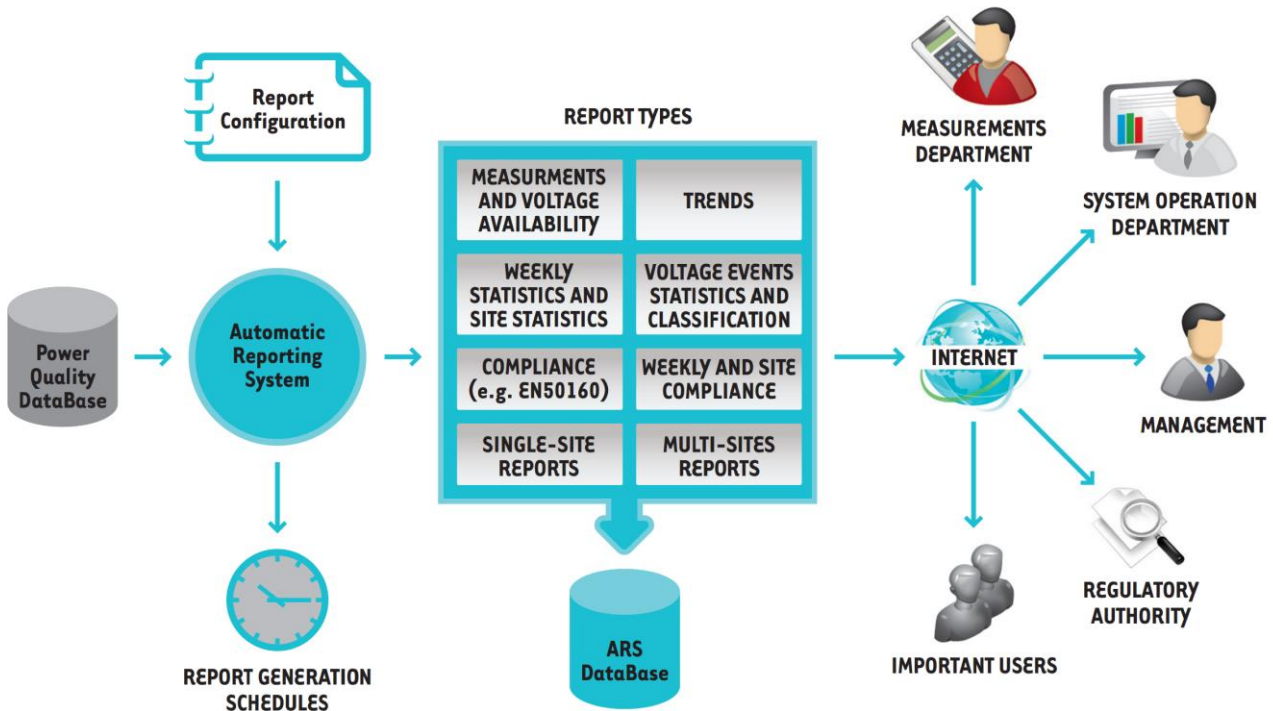
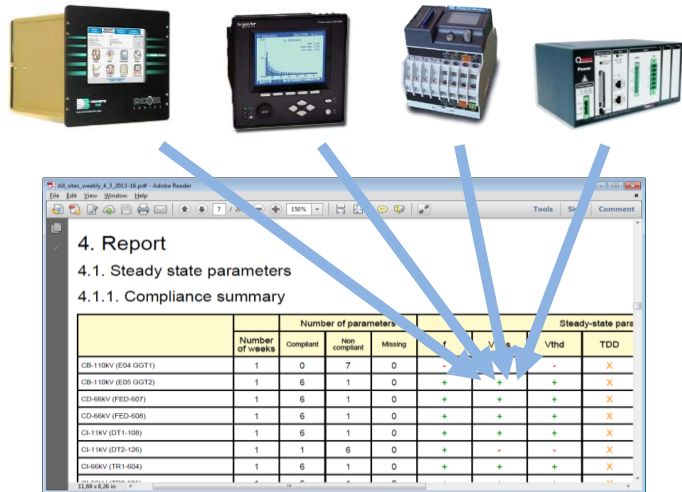


## Introduction

ARS is system for automated report generation, archiving and mailing. Using PQView program as data source, ARS is able to integrate data from various instrument types and databases. Report structures are flexible - users can configure them according to their needs and requests. ARS provides possibility to create detailed reports for single site (instrument), or comparative reports containing data from multiple sites, even databases.

## Key features

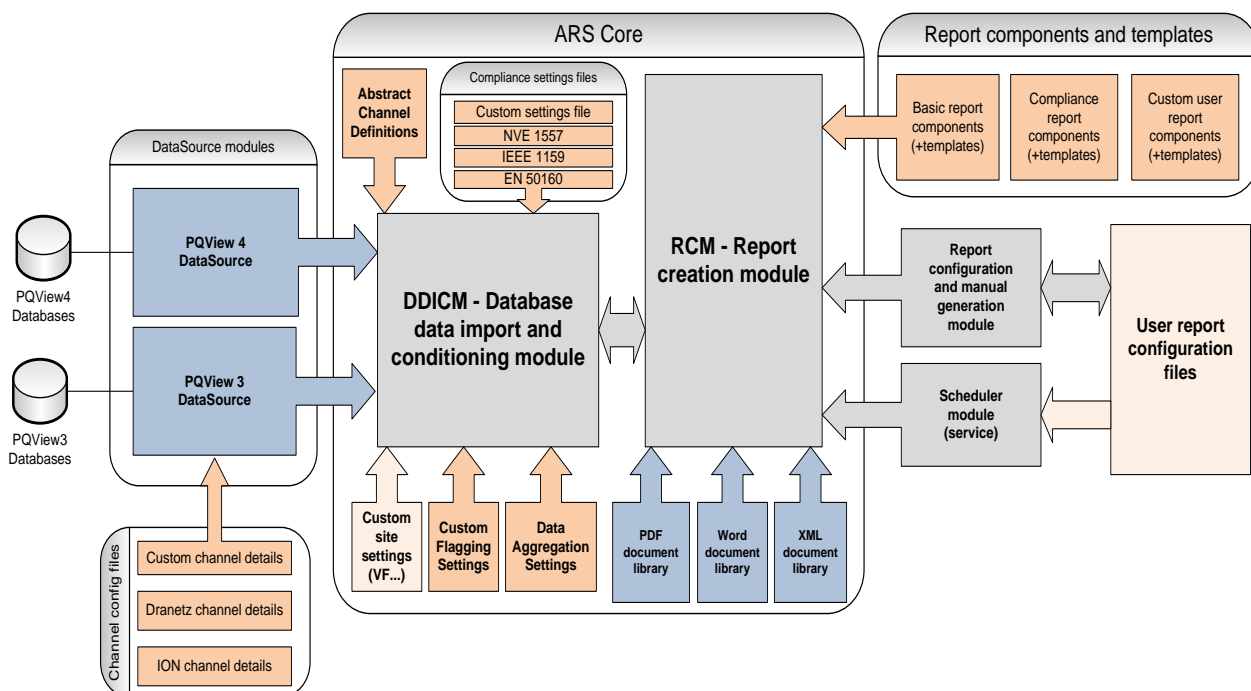
- Open system – independent on one manufacturer
- Support all instrument types and manufactures
- Automatic data collecting and archiving
- Automatic report generation and mailing
- Background processing – no customer support
- Unlimited number of supported sites
- Common database for period up to 10 years
- Settable criteria to meet any standard
- Modular report structure – flexible and configurable
- Easy plug-in based extension acc to specific requests



ARS architecture

## ARS features

- **Generate reports for all PQ parameters:**  
frequency, magnitude, unbalance, harmonics, interharmonics, flickers, signaling voltages, sags, swells, interruptions, RVC,..
- **Automatic generation, archiving and mailing of reports:**  
using various instruments as data sources
- **Report structure customization :**  
different types of reports can be created to meet specific requirements for: system operation department, measurements department, management, regulatory agency, important users...
- **Different report types:**  
basic reports and compliance reports (accordance to the existing standards or user defined criteria and standards)
- **Single or multiple sites report:**  
detailed reports for single measurement site (instrument) or comparative reports for multiple sites, from one or multiple databases
- **Compliance reports:**  
reports generated in accordance with national, regional or international standards and regulations (EN 50160, NVE 1557, NRS 048, CREG 024, IEC 61000-4-30, IEC 1000-3-6, IEC 61000-3-7, IEEE-1159,..)
- **Background processing:**  
once properly configured, application works in background: reports are generated and sent via e-mail automatically, with no need for user intervention
- **Modular report structure:**  
report structure is modular and configurable to meet users' requirements
- **Modular application structure and flexibility:**  
easy application expansion and upgrade with new features and visualisations



ARS structure overview

## ARS description

Large scale power quality monitoring systems generate enormous quantities of measurement data, which usually has to be presented in various reports. Software packets for collecting and analysing measurements from various instruments offer powerful tools for in-depth data analysis. However, these systems provide reporting tools which are limited because only one manufacturer's instruments can be used as data source – it is impossible to combine data from different instrument types into one report. In addition, configuration of reports to suit user's custom requirements is often very hard or impossible. Analysing users' requirements and currently available solutions, we have developed ARS system for automatic generation of custom reports, using different instrument types and databases as data source.

## Structure

Application is structured modularly – easy upgrade and customisation in accordance to user requirements. The user interface is intuitive and user-friendly. Main components of application are:

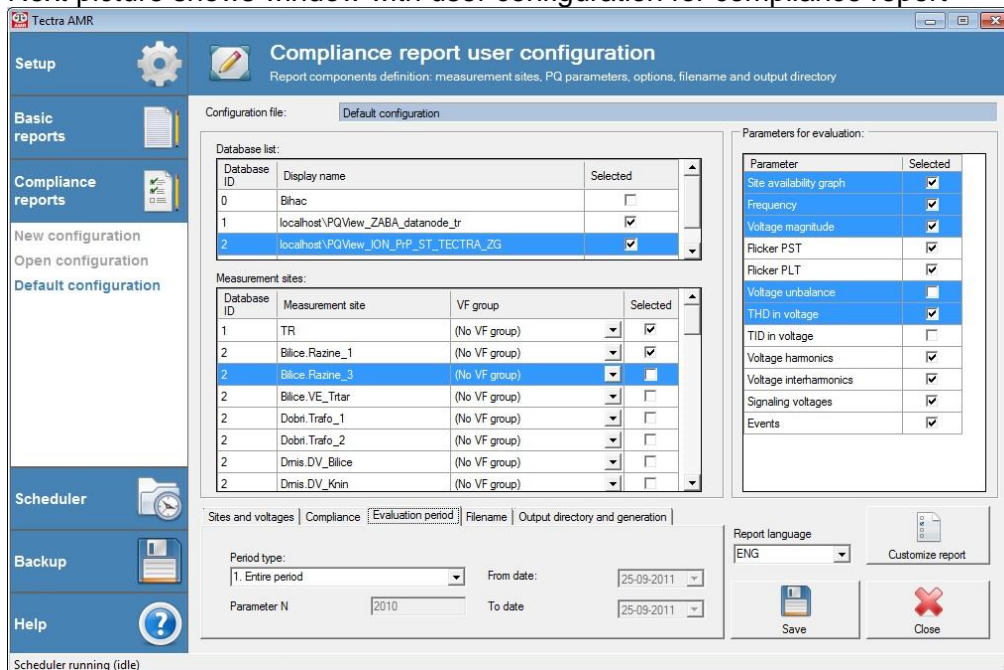
### System setup module

- Database and measurement sites administration
- User privileges management
- Measured quantities setup
- Automated generation scheduler setup

### Report configuration modules

- Configuration of different report types
- Selection of one or multiple sites
- Selection of parameters for analysis
- Selection of components
- Selection of specific parameters
- Selection of time interval
- Saving/loading configuration files

Next picture shows window with user configuration for compliance report

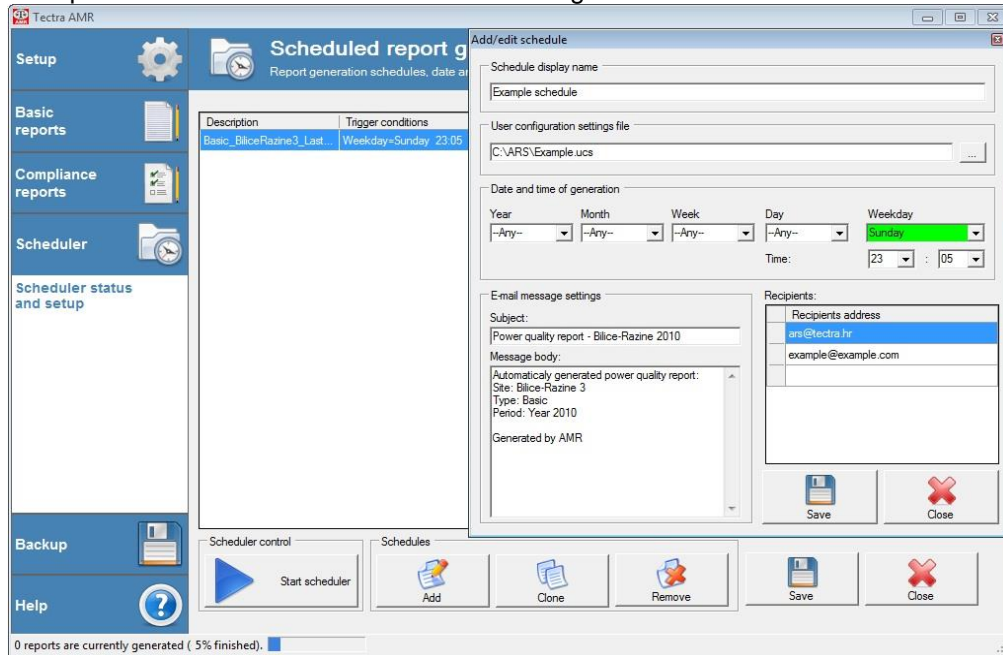


## ARS description

### Scheduler configuration module

- Choosing report configuration file
- Selection of date/time of automatic generation
- Flexible generation time selection – combination of year, month, date, weekday and time
- Recipients, subject and body of e-mail containing generated report that will be sent

Next picture shows window with scheduler configuration module



### Logging module

Logging of application status: automatic and manual report generation phases, warnings, errors. Log messages are stored in text files, and displayed in application upon user request.

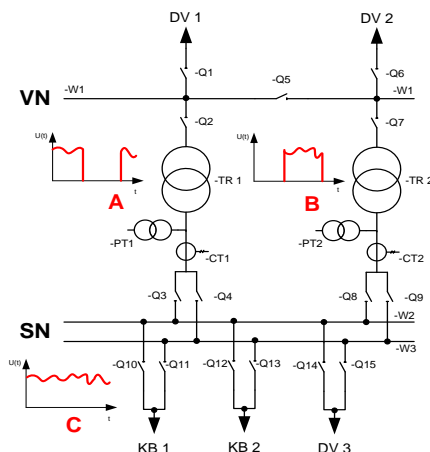
### Backup module

Backup and restore application setting, database and site settings, report configuration files...

### User-specific modules

New modules can be added upon user request: support for new functionalities and report types  
User specific modules should generate various report types as:

- PQ compliance reports according to standards like EN50160, IEEE 1159, NVE 1557,.....
- Non PQ related reports like energy management and loss calculations



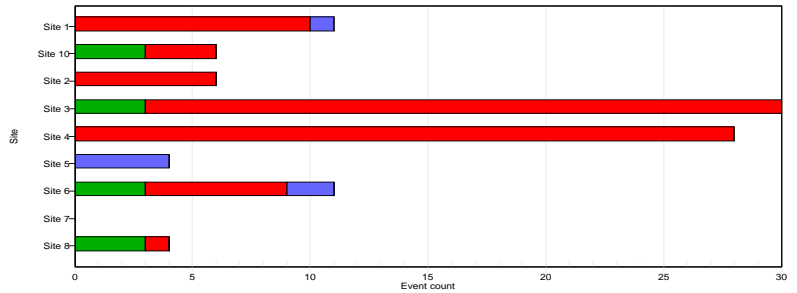
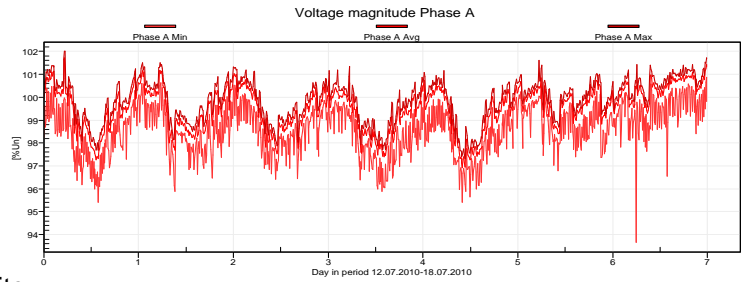
### Virtual feeder

Its common praxis that more transformers are connected in parallel on same busbar, but mainly only one is energized. As the customers are connected to the busbar, compliance evaluation should be done for busbar as well. But, CT and PT are mainly connected to the transformer and not to the busbar. To be able to evaluate compliance on busbar, special „VF“ algorithm has been developed. It allows PQ monitoring system to evaluate compliance on busbar, while having PQ monitors connected to each transformer

# ARS reports

## Basic reports

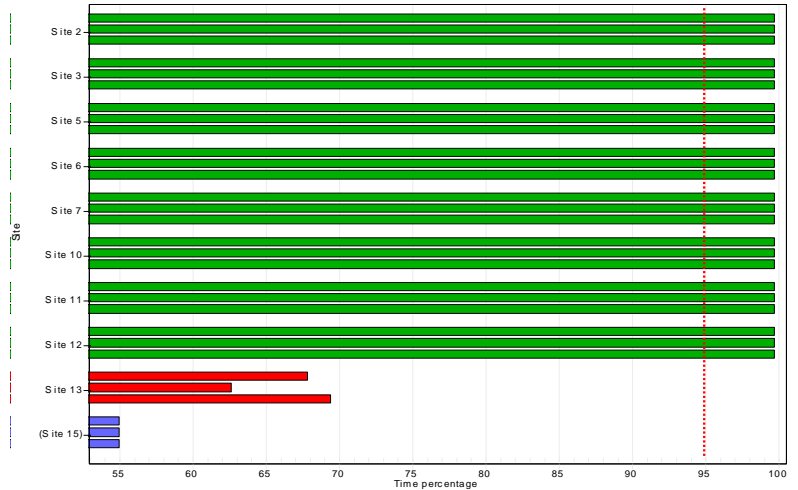
- Time trends of measured quantities (voltage, current, power...)
- Graph statistic of steady-state parameters per weeks
- Graph statistic of steady-state parameters per site
- Graph of Instrument's measurement availability
- Graph of measuring voltages availability
- Graph of voltage events counts (sags, swells, interruptions) and their classification



## Compliance reports

- Graph with compliance of over weeks or over sites
- Graph with compliance for each parameter
- Tables with voltage events classification and statistics – RMS variations, transients, RVC
- Tables with compliance of steady-state parameters over weeks or over sites
- Tables with power quality indices (SARFI, PQI...)
- Number and duration of long voltage interruptions

Compliance by phases in period 19.07.2010 - 25.07.2010  
Compliance criterion: 90%Ua < Vrms < 110%Ua in 95% of time



Next picture shows compliance table for all parameters and events, for multi-sites and multi-weeks

Site name	Number of weeks	Number of weeks			Number of non-compliant (missing) weeks by parameters												Event count		
		Compliant	Non compliant	Missing	f	Vrms	Pst	Plt	Vunb	Vthd	Vtid	Vh	Vih	Vmsf	RVC	Interruptions	Dips	Swells	
Site 1	52	20	32	0	0	16	X	13	0	30	3	0	X	0	11	0	10	1	
Site 2	52	49	3	0	0	0	X	0	0	3	1	1	X	0	0	0	6	0	
Site 3	52	46	6	0	0	0	X	1	0	6	0	0	X	0	0	3	27	0	
Site 4	52	27	25	0	0	25	X	0	0	0	0	0	X	0	0	0	28	0	
Site 5	52	31	21	0	0	0	X	6	6	19	0	0	X	0	7	0	0	4	
Site 6	52	46	6	0	0	6	X	0	0	0	0	0	X	0	6	6	6	2	
Site 7	52	41	11	0	0	0	X	0	0	0	11	0	X	0	6	0	0	0	
Site 8	52	0	0	52	(52)	(52)	X	(52)	(52)	(52)	(52)	(52)	X	(52)	(52)	0	0	0	
Site 10	52	22	19	0	0	6	X	0	0	0	19	0	X	0	0	3	3	0	



## ARS specifications

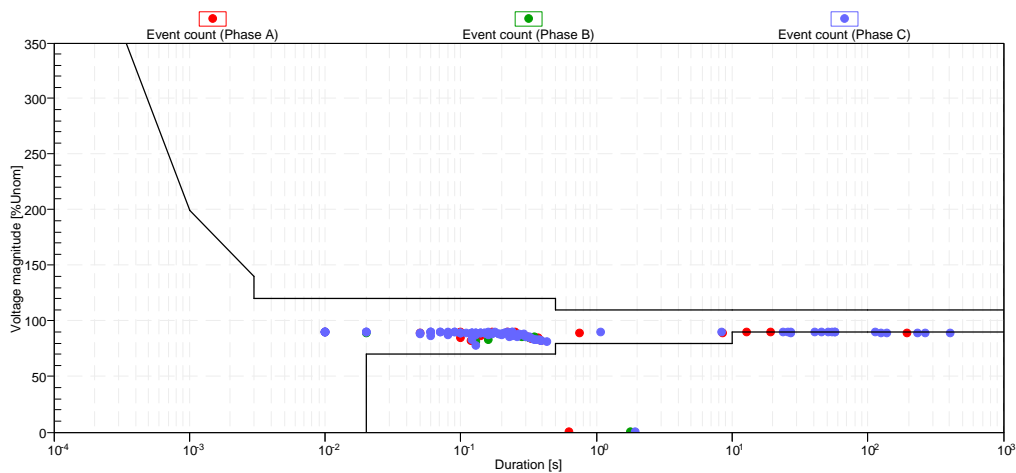
### Common specifications

- Time trends of measurements
- Availability of measurements and voltage
- Statistics over time periods (e.g. weeks)
- Statistics over measuring sites
- Statistics and classification of voltage events
- Selection of time aggregation and flagging
- Selection of voltage type: PN voltage or PP voltage
- Selection of voltage system: single phase or poliphase
- Analysis of events according to DIS-DIP, CBEMA, ITIC,...
- Analysis of compliance according to standards (e.g. EN50160)
- Analysis of parameters and events (single phase or poliphase)

Next pictures shows DIS-DIP table, generated in ARS report:

%Un	T[ms]							
	$t \leq 200$	$200 < t \leq 500$	$500 < t \leq 1s$	$1s < t \leq 5s$	$5s < t \leq 1min$	$1min < t \leq 3min$	$3min < t$	
$80 < U \leq 90$	8	11	2	0	3	0	1	25
$70 < U \leq 80$	0	0	0	0	0	0	0	0
$40 < U \leq 70$	0	0	0	0	0	0	0	0
$5 < U \leq 40$	0	0	0	0	0	0	0	0
	8	11	2	0	3	0	1	25

Next picture shows ITIC curve. generated in ARS report:



### Advanced specifications

- Creates reports using data from various instrument types and databases
- Compatibility with modern Windows operating systems - .NET technology
- User configurable reports: structure, captions, texts, coordinate axes, colours, graph formats
- Advanced algorithms (polyphase and temporal aggregation, flagging, virtual feeder,...)
- Automatic flagging according to IEC61000-4-30, de-energized status or user defined criteria
- Manual flagging / data characterisation (abnormal operating conditions, island mode, )
- Flexible modular structure – easy adaptation and upgrade to meet user requirements