Note:

* The approved updated final settings should be applied and printed out from the relay by using the software of the relay.
* The approved final setting and the printout final setting should be attached with this test format.
* The print out final setting should be signed by SEC AND Contractor.
* The following test format contains minimum required tests and some of settings are mentioned as an example and not as limitation.

1. **GENERAL DATA & INFORMATION**

|  |  |  |  |
| --- | --- | --- | --- |
| Panel No. |  | CT Ratio : \_\_\_\_\_\_ |  |
| Relay Type |  | In |  |
| Manufacturer |  | VT Ratio |  |
| SERIAL NO |  | Vn |  |
| No. of contacts: |  | Draw. & Sh No. : |  |
| Order - No. |  | Conn.Diag.No. |  |
| Software Version |  | DC. Auxiliary. Voltage |  |
| Opto-coupler supply: |  | Frequency Fn | 60 Hz |

1. **MECHANICAL CHECKS AND VISUAL INSPECTION**

As per TCS –P–105 Rev -1, Item no 4.1& 4.12.1.1

|  |  |  |  |
| --- | --- | --- | --- |
| item | Description | Remarks | |
|  | Inspect for any physical damage or defects. | ❑ Yes | ❑ N/A |
|  | Verify connections and ferrules as per approved drawings | ❑ Yes | ❑ N/A |
|  | Check tightness of all the connections. | ❑ Yes | ❑ N/A |
|  | Check Apparatus List | ❑ Yes | ❑ N/A |
|  | Check relay version and switching elements on printed circuit board | ❑ Yes | ❑ N/A |

1. **ELECTRICAL TESTS**

As per TCS –P–105 Rev -1, Item no 4.2& 4.12.1.2

* 1. Function Test

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Description | Remarks | |
|  | Human Machine Interface (HMI) Checked. | ❑Yes | ❑N/A |
|  | Case Earthing checked. | ❑Yes | ❑N/A |
|  | LED’s Function Checked. | ❑Yes | ❑N/A |
|  | Trip Contacts Checked. | ❑Yes | ❑N/A |
|  | Reset Function Checked | ❑Yes | ❑N/A |
|  | Group active Functions Checked | ❑Yes | ❑N/A |
|  | Binary inputs checked. | ❑Yes | ❑N/A |
|  | Output Relays Checked | ❑Yes | ❑N/A |
|  | Event Display on HMI Screen Checked | ❑Yes | ❑N/A |
|  | Test switch / plug checked for correct function. | ❑Yes | ❑N/A |
|  | Watchdog contacts checked | ❑Yes | ❑N/A |
|  | Current shorting facility. | ❑Yes | ❑N/A |

* 1. **GENERAL FUNCTIONS IN THE RELAY**

|  |  |
| --- | --- |
| Function | Selected |
| Phase Distance Protection |  |
| Earth Distance Protection |  |
| Power Swing Detection |  |
| Teleprotection For Distance Protection |  |
| DTT Direct Transfer Trip |  |
| Instantaneous High Speed SOTF Over Current |  |
| Week Infeed ( Trip & / Or Echo ) |  |
| Back Up Over Current Protection |  |
| Earth Fault Over Current Protection |  |
| Teleportation For Earth Fault Over Current |  |
| Auto – Reclose Function |  |
| Synchronism & Voltage Check |  |
| Fault Locator |  |

* 1. **POWER SYSTEM DATA**

|  |  |  |
| --- | --- | --- |
| OHL / UG Cable | |  |
| CT Star Point | |  |
| System Star point | | Solid Earthed |
| Line Length | | Km |
| Line Angle | |  |
| X ∕ = Line Reactance( Ω / Km ) | |  |
| Zero Sequence Compensation Factors | RE  / RL | Z1 = |
| Z2----- Z5 = |
| XE / XL | Z1 = |
| Z2----- Z5 = |

Secondary Injection Measurements:

Setting:

1201=Distance Protection = OFF.

We should insure that:

* CT. & VT. Ratios are as setting in Power System Data 1, Address (0203 to 0206)
* From Setting Group A: Power System Data 2, insure the value of % in:

Address (1103) Measurement: Full Scale Voltage (100 %)

Address (1104) Measurement: Full Scale Current (100 %)

* The Direction of the Earthing is as per approved Drawings & as Setting in Power System Data 1

(i) If the direction of the Earthing is towards the line (Cable or OHL)

The Current is ------------ the Voltage by ----- (As shown below)

|  |  |  |
| --- | --- | --- |
| V1 = | V2 = | V3 = |
| I 1 = | I 2 = | I 3 = |

(ii) If the direction of the Earthing is Towards the Bus Bar

The Current is -------- the Voltage by----- (As shown below)

|  |  |  |
| --- | --- | --- |
| V1 = | V2 = | V3 = |
| I 1 = | I 2  = | I 3  = |

Injected quantities:

Inject 3 Phases Currents & Voltages.

(i) The angle between V & I is (0°)

|  |  |  |
| --- | --- | --- |
| Phase - L1 | Phase -L2 | Phase -L3 |
| ------- V | -------- V | V |
| --------A | --------- A | A |

(ii) The angle between V & I is (------)

|  |  |  |
| --- | --- | --- |
| L1 | L2 | L3 |
| ----------V | ---------V | ----------V |
| -----------A | ---------A | ----------A |

(iii) The angle between V & I is (------)

|  |  |  |
| --- | --- | --- |
| L1 | L2 | L3 |
| ------ V | ------------ V | ------------V |
| ------- A | -------------A | -----------A |

Note: Print out from the Relay is Attached (Primary & Secondary & % values)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameters | Measured Values In The Relay | | | | | | | | |
| At angle ∟ 00 | | | At angle ∟ ------o | | | At angle ∟ -------- | | |
| primary | secondary | % values | primary | secondary | % values | primary | secondary | % values |
| Current IL1 |  |  |  |  |  |  |  |  |  |
| Current IL2 |  |  |  |  |  |  |  |  |  |
| Current IL3 |  |  |  |  |  |  |  |  |  |
| 3I0 |  |  |  |  |  |  |  |  |  |
| I1 - positive Sequence |  |  |  |  |  |  |  |  |  |
| I2 - Negative Sequence |  |  |  |  |  |  |  |  |  |
| Voltage UL1E |  |  |  |  |  |  |  |  |  |
| Voltage UL2E |  |  |  |  |  |  |  |  |  |
| Voltage UL3E |  |  |  |  |  |  |  |  |  |
| Voltage UL12 |  |  |  |  |  |  |  |  |  |
| Voltage UL21 |  |  |  |  |  |  |  |  |  |
| Voltage UL31 |  |  |  |  |  |  |  |  |  |
| 3U0 |  |  |  |  |  |  |  |  |  |
| U1 - positive Sequence |  |  |  |  |  |  |  |  |  |
| U2 - Negative Sequence |  |  |  |  |  |  |  |  |  |
| Apparent power(S) |  |  |  |  |  |  |  |  |  |
| Active power(P) |  |  |  |  |  |  |  |  |  |
| Reactive power(Q) |  |  |  |  |  |  |  |  |  |
| Frequency |  |  |  |  |  |  |  |  |  |
| Power Factor |  |  |  |  |  |  |  |  |  |

* 1. **IMPEDANCE SECONDARY MEASUREMENTS**

Note: Before starting this test, for easy calculation & to get correct readings

In the relay configuration, Setting Group A, power system data 2

Address (1116-1119): setting for Zero Sequence Compensation Factors

RE / RL =0 & XE / XL = 0,

Also Zero Sequence Compensation Factors in the Tester setting should be Zero

* Inject the impedance ( Z ) = --- Ω with angle Φ = ----o ( in Forward Side )

Calculate: R= Z x COS Φ , X= Z x SIN Φ

Then read and record measurement the impedance ----- (Z) (Primary & Secondary)

* Inject the impedance (Z) = -------Ω with angle Φ = ----- o (in Reverse Side)

Calculate: R= Z x COS Φ , X= Z x SIN Φ

Then read and record the measurement impedance ----- (Z) (Primary & Secondary)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Phase | Impedance | Φ = --o | | | Φ = ---o | | |
| Calculated  Z | Measured Z | | Calculated  Z | Measured Z | |
| Primary | Secondary | Primary | Secondary |
| L1 - N | RL1 |  |  |  |  |  |  |
| XL1 |  |  |  |  |  |  |
| L2 - N | RL2 |  |  |  |  |  |  |
| XL2 |  |  |  |  |  |  |
| L3 - N | RL3 |  |  |  |  |  |  |
| XL3 |  |  |  |  |  |  |
| L1 – L2 | RL12 |  |  |  |  |  |  |
| XL12 |  |  |  |  |  |  |
| L2 – L3 | RL23 |  |  |  |  |  |  |
| XL23 |  |  |  |  |  |  |
| L3 – L1 | RL31 |  |  |  |  |  |  |
| XL31 |  |  |  |  |  |  |

Note: [C.T ratio = ------] & [V.T ratio = -------- K.V] = -------

The Primary measured values = Secondary measured values \* [V.T ratio / C.T ratio] = -----------

* 1. **DISTANCE PROTECTION PICK UP THRESHOLD (FAULT DETECTION TEST)**
     1. Phase Fault Current Threshold Detection (minimum I ph>) Test

Address :

(1202)

\*1201: Distance Protection is = ON

\*1202 : Phase Current Threshold (I ph > ) for Distance Measurement= ------A

1203 : 3Io Threshold for Neutral Current Pickup = ------A

1209: Criterion of Earth Fault Recognition not important if it is (3I0 OR 3U0) / (3I0 AND 3U0)

3Io: Earth Fault setting should be < I ph Phase Fault setting.

You must inject voltage more than the setting voltage at Address

2913A) : Maximum Voltage Threshold U < (3 Phase) = ------- V

Or (2915) : Voltage Failure supervision = OFF

& (2910) : Fuse Failure Monitoring = OFF

& (2901) : Measurement Supervision = OFF

Then Inject Phase - Phase Current more than the setting at Address (1202) & Zero Voltage ∟-------° OR ∟--------°

|  |  |  |  |
| --- | --- | --- | --- |
| Phase | Phase Fault I ph > Setting  (Address:1202) | Measurement (A) | |
| Pick Up (A) | Drop Off (A) |
| L1∟----° – L2 ∟-----° | ------- A |  |  |
| L2∟----° – L3 ∟-----° |  |  |
| L3∟----° – L1 ∟-----° |  |  |

**I ph >** **Trip**

&

Inject voltage > the setting voltage at Address (2913A) Or Fuse Failure=Off (The Volt =0)

Inject Phase - Phase Current more than the setting at Address (1202)

* + 1. **EARTH FAULT CURRENT THRESHOLD (3IO) DETECTION**

Address: (1202)

1201: Distance Protection is = ON

1202: Phase Current Threshold (I ph> ) for Distance Measurement = -------- A

1203: 3Io Threshold for Neutral Current (Earth Fault) Pickup=---A

1209: Criterion of Earth Fault Recognition should be selected as = (3I0 OR 3U0)

1204: (3 VO) Threshold Zero Sequence Voltage pick up = -------- V

Note:-

1 - (3Io) Threshold for Neutral Current (earth fault) Pick-Up setting

(Address: 1203A) should be above the phase fault setting (Address: 1202)

2 – You must inject voltage more than the setting voltage at Address

(2913A): Maximum Voltage Threshold U< (3 Phase) =--V

Or (2915): Voltage Failure supervision = OFF

& (2910): Fuse Failure Monitoring = OFF & (2901): Measurement Supervision = OFF

Then, Inject Phase – Earth Fault Current (single phase current) more than the setting at Address (1202) & more than the setting at Address (1203) & Zero Voltage.

|  |  |  |  |
| --- | --- | --- | --- |
| Phase | Earth Fault 3Io >  (Neutral Current ) Setting  (Address:1203) | Measurement (A) | |
| Pick up (A) | Drop off (A) |
| L1 - N | 0.4A |  |  |
| L2 - N |  |  |
| L3 - N |  |  |

Note: I ph > will operate (Pick Up) first, because the setting is less. But the Trip will be with 3Io value.

Inject voltage > the setting voltage at Address (2913A) Or Fuse Failure=Off (The Volt =0)

Inject Phase - Earth Current more than the setting at Address (1203)

3Io

**Trip**

&

* + 1. **ZERO SEQUENCE VOLTAGE THRESHOLD CHECK {3 VO DETECTION} (ADDRESS 1204)**

1204: (3VO) Threshold Zero Sequence Voltage pick up= ---- V

1209A: Criterion of Earth Fault Recognition should be selected as = (3I0 AND 3U0)

1202: Phase Current Threshold (I ph>) for Distance Measurement = ----- A

1203: 3Io Threshold for Neutral Current (Earth Fault) Pickup = ----- A

Note:

(2915): Voltage Failure supervision = OFF

& (2910): Fuse Failure Monitoring = OFF

& (2901): Measurement Supervision = OFF

Then

1 - Inject Phase – Earth Fault Current (Single Phase Current) more than (3I0) Setting

(Address 1203) and also more than Phase Current (I ph> ) Setting (Address 1202)

{Inject 3-Phase Current = Rated Current = ------ A}

2 - Inject 3 VO Zero Sequence Voltage V L1–N =-- v, V L2–N =--- V, V L3 –N = ---V,

Reduce slowly V L1–N voltage till relay E/F element operates, then:

Take the pick up value of the relay by switching On & Off of fault & check the pick up value of distance relay.

|  |  |
| --- | --- |
| Setting value of 3Vo (V) | Measured Pick Up value (V) |
| -------- |  |

3 VO

Trip

&

Make Unbalance in 3 VO, Reduce slowly V L1–N

Inject 3-Phase Current = Rated Current = ---- A

* + 1. **ZONES REACH & TIME TESTING (MANUAL CHECK)**

To test the ZONE Reach & Time, we adjust the ZONES from the relay Settings as following:

Settings:

Device configuration:

0112 Phase Distance -------------

0113 Earth Distance ------------

From Setting Group A :

0013 Distance zones (-----------)

Zone-Z1

1301 Operating Mode Zone-1 ------

1302 R (Z1), Resistance for Ph- Ph Faults --- Ω

1303 X (Z1), Reactance ------ Ω

1304 RE (Z1), Resistance for Ph- E Faults --- Ω

1305 T1-1 Phase, delay for single phase faults --Sec.

1306 T1-multi Ph, delay for single phase faults --- Sec.

Zone-Z1B

1351 Operating Mode Z1B (Over Reach Zone) = --Ω

1352 R (Z1B), Resistance for Ph- Ph Faults -----Ω

1353 X (Z1B), Reactance ------- Ω

1354 RE (Z1B), Resistance for Ph- E Faults= ---Ω

1355 T1B-1 Phase, delay for single phase faults ------- Sec.

1356 T1B-multi Ph, delay for single phase faults ------ Sec.

Zone-Z2

1311 Operating Mode Zone-2 = -------------

1312 R (Z2), Resistance for Ph- Ph Faults -- Ω

1313 X (Z2), Reactance = ----------- Ω

1314 RE (Z2), Resistance for Ph- E Faults---Ω

1315 T2-1 Phase, delay for single phase faults = --- Sec.

1316 T2-multi Ph, delay for single phase faults ---- Sec.

Zone-Z3

1321 Operating Mode Zone-3 ----------

1322 R (Z3), Resistance for Ph- Ph Faults ---Ω

1323 X (Z3), Reactance ------- Ω

1324 RE (Z3), Resistance for Ph- E Faults --Ω

1325 T3 delay ------- Sec.

Zone-Z4

1331 Operating Mode Zone-4 -------------

1332 R (Z4), Resistance for Ph- Ph Faults -- Ω

1333 X (Z4), Reactance -------- Ω

1334 RE (Z4), Resistance for Ph- E Faults ---Ω

1335 T4 delay --------- Sec.

Zone-Z5

1341 Operating Mode Zone-5 ----------------

1342 R (Z5), Resistance for Ph- Ph Faults ---Ω

1343 X (Z5) +, Reactance for Forward direction ----- Ω

1344 RE (Z5), Resistance for Ph- E Faults---Ω

1345 T5 delay -------- Sec.

1346 X (Z5) -, Reactance for Reverse direction -----Ω

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Zones | Settings | | Axis | Fault Types | | | | | | | Time  (m S) |
| Time | Z | L1 - N | L2 - N | L3 - N | L1 – L2 | L2 – L3 | L3 – L1 | L1 L2 L3 |
| Z1  Forward | ----- | ---- | R∟---° |  |  |  |  |  |  |  |  |
| --- | X∟---° |  |  |  |  |  |  |  |
| Z1B  Forward | ------ | --- | R∟---° |  |  |  |  |  |  |  |  |
| ---- | X∟---° |  |  |  |  |  |  |  |
| Z2  Forward | ------ | ---- | R∟---° |  |  |  |  |  |  |  |  |
| ---- | X∟---° |  |  |  |  |  |  |  |
| Z3  Reverse | ------ | ---- | R∟---° |  |  |  |  |  |  |  |  |
| ---- | X∟----° |  |  |  |  |  |  |  |
| Z4  Forward | ------ | ---- | R∟---° |  |  |  |  |  |  |  |  |
| ---- | X∟----° |  |  |  |  |  |  |  |
| Z5  Non Directional | ----- | ---- | R∟----° |  |  |  |  |  |  |  |  |
| ---- | X∟----° |  |  |  |  |  |  |  |
| ---- | R∟----° |  |  |  |  |  |  |  |
| ---- | X∟-----° |  |  |  |  |  |  |  |

Test with omicron:

1. Distance Advanced Distance
2. Choose “Shot Test “.
3. Put the Points.
4. Choose “Add To “.
5. Choose “ALL “, Then OK.

We should ensure from the Parameter that the Earthing is as the actual.

Note: Zones reach & Time Testing (Auto Check). See the Attached Print out from the Relay

* + 1. **DISTANCE DIRECTIONALITY CHECK**

Note:-

* + - 1. If any Zone is adjusted to be Non-Directional, you must reverse it (or adjusted it to be Inactive) to be able to determine the Undefined Areas.
      2. 2 - You must Configure LEDs for Distance Pick up Forward and Distance Pick up Reverse.

Settings:

Device configuration:

0112 Phase Distance: Quadrilateral

0113 Earth Distance: Quadrilateral

From Setting Group A:

0013 Distance zones: Zone-Z5

1341 Operating Mode Zone-5:

From Masking I / O (Configuration Matrix):

LED13 = 3719 = Distance FORWARD

LED14 = 3720 = Distance REVERSE

* + - 1. The 3-Phase Fault Injection, 1- Phase Fault Injection & Ph-Ph Fault Injection must be same for all types of faults.

Test Procedure with OMICRON:

Apply a constant value of the Impedance Z, and change the angle, Select the zone operating time as sufficiently long ( e.g. ----- Sec. ) so that the relay should not trip while rotating / changing the angle.

* Distance Advanced Distance
* Choose “Check Test “.
* Apply a constant value of the Impedance Z
* Choose “Sequence “
* Determine the Range you want to test & determine the increment in the Angle.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Direction | Angels | | | |
| Expected Angels | | Measured Angels | |
| From | To | From | To |
| Forward |  |  |  |  |
| Un-defined |  |  |  |  |
| Reverse |  |  |  |  |
| Un-defined |  |  |  |  |

Undefined

Forward

**Reverse**

Undefined

* + 1. **DISTANCE TELE PROTECTION SCHEMES**

The communication scheme which is selected as a final setting can be tested only.

1. Permissive Under Reach (PUTT) (Z1B Acceleration)

Trip = Z1\*T1 + Z1B\*CR\*T1B + Z2\*T2 + Z3\*T3 + Z4T4 + Z5\*T5

CS= Z1\*TS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Phase | Z | Communication Status | | CR  Simulation | CS  Checking | Trip Time | Transmission Time |
| HEALTHY | FAIL |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

NOTE: LEDs Should Be Checked During Testing

1. **PERMISSIVE OVER REACH (POTT)**

Trip =Z1\*T1 + Z2\*T2 + Z3\*T3 + Z4T4 + Z5\*T5 + (Z1B\*CR\*T1B)

CS = Z1B\* (Z1\*T1 + Z2\*T2 + Z3\*T3 + Z4T4 + Z5\*T5 + (Z1B\*CR\*T1B)) \* TS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Phase | Z | Communication Status | | CR  Simulation | CS  Checking | Trip Time | Transmission Time |
| Healthy | Fail |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

1. **WEAK IN FEED FUNCTION (WITH POTT SCHEME)**

(ECHO only / ECHO and Trip) Address No: 2501

1. Echo only

Settings: Configure Address No:

00379 CB Auxiliary Contact 3 Pole Closed [CB. Close] (Binary Input)

00380 CB Auxiliary Contact 3 Pole Open [CB. Open] (Binary Input)

|  |  |  |
| --- | --- | --- |
| Status | Relay action should be | Relay action |
| C.B off ( Open ) + Carrier Receive  ( Z1B Fault ) | Echo Signal Send Immediately ( CS ) |  |
| C.B on ( Closed ) + Carrier Receive  ( Z1B Fault ) | Echo Signal Send (CS ) after time delay  Address No: (2502A): (40 m Sec.)  Trip / Echo Delay After Carrier Receipt. |  |

1. **(Echo & Trip)**

|  |  |  |
| --- | --- | --- |
| Status | Relay action should be | Relay action |
| C.B off ( Open ) + Carrier Receive  ( Z1B Fault ) | Echo Signal Send Immediately ( CS ) Without Local Trip |  |
| C.B on ( Closed ) + Carrier Receive  ( Z1B Fault ) | Local Trip & Echo Signal Send (CS) after time delay Address No: (2502A): (40 m Sec.)  Trip / Echo Delay After Carrier Receipt. |  |

1. **Under Voltage Pick Up for Local Trip (Weak Infeed Voltage)**

Settings: Address No:

(2502A): Trip / Echo Delay after Carrier Receipt. = -------Sec.

(2505) : Under Voltage (Phase – Earth) = ------- V

(1130A): Pole Open Current Threshold = ------- A

If we apply , one Phase Voltage ‹ Setting in Address No: (2505 ) : Under Voltage ( Phase – Earth ) and we apply the other two Phases Voltage by Normal value and inject one phase current › Setting in Address No: ( 1130A ) : Pole Open Current Threshold = ---- A and the other two phases by Normal value. All this with Carrier Receive then the relay will send an Echo and weak in feed Local Trip after the time of Address No: (2502A) But if the one phase voltage is more than the Address No: ( 2505 ) the relay will send Echo Only after time of Address No: ( 2502A ) : Trip / Echo Delay After Carrier Receipt. = ---- Sec.

|  |  |  |
| --- | --- | --- |
| Under Voltage ( Ph–E) ( V ) | Setting Value = ------ V  Address No: ( 2505) | Measured Voltage = V |
| Trip Time Delay for Local Trip (Sec) | Setting Value = ------ Sec.  Address No: ( 2502A) | Measured Time = Sec. |
| Pole Open Current Threshold (A) | Setting Value = ------ A  Address No: ( 1130A) | Measured Current = A |

1. **Blocking Scheme**

Trip = Z1\*T1 + Z2\*T2 + Z3\*T3 + Z4T4 + Z5\*T5 + (Z1B \* T1B \* CR \*TV)

Cs = Z3 \* TS

NOTE: Z3 IS REVERSE ZONE

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Phase | Z | Communication Status | | CR  Simulation | CS  Checking | Trip Time | Transmission Time |
| Healthy | Fail |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

* + 1. **POWER SWING DETECTION**

Address No: 0120 : Enabled

Setting Group A: 0020: Power Swing

Address No: 2007: Trip Delay after Power Swing Blocking -- Sec. (Raise the Time Setting of Trip Delay after Power Swing Blocking Address No: 2007 to more than the longest time of the Distance Zones)

|  |  |
| --- | --- |
| Power Swing Operating Mode Address No:2002 | Relay Action |
| All zones Blocked |  |
| Z1 , Z1B , Z2 Blocked | No trip with |
| Trip with |
| Z1 , Z1B Blocked | No trip with |
| Trip with |
| Z2 to Z5 Blocked | No trip with |
| Trip with |

When the Fault comes to the line, the Voltage will decrease or the Current increase, then the Impedance will decrease in very short time, then the relay will trip according to the setting of the fault case.

In the Power Swing case , the Impedance will decrease but in very short time , it will be decrease related with proper time for that decreasing, so the Power Swing depend on changing the Impedance with Time ( dZ / dt ). However , the time has to be proper with this changing ( Not very short when the Impedance will decrease ) , then the relay will Block all the Zones ( in case of chosen “All zones Blocked “ in Address No:2002 )

Test Procedure with OMCRON Using (State Sequencer):

1 - Inject Normal Current & Normal Voltage.

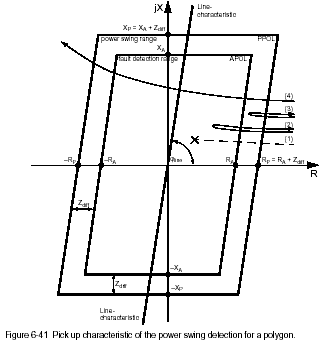
2 – Then Decrease the Voltage by constant (dv/ dt) [(i.e.) Decrease the Impedance by (dZ / dt).]

3 -The Power Swing depend on changing the Impedance with Time (dZ/dt)

4 -The Power Swing Impedance starts before Z5 by --- Ω

5 –When the Impedance enter the Polygon, the Timer in Address No: 2007 Trip Delay after Power Swing Blocking ------- Sec., will operate.

* + - * 1. If the changing of the Impedance in the Polygon is slowly then the relay will be Blocked byThe Power Swing Function.
        2. If the changing of the Impedance in the Polygon is fast and the Impedance is go out from the Polygon and then any Fault will make Trip.



* + 1. **Switch On To Fault (SOTF) Function Check**

1. Instantaneous High Speed SOTF-O/C [SOTF Separate Function]

From Device Configuration:

Address No: 0124 Enabled

Setting Group A:

Address No: 0024

2401: Instantaneous High Speed SOTF-O/C is ON

2404: Iph››› Pick Up 2.5A

Also: Disable the Distance Protection

Address No: 1201Disable Back Up Over Current Protection Address No: 2601

1201: Distance Protection is OFF

1232: Instantaneous Trip after SOTF for Distance Inactive

2601: Operating Mode for Back up O/C OFF

2615: Instantaneous Trip after SOTF for O/C I›› NO

2625: Instantaneous Trip after SOTF for O/C I› NO

2671: Inst. Trip after SOTF for O/C Inverse Type NO

0011: Power System Data 2 (Line Status)

1130: Pole Open Current Threshold 0.1A

1131A: Pole Open Voltage Threshold 30 V

1132A: Seal –in Time after All Closures 0.05 Sec.

1133A: Minimal Time for Line Open before SOTF 0.25Sec.

1134: Recognition of Line Closures with

(i) Manual Close Bi Only

(ii) Current flow OR Manual Close Bi

(iii) Current OR Voltage OR Manual Close Bi

(iv) CB aux. OR Current OR Manual C

1135: Reset of Trip Command

1. Pick UP Reset
2. With CB aux. Open & I‹ Pole Open Current
3. With Pole Open Current Threshold Only

1136: Open Pole Detector

1. OFF
2. With CB aux. Open & I‹Pole Open Current
3. With measurement (U/I, Trip, Pick Up, CB aux.)

1150A: Seal –in Time after Manual Closures -------- Sec.

For C.B Closure Recognition Address No: (1134): by Binary Input Manual Close Only

Raise the Setting of Address No: 1150A): Seal- in Time after Manual Closures

(This Time Controls the Time for Activation of BI: Manual Close)

Test Procedure:

From: Masking I / O (Configuration Matrix), SOTF over current configure the following:

Instantaneous High Speed SOTF O/C has a private Trip, so you must Configure Binary Output and any LED for it. Address No: (4295): SOTF- O/C Trip Command L123,

Also you can Configure Binary Output for SOTF-O/C Picked Up Address No: (4281): SOTF- O/C Picked Up for detecting Pick Up value, but it is not important because the operation of SOTF is instantaneous.

Configure Binary Input for Manual Close Address No: 00356: Manual Close Signal

Configure Binary Input for C.B off Address No: 00380: CB. Aux. Contact 3 Pole Open

Case No. (i):

Inject Current more than the Setting in Address No: 2404: Iph››› Pick Up = 2.5A

With activation of the Binary Inputs of C.B off & Manual Close. » The relay will Trip

Case No. (ii):

Inject Current more than the Setting in Address No: 2404: Iph››› Pick Up = 2.5A

Without activation of the Binary Inputs of C.B off & Manual Close. » The relays will Not Trip

Case No. (iii):

Inject Current Less than the Setting in Address No: 2404: Iph››› Pick Up = 2.5A

With activation of the Binary Inputs of C.B off & Manual Close » The relay will Not Trip

|  |  |  |  |
| --- | --- | --- | --- |
|  | Setting in Address No:2404 | Injected Current | Measured Trip Time (ms) |
| Case No.( i ) | 2.5 | 2.7 |  |
| Case No.( ii ) | 2.5 | 2.7 | No Trip |
| Case No.( iii ) | 2.5 | 2.0 | No Trip |

Note:

1130: Pole Open Current Threshold ------ A

1133A: Minimal Time for Line Open before SOTF ------ Sec.

1132A: Seal –in Time after All Closures ---- Sec.

Instead of using Binary Input: CB. Manual Close, we can Inject Current Less Than the Current in Address No: 1130 for a period of time =250 mSec,

So, the relay will know that the CB. Of the Feeder as it is opened (OFF), also the Time in Address No: 1132A, helping in Monitoring the Increase in Current after CB. is Closed (ON ),

If During that time 250 mSec, the Current Increased More than the Current in Address No: 1130,

Then the relay shall trip by SOTF Function.

Hence, we can make this Test as following:

1134: Recognition of Line Closures with (Current flow OR Manual Close BI)

Using State Sequencer in OMICRON as following:

(1)1st State, Inject Normal Current (1 A) & Voltage (57.73 V) &

Voltage Values for a period of time more than 250 mSec.

(2) 2nd State, Inject Normal Current (1 A) & Voltage (57.73 V)

Values for a period of time less than 2 Sec.

(3) 3rd State, Inject a Current higher than the Current in addres No: 2404: Iph››› Pick Up = 2.5A & Normal Voltage Value (57.73 V) for a period of time less than 2 Sec

Then » The relay will Trip by SOTF Function

1. SOTF ASSOCIATED WITH DISTANCE PROTECTION

1232 = ZONE PICK UP

1232 Dis. = ON

1201 SOTF WITH Dis. = ON

SOTF WITH Z1

T W/O SOTF = Sec

(Manual close) T WITH SOTF= Sec

(Current flow)T WITH SOTF= Sec

SOTF WITH Z1B

TW/O SOTF = Sec

(Manual close)T WITH SOTF = Sec

(Current flow)T WITH SOTF = Sec

SOTF WITH Z2

TW/O SOTF = Sec

(Manual close)T WITH SOTF = Sec

(Current flow)T WITH SOTF = Sec

SOTF WITH Z3

TW/O SOTF = Sec

(Manual close)T WITH SOTF = Sec

(Current flow)T WITH SOTF= Sec

SOTF WITH Z4

TW/O SOTF = Sec

(Manual close)T WITH SOTF = Sec

(Current flow)T WITH SOTF= Sec

Note:-

Disable the back up over current protection add (2601)

Disable the instantaneous high speed SOTF O/C add (2404)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Applied fault in zone | Phase | measured time (s) |
| with the activation of the binary inputs of C.B off and manual close | Z1B |  |  |
|  |  |
|  |  |
| without the activation of the binary inputs of C.B off and manual close | Z1B |  |  |
|  |  |
|  |  |
| with the activation of the binary inputs of C.B off and manual close | Z2 |  |  |
|  |  |
|  |  |
| Z3 |  |  |
|  |  |
|  |  |
| Z4 |  |  |
|  |  |
|  |  |
| Z5 |  |  |
|  |  |
|  |  |

1. SWITCH ON TO FAULT (SOTF) ASSOCIATED WITH BACKUP O/C:

Address NO: 2615 O/C I> = ON

Address NO: 2625 O/C I>> = ON

Address NO: 2671 O/C Ip = ON

Address NO2601 SOTF WITH O/C = ON

2625 SOTF WITH (I>>)

T W/O SOTF =Sec

I set = ……….

(Manual close)T WITH SOTF =Sec

T set = ………

(Current flow)T WITH SOTF =Sec

AD 2615 SOTF WITH (I>)

T W/O SOTF = Sec

I set = ……….

(Manual close)T WITH SOTF =Sec

T set = ………

(Current flow)T WITH SOTF =Sec

AD 2617 SOTF WITH (Ip)

T W/O SOTF = Sec

I set = ……… (Manual close)T WITH SOTF = Sec

TMS = ……… (Current flow)T WITH SOTF = Sec

Note:

-Check the Seal-In Time Setting For Manual Close

Disable the distance protection add (1201)

Disable the instantaneous high speed SOTF O/C add (2404)

Setting of all definite stages is ------ A and ----- sec

Setting of inverse stage is ------ A and ------ sec long inverse

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| address |  | Setting  ( A ) | Phase | Injected current (A) | measured time (msec) |
| Iph >> pickup  add ( 2610) | with the activation of the binary inputs of C.B off and manual close |  |  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| without the activation of the binary inputs of C.B off and manual close |  |  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| Iph > pick up  add ( 2620) | with the activation of the binary inputs of C.B off and manual close |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| without the activation of the binary inputs of C.B off and manual close |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Ip > pick up  add ( 2640) | with the activation of the binary inputs of C.B off and manual close |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| without the activation of the binary inputs of C.B off and manual close |  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Note: when you test any one of current stages you should raise the pick up setting of the others stages

* + 1. **FUSE FAIL MONITORING**

Address (2910)

* FUSE FAILURE MONITORING FUNCTION (3Io & 3Vo) ---------
* VOLTAGE ABSENT MONITORING FUNCTION (3 phase voltages)-----
* FUSE FAILURE MONITORING FUNCTION (3 phase voltages & Δ I )---------
* BROKEN CONDUCTOR ------

Note:-

1. review all LEDs
2. Injection voltage less than (2913A)-max. voltage threshold V)>3-phases)
3. Distance protection after time (2916A) delay time voltage failure supervision.
4. Apply fault at any zone (Z1….Z5) before time (2916A) the relay should operate. 2916A= ----- secs.

* 1 PHASE SETTING = 30V, Vrn = 31v, Vyn=Vbn=60V, 3 PHASE CURRENT = 0.5A. SLOWLY DECREASE RN VOLTAGE & CHECK AT WHICH VOLTAGE FUSE FAIL LED APPEARS
* 3 PHASE SETTING = 5V, DISTANCE BLOCKED SPONTANEOUS INDICATION APPEARS ON FUSE FAILURE OPERATION. 2916A=0 SECS,

Vrn = Vyn=Vbn=60, 3 PHASE CURRENT = 0.5A.SLOWLY DECREASE 3 PHASE VOLTAGE & CHECK AT WHICH VOLTAGE FUSE FAIL LED APPEARS

* FUSE FAILURE MONITORING FUNCTION (3 phase voltages & ΔI)

(AD2913A=5V) . (AD2914A=0.2A)

|  |  |
| --- | --- |
| STAT1 | STAT2 |
| L1  I=------ V=------ | L1  I= ---- V=5 |
| L2  I=------- V=------- | L2  I= ------ V=5 |
| L3  I=------- V=------- | L3  I= ------ V=5 |

For voltage fail supervision add. (2915) is with current supervision

Note: before starting the test you must specify LEDs to failure voltage absent add. (168) and V.T fuse failure alarm instantaneous add. (170) and V.T fuse failure alarm> 10sec add.(169) and distance is blocked add.(3652) also you may specify a binary output for V.T fuse failure alarm> 10sec add.(169) and distance is blocked add.(3652) to be able measuring the time all of that can be done from the Masking in distance general and measurement supervision.

1. **For balanced load:**

If the current is balanced in the 3 – phase and its amplitude is more than the setting.

{Maximum current threshold I< add (2912A)} and the voltage difference in between any two phases is more than the setting {minimum voltage threshold U> add. (2911A)}, the fuse failure monitor FFM will appear instantaneously with distance blocking.

1. Fuse failure measurement add. (2911A)

Injected current in 3- phase = 0.2A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| minimum voltage threshold U> add.(2911A) setting | Pick up voltage (V) | | | FFM and distance block appear inst. |
| R | Y | B |
| 30 V |  | 57.73 | 57.73 |  |
| 57.73 |  | 57.73 |  |
| 57.73 | 57.73 |  |  |

1. For current less than the setting of Maximum current threshold I< add. (2912A) and zero voltage appear for more than the setting (add.2911) FFM will appear after 10 sec with distance blocking.

1. Maximum voltage threshold U< (3 phase) add. (2913A)

You can check that with applying the normal voltage 3 – phase and 3- phase current above the setting of {open pole threshold add (1130A)} and the voltage is reduced in the 3- phase to less than the setting {maximum voltage threshold U< (3 phase) add (2913A)} a voltage absent will appear after a time delay setting {delay voltage failure supervision add (2916A)}.

Injected current = .2

1. When VT MCB is off distance protection blocked.

VT MCB TRIP :( 00361) power syst.Data2:-

ZONE 1: Without Vt MCB Trip: Distance trip ………….

: With VT MCB Trip : Distance blocked & (O/C trip ………

ZONE 1B: Without VT MCB Trip: Distance trip ………….

With VT MCB Trip : Distance blocked (O/C trip) …..………

ZONE 2: With OUT VT MCB Trip: Distance trip ………….

: With VT MCB Trip : Distance blocked (O/C trip) …..………

ZONE 3: Without VT MCB Trip: Distance trip ………….

: With VT MCB Trip : Distance blocked (O/C trip) …..……

ZONE 4: With OUT VT MCB Trip: Distance trip ………….

: With VT MCB Trip : Distance blocked (O/C trip) …..………

ZONE 5: With OUT VT MCB Trip: Distance trip ………….

: With VT MCB Trip : Distance blocked (O/C trip) …..………

Note:-

* All LEDs should be reviewed.
* BI: failure feeder vt mcb trip. (AD3615)
* make O/C = ON
  + 1. **FAULT LOCATOR**

Line length = ----- Km x = ------- Ω / km Q=------ 0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | R-N | Y-N | B-N | R-Y | Y-B | B-R |
| Injected impedance | ------- | ------ | ------- | --------- | ---------- | -------- |
| Relay reading (Km) | km | km | km | km | km | km |

* + 1. **MEMORY TEST**

1. Memory time measurement test

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sequence-1 | | | | | | Sequence-2 | | | | | | Sequence-3 | | | | | | |
| Time =---- sec | | | | | | Time was changed | | | | | | Time = ---- sec | | | | | | |
| Va | Vb | Vc | Ia | Ib | Ic | Va | Vb | Vc | Ia | Ib | Ic | | Va | Vb | Vc | Ia | Ib | Ic | |
|  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |
|  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |

Memory time measurement = sec

1. **MEMORY VOLTAGE MEASUREMENT TEST**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sequence-1 | | | | | | Sequence-2 | | | | | | Sequence-3 | | | | | |
| Voltage for this fault was changed | | | | | | Time = ------ sec | | | | | | Time =------ sec | | | | | |
| Va | Vb | Vc | Ia | Ib | Ic | Va | Vb | Vc | Ia | Ib | Ic | Va | Vb | Vc | Ia | Ib | Ic |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Memory voltage measurement = V

* + 1. **BACK UP OVER CURRENT PROTECTION: (EMERGENCY)**

Note: while testing any stage of over current you have to raise the setting of the other stages.

1. For IEC curve add. (2660) is normal curve

Setting: Ip > pick up add. (2640) = ------ A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R-Y | Y-B | B-R | Calculated time ( sec ) |
| Inj. Current = 2 Ip = 1A | ---- A | ------ A | ---------- A | -------sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 4 Ip = 2 A | ---- A | -------- A | ----------- A | ------ sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 6 Ip = 3 A | ------ A | ------- A | ---------- A | ------- sec for  T= ------- |
| Measured time sec |  |  |  |

T = 0.14TP / {(I/IP) 0.02 – 1} (SEC),

WHERE:

T: TRIP TIME

TP: SETTING VALUE TIME MULTPLIER

IP: SETTING VALUE CURRENT

I: FAULT CURRENT

Setting: 3I0p pick up add. (2650) = ------ A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R-N | Y-N | B-N | Calculated time ( sec ) |
| Inj. Current = 2 Ip = 1A | ------- A | ------- A | --------- A | ---- sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 4 Ip = 2 A | -------- A | ------- A | -------A | ----- sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 6 Ip = 3 A | -------- A | -------- A | ------- A | ----- sec for  T= -------- |
| Measured time sec |  |  |  |

T = 0.14TP / {(I/IP )0.02 – 1} (SEC), WHERE:

T: TRIP TIME

TP: SETTING VALUE TIME MULTPLIER

IP: SETTING VALUE CURRENT

I: FAULT CURRENT

1. **For IEC curve add (2660) is very inverse curve**

Setting: Ip > pick up add (2640) = ------ A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R-Y | Y-B | B-R | Calculated time sec |
| Inj. Current = 2 Ip = 1A | -------- A | -------- A | ---------A | ------ sec for  T= ------- |
| Measured time sec |  |  |  |
| Inj. Current = 4 Ip = 2 A | --------- A | -------- A | --------- A | ------- sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 6 Ip = 3 A | --------- A | ------- A | ---------- A | ------ sec for  T= ------ |
| Measured time sec |  |  |  |

T = 13.5 TP / {(I/IP) – 1} (SEC), WHERE:

T: TRIP TIME

TP: SETTING VALUE TIME MULTPLIER

IP: SETTING VALUE CURRENT

I: FAULT CURRENT

Setting: 3I0p pick up add (2650) = ------ A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R-N | Y-N | B-N | Calculated time sec |
| Inj. Current = 2 Ip = 1A | ------ A | -------- A | ------A | ----- sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 4 Ip = 2 A | ------- A | ------- A | ------A | ------ sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 6 Ip = 3 A | ------- A | ------ A | ------A | ------ sec for  T= -------- |
| Measured time sec |  |  |  |

T = 13.5 TP / {(I/IP) – 1} (SEC), WHERE:

T: TRIP TIME

TP: SETTING VALUE TIME MULTPLIER

IP: SETTING VALUE CURRENT

I: FAULT CURRENT

1. **FOR IEC CURVE ADD (2660) IS EXTREMELY CURVE**

Setting: Ip > pick up add (2640) = ------ A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R-Y | Y-B | B-R | Calculated time sec |
| Inj. Current = 2 Ip = 1A | ------ A | -------- A | ------ A | ---- sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 4 Ip = 2 A | ------- A | ------- A | ------- A | ------ sec for  T= ----- |
| Measured time sec |  |  |  |
| Inj. Current = 6 Ip = 3 A | -------- A | ------- A | ------- A | ------- sec for  T= ------- |
| Measured time sec |  |  |  |

T = 80 TP / {(I/IP )2 – 1} (SEC), WHERE:

T: TRIP TIME

TP: SETTING VALUE TIME MULTPLIER

IP: SETTING VALUE CURRENT

I: FAULT CURRENT

Setting: 3I0p pick up add (2650) = ------- A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R-N | Y-N | B-N | Calculated time sec |
| Inj. Current = 2 Ip = 1A | ------- A | ------A | ------ A | ----- sec for  T= ----- |
| Measured time sec |  |  |  |
| Inj. Current = 4 Ip = 2 A | ------- A | -------A | ------ A | ------ sec for  T= ------- |
| Measured time sec |  |  |  |
| Inj. Current = 6 Ip = 3 A | ------ A | -------A | ------- A | ------ sec for  T= ------- |
| Measured time sec |  |  |  |

T = 80 TP / {(I/IP )2 – 1} (SEC), WHERE:

T: TRIP TIME

TP: SETTING VALUE TIME MULTPLIER

IP: SETTING VALUE CURRENT

I: FAULT CURRENT

1. For IEC curve add (2660) is long inverse

Setting: Ip > pick up add (2640) = ------ A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R-Y | Y-B | B-R | Calculated time sec |
| Inj. Current = 2 Ip = 1A | ------ A | ------- A | ------ A | ----- sec for  T= ----- |
| Measured time sec |  |  |  |
| Inj. Current = 4 Ip = 2 A | ----- A | ------- A | ------- A | ------ sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 6 Ip = 3 A | ------ A | ------- A | ------ A | ------ sec for  T= -------- |
| Measured time sec |  |  |  |

T = 120TP / {(I/IP) – 1} (SEC), WHERE:

T: TRIP TIME

TP: SETTING VALUE TIME MULTPLIER

IP: SETTING VALUE CURRENT

I: FAULT CURRENT

Setting: 3I0p pick up add (2650) = -------- A

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R-N | Y-N | B-N | Calculated time sec |
| Inj. Current = 2 Ip = 1A | ------ A | --------- A | -------- A | ----- sec for  T= ------- |
| Measured time sec |  |  |  |
| Inj. Current = 4 Ip = 2 A | ----- A | -------- A | ------ A | ------ sec for  T= ------ |
| Measured time sec |  |  |  |
| Inj. Current = 6 Ip = 3 A | ------- A | -------- A | -------- A | ------- sec for  T= ------- |
| Measured time sec |  |  |  |

T = 120TP / {(I/IP) – 1} (SEC),

WHERE:

T: TRIP TIME

TP: SETTING VALUE TIME MULTPLIER

IP: SETTING VALUE CURRENT

I: FAULT CURRENT

1. **low set stage I >**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Iph > | | | | | Operating Time (s) for ------- A | |
| Phase | Pick Up | | Drop Off | |
| Setting | Measured | Calculated | Measured | Setting | Measured |
| R-Y |  |  |  |  |  |  |
| Y-B |  |  |  |  |  |
| B-R |  |  |  |  |  |

Setting: Iph > pick up add. (2620) = 1 A, T Iph > time delay add. (2621) = 0.5 sec

Setting: 3I0 > pick up add (2622) = 1 A, T 3I0 > time delay add. (2623) = 0.5 sec

|  |  |  |  |
| --- | --- | --- | --- |
|  | Injected current A | Time sec | |
|  |  | Setting | Measured |
| R-N |  | -------- |  |
| Y-N |  |  |
| B-N |  |  |

1. **high set stage I >>**

Setting: Iph >> pick up add (2610) = 1 A, T Iph >> time delay add. (2611) = 0.5 sec

|  |  |  |  |
| --- | --- | --- | --- |
|  | Injected current A | Time sec | |
|  |  | Setting | Measured |
| R-Y |  | -------- |  |
| Y-B |  |  |
| B-R |  |  |

Setting: 3I0 >> pick up add (2612) = 1 A, T 3I0 >> time delay add. (2613) = 0.5 sec

|  |  |  |  |
| --- | --- | --- | --- |
|  | Injected current A | Time sec | |
| Setting | Measured |
| R-N |  | --------- |  |
| Y-N |  |  |
| B-N |  |  |

* + 1. **STUB PROTECTION**

Note: you must specify a binary input active low for {Enable I- STUB bus function add

(7131)} and binary output and LED for {O/C I- STUB TRIP add. (7235)}.

Setting: Iph > STUB pick up add. (2630) = 1 A, T Iph time delay add. (2631) = 0.5 sec

|  |  |  |  |
| --- | --- | --- | --- |
|  | Injected current A | Time sec | |
|  |  | Setting | Measured |
| R-Y |  |  |  |
| Y-B |  |  |
| B-R |  |  |

Setting: 3I0 > STUB pick up add (2632) = 1 A, T 3I0 STUB time delay add. (2633) = 0.5 sec

|  |  |  |  |
| --- | --- | --- | --- |
|  | Injected current A | Time sec | |
|  |  | Setting | Measured |
| R-N |  |  |  |
| Y-N |  |  |
| B-N |  |  |

* + 1. **ANNUNCIATIONS**

**LEDs**

|  |  |  |
| --- | --- | --- |
| LEDS | Description | Checked |
| LED1 | Pickup Distance Phase L1 ( Start ) |  |
| LED2 | Pickup Distance Phase L2 ( Start ) |  |
| LED3 | Pickup Distance Phase L3 ( Start ) |  |
| LED4 | Pickup Distance Neutral ( Start ) |  |
| LED5 | Zone 1 Trip ( Forward ) |  |
| LED6 | Zone 1B Trip ( Forward ) |  |
| LED7 | Zone 2 Trip ( Forward ) |  |
| LED8 | Zone 3 Trip ( Reverse ) |  |
| LED9 | Zone 4 Trip ( Forward ) |  |
| LED10 | Zone 5 Trip ( Forward ) |  |
| LED11 |  |  |
| LED12 |  |  |
| LED13 |  |  |
| LED14 |  |  |

* + 1. **BINARY OUTPUT**

|  |  |  |
| --- | --- | --- |
| Annunciation Contact | Description | Checked |
| R1 | Trip |  |
| R2 | Trip |  |
| R3 | Start |  |
| R4 | Start |  |
| R5 | Trip |  |
| R6 | Trip |  |
| R7 | Trip |  |
| R8 | Start |  |
| R9 | Watchdog |  |

All Binary Inputs Checked