

**INDEPENDENT POWER TRANSMISSION OPERATOR S.A.  
DEPARTMENT OF TRANSMISSION PROJECTS**

May 2015

**TECHNICAL DESCRIPTION TD-10 / 3**  
**SEQUENCE EVENT RECORDER (SER)**

**I. SCOPE**

This technical description covers the functional requirements, the technical features and the testing of a Sequence Event Recorder System (SER).

**II. KEYWORDS**

Sequence of Events Recorder System, Event Recorder, Sequential Event Recorder, Monitoring System.

**III. USE**

The Sequence Event Recorder will be used in 150 kV switching stations and substations control buildings to record digital signals related to the continuously changing state of field contacts and circuits.

**IV. OPERATING AND STORAGE CONDITIONS**

Installation : Inside the substation control buildings.  
Operational temperature :  $0 \div 50^{\circ}\text{C}$   
Humidity (during operation):  $5\% \div 80\%$  non-condensing  
Storage Temperature :  $-10 \div 55^{\circ}\text{C}$

**V. STANDARDS**

All testing shall conform to either IEC or IEEE standards.

**VI. OPERATING VOLTAGE OF SER**

- a. Operating Voltage : 110 V D.C.
- b. Operating Voltage Tolerance : +10%, -15%

## **VII. REQUIRED HARDWARE CONFIGURATION OF SER**

The SER shall consist of the following :

- a. Input units
- b. CPU
- c. Screen
- d. Keyboard
- e. Printer

The SER can be either of a compact type (containing all the above items or some of them in one unit) or of a distributed type (each of the above items to be separate) .

## **VIII. REQUIRED CHARACTERISTICS OF SER INPUTS**

- a. Capacity : 512 digital inputs
- b. Resolution : 1 ms.
- c. Input Voltage (\*)  
(wetting voltage) : 110 V DC
- d. Scanning Rate : 1 ms.

## **IX. FUNCTIONAL REQUIREMENTS OF SER**

- a. Each input of SER shall be capable of being programmed by the user either as normally opened (N.O.) or normally closed (N.C.)
- b. Each input of SER shall be described by four (4) fields (bay name, device of equipment, alarm or event description, date-time). The description of each input shall be given by the user either via the SER keyboard as well as via a portable PC (laptop) connected to SER and it shall be stored in non-volatile memory. The description should be possible to be retracted or modified by the user, later on. In case of a power loss of SER, the registered data and settings should not be lost. It should be possible for the same input to have different descriptions in ON and OFF.
- c. The event and alarm list which are recorded from SER should be displayed on screen chronologically assorted and should contain all the information of the 4 fields of description (mentioned in previous paragraph) for each event or alarm recorded. The accuracy of recorded time shall be 1 ms. An AS (Alarm Summary) function should be available, in order to have on screen all active alarms at a given moment.

- d. The printing of the event and alarm list should be continuous and the printed pages should contain all the information of the 4 fields of description (mentioned in previous paragraph) for each event or alarm recorded.
- e. The user shall be able, at any time, to recall and print information saved by SER, as well as groups of events or alarms, selectively, using criteria as following:
  - Bay name
  - Device of equipment
  - Description of an event or alarm
  - Date – time
- f. All units of SER shall communicate flawless among themselves. All bidders are required in their offers to indicate, where applicable, the maximum distance among the units for which operation is carried out without problems. In other words the maximum distance between
  - Input units and CPU
  - CPU and screen \*
  - CPU and printer \*
  - CPU and keyboardfor which flawless operation of the SER can be guaranteed.
  - \* Minimum required distance based on PPC control room arrangement is 25 m.
- g. The SER shall be equipped with an output contact for the energization of a bell. To this output contact a number of inputs will be assigned. The assignment of inputs will be carried out by the user via the system software or by any other means the SER may possess.
- h. The memory of SER should be of “semi-conductor non volatile memory” type, “First In- First Out” (FIFO), which should have the capability of storing 1000 events at least (e.g. flash disk).
- i. SER should have the capability of communicating with remote control centers via TCP/IP giving full access to SER from Remote Station (either programming new points or retrieving data) with security. All necessary hardware and software (licensed) shall be provided.

**X. PRINTER & SCREEN CHARACTERISTICS**

(if separate printer is offered).

- a. Printer type : 24 pin dot matrix.
- b. Printer supply voltage : 220 V A.C.
- c. Size of supply paper : A4

- d. Mean Time Before Failure (MTBF) of the printer : > 20.000 POH
- e. Print Head Life : > 400 x 10<sup>6</sup> characters
- f. Screen supply voltage : 220 V A.C.
- g. The screen should be immune to electrical noise and transients.

## **XI. OPERATING SETUP PARAMETERS**

The following parameters of the SER shall be settable.

### **a. Digital Inputs**

(This should include the following) :

- Input ID
- Triggering ON of a N.O. or OFF a N.C. contact.
- Debounce time for digital inputs settable 0-20000ms

## **XII. SOFTWARE**

The software of SER should be based on Professional "WINDOWS", last revision. The SER should be equipped with at least one "USB" and an Ethernet port, as well as with the proper software for communication with a portable PC (laptop) and Remote Station, with which shall have the capability of exchanging data and settings. The bidder should provide also the communication cable between SER and the portable PC, as well as the necessary software. All software licenses shall be provided as well as a backup for restoring the system in case of drive fail.

## **XIII. CONNECTION CABLES**

All bidders are required to offer all required cables (with total immunity against over-voltages and noise) for the connection of the various units of the SER and indicate clearly in their offer the type and length of cable used or required for each connection.

Furthermore, in the case of distributed type SER, the cables for the connection of CPU and printer, and CPU and screen must be 25 m in length and totally immune to electrical noise and transients.

## **XIV. ADDITIONAL REQUIRED CHARACTERISTICS OF SER**

- a. The base chassis for the input units shall be 19" rack-mountable and with a cover of IP20 class protection as per IEC-524.  
All bidders are required in their offer to indicate dimensions of the base chassis and cover.
- b. All inputs shall be equipped with proper circuits for protection against interference.
- c. In case of memory overflow the new records will replace the oldest ones, without disturbing the SER's operation. The system's memory should be enough to keep the events of at least one year, before overflow.

- d. SER shall be suitable to operate flawlessly in the hostile environment of substations and be specifically designed for such applications.
- e. SER should be equipped with internal synchronization clock and should have the capability of synchronizing from external source via GPS. For this reason a GPS antenna, a GPS receiver, as well as all the necessary materials for this application, will be included in the bidder's offer.

Antenna location	: The antenna will be located on the roof of the substation's control building
Antenna housing	: The antenna shall be placed in a weather proof plastic housing.
Lightning Protection	: Surge protector with response time $\leq 1$ ns and a discharge current of 10 kA, housed in an aluminum case.
Signal strength at the input of the antenna	: $\sim 1 \times 10^{-16}$ Watt, i.e. below the general noise level.
Temperature Range	: $-30^{\circ}\text{C}$ to $+85^{\circ}\text{C}$
Antenna supports	: the antenna will be supported by brackets of anodized aluminum and designed to withstand strong winds.
Low-noise preamplifier (the supply or not of this device will be defined on the inquiry, as it depends on the distance between the antenna and the receiver.)	: Fitted behind the antenna shall be an extremely low-noise preamplifier. The low-noise preamplifier will be located inside the substation control building.
GPS-receiver location	: Inside the substation control building, rail mounted
GPS-receiver supply voltage	: 110 V DC
GPS-receiver configuration and setup	: Via professional "windows" based software which must be included in the supply.

GPS-receiver interfaces	: Serial interfaces with RS 422 hardware or RS 232 or RS 485. In any case to match with computer
Cabling	: All required cabling for the connection of antenna, preamplifier and receiver and of the GPS system to the SER, must be included in the supply.

## **XV. TESTS**

### **a. Routine tests**

Isolation as per IEC-255-5, 2 kV RMS for one (1) min.

### **b. Type tests**

1. Impulse withstand as per IEC-255-5, 5 kV, 1.2/50  $\mu$ s, 0.5 Joule.
2. Burst disturbance test (surge withstand) as per IEC-255-22 or ANSI / IEEE C37.90.1, 2.5 kV 1 MHz damped sine wave.
3. Vibration as per IEC-68-2-6.  
Acceleration : 0.5g<sub>n</sub>  $\pm$ 25%.  
Frequency range : 10 Hz – 150 Hz  
Number of sweep cycles : 20.  
Sweep rate : 1 octave / min  $\pm$ 10%.  
Duration of endurance : 2 hours and 30 minutes.
4. RFI Protection as per IEC-801-3 and IEC-801-6 or ANSI / IEEE C37.90.2.

**NOTE :** If type test reports for the above stated tests are available, then these test reports must be submitted along with the technical offer. In addition, the economic offer must include prices for the execution of the above type tests and regardless of the existence of type test reports.

## **XVI. DATA TO BE SUPPLIED BY BIDDERS**

- a. Reference list of the offered SER, which shall include the following:
  - User name and country.
  - Year of sale.
- b. Spare Parts  
A list with recommended spare parts along with item prices must be submitted. (Prices to be indicated in the economic offer).  
The purchaser reserves the right to buy all recommended spare parts or buy some of them or not to buy anything at all.

- c. Installation and programming (set-up) Instructions and Pamphlets
1. Bidders, shall submit along with their technical offer, pamphlets describing the SER.
  2. Bidders shall also submit, a drawing indicating how the various units are to be connected (wherever it is applicable) indicating also type of connection cable and distance.

**XVII. REQUIRED DATA WHICH IS TO BE PROVIDED BY THE SUCCESSFUL BIDDER**

The successful bidder is required to submit for approval before the delivery of the equipment the following:

1. Detail drawings of the SER for the wiring of the field signals.
2. Detail grounding instructions of the various units of SER.
3. Detail connection instructions for the various units. Cable data and distances must also be indicated.
4. Pamphlets describing the SER.
5. Detail programming instructions for the SER.

**XVIII. PACKING**

The SER must be properly packaged for transportation. Each SER system, as described in the inquiry, must be packaged in its entirety in one box which must also be labeled accordingly.

**XIX. ATTACHMENT "A"**

Bidders must complete and provide all required data indicated in attachment "A".

Failure to comply with this request will constitute sufficient reason for rejection of the offer.

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ATTACHMENT "A"

(Failure to comply will constitute sufficient reason for rejection of the offer).

1. SER configuration : .....  
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2. SER type : .....
3. SER capacity : .....
4. Operating voltage of the SER : .....
5. Input voltage (wetting voltage of inputs) : .....
6. SER resolution : .....
7. Scanning rate : .....
8. Maximum distance (wherever it is applicable) for flawless operation between :  
Input units and CPU : .....  
CPU and screen : 25 m (for distributed type SER).....  
CPU and printer : 25 m (for distributed type SER).....  
CPU and keyboard : .....
9. Printer type : .....
10. Printer supply voltage : .....
11. Type of provided software : .....
12. Is RAM storage capability available ? : .....
13. Are inputs optically coupled ? : .....
14. Are the requirements of paragraph No. IX satisfied ?  
Elaborate : .....  
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15. List all cables (wherever applicable) indicating type and other critical characteristics for connection of various units among themselves : .....

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16. Is output contact available for energization of a bell via a selected number of inputs ? : .....

17. Indicate base chassis and cover dimensions of the input units : .....

18. Is port available for data transmission to a master station : .....

19. Protection class of base chassis and cover of the input units : .....

20. Are detail instructions for connection, programming and grounding going to be provided ? : .....

21. Are special cables required for carrying the signals between equipment and input units for a maximum distance of 500 m ?  
If so, indicate cable characteristics. : .....

22. How is the screen protected against noise and transients ? : .....

23. Method of synchronization : .....

24. Deviations (if any) : .....

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