INDEPENDENT POWER TRANSMISSION OPERATOR S.A.
NTPD/ SPECIFICATIONS & EQUIPMENT SECTOR S/S – EHV S/S

MARCH 2009

Technical Description 31/B

Technical description for digital phase overcurrent relays for 400 KV, 150KV, 30 KV sides of ATR and reactors

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1. Introductory remarks – range of application.

This technical description concerns digital overcurrent relays to be installed in IPTO power transmission system. It establishes requirements for the performance, design, testing and operation of the relevant equipment and related software. The relays are primarily intended to provide fast, selective and reliable clearance of faults in transmission network and especially in 400, 150, 30 KV sides of ATR and reactors.

2. References and standards.

The items to be offered (hardware/software) will conform to the international standards and codes of practice, mainly:

- Currently valid IEC-61850, 60255-3, 60255-5 60255-22 and 60255-21 standards applicable for such devices covering performance, insulation and disturbance requirements, indicately :
  - Dielectric withstand : IEC 255-2,5
  - Vibration and shock during operation : IEC 255-21 class II
  - Disturbance tests :
    IEC 255-22-1 class III,
    IEC 255-22-4 class III or IV,
    IEC 801-4 level 4,
    IEC 255-22-2 class III
    IEC 801-2 class III (type approval)

In case of lack of international regulations, conformity to the national standards (i.e. the manufacturer's country standards) applicable for such devices could be considered, subject to purchaser's approval (ANSI, IEEE, VDE, …). In that case the corresponding IEC standard will be mentioned.
Finally, conformity statement of the manufacturer according to the provision of EU directive 73/23/EEC and 89/336/EEC will be required.

3. Operating environment.

- Network data
  The relays will be installed in transmission network of IPTO.
  Rated voltage : 400, 150, 30 KV
  System neutral : earthed
  Nominal frequency : 50 Hz (in emergency conditions frequency could be between 47.5 Hz και 51 Hz)
  The secondary nominal current of CTs is 1A or 5A.

- Power supply
  In IPTO substation for the supply of the control equipment is available a battery system providing DC voltage of a level 220V DC / 110V DC.

- Ambient conditions
  The relays will be designed for indoor operation over a temperature range from -5° to +55ºC and a humidity range from 10% to 90%.

4. Protection basic performance and functions.

- Required protection functions of the relay
  a. Definite time phase, earth and negative sequence overcurrent protection with two (2) stages for phase, earth and negative sequence: (I>, I>>), (I_E>, I_E >>) and (I_2>, I_2 >>). In total six (6) stages.
  b. Inverse time phase, earth and negative sequence overcurrent protection with characteristic curves as per IEC 60255-3, which are inverse time, very inverse time, extremely inverse time and long inverse time with one overcurrent stage for phase Ip and one for earth Ip_E, respectively. Two, in total.

- Required setting ranges of the relays
  a. Definite time overcurrent protection
     1. phase (I>): (0,1 to 4) x I_N in steps of 0,1A
     2. earth (I_E>): (0,05 to 1) x I_N in steps of 0,1A
     3. phase (I>>): (0,1 to 20) x I_N in steps of 0,1A
     4. earth (I_E>>): (0,05 to 1) x I_N in steps of 0,1A
     5. time delay : 0 - 150 sec in steps of 0,1sec

  b. Inverse time overcurrent protection
     1. phase (Ip): (0,1 to 3,2) x IN in steps of 0,1A
     2. earth (IpE): (0,1 to 1,0) x IN in steps of 0,1A
     3. Time multiplier: 0,05 – 1,5 sec (IEC) or 0,5-15 sec (ANSI)

5. Additional functions.

Except of the basic overcurrent protection as described above the following additional functions are required:

- Hardware options
  - A number of LEDs on the relay front panel or on the display for indications of the fault type and health of the relay and dc supply.
    It is desirable of LEDs to be programmable by the user. In the offer the number of LEDs on the relay front panel must be mentioned.
  - Optoisolator digital inputs for remote control of various functions three (3) at least.
  - Digital outputs (preferably programmable by the operator) two (2) for operation (heavy duty) and three (3) for indication. Five (5) in total.
    Minimum requirements:
    - ♦ Trip command
    - ♦ Contacts for indication of the type of fault and operation mode
    - ♦ Self – check (watchdog)

- ♦ Operation of relay

- Software options.
  - The relay settings can be changed remotely by the serial interface or locally by the relay front panel interface.
  - Event reporting (minimum requirements) :
    - ♦ Indication of the last 4 events.
    - ♦ Information provided : Date/time of the event, type of fault, values of trip currents.

6. Design and construction.

All functions will be included in a housing providing degree of protection IP50 according to IEC.
The construction preferably will be of modular design with plug-in unit facilitating repairs.
The installation will be flush mounting.
All the appropriate accessories (special cables/ plugs interfaces, adaptors etc.) for communication and testing have to be included in the price.
In the case of draw-out input unit, automatic short-circuit of current contacts have to be foreseen.
The dc/dc converter accommodated in the relay housing will provide operation having an input voltage 220 VDC.
The trip and ON output contacts will be of heavy duty with the following ratings:

- Output contacts
  - Continuous current carrying capacity : 5 A
  - Making capacity : 30 A
  - Breaking capacity : 0.5 A στα 220V DC

- Signaling contacts
  - Continuous current carrying capacity : 5 A
  - Making capacity : 10 A
  - Breaking capacity : 0.1 A στα 220V DC

7. Communication and interfaces.

The relay must be equipped with the following ports and interfaces:
- User interface (keyboard & displays) on the front plate of the relay ensuring dialog with the relay permitting setting, operation, metering and fault reporting.
- The relay shall be capable for communicating via an Ethernet port via IEC-61850 protocol.
- Serial interface (standard type serial port) RS232 for connection of a personal computer and for data transfer to the control centre via modem.

The communication protocols will be compatible with the standard public communication networks according to the recommendation of the international regulations.

Together with the relay, the supplier must provide twenty (20) cables at least for the communication of the relay with PC.

8. Software.

Software for the operation of the offered devices will be provided on the basis of a royalty free, non-exclusive, with irrevocable license to use for the operation of the relays. This term is applicable for the software covering all issues: Settings, setting transmission, fault reporting, communication relay-PC and communication relay – remote station.
The software shall be menu-driven, friendly to the user and easy to be followed even by an inexperienced operator (three (3) copies at least).

9. Tests.

The package to be offered will be in compliance with the standards mentioned in §2 above.
The offered devices shall be certified by conformance test performed in accordance with IEC-61850-10. The certificate must be of level A (level A means independent Lab, e.g. KEMA).
The certificate can be of level B (manufacturer's Lab) if the manufacturer's Lab has been qualified by the UCA International Users Group.
In the first case the certificate (level A) must be submitted along with technical offer. In the second case the certificate (level B), along with the UCA International Users Group certification to the manufacturer must be submitted in the technical offer.
Existing certificates and tests reports will be accepted provided that they will be found satisfactory by the purchaser. Conformity to the relevant EU directives and guidelines is also required.

10. Additional requirements.

Bidders have to provide full documentation concerning the installation, commissioning, operation, testing, troubleshooting of the equipment. Furthermore complete instructions will be delivered for the operation of the related software.
Also references and documentation will be provided which demonstrate that the offered hardware/software packages have been used in commercial scale and that the offered material is part of the manufacturer's standard production.
Guarantee of good operation for a period of at least five (5) years.

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ATTACHMENT "A"

1. Type of the offered relay : ……..

2. Does the offered relays conform to the international standards and codes stated in §2 ? : ……..

3. Temperature and humidity conditions for which the relay is designed to operate : ……..

4. Has the relay two (2) stages of negative sequence (I_2>, I_2>>) : ……..

5. Required setting ranges of the relay

   a. Definite time overcurrent protection
      1. phase (I>) :(……to…….)× I_N, in steps of …..A
      2. earth (I_E>) :(……to…….)× I_N, in steps of …..A
      3. phase (I>>) :(……to…….)× I_N, in steps of …..A
      4. earth (I_E>>) :(……to…….)× I_N, in steps of …..A
      Time delay :(……to…….) sec, in steps of …..sec

   b. Inverse time overcurrent protection

      1. phase (Ip) : (….. to…..) x I_N, in steps of ……A
      2. earth (IpE) : (…..to.….) x I_N, in steps of ……A
      Time multiplier : ……..to…….

6. Are there LEDs for indications, on the relay front panel? : ……..
   - Are the LEDs programmable? : ……..

7. Number of digital inputs : ……..

8. Number of digital outputs : ……..
   - Are they programmable? : ……..

9. Can the relay settings be changed remotely or locally by front panel interface? : ……..

10. How many indications and of which information, can be recorded? : ……..

11. Degree of protection for relays housing : ……..

12. Is the construction modular with plug-in units? : ……..

13. Are accessories such as, cables, plugs, adaptors etc, included in the offer? : ……..

14. Is the input unit of draw out type? : ……..

-Is automatic short-circuit of the current contacts, foreseen? : ……..

15. Output contacts

- Continuous current carrying capacity : ……..……..
- Making capacity : ……..……..
- Breaking capacity : ……..……..

16. Is the relay equipped with keyboard and display, for user interfacing? : ……..……..

17. Is the relay capable of communicating via Ethernet port via IEC-61850 protocol? : ……..……..……..

-Are certificates according to IEC-61850-10, provided? : ……..……..……..

18. Is the relay equipped with serial port for connection with PC? : ……..……..

19. Can the relay be configured by an integrated keyboard-display and also by PC? : ……..……..

20. Are the necessary cables for communication of the relay with PC, provided? : ……..……..

21. Is the software provided royalty free and user friendly? : ……..……..

22. Is the software covering issues of settings, setting transmission, fault reporting, communication with PC and remote center? : ……..

23. Is the offered hardware/software used in commercial scale and part of the manufacturer’s standard production? : ……..

24. Is guarantee of good operation for a period of at least five (5) years provided? : ……..

25. Power consumption of the relay : ……..

26. Dimensions of the relay : ……..