**Brief information about the project**

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| URN and project name: | AP09562138 "Research on innovative microprocessor-based resource-saving relay protection device" |
| Implementation Timeline: | 23.06.2021-31.12.2021 |
| Relevance: | Relay protection devices use information from current transformers (CTs) to obtain information, which in 6-220 kV electrical installations contain from 10 to 90 kg of high-quality copper and steel and in some cases have inadmissible errors in transient modes at significant short-circuit currents. In addition, dangerous voltages may occur when their secondary circuits are broken.  Development of protections using other transducers will allow to exclude disadvantages and increase reliability of the whole system of protection by duplicating both traditional protections and CTs. We propose to use reed switches, which in some properties are superior to other magnetically controlled elements, (reed switch can perform the functions of both CT and relay). |
| Objective: | To improve the reliability of power supply system operation by developing a microprocessor-based resource-saving relay protection device, which does not need measuring transformers to obtain information, and can give a new impetus to the development of relay protection devices. |
| Expected and achieved results: | The following results have been achieved:  - microprocessor base for relay protection device construction was analyzed and selected;  - a scheme for connecting the reed sensor to the selected microprocessor was -developed and several variations of the program code were written;  - experimental research of the created microprocessor-based resource-saving relay protection device with the use of reed switches is carried out;  - The applicability of the created device was analyzed on the basis of the obtained characteristics and compared with existing relay protection -devices receiving information from measuring transformers.  Possible applications of the results obtained. The developed several variations of the program code for the realization of reed relay protection devices with different set of functions will provide a basis for further research and construction of systems in which several relay protection devices can communicate with each other and function based on new algorithms.  In foreign periodicals:  1) The article "Determination of the magnitude of the short-circuit surge current for the construction of relay protection on reed switches and microprocessors" was published in the peer-reviewed scientific edition included in the Scopus database: Eastern-European Journal of Enterprise Technologies (percentile 44) [(https://www.scopus.com/sourceid/21100450083](https://www.scopus.com/sourceid/21100450083));  2) prepared and submitted for publication the article "Determination of reed switch parameter changes in resource-saving relay protection devices of the electrical part of power installations" in the conference proceedings: X All-Russia Scientific Conference with International Participation "Thermophysical Basis of Energy Technologies" (TOET-2021) on the results of the conference will be published in the journal indexed in SCOPUS and Web Of Science;  3) The article "Method for indirect measurement of the phase capacitance of a distribution substation and the single-phase earth fault current" was published in the proceedings of the conference: EUROCON 2021 - 19th IEEE International Conference on Smart Technologies, Proceedings, 2021, pp. 513-517 [(](https://ieeexplore.ieee.org/document/9535640)https://ieeexplore.ieee.org/document/9535640);  4) the article "Analysis and selection of microprocessor base for building relay protection" was prepared and submitted for publication in the conference materials (the report was made at the conference, comments came, repeated review): II International Scientific and Technical Conference "Smart Energy Systems 2021" SES-2021, (the conference articles in English and those that passed the selection will be published by the publishing house in the journal E3S Web of Conferences (Scopus Q3/Q4));  In domestic periodicals:  5) an article was published in Scientific Journal of Astana IT University ISSN (P): 2707-9031, ISSN (E): 2707-904X ([Journal-AITU\_6vol-1-52-58-1.pdf (astanait.edu.kz)](https://sj.astanait.edu.kz/wp-content/uploads/2021/10/Journal-AITU_6vol-1-52-58-1.pdf)):  A. Neftisov, O. Talipov, O. Andreeva / Device for determining the value of the steady-state electricity in the primary circuit using a reed switch and a microprocessor / DOI: 10.37943/AITU.2021.75.95.005 / Scientific Journal of Astana IT University ISSN (P): 2707-9031, ISSN (E): 2707-904X / No. 6 52 - 58 p.  Patents  6) The patent of the Republic of Kazakhstan on useful model "Device for realization of method of identification of alternating current in a conductor by means of closing reed switch and microprocessor" (application № 123585, incoming № 2021 - 34310 from 21.10.2021) was received; |
| **Composition of the research team** | |
| C:\Users\Win10_Game_OS\Downloads\WhatsApp Image 2022-02-14 at 15.19.48.jpeg | **Neftisov Alexander Vitalievich** |
| Scientific supervisor of the project |
| Date of birth: 16.05.1989. |
| Academic Degree/Academic Degree: PhD, associate professor |
| Main place of work: Astana IT University |
| Area of expertise: scientific direction - relay protection, automation, Industry 4.0. |
| Researcher ID \* |
| Scopus Author ID\*56001855300  https://www.scopus.com/authid/detail.uri?authorId=56001855300 |
| * [https://orcid.org/0000-0003-4079-2025](https://www.scopus.com/redirect.uri?url=https://orcid.org/0000-0003-4079-2025&authorId=56001855300&origin=AuthorProfile&orcId=0000-0003-4079-2025&category=orcidLink%22) |
| List of publications:  1) Determination of the magnitude of short-circuit surge current for the construction of relay protection on reed switches and microprocessors // Eastern-European Journal of Enterprise Technologies Vol. 6 No. 5 (114) (2021): Applied physics 41-48 p. [https://doi.org/10.15587/1729-4061.2021.245644 //](https://doi.org/10.15587/1729-4061.2021.245644%20//) Alexandr Neftissov, Andrii Biloshchytskyi, Olzhas Talipov, Oxana Andreyeva  2) Method for indirect measurement of the phase capacitance of a distribution substation and the single-phase earth fault current // EUROCON 2021 - 19th IEEE International Conference on Smart Technologies, Proceedings, 2021, pp. 513-517 // Alexandr Neftissov Biloshchytskyi, A., Novozhilov, A., Kislov, A..  3) Analysis and selection of microprocessor base for building relay protection // "Smart Energy Systems 2021" SES-2021 E3S Web of Conferences (Scopus Q3/Q4)); // Alexandr Neftissov Oxana Andreyeva, Olzhas Talipov, Lalita Kirichenko and Yuri Piskovatskiy  4) Device for determining the value of the steady-state electricity in the primary circuit using a reed switch and a microprocessor // DOI: 10.37943/AITU.2021.75.95.005 / Scientific Journal of Astana IT University ISSN (P): 2707-9031, ISSN (E): 2707-904X / #6 52 - 58 p. // Alexandr Neftissov O. Talipov, O. Andreeva  5) DETERMINATION OF CHANGES IN THE PARAMETERS OF REED SWITCHES IN RESOURCE-SAVING RELAY PROTECTION DEVICES OF THE ELECTRICAL PART OF POWER PLANTS // X All-Russian Scientific Conference with International Participation "THERMOPHYSICAL BASES OF ENERGY TECHNOLOGIES" // Alexandr Neftissov Talipov O.M., Andreeva O.A., Kirichenko L.N..  6) Determination of changes in the parameters of reed switches in resource-saving relay protection devices of the electrical part of power plants // Republican scientific and technical journal "University enbekteri - Proceedings of the University" // Alexandr Neftissov O. Talipov. Talipov, O. Andreeva |
| **https://tou.edu.kz/arm/storage/images/employees/1512/5e5e32feeb8bc2.48936159.jpg** | **Talipov Olzhas Manarbekovich** |
| Senior Scientist |
| Date of birth: 08.03.1980. |
| Academic Degree/Academic Degree: PhD Dr, associate professor |
| Primary employment: NJSC "Toraighyrov University" |
| Area of expertise: scientific direction - relay protection, electric power engineering, heat power engineering. |
| Researcher ID \* |
| Scopus Author ID\* 57196418466  https://www.scopus.com/authid/detail.uri?authorId= 57196418466 |
| https://orcid.org/0000-0002-8355-1769 |
| List of publications:  1) Determination of the magnitude of short-circuit surge current for the construction of relay protection on reed switches and microprocessors // Eastern-European Journal of Enterprise Technologies Vol. 6 No. 5 (114) (2021): Applied physics 41-48 p. [https://doi.org/10.15587/1729-4061.2021.245644 //](https://doi.org/10.15587/1729-4061.2021.245644%20//) Alexandr Neftissov, Andrii Biloshchytskyi, Olzhas Talipov, Oxana Andreyeva  2) Method for indirect measurement of the phase capacitance of a distribution substation and the single-phase earth fault current // EUROCON 2021 - 19th IEEE International Conference on Smart Technologies, Proceedings, 2021, pp. 513-517 // Alexandr Neftissov Biloshchytskyi, A., Novozhilov, A., Kislov, A..  3) Analysis and selection of microprocessor base for building relay protection // "Smart Energy Systems 2021" SES-2021 E3S Web of Conferences (Scopus Q3/Q4)); // Alexandr Neftissov Oxana Andreyeva, Olzhas Talipov, Lalita Kirichenko and Yuri Piskovatskiy  4) Device for determining the value of the steady-state electricity in the primary circuit using a reed switch and a microprocessor // DOI: 10.37943/AITU.2021.75.95.005 / Scientific Journal of Astana IT University ISSN (P): 2707-9031, ISSN (E): 2707-904X / #6 52 - 58 p. // Alexandr Neftissov O. Talipov, O. Andreeva  5) DETERMINATION OF CHANGES IN THE PARAMETERS OF REED SWITCHES IN RESOURCE-SAVING RELAY PROTECTION DEVICES OF THE ELECTRICAL PART OF POWER PLANTS // X All-Russian Scientific Conference with International Participation "Teplofizicheskiye osnovy ENERGETICheskikh TECHNOLOGIY" // Alexandr Neftissov Talipov O.M., Andreeva O.A., Kirichenko L.N..  6) Determination of changes in the parameters of reed switches in resource-saving relay protection devices of the electrical part of power plants // Republican scientific and technical journal "University enbekteri - Proceedings of the University" // Alexandr Neftissov O. Talipov. Talipov, O. Andreeva |
|  | **Andreeva Oksana Aleksandrovna** |
| Project position: Senior Researcher |
| Date of birth: 12.09.1973 |
| Ph.D. in Engineering, Associate Professor |
| Primary employment: NJSC"Toraighyrov University" |
| Research interests: Methods and devices for diagnostics of electric machines, automation of technological processes and productions. |
| Researcher ID https://app.webofknowledge.com/author/#/record/6141347 |
| Scopus Author ID <https://www.scopus.com/authid/detail.uri?authorId=56177710100> |
| ORCID\* [**https://orcid.org/0000-0001-8680-5712**](https://orcid.org/0000-0001-8680-5712) |
| List of publications \*\* and patents \*\*  1) Investigation of the properties of reed switches in devices for resource-saving relay protection of the electrical part of power plants  Neftissov, A.V., Andreyeva, O.A., Sarinova, A.Z.  AIP Conference Proceedingsthis link is disabled, 2021, 2337, 030010  2) Method of diagnostics of the short-circuited rotor damage on point induction converters  Andreyeva, O., Neftissov, A., Mileiko, A..  AIP Conference Proceedingsthis link is disabled, 2021, 2337, 030001  3) The resource-efficient device for protecting the electrical part of power plants  Neftissov, A.V., Kislov, A.P., Andreyeva, O.A..  AIP Conference Proceedings this link is disabled, 2020, 2212, 020043  4) Simulation of three-phase transformer operational conditions  Volgina, E., Novozhilov, A., Kolesnikov, Y., ...Novozhilov, T., Andreeva, O..  News of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences this link is disabled, 2019, 5(437), pp. 26-33  5) Optical voltage converters based on electro-optical effect. Bulletin of PSU, Energetics Series No.1, 2020. , Andreeva O.A., Kaidar A.B., Kaidar M.B., Shapkenov B.K., Markovsky V.P., Talipov O.M., Kuanyshbai Sh.S.  6) Telecommunication systems as a transport environment of automated control systems and problems of information security. Bulletin of PSU, Energetics Series No.1, 2020. P.458-464, O.A. Andreeva, A.D. Tastenov, M.A. Chuprina. |