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THE MANAGEMENT OF THE ENERGY RESOURCES

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Abstract: The PC is finding more and more application in machine monitoring and process control. The PC based distributed system enable integration of fully automatic control of electric power resources in a manufacturing company.

Key works: energy resources, energy parameters, monitoring, supervising system

1. INTRODUCTION

The PC- based "open" system architecture makes it possible to develop important applications with personalized or already existing software packages which are particularly suitable for :

- monitoring the energy consumption for supervising the plant or for implementing the cost reduction strategies;
- subdividing the various production departments or single manufacturing units according to the costs.

The Automatic Monitoring System of the Electric Power Network of a manufacture type company designed by IPA CIFATT . use the and resources of the computer and the electronic counter UPM30 produced by Algodue.

The system monitor by the UPM 30 are reading and transmitting the energy parameters- voltage, current , energy and power factor in industrial distribution networks and station. By the configuration these counters can be used in mono or tri –phased electric power systems.

The Automatic Monitoring System of the Electric Power Network is implemented in the main electric station of the company and substitute the old analog power recorders in order to modernize the measurement installations and create a more reliable measurement tools .

The major electric consumers are the eight furnaces supplied by power transformers 6kV/0.4kV at 3.5MW.

The system use the PC technology for measurement functions. It use at the local level an Universal Power Meter 30 network which provide the serial data communication on the industrial bus Standard RS 485. It is a small size application in wich the I/O are in close vicinity to the host computer. The communication interface provides a simple point to point connection. The PC is the master and the elctronic counters are slaves in the RS 485 network. The sistem offer the following options:.

- Global measurement of the main electric power parameters for all consumers;
- Alarm handling, security management and networking
- Configuration for the measurement devices
- Automated transformers charge supervision; fault occurrence
- Installation visualisation
- Parameter record files and printouts:
    - graphs and tables with the time stamp;
    - energy consumption;
    - active and reactive power;
    - set points and process critical values;

The PC provide:

- human-machine interface ;
- Acquisition and supervision of the energy parameters;
- Acquisition and supervising of the furnace temperature in several points;
- Global control of the furnace technology prescription.
- Optimization programs for the technological process;

The Start Screen (Figure 1) represents the main interface actually selected with the third transformer:

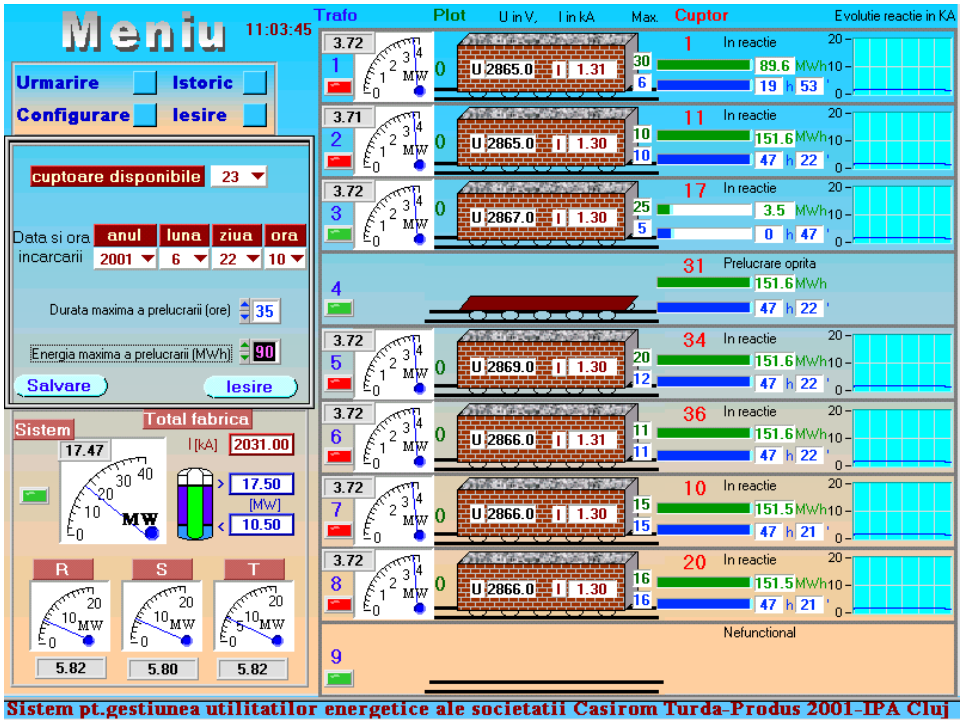


Figure 1

2. EQUIPMENT STRUCTURE - MAIN FUNCTIONS OF THE SYSTEM

It is possible to install 32 Power Meters on a communication port COM using an RS232/485 interface. The system can be expanded using a Multiport Serial Card.

The functions of the supervising systems are implemented in application program:

- the program from the UPM 30 memory;
- the program realized on the PC ;

UPM 30 is an intelligent power meter with an RS485 serial port for data communications.

The central part of application is performed by the PC program, developed on the virtual instrumentation principle under the LabWindows CVI application. The main functions of the program are:

- energy monitoring of the network plant;
- reactions monitoring of the furnace of Silicium Carbured;
- acquisition of the energy parameters in a specific database;
- acquisition of the vital parameters of the reactions from the ovens;
- graphic or tabular visualization of the final parameters.
- reports structuring of the events;
- application configure, UPM 30 parameters and warning limits for the parameters;
- the security of the major operations under a special password control;

The supervising of the alarm setpoints, the status control of the communication link with UPM 30 , create operator warnings on two levels:

- acoustic level (the system has a multimedia component which permit the voice message);
- optic level (using the multiple tasks which cancel any other active operation till the operator acknowledge the output)

These alarms and warnings are memorized in the events report and are available for later visualization.

3. AUTOMATION INSTALLATION

For the current application we have the following structure:

- two UPM 30 which are configured for three-phase system used for the L1 and L2 high voltage network factory inputs on 110 kV;
- two UPM 30 which are configured for three-phase system used for PT1 transformer substations;
- two UPM 30 which are configured for three-phase system used for PT2 transformer substation;
- one UPM 30 which are configured for three-phase system used for the energy measurement from other production units excepting the Silicium Carbured manufacturing unit;

- eight UPM 30 which are configured for single-phase system used high power furnaces transformers.

The application provides the possibility to monitor individually each consumer by four virtual Power Meters software, which means (see fig 2):

- factory global consumption;
- furnace unit consumption;
- transformer stations consumption;
- the power loss between interconnection substations and transformers units;

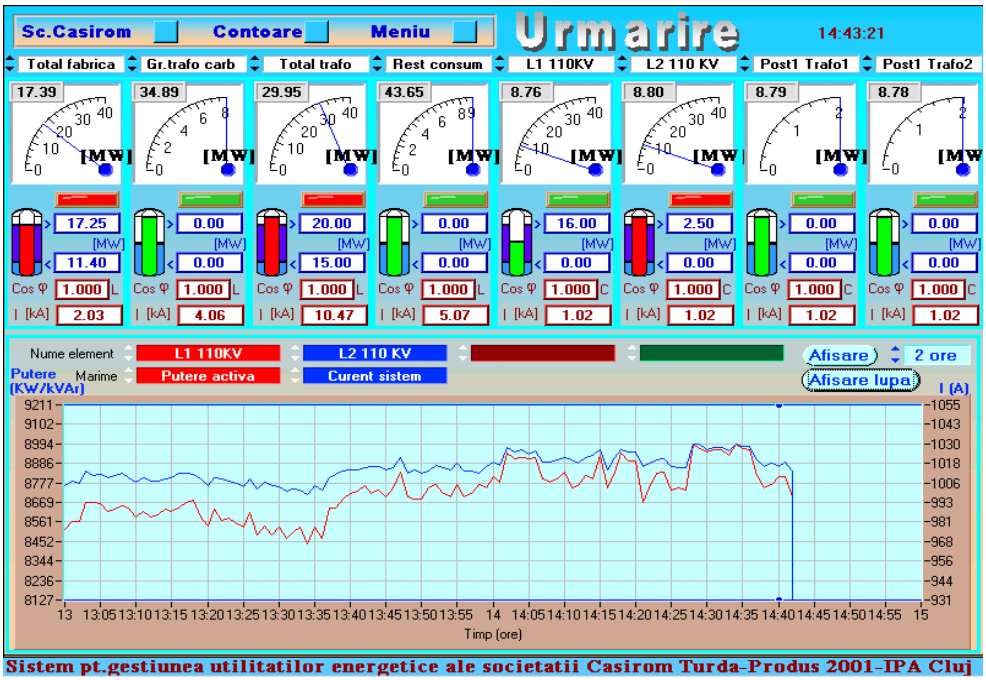
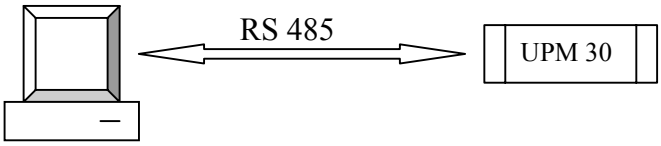


Figure 2

Communications protocol: communication with the UPM 30 takes place by means of an asynchronous serial transmission, half-duplex RS485. All transmitted characters are part of the ASCII code.

The RS485 standard interface enables a multidrop connection, which is the connection of several instruments to a host with only one cable.

The interrogation of a single instrument is always possible using the instrument SERIAL NUMBER. or with the LOGICAL NUMBER after it has been assigned in the configuration phase.



The protocol specifications define the check codes , the data sequence , necessary for proper data exchange.

The protocol uses an alternating connection on a single line (half duplex). This means that on a single physical connection line messages move in two opposite directions. First, the Host computer message is addressed to a single instrument, then in the opposite direction the reply of the instrument towards the Host.

In a multi- point type connection, every connected device must have a code which unmistakably identifies it . Only in this way it is possible to communicate with a device without influencing the other devices connected to the same line.

The interrogation sequence of a UPM 30 is initiated by the host in order to read the data that the instrument measures and elaborates and can in no way alter its normal functioning or configuration.

Here below is the sequence of characters necessary for correct interrogation:

<STX>02R00<ETX>(51H)

Begin block character	<STX>	It is always the character
[Instrument identification]	02	It is normally represented by the logical number expressed in hexadecimals (01-FF). The character S(53H) can also be used followed by the instrument serial number (9 alpha numeric characters)
Command	R00	It is always the character R followed by the variable number to be read, expressed in hexadecimals
End block character	<ETX>	It is always the character <ETX>
Check character		It is one single characters which results from exclusive or/(xor) of all the characters from <STX> up to and including <ETX>. It is used for verification of transmitted data.

4. SOFTWARE SPECIFICATIONS

The application program depends on the system topology and offers the following functions:

- Creates and updates a prescriptions – library (pre-set) that contains the technological parameters of the process;
- Enables a fast and secure access, on several selection criteria, to this library, also displaying the data in accordance with each criterion;
- Automatically updates the technological prescription (pre-set values) and also update them , on present requests(under a special control);
- Reads the parameters from the local counters at sampling periods and stores them into historical files;
- Sets alarms on the screen whenever one of the measured data , received from the local energy counters, is out of preset limits;
- Creates historical files with process information that can be consulted afterwards;

- Displays the measured data as strings or as graphs;
- Provides access to historical files – information and graphically displays the collected parameters versus time, on different ranges and at different starting points;

5. CONCLUSIONS

The equipment designed for the application can be implemented in all industrial areas where the electric energy consumption is very important as a major part of the final product cost. The Automatic Monitoring System of the Electric Power Network is a tool for the operators to reduce the energy consumption and reduce the costs. The equipment is based on PC technology has an easy I/O connectivity and reduces the system downtime with detailed diagnostics. The flexible user interface shows the furnaces status in real time and prompts the operators through repair steps.

The flexibility and modular structure permit to extend the current configuration so that the system will cover a larger area, which includes consumers.

6. REFERENCES

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