitte. This feature requires some extra consideration when chosing the bus system solution. Different payloads will have different bandwidth requirements, both with regards to maximum data rate and also availability. Questions to be answered are the number of buses required, demands on bandwidth and power consumption.

Chapter 2

Satellite bus systems

The first choice to be made is whether or not two or more buses should be implemented, one for the satellite basic operations and others for the payload. Seeing as we want a robust module based satellite at least two buses are needed. Two seperate buses would increase the power consumption, however the current going through the bus while idle is almost negilable, restricted to the leak current from the transistors. Power consumption will depend on the type of bus used, but low power buses are available.

Bandwidth requirements can vary greatly depending on the payload, especially if continous bursts of data from the payload is to be sent to either a storage device or directly to the downlink antenna. For the command bus this is not an issue. The data bus however should be able to operate at high speeds in order to accomodate one or more payloads. There are several methods for implementing this, two of which shall are presented here. Two-wire solutions, inspired by Philips' I^2C bus, are used in most, if not all compact devices. It is an active low bus, meaning that the bus is drawn to ground to initiate communication. In order to meet todays requirements the second version of I^2C has low supply voltages and a high speed mode with bit rates of up to 3.4 Mbit/s, according to [Phi00]. The second choice is using field buses such as CAN and Foundation Fieldbus. These are designed to operate in harsh conditions and with good robustness. These qualities are however designed with regards to great distances. Inside the cube-satellite the maximum distance between two components will be 30cm. Although some micro controllers have built in CAN controllers, most does not. This will require additional components, which in turn will increase power consumption. A third alternative is to set up an RS485 seriall network between the payload, storage devices and downlink antenna. According to [ReS07] a short range RS485 network can have data rates of up to 10Mbit/s. This network does require more power with a maximum curretn 10 times larger than for the I^2C bus.

Chapter 3

Conclusion

According to the specifications given by [EB06] for the satellite, each downlink should have a maximum bit rate of 9.6 Kbit/s. Compared to this bit rate, the high speed mode of the I^2C bus will be more than adequate for this satellite, both for the command bus and the data bus. In addition, it is also the best choice with regards to power consumption. The actual layout of the bus, and other smaller dedicated buses that will be nessecary, can not be shown at this stage of development. This document is only meant to decide on a bus solution for the entire satellite and not to show the actual implementation.

Bibliography

[EB06] Roger Birkeland Elisabeth Blom, Erik Narverud. Technical satellite specification, December 2006.

[Phi00] Philips. I2c-bus specification, version 2.1. January 2000. http://www.nxp.com/acrobat_download/literature/9398/39340011.pdf.

[ReS07] ReSmith.com. Rs485 quick reference. January 2007. http://www.rs485.com/rs485spec.html.