

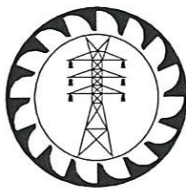
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CEB  
SPECIFICATION

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## THREE PHASE POWER QUALITY ANALYZER



CEYLON ELECTRICITY BOARD  
SRI LANKA



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## SPECIFICATION FOR THREE PHASE POWER QUALITY ANALYZER

### 1.0 SCOPE

This specification covers the general requirements of design, manufacture and testing of Three Phase Power Quality Analyzers to be used in low voltage distribution system of Ceylon Electricity Board.

### 2.0 SYSTEM PARAMETERS

(a)	Nominal voltage (U)	230V/400V
(b)	System highest voltage ( $U_m$ )	240V/440V
(c)	System frequency	50 Hz
(d)	Number of phases	Single /Three Phase
(e)	Method of earthing	Effectively earthed
(f)	System fault level	25 kA



### 3.0 SERVICE CONDITIONS

(a)	Annual average ambient temperature	30 °C
(b)	Maximum ambient temperature	40 °C
(c)	Minimum ambient temperature	6 °C
(d)	Maximum relative humidity	90%
(e)	Environmental conditions	Humid tropical climate with heavily polluted atmosphere
(f)	Operational altitude	From M.S.L. to 1900 m above M.S.L.
(g)	Isokeraunic (Thunder days) level	100 days

### 4.0 APPLICABLE STANDARDS

The equipment and components supplied shall conform to the latest edition of the standard specified below and amendments thereof.

(a)	IEC 61000-4-30:2015	Electromagnetic compatibility (EMC) - Part 4-30: Testing and measurement techniques - Power quality measurement methods
(b)	IEC 61000-4-7:2009	Electromagnetic compatibility (EMC) - Part 4-7: Testing and measurement techniques - General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto
(c)	IEC 61000-4-15:2010	Electromagnetic compatibility (EMC) - Part 4-15: Testing and measurement techniques - Flicker meter - Functional and design specifications
(d)	IEC 61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
(e)	IEC 61326-1:2012	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

However in the event of discrepancy, details given in this CEB specification supersede above standards.

### 5.0 BASIC FEATURES

The Power Quality Analyzer shall comply with the IEC 61000-4-30 standard under **Class A** measurement method to view power quality characteristics on real time basis and also store them

over a period for retrieval and analysis using inbuilt facilities and for downloading to a computer for analysis. It shall have an intrinsically safe and of compact lightweight design suitable for outdoor use (drip and dust proof), under service conditions mentioned in clause 3.0.

The analyzer shall be a portable device and suitable for use in a confined space.

### 5.1. Measuring Parameters

The Power Quality Analyzer shall be designed to conveniently analyze following parameters;

- (a) Voltage & current waveforms (AC and DC)
- (b) Power Factor
- (c) Power & Energy
- (d) Harmonics
- (e) System unbalance
- (f) Transients
- (g) Voltage Sags , Swells
- (h) Flicker
- (i) Frequency
- (j) Energy losses due to unbalance & Harmonic issues

### 5.2. Storage Capacity

It shall be provided inbuilt circuitry for storage of data from electricity distribution system over a period of at least 30 days and facility for downloading the data into a computer for analysis. Internal memory shall be non-volatile type with capacity not less than 8GB. It shall be available removable memory storage capabilities (SD card slot accessible).

### 5.3. Battery

Rechargeable battery (preferably Li-ion) shall be available to cover power outages at least up to 03 hours and readily available in local market.

### 5.4. Safety

The Power Quality analyzer shall comply with the safety requirements specified in IEC 61010-1 with ratings: 1000 V CAT III and Pollution Degree 2

### 5.5. Computer Software

Software should be provided with the equipment to configure, download and analyze the data. The software should be run on Microsoft Window platform and compatible with latest Microsoft Windows version 7, 8.1 or 10.

### 5.6. Input /Output Characteristics

The equipment shall support at least following wiring configurations.

- (a) Three phase four wire system WYE
- (b) Three phase three wire system Delta
- (c) Single phase with neutral
- (d) Three phase system without neutral WYE (3 Phase IT)

Following voltage and current input characteristics, and display modes for analysis shall be available in the analyzer.

#### 5.6.1. Voltage Inputs

- |                           |                                     |
|---------------------------|-------------------------------------|
| (a) Number of inputs      | : 4(3 phase + neutral) – DC coupled |
| (b) Maximum input voltage | : 1000 V                            |
| (c) Nominal voltage range | : 0 V to 1000 V                     |



**5.6.2. Current Inputs**

- (a) Number of inputs : 4 (3phase + neutral) – DC coupled  
 (b) Type :Flexible probes current measuring clamps for AC and DC  
 (c) Range : 0.5A to 2000A

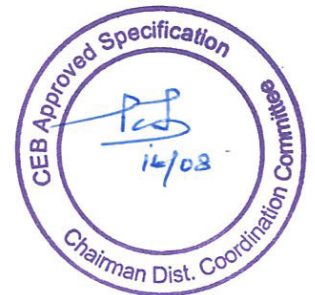
**5.6.3. Sampling System**

- (a) Resolution : 16 bit analog to digital converter on 8 channels  
 (b) Minimum sampling speed (for steady state) : 25 kHz on each channel simultaneously according to IEC61000-4-30  
 (c) Minimum sampling speed (for transients) : 200 kHz on each channel simultaneously  
 (d) Nominal frequency : 50 Hz

PLL Synchronization is required.

**5.6.4. Display Modes**

- (a) Waveform display (4 cycles of 4 waveforms on screen)  
 (b) Phasor diagram (to be displayed with waveform display)  
 (c) Meter readings (Provides tabulated view of all available readings)  
 (d) Trend graph  
 (e) Bar graph  
 (f) Event list

**5.6.5. Communication with PC**

Analyzer shall be provided with a USB port with accessories to connect to a PC.

Communication ability with a GPRS modem with necessary software and accessories shall be provided if specified in Price Schedule

**5.7. Accuracy and Range**

The analyzer shall be fully operational under following parameter ranges with specified accuracy.

Parameter	Range	Accuracy
Voltage	0 V – 1000 V	±0.1% or less
Current	0.5 A – 2000A	±0.5% or less
Frequency	46 Hz – 53 Hz	±0.01 Hz or less
Power factor	0 – 1	±0.1% or less
Phase angle	-360° to +0°	±0.1% or less

**5.8. Analysis and Results**

Following information/data shall be obtained from the analyzer for data analysis.

Voltage/Current/Frequency	Average RMS values, Maximum and Minimum Values, Capability to measure fundamental components of current and voltage
Sags and Swells	As specified in IEC 61000-4-30
Harmonics	Harmonic Voltages, Currents and Power THD , TDD, Harmonic order from 1 to 50 <sup>th</sup>
Power and Energy	Active, Reactive, Apparent Power and Power Factor
Unbalance	Negative, Zero and Fundamental values and Phase angles

Power Loss	Due to unbalance and harmonics
Transients	Trigger on sags, swells, interruptions and current levels as specified by IEC 61000-4-30
Flicker	As per IEC 61000-4-15

Averaging time of the steady state parameters shall be configurable between 0.25 s to 2 hrs in data logging mode. In addition to the default parameter sets, customer selected parameter sets should be configurable. Customer should be able to configure threshold values for parameters.

## 6.0 QUALITY ASSURANCE

The manufacturer shall possess ISO 9001:2008 or latest Quality Assurance Certification valid throughout the delivery period of this bid, for the manufacture of Power Quality Analyzers for the plant where manufacturing is being done. The Bidder shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacturer, along with the offer.

## 7.0 ADDITIONAL REQUIREMENTS

### 7.1. Manufacturing Experience

The manufacturer shall have minimum of 8 years experience in manufacturing Power Quality Analyzers. In addition, minimum of five (5) years experience shall be in manufacturing for orders from outside the country of the manufacturer. The product offered has to be in same voltage range of offered item and shall have been used in service utilities over past 5 years.

Manufacturer shall furnish a list of purchasers with year and quantity of the product offered with the offer to prove his manufacturing experience.

### 7.2. Packing

Each Power Quality Analyzer shall be suitable packed separately in a bio-degradable packing material to withstand rough handling and carry a label indicating the name of item, model/type No. etc.

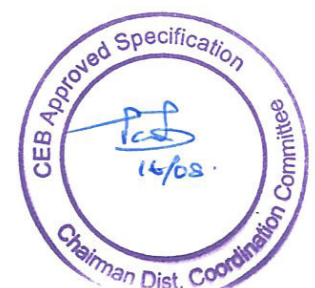
### 7.3. Warranty

Warranty shall be provided for the instrument for at least three (3) years.

### 7.4. Accessories and Documents to be supplied with the Instrument

Following accessories and documents shall be supplied with the Power Quality Analyzer;

- (a) Hard carrying case for the transportation of instrument
- (b) Soft carrying case
- (c) Operator manual
- (d) User guide for computer software
- (e) Power adapter / Battery charger
- (f) Standard batteries (3 hours or more)
- (g) Complete set of test lead and alligator clip set
- (h) Complete set of flexible current measuring clamps for AC and DC
- (i) 8 GB SD card
- (j) USB cable/cables
- (k) International plug adaptor set



## 7.5. Technical Literature and Drawings

Technical literature in English language on the installation with necessary connection diagrams and drawings, calibration and maintenance, user manuals shall be supplied with the instrument and they shall be descriptive & self-explanatory.

A calibration certificate shall be available for each power quality analyzer.

## 7.6. Calibration

The bidder shall provide the following details with respect to calibration of instruments.

- (a) Calibration interval
- (b) Address of places available for calibration of power quality analyzers

## 8.0 INSPECTION AND TESTING

### 8.1. Test Certificates

EMC and other test certificates, performance curves conforming to the international standards to be furnished with the offer.

The test certificates shall clearly indicate the following:

- (a) Name, address & country of the testing authority
- (b) Date of testing
- (c) Name of instrument type tested
- (d) No. of pages of the type test certificates
- (e) Manufacturer's identity / serial No. etc.
- (f) Basic parameters
- (g) The standard to which the equipment type tested
- (h) Comments & observations of the testing authority



Test certificates referred to shall be from an **accredited independent testing laboratory acceptable to the CEB**. Proof of accreditation by a national/ international authority shall be forwarded with the offer. Test reports shall be complete including all the pages as issued by the testing authority and shall be in English language. Parts of test reports shall not be acceptable.

### 8.2. Inspection

The Successful bidder shall make necessary arrangements for inspection by an Engineer appointed by the CEB and also to carry out in his presence necessary tests to verify the overall functionality of the equipment, software and accessories. CEB may waive off the inspection with the condition of witnessing the acceptance tests by an independent testing authority acceptable to CEB. In such a situation a notice of waive off will be issued in advance to the supplier.

## 9.0 INFORMATION TO BE FURNISHED WITH THE OFFER

The following shall be furnished with the offer.

- (a) Test Certificates in accordance with the clause 8.1.
- (b) Duly filled and signed 'Annex - B: Schedule of Technical Requirements and Guaranteed Technical Particulars'.
- (c) Documents to prove manufacturer's experience in accordance with Clause 7.1.
- (d) Documentary evidence in accordance with clause 7.5.
- (e) ISO 9001:2008 or latest Quality Assurance Certificate in accordance with clause 6.

## 10.0 ANNEX

Annex – A: Schedule of Technical Requirements and Guaranteed Technical Particulars  
Annex – B: Non-Compliance Schedule

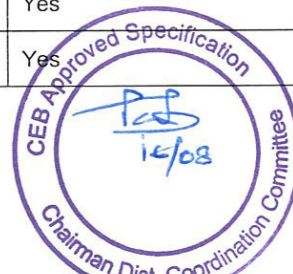


**SCHEDULE OF TECHNICAL REQUIREMENTS AND GUARANTEED TECHNICAL PARTICULARS**  
(CEB Requirements shall be filled by the procurement entity and information of the offer shall be filled by the manufacturer)

		CEB Requirement	Offered
1.	Name of the Manufacturer		
2.	Country of Origin		
3.	Make and Model No.		
4.	Applicable Standards	IEC 6100-4-30 Class-A additionally IEC 61000-4-7 for Harmonics IEC 61000-4-15 for Flicker IEC 61010-1 for safety IEC 61326-1 for EMC	
5.	Dimensions		
6.	Weight		
7.	Operating Ranges		
	(a) Voltage	0V -1000V	
	(b) Current	0.5 A-2000A	
	(c) Frequency	46 – 53 Hz	
	(d) Power factor	0-1.0	
	(e) Phase angle	-360° to +0°	
8.	Whether both AC and DC values of currents and voltages can be measured? (Yes/No)	Yes	
9.	Accuracy		
	(a) Voltage	±0.1% or less	
	(b) Current	±0.5% or less	
	(c) Frequency	±0.01Hz or less	
	(d) Power factor	±0.1% or less	
	(e) Phase Angle	±0.1% or less	
10.	Inputs		
	(a) Voltage	3 Phase + Neutral (With DC Coupled)	
	(b) Current	3 Phase + Neutral (With DC Coupled)	
11.	Sampling System		
	(a) Resolution	16 bit analog to digital converter on 8 channels	
	(b) Minimum sampling speed (for transient state)	200 kHz on each channel simultaneously	



	(c) Minimum sampling speed (for steady state)	25 kHz on each channel simultaneously according to IEC 61000-4-30	
	(d) Synchronization technique and no. of sampling points per 10 cycles		
	(e) Nominal frequency	50 Hz	
12.	Display Modes		
	(a) Waveform display	4 cycles of waveform of 4 waveforms on Screen	
	(b) Phaser diagram	with waveform display	
	(c) Meter readings	Tabulated view of all available readings	
	(d) Graphs	Trend graph/Bar graph	
	(e) Event list	Available	
13.	Measurement		
	(a) Voltage/Current/Frequency	As per clause 5.8	
	(b) Dips & swells		
	(c) Harmonics		
	(d) Power & Energy		
	(e) Unbalance		
	(f) Power loss		
	(g) Transients		
14.	Suitability in operation in the environmental conditions mentioned in clause 3.0 (Yes/No)	Yes	
15.	Warranty (Years)	3	
16.	General		
	(a) Display		
	(b) Data Logging	Averaging time shall be configurable between 0.25 s to 2 hrs in data logging mode	
	(c) Memory	8 GB	
	(d) Whether additional SD card is provided?	Yes (8 GB)	
	(e) Real time clock available? (Yes/No)		
17.	Accessories Provided;		
	(a) Power adapter	Yes	
	(b) International Plug adapter set	Yes	
	(c) Test leads and alligator clip set	Yes	
	(d) Flexible current probes	Yes	
	(e) Current clamps	Yes	



	(f) Soft carrying case	Yes	
	(g) Hard carrying case	Yes	
	(h) USB cable	Yes	
	(i) Battery	Yes	
18.	Software Package		
	(a) Compatible version of windows	Microsoft Windows version 7, 8.1 or 10	
	(b) Can data be downloaded to a PC?	Yes	
	(c) Does software package help for further analysis of data ?	Yes. It should have capability to calculate TDD	
19.	Safety	Compliance with: IEC 61010-1 Rated: 1000V CAT III Pollution Degree 2	
20.	Whether information provided as per clause 9.0 ?	Yes	

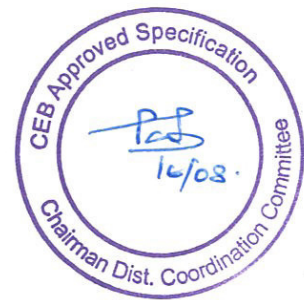
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Signature and seal of the Manufacturer

.....  
Date

I/We certify that the above data are true and correct

.....  
Signature and seal of the Bidder

.....  
Date



**Non-Compliance Schedule**

On this schedule the bidder shall provide a list of non-compliances with this specification, documenting the effects that such non-compliance is likely to have on the equipment life and operating characteristics. Each non-compliance shall be referred to the relevant specification clause.

Clause No.	Non-Compliance

.....  
Signature of the Manufacturer

.....  
Date

I/We certify that the above data are true and correct

.....  
Signature and seal of the Bidder

.....  
Date

