



VEBKO ONLINE HELP

Directional Earth Fault (DEF) Protection Function Test in MICOM P141 Relay

Category	tester
Section	Testing of relays protection functions
Language	English
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If the earth fault current in the protected zone is able to rotate from both sides, it is necessary to use the DEF function so that the fault direction is specified. One of the common systems that require such protection is parallel feeders or ring networks.

For earth fault standard protections, there are two options available for polarization including zero sequence or residual voltage and negative sequence.

Here, zero sequence is used. Since at the creation time of earth fault, residual voltage is created, it is possible to use this element to polarize directional elements. This process is called zero sequence polarization, residual voltage polarization or Neutral Displacement Voltage Polarization.

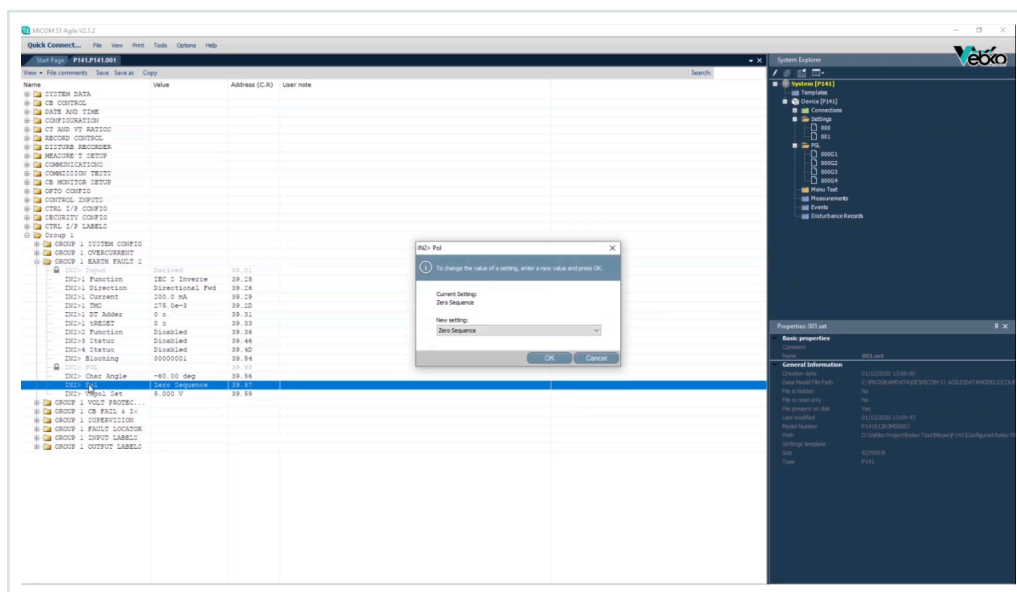


Figure 1

Since under normal conditions due to reasons such as imbalance, low precision of VT or equipment error, there may be small amounts of residual voltage, there is an option to specify the threshold for this element which can be seen as IN>VNPOL set in relay settings. P141 relay receives this voltage from Residual Voltage input which is provided by open triangle connection or VT.

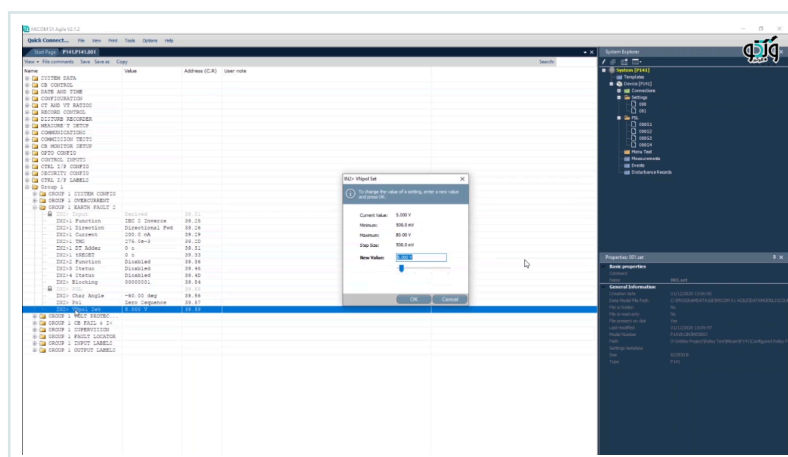


Figure 2

Using IN2>Char Angle parameter, the RCA value in MiCOM P141 relay is set at -95 to +95 degrees range.

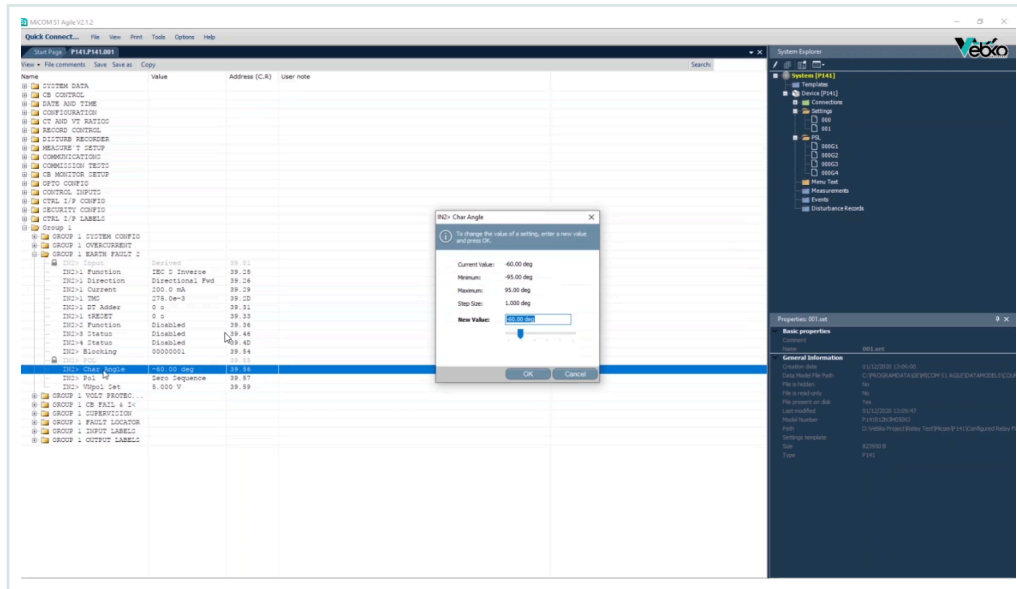


Figure 3

Generally, the following relation is established in the mentioned relay:

Directional forward: $-90^\circ < (\text{angle}(\text{IN}) - \text{angle}(\text{VN} + 180^\circ) - \text{RCA}) < 90^\circ$

Directional reverse: $-90^\circ > (\text{angle}(\text{IN}) - \text{angle}(\text{VN} + 180^\circ) - \text{RCA}) > 90^\circ$

Directional earth fault function test or 67N function is executed based on the settings of the first stage in the number 1 settings group. Note that EF1 and EF2 functions can be activated in MiCOM P141 relays. In EF1, the measured current is used directly; also, current transformers or Residual Connection are used as well. In EF2 the residual current calculated from the sum of the three-phase currents is used. This is why EF2 is used.

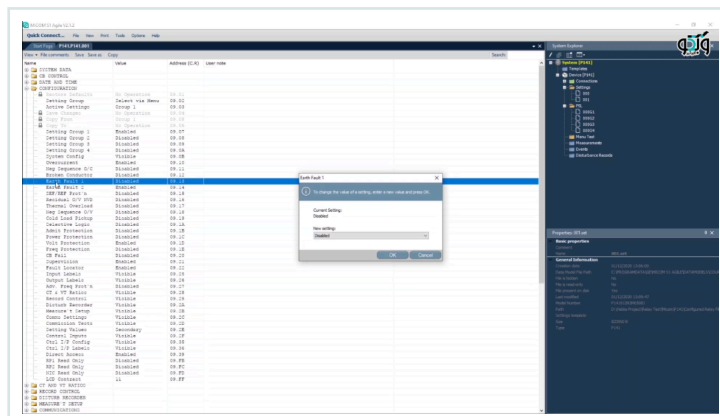


Figure 4

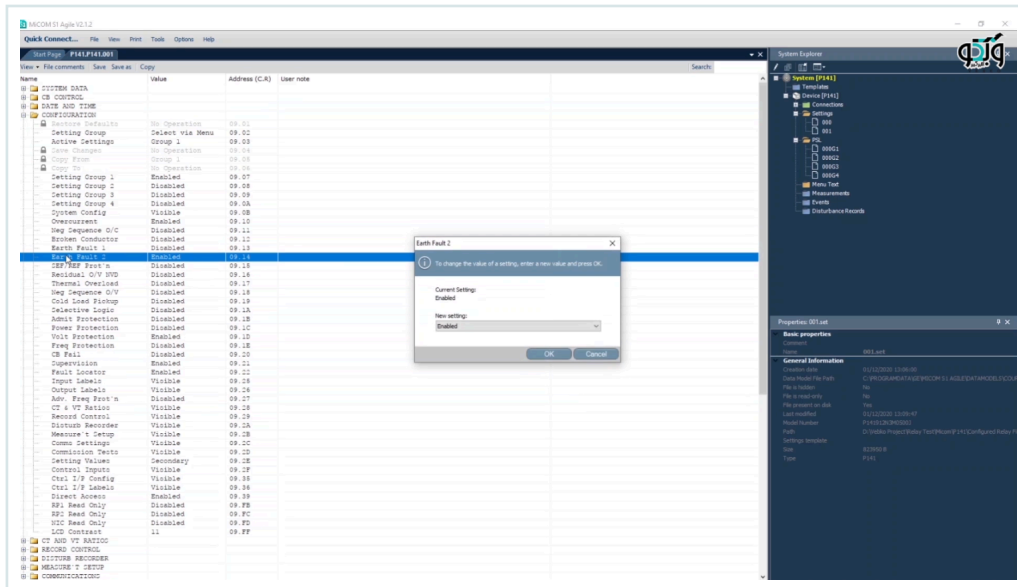


Figure 5

In Settings section, the activation state of this element is indicated by Standard Inverse curve in forward direction while the 200 mA setting is indicated by a 0/275 TMS. Also, a -60 degree performance angle is considered. In the end, the polarization voltage threshold is recorded to be 5 volts.

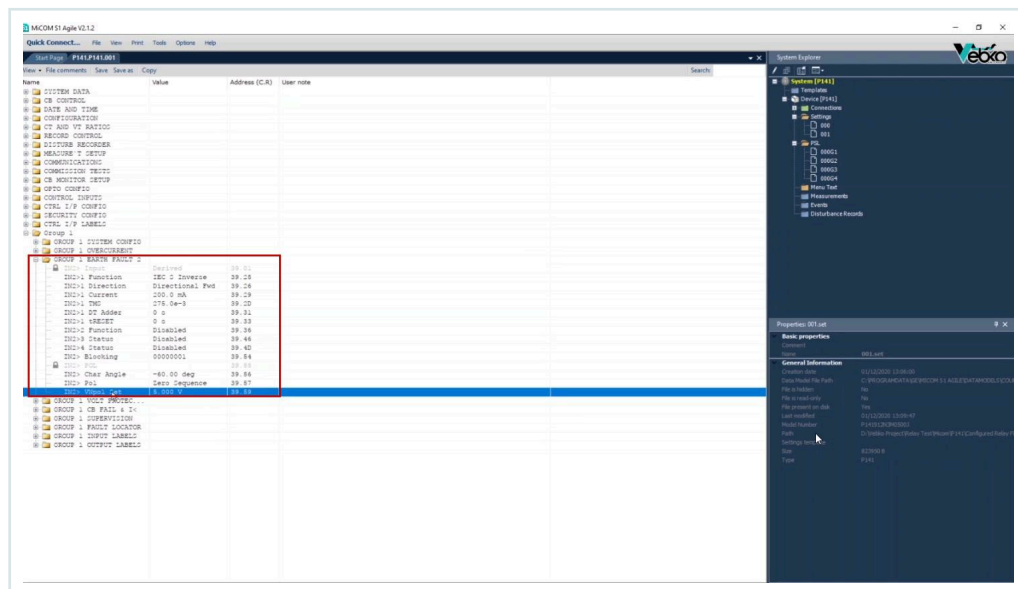


Figure 6

It is possible to use the Voltage Transformer Supervision element (VTS) to block the performance of directional residual current element. This is done in IN2>Blocking cell; if number 1 is selected, the VTS blocks the performance of directional residual current and if number zero is selected, in case of

VTS performance, stage turns into a non-directional factor.

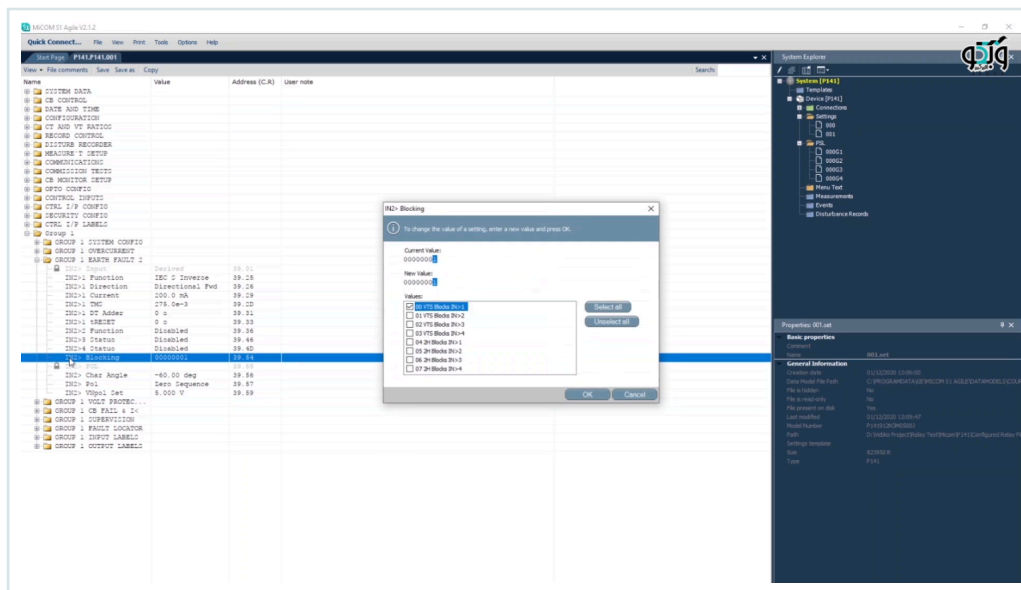


Figure 7

Before considering any case, it is examined to see which output and LED are used for the performance of directional residual current protection. To do so, PSL or Programmable Scheme Logic is used. It is possible that a separate contact is considered for the performance of each phase. Also, fault trigger record activation is checked for this factor as well.

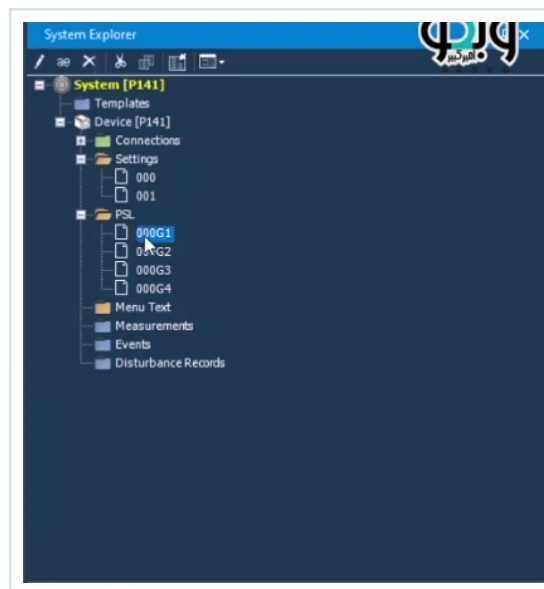


Figure 8

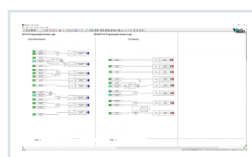


Figure 9

If the user wishes to test a directional residual current function manually and without using XRIO or CSV files, they only need to double-click on Overcurrent element in General Test Object window and by selecting the directional element in Relay Parameters tab,

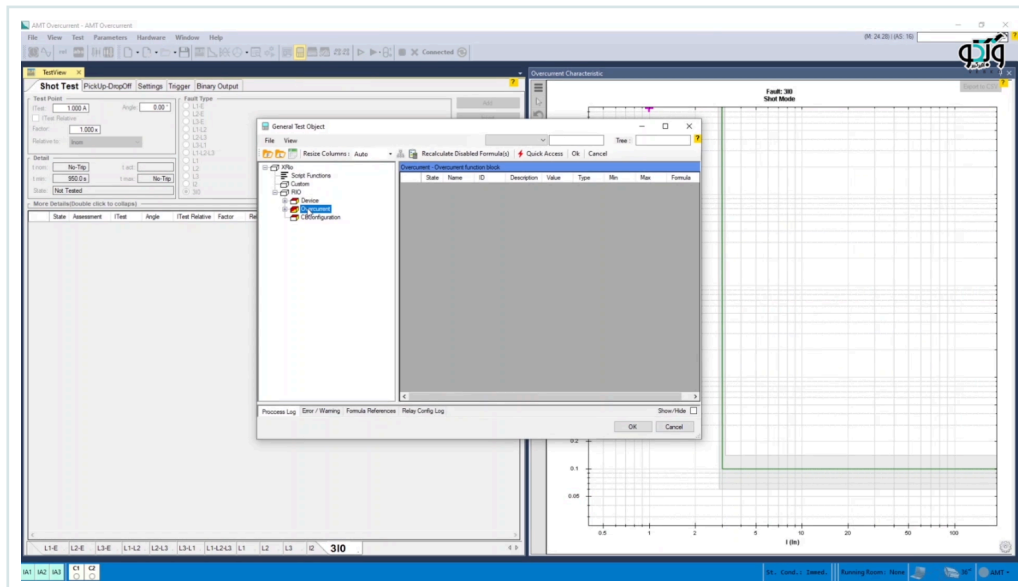


Figure 10

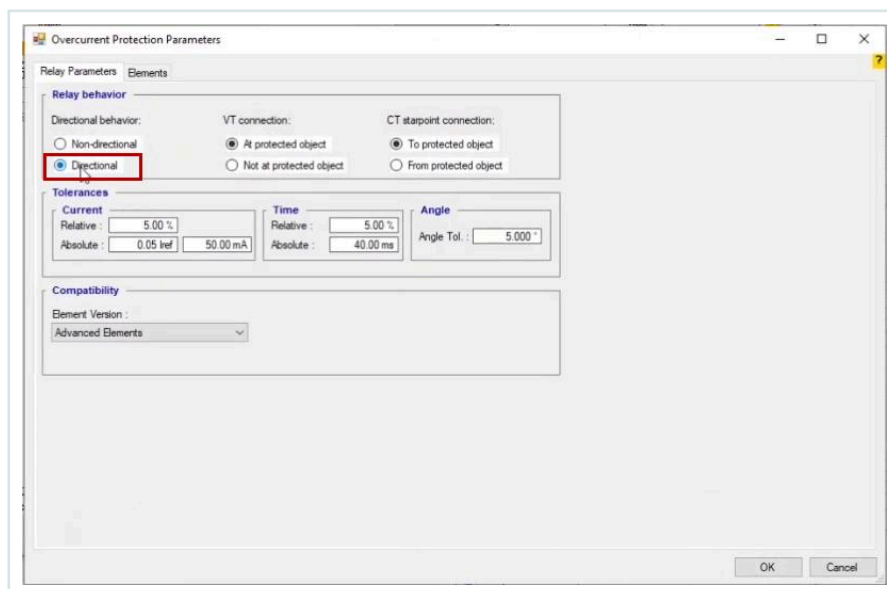


Figure 11

enter the setting values in Elements tab. Residual section is used for this purpose. Also, in Define Element Directional Behavior section the operation angle is entered. Here, this angle is set at -60 degrees.

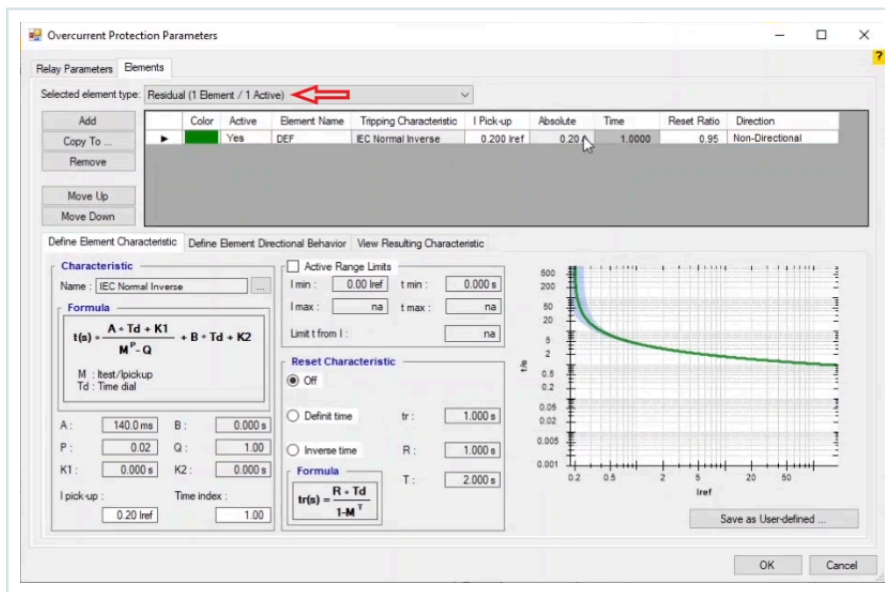


Figure 12

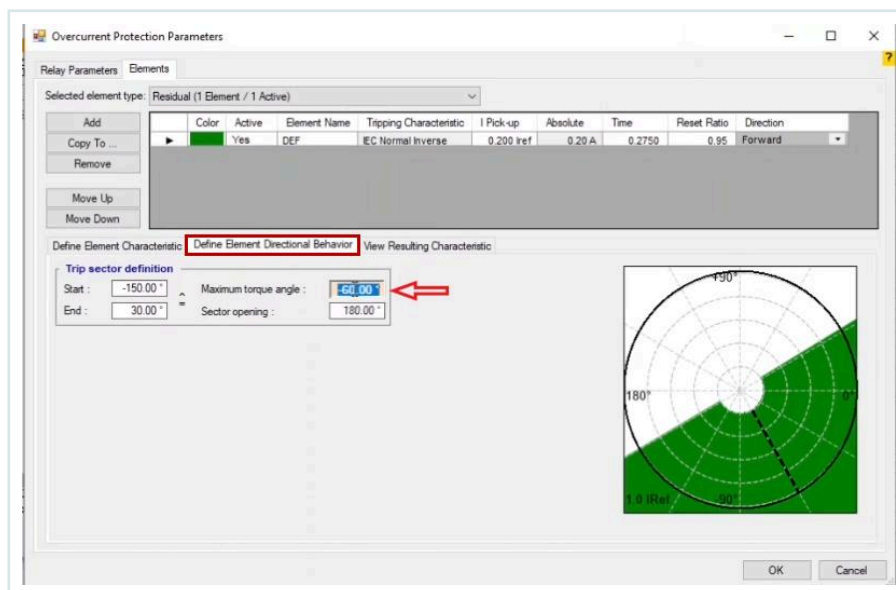


Figure 13

In the first step of the test, a current twice the one specified in the settings section is injected into the relay in the best operation angle which is -60 degrees, and the operation time is compared to the time predicted by the software. This process can be continued by injecting 4 times the specified current. Also, some shots can be set to ensure inactivity of the relay in the blocking area and the test can be continued at the border of operation angles by adding new points.

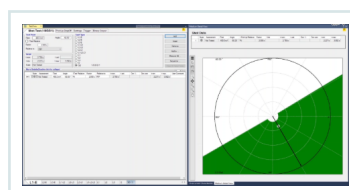


Figure 14

The next step is to enter the current setting and the angle in pickup and drop off section. To do this, Medium Detail View window can be used which gives a complete indication of the characteristic. The process of specifying Pickup and Drop off can be completed first for the current value and then the angle values.

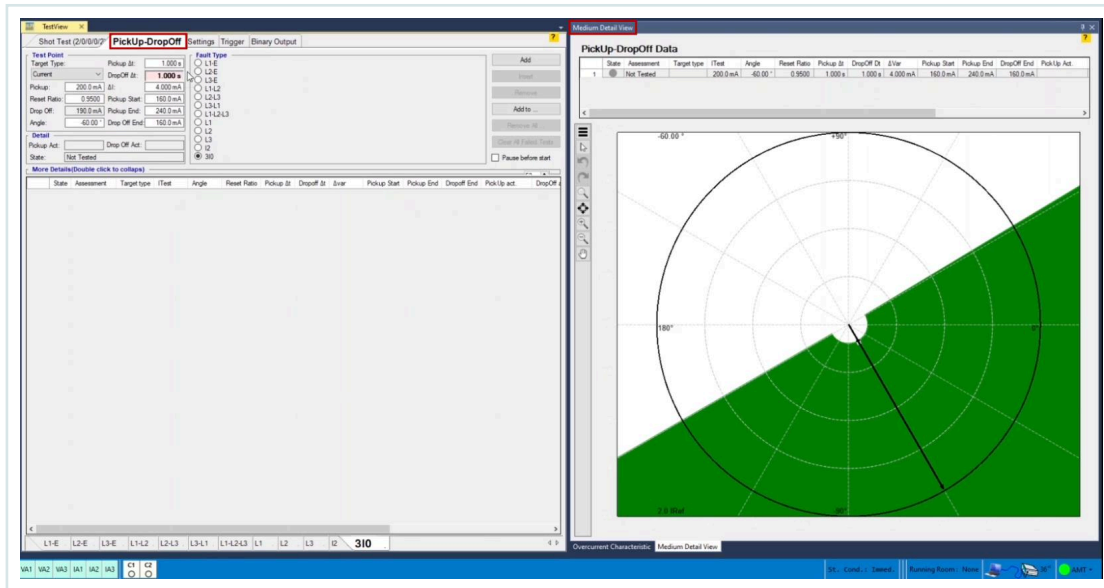


Figure 15

By specifying the settings in setting and trigger tabs, other contacts or elements can be selected to specify the test results.

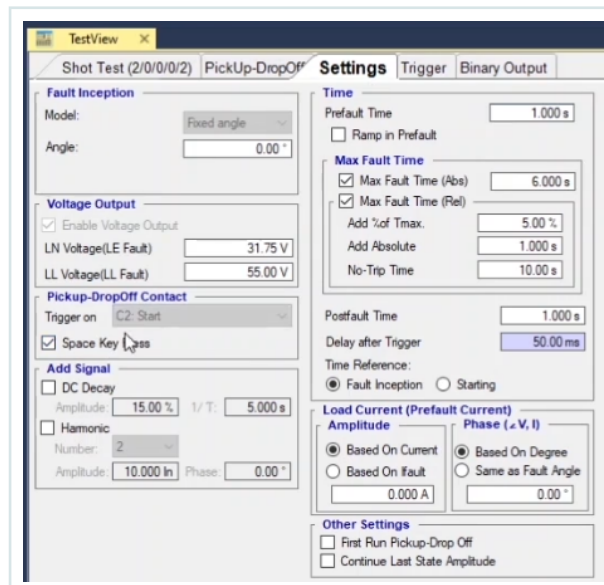


Figure 16

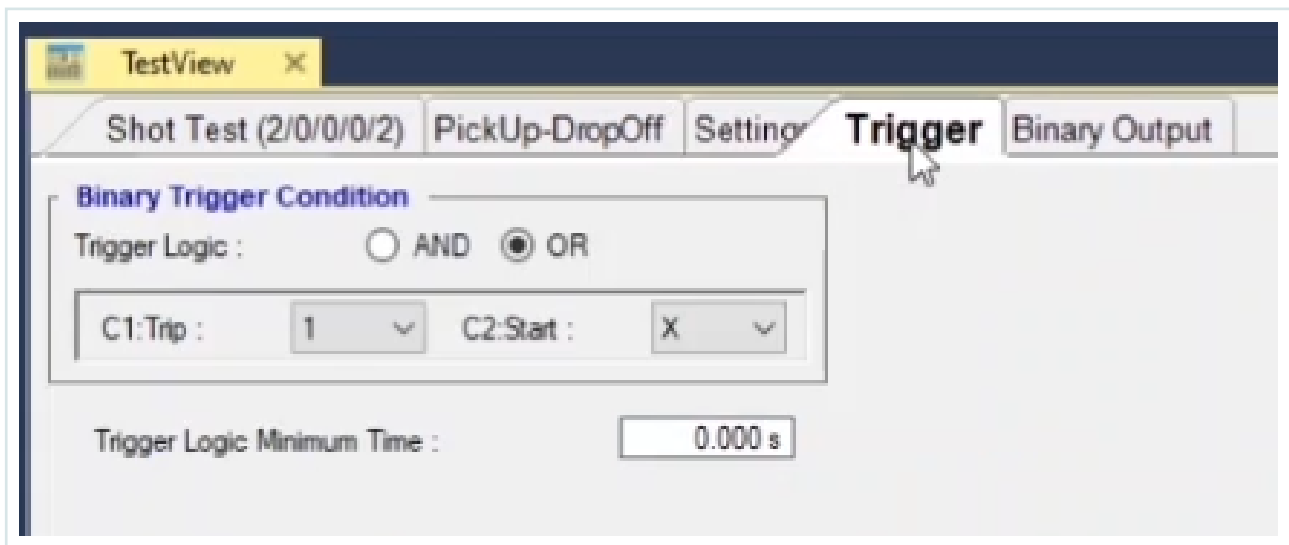


Figure 17

[jg1]MICOMP141_DIRECTIONAL_EARTH_FAULT