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DATA ANALYSES OF ONBOARD DISTRIBUTION NETWORK

Paul BURLACU[1]
Mircea TARHOACA[2]
[1] Lecturer, PhD, "Mircea cel Batran" Naval Academy,
[2] PhD student, Eng., "Mircea cel Batran" Naval Academy

Abstract: *This paper presents a real-time software implementation for a vessel network supply data acquisition system. The software that are used is realized in LabVIEW and the hardware target is a NI-USB-6221 Data Acquisition System from National Instruments.*

Introduction

Onboard of a ship the voltage values are different starting with light, power supply and emergency supply so this is the reason of using transformers. All of this are covered by Naval Registers. For navy ships using the STANAG 1008 Register is compulsory, so this study is in total agreement of this.
Nowadays, ensuring the quality parameters for a ship network is a core requirements for Naval Registers, due to deployment of a large number of electrical equipment. Taking all the above in consideration, this paper presents a real-time software implementation for a vessel network supply data acquisition system. The entire work carried-out for hardware equipment that consists in NI-USB-6221 Data Acquisition System was done using a quite new technology for digital systems provided by National Instruments which allowed us to monitories the main characteristics of the ship supply network. Beside the default graphical characteristics that were obtained a description of the STANAG 1008 Register was presented in order to implement the Data Acquisition System.
NI measurement device and application software were configured for acquiring and sending data to device. The graphs were recorded so we gathered all information for this study.
Sensors and transducers detect physical phenomena. Signal conditioning components condition physical phenomena so that the measurement device can receive the data. The computer receives the data through the measurement device. Software controls the measurement system, telling the measurement device when and from which channels to acquire data. Software also takes the raw data, analyzes it, and presented it in a graphic mode and file report that can help us to understand the phenomena.
1. Purpose of measurements
The purpose of measurements performed in the on-shore power station is to determine the quality parameters of the provided energy (substation and converter - SC) in compliance with 1008 STANAG standard requirements
2. Supporting documents
In order to determine, define, calculate and measure the technical parameters to be met by the electrical power systems on board warships the requirements of STANAG 1008 NAV (EDITION) - Characteristicsofshipboard electrical power systems in the north of warships atlanticnavies Treaty have been used.
Compliance with the technical requirements of these standards ensures functional compatibility between the electrical power source, which is the ship's power system (including generators and distribution systems to the consumer), and the electrical consumers.

3. The importance of parameter measurement in the power station
Electrical parameter measurement in the distribution network primarily aims to check their compliance with the quality standards required by STANAG 1008 and the designer.
4. Technical report
The electric power distribution is achieved by help of two independent null insulated distributions.The measurements were performed on first semester of 2015, and lasted one hour.
The structure of the gauging and data processing system was as follows:

- R, S, T bars were chosen as measurement reference points of distribution …
- 3 rapid voltage converters and 1 frequency converter.
- gauging and calculation portable system Lenovo G510, with data acquisition card DAQCardNI-USB-6221 – National Instrumens SUA, with 16 channelswhichensure 16 bit analog/digital conversion at a samplingfrequency of 4.2 KS/s.
- voltage signal acquisition has been performed for 60 mins for #1 convertor and for 24 mins for #2 converter and instantaneous values of voltage and frequencythatweresimultaneous on the three phases wererecorded.
- data acquisition and processing software LabVIEW 2013 and application software designed for the acquisition platform.

The measurements were performed with no-load run sources, according to the situation on the day the measurements were performed.

5. Outcomes
Electric parameters defined as per STANAG 1008 were taken into consideration.
Calculation algorithms are in accordance with the definitions and formulas within this standard.
Data acquisitions and parameter calculation were performed with the help of the application software.
The outcomes are included in Table 1. Annexes 1.1 and 1.2 show graphs of the analysed parameters.

Conclusions

In no load running and according to the outcomes in table 1, it may be concluded that the quality requirements for the energy supply in compliance with STANAG 1008 have been met.

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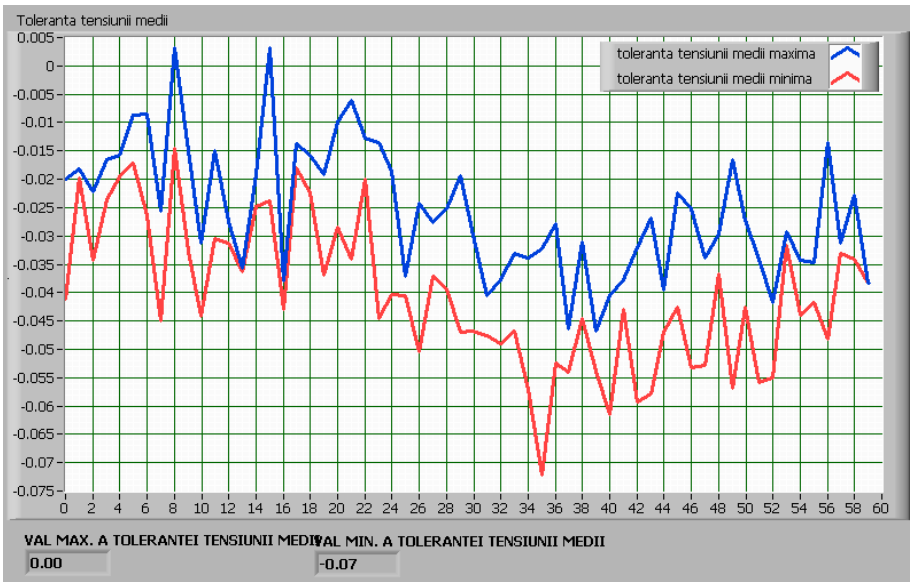
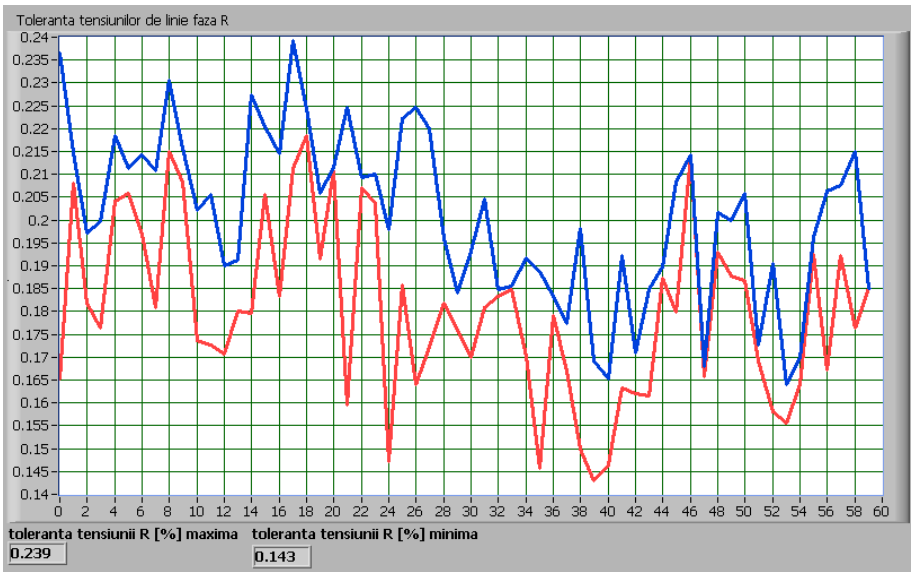
Table 1: PARAMETERS OF POWER STATION

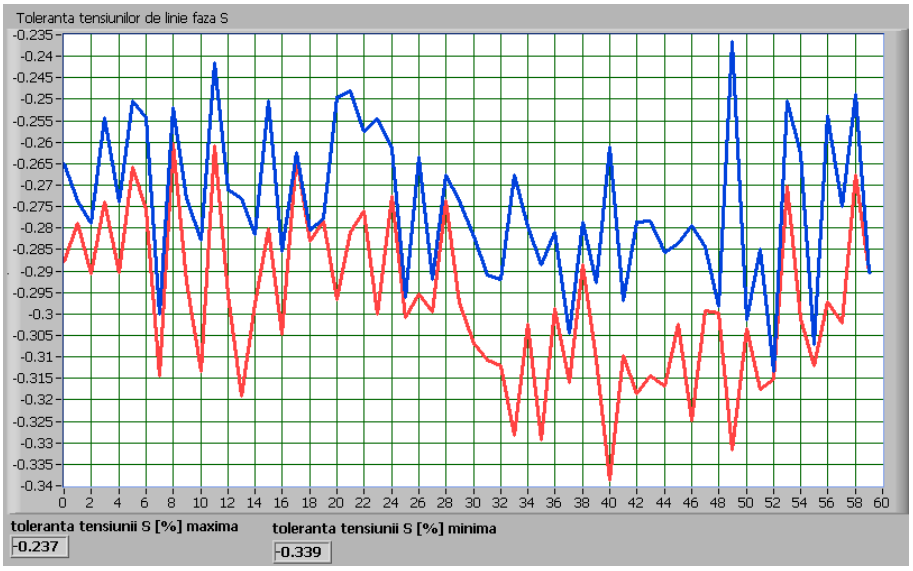
No parameter	Physical quantity	Values as per STANAG 1008			RECORDS					
		Disruptive factors			CONVERTER 1			CONVERTER 2		
		ext.	int.	cum	Phases			Phases		
					RS	ST	TR	RS	ST	TR
1	2	3	4	5	6	7	8	9	10	11
1	Nominal Voltage	447V (voltage adjusted in order to recover voltage drops on JT connector)								
1.1	Mean Stress Variation [%]	± 5		± 6	0.00			0.52		
					-0.07			-0.08		
1.2	Circuit Voltage Variation + 1.3 [%]	± 7		± 8	0.239	-0.237	0.045	0.511	0.495	0.562
					0.143	-0.339	-0.049	-0.167	0.036	-0.116
1.3	Circuit Voltage Unbalance Variation [%]		2		0.003			0.001		
1.4	Voltage Modulation		2 %		0.04	0.05	0.03	0.03	0.03	0.03
1.5	Voltage Transitory Variation [%]		± 16		condition that was automatically met since the domain was not exceeded ± 16%			condition that was automatically met since the domain was not exceeded ± 16%		
1.6	Recovery Time [s]		2 s		condition that was automatically met since the domain was not exceeded ± 16%			condition that was automatically met since the domain was not exceeded ± 16%		
1.7	Voltage Peak [kV]		2KV		<2 KV no voltage peaks during the defined period of time of <1ms			<2 KV no voltage peaks during the defined period of time of <1ms		
2	Waveform									
2.1	Total Harmonic Distortion [%]		5		1.303	1.421	1.330	1.274	1.352	1.325
2.2	Individual Harmonic [%]		3		1.181	1.252	1.160	1.162	1.215	1.173
2.3	Deviation Factor [%]		5		4.747	4.87	5.14	4.404	4.59	4.16
3	Frequency	60 Hz								

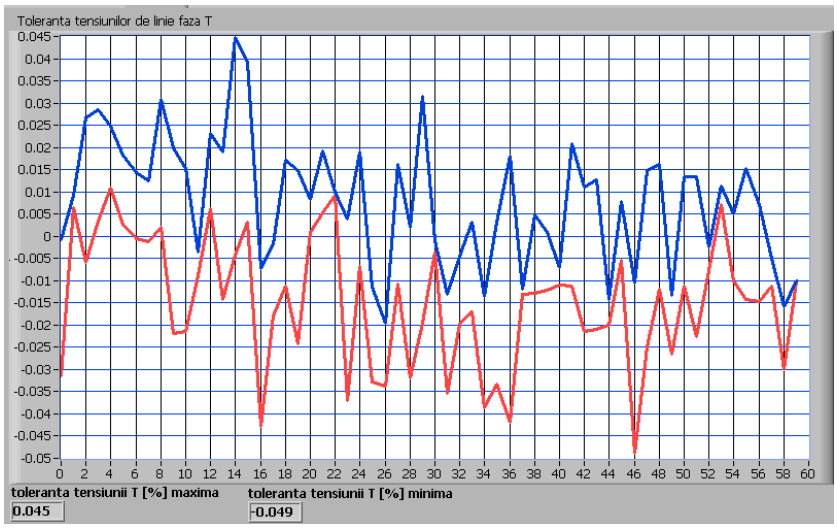
3.1	Frequency Variation [%]	± 3		± 5.5	0.017	0.064
					0.017	0.052
3.2	Frequency Modulation [%]		0.5		0.003	0.015
3.3	Frequency Transitory Variation [%]		± 4	± 5,5	condition that was automatically met since the domain was not exceeded 4%	condition that was automatically met since the domain was not exceeded 4%
3.4	Recovery Time [s]		2 s		condition that was automatically met since the domain was not exceeded 4%	<2 s. condition that was automatically met since the domain was not exceeded ± 4%

Annex 1
Quality parameters according STANAG 1008
Converter 1, acquisition time 60 minute

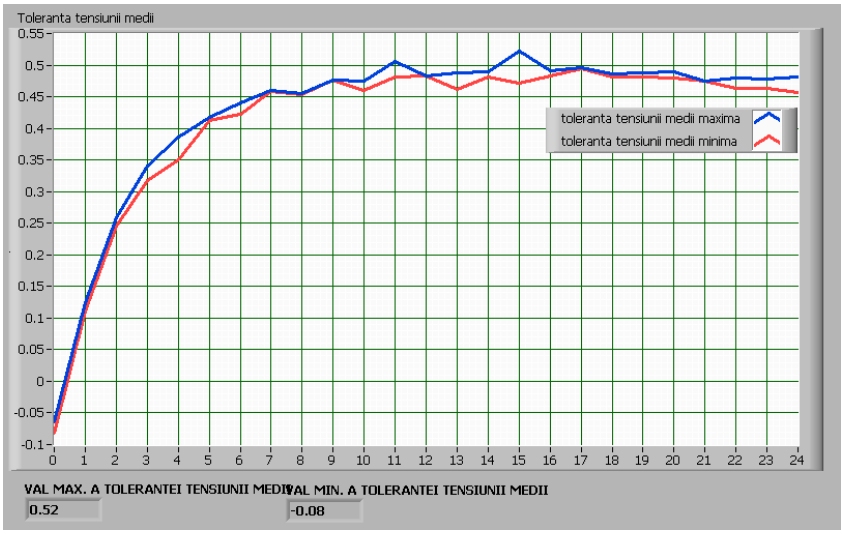


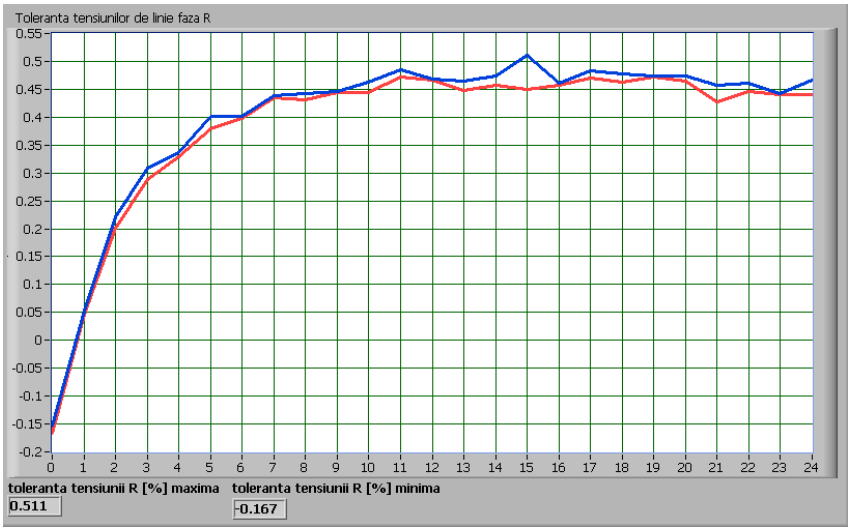


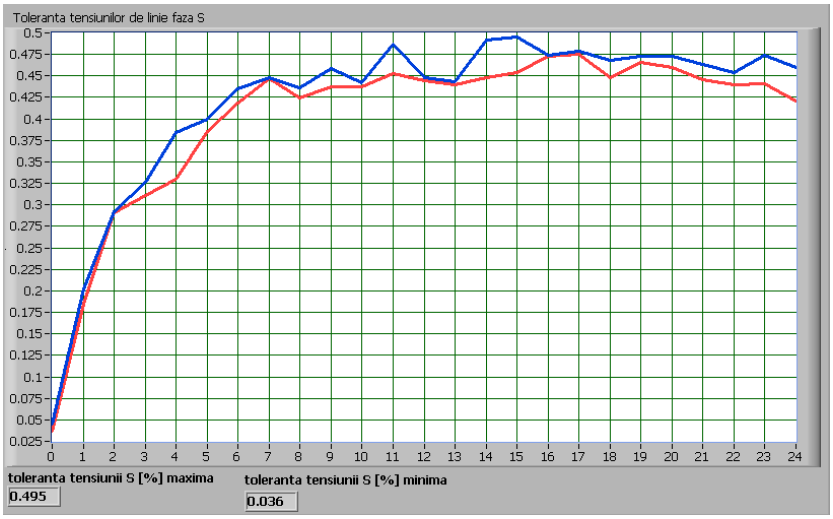


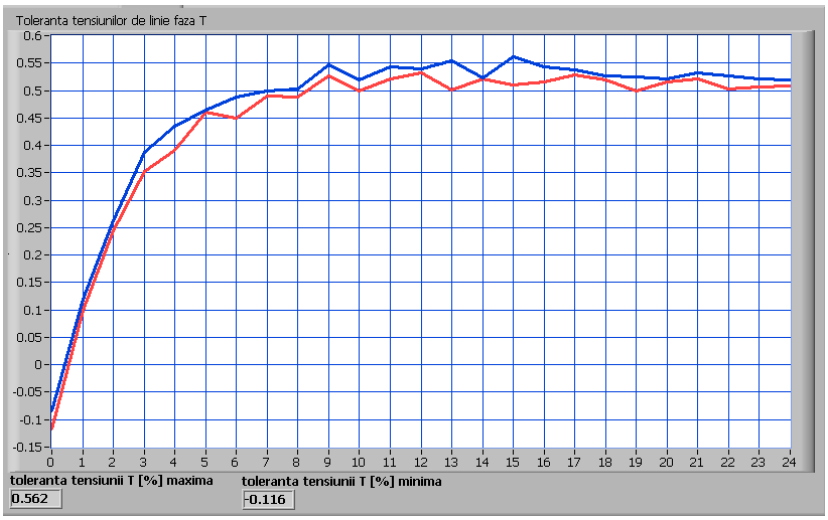


Annex 2
Quality parameters, 440V, 60 Hz according STANAG 1008
Converter 1, acquisition time 24 minute






Toleranta tensiunilor de linie faza S
toleranta tensiunii S [%] maxima
0.495
toleranta tensiunii S [%] minima
0.036


Toleranta tensiunilor de linie faza T
toleranta tensiunii T [%] maxima
0.562
toleranta tensiunii T [%] minima
-0.116