

## Exercise (SS 2022)

### Communication Systems and Protocols

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## Task 1: Actuator Sensor Interface (ASI)

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In the following a data transmission on the ASI bus is considered. Thereby a master wants to transmit the bit vector 01001 to the slave having address 26<sub>d</sub>. The telegram format of the ASI bus is shown in Figure 1.1.

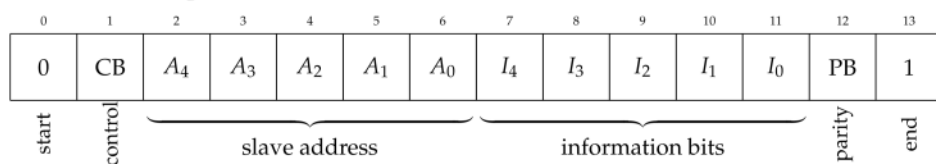


Figure 1.1: ASI packet format, master call

- 1.1 Specify the course of the sender voltage on the ASI bus. A time offset does not need to be considered (Note: The control bit must have value '0' for data transmission, use even parity without considering start / stop bits). Use figure 1.2 and Manchester as per IEEE 802.3

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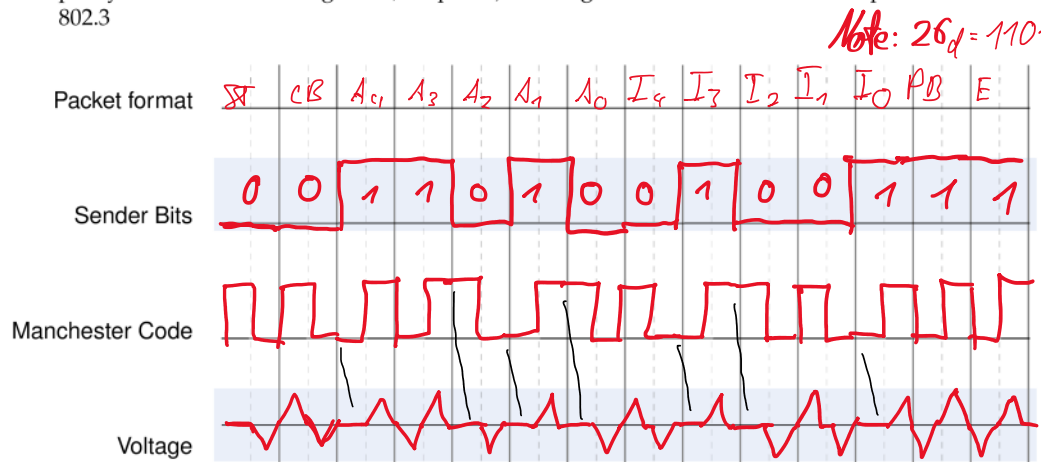


Figure 1.2: Waveform of the sender voltage

- 1.2 Figure 1.3 shows the waveform on the ASI bus when transmitting a master call. Due to external influences the transmission has been disturbed. Mark the errors and name the rule(s) by which they are detected.

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- 1.2.:
- first pulse must be negative. Last pulse positive
  - No two succeeding pulses with same parity
  - Max.  $\frac{1}{2}T_b$  between pulses

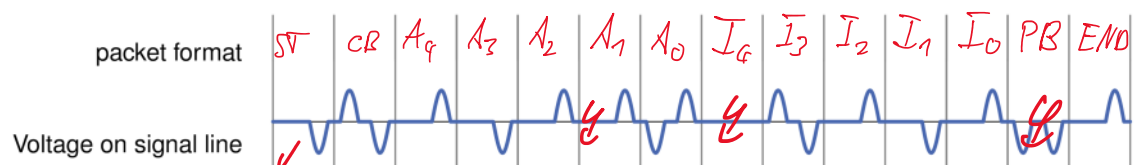


Figure 1.3: Waveform of the sender voltage

## Task 2: I<sup>2</sup>C-Bus Synchronization

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Three I<sup>2</sup>C Bus Masters want to send data to one slave. Each node needs one time step to read in data from external signal lines (SCL, SDA). The reaction time within each node is negligibly small (0 time steps). The individual masters want to establish a clock signal according to the following table 2.1:

Master	Low period	High period
A	<u>8</u>	<u>4</u>
B	<u>4</u>	<u>12</u>
C	<u>12</u>	<u>8</u>

Table 2.1: clock signals

Assume that Master B is initiating the communication cycle.

2.1 In general, which functionality does the I<sup>2</sup>C bus provide for the case that multiple master nodes want to communicate at the same time with the same slave node?

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2.2 Complete the waveforms of the signals that result from the interaction between the nodes on the SCL signal.

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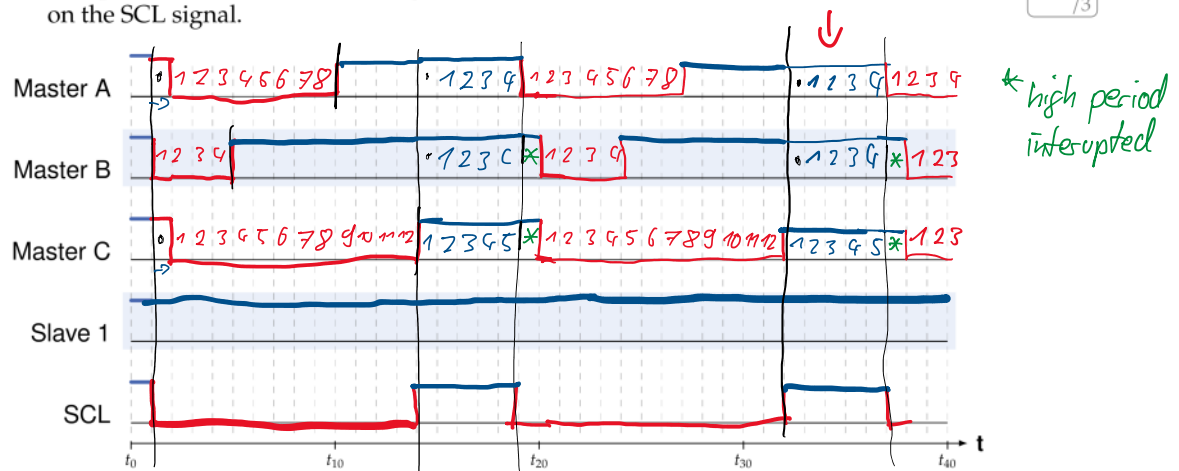


Figure 2.1: Signal sequence

2.3 In general, which functionality does the I<sup>2</sup>C bus provide for the case when there is a fast and a slow master node?

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-Insertion of wait states through longer "low periods"

## Task 3: FireWire

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- 3.1 FireWire uses a special coding scheme with an additional STROBE signal. Indicate the impulse diagram for the case that the following bit sequence (given in binary notation) should be transmitted. Use figure 3.1

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10011010001101110111100,

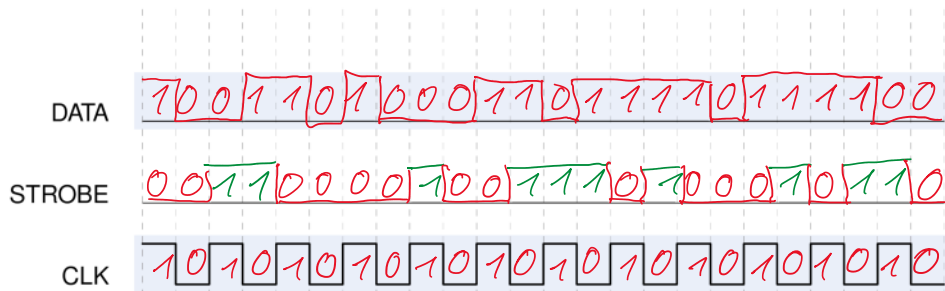


Figure 3.1: FireWire impulse diagram

Several FireWire devices are interconnected as shown in Figure 3.2.

- 3.2 Perform the three steps of address assignment for this network. Assume that every node needs one time unit for processing and forwarding of a message. Every node can process several incoming messages in parallel. In Figure 3.2 fill in the address that is obtained by every node. Which node becomes root of the tree?

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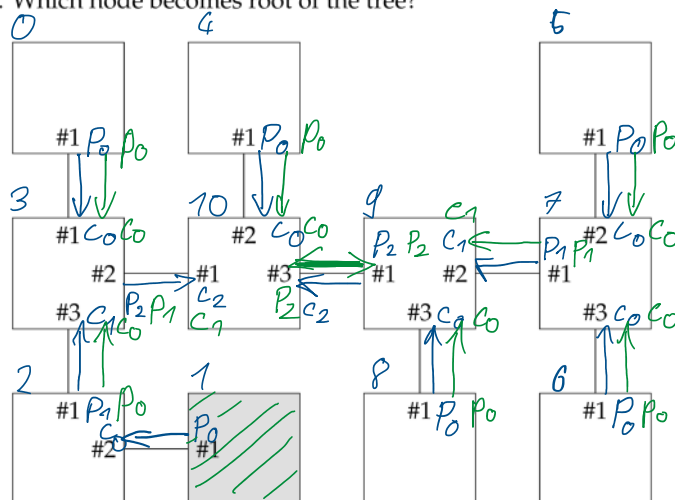


Figure 3.2: FireWire network

- 3.3 Now assume that the node highlighted in grey is not part of the network any more. What is the problem now during address assignment? How could this problem be solved?

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\* without gray node  
! collision occurs

**FireWire structures**

- 3.4 Different FireWire structures were built during a student laboratory. During test phase you notice that not all FireWire systems are working correctly. Please state if the FireWire systems given below are working correct. Mark the roots, if the systems are correct. Give a reason, if the FireWire system is not working correctly.

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	Correct	Wrong	Reason
	X		
	X		
	X		No Ring allowed
	X		Only point 2 point connections allowed
	X		
	X		No Ring allowed

Table 3.1: FireWire structures