SPECIAL CHARACTERISTICS FOR SMOR 4000 MODELS

INTRODUCTION

SMOR4000 relays are digital protection, control and measuring units belonging to SMOR-B family. This model includes the whole functionality of SMOR-B relays, and additionally it offers a ground overcurrent unit (67N), especially designed for use in isolated ground networks.

PROTECTION FUNCTIONS

Overcurrent Units

50/51P
67N Isolated
46P

Voltage Units

27
59/59N

Frequency Units

81U
81O

Directional Units

67P/67N Isolated

GROUND UNIT CONNECTION

In order to connect the ground unit, it is strongly recommended to use a toroidal transformer with the appropriate sensitivity covering the three phases, instead of the sum of currents of three different CTs. By doing that, we will avoid errors due to the dispersion of characteristics of the CTs.

This way of connection is shown on the external connections diagram in figure A4.

GROUND DIRECTIONAL UNIT 67N

OPERATION PRINCIPLE

The RMS values of the Ground Current (In) and Ground Voltage (Vn) are combined according to figure A1. If the resulting point is inside the Operation Zone, the unit will pick up and start counting the instantaneous unit delay time. If when picking up, the directional unit does not give permission for a trip, the unit will be reset and a "Directional Block" event will be generated. The same will happen if the trip inhibition appears during the instantaneous delay countdown. Once it has tripped, the protection does not take into account the directional permission, and maintains the trip while the fault condition is present. The operation characteristic of the directional unit is shown on figure A2.

After the first trip, the relay will start counting a so called "deviation time to instantaneous". The delay time will not be taken into account for trips taking place during this deviation time countdown. Once the deviation time has expired, the unit will return to normal operation.

For a certain operation current, the operation voltage is never lower than 95% nor higher than 105% of the corresponding value according to the trip characteristic. In the same way, for a certain operation voltage, the operation current is never lower than 95% nor higher than 105% of the corresponding value according to the trip characteristic.

The unit can be disabled by setting a zero (0) on the IL setting.

Directional Unit

The ground directional unit of SMOR4000 models is voltage polarized. For operating, the unit measures the phase angle between current Io and the polarization voltage Vp. The voltage is shifted the characteristic angle (α) (see figure A2), and we get V'p. Then, the unit measures the angle between Io and V'p. If this angle is less than 90º, Io and V'o will be on the same side of the characteristic, and there will be permission to trip. Otherwise, if the angle is higher than 90º, Io and V'p will be on opposite sides of the characteristic, and trip will be inhibited.

In isolated ground networks, default currents are mainly capacitive, so the characteristic angle (α) for this type of networks is usually 90º capacitive.

In order to avoid non desirable effects on the edge of the characteristic, the directional unit includes hysteresis. This means that, when Io is in the non-operative zone, an H angle must be entered into

the Operation zone before allowing a trip. However, once permission has been given, Io must return to the Non-operation zone so that trip is inhibited again. Please refer to Figure A3, where the operation current shifts, changing from Io1 to Io2, Io3 and Io4. V'p is supposed to be fix.

When current is Io1, trip is inhibited. Current turns and changes to Io2; as this position is inside the hysteresis angle, the trip will continue to be inhibited. When current is at Io3, trip is permitted, and if it keeps on turning it will move to Io4. In this case, the trip will continue to be enabled until Io returns to the non-operative zone.

The Hysteresis angle H is 2.5º for SMOR4000 relays.

67N UNIT SETTINGS

Voltage limits:
Vh: 2-45 V, in steps of: 1 V
Vl: 2-45 V, in steps of: 1 V

Current limits:
IL: 5-100 mA, in steps of: 1mA
IH: 3.75 x IL, Fix

Time delay tripping time:
0.03-3.00 s, in steps of: 0.01

Instantaneous trip deviation time:
1.0-10.0 s, in steps of: 0.1

Voltage transformation ratio:
1-4000, in steps of: 1

Directional Settings

Characteristic angle (α):
-90º to +90º, in steps of: 0,01

FIGURES

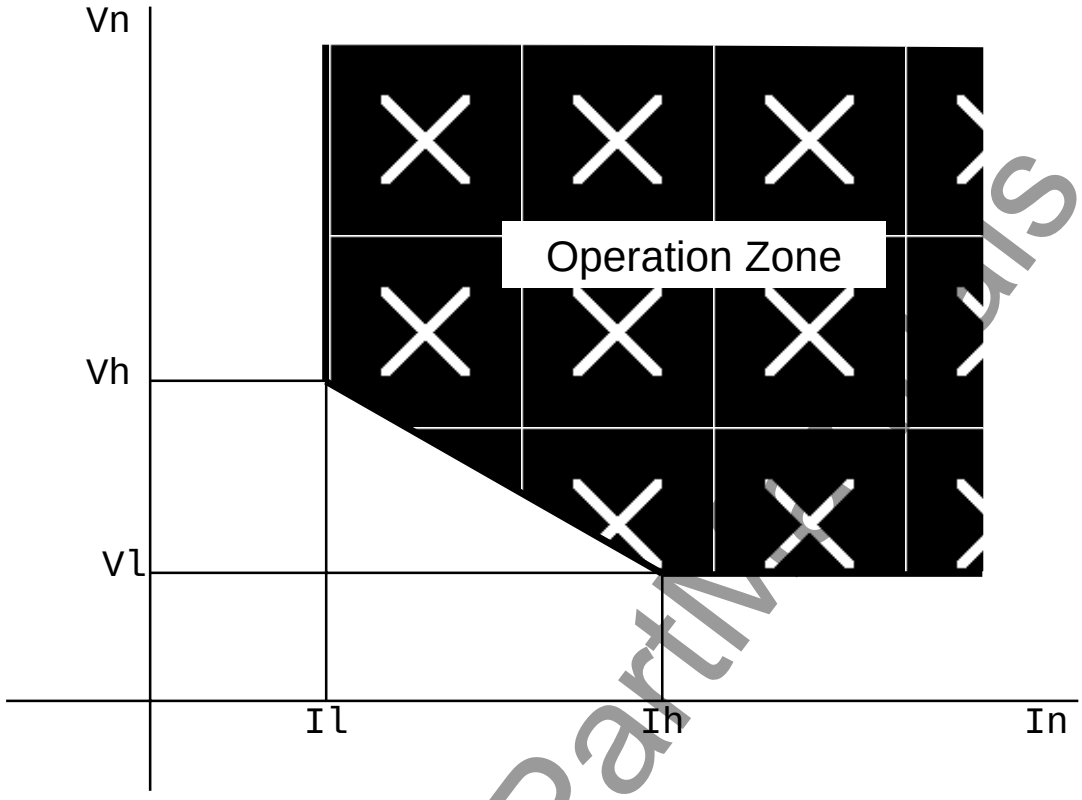

Figure A1 V-I Relation in 67N unit

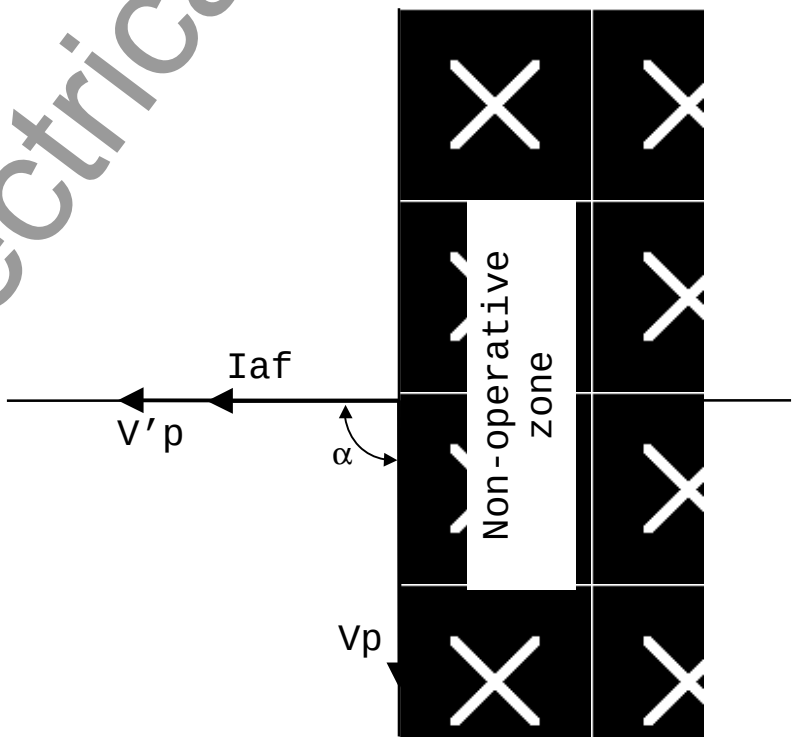

Figure A2 Directional Unit Characteristic

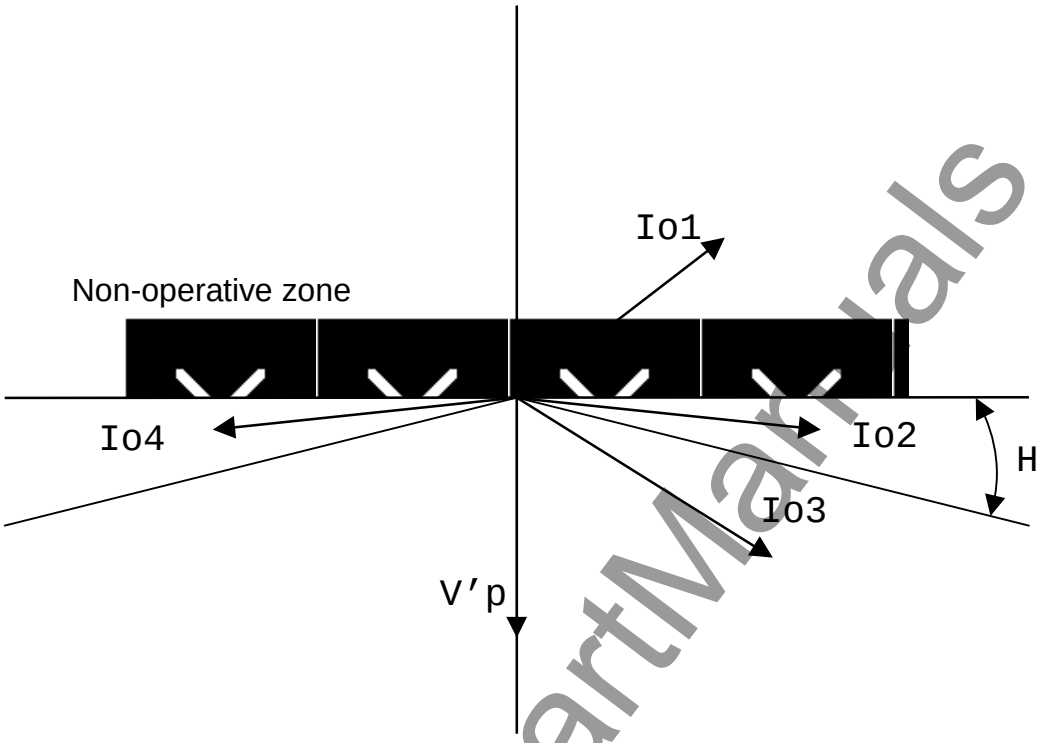

Figure A3 Directional Unit Hysteresis

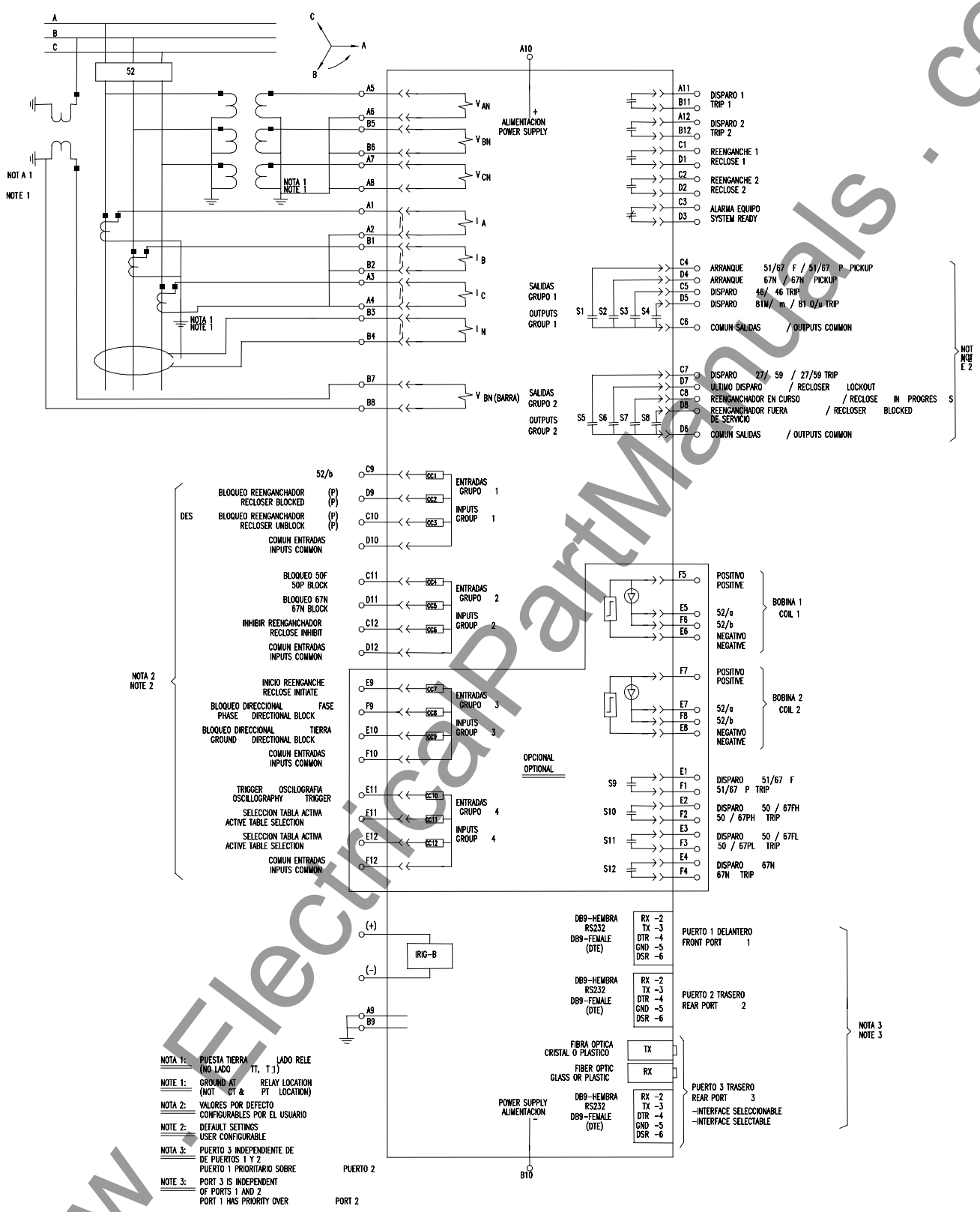

Figure A4 External Connections Diagram