DEVELOPMENT OF THE NEW METHOD FOR TRANSMISSION OF CURRENT AND VOLTAGE MEASUREMENTS IN ACCORDANCE WITH IEC 61850 PROVIDING REDUCTION OF THE TRAFFICS TO THE "PROCESS BUS

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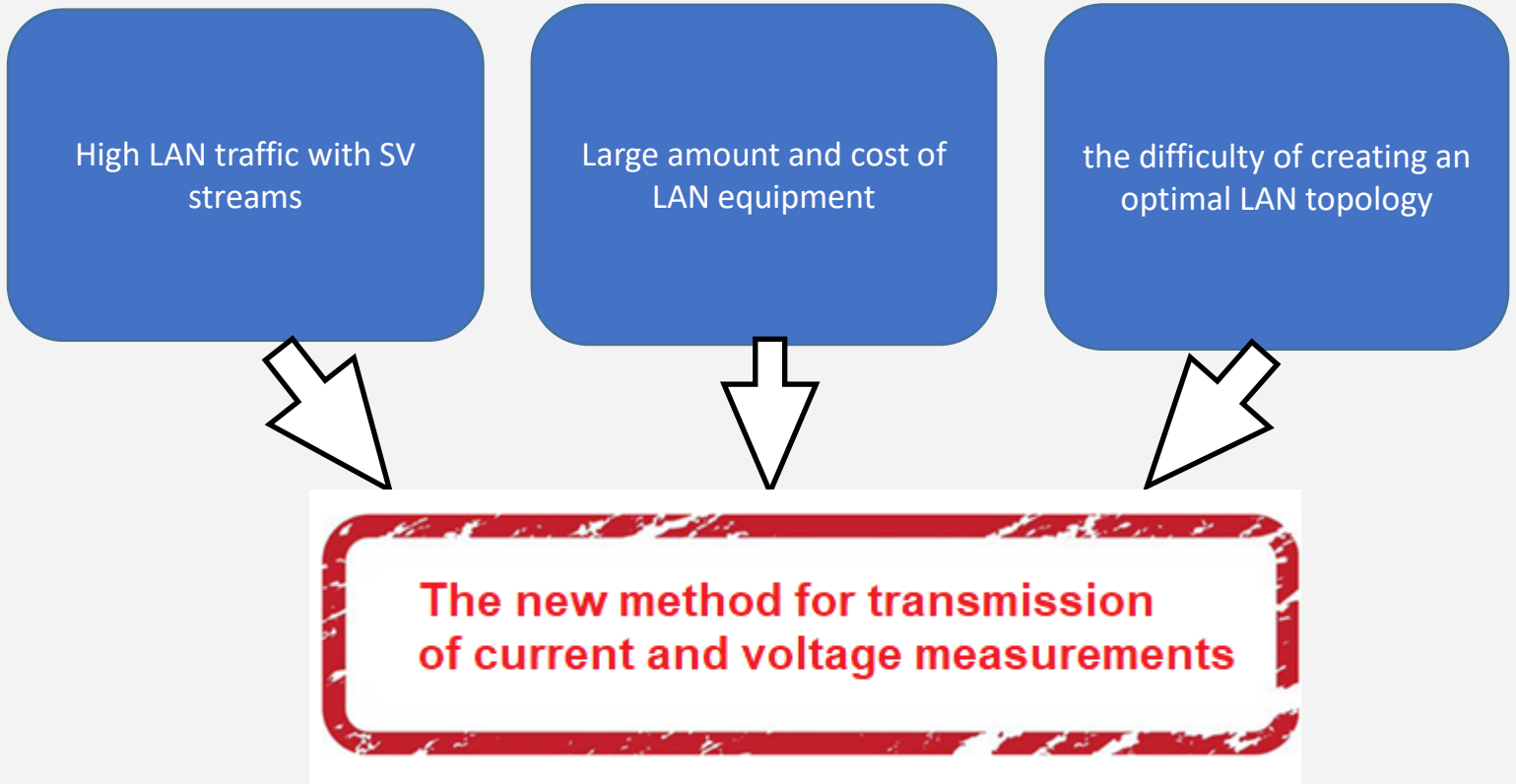
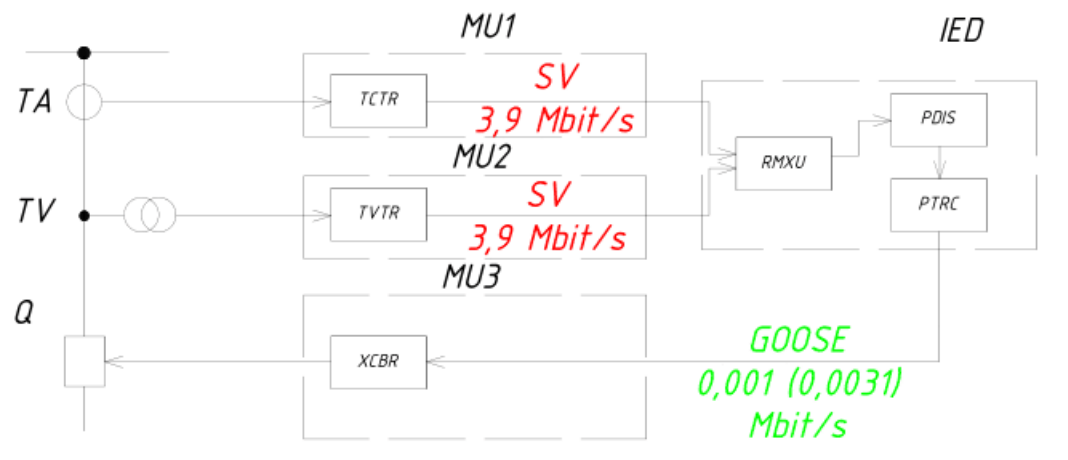
USER SPOTLIGHT SERIES BY RTDS Technologies

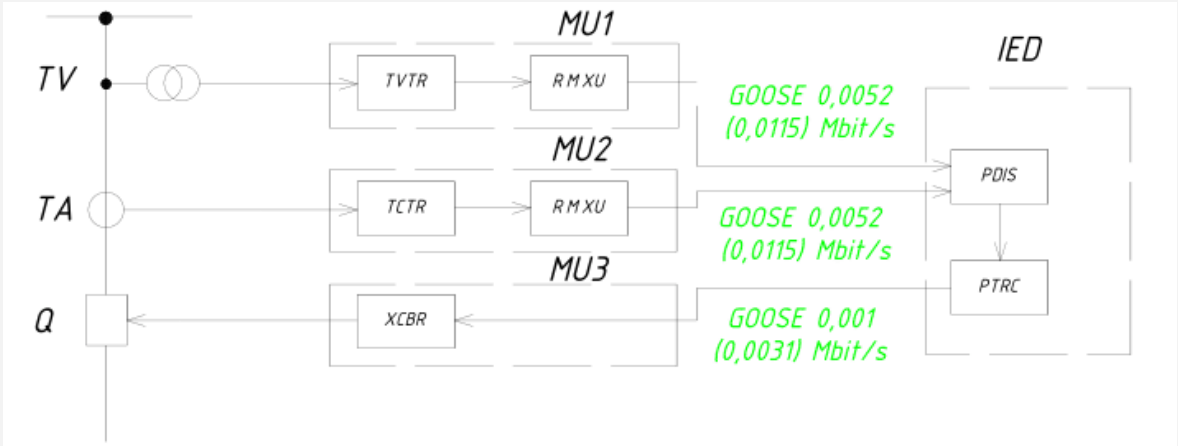
THE NEW METHOD FOR TRANSMISSION OF CURRENT AND VOLTAGE MEASUREMENTS



MEASUREMENT TRANSMISSION METHODS

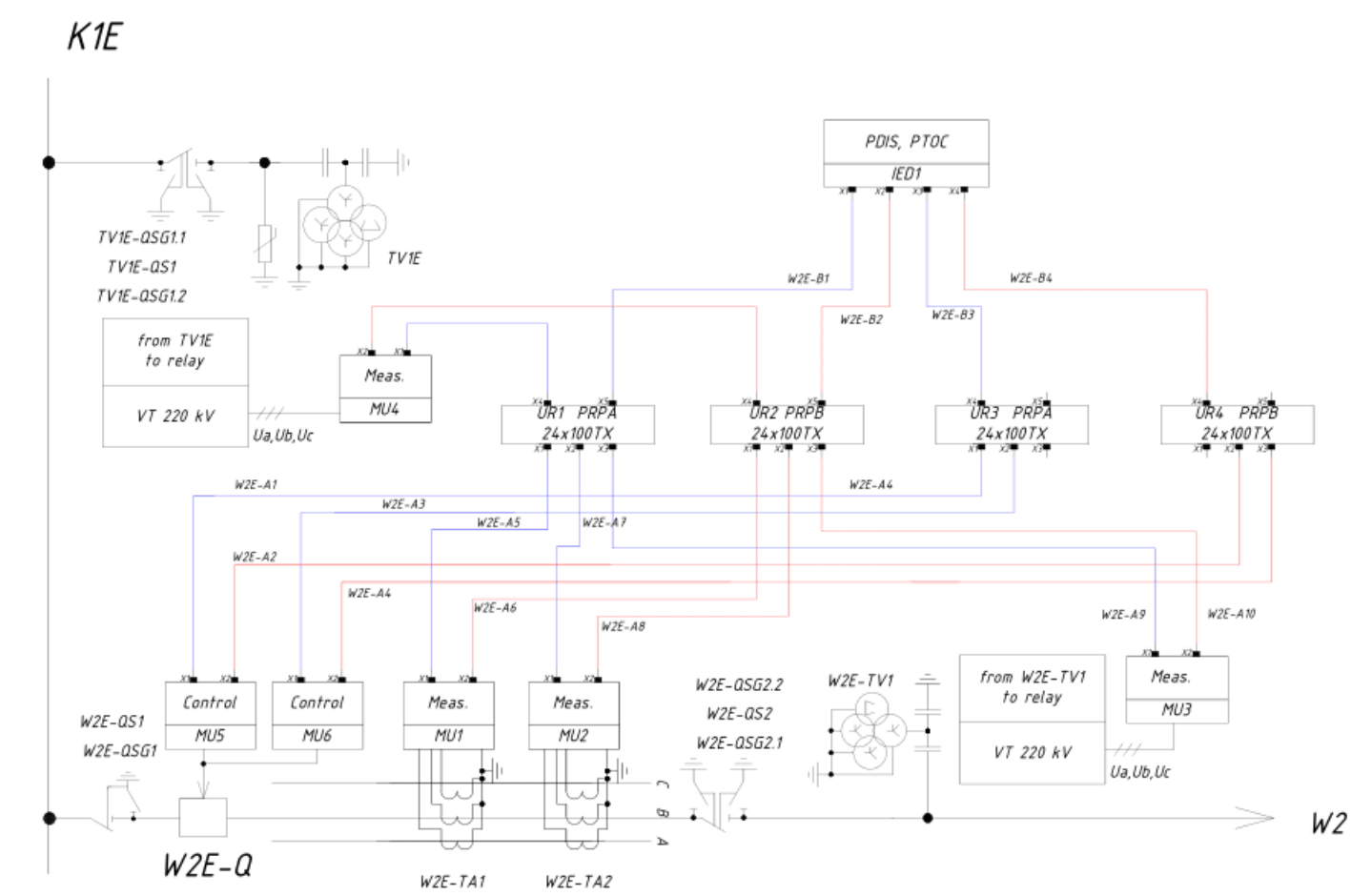


OLD method of transmitting measurements via SV protocol.

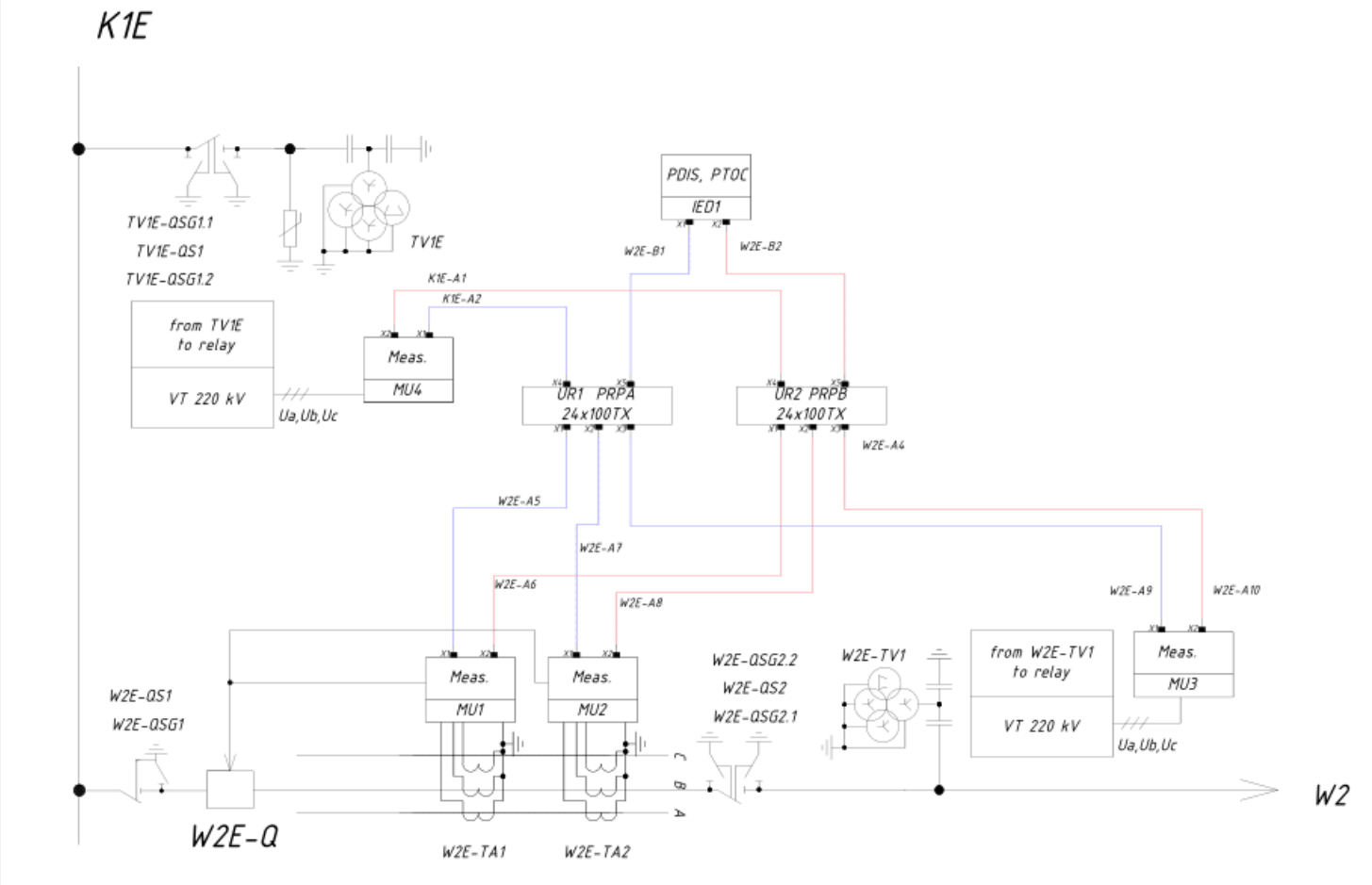


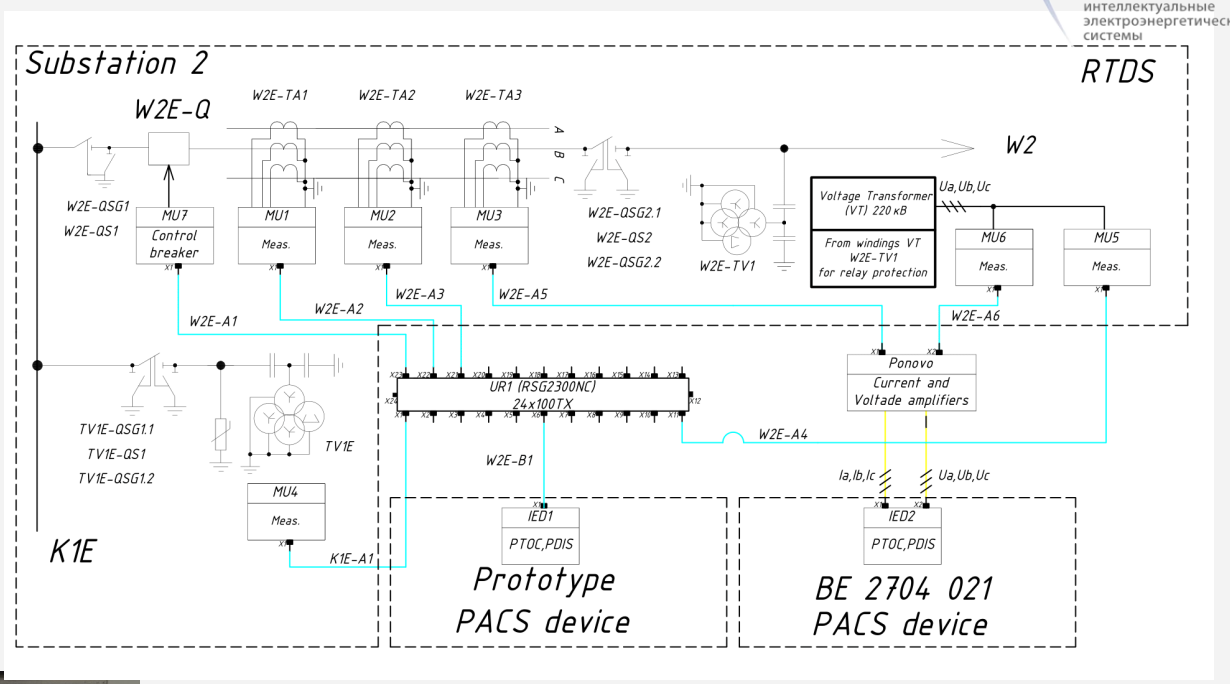
NEW method of transmitting measurements via GOOSE protocol.

STRUCTURAL SCHEME WITH SV



STRUCTURAL SCHEME WITH GOOSE

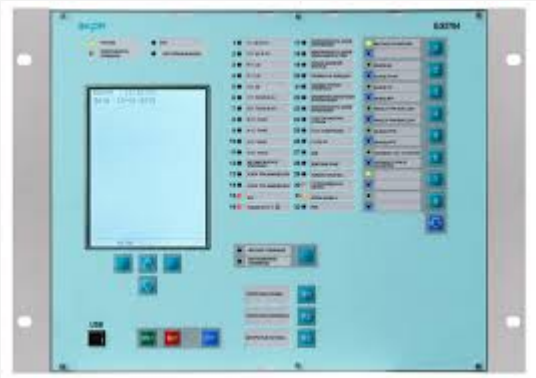




Connection scheme of the prototype PACS device for digital substation to the RTDS

TESTING THE NEW METHOD OF MEASUREMENTS TRANSMISSION

SV+GOOSE



IED by EKRA

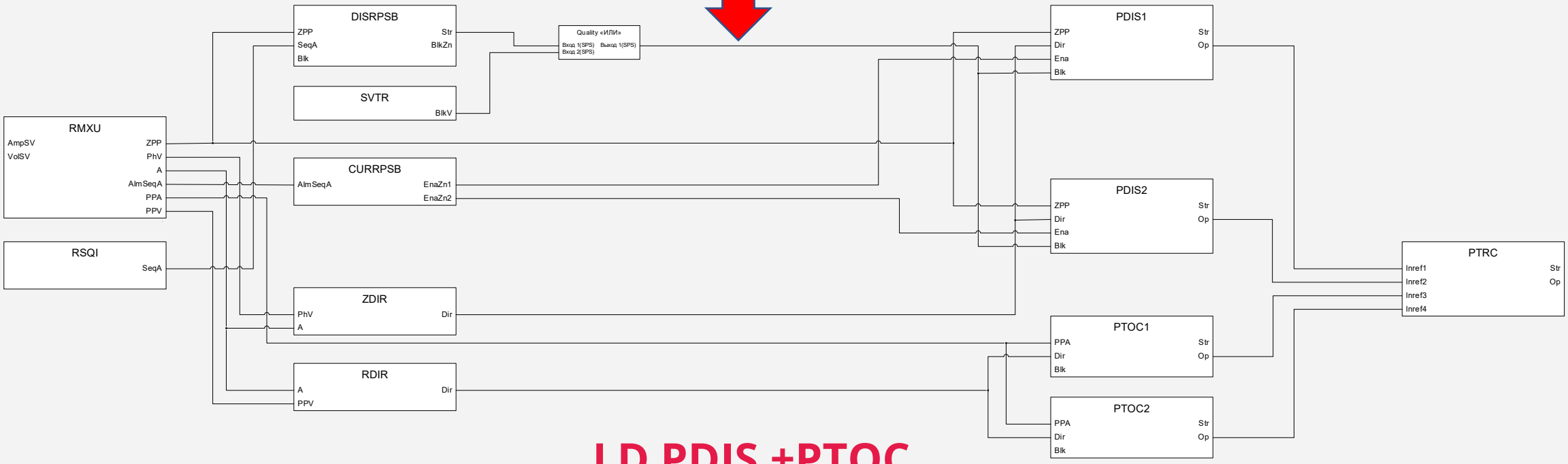
SV+GOOSE

Prototype IED

GOOSE+GOOSE (new method)

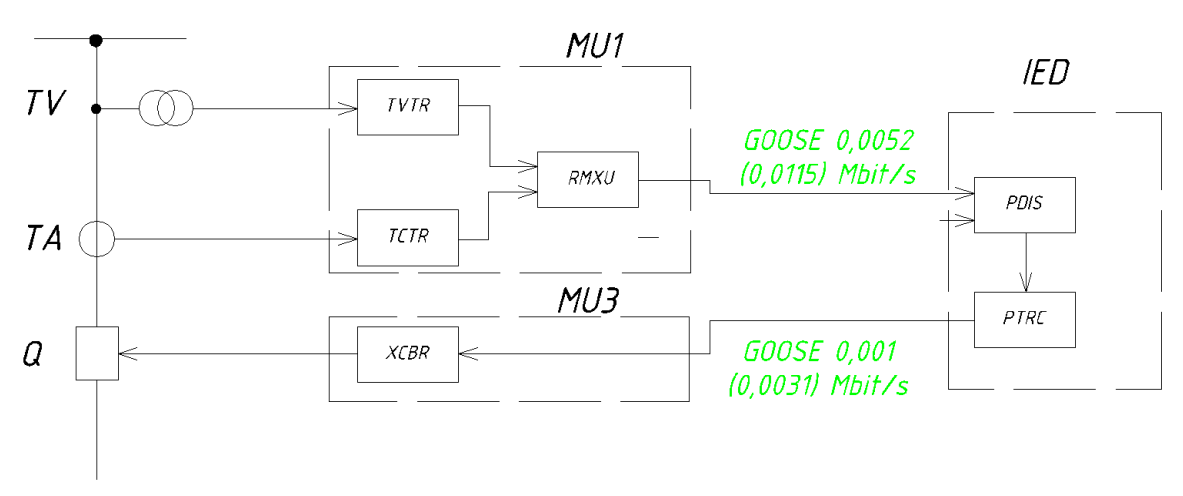
Prototype IED

LOGIC FOR PROTOTYPE IED

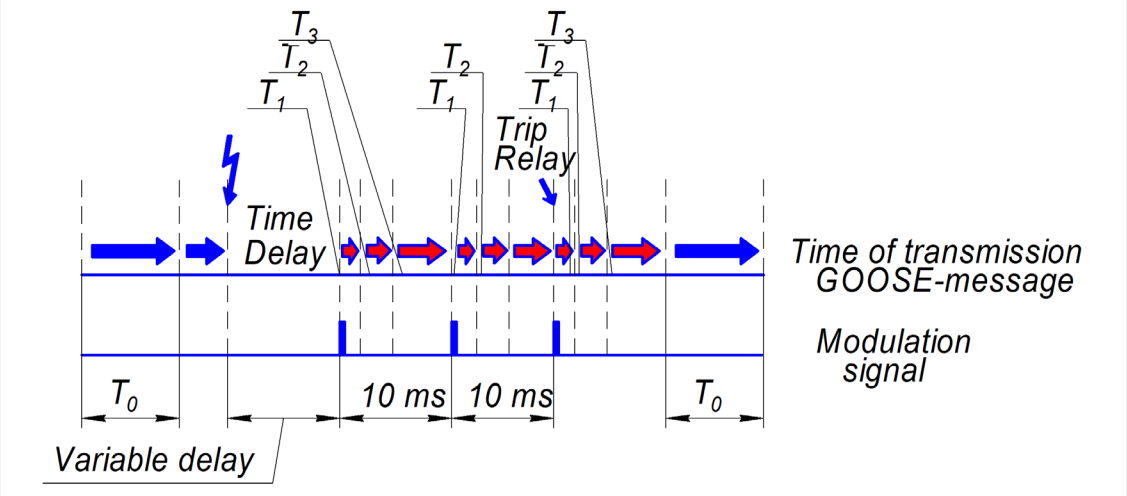


LD PDIS +PTOC

NEW METHOD TRANSMISSION FOR MEASUREMENTS

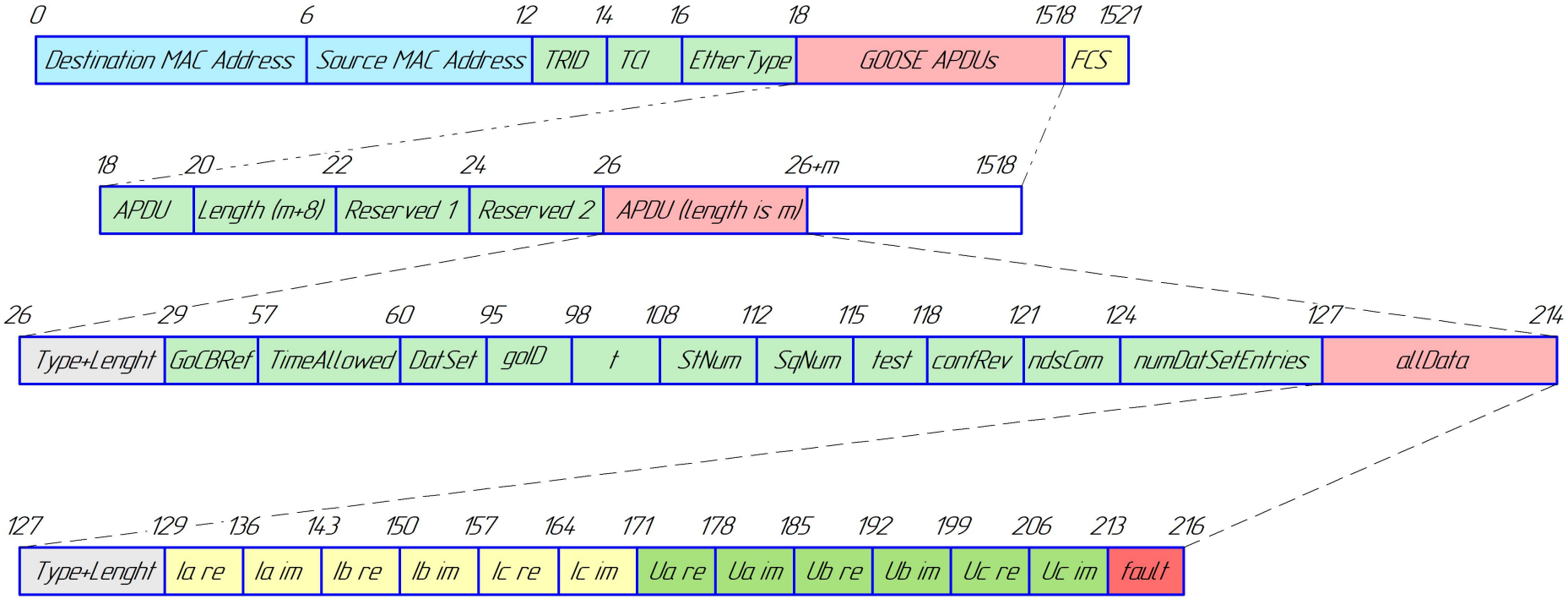


General scheme GOOSE sending



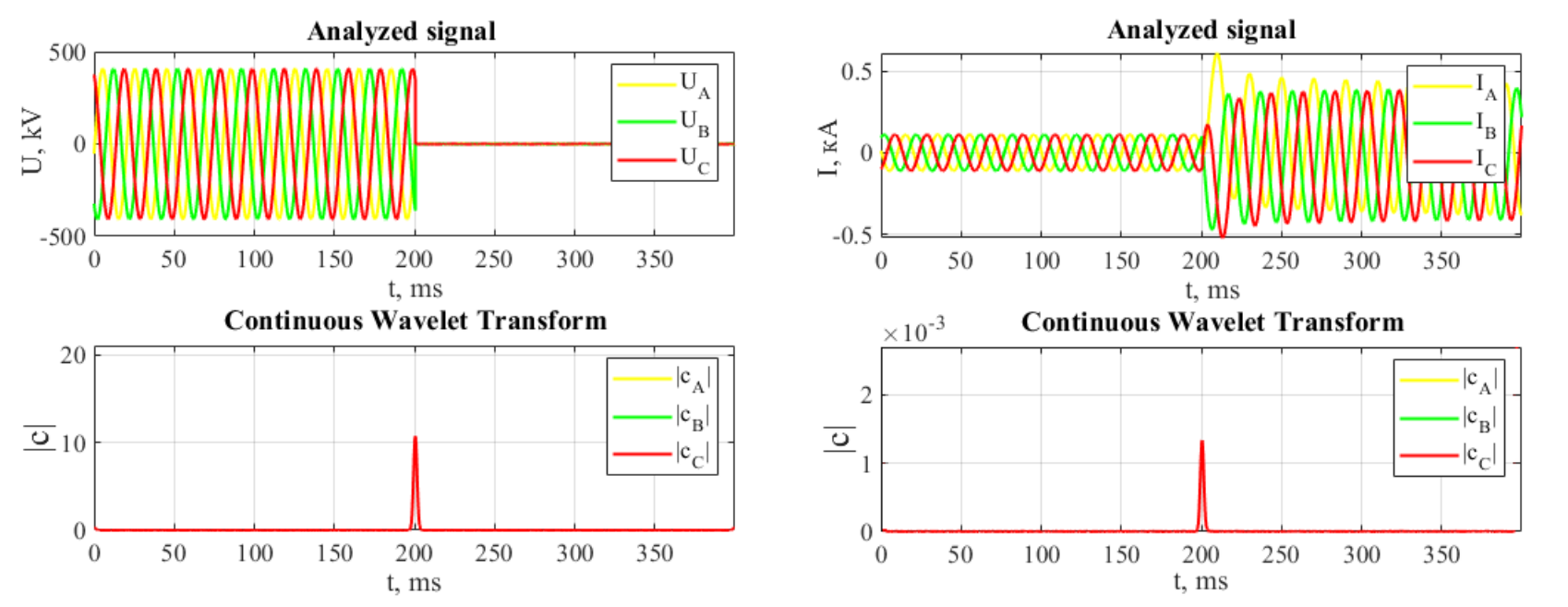
GOOSE sending algorithm

NEW METHOD TRANSMISSION FOR MEASUREMENTS



GOOSE structure

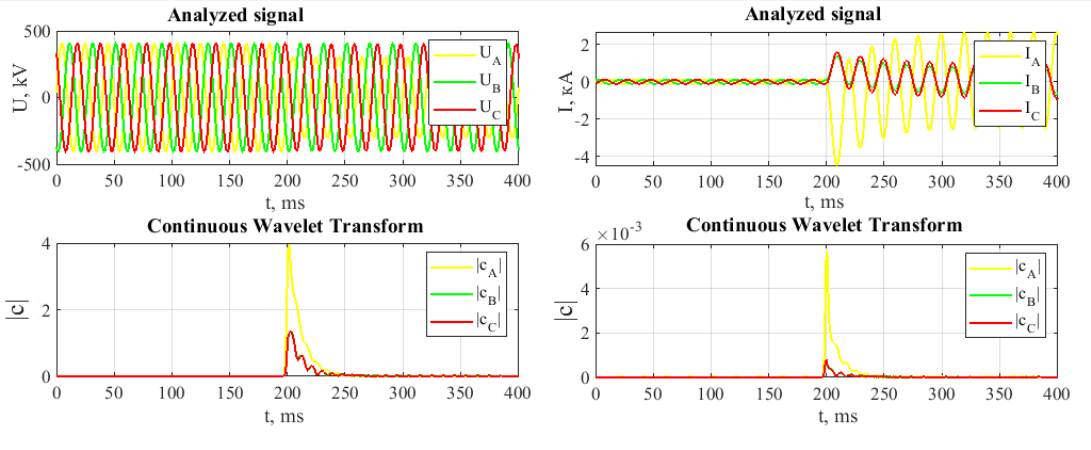
FAULT DETECTOR ALGORITHM



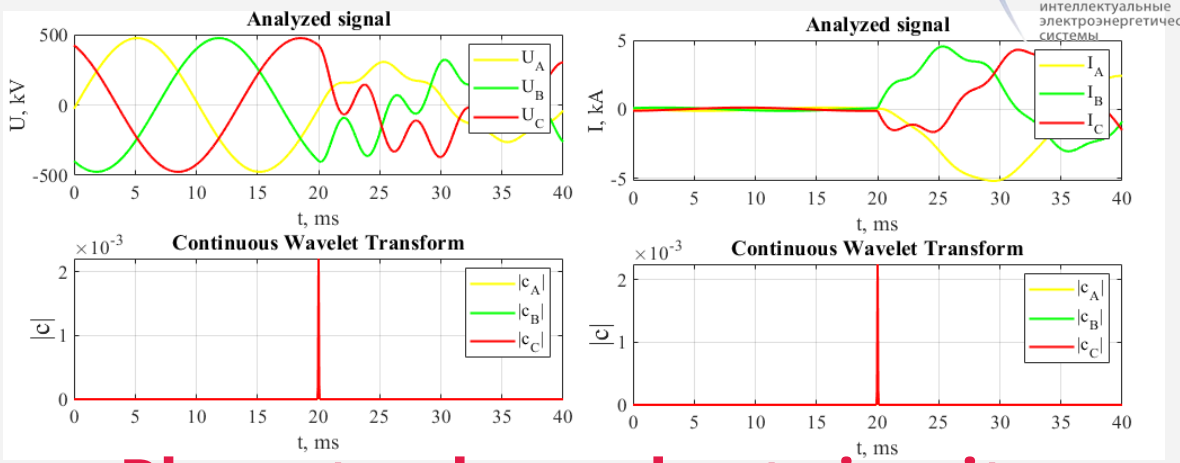
Fault detector

moment of occurrence of an emergency disturbance is accompanied by the maximum of the function obtained by the Morlet wavelet transform.

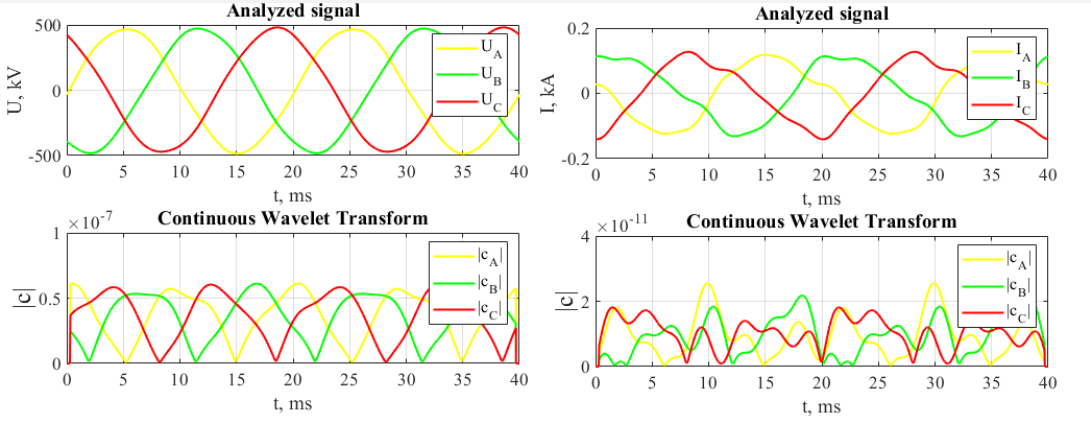
TEST CASES FOR FAULT DETECTOR



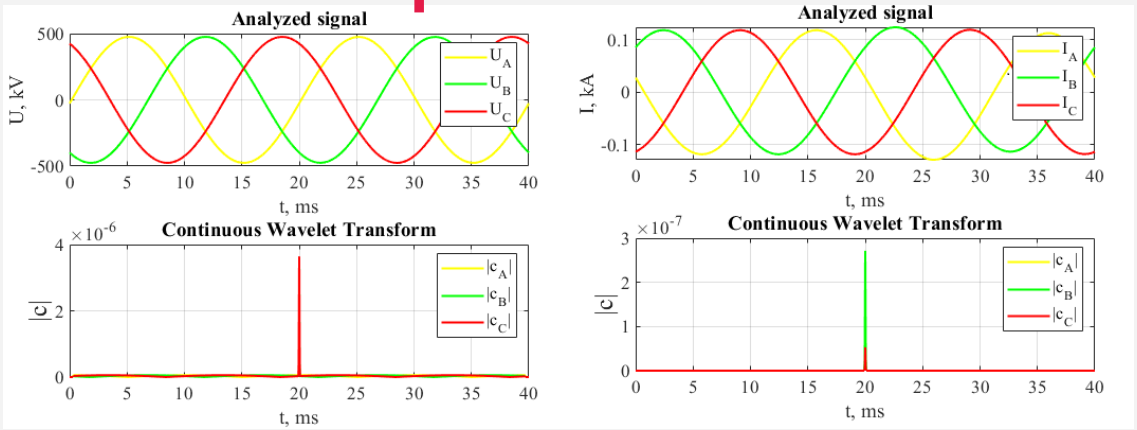
Single phase short circuit case



Phase to phase short circuit case

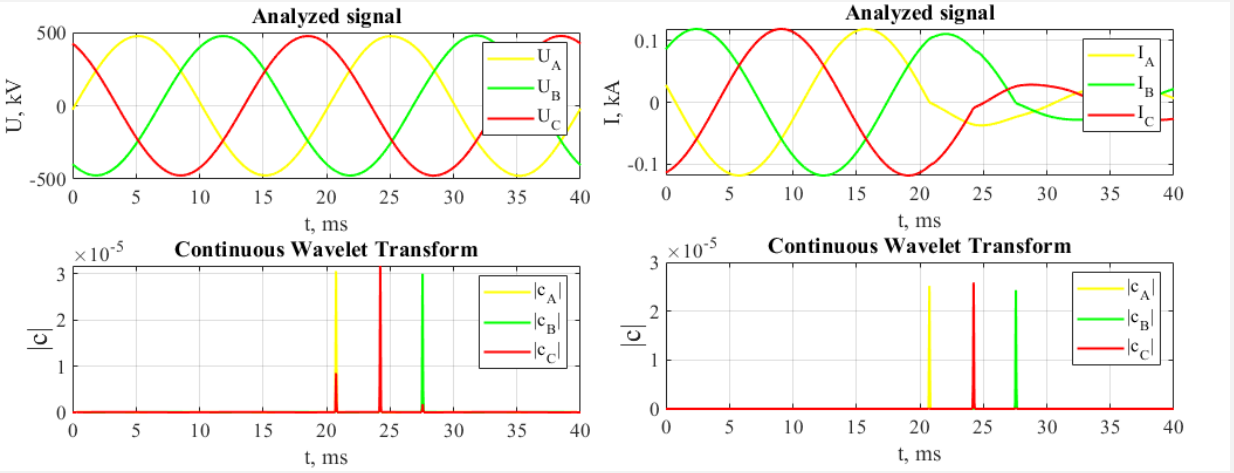


Non-sinusoidal case

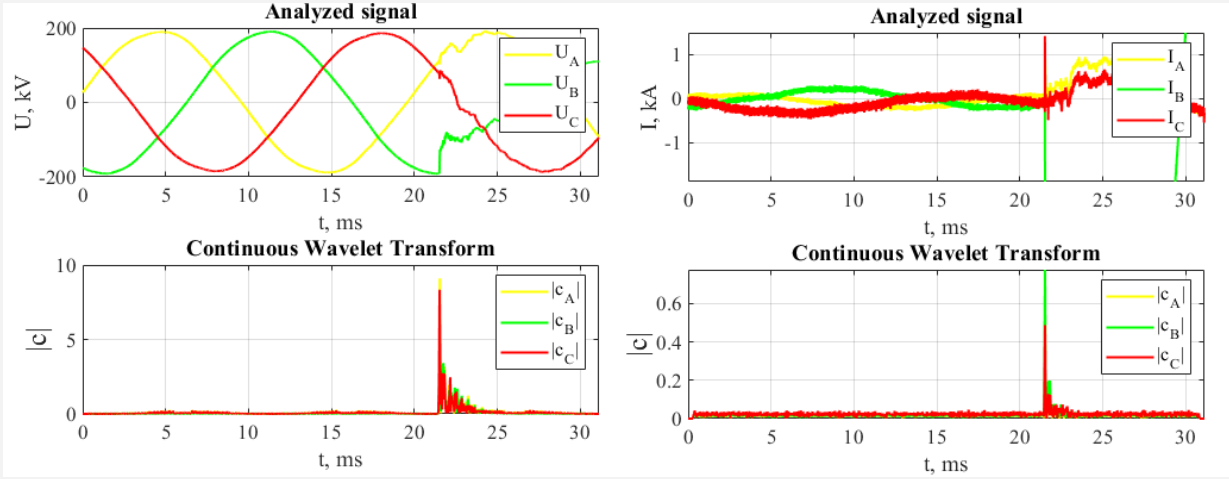


Load Power case

TEST CASES FOR FAULT DETECTOR

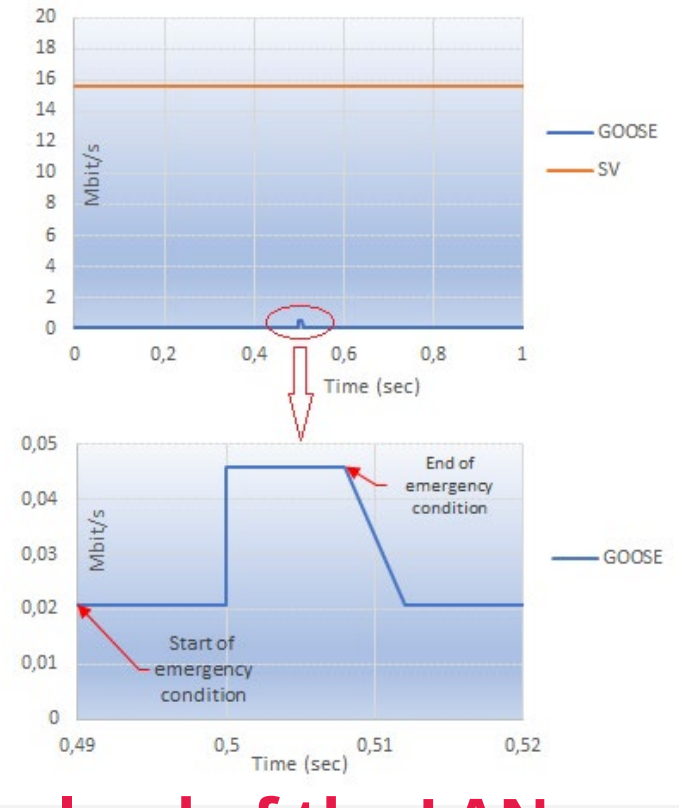


Line disconnection case

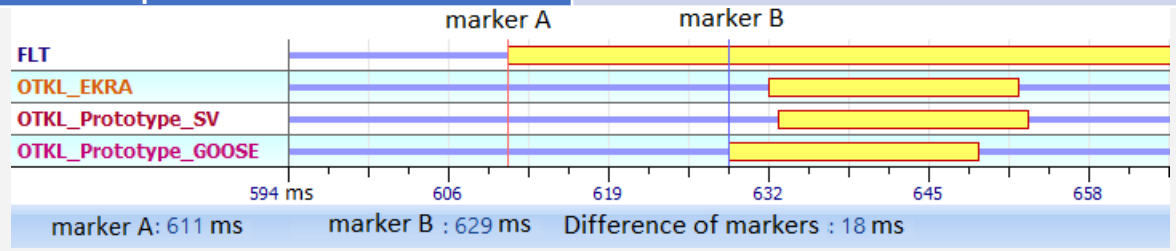


Real short circuit case

EVALUATION OF THE ROUND TRIP TIME FROM PACS FUNCTIONS START TO CIRCUIT BREAKER OPENING COMMANDS



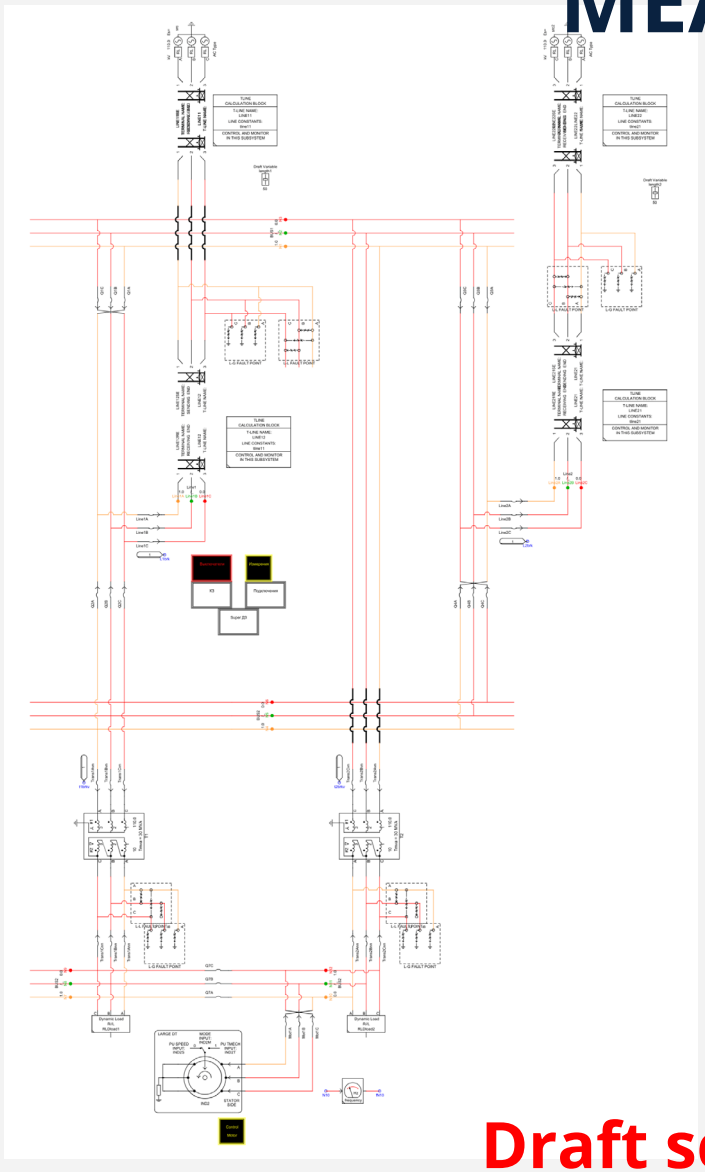
Measurement transfer option	PACS device
Transmission of current and voltage measurements using the SV protocol and sending a command to open a circuit breaker using the GOOSE protocol	Device protection series BE 2704 021 production Research and Production Enterprise "EKRA".
Transmission of current and voltage measurements using the SV protocol and sending a command to open a circuit breaker using the GOOSE protocol	Industrial computer with developed software that implements the functions of relay protection devices and data transfer protocols
Transmission of measurements of currents and voltages and transmission of commands to open a circuit breaker using the GOOSE protocol.	Industrial computer with developed software that implements the functions of relay protection devices and data transfer protocols



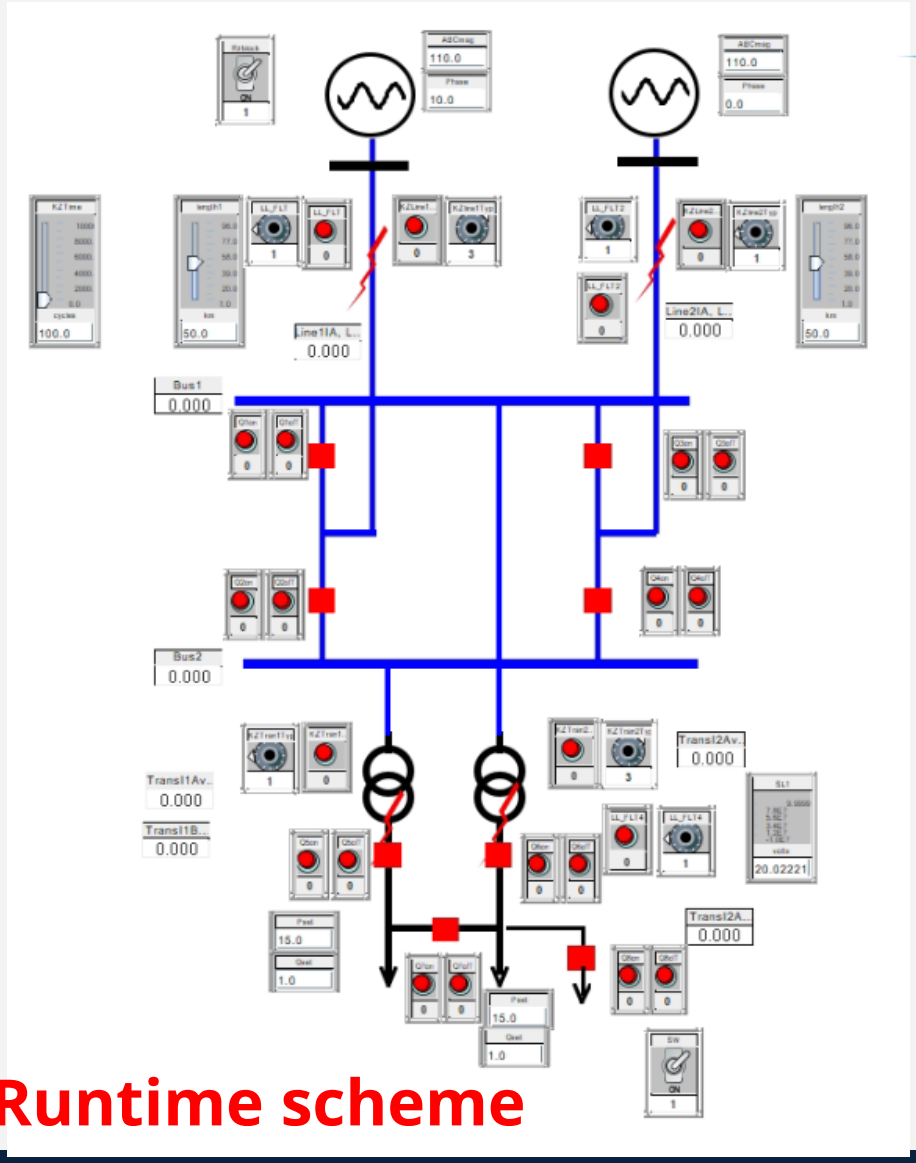
The load of the LAN communication channel when transmitting an SV and GOOSE messages

Comparison of the execution time of the PACS functions

TESTING THE NEW METHOD OF MEASUREMENTS ON RTDS

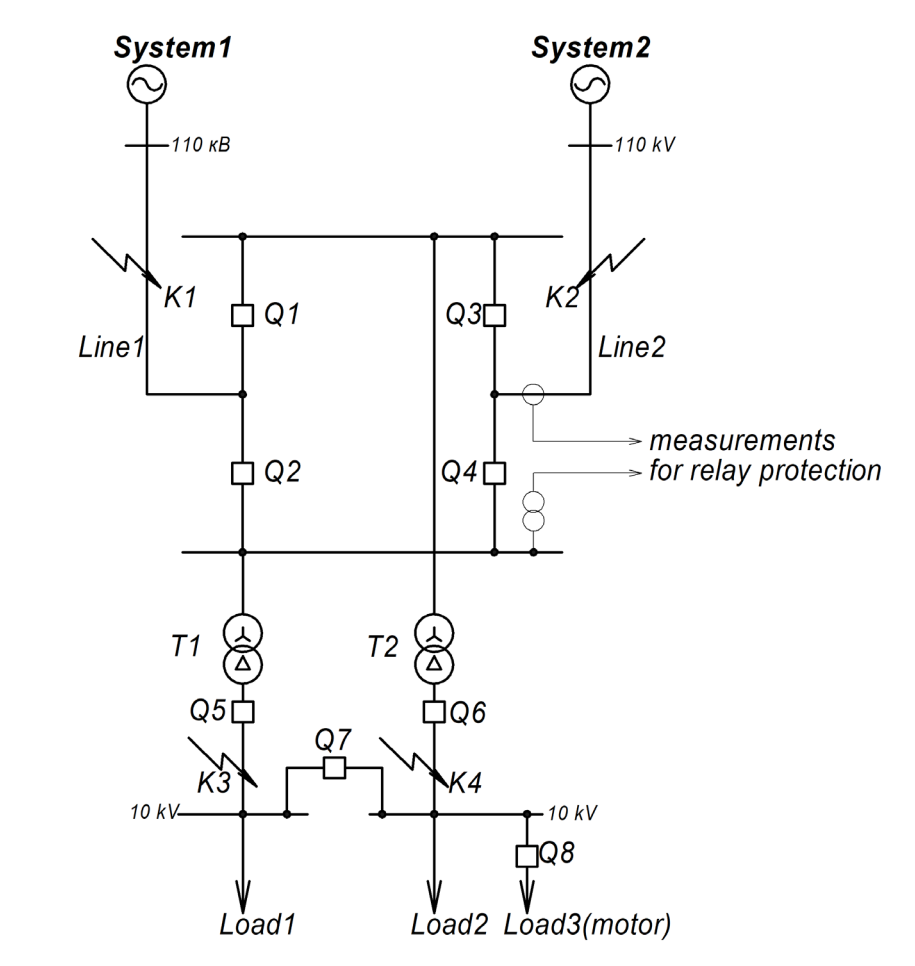


Draft scheme



Runtime scheme

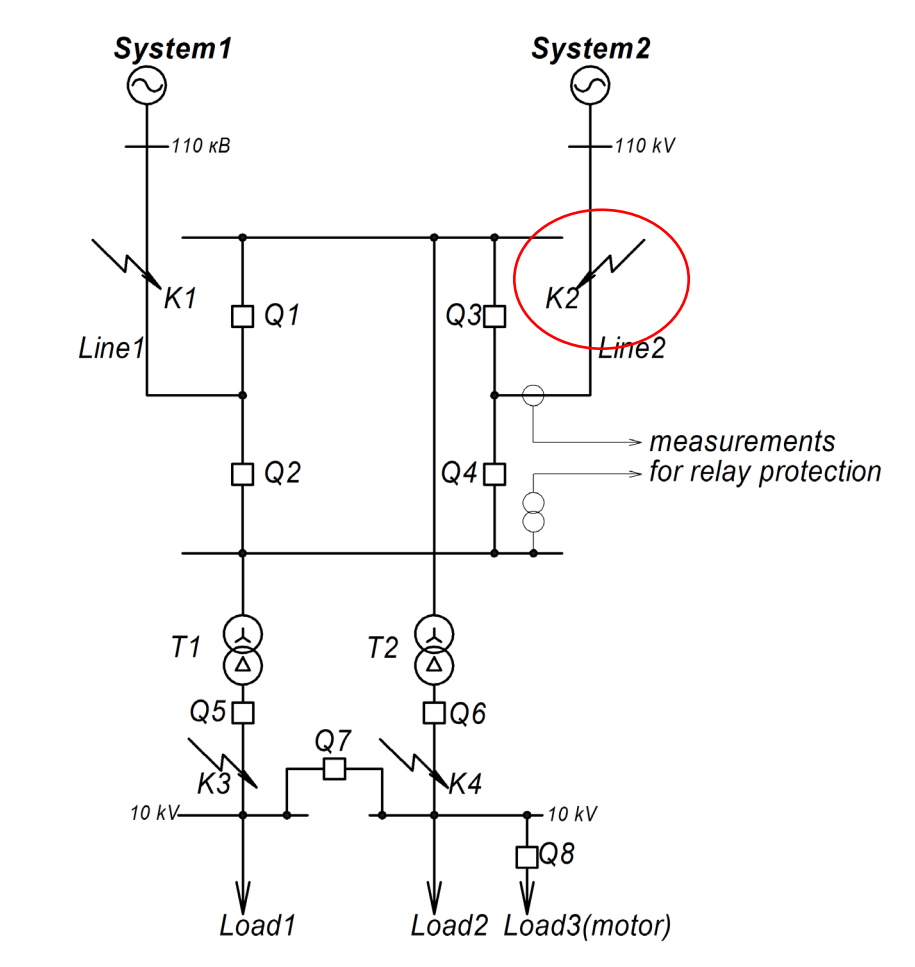
TESTING THE NEW METHOD OF MEASUREMENTS ON RTDS

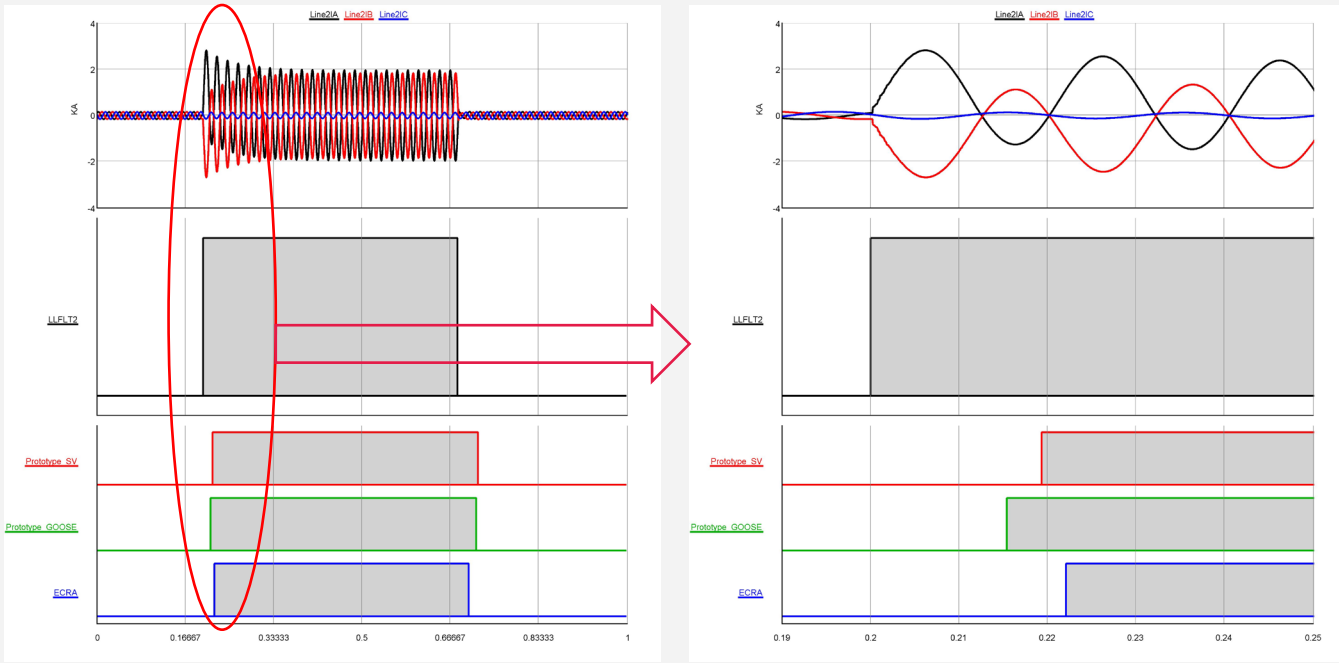


№	Case
1	Phase to phase fault AB at.K2
2	Increasing power for Line 2
3	External fault at K1

Scheme of the grid under investigation

TESTING THE NEW METHOD OF MEASUREMENTS ON RTDS

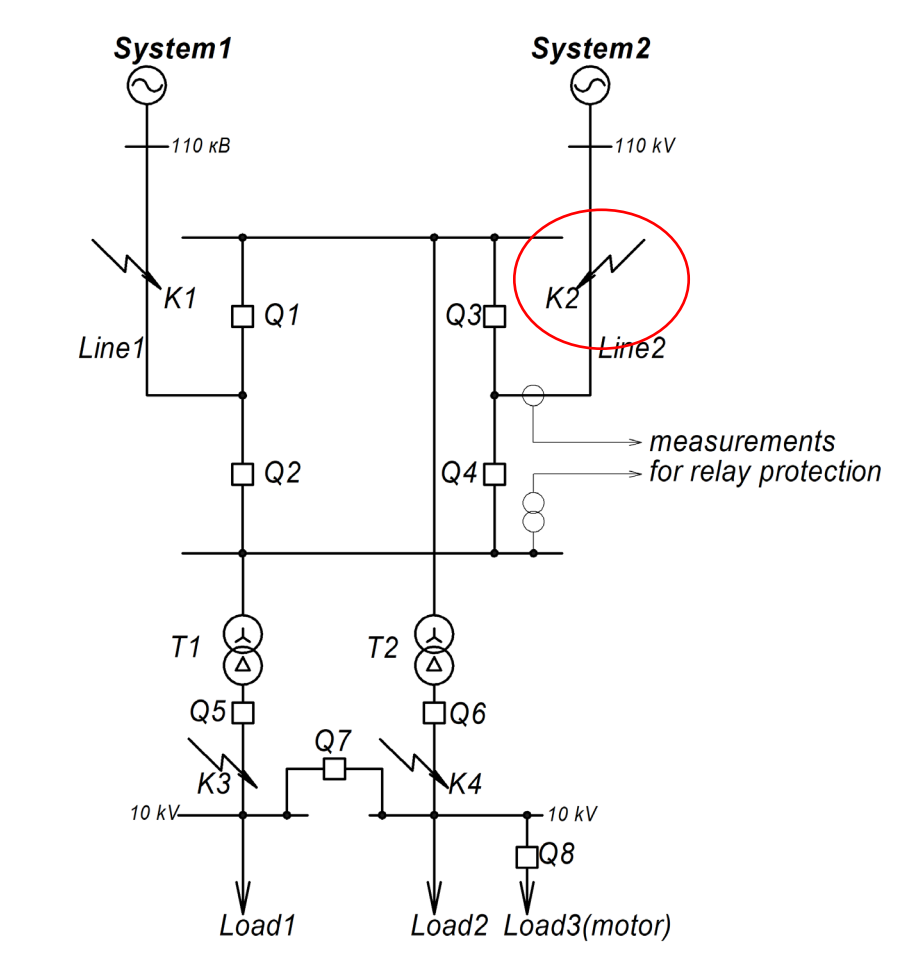




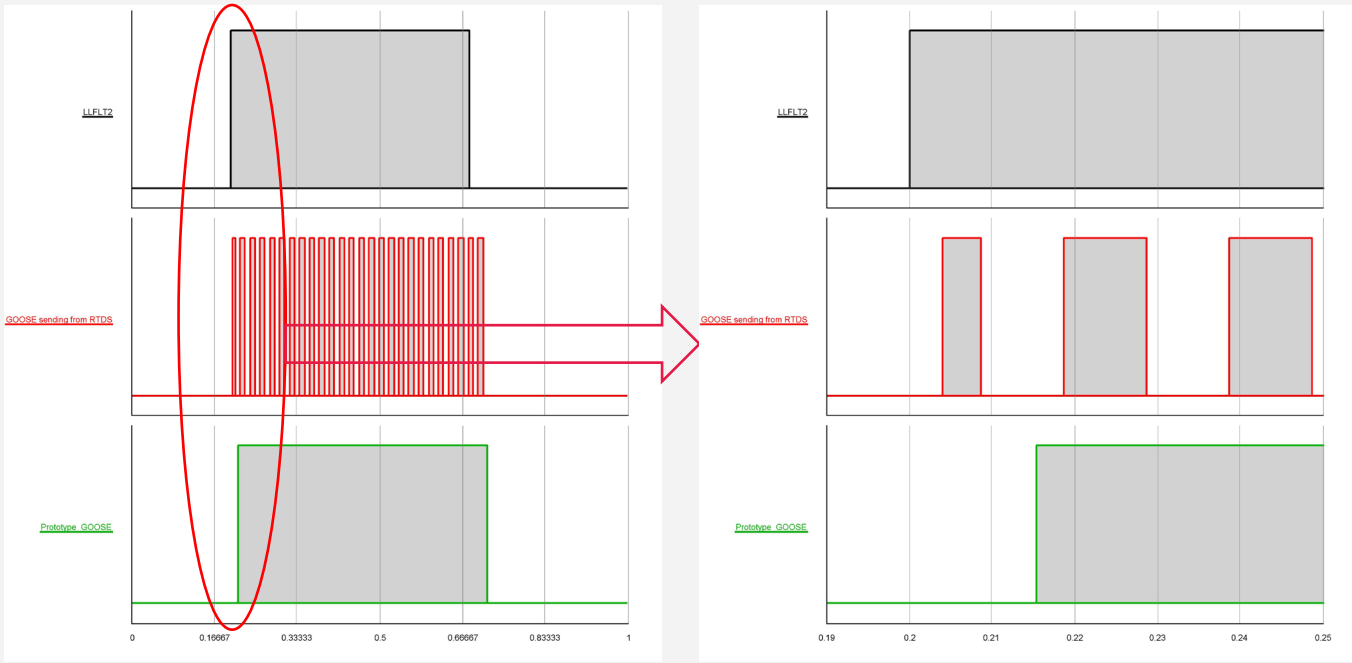
Phase to phase fault AB at.K2

Scheme of the grid under investigation

TESTING THE NEW METHOD OF MEASUREMENTS ON RTDS

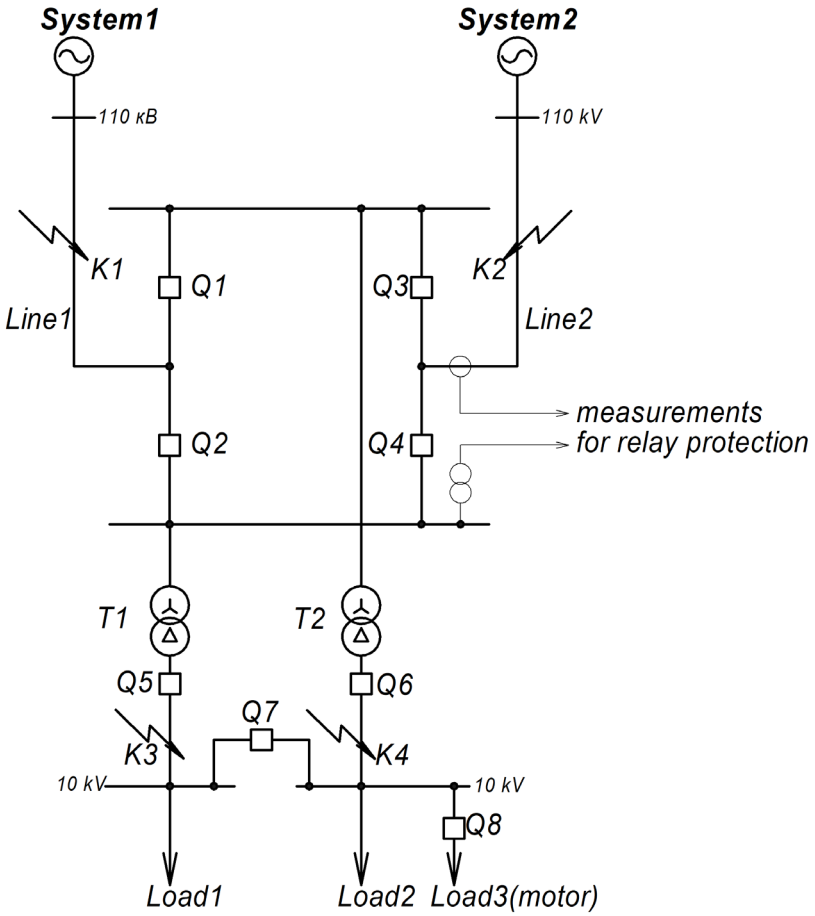


Scheme of the grid under investigation

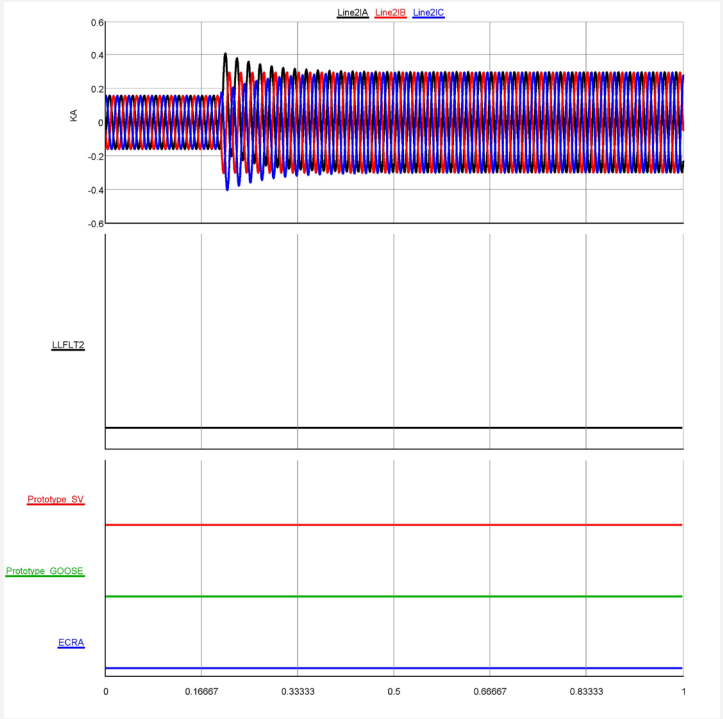


GOOSE sending from RTDS (calculated phasors)

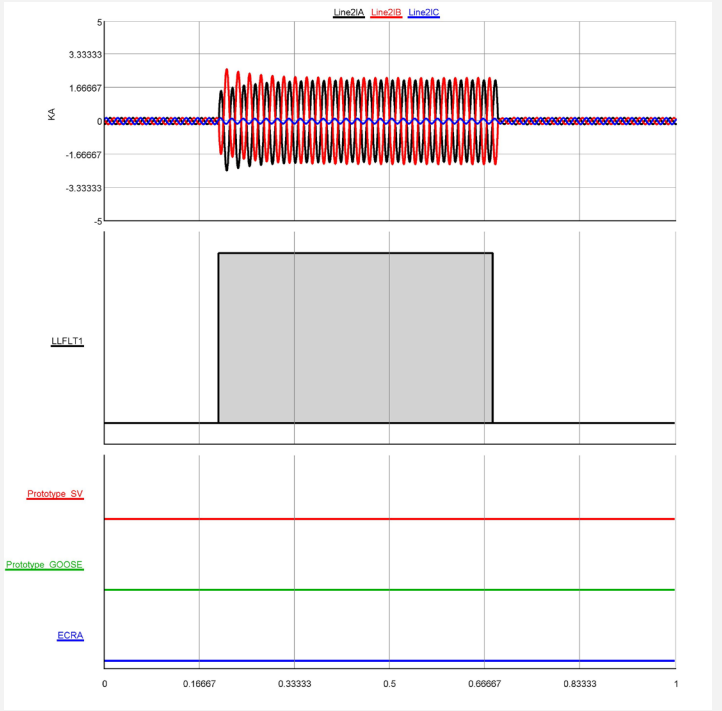
TESTING THE NEW METHOD OF MEASUREMENTS ON RTDS



Scheme of the grid under investigation

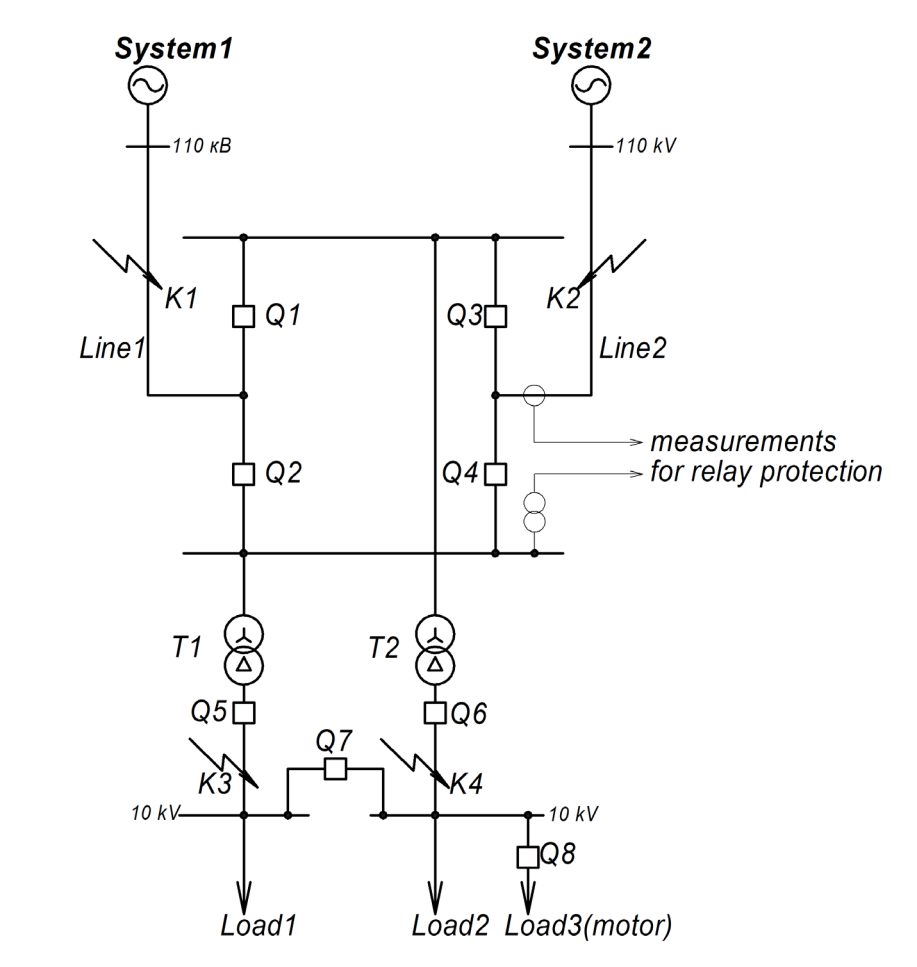


Increasing power for Line 2

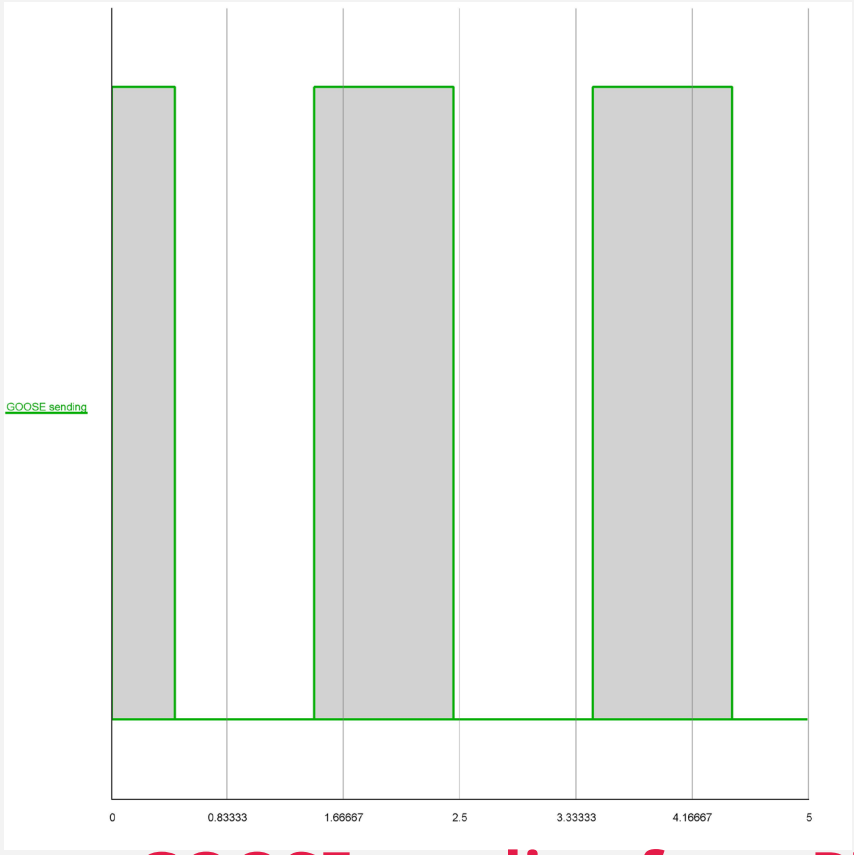


Phase to phase fault AB at.K1 (External fault)

TESTING THE NEW METHOD OF MEASUREMENTS ON RTDS



Scheme of the grid under investigation



GOOSE sending from RTDS for 2 and 3 cases (calculated vectors)

CONCLUSIONS

The new method for current and voltage measurements transmission, meeting the requirements of IEC 61850 standard and providing a reduction of the information load on the LAN in comparison with IEC 61850 9.2 LE was proposed.

Based on the test results, it was revealed that the new method for measurements transmission using GOOSE messages ensures the required speed of the distance protection algorithms and reduces the workload of the "process bus" LAN in emergency condition by more than 1000 times, depending on the substation scheme.

Application of the developed method of data transmission from measuring transformers allows to reduce the number of switches in the LAN, and also to use the combined architecture of the "bus stations" and "process buses" for the creation PACS for digital substation.