



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

SPECIFICATION SS-131 / 6

PHASE AND EARTH **DEFINITE AND INVERSE TIME** **OVERCURRENT RELAYS** **WITH DIRECTIONAL CAPABILITY** **FOR BOTH PHASE AND EARTH** **FOR 150 kV TRANSMISSION LINE & TRANSFORMERS** **BAYS PROTECTION**

ATHENS - GREECE

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SPECIFICATION SS-131 / 6
PHASE AND EARTH
DEFINITE AND INVERSE TIME
OVERCURRENT RELAYS
WITH DIRECTIONAL CAPABILITY FOR BOTH PHASE
AND EARTH
FOR 150kV TRANSMISSION LINE TRANSFORMER
BAYS & PROTECTION.

I. SCOPE

This specification covers the requirements concerning the technical and operational characteristics of definite time and inverse time 3-phase and earth overcurrent relays with directional capability for both phase and earth.

The relays are to be used as back-up protection for the 150 kV Transmission Lines and 150kV Transformers bays.

II. KEYWORDS

Overcurrent relays, phase and earth (ground).

III. 150 kV SYSTEM CHARACTERISTICS

Current transformer ratio	:	500 - 1000 / 1A.
Voltage transformer ratio	:	$160000/\sqrt{3} : 120/\sqrt{3} \text{ V}$
System nominal voltage	:	150 kV
Maximum system voltage	:	170 kV
System frequency	:	50 Hz
Number of CTs	:	3, single phase
Number of VTs	:	3, single phase

IV. RELAY MOUNTING REQUIREMENTS

1. The relay shall be housed in a case which shall be suitable for flush panel mounting or surface panel mounting.
2. The relay shall be suitable for rear or front connection.
3. The relay shall be equipped with screw type (preferably) terminal blocks which shall be suitable for 2.5 mm² conductors.

V. RELAY REQUIRED AUXILIARY VOLTAGE
(POWER SUPPLY)

The relay auxiliary voltage must be : 110 V DC.

VI. RELAY REQUIRED FUNCTIONS

The relay must be equipped with the following functions:

- a. Definite time overcurrent phase and earth protection with two (2) overcurrent stages, low and high, for both phase and earth ($I >$,

$I_{>>}$, I_E and $I_{E>>}$) and with directional capability for both phase and earth.

- b. Inverse time overcurrent phase and earth protection with overcurrents stage, for both phase and earth ($I_{>}$, I_E) and with directional capability for both phase and earth.
- c. The inverse overcurrent phase and earth protection must include curve types either based on IEC or IEEE/ANSI as indicated below:

per <u>IEEE / ANSI</u>	per <u>IEC</u>
Short-time inverse	Short-time inverse
Moderately inverse	Standard inverse
Inverse	Very inverse
Very inverse	Extremely inverse
Extremely inverse	Long-time inverse

- d. Breaker failure protection. This function will check the fault current exciting the relay for a certain (adjustable) period of time after the trip command has been given to the relevant circuit breaker. In case the fault current exists after this period of time (meaning the breaker has failed to open) an appropriate contact of the relay should be energised.

VII. RELAY REQUIRED RATED CURRENT AND VOLTAGE INPUT AND RATED FREQUENCY.

1. Rated current (I_n) : 1 A
2. Rated voltage (U_n) : $120/\sqrt{3}$ V
3. Rated frequency (f_n) : 50 Hz

VIII. INFORMATION WHICH THE SUPPLIER MUST KNOW FOR THE PHASE AND EARTH DIRECTIONAL CAPABILITY OF THE RELAY

Because the relay will be supplied by three single phase CTs and three single-phase VTs, it must be capable of calculating the earth current (I_o) and earth voltage (V_o) by itself.

IX. RELAY REQUIRED SETTING RANGES

a. Definite-time overcurrent element.

a.1.

<u>Low Overcurrent Element</u>	<u>Range</u>
Phase ($I >$)	$(0.1-3) \times I_n$ in steps of 0.1 A
Earth ($I_E >$)	$(0.1-3) \times I_n$ in steps of 0.1 A
Delay time for $I >$ and $I_E >$	0.1-6 s in steps of 0.1 s

a.2.

<u>High Overcurrent Element</u>	<u>Range</u>
Phase ($I >>$)	$(0.5-8) \times I_n$ in steps of 0.1 A
Earth ($I_E >>$)	$(0.5-8) \times I_n$ in steps of 0.1 A
Delay time for $I >>$ and $I_E >>$	0.1–6 s in steps of 0.1 s

b. Inverse-time overcurrent element.

<u>Overcurrent Element</u>	<u>Range</u>
Phase ($I >$)	$(0.1-3) \times I_n$ in steps of 0.1 A
Earth ($I_E >$)	$(0.1-3) \times I_n$ in steps of 0.1 A
Time multiplier	0.1-3.2s in steps of 0.1 s

X. ADDITIONAL REQUIREMENTS

The relay must be :

- of the numerical type.
- equipped with fault recording capability
- capable of blocking 2nd harmonics
- equipped with at least seven (7) NO output contacts. Six (6) of them will be programmable to allow the user to choose which of the definite time or the inverse time elements ($I >$, $I >>$, $I_E >$, $I_E >>$) are related to the contacts. One (1) contact will be related to the function of breaker failure and it will be time adjustable.
The output contacts must have the following characteristics

- Continuous current rating: 5 A.
- Breaking capacity : 0.3 A at 110 V DC for $L/R=40$ ms
- Making capacity: 30 A for 0.5 s

XI. RELAY MEANS OF CONFIGURATION

The relay shall be configured via :

- a. an integrated keypad and an LC screen.
- b. a PC through a proper port and appropriate software which must be included in the supply.

XII. SOFTWARE

Any software need for the parameterization and setting of the relay must be supplied

XIII. TESTS

a. Routine tests.

a.1. Insulation tests as per IEC 60255-5.

a.1.1. Dielectric withstand : 2 kV rms, 50 Hz, 1 min,
between all terminals and case earth.

b. Type tests.

b.1. Impulse test as per IEC 60255-5 : 5 kV peak, 1.2/50 μ s, 0.5 J

b.2. High frequency test
as per IEC 60255-2-1, class III
or IEEE / ANSI C 37.90.1 : 2.5 kV peak, 1 MHz,
400 shots per second,
duration = 2 s.

b.3. Fast transient test
as per IEC 60801-4, class III / IV : 4 kV

b.4. Vibration test
as per IEC 60068-2-6 : Acceleration : 0.5g \pm 25%
Frequency range: 10 – 150 Hz
Number of sweep cycles: 20
Sweep rate: 1 octave / mm \pm 10%.
Duration of endurance: 2 hours
30 minutes

NOTE :

Bidders are required to submit, if available, any official test reports for all of the above tests along with their technical offer. Acceptance or not lies on the judgment of IPTO S.A.

XIV. ADDITIONAL DATA TO BE SUPPLIED BY BIDDERS

1. Reference list
A reference list of the offered type relay shall be submitted in which the following shall be included :
 - Country and Customer
 - Number of installed relays
 - Date of order.
2. Drawings pamphlets
Bidders are requested to submit along with their technical offers, outline drawings, wiring diagrams and any information and data which will attributed to the complete description of the offered relay.
3. Connection drawing of the relay with CTs and VTs
In the offer, a connection diagram must be included depicting the connection of the relay to the available CTs and VTs

XV. ATTACHMENT "A"

Bidders are requested to complete attachment "A".
Failure to comply with this request will constitute sufficient reason for rejection of the offer.

XVI. COMMUNICATION AND INTERFACES

The relay shall be fitted with two (2) serial ports for reasons of interfacing and specifically with:

1. One serial port suitable for the connection to a PC.
An operator program shall be available to enable user friendly parameterization of the relay.
2. One serial port suitable for system interface shall be available for connection to a digital computerized substation control system. The communication protocol shall be as per IEC 61850. The relevant certificates, in accordance with IEC 61850-10, must be submitted. The certificates must be of level A (level A means independent Lab, e.g. KEMA).
The certificates 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 certificates (level A) must be submitted along with technical offer. In the second case the certificates (level B) along with the UCA International Users Group certification to the manufacturer must be submitted in the technical offer.

XVI. GUARANTEE

Guarantee of good operation for a period of at least five (5) years must be provided.

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ATTACHMENT "A"

1. Type of the offered relay :
2. Is the offered relay suitable for flush mounting or surface mounting? :
3. Relay rated current :
4. Relay rated voltage :
5. Relay rated frequency :
6. Relay auxiliary voltage (Power supply) :
7. Are the relay's terminals of the screw type and suitable for 2.5 mm² conductors ? :
8. Does the relay meet the required functions listed in paragraph VI of the specification ? :
9. Relay setting ranges.
 - 9.a. Definite Time.
 - 9.a.1.

<u>Low Overcurrent Element</u>	<u>Range</u>
Phase x I _n in steps
Earth x I _n in steps
Delay time for phase and earth in steps

9.a.2.

High Overcurrent Element	Range
Phase x In in steps
Earth x In in steps
Delay time for phase and earth in steps

9.b. Inverse Time.

Overcurrent Element	Range
Phase x In in steps
Earth x In in steps
Time multiplier in steps

10. Can the relay block 2nd harmonics ? :
11. List all relay contacts and their characteristics :
(acc. § X.d) :
:
12. Is the relay equipped with fault recording capability? :
13. Is the relay equipped with breaker failure function? :
14. Can the relay operated with the the assumptions of paragraph VIII? :
15. Is any parameterization software provided? :
16. Is the offered relay equipped with two (2) serial ports? One for connection to a PC, and the other for connection to a digital computerized substation control system? :
17. Can the relay be configured by an integrated keyboard and an LC screen and also by a PC? :
18. Is guarantee of good operation for a period of at least five (5) years provided ? :
19. Have the offered relays been certified

- by conformance test performed in
accordance with IEC 61850-10? :
-Are certificates provided? :
20. Power consumption of the relay :
21. Weight of the relay :
22. Dimensions of the relay :

*II/AG/a.k/SS-131e/18.07.2000
IIδ/pm/AG/JUNE 2004
IIδ/GS/August 2006
IIδ/pm/IA/July 2008
IIδ/pt/IA/November 2008*