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OVERVOLTAGES ON LAN NETWORK IN THE LARGE INDUSTRIAL PLANT

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Abstract: This paper presents disturbances measurement results inside the computer network during normal conditions. They become realized in local computer network for large industrial plant. This object was supply on 6kV voltage level. All electric power devices are also supply from 6kV distribution network. Total power of all installed electric devices is about 7MW. Major parts of the devices used for manufacturing process are controlled by LAN (Local Area Networks).

Keywords: LAN, overvoltage, measurements, large industrial plant.

1. Introduction

To ensure stable and failure-free conditions for electronic devices it's necessary to have knowledge about electromagnetic risk on it installation place. This problem is crucial in vast industrial plants where large numbers of mesurments are made automatically. And also where production process base on received values. For all kind of communication local computer network (LAN) are often used. In this kind of objects all impulse disturbances can provide incorrect work of all LAN controlled electric devices.
This can also break down all production process in worst case. To choose right protection system for electronic devices in industrial plants it's necessary to take into consideration all kind off possible danger. All kind of disturbances and its sources must be explored. It's necessary also to carry on recording all appeared disturbances in LAN network.
Authors take into account all above facts and try to estimate danger in LAN network of large industrial plant described below.

2. Analyzed LAN operating environment

Measurements made in industrial plant where among other things six asynchronous motors were used for production process. Summary load which this motors makes for electric power distribution network is 5,61MW.
They work in different configurations with different simultaneousness factor. They are supply form 6kV switching station bus bars. This station is atypically placed on the third floor. Switching substation is supply from two different directions. It had also sectioned bus bars.
All switching operations were made by vacuum circuit breaker on 6kV voltage level. Rest details about it can be seen on circuit diagram - Fig. 2. On the 0.69kV voltage level two AC/AC converters are present with total load 2MW. There are controlled according the manufacturing process.
All loads are installed in three large production halls. In the office rooms next to the one off production hall and MV switching substation LAN network is installed. LAN is expanded according to central supervision monitoring system (CSMS) and production process necessity. Selected group of computers have got external output to the global computer network – internet. This connection allows remote control of the CSMS and production process too. AC/AC converters are also controlled by CSMS. The CSMS makes large energy savings by proper AC/AC motor steering. AC/AC converters are connected to CSMS by LAN. They produce all kind of disturbances and they are very sensitive for it. Industrial plant is equipped in central access and work time measurement system. This system is also connected to LAN. System uses close-up cards and special computer software.

Fig. 1. Industrial plant 6kV switching substation

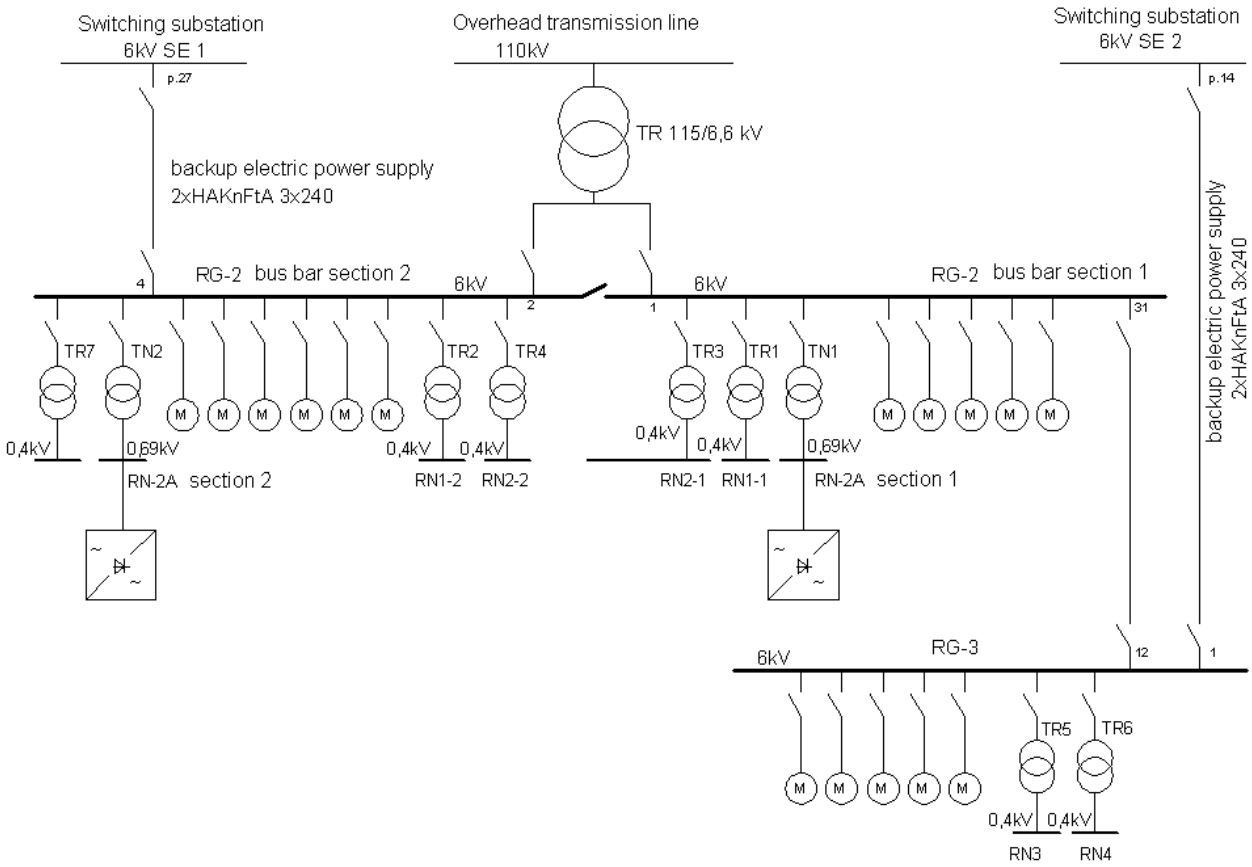

Fig. 2. Simplified circuit diagram of the 6kV industrial plant electric power distribution network [1]

3. Measurement results

Disturbances measurements were made in office rooms in sequential order nearby production hall. Different connection configurations were examined. All measurements were made during well-working production process. Measurement recording are made in different time steps. Local computer network was directly connected to the LAN switch and indirectly to the server.

During measurements local wiring system (RJ45 connector- Fig.3.) was disconnected from end-user workstation computer. It was used for instant 1MΩ matching impedance.

All presented measurement results were made in one office room with LAN connection in it. All recorded values in RJ45 connector have got maximal values on 250mV level and peak to peak values on 500mV level.

There no differences for peak to peak values level for which wires in the cable we made recordings – Fig. 4-9.

4. Conclusions

Measurement results shows character of the disturbances in local computer network during industrial plant production process. They are accidental and non destructive for electronic devices. They appears during well-working production equipment.

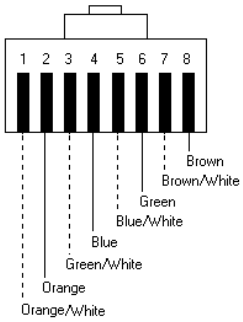

Fig. 3. RJ45 connector used in LAN [2]

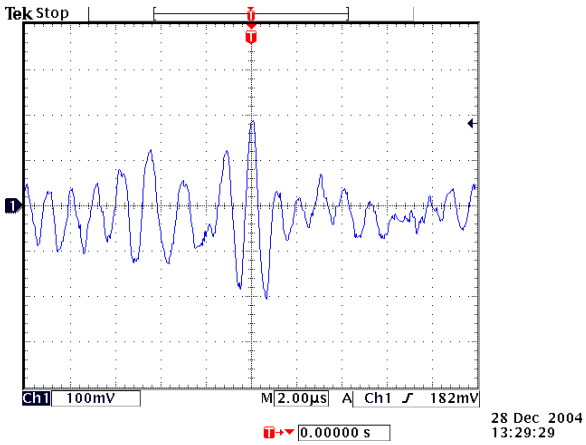

Fig. 4. RJ45 connector voltage waveform between pins 2-3

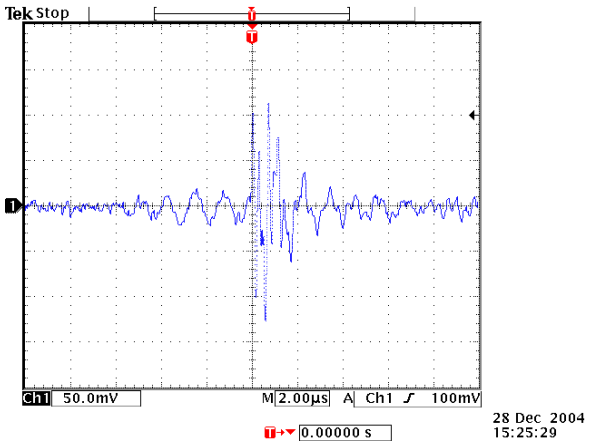

Fig. 5. RJ45 connector voltage waveform between pins 3-4

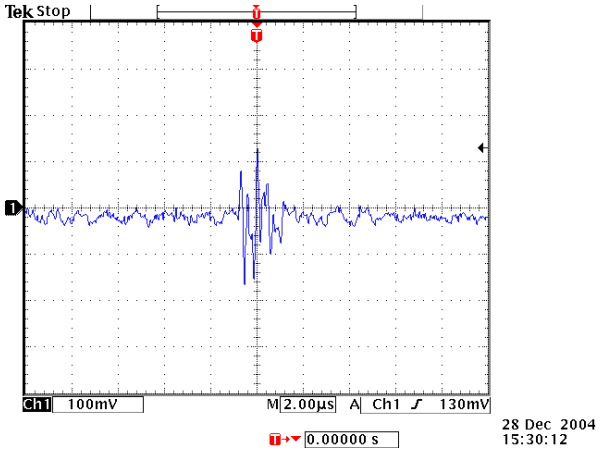

Fig. 6. RJ45 connector voltage waveform between pins 4-5

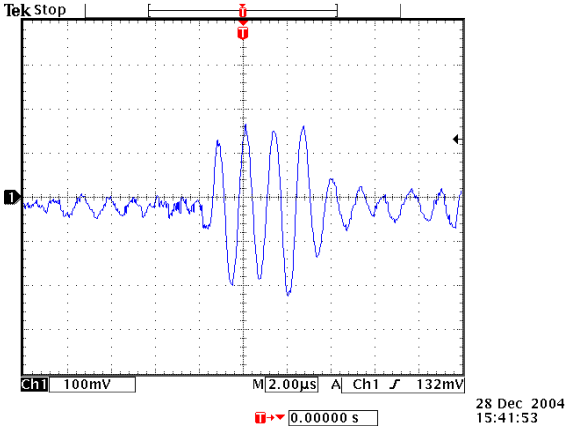

Fig. 7. RJ45 connector voltage waveform between pins 2-4

In the communication protocol used in local computer networks different error correction software is applied. This kind of procedure can eliminate most of typical disturbances in data transmission lines. Recorded disturbances can cause repetition data transfer procedure.

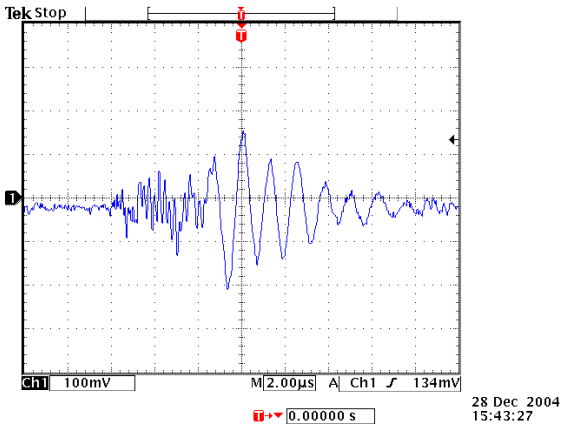

Fig. 8. RJ45 connector voltage waveform between pins 4-7

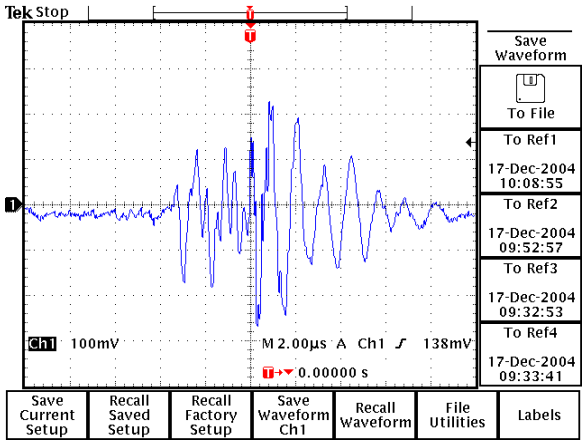

Fig. 9. RJ45 connector voltage waveform between pins 1-8

In industrial plants which base on electronic steering devices on low voltage level this kind of disturbances reduction can be fallible for extreme situations.
Of course it must be seen that all recordings were made for well-working industrial plant production process. In case of failure conductions maximal values in local computer network can be on much more higher level then recorded one.

Acknowledgment

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5. References

1. Technical documentations delivered by industrial plant owner.
2. K. Krysiak, „Sieci komputerowe. Kompendium”. Wydawnictwo Helion, 2003.