Chapter-1
How to Communicate with Relay

General Requirements:
1-Pcm600software
2-Ethernet cable required for Connection between laptop and relay
ref615

Configure this ip address to laptop as indicated steps in this pictures

Left click on (open network and sharing center)
Left click on (change adapter settings)
Left click on (local area connection)
right click on (local area connection) And left click on (properties)
left click on (internet protocol version 4 (tcp/ipv4))
Then left click on (properties)
Type ip address
The forth address must be different from ip address of relay
Chapter-2
Relay configuration
Steps to make new project in relay ref615
1-Open pcm600
2-make new project as follow {file>new project}
3-type name of project and description of project

Create New Project

Server name:
My computer [AUX-AIR-ROO1/PCONSERV52014]

Project name:
name of project

Description:
description of project

Create  Cancel
4-make new substation as follow {new>general>substation}

5-make new voltage as follow {substation>new>general>voltage level}
6-make new bay as follow {voltage level>new>general>bay}
7-make new relay as follow {bay>new>feeder ieds>ref615}
Steps to read online from relay through laptop

Click on \{bay>new>feeder ieds>ref615>then click \{next\}
Type ip address of relay and click next

Click next

Online connection is established between relay and laptop
Chapter-3
Test equipment with relay

- Outputs contacts
- Connect VT wires between Freja and relay
- Connect CT wires between Freja and relay
- Input contacts
Chapter-4
Setting of relay

the Setting over current
setting of earth fault
Chapter-5
Test of relay

To test pickup over current

Make operating curve type is definite time, time 50 MS
Inject each phase until relay pickup and compare pick up with final settings
To test pick up time of normally inverse curve
Make setting as indicated picture

<table>
<thead>
<tr>
<th>Setting Group 1</th>
<th>Start value</th>
<th>Start value Mult</th>
<th>Time multiplier</th>
<th>Operating curve type</th>
<th>Type of reset curve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.00</td>
<td>0.40</td>
<td>0.8</td>
<td>IEC Norm. inv.</td>
<td>Immediate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting Group 2</th>
<th>Start value</th>
<th>Start value Mult</th>
<th>Operate delay time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.05</td>
<td>1.0</td>
<td>40</td>
</tr>
</tbody>
</table>

- Pick up value: 1.00
- TMS Value: 0.40
- Type of curve: Immediate
Equation for curve operate time

\[ t(x) = \left( \frac{A}{\left( \frac{I}{I^*} \right)^B} + B \right)^{-k} \]

- \( t \) is operate time in seconds
- \( I \) is measured current
- \( I^* \) is injected current
- \( k \) is Time multiplier

Table for types of curves

<table>
<thead>
<tr>
<th>Curve name</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) ANSI Extremely Inverse</td>
<td>28.2</td>
<td>0.1217</td>
<td>2.0</td>
</tr>
<tr>
<td>(2) ANSI Very Inverse</td>
<td>19.61</td>
<td>0.491</td>
<td>2.0</td>
</tr>
<tr>
<td>(3) ANSI Normal Inverse</td>
<td>0.0086</td>
<td>0.0196</td>
<td>0.02</td>
</tr>
<tr>
<td>(4) ANSI Moderately Inverse</td>
<td>0.0516</td>
<td>0.1140</td>
<td>0.02</td>
</tr>
<tr>
<td>(6) Long Time Extremely Inverse</td>
<td>64.67</td>
<td>0.250</td>
<td>2.0</td>
</tr>
<tr>
<td>(7) Long Time Very Inverse</td>
<td>28.65</td>
<td>0.712</td>
<td>2.0</td>
</tr>
<tr>
<td>(8) Long Time Inverse</td>
<td>0.086</td>
<td>0.186</td>
<td>0.02</td>
</tr>
<tr>
<td>(9) IEC Normal Inverse</td>
<td>0.14</td>
<td>0.0</td>
<td>0.02</td>
</tr>
<tr>
<td>(10) IEC Very Inverse</td>
<td>13.5</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>(11) IEC Inverse</td>
<td>0.14</td>
<td>0.0</td>
<td>0.02</td>
</tr>
<tr>
<td>(12) IEC Extremely Inverse</td>
<td>80.0</td>
<td>0.0</td>
<td>2.0</td>
</tr>
<tr>
<td>(13) IEC Short Time Inverse</td>
<td>0.05</td>
<td>0.0</td>
<td>0.04</td>
</tr>
<tr>
<td>(14) IEC Long Time Inverse</td>
<td>120</td>
<td>0.0</td>
<td>1.0</td>
</tr>
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</table>

Calculate operate time from equation

\( \text{i} > \) start vale is pick up current as final setting

\( I \) is injected current

Compare operate time from test with operate time calculated
To test pickup earth fault
Make operating curve type is definite time 40 MS
Inject single phase until relay pickup and compare pick up with final settings
As indicated picture
To test pickup time of earth fault

Equation for curve operate time

\[ t[s] = \left( \frac{A}{\left( \frac{I}{I_>} \right)^2} + B \right)^{-k} \]

- \( t[s] \) Operate time in seconds
- \( I \) Measured current
- \( I_> \) set Start value
- \( k \) set Time multiplier

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<td>64.07</td>
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Calculate operate time from equation

Start value is pick up current as final setting

I is injected current

Compare operate time from test with operate time calculated
Chapter 6
Relay normalization

Upload final setting to relay