

Exercise 10: Distributed Applications using the Modbus Protocol

Overview

In this session, we will extend the Modbus exercise from the last session by adding a Modbus master implementation. This will allow us to form autonomous networks of multiple microcontrollers. This means that we do not need a host PC any more and our application will really be “embedded”.

As this exercise heavily relies on the fact that the previous exercise has been finished, please do not start working on it before you have verified that your slave implementation works and conforms to the specification. Otherwise, you might influence the other nodes on the network.

Modbus Master Implementation

Exercise 10.1

For the following exercises, set the slave ID of your device to your group number to avoid conflicts with slave devices of other groups.

- Develop an application that can switch between Modbus master/slave mode using a button.
 - In slave mode, the device maintains a set of holding registers and responds to requests from the master as implemented in previous exercise (including the temperature sensor application).
 - In master mode, it periodically generates read and write commands and verifies that the register content is as expected (omit write commands to register 15 of course).

To verify the master implementation, use the device from another group in slave mode and build a network by attaching the slave’s TX line to the master’s RX line and the slave’s RX line to the master’s TX line. Attach the cable directly to PDO and PD1, respectively (see figure 1).

On the LCD of master and slave, show:

- **The current mode:** Master mode, slave mode.
- **Current communication traffic going on:** On the slave whether the slave has recently been read from or written to, and which register is involved. On the master which slave and register is currently queried and, if available, the response.
- **The current temperature in °C:** On the slave the local temperature and on the master the one retrieved from the slave.
- **The current register values:** On the slave only.

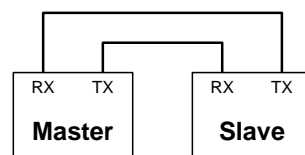


Figure 1: Direct connection of Master and Slave

Distributed Applications with Multiple Slaves

Exercise 10.2

- Form networks of multiple slave devices and one master device (compare figure 2). Make sure that you use a different slave ID for each of the slaves (the group number). Attach the **TX** lines of all slaves to the master's **RX** line and all slave's **RX** line to the master's **TX** line. Visualize the temperature values of all slaves on the master's LCD.
- Exchange the master to verify that every node is actually “compliant” to our modified Modbus protocol.

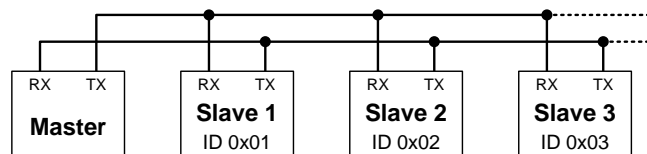


Figure 2: Modbus Network with multiple Slaves