

POWER QUALITY MONITORING SYSTEM

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REZUMAT. In scopul realizarii prevederilor Standardului de performanta pentru serviciul de distributie a energiei electrice, EON Moldova Distributie a implementat, incepand cu anul 2009, un sistem centralizat de monitorizare a calitatii energiei electrice in statii de transformare, folosind analizoare stationare de calitate montate pe partea de MT a transformatorului/ transformatoarelor de forta.

ABSTRACT. To implement the provisions of the service performance standards for electricity distribution, EON Moldova Distribution has implemented since 2009 a centralized system for monitoring the quality of electrical energy in transformer stations using quality analyzers mounted on the stationary MV transformer / power transformers.

1. OVERVIEW

In order to achieve the performance standard provisions for distribution service EE Distribution EON Moldova has implemented since 2009 a centralized electrical power quality monitoring transformer stations using stationary analyzers quality, class A, mounted on the MV transformer / power transformers. In the first phase analyzers were installed in 41 stations, after system developing, so that presently monitors the transformer stations on the MT, and all interconnection lines with Transelectrica. Also have acquired and portable analyzers class, and in 2011 were mounted analyzers and power producers (wind, solar, hydro, electric cogeneration). All analyzers are integrated into the monitoring system EMOD.

Central Status: Total = 228 pc. :

- Stationary analyzers 216, of which 145 with GPRS communication and communication Ethernet (ETH) 71 (of these, 19 power analyzers are mounted on power plants - 6 with communication ETH)
- Portable Analyzers (all GPRS): 12 pcs.

All parameters are monitored as requested by ANRE performance standard (values that follows the standard SR EN 50160) of the entire network EMOD (LV, MV, HV). Analyzers, have the possibility to make oscillographic recorders of events during 5 seconds, which is very useful to highlight flaws in network and fault analysis. Each analyzer with universal clock synchronization (UTC) is done the local via GPS.

2. POWER QUALITY MONITORING SYSTEM STRUCTURE

- Data acquisition module for each analyzer, consisting of all necessary means to the acquisition, aggregation, storing and transmission measurements monitored by storing and analyzing:
 - Power Quality Analyzer
 - GPRS modem *)
 - Voltage source modem *)
 - GPS module for clock synchronization*) for data transmission via Ethernet, these components are missing.
- Storing and analyzing data, which includes:
 - Storage component installed on the central server and includes a relational database Oracle server processes that extract data from acquisition modules;
 - Analyze the components installed on the client machine through which users manage system modules, view and extract data with regular reports on power quality monitored

Introduction of WIN PQ application

At the launch of the application by the user, it displays a dashboard (start window organized by county, with icons for each analysis) through which access to the analyzers integrated into the system.

Fig. 2 presents the homescreen of the software. In Fig. 3 the shape and structure of the icon for each analyzer are depicted.

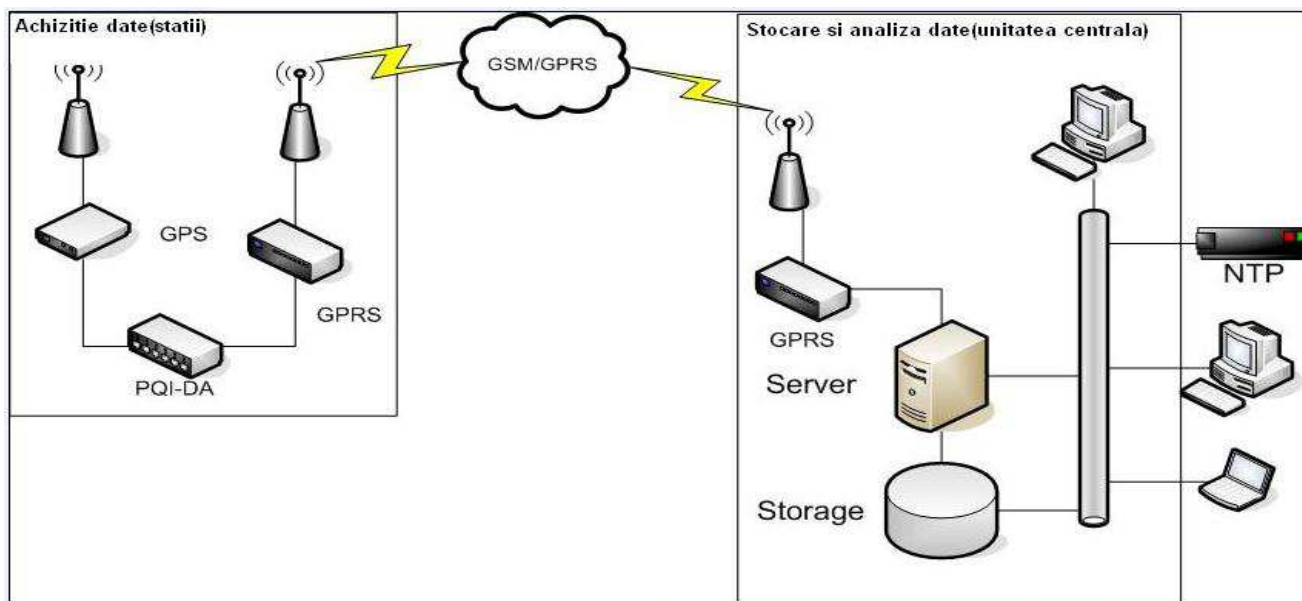


Fig. 1. System architecture

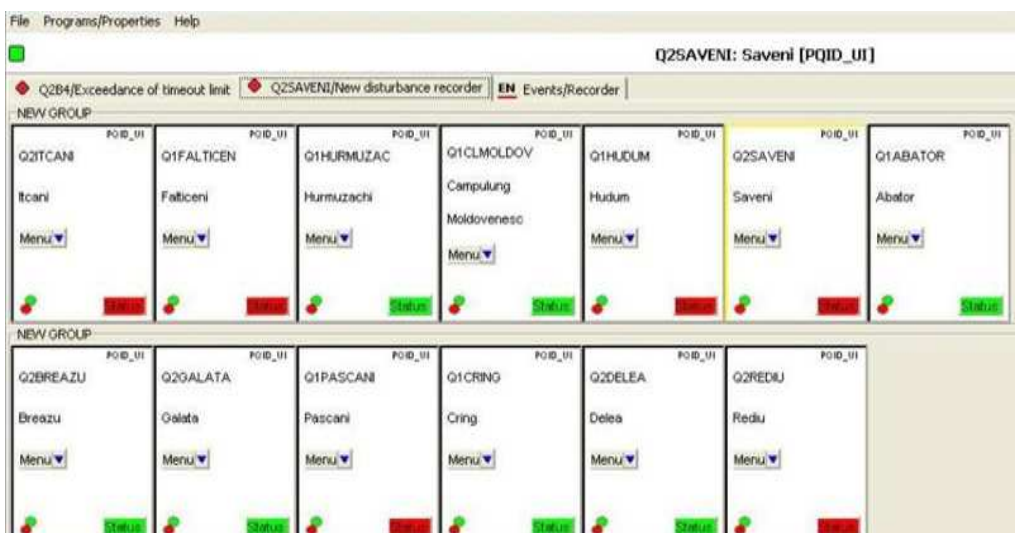


Fig. 2 Home screen of the software

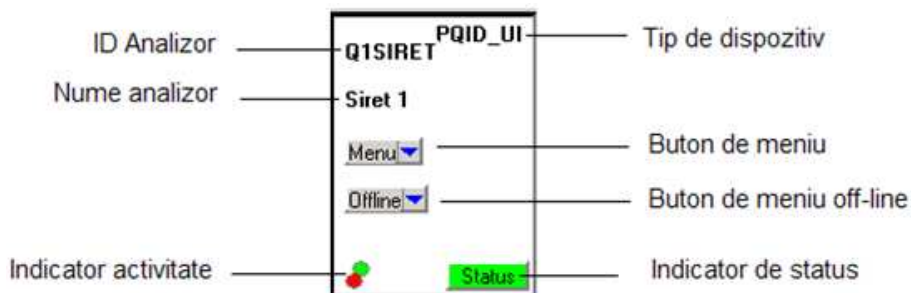


Fig. 3. Analyzer icon example

For each analyzer from the system, the application keeps its data structures for a period of timeout, the default value of 30 minutes.

If the time elapsed is greater than during the timeout, the dashboard displays the icon of the review red.

Display Mode "Status" (Fig. 4) provides information about new events occurring (fault and event records power quality).

In Fig. 5 is presented the menu of network analyzers.

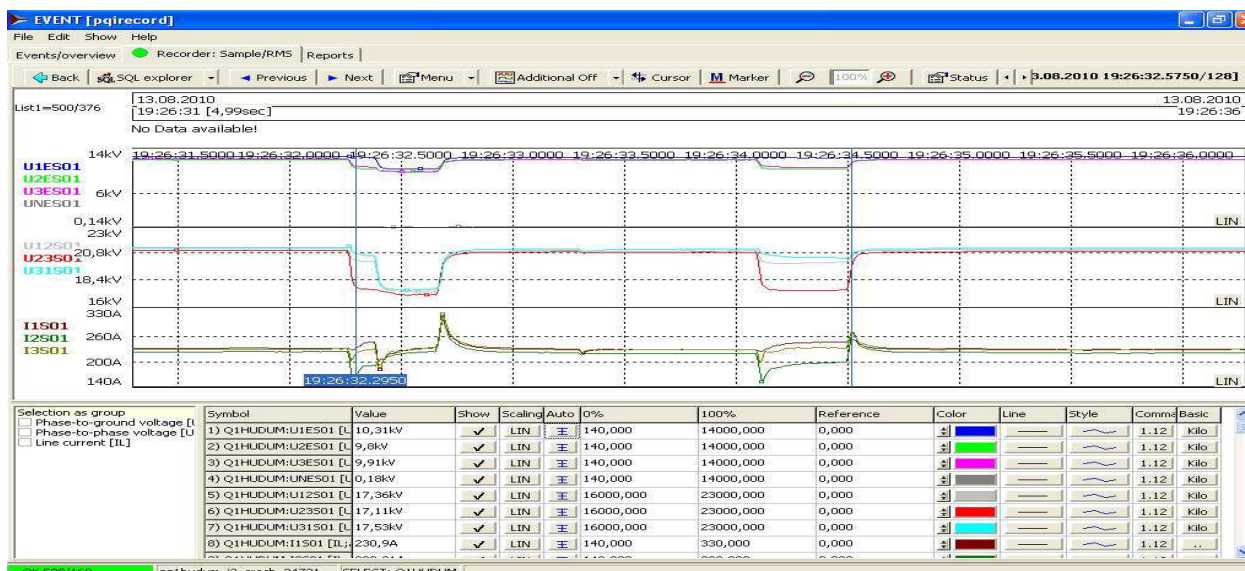


Fig. 4. View example for the "Status" display mode

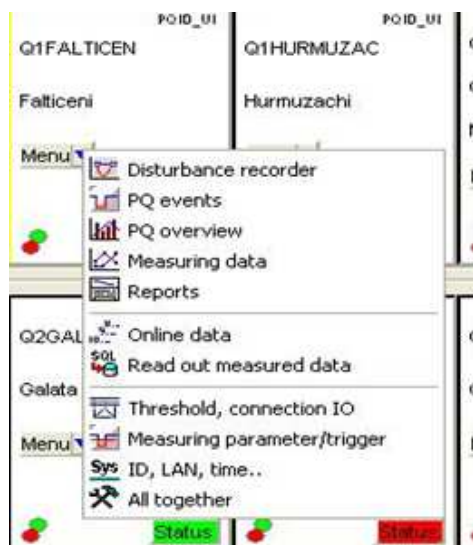


Fig. 5. Menu of network analyzers

Reports:

The application allows the automatic generation of pre-defined reports, user-selectable periods. It is mandatory to generate reports required by performance standards (Fig. 6 - Main technical parameters of power quality, parameters related to the quality of the voltage curve according to EN 50160, the dips).

For better tracking quality parameters were subsequently developed a number of additional reports

(Fig. 7) (using the intranet), particularly useful in the monitoring of power quality (providing data from reports other form of application)

3. FRAMING QUALITY PARAMETERS EC (MANUFACTURERS) IN STANDARD LIMITS

Framing values required by standard EN 50160 for: frequency, voltage flicker, unbalance and THD are obtained from records effective averages 10 minutes, the duration of a week. P 95 reports obtained either from the application or from additional reports provide image observance of the provisions of the standard or not.

For electricity producers compliance by the required quality parameters is the essential condition of connection to the electricity distribution. Power quality monitoring is done throughout their operation.

The meaning of the icons in Fig. 8:

- Analysers' GPRS communication: active, gray inactive, red with gray menu button, not integrated into the system, yellow
- Analysers' communications by ETH: active, blue, inactive, red with blue menu button.

Overview of quality parameter / Monthly report [01.03.2013]

	Q1bobosani	Q1chromeni	Q1Mkasi	Q1palestina	Q1rombait	Q1rosiori	Q1sibiu	Q1sibiu1
1.Events: Transient interruption (<=1 second)	0	0	0	0	0	0	0	0
2.Events: Short interruption of supply	0	0	0	1	0	0	0	0
3.Events: Long interruption of supply	0	0	0	1	0	0	0	0
4.Events: D(U) Deep dip about all phases	0	0	0	0	0	0	0	0
5.Frequency [Hz] (average)	50	50	50	50	50,01	50,01	50	50
6.Average I03 [V]	2122,5	2134,29	2104,1	2142,06	4212,9	2059,05	4322,78	11825,23
7.Average I03 [V]	2158,85	21430,67	21497,73	21455,42	4289,9	21746,37	4304,01	118874,18
8.Average I03 [V]	21300,05	21372,9	21605,49	21497,51	4300,58	21727,1	4316,38	118075,55
9.Events: SPCAS2 Slow voltage change	0	0	0	0	0	0	0	0
10.Events: SPCAS2 (Related weeks >5% of the interval)	0	0	0	0	0	0	0	0
11.Events: SPCAS2 Slow voltage change	0	0	0	0	0	0	0	0
12.Events: SPCAS2 (Related weeks >5% of the interval)	0	0	0	0	0	0	0	0
13.Events: SPCAS3 Slow voltage change	0	0	0	0	0	0	0	0
14.Events: SPCAS3 (Related weeks >5% of the interval)	0	0	0	0	0	0	0	0
15.Events: SPCAS3 Fast voltage change (10ms values)	0	0	0	1	3	3	3	1

Fig. 6. ANRE report-The main technical parameters of quality - full report of application WinPQ

Raport Goluri

Stata: DELPHI_G1
Perioada: 01-Jan-2013 00:00:00 - 18-Apr-2013 00:00:00
nr Goluri: 16

Data Start	Data End	Durata Sec.	Durata Milli Sec.	Remanenta	Nominala
05-Jan-2013 16:17:28	05-Jan-2013 16:17:29	00	389		89.13
30-Jan-2013 06:31:54	30-Jan-2013 06:31:54	00	360		75.03
05-Mar-2013 10:34:22	05-Mar-2013 10:34:22	00	559		88.05
10-Mar-2013 02:14:02	10-Mar-2013 02:14:02	00	050		84.29
14-Mar-2013 18:28:48	14-Mar-2013 18:28:48	00	380		87.86
14-Mar-2013 18:54:26	14-Mar-2013 18:54:26	00	001		89.24
15-Mar-2013 17:42:31	15-Mar-2013 17:42:31	00	080		87.76
22-Mar-2013 12:10:44	22-Mar-2013 12:10:45	00	633		88.73
28-Mar-2013 01:53:40	28-Mar-2013 01:53:41	00	431		31.66
28-Mar-2013 17:16:28	28-Mar-2013 17:16:28	00	491		89.52
01-Apr-2013 08:29:33	01-Apr-2013 08:29:34	00	622		49.55
01-Apr-2013 15:32:37	01-Apr-2013 15:32:38	00	440		86.98
06-Apr-2013 04:14:41	06-Apr-2013 04:14:41	00	610		72.84
17-Apr-2013 07:28:21	17-Apr-2013 07:28:21	00	130		81.45
18-Apr-2013 15:30:05	18-Apr-2013 15:30:05	00	489		55.47
18-Apr-2013 18:11:20	18-Apr-2013 18:11:21	00	109		82.83

Fig. 7. Dips report - the additional reports

QZISCENTR2/Violation of timeout limit | Q1CRITEL1/Violation of timeout limit | Q2RADAUTI2/Violation of timeout limit | Q2NEGRESTI

Tail

PQID_UT Q1GORBAN Gorban Electica Serv 1 Menu Status	PQID_UT Q2GORBAN2 Gorban Electrica Serv 2 Menu Status	PQID_UT Q3GORBAN3 Gorban 3 Evaitech Menu Status	PQID_UT Q1MONTANA CFV Montana Tg. Frumos Menu Status	PQID_UT Q2TATARAS Q2TATARAS	PQID_UT Q3TATARAS Q3TATARAS	PQID_UT Q1VUTCANI Vutcani Menu Status
PQID_UT Q1ALFALAND OFV Alfa Land Bobosani Menu Status	PQID_UT Q5MCALOR1 Cel.20 kV Modern Color 1 Menu Status	PQID_UT Q6MCALOR2 Cel.20 kV Modern Color 2 Menu Status				

Fig. 8. Dashboard

POWER QUALITY MONITORING SYSTEM

marime	val min	time val min	val max	time val max	proc val max	val avg	val 95	val std
F	0	1/17/2013 8:39:59 AM	50.1090	4/15/2013 10:59:59 PM	100.22	49.2399	50.0330	50
PLT12	0	1/19/2012 5:59:59 PM	227.21	9/19/2012 7:59:59 AM	22721	0.85	0.73	1
PLT23	0	1/19/2012 5:59:59 PM	147.33	3/21/2013 3:59:59 PM	14733	0.72	0.77	1
PLT31	0	1/19/2012 5:59:59 PM	228.16	9/19/2012 7:59:59 AM	22816	0.86	0.73	1
THD12	0	1/17/2013 8:39:59 AM	61.28	3/21/2013 3:19:59 PM	766	1.75	2.44	8
THD23	0	1/17/2013 8:49:59 AM	58.53	3/21/2013 3:19:59 PM	731.63	1.61	2.28	8
THD31	0	1/17/2013 8:39:59 AM	59.95	3/21/2013 3:19:59 PM	749.38	1.69	2.33	8
U12	7.84	3/21/2013 2:29:59 PM	124489.57	1/25/2013 9:19:59 PM	108.25	118576.94	122929.63	115000
U23	8.69	3/21/2013 2:29:59 PM	124938.46	1/25/2013 9:19:59 PM	108.64	118846.73	123255.53	115000
U31	8.22	3/21/2013 2:29:59 PM	125376.81	1/25/2013 9:19:59 PM	109.02	119282.91	123696.87	115000
UU	0	1/17/2013 8:39:59 AM	100.82	3/21/2013 2:59:59 PM	10082	0.35	0.46	1

Fig. 9. Exceeding the limits mentioned standard EN 50160

Table 1

Supervised quality parameters producers

	marime	val min	time val min	val max	time val max	proc val max	val avg	val 95 %	val std
Produc cer 1	F	49,9087	4.6.2013 12:10:00 AM	50,1088	4.15.2013 10:00:00 PM	100,22	50,0003	50,0331	50
	PLT12	0,05	3.3.2013 4:00:00 AM	77,88	4.18.2013 4:00:00 PM	7788	0,24	0,38	1
	PLT23	0,04	2.17.2013 4:00:00 AM	77,91	4.18.2013 4:00:00 PM	7791	0,22	0,32	1
	PLT31	0,05	2.17.2013 2:00:00 AM	77,9	4.18.2013 4:00:00 PM	7790	0,24	0,36	1
	THD12	0,62	4.20.2013 4:00:00 AM	2,52	2.14.2013 2:10:00 PM	31,5	1,4	1,88	8
	THD23	0,53	4.20.2013 4:00:00 AM	2,63	4.2.2013 7:00:00 PM	32,88	1,36	1,84	8
	THD31	0,61	1.5.2013 7:00:00 AM	2,61	4.18.2013 2:20:00 PM	32,63	1,44	1,93	8
	U12	14615,55	1.30.2013 6:10:00 PM	22049,35	2.14.2013 4:10:00 PM	106,01	21064,47	21413,46	20800
	U23	14645,78	1.30.2013 6:10:00 PM	22092,23	2.14.2013 4:10:00 PM	106,21	21110,97	21455,39	20800
	U31	14661,61	1.30.2013 6:10:00 PM	22116,03	2.14.2013 4:10:00 PM	106,33	21127,97	21470,18	20800
	UUNS	0	1.1.2013 12:30:00 AM	155,81	3.5.2013 7:20:00 AM	5193,67	0,21	0,34	3

4. CONCLUSIONS

- ✓ The system has been successfully implemented, making demands of SPSDEE - ANRE; monitoring can be done on all voltage levels (the MV mobile analyzers);
- ✓ Automated reports can be edited on-line for predetermined periods - either WinPQ application or intranet using the "Additional Reports";
- ✓ Submit annual report ANRE main quality parameters of at least 5 of the EMOD transformer stations;
- ✓ P 95 reports obtained from the manufacturers mounted analyzers shows that currently there are no quality parameter inconsistency;
- ✓ In some of the stations are slightly exceeding the EMOD flicker on one, two or all phases, and only in a station is exceeded the voltage asymmetry.
- ✓ Portable analyzers have been used quite a bit during 2012 because they were only 5-6 requests from clients (users) - Since specifying quality monitoring in PCC - the vast majority of responses to complaints / complaints regarding the inconsistency parameters the provisions of the standard based on the records of the transformer stations stationary analyzers (enough information);
- ✓ Media coverage proposed service quality monitoring site EMOD offering different information for different categories of consumers (users).

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