Permanent Power Quality Measurement

1 Descriptions of Function

All prior work (intellectual property of the company or individual) or proprietary (non-publicly available) work should be so noted.

1.1 Function Name

Permanent Power Quality Measurement

1.2 Function ID

IECSA identification number of the function

G-3.8.1,G-3.8.2,D-11,C-9.4,C-9,C-9.1,C-9.5

1.3 Brief Description

Describe briefly the scope, objectives, and rationale of the Function.

The purpose of the permanent power quality measurement enterprise activity is to provide long-term and continuous monitoring in order to provide reliability and benchmarking statistics.

1.4 Narrative

A complete narrative of the Function from a Domain Expert's point of view, describing what occurs when, why, how, and under what conditions. This will be a separate document, but will act as the basis for identifying the Steps in Section 2.

Many customers which can include utilities and large consumers of electric power have a need for an installed permanent power quality measurement system. Historically, power quality meters were portable and installed on a temporary basis in order to capture, diagnose and solve a specific problem that might be occurring in the facility. However, with increased demands for power quality and reliability benchmarking, power quality contracts, billing and energy use verification, predictive maintenance and others, the need and demand for permanent power quality monitoring has increased dramatically in recent years.

The following is a typical scenario. An electric utility realizes the need for a permanently installed power quality measurement system. The reason could be new standards from the state PUC or competitive threats or even just to keep existing customers happy. In addition, the utility could be implementing power quality contracts and needs a mechanism to verify performance. A utility will then generally procure and install monitors at various locations. The locations could be statistically selected or just placed at key customer locations. Once the instruments are installed, it will be necessary to establish communication from a central location to the instruments. At the central server location, there will generally be two types of applications. The first is the downloading application that uses the communication medium selected and is used to setup and download the data from the instruments in the field. This requires communication from the central server location to the monitoring instrument either by telephone, Internet, satellite or other. Typically this is done on a daily basis or after a significant event occurs. The instrument captures and stores event data in standard or proprietary form inside instrument. Optional gateway device downloads event data from instrument, converts it to a standardized format (IEEE 1159.3 PQDIF), and stores until downloaded by enterprise system. Enterprise system downloads data from the instrument or gateway, converts to standard format if necessary, and puts in standardized file hierarchy (IEEE 1159.3 PQDIF Annex C) and/or a commercial power quality database (e.g. PQView). The second application resides on the central server and is usually a database application that is used to characterize, store and report results from the data collection. The central server also typically acts as a web server and is used to supply data over corporate intranets or the internet itself.

1.5 Actor (Stakeholder) Roles

Describe all the people (their job), systems, databases, organizations, and devices involved in or affected by the Function (e.g. operators, system administrators, technicians, end users, service personnel, executives, SCADA system, real-time database, RTO, RTU, IED, power system). Typically, these actors are logically grouped by organization or functional boundaries or just for collaboration purpose of this use case. We need to identify these groupings and their relevant roles and understand the constituency. The same actor could play different roles in different Functions, but only one role in one Function. If the same actor (e.g. the same person) does play multiple roles in one Function, list these different actor-roles as separate rows.

Grouping (Community)		***Group Description***
Permanent power quality measurement top level		Top level group with all important actors
Actor Name	***Actor Type (person, device, system etc.)***	***Actor Description***
Central	System	Downloads instruments located in the field, accepts incoming calls from

Grouping (Community)		*Group Description*
Permanent power quality measurement top level		Top level group with all important actors
Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
Server		instruments, creates database of event and steady-state data, generates reports and summary graphs and tables
PowerQuality Instrument	Device	Captures and records power quality events and sends to central server
Database and SoftwareProvider	Software	Provides download, archiving and reporting software
Communication	Device and System	Mechanism for power quality instrument to contact or be contacted by the central server
Customer	Person	Group interested in data collected from instruments, could be utility and/or end-use customers

Replicate this table for each logic group.

1.6 Information exchanged

Describe any information exchanged in this template.

Information Object Name	*Information Object Description*
Site selection	Place where monitor is to be installed

Information Object Name	*Information Object Description*
Site selection	Place where monitor is to be installed
Raw Power quality event data	Events and performance monitoring results captured by power quality instruments
Data summaries, graphs and tables	Post processed raw data summarized and presented in reports and graphs

1.7 Activities/Services

Describe or list the activities and services involved in this Function (in the context of this Function). An activity or service can be provided by a computer system, a set of applications, or manual procedures. These activities/services should be described at an appropriate level, with the understanding that sub-activities and services should be described if they are important for operational issues, automation needs, and implementation reasons. Other sub-activities/services could be left for later analysis.

Activity/Service Name	*Activities/Services Provided*
Event capture	Instruments in the field must capture events when the occur
Data download	Periodically, the central server must download the data from the instruments in the field
Characterization and Storage	After download, the data is characterized and stored in a central database
Reporting	Periodically, various reports are generated summarizing the data collected

1.8 Contracts/Regulations

Identify any overall (human-initiated) contracts, regulations, policies, financial considerations, engineering constraints, pollution constraints, and other environmental quality issues that affect the design and requirements of the Function.

Contract/Regulation	*Impact of Contract/Regulation on Function*

Policy	From Actor	May	Shall Not	Shall	Description (verb)	To Actor

Constraint	Type	Description	Applies to

2 Step by Step Analysis of Function

Describe steps that implement the function. If there is more than one set of steps that are relevant, make a copy of the following section grouping (Preconditions and Assumptions, Steps normal sequence, and Steps alternate or exceptional sequence, Post conditions)

2.1 Steps to implement function

Name of this sequence.

2.1.1 Preconditions and Assumptions

Describe conditions that must exist prior to the initiation of the Function, such as prior state of the actors and activities

Identify any assumptions, such as what systems already exist, what contractual relations exist, and what configurations of systems are probably in place

Identify any initial states of information exchanged in the steps in the next section. For example, if a purchase order is exchanged in an activity, its precondition to the activity might be 'filled in but unapproved'.

Actor/System/Information/Contract	***Preconditions or Assumptions***
Power quality instrument	Instruments installed and ready to capture, communication system functioning properly

2.1.2 Steps – Normal Sequence

Describe the normal sequence of events, focusing on steps that identify new types of information or new information exchanges or new interface issues to address. Should the sequence require detailed steps that are also used by other functions, consider creating a new "sub" function, then referring to that "subroutine" in this function. Remember that the focus should be less on the algorithms of the applications and more on the interactions and information flows between "entities", e.g. people, systems, applications, data bases, etc. There should be a direct link between the narrative and these steps.

The numbering of the sequence steps conveys the order and concurrency and iteration of the steps occur. Using a Dewey Decimal scheme, each level of nested procedure call is separated by a dot '.'. Within a level, the sequence number comprises an optional letter and an integer number. The letter specifies a concurrent sequence within the next higher level; all letter sequences are concurrent with other letter sequences. The number specifies the sequencing of messages in a given letter sequence. The absence of a letter is treated as a default 'main sequence' in parallel with the lettered sequences.

Sequence 1:

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1.1 – Do step 1
1.2A.1 – In parallel to activity 2 B do step 1
1.2A.2 – In parallel to activity 2 B do step 2
1.2B.1 – In parallel to activity 2 A do step 1
1.2B.2 – In parallel to activity 2 A do step 2
1.3 – Do step 3
1.3.1 – nested step 3.1
1.3.2 – nested step 3.2
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Sequence 2:

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2.1 – Do step 1
2.2 – Do step 2
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#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
#	*Triggering event? Identify the name of the event.*[1]	*What other actors are primarily responsible for the Process/Activity? Actors are defined in section1.5.*	*Label that would appear in a process diagram. Use action verbs when naming activity.*	*Describe the actions that take place in active and present tense. The step should be a descriptive noun/verb phrase that portrays an outline summary of the step. "If …Then…Else" scenarios can be captured as multiple Actions or as separate steps.*	*What other actors are primarily responsible for Producing the information? Actors are defined in section1.5.*	*What other actors are primarily responsible for Receiving the information? Actors are defined in section1.5.* *(Note – May leave blank if same as Primary Actor)*	*Name of the information object. Information objects are defined in section 1.6*	*Elaborate architectural issues using attached spreadsheet. Use this column to elaborate details that aren't captured in the spreadsheet.*	*Reference the applicable IECSA Environment containing this data exchange. Only one environment per step.*
1.1	Site Selection and Installation	Customer	Site Selection and Installation	Customer selects sites for permanently installed power quality monitors and installs them	Customer	Customer	Site Selection		Intra-Customer Site
1.2	Event Capture	PowerQualityInstrument	Event Capture	If thresholds are exceeded the power quality instrument captures and records and event	PowerQuality Instrument	PowerQualityInstrument	Raw power quality event data		NA

[1] Note – A triggering event is not necessary if the completion of the prior step – leads to the transition of the following step.

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
1.3	Event Transmittal	Database and SoftwareProvider	Event Transmittal	If an event is triggered, the instrument calls back to the central server and the server downloads the data	PowerQuality Instrument	Central Server	Raw power quality event data	Basic telecommunication constraints such as modem and dial up telephone connection, but could also include internet TCP/IP connectivity or even cellular	Customer / ESP
1.4	Data Storage, Characterization and Reporting	Database and SoftwareProvider	Data Storage and Characterization	Based on events recorded, data is characterized and loaded into a database and reports are generated	Central Server	Customer	Data report that includes a sag score	Data management in terms of culling important information	Customer / ESP

2.1.3 Steps – Alternative / Exception Sequences

Describe any alternative or exception sequences that may be required that deviate from the normal course of activities. Note instructions are found in previous table.

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments

2.1.4 Post-conditions and Significant Results

Describe conditions that must exist at the conclusion of the Function. Identify significant items similar to that in the preconditions section.

Describe any significant results from the Function

Actor/Activity	***Post-conditions Description and Results***
Power quality instrument	Instruments installed and ready to capture, communication system functioning properly

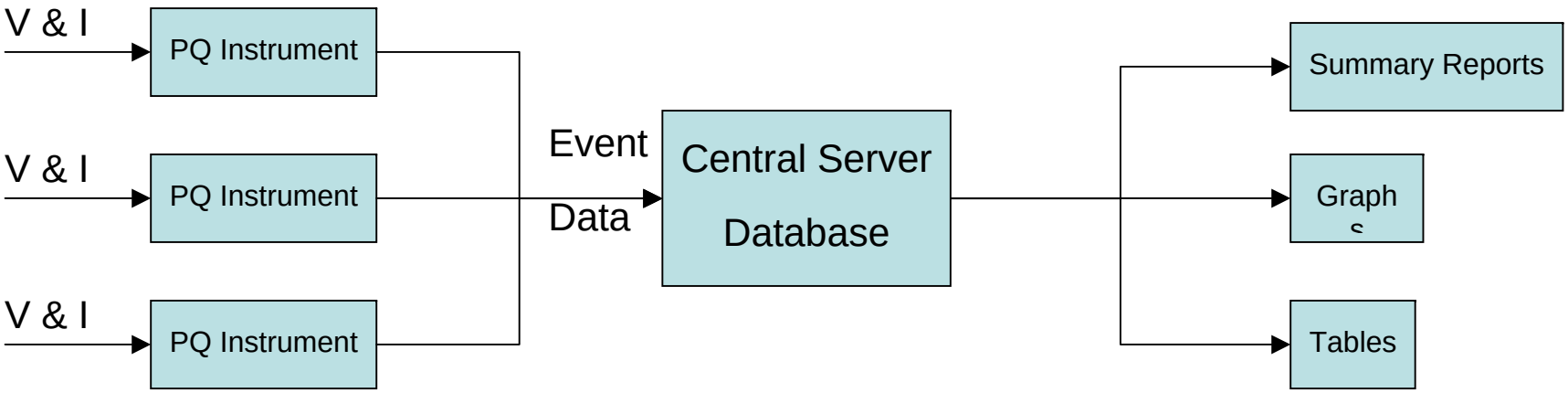
2.2 Architectural Issues in Interactions

Elaborate on all architectural issues in each of the steps outlined in each of the sequences above. Reference the Step by number..

Microsoft Excel Worksheet

2.3 Diagram

For clarification, draw (by hand, by Power Point, by UML diagram) the interactions, identifying the Steps where possible.



3 Auxiliary Issues

3.1 References and contacts

Documents and individuals or organizations used as background to the function described; other functions referenced by this function, or acting as "sub" functions; or other documentation that clarifies the requirements or activities described. All prior work (intellectual property of the company or individual) or proprietary (non-publicly available) work must be so noted.

ID	Title or contact	Reference or contact information
[1]		
[2]		

3.2 Action Item List

As the function is developed, identify issues that still need clarification, resolution, or other notice taken of them. This can act as an Action Item list.

ID	Description	Status
[1]		
[2]		

3.3 Revision History

For reference and tracking purposes, indicate who worked on describing this function, and what aspect they undertook.

No	Date	Author	Description
0.			