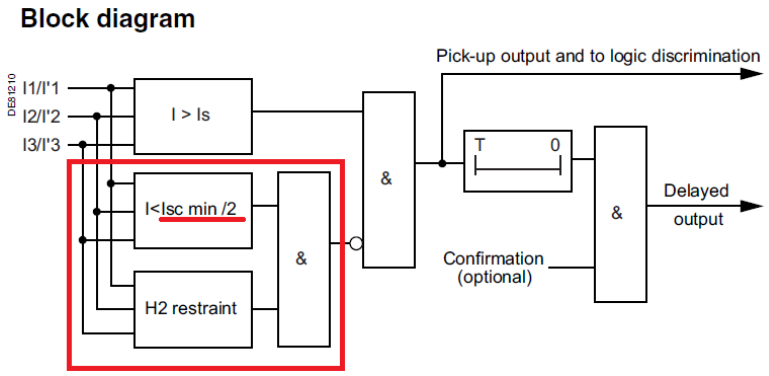
What is the role of Harmonic 2 setting in phase fault protection setting?

We can use Harmonic 2 restraint setting parameter for phase fault if we want to set a DT curve very close to transformer inrush current. In below we will demonstrate this fact with an example.

In phase fault, instead of earth fault, we have this opportunity to set H2 ratio (but not for all series) and there is also an additional item to be set which is Icc setting.

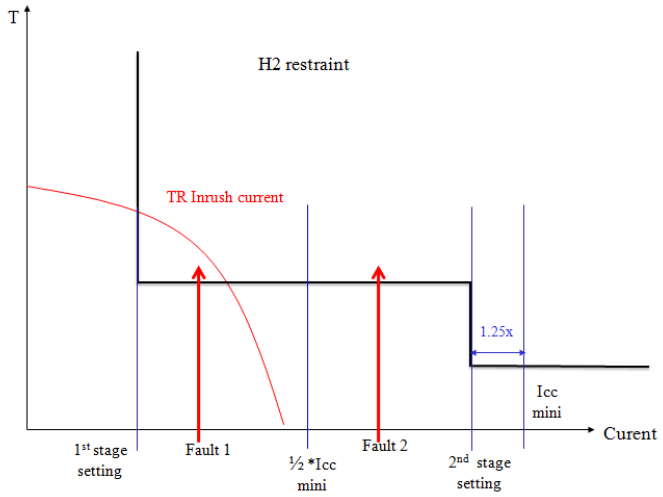
The Icc (French abbreviation, equivalent of Isc) is the minimum short-circuit current of feeder on which the relay is installed. But be informed the relay will take into account just half of this amount for function's restraint. This point also is mentioned in block diagram of phase over current protection. Icc should be set by the user.



The use of Icc/2 is that H2 restraint option is active for all current less than Icc/2 and is not active for all current above Icc/2.

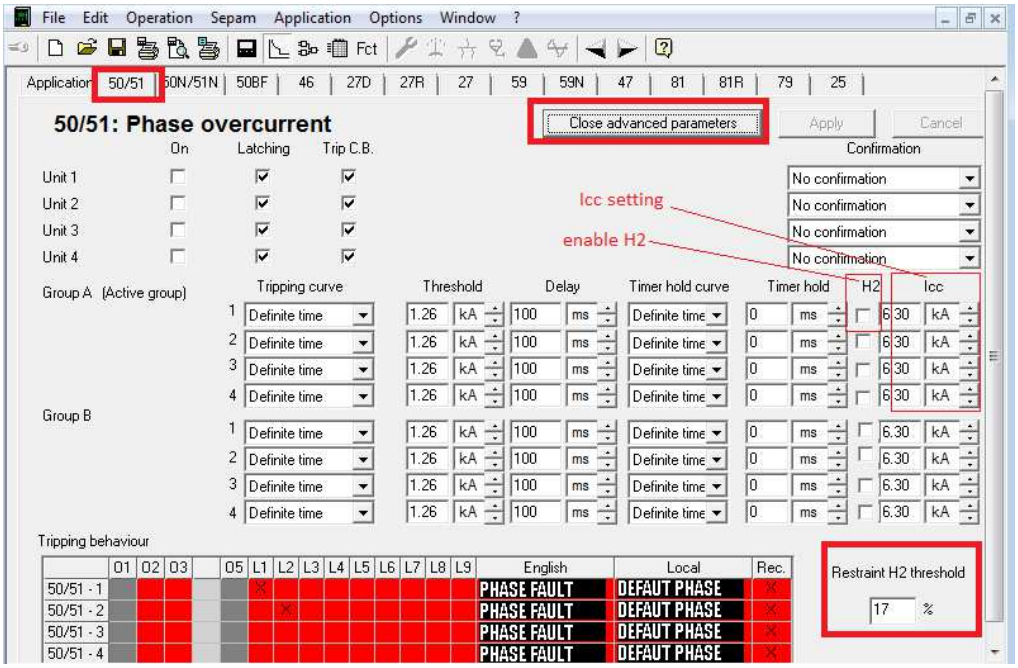
If we take the example of following diagram:

- The red curve is the transformer inrush current
- Icc (min) is the minimum short circuit of feeder
- The relay has got two DT curves
- The second DT curve's setting is done according to Icc
- The first DT curve even crossing inrush current
    - If H2 restraint is not enabled , 50/51 will trip during inrush
    - If H2 restraint is enabled according to correct H2 setting 50/51 will not trip
- In this case we assume that H2 is enabled , and Icc and H2 ratio setting is done correctly
- Icc/2 also plotted in the diagram to show the H2 restraint and non restraint area.
- Fault 1 is located below Icc/2
- Fault 2 is located above Icc/2



By considering all items above it is correct to say:
→For inrush current : as it is less than Icc/2 , H2 is active then although 1st step setting is in PUP condition, but it is limited to act by H2 so there isn't any TRIP signal.
→For Fault 1: as it is less than Icc/2, H2 is active then although 1st step setting is in PUP condition, but it is limited to act by H2 so there isn't any TRIP signal.
→For Fault 2: as it is bigger than Icc/2, then H2 is not active anymore and because of passing 1st step setting then it will PUP and there would be a TRIP signal.

Last step is to know where to set and which parameters should be set?
1. For enabling the H2 restraint → got to 50/51 protection / advanced parameters / enable H2 restraint
2. Setting for H2 restraint → H2 ratio (restraint H2 threshold)/ Icc



3. Setting of Icc value according short circuit study which is done for network

The setting parameters and ranges for all Sepam series are available in following table:

Sepam series	H2 option	H2 Ratio setting	Icc setting
20	Yes /No	Fixed-**17**%	Possibility to set from **In** to **999** KA
40	Yes /No	Possibility to set from **5** to **50**%	Possibility to set from **In** to **999** KA
60	Yes /No	Possibility to set from **5** to **50**%	Possibility to set from **In** to **999** KA
80	Yes /No	Possibility to set from **5** to **50**%	Possibility to set from **In** to **999** KA