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**SUPPLY OF SCADA EQUIPMENT OF FLOW METERS UNDER SOP-I, KWSSIP**

**RFB No:**

**Loan No.:** P164704; Loan IBRD 8994 – PK

**Project:**KARACHI WATER & SEWERAGE SERVICES IMPROVEMENT PROJECT(KWSSIP)

**Purchaser:** PROJECT IMPLEMENTATION UNIT (PIU) KWSSIP,
 KARACHI WATER & SEWERAGE CORPORATION (KW&SC)

**Country:** PAKISTAN

**VOLUME-II: SPECIFICATIONS**

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**SECTION VII**

**SPECIFICATIONS**

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#

# SUPPLY OF SCADA EQUIPMENT OF FLOW METERS UNDER SOP-1, KWSSIP

All ISO, AWWA, ASTM, BS or any other standard referred here in all the sections of these Technical Specifications means the latest edition of these standards.

In case, any equivalent standard is requested to be applied by the Supplier, then the Supplier shall submit the authentic latest edition of the equivalent standard to be applied along with the copy of latest edition of the standard referred herein with full justification for applying the equivalent standard. The Supplier shall apply the equivalent standard after getting approval from the Project Manager/Purchaser.

The Supplier shall obtain all related existing services information/data for the execution of different components of the project from the concerned Departments. In case any information/ data cannot be obtained, it is deemed to be investigated by the Supplier.

## GENERAL OBLIGATIONS

The Conditions of Contract apply to all Sections of the Specifications the same as if they were written herein. Unless otherwise specified all materials incorporated in the Goods shall be new. Materials not otherwise designated by detailed Specifications shall be of the best quality and suitable for the purpose intended and shall be relevant to American or British Standard or equivalent certified English translated Standard where applicable.

### Workmanship

Workmanship for Installation of Goods shall be observed in conformance with the best trade practice and as per Price Schedules.

### Drawings

All Related Services, during its progress, and upon Completion, shall conform to as shown on the tender, construction and shop drawings. The Supplier shall complete the Related Services in every detail as specified by the Project Manager/Purchaser. Should any detail or details be omitted from the Drawings and Specifications which are essential to its intended completeness, then it shall be the responsibility of the Supplier to furnish and install such details, so that upon Completion, Goods are ready for use and successful operation.

#### Tender Drawings

The Drawings issued with the Bidding Documents and hereinafter referred to as Tender Drawings are typical drawings with regard to Goods. However, the Supplier shall submit its engineering design for approval of the Project Manager which shall be used for execution purpose.

#### Drawings for Installation of Goods

After award of Contract, Installation Drawings will be prepared by the Supplier for installation of Goods by the civil works contractor and as approved by the Project Manager. The Supplier will be solely responsible for design of all the Goods and every detail in the Installation Drawings pertaining to Electro-Mechanical and SCADA works. Installation of Goods shall be executed by the civil works contractor in conformity with the Installation Drawings issued by the Supplier for Goods.

#### Checking Drawings

The Project Manager shall check all the Installation Drawings carefully as soon as practicable after receipt, but this check/ review will not relieve the Supplier of any of his responsibility under the Contract.

### Standards and Supplementary Specifications

#### Applicable Standards

All workmanship, materials, equipment and associated components throughout shall where applicable and unless otherwise stated in the Contract comply with International Standards i.e., ISO, American or British Standards and Code of Practices or other Standards and Codes of Practice subject to the following conditions:

#### American and British Standards or Codes of Practice

The relevant American or British Standard and Code of Practice with all subsequent amendments, changes or additions as thereafter adopted and published, that are in effect at the date for submission of tender.

#### Standard Not Specified

If no Standard is indicated, then the relevant American or British Standard or equivalent certified English translated Standard, if any, shall apply.

#### Other Standards

Other Standards or Codes of Practice proposed by the Supplier at the time of tendering provided that these Standards or Codes of Practice are equivalent or superior to the relevant American or British Standards or Code of Practice, and certified translations of the Standards or Codes are supplied with Tender.

### Data to be Supplied

The following data must be submitted with the tender and the relevant section of these documents completed (i.e., in Annex-1)

* Copies of Standards or Codes of Practice proposed (including certified English translations).
* Full technical data.
* List of similar projects where all type of proposed flow meters have been used successfully.
* Confirmation that all Goods supplied are fully compatible and complete in all respects.

The Supplier shall assist in all means the Project Manager and civil works contractor in installing the meters, integration of meters or any information required by the Project Manager for successful commissioning and Completion. In case of non-assistance or delay in providing assistance to civil works contractor/ installation of meters or any information required by the Project Manager, the Project Manager may penalize the Supplier under GCC 27.1.

### Project Manager's Approval

The acceptance of a tender based upon a Standard or Code of Practice proposed by the Supplier shall only signify the Project Manager's general approval to use of such Standard or Code of Practice, and shall not make the Project Manager liable to accept a standard of workmanship subsequently found to be inferior to the corresponding American or British Standard or equivalent certified English translated Standard Codes of Practice.

### Certificates

Where the relevant Standard provides for the furnishing of a certificate to the Purchaser or Project Manager at their request, stating that the materials/equipment supplied comply in all respects with the Standard, the Supplier shall obtain the certificate and forward it to the Project Manager.

### Products

* All Goods covered by these Specifications shall be procured, from internationally reputed manufacturers, subject to approval of the Project Manager.
* The manufacturers shall have at-least 10 years of experience in manufacturing of similar type of Goods.
* The manufacturer shall have installed such instruments in at least 5 relevant projects supported with the completion certificates.
* The material and equipment furnished and installed by the Supplier shall be first quality, new, full-size and weight, free from defects, in first- class condition and standard in every respect.
* Where two or more units of the same class of equipment are required, these units shall be products of the same manufacturer.

### Documents Deliverables

Following documents shall be provided by the Suppliers as part of their Bids:

Table 1.1: Documents Deliverables

| **Sr. No.** | **Title** | **At the Bidding stage** | **As part of detailed Design upon award of Contract** |
| --- | --- | --- | --- |
| 1 | Project Schedule |  |  |
| 2 | Instrument List with OEM | * preliminary
 | * detailed
 |
| 3 | I/O List | preliminary | detailed |
| 4 | Control Philosophy & MethodologyModule Interlocking/C&E SheetsHMI Graphics Animation & ControlAlarm GenerationBypass/Maintenance Override | ✓ | detailed |
| 5 | Module Panel Wiring Drawings Note 1 | ✓ | * detailed
 |
| 6 | Instrument Data Sheets Note 1 | detailed |  |
| 7 | Instrument Loop Drawings Note 1 | ✓ |  |
| 8 | Module Programs (printed + soft copy) | ✓ |  |
| 10 | SCADA Server Configuration/Programs (Printed + soft copy) | ✓ |  |
| 11 | Instrument Calibration Manual, Sheets & Certificates Note 1 | ✓ |  |
| 12 | Instrument Installation & Hook-up Drawings Note 1 | preliminary |  |
| 13 | FAT and SAT Manuals/Procedures | - |  |
| 14 | Operation & Maintenance Manuals | - |  |

***Note 1:*** *A Drawing Folder with all the relevant Drawings and Instrument Data Sheets shall be provided by the Supplier.*

### Submittals

Before commencing work and prior to purchase of fittings and other equipment, the Supplier shall consult the instruments manufacturer and submit as part of Bid and Detailed Design the following documents/drawings, copies of the applicable Standards in both soft and hard form for review and approval of the Project Manager:

* Catalogues/brochures of the proposed product
* Details of testing facilities at the manufacturer’s plant
* Quality assurance certificates
* Complete manufacturer's data, copies of the latest edition of applicable standards and installation instructions.
* Certificate of testing of fittings, gratings and mounting arrangements including test data to show that all tests have been performed and all requirements have been met.
* Catalogue data for all valves, accessories, and fittings showing illustrations and schedule of parts to facilitate assembly and disassembly.
* Joint detail drawing and joint assembly procedures.
* Welding Procedure Specifications for the joints
* Manufacturer's recommended specifications for transporting, handling, loading, unloading, stock piling and storage of materials.
* Method Statement describing in sufficient detail how the works will be performed for all the installations.

### Calibration and Certificates

Supplier will keep all the records of instruments calibration including Manufacture certificates and will get approval from the Project Manager before installation of the Instruments. Supplier will submit Calibration Procedure/Manual for Project Manager’s approval and shall place all the records at each relevant station.

### Tests

The Manufacturer/ Supplier shall have available all means required, all materials, machinery, inspection equipment to carry out testing operations in his workshop.

The fittings shall be tested as per international standards as required by the Project Manager. All testing shall be done at the expense of the Supplier to establish that the materials and the performance requirements of these Specifications and the Supplier's guarantees have been fulfilled.

### Inspection

The Supplier shall inspect all products for damage immediately before installation. Any products that are damaged or not in accordance with the Specifications shall immediately be repaired or removed from the Site and replaced.

The manufacturer shall ensure that all the applicable codes, brochures and standards are available at their facility for the Purchaser’s reference during any visit or inspection. The manufacturer shall provide full assistance and co-operation for any inspection, when required by the Purchaser. When requested, the manufacturer shall provide access to and copies of all material certificates and inspection and test results obtained in the course of quality verification.

A detailed Inspection and Test Plan for Goods has been provided in *“Section VII - Schedule of Requirements”* of Volume-I.

### Testing and Commissioning

Upon partial or full completion of installation of Goods, testing and Commissioning of Flow Meters and SCADA system shall be carried out by the civil works contractor in collaboration with Supplier. The Commissioning shall be considered completed when complete SCADA system including all flow meters and associated software are put into operation successfully, acquiring data and is providing results upto satisfaction of the Purchaser.

If Commissioning is not successful then Supplier is responsible to identify the fault and supervise the rectification works (to be carried out by civil works contractor). No extra payment shall be made to the Supplier for identifying faults, supervising the rectification works and re-commissioning of the system up to the satisfaction of the Purchaser.

### Warranty

The Supplier shall warrant that all the Goods are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the Contract.

The Supplier shall further warrant that the Goods shall be free from defects arising from any act or omission of the Supplier or arising from design, materials, and workmanship, under normal use in the conditions prevailing in the country of final destination.

Goods to be furnished shall be warranted for a period of five (05) years from the date of Completion except batteries, which shall have the warranty period on one (01) year. Warranty shall be provided by OEM executable through Supplier. Further, the Supplier during complete warranty period will be liable to furnish all necessary requirements to claim the warranty of Goods i.e. on-site diagnostic/repair by OEM or OEM certified personal, dismantling, transportation/shipment to and from OEM etc. at its own cost up to complete satisfaction of the Purchaser. Furthermore, if there is some delay by OEM to repair/replace the Plant then during this period the Supplier shall be liable to install same Good at its own cost so that there is no hinderance in operation.

The Purchaser shall give notice to the Supplier stating the nature of any such defects together with all available evidence thereof, promptly following the discovery thereof. The Purchaser shall afford all reasonable opportunity for the Supplier to inspect such defects.

Upon receipt of such notice, the Supplier shall, within fifteen (15) days, expeditiously repair or replace the defective Goods thereof, at no cost to the Purchaser.

If having been notified, the Supplier fails to remedy the defect, within thirty (30) days, the Purchaser may proceed to take within a reasonable period such remedial action as may be necessary, at the Supplier’s risk and expense and without prejudice to any other rights which the Purchaser may have against the Supplier under the Contract.

### ACCEPTANCE CRITERIA

The following requirements shall be fulfilled by the Supplier in order for the Goods to be approved and accepted by the Project Manager:

* The Supplier shall provide the Project Manager with copies of all the type test results and certification.
* The Purchaser/ Project Manager may reject Goods that does not successfully pass the required tests (as specified in *Section VII - Schedule of Requirements”* of Volume-I) or fully comply with the requirements of this specification.

### Scope of Work

In broader terms, the Supplier will carry out the following scope of work comprising supply, deliver at final destination, training of civil works contractor for installation of Goods and training of SCADA based bulk customer metering & billing system:

1. Small UPS with battery backup at site
2. Establishment of Central Control Room (CCR) with all its equipment
3. Associated hardware/software to display real time water statistics in CCR.
4. Automated volumetric billing and its printing using SCADA system.
5. Integration of SCADA for Bulk Flow Meters with SCADA of Customer Flow Meters

#### Central Control Room (CCR) Equipment

The SCADA system equipment at CCR shall consist of but not limited to the following:

1. 02 No. SCADA servers with operating software
2. 02 No. Historian servers with operating software
3. 04 No. Operator workstations with 32” LED Monitor
4. 04 No. Engineering workstations with 32” LED Monitor
5. 04 No. 75” LED TV/displays
6. 01 No. SCADA software with associated licenses
7. 02 No. 20kVA Uninterruptible Power Supply (UPS) providing 06 hours battery backup for CCR
8. 04 No. A4 size monochrome laser printers
9. 02 No. A3 size color laser printers
10. 02 No. A3 size Photocopier machines
11. Local Area Network (LAN) comprising routers/switches, Firewall and other networking equipment
12. Ancillary equipment including installation material, cables, perforated cable trays, clamps mounting kits, GI/PVC conduit (flexible) etc.
13. All types of electrical wiring, DBs etc., for full installation and operation of CCR

#### Field Instruments

The following field equipment shall be procured under separate package:

* Battery Operated Ultrasonic Customer Meter with AMR (with M-bus interface)
* Battery Operated Electromagnetic Meter with GSM Kit
* GSM kits/ RTUs with battery for existing electromagnetic meters
* Remote Shutoff Valves
* GSM RTUs with Battery

However, This Package scope includes the following:

* IP 67 Cabinet of suitable capacity with marshaling (Terminal blocks, interposing relays, Circuit Breakers, Instrument Power supply, Cable Glands etc) for "GSM Enabled RTU/Data Logger
* Small UPS with battery backup of 06 Hours

#### Telecommunication Infrastructure

The following field equipment shall be procured under separate package:

* AMR Mobile Handheld Converter unit for meter reading through Wireless M-Bus

However, This Package scope includes the following:

* GSM/GPRS services provided by telecom service provider

### General Requirements

The general requirements for the SCADA system shall be as follows:

1. All equipment shall be suitable for continuous operation
2. All analog transmitting signals shall be 4-20 mA/0-10 V.
3. All digital outputs shall be volt free contacts.
4. Higher level interfaces (Modbus, Profibus HART, etc. as per Supplier’s specific system design)
5. Fluid intrusive transducers/components of all instruments shall be suitable for the applied service fluids.
6. Nameplates with tag numbers shall be provided for all instruments and other accessories such as junction boxes, cabinets, panels, etc.
7. Brass cable glands shall be used for cables entering field instruments or control panels
8. Measuring units of applicable parameters shall be:

Flow = Million Gallons (Imperial) per Day (MGD)

Pressure = Bars (bar)

Temperature = Degree centigrade (oC)

Current = Ampere (A)

Voltage = Volt (V)

Frequency = Hertz (Hz)

### SCADA System Topology

The Suppliers are free to use contemporary SCADA system in designing their solution for water monitoring system. However, archival of all water flow data is required to be done on Purchasers proprietary hardware located at the CCR. Similarly, data processing to generate graphical and text reports, trends, logs etc. shall be done over software running on the Control System equipment, thus no Cloud storage or processing is required. Conceptual drawing of SCADA topology is shown in
**Figure 1**. The Suppliers shall clearly provide a functional description of each of the following aspects of their proposed SCADA based water monitoring system:

#### Transducers/Sensors

Transducers / Sensors mainly include smart flow meters, remote shutoff valves and motion sensors with buzzer. However, additional sensors for a fully functional system shall also be provided by the Supplier if deemed necessary.

#### Gateways and Data Acquisition

Supplier shall describe this layer of his proposed solution and identify both hardware and software deployed to transport the water measurement data. Additional data generated by flow meters shall be transported to the next layer. The Supplier shall also describe his network topology and telecommunications backbone for both LAN and WAN.

#### Central Control Room (CCR)

CCR traditionally provides process Management Services. Data analytics are required to be performed on the servers. Software and related applications required for monitoring and control. CCR shall comprise but not limited to the equipment as stated above.

#### Application

The Supplier shall suggest solutions to monitor and analyze Raw Data collected from different type of Flow Meters identifying leaks in the system and remote shut off valves. Proposed software shall ingest data collected from sensors and flow meters to perform, device control, monitoring and, data analytics services.

#### Data Communication

The data communication media shall comprise data transmission and receiving equipment at all field sites. All of the sites shall be separately maintained to facilitate data communication by public cellular network. All of the equipment shall be built on international standards. Supplier shall state the international standards complied by the proposed equipment. The telecommunication media between the CCR and the field modules at different sites shall be GSM/GPRS/LTE system and necessary interfaces to be provided.

***GPRS/GSM/LTE (Telecommunication Medium)***

GPRS/GSM/LTE provided by telecom service provider shall be used as a telecommunication medium to provide realistic data capability via cellular telecommunications technology. The Supplier shall indicate the normal and maximum and data transmission speed in Kbps. GPRS/GSM/LTE modems shall be installed at each site. Supplier shall be responsible for the monthly recurring charges for five (05) year and one-time installation and subscription charges shall also be paid by the Supplier. Suppliers shall justify the use of their proposed communication interface by indicating the size of data (bits/bytes) generated by the flow meter for individual water flow reading transmitted to the CCR.

#### Security

The Supplier shall provide cyber security solutions which will prevent malicious software, data breaches & hacking across the network.



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**Figure-1: Topology of SCADA System**

### Physical Layer Interfaces

#### Telecommunication interface (GPRS/GSM/LTE Equipment)

Minimal features shall be as follows:

* Power Loss alert
* Support data upload via GPRS and SMS on schedule
* Support data upload via GPRS and SMS triggered by alarm or manual check
* Real time alarm report via GSM SMS and/or GPRS data
* Device setup parameter check and status report via GSM SMS and/or GSM data
* Supports local and remote setup via GPRS
* Programmable data capturing type, range, start point, threshold and pulse level
* RS232 port for local setup or data transmission
* RS485 port for device measurement supporting industrial Modbus protocol
* Support dynamic domain name or fixed IP
* Support UDP or TCP or appropriate LTE protocols
* 4 MB Nonvolatile memory storing data logged
* Internal rechargeable battery backup
* Operating temperature 0 to 50°C
* Any additional requirement for successful operation of the entire system

#### Configuration/Management

* Web configuration interface; password protected
* 02 login levels (user, admin)
* Easy Installation Wizard
* Telnet Session for Local or Remote Management
* Firmware upgrades through HTTP, TFTP, or FTP
* Configuration File Backup and Restore
* Support of TR-069
* Any additional requirement

#### Interfaces

* ADSL Port (RJ-11)
* Fast Ethernet Ports (RJ-45)
* WLAN according to IEEE 802.11b/g/n 1x USB Host 2.0
* Any additional requirement for successful operation of the entire system

### Central Control Room

The Purchaser will inform the location to be used as Central Control Room. In room design and layout shall be prepared and submitted by the Supplier showing electrical, networking etc. works for the approval of the Project Manager.

#### SCADA & Historian Servers

The servers shall be based on open system and fault tolerant architecture based on international (ISO, IEC,) and widely accepted in practice industry standards, especially for the following subsystems:

* Computer network and associated communication protocols,
* Operating systems,
* Graphic user interface,
* Import/export database facility,
* Programming languages used for the coding of application program,
* Processors,
* Computer interfaces,
* Computer peripheral equipment.
* Modular software architecture with formalized and openly published Application Program Interfaces (API) to enhance the application portability and system opening to third party software package,
* Minimum dependency between hardware equipment and software, modular design concept in terms of functionality and capacity.
* The hardware facilities shall be based on similar product line equipment in order to minimize spare parts, maintenance, training and expandable supplies costs.

All the hardware equipment shall be based on off-the-shelf products and incorporate the latest trend in hardware equipment from manufacturers' catalogues.

The design of hardware configuration shall ensure an efficient and reliable operation of all the functions detailed herein. The Supplier shall quote and provide, as part of the contract, any equipment not specifically identified in this section but which is necessary for the correct operation of the SCADA System.

##### Basic Design Principles

The tasks to be performed by various servers are defined in the preceding sections. These tasks may be carried out either individually by separate and dedicated computers or by computers regrouping several of these functions. The number of computers allocated to each function shall be proposed by the Supplier in order to meet the performance, sizing and availability requirements.

Power loss detection, automatic shutdown and resumption of server/workstation operation shall be provided.

##### Server Requirements

General specifications for Server and Workstation are given below however, the Supplier will be liable to submit detailed specs with technical data sheet to the Project Manager for approval:

Processing units

The processors shall preferably use RISC (Reduced Instruction Set Computer) with 64 bits architecture. Servers shall be based on the latest Intel® Xeon® gold series processors with latest generation.

Main memory

Each server and workstation must have sufficient random-access memory to meet the system performance requirements. Moreover, memory shall be field expandable to meet the future expansion requirements.

Server system terminal

Each server shall be equipped with a system terminal used for operational control of the server and for system diagnostics. These terminals shall allow monitoring and controlling of the state of the server. From these terminals, it shall be possible to halt or to run the system. Moreover, the access to these system terminals shall be protected by password. Each terminal shall consist of a VDU (32" at least) with a wireless keyboard and mouse.

Disk storage units

The disk storage units, for servers and workstations, shall use a latest industry standard interface. The following minimum requirements shall be met for each storage device (disk and controller):

* SATA 3 (6 Gbit/s transfer rate interface) min. capacity 2 TB
* Average access time less than 9ms.
* Buffer size 16Mb
* Average latency 5ms
* Hot swap capability
* Max transfer rate better than 600MB/s,
* Write protect mechanism
* Error checking capability
* Capability to report hardware and software errors.

Furthermore, the Supplier shall propose RAID based technical solution to ensure a high data availability (e.g., mirroring method) for disk units of servers.

Archival mass storage units

Write Many Read Many (WMRM) optical disk storage units shall be proposed as mass storage units. This storage system shall be compliant with the industrial standard such as DVD-RAM. A user-friendly software utility to be provided to facilitate DVD writing.

DVD-ROM units

Each server and workstation shall be equipped with a DVD-ROM unit for software delivery. The DVD-ROM units shall have the following features or latest applicable features available in the market:

* Capacity: 8.5 GB/side (Dual Layer - DL)
* Data transfer rate 11 MB/s SL - 8 MB/s DL - 6 MB/s CR-ROM
* Interface SATA/SCSI

##### Main Features

A common server shall function as both SCADA and Historian server and shall be as per the following minimum specifications:

* Intel® Xeon® gold series processor latest version
* Intel latest series chipset
* 64GB RAM
* 8TB Internal Hard disk drive
* 1TB SSD Hard Drive
* 2GB Graphic Card
* Thermal Take, Cooler Master or Equivalent Tower Casing
* HDMI port for connection to the High quality monitor
* DVD/RW drive
* Latest MS WINDOWS Server Operating System or latest
* Keyboard, Mouse and Peripheral Interface Cards
* 2U Rack mount chassis including redundant power supply (Minimum 500W)

Two (02) No. SCADA servers shall be used, one as main and other as backup storage. In addition, Data shall also be stored on external media.

Two (02) No. Historian and data Archival servers shall be used, one as main and other as backup storage. In addition, Data shall also be stored on external media.

#### SCADA Software

SCADA software with one-time license suitable for the control and monitoring applications shall have the following functions:

* Graphical display for the different functions and utilities
* Real time status indication
* Historical recording for events and trending of variables
* Report generation: SCADA Software will be provided and configured with Reports updating. (3) No. of consolidated Reports i.e., Daily, Weekly and Monthly, shall be configured on SCADA Server
* Different access levels between operators and managers
* All Software used shall be licensed in the name of KW&SC
* The SCADA software for water monitoring shall have the provision for integration with control software for actuators in future
* The SCADA software shall have the provision to connect all existing meters and shall have the provision to include future meters
* Different access levels between operators and managers
* All Software used shall be licensed in the name of the Purchaser
* User-defined export formats for exporting to billing systems
* Automatic export functionality
* Grouping of meters
* Management of users
* Overview of info codes
* Advanced filtering
* Software shall have an option to track the manipulation of data

#### Operator and Engineering Workstations

The operator and engineering workstations shall be PC based with the following specification as minimum:

* Intel core i9 CPU with latest generation/version
* 64 GB RAM
* 2 TB Hard disk drive
* 32" LED monitor
* DVD/RW drive
* HDMI port for connection to the High quality monitor
* I/O ports one bidirectional parallel port and four universal serial bus
* Windows 11 or latest operating system

#### Uninterrupted Power Supply (UPS) AT CCR

* Uninterruptible Power Supply (UPS) of 20 kVA capacity providing at least 06 hours battery backup for all CCR equipment including but not limited to SCADA server, Historian and Data Archival, Operator workstation, Engineering workstation, LAN components, 75" LED, Printers, Photocopier, including all accessories and other incidentals.
* Dual AC UPSs shall be provided for all equipment at the CCR. It shall be rated to supply the installed load with 30% spare capacity for future use.
* AC UPS shall comprise of chargers, battery bank and invertors. The switch over from mains to the UPS supply and vice versa shall be accomplished in less than 5 msec.
* The UPS shall be floor or wall mounted; self-contained and metal clad and shall be suitable for supplying a nonlinear load.
* It shall be possible to open the enclosure front door when the unit is in use without exposing any live contact to touch.
* The UPS shall be an on-line type incorporating a six-pulse rectifier and pulse width modulation inverter technology with microprocessor control. It shall incorporate a static bypass switch, which shall operate in the event of UPS failure, overload or manual initiation in order to transfer the output supply to mains without disturbance to the output supply.
* The UPS shall incorporate a dc under voltage trip circuit to electronically trip the UPS output in order to protect the batteries.
* The output of the inverter shall be a pure sine wave having less than 2% THD for linear loads and less than 4% for nonlinear load. It shall be suitable for load power factors 0.7 lag to 0.9 lead.
* The unit shall have a dynamic response such that a 100% step load causes an output voltage transient of less than ± 4% with a recovery time of less than 4 msec.
* For three phase output units the output voltage shall not vary by more than ± 1% for an unbalance of 10%.
* The load crest factor shall not be less than 3:1.
* The efficiency at full load and 0.8 power factor shall be greater than 88%.
* The unit shall incorporate a monitoring and diagnostics system to provide an audible alarm to provide warnings and fault indication.
* The following parameters shall be monitored:
* Inverter output voltage
* Battery voltage
* Static bypass voltage
* Output current
* Inverter output frequency
* Available battery bridging time at rated load
* Available battery bridging time depending on actual load.
* Indicators to indicate
* UPS status
* UPS alarm conditions.
* It shall be possible for operations and maintenance personnel to determine the cause of UPS failure by viewing a fault annunciation display or by interrogation of a ‘user friendly’ integral key pad and display unit.
* The UPS shall have an emergency power off facility. This shall be operable both locally and remotely. A 24 V dc emergency shutdown relay shall be provided to accept the remote shut down signal.
* The UPS shall be required to be manually reset after operation of the emergency shutdown.
* The UPS shall provide a volt free contact output to indicate:
* Warning, i.e., low battery capacity
* Fault
* Static bypass in use.
* The UPS shall have an overload capacity of 150% for 30 seconds and shall be protected in the event of a short circuit of the output.
* The batteries shall be housed, either within the UPS enclosure or within a separate matching battery cubicle suitable for location adjacent to the UPS.
* The batteries shall be of the maintenance free sealed for life lead acid type.
* Batteries shall be contained within translucent impact resistant flame retardant polypropylene cases. They shall be designed for no maintenance and shall have a life in service of at least 5 years.
* The cells shall be arranged in tiers to enable a rapid visual check and access for maintenance. Terminals shall be shrouded to prevent accidental contact. The battery enclosure shall be corrosion resistant and ventilated to prevent the buildup of gases.
* The battery installation shall be supplied complete with all tools etc. necessary for the safe and efficient maintenance of the batteries.
* Warning notices shall be provided for wall mounting to warn of the presence of charge gases.
* The battery supply to the UPS shall be via a fused load break switch disconnected circuit breaker.
* The battery recharge time to 90% of full charge shall be approximately ten times the discharge time at full load.

#### Printers

A4 size monochrome and A3 size color laser report printers shall be supplied and installed to print documents and reports generated by the SCADA workstation. The printers shall be supplied complete with interconnecting cables and toner cartridges. The printers shall be powered from 220V AC UPS power supply.

* A3 color laser printer shall be duplex type having minimum print speed of 26 ppm for black & white and 10 ppm for colored in A4 size. Its minimum resolution shall be 1200x1200 dpi. It shall have USB 3.0 and Ethernet 10/100Base-TX interfaces. Its monthly duty cycle shall not be less than 6000 pages.
* A4 monochrome laser printer shall have the capability to print legal sized papers. It shall be duplex type having minimum print speed of 26 ppm in A4 size. Its minimum resolution shall be 1200 x 1200 dpi. It shall have USB 3.0 and Ethernet 10/100Base-TX interfaces. Its monthly duty cycle shall not be less than 8000 pages.

#### Photocopier Machine

The A3 size photocopier machine shall have the following minimum specifications:

* Copying process: Four laser beams and electro-photographic printing
* Copy speed: 70 copies per minute (A4)
* Resolution: 1,200 dpi
* Multiple copy: Up to 999
* Warm-up time: Less than 30 seconds
* First copy speed: Less than 4 seconds
* Zoom: 25-400% (in 1% steps)
* Memory: 160 GB Hard Disk Drive
* Paper input capacity: Standard: 2 x 1,550-sheet paper tray(s), 2 x 550-sheet paper tray(s), 100-sheet bypass try, Max.: 8,300 sheets
* Automatic Document Feeder (ADF) capacity: 150 – 250 sheets (less than 80 -69 g/m2)
* Paper output capacity: Standard: 500 (A4), 250 (A3) sheets
* Paper size: A6 –A3
* Power source: 220 – 240 V, 50 – 60 Hz

#### LED Display

The 75’ LED Displays (04 No.) shall enhance monitoring capabilities as well as operator awareness and response. Real-time SCADA system for various sites of KW&SC shall allow multi-user access to control room LED displays and provide decision-making support for critical situations. The LED shall meet the following requirements:

| **Parameter** | **Least Required Value/Standard** |
| --- | --- |
| Display Size (in inches) | 75” |
| Resolution | 4K |
| Brightness (Typ.) | 450nit |
| Contrast Ratio | 5000:1 |
| Viewing Angle (H/V) | 178:178 |
| Response Time (G-to-G) | 4ms |
| Input | Analog D-SUB, DVI-D, Display Port 1.2, HDMI1, HDMI2, Component (CVBS Common) |
| Output | RS232C (in/out) through stereo jack, RJ45 |
| Power Supply | AC 100 - 240 V~ (+/- 10 %), 50/60 Hz |
| Features | ACM Support (Advanced Color Management), Auto Source Switching & Recovery, Lamp Error Detection, Super Clear Coating, TemperatureSensor, RS232C/RJ45 MDC, DP 1.2 Digital Daisy Chain (Supporting 2x2 UHDResolution, HDCP Support), Smart Scheduling,Smart F/W update, Clock Battery (80hrs Clock Keeping) Built In MagicInfo (Lite, Premium-S, Videowall-S) |

#### Local Area Network (LAN) at CCR

* 1000 Mbit/s standard Ethernet Local Area Network shall be provided in order to ensure the necessary system availability.
* IT switches/Routers shall be industrial type rated up to 65°C ambient temperature equipped with necessary interface to connect with the fiber optical cable. They shall comply with IEEE standards for local area networking. The proposed switches shall be equipped with a redundant power supply to ensure a high reliability.
* Network Management System (i.e. both hardware and software) suited to the proposed LAN and based on Simple Network Management Protocol (SNMP) standard shall be provided. LAN equipment shall comply with the required performance.

#### Small Uninterrupted Power Supply (UPS) at Site

* Small UPS of 400 VA capacity with Battery Backup of 6 Hours, Safety Box, IP67 Enclosure to be installed for RTUs, LUT's, PIR motion sensor and Remote Shut Off Valve Site.
* The UPS capacity shall be sufficient to power the load for a period of 24 hours.
* AC UPS shall comprise of chargers, battery bank and invertors. The switch over from mains to the UPS supply and vice versa shall be accomplished in less than 5 msec.
* The UPS shall be floor or wall mounted; self-contained and metal clad and shall be suitable for supplying a nonlinear load.
* It shall be possible to open the enclosure front door when the unit is in use without exposing any live contact to touch.
* The UPS shall be an on-line type incorporating a six-pulse rectifier and pulse width modulation inverter technology with microprocessor control. It shall incorporate a static bypass switch, which shall operate in the event of UPS failure, overload or manual initiation in order to transfer the output supply to mains without disturbance to the output supply.
* The UPS shall incorporate a dc under voltage trip circuit to electronically trip the UPS output in order to protect the batteries.
* The output of the inverter shall be a pure sine wave having less than 2% THD for linear loads and less than 4% for nonlinear load. It shall be suitable for load power factors 0.7 lag to 0.9 lead.
* The unit shall have a dynamic response such that a 100% step load causes an output voltage transient of less than ± 4% with a recovery time of less than 4 msec.
* For three phase output units the output voltage shall not vary by more than ± 1% for an unbalance of 10%.
* The load crest factor shall not be less than 3:1.
* The efficiency at full load and 0.8 power factor shall be greater than 88%.
* The unit shall incorporate a monitoring and diagnostics system to provide an audible alarm to provide warnings and fault indication.
* The following parameters shall be monitored:
* Inverter output voltage
* Battery voltage
* Static bypass voltage
* Output current
* Inverter output frequency
* Available battery bridging time at rated load
* Available battery bridging time depending on actual load.
* Indicators to indicate
* UPS status
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* It shall be possible for operations and maintenance personnel to determine the cause of UPS failure by viewing a fault annunciation display or by interrogation of a ‘user friendly’ integral key pad and display unit.
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* The UPS shall be required to be manually reset after operation of the emergency shutdown.
* The UPS shall provide a volt free contact output to indicate:
* Warning, i.e., low battery capacity
* Fault
* Static bypass in use.
* The UPS shall have an overload capacity of 150% for 30 seconds and shall be protected in the event of a short circuit of the output.
* The batteries shall be housed, either within the UPS enclosure or within a separate matching battery cubicle suitable for location adjacent to the UPS.
* The batteries shall be of the maintenance free sealed for life lead acid type.
* Batteries shall be contained within translucent impact resistant flame retardant polypropylene cases. They shall be designed for no maintenance and shall have a life in service of at least 5 years.
* The cells shall be arranged in tiers to enable a rapid visual check and access for maintenance. Terminals shall be shrouded to prevent accidental contact. The battery enclosure shall be corrosion resistant and ventilated to prevent the buildup of gases.
* The battery installation shall be supplied complete with all tools etc. necessary for the safe and efficient maintenance of the batteries.
* Warning notices shall be provided for wall mounting to warn of the presence of charge gases.
* The battery supply to the UPS shall be via a fused load break switch disconnected circuit breaker.
* The battery recharge time to 90% of full charge shall be approximately ten times the discharge time at full load.

#### Cabinet for GSM Enabled RTU/Data Logger at Site

The Outdoor 18U temperature ccontrolled ooutdoor cabinet, field ready (full assembled) of IP 67 rating with marshaling (Terminal blocks, interposing relays, Circuit Breakers, Instrument Power supply, Cable Glands etc) for "GSM Enabled RTU/Data Logger with battery Backup" including all accessories, cables and other incidentals. Cabinet must be Power Coated and door without vented hole. Steel rear doors without vented hole, Front and rear doors with front metal band door lock. The structure of front and rear door should be free solder reinforcement. Two number of PDU (230 VAC) and Cable Channel(100mm), an earthing strip of 150mm x 3mm, 10A,220V Socket link with UPS Line should be included. In the rack there must be maintained 1U = 1.75 inches‘ space with Cable Manager. Minimum Thickness is of 2mm with mounting angle of 1.5mm.

## TRAINING ON OPERATION OF THE SYSTEM

After successful Completion, the Supplier shall provide training to Engineers, Associate Engineers, Meter Readers and any other staff nominated by the Purchaser. Trainings shall be executed at Site and in office by OEM or Certified Representative of OEM including supply of brochure, manuals, tools, equipment etc. and as directed by the Purchaser.

Application and operational training of the Purchaser staff to be provided by the official trainer(s) of the original equipment manufacturer (OEM) in Pakistan. The training will cover all aspect of the instrument operation and application in detail including instrument setting, calibration, measurements, preventive maintenance, result interpretation, use of processing software, SCADA interfacing with other applications etc. Trainings shall include but not limited to the following:

* Providing Training on Routine Configuration / programming (only interfacing) of SCADA Server including Mobile App & Clients, troubleshooting, results acquisition etc. complete in all respects and as directed by the Purchaser
* Providing training on RTU & Radio System including troubleshooting, maintenance etc. complete in all respects and as directed by the Purchaser.
* Providing training on Flow Meters of all Types including reading values, handling, troubleshooting, alarm interpretation, error codes etc. complete in all respects and as directed by the Purchaser.
* Providing training on Remote Shutoff Valves of all Types including reading values, handling, troubleshooting, alarm interpretation, error codes etc. complete in all respects and as directed by the Purchaser.
* Providing training on SCADA system and AMR system along with SCADA, AMR and billing software including reading values, handling, troubleshooting, alarm interpretation, error codes etc. complete in all respects and as directed by the Purchaser
* Any other training as deemed necessary by the Project Manager/ Purchaser.

**ANNEX-1**

 **SCHEDULE OF TECHNICAL DATA**

SCHEDULE OF TECHNICAL DATA

Key system and component parameters of the deliverables required are listed in the following Table. Minimum value of the parameter is listed in the “Minimum Required Value” column. Bidders are required to duly fill in all information of their proposed equipment in the “Offered Value” column of this table and provide with their bids. Bidders failing to do so are liable to be declared non-responsive by the Employer.

|  |
| --- |
| **SCHEDULE OF TECHNICAL DATA** |
| **LED Display** |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer | – |  |
| 2 | Model no. | – |  |
| 3 | Country of origin | – |  |
| 4 | Type  | – |  |
| 5 | Display Size (in inches) | 75” |  |
| 6 | Resolution | 4K |  |
| 7 | Brightness (Typ.) | 450nit |  |
| 8 | Contrast Ratio | 5000:1 |  |
| 9 | Viewing Angle (H/V) | 178:178 |  |
| 10 | Response Time (G-to-G) | 4ms |  |
| 11 | Input | Analog D-SUB, DVI-D, Display Port 1.2, HDMI1, HDMI2, Component (CVBS Common) |  |
| 12 | Output | RS232C (in/out) through stereo jack, RJ45 |  |
| 13 | Power Supply | AC 100 - 240 V~ (+/- 10 %), 50/60 Hz |  |
| 14 | Features | ACM Support (Advanced Color Management), Auto Source Switching & Recovery, Lamp Error Detection, Super Clear Coating, TemperatureSensor, RS232C/RJ45 MDC, DP 1.2 Digital Daisy Chain (Supporting 2x2 UHDResolution, HDCP Support), Smart Scheduling,Smart F/W update, Clock Battery (80hrs Clock Keeping) Built In Magic Info (Lite, Premium-S, Videowall-S) |  |
| **A3 Colour Laser Printer** |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer | – |  |
| 2 | Model no. | – |  |
| 3 | Country of origin | – |  |
| 4 | Type  | Full Duplex |  |
| 5 | Print speed | 26ppm for black & white10ppm for Colour  |  |
| 6 | Resolution | 1200x1200dpi |  |
| 7 | Interface | USB 3.0, Ethernet 10/100 Base TX |  |
| 8 | Duty Cycle | 6000 Pages |  |
| 9 | Power Supply | 220V AC |  |
| **A4 Monochrome Laser Printer** |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer | – |  |
| 2 | Model no. | – |  |
| 3 | Country of origin | – |  |
| 4 | Type  | Full Duplex |  |
| 5 | print speed | 26ppm  |  |
| 6 | Resolution | 1200x1200dpi |  |
| 7 | Interface | USB 3.0, Ethernet 10/100 Base TX |  |
| 8 | Duty Cycle | 8000 Pages |  |
| 9 | Power Supply | 220V AC |  |
| **Photo Copier Machine** |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer | – |  |
| 2 | Model no. | – |  |
| 3 | Country of origin | – |  |
| 4 | Type  | – |  |
| 5 | Copying process | Four laser beams and electro-photographic printing |  |
| 6 | Copy speed | 70 copies per minute (A4) |  |
| 7 | Resolution | 1,200 dpi |  |
| 8 | Multiple copy | Up to 999 |  |
| 9 | Warm-up time | Less than 30 seconds |  |
| 10 | First copy speed | Less than 4 seconds |  |
| 11 | Zoom | 25-400% (in 1% steps) |  |
| 12 | Memory | 160 GB Hard Disk Drive |  |
| 13 | Paper input capacity | 2 x 1,550-sheet paper tray(s), 2 x 550-sheet paper tray(s), 100-sheet bypass try, Max.: 8,300 sheets |  |
| 14 | Automatic Document Feeder (ADF) capacity | 150 – 250 sheets (less than 80 -69 g/m2) |  |
| 15 | Paper output capacity: Standard | 500 (A4), 250 (A3) sheets |  |
| 16 | Paper size | A6 –A3 |  |
| 20 | Power source | 220 – 240 V, 50 – 60 Hz |  |
| **Switches/ Modem** |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer | – |  |
| 2 | Model no. | – |  |
| 3 | Country of origin | – |  |
| 4 | Type  | Industrial Grade |  |
| 5 | Ambient Temperature | 65 oC |  |
| 6 | Provision | SFP for OFC Interface |  |
| 7 | Compliance  | IEEE Standard for LAN |  |
| 8 | Power Supply  | Equipped with Redundant power supply |  |
| **Operator and Engineering Workstation** |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer | – |  |
| 2 | Model no. | – |  |
| 3 | Country of origin | – |  |
| 4 | Operator terminal deployed for various functions (PC) processor | Intel core i9 CPU with latest generation/version |  |
| 5 | HDMI Port | Yes |  |
| 6 | Hard disk storage capacity | 2 TB |  |
| 7 | RAM | 64 GB |  |
| 8 | Keyboard, mouse and VDU provided | YesVDU: 32" |  |
| 9 | DVD R/W | Yes |  |
| 10 | Technical literature Enclosed (Yes/No) | Yes |  |
| 11 | Operating System | Licenced Window 11 or Equivalent |  |
| **SCADA & Historian Server** |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer | – |  |
| 2 | Model no. | – |  |
| 3 | Country of origin | – |  |
| 4 | Server deployed for various functions (PC) processor | Intel® Xeon® processor Latest Version |  |
| 5 | Intel latest series chipset | Yes |  |
| 6 | Hard disk storage capacity | 2 TB |  |
| 7 | RAM | 64 GB |  |
| 8 | Internal Hard disk drive | 8TB |  |
| 9 | SSD Hard Drive | 1TB |  |
| 10 | Graphic Card | 2GB |  |
| 11 | Keyboard, Mouse | Yes |  |
| 12 | Thermal Take, Cooler Master or Equivalent Tower Casing | Yes |  |
| 13 | 2U Rack mount chassis including redundant power supply (Minimum 500W) | Yes |  |
| 14 | Latest MS WINDOWS Server Operating System | Yes |  |
| 15 | HDMI Port | Yes |  |
| 16 | DVD R/W | Yes |  |
| 17 | Average access time | less than 9ms |  |
| 18 | Buffer size | 16Mb |  |
| 19 | Average latency | 5ms |  |
| 20 | Hot swap capability | Yes |  |
| 21 | Max transfer rate | better than 600MB/s |  |
| 22 | Write protect mechanism | Yes |  |
| 23 | Error checking capability | Yes |  |
| 24 | Capability to report hardware and software errors | Yes |  |
| 25 | Technical literature Enclosed (Yes/No) | Yes |  |
| 26 | Operating System | MS Windows Server Operating system |  |
| **UPS**  |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer | – |  |
| 2 | Model no. | – |  |
| 3 | Country of origin | – |  |
| 4 | Type  | – |  |
| 5 | Battery Backup time | 6 Hrs |  |
| 6 | Switch Over from main to UPS supply and vice versa | Less than 5ms |  |
| 7 | Pure Sine wave | Less than 2% THD for linear LoadLess than 4% for Non linear Load |  |
| 8 | Power Factor  | 0.7 lag to 0.9 lead |  |
| 9 | Load Crest Factor | Less than 3:1 |  |
| 10 | Efficiency at full load and 0.8 PF | Greater than 88% |  |
| 11 | Over load capacity  | 150% for 30 sec |  |
| 12 | Battery type | Lead acid Maintenance free |  |
| 13 | Service life of battery | 5 years |  |
| 14 | Technical literature Enclosed (Yes/No) | Yes |  |
| **SCADA/HMI Software** |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer  |  |  |
| 2 | Version no. |  |  |
| 3 | Operating System | Unix/Xenix/ MS-Windows |  |
| 4 | Key Features | As per Technical specifications |  |
| 5 | Licences  |  |  |
| **Cabinet for GSM Enabled RTU/Data Logger** |
| **Sr. No** | **Parameter** | **Minimum Required Value** | **Offered value/Specifications** |
| 1 | Manufacturer | – |  |
| 2 | Model no. | – |  |
| 3 | Country of origin | – |  |
| 4 | Size of Cabinet  | 18U |  |
| 5 | Temperature Controlled | Yes |  |
| 6 | Protection Class | IP 67 |  |
| 7 | Thickness of Sheet | 2mm |  |
| 8 | Powder Coated | Yes |  |
| 9 | Front door without vented hole | Yes |  |
| 10 | Steel rear doors without vented hole | Yes |  |
| 11 | Front and rear doors with front metal band Door lock | Yes |  |
| 12 | PDU (230V) | 2 Nos. |  |
| 13 | Earth Strip | 3x150mm |  |
| 14 | 220V Socket link with UPS Line | Yes |  |
| 15 | 1U = 1.75 inches Cable Manager | Yes |  |
| 16 | Technical literature Enclosed (Yes/No) | Yes |  |