



SECTION – 2.18

POWER QUALITY METER (PQM)

1.0.0 INTRODUCTION

This section covers the requirements of Power Quality Meters (PQM) for 132 kV Substation of GIPCL and GSS (GETCO) end .

2.0.0 SCOPE OF WORK

2.1.0 The scope of work shall include the following equipment.

- Considering the limited quantity, the need for standardization across Owner's installations, existing availability of spares, ease of operation and maintenance, and proven compatibility with existing systems, as well as established approvals from competent statutory authorities based on prior use in RE projects of the Owner, the specified make and model are mandatory requirements.

Accordingly, the Bidder shall supply Schneider Make Model ION 92040 (Power Logic Series) with required accessories and communication ports (including memory card).

However, for general technical requirements, the Bidder shall comply in all respects with the specifications outlined in this section.

- PQM shall be complete in all respect including all the technical features as per IS/IEC standard and matching with CEA requirements & guidelines.
- The EPC contractor shall be responsible for complete installation, testing, commissioning, internal wiring, terminal blocks (TTBs), cabling, and SAS/ SCADA / EMS integration, including DC loading and instrument transformer burden limits etc in the scope of the bidder.
- One (1) number of PQM at 132kV GIPCL for Line-3 and One (1) number of PQM for Line-4.
- All software and associated licenses shall be provided on a perpetual basis, with no recurring or subscription-based costs to the Owner.
- For PQM at GETCO end, the Bidder shall provide the cost on an optional basis for a quantity of two (02) numbers.

3.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the relevant IS / IEC standards including amendments, if any, except where modified and / or supplemented by this specification.

Sl. No.	Number of Standard / Codes	Description
1.	IEC 61000-4-30	Testing and measurement techniques - Power quality Measurement methods
2.	IEC 61000-4-15	Testing and measurement techniques – Flicker
3.	IEC 61000-4-7	Testing and measurement techniques - General guide on harmonics and inter harmonics measurements and instrumentation, for power supply systems
4.	IS 15959	Data exchange for electricity meter reading, tariff and load control
5.	CEA Regulations	Technical Standard for Connectivity to the Grid, February, 2019 or, its latest amendment.



4.0.0 TECHNICAL REQUIREMENTS

4.1.0 Standard Requirements

- 4.1.1 It shall provide continuous monitoring of a three-phase system. It shall provide metering of current, voltage, real and reactive power, energy use, cost of power, power factor and frequency. Ethernet communications shall be available through the optional Multinet module. All meters shall be compliant to IS 15959 and its latest amendments.
- 4.1.2 The power quality meter shall support 3 elements Wye, 2.5 element Wye, 2 element Delta, and 4 wire Delta systems.
- 4.1.3 PQM shall be compact, multi-function panel mount power quality monitor, which measures, calculates and displays major electrical parameters of three phase power system like Voltage, Current, Active / Fundamental Reactive / Apparent Power and Energy, Individual Harmonics, Sags and Swells. The power quality meter shall have a frequency range of (45 to 69.9) Hz.
- 4.1.4 Three phase metering and power quality analysis shall be provided by a power quality meter. Metering shall include A, V, W, Wh, Wcost, Var, Varh, VA, VAh, Hz, and PF in True RMS or displacement (fundamental) quantities. Power analysis features shall include an event recorder, waveform capture, trace memory, harmonic spectrum display (through the maximum up to 63rd harmonic with total harmonic distortion) and a data logger function. All analysis data shall be non-volatile.
- 4.1.5 The Power Quality Meter shall have the following features:
- Power Quality measurement according to IEC 61000-4-30, class A
 - Harmonic, inter-harmonics and phase angles of the harmonics acc. to IEC 61000-4-7
 - Energy management and power monitoring functionality
 - Integrated cyber security functions
 - Standard input measuring circuits
- 4.1.6 Measuring and metering of harmonics shall be a continuous process with meters complying with provisions of IEC 61000-4-30 Class A and complying with CEA guidelines (Technical Standard for Connectivity to the Grid) dated February, 2019 or, its latest amendment.
- 4.1.7 The data measured and metered as mentioned in sub-paragraph (4.1.6) with regard to the harmonics, shall be available with Owner / GIPCL and it shall also be shared in a particular format with the GETCO periodically as and when required.
- 4.1.8 In addition to harmonics, periodic measurement of other power quality parameters such as voltage sag, swell, flicker, disruptions shall be done as per relevant IEC standard and reports shall be generated as per EN 50160 / relevant IEC/IS standard.
- 4.1.9 The Power Quality Meter shall convert instantaneous voltage and current values to digital values and use the digital values to calculate parameters.
- 4.1.10 Power Quality Meter shall Maintain internal data logs and record metering, status, event and alarm data into these logs as specified in the logging configuration for minimum period of 1 month.
- 4.1.11 Four switch inputs (if required) shall be provided which can be programmed for relay activation, counters, logic, demand sync, reset and alarms. Four output relays (if required shall be provided which can be programmed to activate on alarms, set points, switch inputs, kWh pulse, trace memory triggers or communications control. These output relays shall also be able to use demand metering values of A, VAR, W and VA to control load shedding.



- 4.1.12 Proper interface shall be provided via four isolated 4-20mA outputs (if required programmable from measured and calculated parameters. Transducer monitoring shall be provided via a 4-20mA input. Preprogrammed logic shall allow control for power factor correction. Current inputs shall be via 1 amp CTs and no VTs shall be required for voltages up to 600V. Universal auxiliary power can be 110 to 230V AC/DC. Local user interface shall include a keypad and display for entering all set points and reading all measured values, and LED indicators for output relays, communication status and alarm status.
- 4.1.13 It shall be panel mount with display, offers an easy local interface. Models shall have RS485 communications for programming and monitoring. Users can replace expensive additional devices by-adding the CONTROL, TRANSDUCER and POWER analysis options to the PQM as required.
- 4.1.14 Communication Protocols shall be:
Ethernet: IEC 61850, Modbus TCP, Gateway/Master, NTP
Serial: Modbus RTU master and gateway function for RS485 devices
- 4.1.15 Data export shall be made as per below:
- Power Quality Data Interchange Format (PQDIF) as per IEEE 1159.3, measured value recorder
 - CSV data for Power Quality recordings, measured value recorder
 - COMTRADE according to IEEE/IEC, fault records.
- 4.1.16 Energy Monitoring System shall access the required format as per above stored in the EMS itself and shall be capable of transferring data in required approved mode to SCADA/SAS as is when basis.
- 4.1.17 The PQM shall be connected to 0.2S class current transformer (CT) and 0.2 Class PT at 132kV Transmission line GIPCL end & GETCO end. For GIPCL end 132 kV transmission line, PQM shall be part of Line relay panel. For GETCO end, it shall be preferably mounted in 132 kV C&R panel in co-ordination with GETCO. However, in event, it is not feasible to install the panel in line panel, bidder shall provide required panel / enclose with required CT/PT wiring / cabling etc. at GETCO end.
- 4.1.18 The power quality meter shall be connected
- Directly for circuits up to 690V L-L
 - With Potential Transformers for circuits above 690V L-L
- 4.1.19 The delivered system is expected to provide meaningful measurement of the acquired data so that it is useful to the operators in assessing the current state of grid and can be used for carrying out the post- facto analysis. PQM should be integrated with PPC on TCP/IP for faster response.
- 4.1.20 An RS232 computer interface port shall be located on the front panel. Two RS485 and one RS232 communication ports shall be provided for simultaneous access using Mod Bus RTU protocol. Windows® based / any other standard software shall be provided to enable set point programming.
- 4.1.21 **Cyber Security** minimum feature of PQM shall be as per below:
- Role based access control (RBAC): password protection against unauthorized usage, central user management.
 - Secured and protected communication via IEC 61850 protocol, Web browser communication via https://
 - Firmware signature: only firmware signed by Manufacturer of PQM shall be loaded
 - Security log: non-volatile storage of SYSLOG event
- 4.1.22 **Test Terminal Block**



TTB shall be of 3 phase-4 wire type. TTB shall be mounted below the meter and in front of the panel. TTB shall be of large size and shall be of SCREW type (e.g. Dev industries model no 4SF)

4.1.23 Operation and display:

- Graphic display including operation via 4 function keys
- Integrated web server to interact with PC and HTML pages

4.1.24 Time Accuracy - Each meter shall have a built-in calendar and clock, having an accuracy of 10 seconds per month or better. The calendar and clock shall be correctly set at the manufacturer's works. The date (year-month-day) and time (hour-min.-sec.) shall be displayed on the meter front on demand. Meter shall have the intelligence to synchronize the time with GPS (Local GPS/CDCS GPS) signal and from PC using software. Limited time synchronization through meter communication port shall be possible at site. When an advance or retard command is given, twelve subsequent time blocks shall be contracted or elongated by five seconds each. All clock corrections shall be registered in the meter's memory and suitably shown on print out of collected data.

4.1.25 The meters shall be capable of receiving periodic time synchronization signals via proper online system. The meter time shall be in synchronism with GPS time master system. Time synchronization shall be carried out by NTP (Network Time Protocol), and it shall be synchronized with the master time clock. Necessary hardware and software shall be provided for the same.

4.1.26 The power quality meter shall have the features similar to Siemens-SICAM Q100 or equivalent.

4.2.0 Power Quality Measurement Parameters

Power Quality Meter Operational measured quantities, Power, Energy, Flicker, MSV Harmonics / Inter-harmonics, harmonics power, Data availability and Display list shall be not less than SICAM Q100.

4.3.0 Graphical Analysis

- a. Per phase individual harmonic bar graph representation.
- b. Real time vector representation of all 3 Phases for complete system analysis.

4.3.1 Alarms, set point triggers, input and output events can be stored in a 150 event record and time and date stamped by the internal clock. This is useful for diagnosing problems and system activity. Minimum and maximum values are also continuously updated and time stamped.

4.4.0 Wiring/Cabling Requirements

Required cabling / wiring shall be done by bidder with adequate size of cable/wires.

4.5.0 Power Quality Meter shall be capable of storing following Logs for period of 1 month minimum

- Energy Log
- Data Log
- Min/Max log
- Load Factor Log
- Time of Use Log
- Event Log
- Set point Log
- Alarm Log



- 4.6.0 Power Quality Meter shall be capable of communicating over Ethernet/IP Network and shall have internal web pages for configuration, real time data viewing, diagnostics and maintenance.
- 4.7.0 The power quality meter shall have virtual wiring correction capability to correct wrong wiring during commissioning.
- 4.8.0 Power Quality Meter shall have display to provide visualization for data and shall include:
- Real Time viewing of voltage, current, power, demand
 - Accumulated Energy and Time of Use readings
 - Flicker readings in Instantaneous, Short Term (PST), and Long Term (PLT).
 - Alarm conditions.
 - Phasor analysis.
 - Harmonic spectrum analysis and waveform scopes for both voltage and current.
 - Real Time trending.
 - Log status.
 - Configuration settings.
 - Time of Use.
 - Test Mode
- 4.9.0 The power quality meter shall provide the following accuracies. Accuracies shall be measured as percent of reading at standard meter test points.
- Power meter shall meet Class 0.2S accuracy requirements according to IEC 62053-22.
 - Voltage accuracy shall be within less than 0.05% for the one-second reading and less than 0.1% for 100-millisecond reading.
 - Current accuracy shall be within less than 0.025% for the one-second reading and less than 0.1% for the 100-millisecond reading.
 - Frequency shall have a display resolution accuracy of less than 0.01 Hz for the one-second reading and less than 0.03 Hz for the programmable 2-20 cycle readings.
 - The meter shall have an internal precision real time clock providing max accuracy at full Temperature range to 3.5 ppm, or less than 10 seconds per month drift.
- 4.10.0 Energy management minimum features shall be as per below:
- Active, reactive and apparent power and energy
 - 4 Quadrant Power - consumption and delivery/inductive and capacitive etc.
- 4.11.0 The power quality meter shall have calibration components that include
- Precision internal references with real-time auto calibration for voltage and current channels
 - The ability to self-calibrate at a rate not longer than every ten seconds, for the life of the Meter
 - The meter must stabilize its readings once "out of the box" and connected, within 10 seconds
- 4.12.0 The power quality meter shall have 16-bit Waveform and Fault Recorder.
- The meter shall record up to 1024 samples per cycle continuously on all 8 channels simultaneously, and transient captures sensitive to at least 800,000 samples per cycle.
 - The meter shall perform voltage and current recording with pre and post-event analysis when a waveform limit is exceeded. Pre and post-events shall be configurable to up to 179 cycles.
 - Fault recording shall offer 8 times full scale capture capability.
 - The meter shall allow viewing of Harmonic magnitudes to the 511th order. Real time Harmonic magnitudes shall be resolved to the 127th order. The meter's Harmonic measurement shall fully comply with the IEC 61000-4-7 standard.
 - Percent THD and K-factor shall be calculated by the meter.
 - PQM meters shall be integrated with SCADA / SAS / EnMS and the Power Plant Controller for comprehensive monitoring, control, fault recording, and data viewing and retrieval.



4.13.0 Housing Specification

- Protection Degree: IP-40 or, better.

5.0.0 DRAWINGS, DATA AND MANUAL

5.1.0 To Be Submitted After Award of Contract:

- Technical data sheets
- Dimensional general arrangement drawing
- Interconnection / wiring diagram
- Catalogues / drawings.
- Quality plan
- Test certificates
- O&M manual

6.0.0 TESTS

a. Type Tests reports / certificates shall be provided by the vendor and the same shall be valid within last 5 years.

b. Routine Tests

Each complete unit shall undergo routine testing. The list of Routine tests to be performed in the factory shall be as per IEC/IS standard.

c. Field Tests

The Contractor shall carry out the field-testing of PQMs after installation and integration between GIPCL & GETCO. The list of field tests shall be as per IEC/IS standard.