Technical Specification

For

Communicable and Non-communicable Fault Passage Detection System for 33KV and 11KV Overhead Networks.

Technical Specification for Communicable and Non-communicable Fault Passage detection System for 33KV and 11KV overhead Networks.

1.0 : General

1.1 Scope of Work: *Bidder shall design, engineering, manufacturing, testing at manufacturer's works, supply, delivery, erection, testing and commission of communicable/non-communicable (as per the scope of bidder for a particular tender) type* Fault passage Indicator (*FPI)/* Fault Sensing Indicator (*FSI) in the selected feeders and integration to SCADA Control Centre, Kolkata, already commissioned in WBSEDCL system. Communication Network has been provided by Reliance. For communication with Control Centre, Reliance VPN shall be used with SIM having Static IP supplied by Reliance.*

In case of Non communicable type FPI/FSI, Bidder shall supply, install and commission FPI/FSI as per clause no. 2.1.4 of this specification without RF communication facility in the selected feeders of the Utility. Suitable Hot stick,>60KV insulated, preferably 09 meter long and Magnet for Manual reset shall be part of the supply.

Communicable and non communicable FPI/FSI shall be used in a combination in the selected feeders to optimise the system. Bidder has to design the system to optimise the quantity of FPI/FSI (both configurable and non configurable with communication equipment) to get the desired benefit out of the proposed system.

This specification applies to a system allowing to remotely monitoring appearance of faults on an Overhead Medium Voltage network so that to localise faulty sections and send patrols for rectification of fault/reconfiguration of the network accordingly.

The system shall be made of:

- Fault Passage detection and Indication systems with wireless communication to be installed on 33KV & 11KV Overhead Electric networks, as specified in this document.

1.2 Quality Assurance :

The Bidder shall supply documentary proof that the manufacturer possesses ISO 9001 and ISO 14001 Quality insurance certification, from an independent internationally recognized body, for the design, manufacture and testing of Fault Indicators and remote monitoring and control equipment for medium voltage lines.

2.1.1 System parameters

The Fault detection systems shall be designed to operate on a 33KV & 11KV overhead network with the following characteristics:

- Nominal Operation Voltage : 33KV for 33KV networks and 11KV for 11KV networks
- System Maximum Voltage : 36 kV & 12KV
- Frequency : 50 Hz
- No.of phases 3
-System fault current : 25KA/3 sec for 33KV system & 18.4KA/3 sec for 11KV System.

- Type of neutral earthing : For 33KV: Earth through earthing transformer
  For 11KV: Solidly grounded system.
- Conductor diameter : 5 to 16 mm

One single product shall be proposed to cover the whole range of above characteristics: Particularly, the same product should be installed on any network for 11KV and 33 kV.

2.1.2 Climatic Conditions:

The Fault detection system shall be designed to operate in the following environmental conditions:

i)	Temp. Variation	: +4 deg C to +50 deg. C
ii)	Max. Daily average temperature	: +45deg C
iii)	Max. relative humidity	: 100%
iv)	Average rainfall	: 200cm
v)	Max. Height above sea level	: 1000 meters
vi)	Max. Wind Pressure & wind speed	: 150Kg/sq.m & 4 2 m/sec
vii)	Average no. of thunderstorm days per year	: 200.

2.1.3 Purpose of equipment

The main functions of the equipment are:

-To detect phase-to-phase and phase-to-earth fault currents on the MV network.

-To detect voltage presence interruptions.

-To time stamp faults and Voltage dips and store them in memory

-To transmit information to the Control Centre spontaneously via the GSM/GPRS network.

-To provide a local light indication of fault.

-To measure load current on the line (for communicable FPI/FSI)

-To provide operators with all useful information for fault finding and preventive maintenance.

-To be self-supplied at all times, including during outages.

2.1.4. Components:

The detection system shall be comprising of the following parts, under the scope of bidder:

-**Fault Passage Indicators/ Fault Sensing Indicator** shall be clipped on the overhead lines. One such device shall be clipped on each phase so that to measure current and Voltage presence in this phase and compute fault detection algorithm accordingly. A short-range radio interface shall be embedded in this Fault Passage Indicator/ Fault Sensing Indicator so that to allow it communicate with the GSM/GPRS communication interface mentioned below.

-A GSM/GPRS communication interface, pole-mounted, acting as a communication gateway between Fault Passage Indicators using short-range radio and the remote control centre using GSM/GPRS communication.

GSM/GPRS communication Equipment shall get supply from battery/battery charger with a single phase PT connected in the same pole with proper fuse arrangement. Battery of reputed make shall be rated for at least 6Hrs. backup for the system shall have to be supplied. Supply, installation and commissioning of PT, Surge arrestor & mounting arrangement as per WBSEDCL specification shall be under bidder's scope.

EARTH CONNECTION:

The unit shall be provided with suitable earthing terminal clearly marked as (±). Two nos. of earthings shall also be provided to the Aux. transformer & accessories. This is under bidder scope.

2.1.4.1 GSM/GPRS communication interface

The GSM/GPRS communication interface shall be fitted in a compact enclosure suitable for mounting on a pole (PCC/Rail/Tubular/H-beam etc). This box shall include the following functions:

- Short range radio Interface to up to 9 Fault Passage Indicators/ Fault Sensing Indicator in a 100 m range. It shall be able to interface up to 9 Fault Passage indicators installed within a range of 100 m maximum, corresponding to up to 3 overhead lines.

- GSM/GPRS communication to SCADA Control Centre

- Battery and Battery Charger – with 8 hrs. backup

- Configuration of the communication interface (GSM/GPRS communication, definition of alarms…) and Fault Passage Indicators/ Fault Sensing Indicator (Fault detection thresholds…) by connection of a laptop using the configuration software to an RS232/RS 485/RJ 45 port on the communication interface. The same software shall also include full diagnostic capabilities.

2.1.4.2 Fault Passage Indicator (FPI)/Fault Sensing Indicator (FSI)

The Fault Passage Indicator (FPI)/Fault Sensing Indicator (FSI) shall be designed to be clipped on the Overhead line. 3 Fault Passage Indicators/ Fault Sensing Indicator shall be clipped on one line, one on each phase. *In case of either vertical or horizontal configuration of line, efficiency of FPI/FSI should not be degraded*. It shall include the following functions:

- Measurement of current running in the phase it is clipped on

- Detection of Voltage absence/presence on the phase it is clipped on

- Detection of phase-to-phase and phase-to-earth faults

- Short-range radio communication with a GSM/GPRS communication interface within a maximum distance of 100m.

It shall be self-supplied from a non-rechargeable (lithium-ion) battery of a minimum life time 10 years, in the temperature conditions specified above, including at least 1 short range radio communication with the GSM/GPRS communication interface every hour and minimum 400 hours flashing for fault indication all over these 10 years. For Non communicable type FPI/FSI, 800 hours flashing for fault indication over 10 years shall be provided.

The Fault Passage Indicators/ Fault Sensing Indicator shall be suitable for outdoor use in the tropical climate condition stipulated in the relevant paragraph. The components used in the Fault Passage Indicators shall be suitably protected from direct sunlight to prevent malfunctioning due to solar radiation. The Fault Passage Indicators shall be suitable for mounting on live line conductors and suitable clamps shall have to be designed

so that the Fault Passage Indicator/ Fault Sensing Indicator can withstand winds pressure as specified without falling from the line. The Fault Passage Indicator shall be fully self-contained type without any external connection, indicator or sensors. The Fault Passage Indicators/ Fault Sensing Indicator shall be suitable for use on multiple lines supported by the same pole.

2.2 Operational specifications

2.2.1 Fault detection:

Fault detection shall be performed by the Fault Passage Indicator/ Fault Sensing Indicator described above. Fault sensing shall be made from current measurement and Voltage presence detection, based on detection of the electromagnetic field and its variations.

The Fault Passage Indicator/ Fault Sensing Indicator shall be of the programmable type, suitable for sensing:

- Short-circuit faults

- Low earth leakage faults down to 6A.

The Fault Passage Indicators Fault Sensing Indicator / shall detect faults based on 02(two) simultaneous tripping criteria:

- In order to high fault currents (typically phase-to-phase faults), it shall operate when the phase current exceeds an absolute threshold for a fixed duration of about 50 ms. This absolute threshold must be user configurable to different values preferably between 75A to 800A based on nominal currents.

- In order to detect low fault currents (typically resistant phase-to-earth faults), it shall operate when it detects the phase current increase within a fixed duration (about 50ms) exceeds a relative threshold. This threshold must be configurable to at least 6 different values between 6A and 160A.
It shall be possible to disable this second tripping criterion.

In case of faults, the Fault Passage Indicator/ Fault Sensing Indicator which are detecting the variation of the electromagnetic field due to fault current (Fault Passage Indicators/ Fault Sensing Indicator installed between the circuit breaker and fault point) shall provide a fault indication, while Fault Passage Indicators downstream the fault or on non-faulty branches shall not provide any indication.

The fault indication shall be provided:

- by the means of a flashing light system offering a good contrast against sunshine (red colour) and an MTBF of the light emitting system at least 45000 Hours (LEDs for instance). It shall provide a very high visibility of an intensity of 40 Lumens (minimum) and give a 360° visibility angle from at least 50m in sunny day conditions, and at least 300m at night. Total flash duration for Non communicable type FPI/FSI shall not be less than 800 hours & for communicable type FPI / FSI shall not be less than 400hrs. Flashing period for permanent faults shall be 2 flash in every 12 sec.

GSM/GPRS interface shall itself forward the alarm to the SCADA Control Centre according to its configuration.

The Fault indication shall remain until:

- a time-out, configurable to at least 4 possible values between 2 and 16 hours, has expired,

- the medium voltage is back,

- the Fault Passage Indicator is reset manually,
- whatever condition comes first.

Caution: since the load current might be very low upon MV return, load current reset is not acceptable.

The Fault indication reset shall consist in:

- stopping the local light indication flashing

- sending an alarm to the GSM/GPRS interface which shall itself forward this alarm to the SCADA Control Centre according to its configuration.

The Fault Passage Indicator/ Fault Sensing Indicator shall include some self-test possibility usable when it is on the line (powered or not).

The Fault Passage Indicator /Fault Sensing Indicator shall be selective in action as indicated below

- It shall not respond to any sudden variation (increases/decrease) in load current

- It shall not respond to an over current not due to a fault

- It shall not respond to high magnetising inrush currents, created upon line energising.

2.2.2 Detection of voltage presence and absence

The Fault Passage Indicator/ Fault Sensing Indicator shall send a message to the GSM/GPRS interface as soon as it detects disappearance or appearance of Voltage on the conductor. The GSM/GPRS interface shall then memorise the information as a time-stamped event and send an alarm to the control centre according to its configuration.

2.2.3 Digital inputs

The GSM/GPRS interface shall allow connection of information from sensors available in the immediate vicinity to potential-free inputs. At least 6 potential-free digital inputs shall be included in the GSM/GPRS interface.

2.2.4 Measurements

The Fault Passage Indicator /Fault Sensing Indicator shall continuously measure the current running in the conductor on which it is clipped and periodically send the minimum, maximum and average values measured to Control Centre over ***IEC 104 protocol***. The GSM/GPRS interface shall then store this information to allow reading it locally by connecting a PC or remotely from the control centre. The sending period shall not be more than 1 hour.

2.2.5 Event time-stamping

Any change of state of information shall generate a time-stamped event stored in the GSM/GPRS interface memory.
The event storage capacity shall be at least 100 stamped events.

2.2.6 Short-range radio

Short range radio shall use license-free ISM band. It shall be designed so that to allow a maximum distance between GSM/GPRS interface and the Fault Passage Indicators equal to 100m or more.

Indicators of short range radio transmission quality shall be available and displayed by connection of a PC to the GSM/GPRS interface.

Antennas for short-range radio communication shall be embedded in or fixed on the products (GSM/GPRS interface and Fault Passage Indicator) so that no specific installation is required.

2.2.7 Communication with the Control Centre

Communication between the GSM/GPRS interface and the SCADA Control Centre shall be through GSM/GPRS network, dual-band 900 MHz – 1800 MHz, and using IEC104 protocol.

Each monitored information (fault current detection, voltage absence/presence, digital inputs etc…) shall be configurable as "alarming" when changing state, individually and independently of others.

Additionally, SMS functionality to minimum 2Mobile numbers should be supported by the GSM/GPRS Communication equipment for alerting the Service Staff also.

Monitored information configurable as “alarming” shall include at least the following, consisting both of MV network diagnostic information and monitoring equipment internal faults for self-diagnostic purpose:

- Fault detection appearance with indication of Fault Passage Indicator/ Fault Sensing Indicator reporting the fault and tripping criteria tripped.

- Fault detection disappearance with indication of Fault Passage Indicator/ Fault Sensing Indicator reporting the fault and tripping criteria tripped.

- Voltage absence

- Voltage presence

- Change of state of a digital input

- Fault Passage Indicator/ Fault Sensing Indicator absent (failure of the GSM/GPRS communication interface to communicate with it through short range radio)

- Fault Passage Indicator / Fault Sensing Indicator battery low

2.2.8 Configuration and maintenance

FPI/FSI and communication equipment for Control Centre shall be configured and diagnostic shall be performed by connecting a laptop PC to the GSM/GPRS interface unit.

Configuration shall include:

2.2.8.1 Scanning of all Fault Passage Indicators in the short range radio range (at least 100m) and assigning of an identification (typically number) to each of them, so that to allow identification of line (when GSM/GPRS interface is monitoring 9 Fault Passage Indicators and phase on the line on which each Fault Passage Indicator/ Fault Sensing Indicator is clipped-on, in order to allow identification by the control centre of line and phase where faults or voltage absence are detected.

2.2.8.2 Configuration of fault detection thresholds and other characteristics.

2.2.8.3 Configuration of communication: PIN code, telephone numbers (control centre and mobile for sending SMS messages), transmission speed, etc…

2.2.8.4 Configuration of alarms, as explained above

Diagnostic shall include at least display of the current value of all information monitored (Fault Passage indicators list and status, Fault indications (phase-to-phase and phase-to-earth) from Fault Passage indicators/ Fault Sensing Indicators, digital inputs, measurements….) and an embedded protocol analyser showing frames received and sent.

2.3 Additional requirements

2.3.1 Marking

Each Fault Passage Indicator/ Fault Sensing Indicator shall carry a weather and corrosion proof plate indicating the following particulars.

- Property of WBSEDCL
- Manufacturer's identification.
- Date & Model or type number (as per catalogue)
- Year of manufacture in characters big enough to allow reading from the ground so that to provide indication of battery age.
-property of WBSEDCL

Type Test Report (not more than 5 yrs. old from the date of opening of tender) including for PT / Aux. Transformer & Surge arrestor, as per following tests to be submitted in bid documents:

2.3.2 Environmental specifications:

Mechanical resistance to vibration and shocks

The equipment shall have vibration resistance in accordance with

As per IEC 60068.2.6: 10 to 500 Hz; 0.7 mm peak to peak from 10 to 59Hz and 5g from 59 to 500 Hz.

As per IEC 60068.2.27: 40g / 6 ms / 2000 positive and 2000 negative shocks in each direction, in the three directions.

Dielectric withstand

As per IEC 61010 : Insulation : 2 kV for 1 min at 50 Hz.

As per EN 60-950 Impulse wave (1.2/50 µs): 5 kV

Electromagnetic compatibility:

Electrostatic discharge as per IEC 61000-4-2 : Level 3

Radiated fields as per IEC 61000-4-3 : Level 3

Radio frequency as per IEC 61000-4-6 : Level 3

Magnetic immunity, 50 Hz, as per 00IEC 61000-4-8 : Level 4

Emissions as per EN 55011 : Class A

IP Certification

GSM/GPRS Communication equipment Enclosure shall have suitable IP Certificate for IP 55

TRANSPORT OF EQUIPMENT TO SITE. The bidder shall be responsible for the loading, transport, handling and off loading of all equipment and materials from the place of manufacture to site. The bidder shall be responsible for any type of damage during transportation.

2.3.5 Training

Before Commissioning & after completion of Erection of the FPI/FSI, the successful bidder shall deliver installation, Operation & Maintenance Training including RF module settings at different site to the personnel as deputed by the awarding authority. The successful bidder shall submit the training schedule to the site authority for WBSEDCL. The Training should be comprehensive to the satisfaction of the trainees. The Trainer should cover both theoretical & practical aspects of the modules, operation & maintenance requirements of the modules etc. The trainer shall also exhibit major components of the modules separately for visual clarity of the trainees with better understanding. The successful bidder shall bear every cost required for the Training.

Guarantee/Warrantees: All equipments/materials shall be guaranteed/warrantees complying policy guideline of WBSEDCL.

2.3.5 Documentation

Each device shall be supplied with a user manual for installation, maintenance and commissioning at site.

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