

How to manage the interaction between two curves, IDMT and DT, while tripping time of IDMT curve is much faster than DT? This may happen actually at the end of tripping curve.

Important: We would like to lead off by drawing your attention to the fact that this solution is practical just for Sepams series 40, 60 and 80. It is mandatory to use the Logic equations option which is only available in mentioned Sepam ranges. So there is no any solution to fix this issue in series 20.

Problem Explanation: What do we mean by “while tripping time of IDMT curve is much faster than DT”? In order to make it easier to be understood we refer you to Figure No.1.

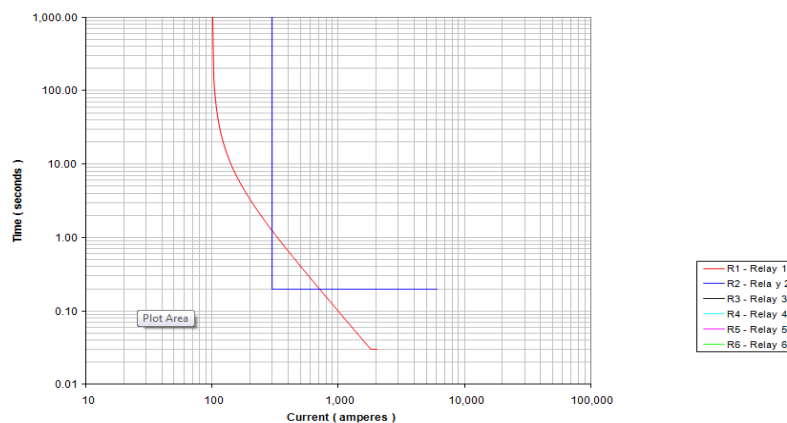


Figure No.1

As it is shown in the figure, after cross point between red and blue curve (IDMT and DT curves) IDMT tripping time is much faster. Please be careful in any fault current (overload / short circuit) the relay will trip referring to its minimum tripping time. To be more precise in above figure after 700A red curve would trip before blue one. The actual tripping curve of relay is shown in Figure No.2.

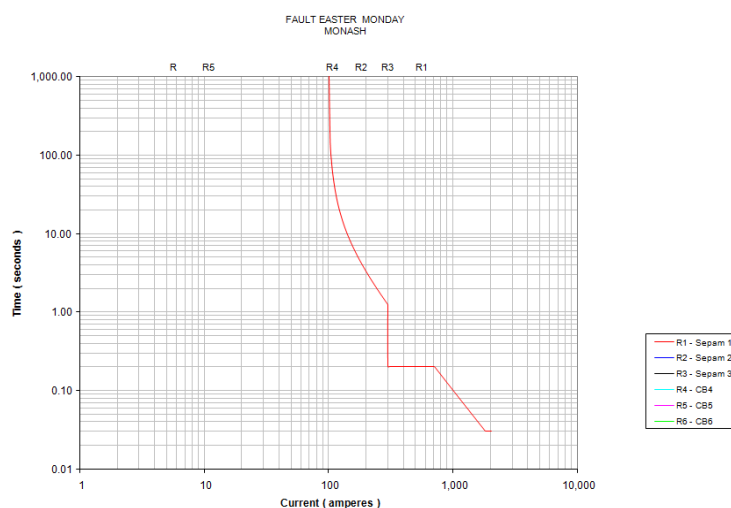


Figure No.2

Customer request:

Some customers may ask to have just tripping time of DT curve instead of fast tripping time of IDMT for currents above 700A. They actually need to have just DT curve and delete IDMT curve for currents above 700A.

Possible solutions:

- 1- We do recommend if it is possible, to manage the TMS (or 10I/Is) setting parameter of IDMT curve. In this case by increasing the TMS you can fix this problem. But for sure this solution should be in line with your protection plan and coordination study regarding to upstream setting parameters as well.
- 2- This FAQ is trying to answer to cases where it's not allowed to change the TMS (or 10I/Is set point). They may have some limitation imposed by utility companies. Or they may face this problem many years after running the projects and now they cannot manage a new coordination study. So in this solution we will write some logic in Logic Equation area of Sepam relays fixing the problem.

Explaining the second solution:

We will add one more element to the setting. It would be a DT tripping curve with minimum threshold of two other elements and time delay of DT curve. Imagine the CTs characteristics and above curves printed in both fig. are assigned as bellow in the relay:

CT ratio : 100/1

First element of relay: IDMT IEC EIT/C curve, current threshold: 100A , Delay:100ms ( or TMS=0.124)

Second element of relay: DT, current threshold: 300A, Delay: 200ms

As mentioned above in order to solve the problem we need to add another curve as DT, current threshold: 100A, Delay: 200ms. As you see we used minimum threshold and delay of DT curve. Please check the Figure No.3

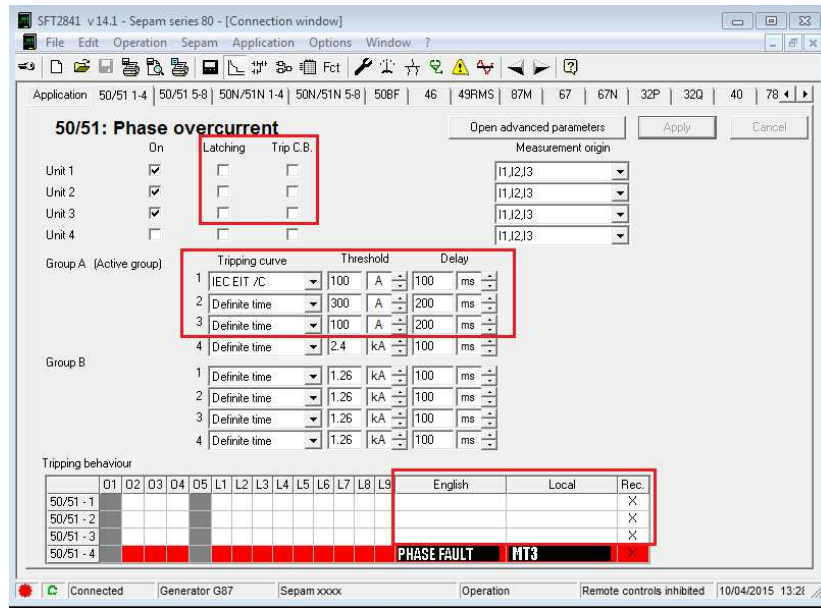


Figure No.3

As it is highlighted in above figure the Trip circuit breaker and latch options are not in service. The circuit breaker trip management should be done through logics. More importantly we remove all dedicated messages for all three elements. For removing the defined messages you should go through

Matrix/ protection/ Events. Please check figure in below:

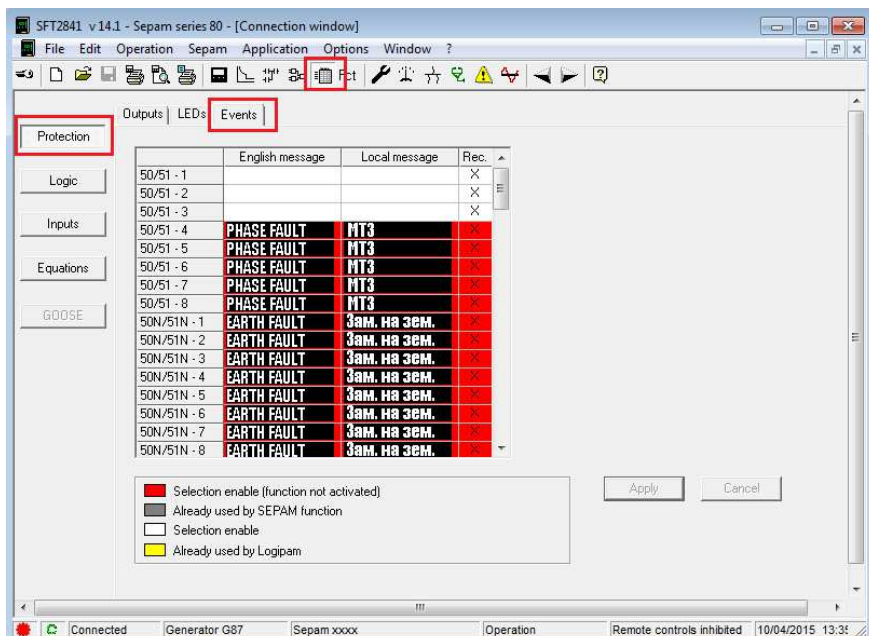


Figure No.4

Then by double clicking in the related boxes for English message and Local message you can remove the messages in three steps. Please check the below figure as well.

- 1- Double click in the dedicated box
- 2- Choose “ no message “option
- 3- Click on Ok button to confirm the change

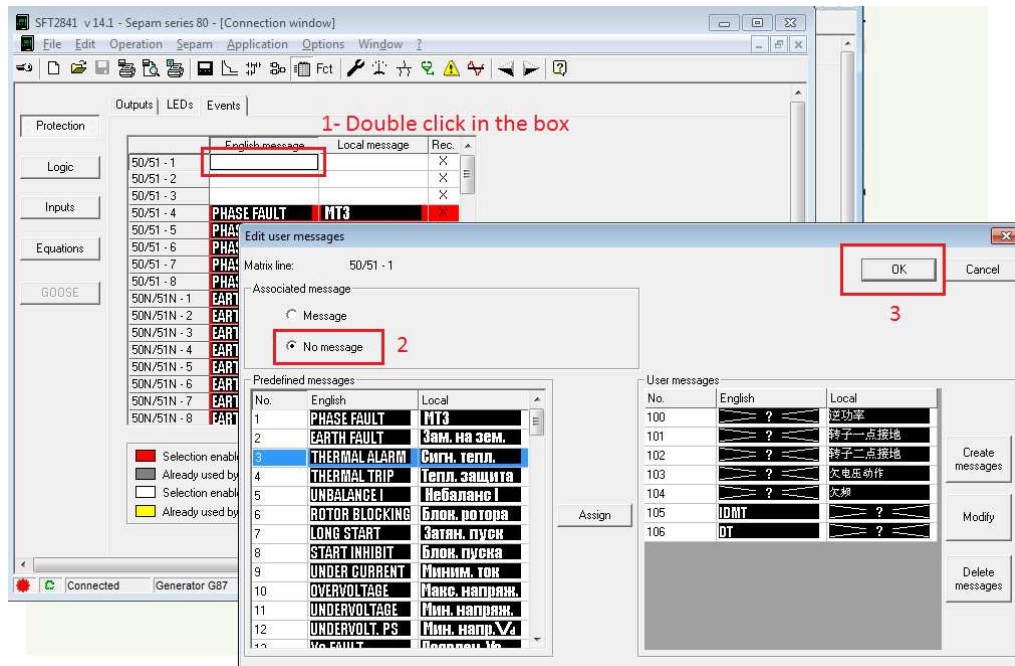


Figure No.5

For adding the logics you should go through Equations as shown in Figure No.6 in below and write following lines:

- 1-  $VL1 = (P50/51\_1\_3 \text{ OR } P50/51\_2\_3) \text{ AND } P50/51\_3\_3$
- 2-  $V1 = VL1$
- 3-  $V\_TRIPCB = VL1$
- 4-  $V2 = P50/51\_1\_3 \text{ AND } P50/51\_3\_3 \text{ AND } (\text{NOT } P50/51\_2\_3)$
- 5-  $V3 = P50/51\_2\_3 \text{ AND } P50/51\_3\_3$
- 6-  $LATCH(V2, V3)$

Lines 1: P50/51\_1\_3 is first element of 50-51 protection delayed output. P50/51\_2\_3 is second element of 50-51 protection delayed output.

As it is clear inside relay all settings would be in OR logics so we write the first phrase as VL1 OR VL2 to have the same but we add AND of last curve. It means for end of IDMT part (the fats part) it will wait till

the condition in VL2 became true. So means for current above 700A relay will follow DT curve and delay of VL3 which is same as 200ms and exactly same delay of DT setting.

Line2: We assign VL1 in V1.As V1 is an output variable then it is available through Matrix meaning that we can assign other outputs, LED and any messages to V1. We add it in the logic for this kind of custom setting.

Line3: this line is very important. As it was mentioned before we do not manage tripping order directly through protection page. It is a must no to do that. But to have the same behavior as tripping order we should assign VL1 to trip the CB. This line also will manage the tripping context issue.

Lines 4 and 5: These lines are managing the reporting of tripping issue regarding to LEDs and messaging.

Line 6: If you need to latch protection (which is normally the case for over current and earth fault protection) again should be managed by logic and not directly through protection page. So this is why we add the latch order as well. In case if your users do not need the latch order so you can easily delete this line.

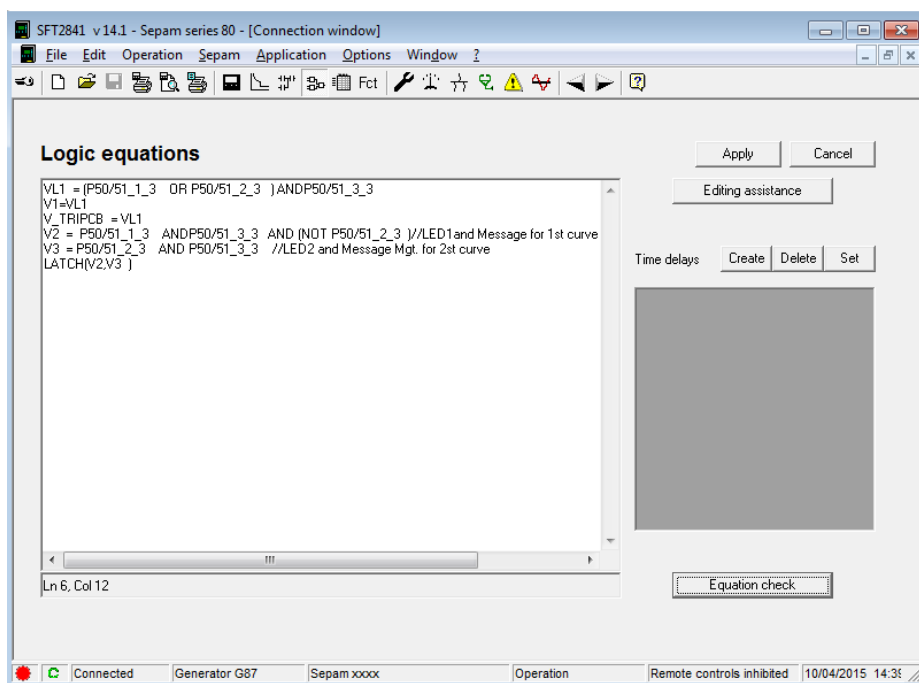


Figure No.6

Some setting and assignment to be done:

As mentioned above for LED and message management we need to use Matrix.

For this we should go through SFT2841 Matrix / Equation and take action for V2 and V3.

For V2 which is IDMT tripping behavior we assigned LED1 and IDMT message.

For V3 which is DT tripping behavior we assigned LED2 and DT message.

For V1 as mentioned before customer is free to assign other outputs, Led and messages if needed.

Please notice following figures:

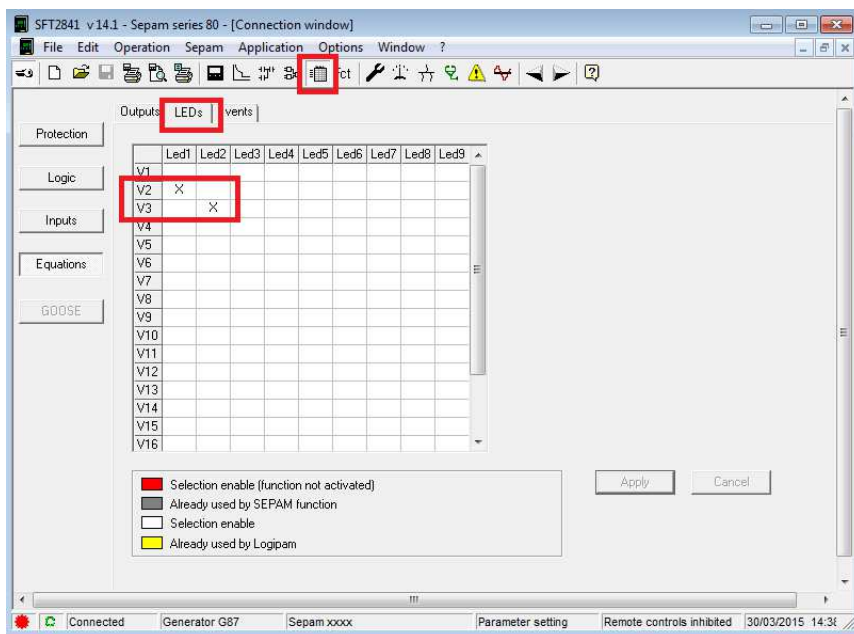


Figure No.7

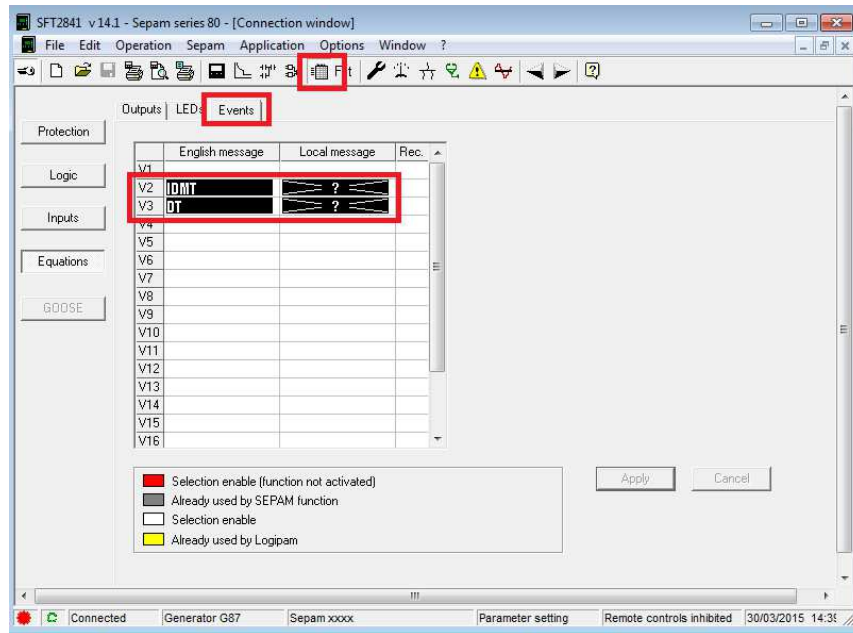


Figure No.8

Validation Tests for logics:

To make it easier to be understood the logic has been tested:

The first column is showing the testing points. The second column is showing the calculated tripping time using dedicated formula of each curve. Two other columns are showing the actual tripping time of rely. One of them as mentioned is showing tripping time without activation of equation. And the other one is showing tripping time considering equations in relay logic.

As it is clear the tripping time for current after 7 times of  $I_s$  (700A) is fixed to 200ms while using equations. These results validate the correct behavior of equations.

Test current	Tripping time ( second)		
	calculated(curve)	without Equation	with equation
1.5*I <sub>s</sub> =150A	7.92	7.75	7.76
2*I <sub>s</sub> =200A	3.3	3.25	3.24
2.5*I <sub>s</sub> =250	1.88	1.86	1.86
3.5*I <sub>s</sub> =350A	0.2	0.211	0.224
4*I <sub>s</sub> =400A	0.2	0.22	0.22
5*I <sub>s</sub> =500A	0.2	0.203	0.205
6*I <sub>s</sub> =600A	0.2	0.202	0.211
7*I <sub>s</sub> =700A	0.2	0.213	0.205
8*I <sub>s</sub> =800A	0.157	0.157	0.206
9*I <sub>s</sub> =900A	0.123	0.137	0.207
10*I <sub>s</sub> =1000A	0.1	0.106	0.198
10.5*I <sub>s</sub> =1050A	0.0906	0.102	0.2
11*I <sub>s</sub> =1100A	0.082	0.087	0.202

Figure No.9

Moreover here in below we report 3 test point of 2\*Is, 5\*Is and 9\*Is just to show the LED reporting, message reporting and tripping context.

For 2\*Is we should have the LED1: on and message as: IDMT and tripping current as 200.

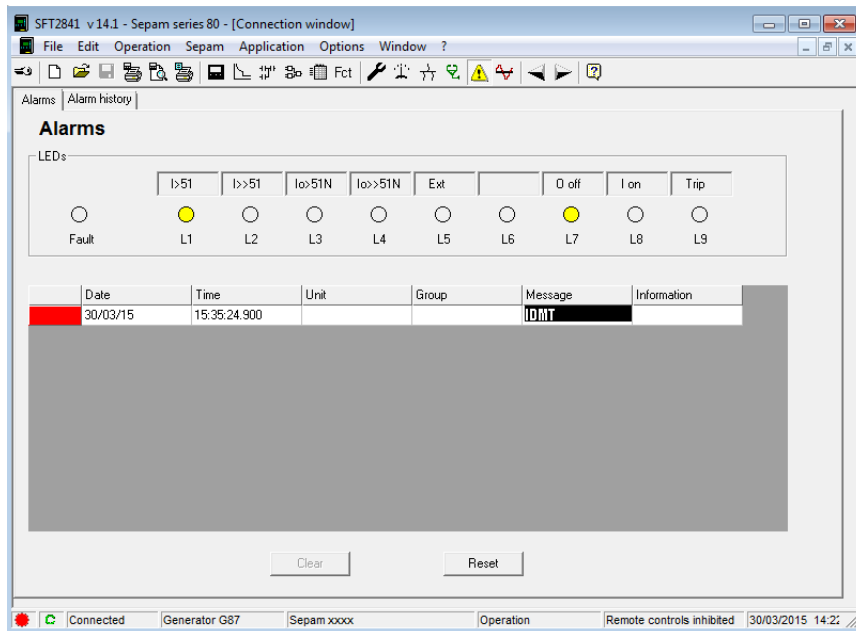


Figure No.10

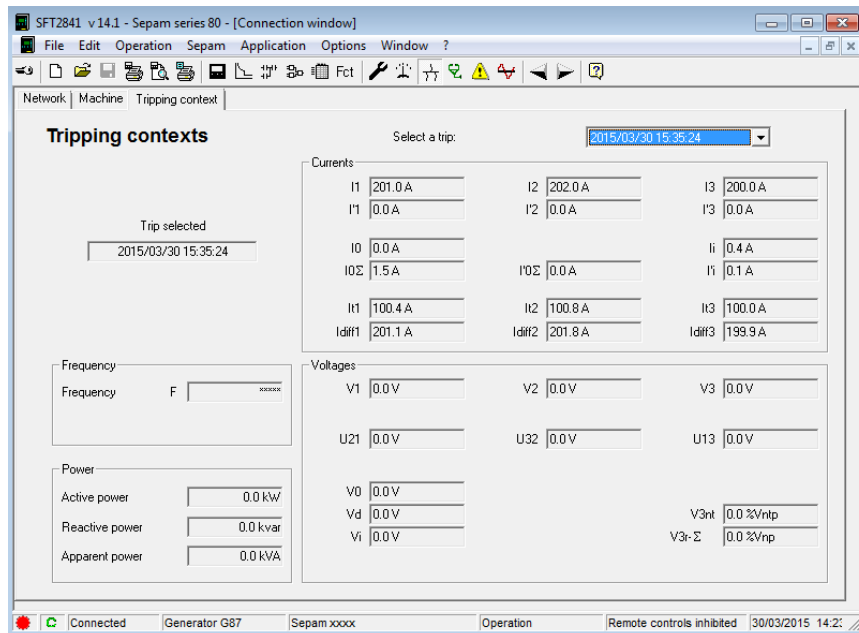


Figure No.11

For 5\*Is we should have the LED2: on and message as : DT and tripping current as 500.

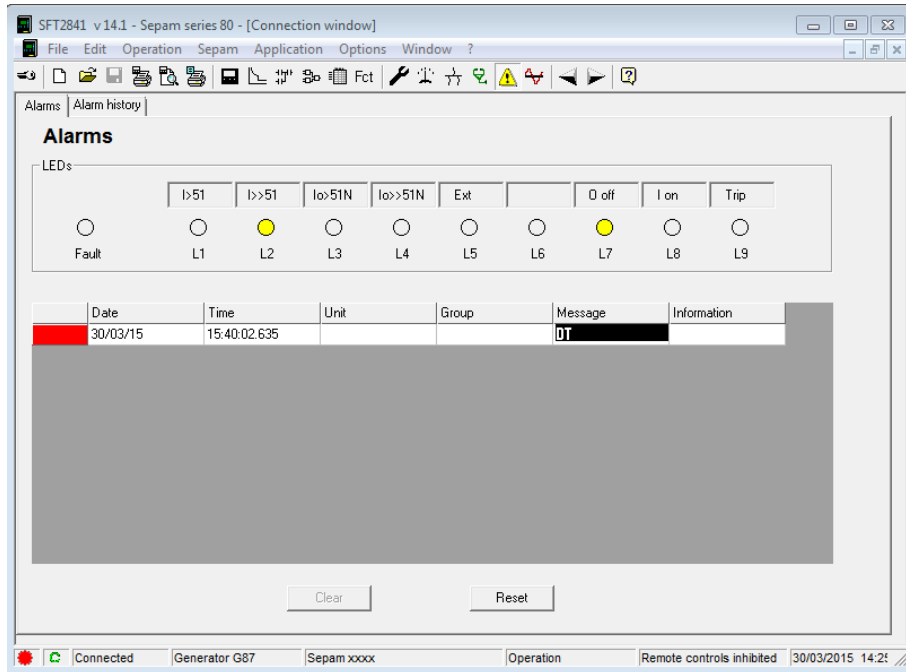


Figure No.12

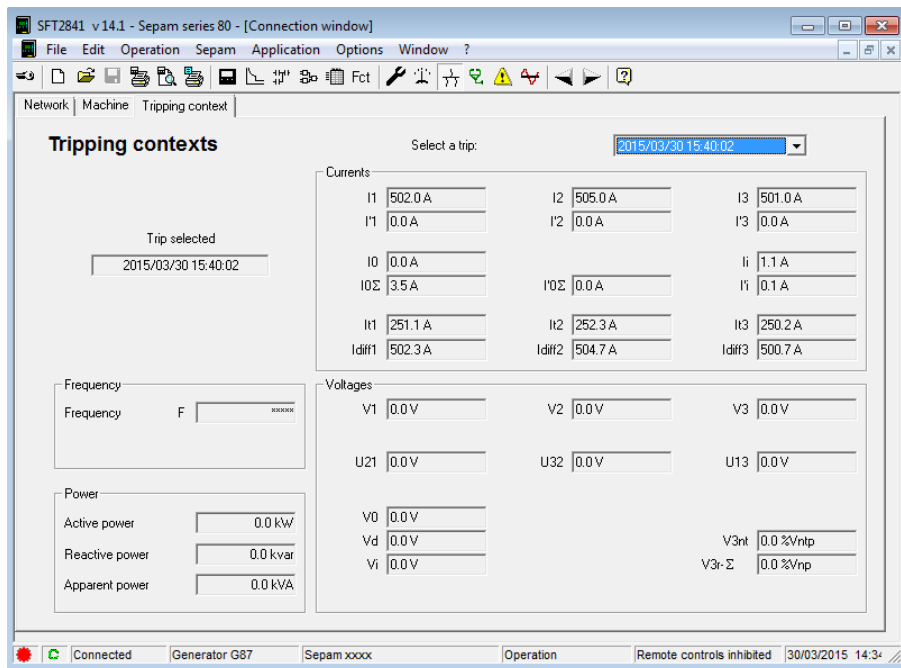


Figure No.13

For 9\*Is we should have the LED2: on and message as : DT and tripping current as 900.

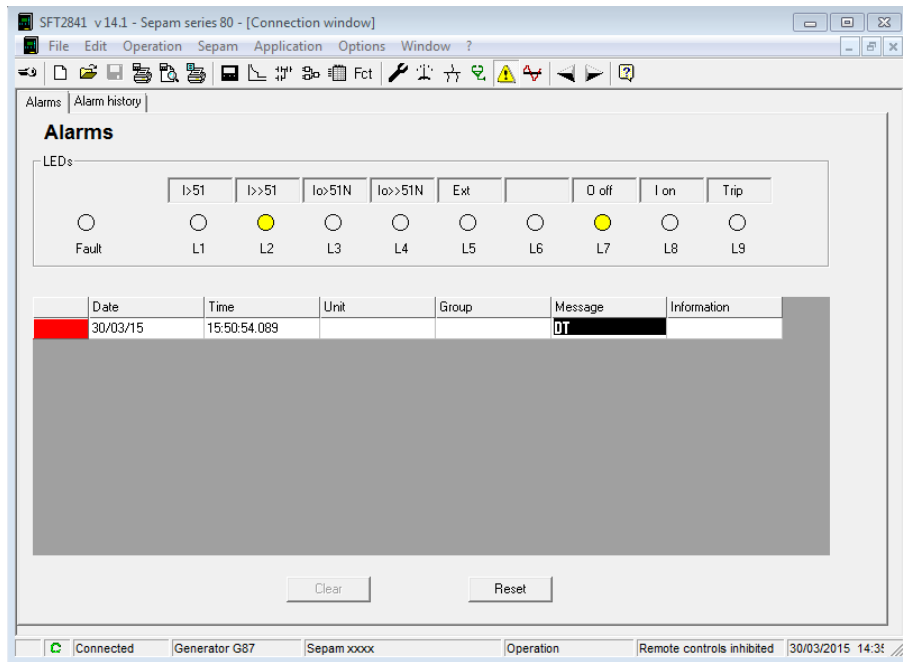


Figure No.14

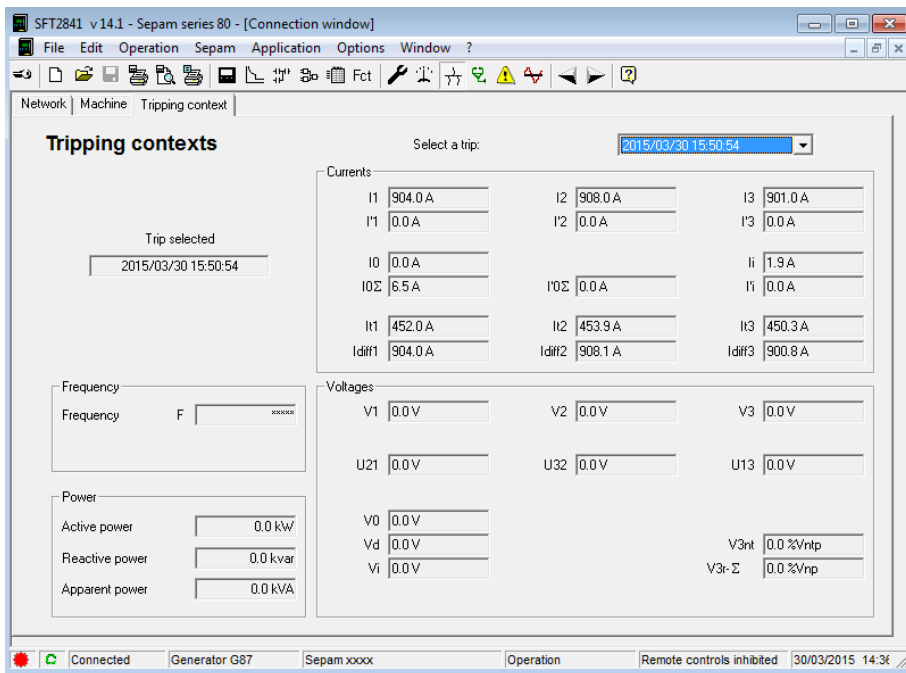


Figure No.15