

## I. IDENTIFICATION DATA

<b>Thesis name:</b>	<b>Minimal Design of IO-link Device</b>
<b>Author's name:</b>	<b>Bc. Denys Postoialko</b>
<b>Type of thesis :</b>	master
<b>Faculty/Institute:</b>	Faculty of Electrical Engineering (FEE)
<b>Department:</b>	Department of Electric Drives and Traction.
<b>Thesis reviewer:</b>	Ing. Tomáš Košťál
<b>Reviewer's department:</b>	Department of Electric Drives and Traction.

## II. EVALUATION OF INDIVIDUAL CRITERIA

<b>Assignment</b>	<b>challenging</b>
<i>Evaluation of thesis difficulty of assignment.</i>	
<p>The aim of the thesis was to present an overview of the IO-Link industrial communication standard and to design, manufacture, debug and test a communication device for this standard. Documentation of all these processes should have been part of the thesis as well. I consider especially the required test procedures as challenging because it consists of various types of measurements with respect to number of standards.</p>	

<b>Satisfaction of assignment</b>	<b>fulfilled with major objections</b>
<i>Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.</i>	
<p>First point of the assignment was to present an overview of the IO-Link standard. Presented information seems to be outdated and incomplete as current official versions of IO-Link specification does not contain some of the facts presented in the thesis. Some parts of this overview are not clearly described.</p> <p>Second point of the thesis was to create the schematic and PCB design for a device capable of the IO-Link communication. The submitted thesis does not prove explicitly that this point of the assignment was fulfilled as it does not contain any schematic nor PCB design of the device (except power supply part schemes that were borrowed from a datasheet). The thesis does not contain any reasonable photography of the device as well. The presented measurements suggest that the device has been manufactured but it should be proved by the documentation. The topic has been solved in a company so it can be understood that some materials are confidential. However at the end of the thesis author claims that "Principal scheme of IO-Link Device" is an attachment of the thesis, but there is no such an attachment. Similarly, the author claims that the "electrical principal scheme" is on the attached CD, but the provided CD contains nothing except the electronic version (PDF file) of the printed thesis.</p> <p>Third point of the assignment was to prepare test plan based on the IO link standard. Provided list of planned measurements at the beginning of Chapter 7 does not contain even the measurements that were conducted and cannot be considered as a test plan. Author lists a document called IO-Link Test Specification (as an item N<sup>o</sup> 24 in the list of related literature), but he doesn't cite it anywhere in the text of the theses so it seems that he hasn't used it at all. Author doesn't explain why he has chosen measurements based on particular standards that are not mentioned in IO-Link Test Specification.</p> <p>As mentioned before, there are no schemes of the designed circuit nor the PCB design of the device so the provided documentation cannot be considered as sufficient to comply with point five of the assignment.</p>	

<b>Method of conception</b>	<b>partially applicable</b>
<i>Assess that student has chosen correct approach or solution methods.</i>	
<p>Presented procedure of designing parts of the electrical circuit of the device (especially the designing of the power supply) can be considered as very good. However the methodology of the testing procedure is not well documented and it is limited only to very short incomplete introduction at the beginning of Chapter 7. In Chapter 4 a proposal of a time schedule was presented, but it hasn't been mentioned anywhere in the thesis whether it was fulfilled or not.</p>	

### Technical level

**C - good.**

*Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.*

This thesis shows a good level of technical knowledge especially in the field of power supply design. The author proved that he can use technical documents like datasheets or standards. However, the poor level of the language and mistakes degrade the technical level in some passages of the thesis. Chapter 5.2.2 is another confusing thing as it is called Simulation but presents no simulation results.

### Formal and language level, scope of thesis

**E - sufficient.**

*Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.*

The level of the language of the theses is very poor. The author is not a native speaker so certain level of language mistakes and misspellings would be acceptable. However, the author does not respect even the basic grammatical rules of the English language such as the sentence structure "subject-verb-object" (p. 20, 27...). It is obvious that some sentences were translated word by word from some Slavic language. The author should improve his work with the dictionary as he is misunderstanding meanings of some words e.g. meaning of the word "performance" (p. 33, 53) which does not mean introduction or presentation. There are also consistency misspellings such as "interphase" instead of "interface". Other grammatical improvements could be done in the fields of article usage and conjunctions. All these facts caused that some parts of the text were difficult to understand or unclear.

There could be some improvements in the formal notation like stating variables in italic or making spaces between numbers and units.

There are also inconsistencies in designation of symbols in schemes. Designations in Figure 5.2 are not the same as in 5.4 and 5.5 without any explanation even when all of these figures present the same part of the circuit.

Abbreviations SIO and NRST that occur in the text are not explained and are not mentioned in the List of abbreviations.

It is obvious that no proofreading was made at all.

### Selection of sources, citation correctness

**E - sufficient.**

*Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.*

The author should improve his work with sources and citations. Some information presented in the thesis was not contained in the sources the author cites. Some of the information, tables or figures came from different sources than the author claims. For example Figure 2.3 is referenced to a source where it does not occur, Table 2.2 is not in source [5] but in source [6] etc.

### Additional commentary and evaluation

*Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.*

The thesis presents information about designing and testing a communication device for the IO-Link standard. However, it is not very clear what the device is good for. The IO-Link standard should be used for connecting various sensors and actuators into industrial networks. It is not clearly presented in the thesis whether the designed device is capable to connect any sensor or actuator. It is not mentioned in the text whether the proposed pin header presented in Chapter 3 was carried out in a proposed state. No further design documentation is provided so it is difficult to evaluate whether all goals were achieved.

### III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

*Summarize thesis aspects that swayed your final evaluation. Please present apt questions which student should answer during defense.*

The presented thesis shows some parts of designing procedure of a communication device for the IO-Link industrial standard and its testing. However it is not clear from the thesis what is this device capable of. There are no electrical schemes or PCB designs despite the author claims that they are provided as an attachment. There is no reasonable photography of the manufactured device. The procedure of selection of the tests is also not very clear as the methodology is not well stated. It is not clear why some of the tests were conducted according to standards that are not even mentioned in the IO-Link Test Specification. The overall low level of English and lack of proofreading causes difficulties of understanding. Author's work with sources could be better as he presents some information from uncited sources or provides wrong sources for some figures and tables.

I have following questions:

- 1- Two and three wire connection interfaces of the IO-Link standard called PHY1 and PHY2 are presented in the thesis (Chapter 2.2). However the current specification of the IO-Link (IO-Link Interface and system specification V1.1.2, 07/2013, IO-Link Community 10.002) does not mention the possibility of two wire connection nor does it mention designations PHY1 and PHY2. Is it then possible to connect IO-Link devices with a two-wire interface? If this two-wire interface implemented in the Master and Slave devices available on the market?
- 2- Can you explain meaning of the term  $T_{\text{cycle}}$  that occurs in Table 2.2 and how is related to the number of frames in the same table? In Chapter 2.2 you declare that in case of two-wire interface it is not necessary to keep the minimum transfer time  $T_{\text{cycle}}$  but source [6] claims the opposite. What is true?
- 3- What is the connectivity of the manufactured device? Is it possible to use there interfaces like SPI or I<sup>2</sup>C? In Table 5.3 you evaluate possible MCUs to be used also by presence of the I<sup>2</sup>S (Inter-IC Sound) interface. Why do you need I<sup>2</sup>S for the IO-Link device?

I evaluate handed thesis with classification grade **D - satisfactory**.

Date: **8.6.2017**

Signature: