DEIF A/S

Differential current relays

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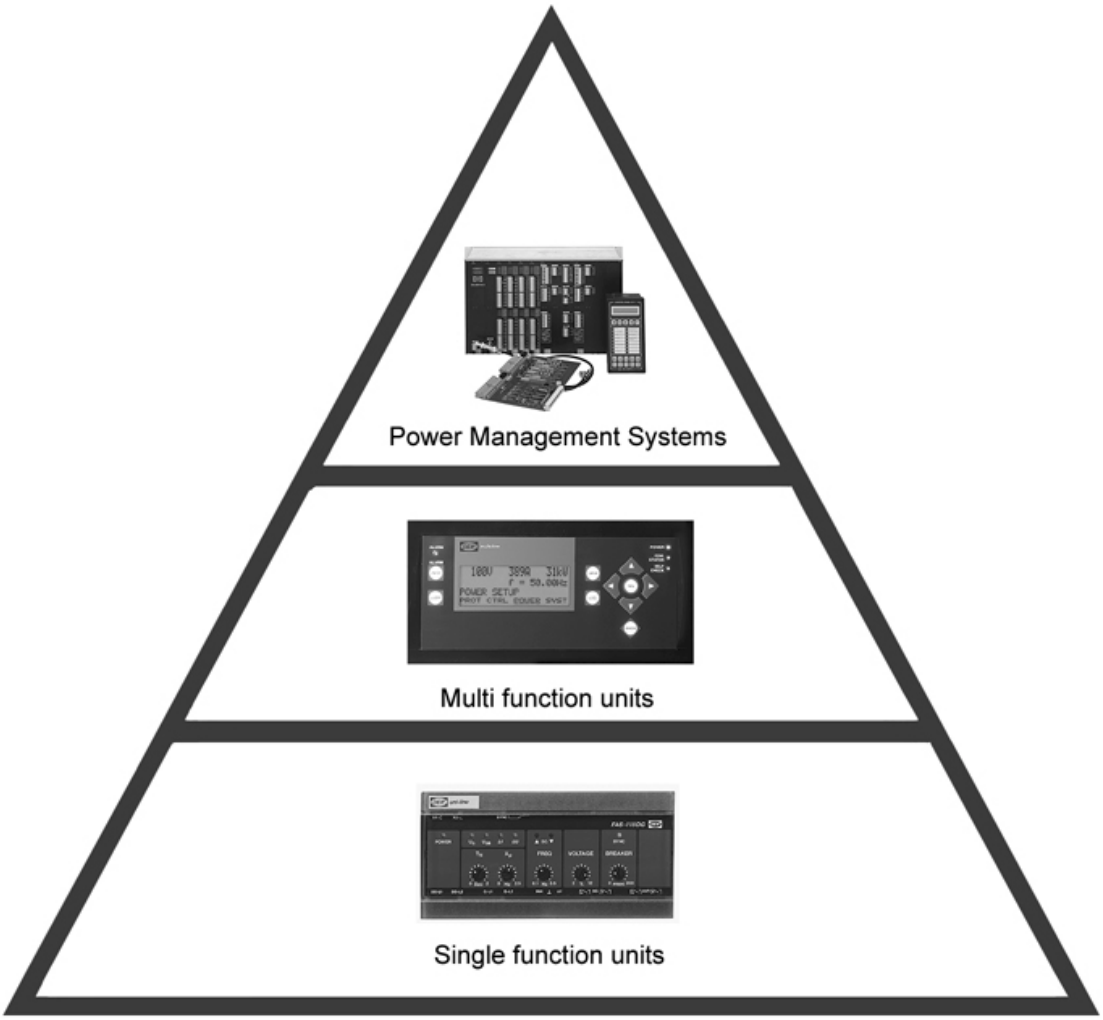

Application notes

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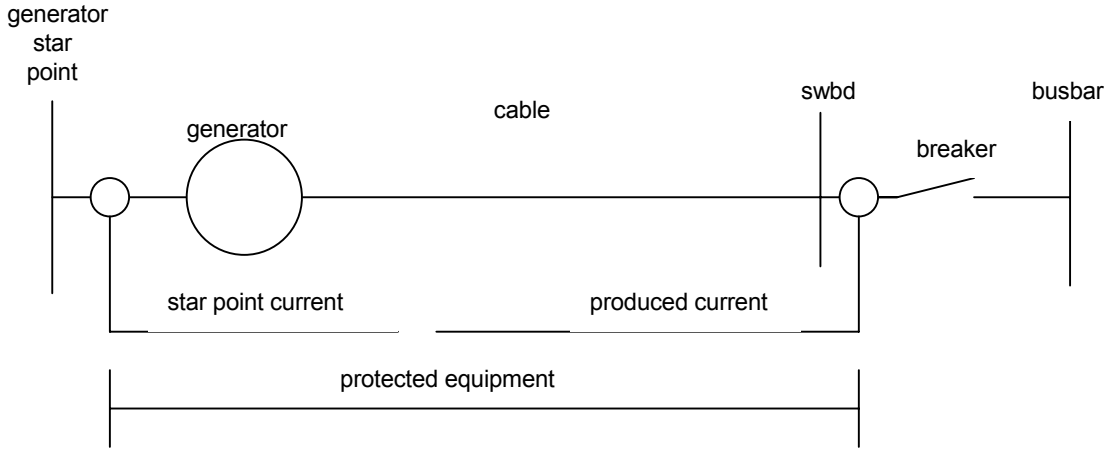
1. Differential current protection

Differential current protection is protecting a generator and (typically) the cable between the generator and the main switchboard against internal short circuits.

Symbol: I'>

DEIF has 3 differential current protection relays:

- Uni-Line RMC-131D
- Multi-Line MDR-1
- DELOMATIC module CRM-1 diff.



The differential current is the difference between the current measured in a phase in the generator terminal box (star point) and the current measured in the same phase in the switchboard. This value should be zero but due to imbalance in the measuring circuits (current transformer deviations, measuring input deviations etc.) a deviation occurs.

This deviation can be compensated for externally or internally in the protection relay.

- RMC-131D requires external compensation.
- MDR-1 has an internal compensation system.
- DELOMATIC CRM-1 diff. requires external compensation.

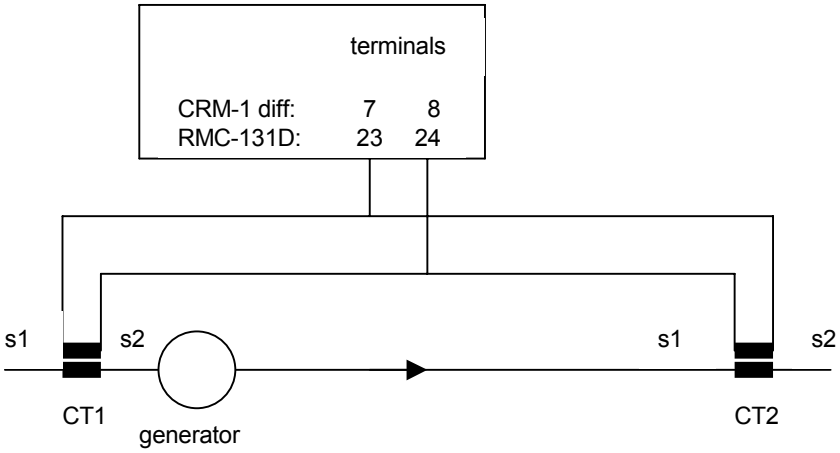
1.1. Uni-Line RMC-131D/DELOMATIC CRM-1 diff.

RMC-131D is a simple DIN-rail mounted differential current relay. The relay accepts 3 current inputs. As the measurement of I' requires 6 current transformers (2 per phase), it can be seen that the I' value must be achieved before connecting the relay. This means that RMC-131D does not have internal compensation. Therefore take very much care during the installation to avoid false trips.

DELOMATIC CRM-1 diff. is a 19" double-height plug-in module for the DELOMATIC multi-function system. The working manner is similar to RMC-131D, i.e. a simple differential current relay.

1.1.1. RMC-131D/CRM-1 diff. wiring

Only phase L1 is shown:



The differential current (measured on the terminals) occurs as a result of the connection between CT1 and CT2.

1.1.2. RMC-131D/CRM-1 diff. hints

In order to maintain the balance in the system all the time (even in external short circuit or large consumer start situations) it is essential that:

- The current transformers CT1 and CT2 are of the same make and of the same type.
- The saturation level of the CTs is 8 times better than the nominal generator current.
- Impedance is the same in the circuits CT1 to RMC-131D/CRM-1 diff. and CT2 to RMC-131D/CRM-1 diff. This can be achieved by using the same cable lengths or as this is not always possible by using cables of different sizes as the circuit CT1 to RMC-131D/CRM-1 diff. normally is much longer than the other one.

Finally it may be necessary to set the time delay higher than originally planned.

As it can be seen from the above RMC-131D/CRM-1 diff. has a number of technical disadvantages. By choosing the Multi-Line MDR-1 relay these disadvantages can be avoided.

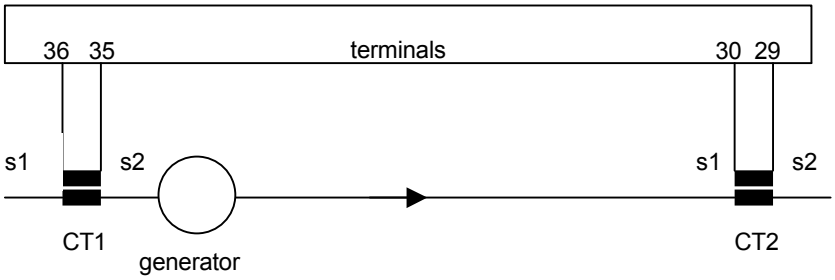
1.2. Multi-Line MDR-1 relay

MDR-1 is an advanced differential current relay mounted on the panel front. The difference between RMC-131D and MDR-1 is that RMC-131D has 3 current inputs and MDR-1 has 6 current inputs. Also MDR-1 is a programmable unit with a display showing either the actual current or the differential current, while RMC-131D is a "blind" unit, adjusted via potentiometers in the front.

This means that a compensation curve related to the actual running current could be programmed, i.e. MDR-1 is a more advanced unit and can easier avoid false trips.

1.2.1. MDR-1 wiring

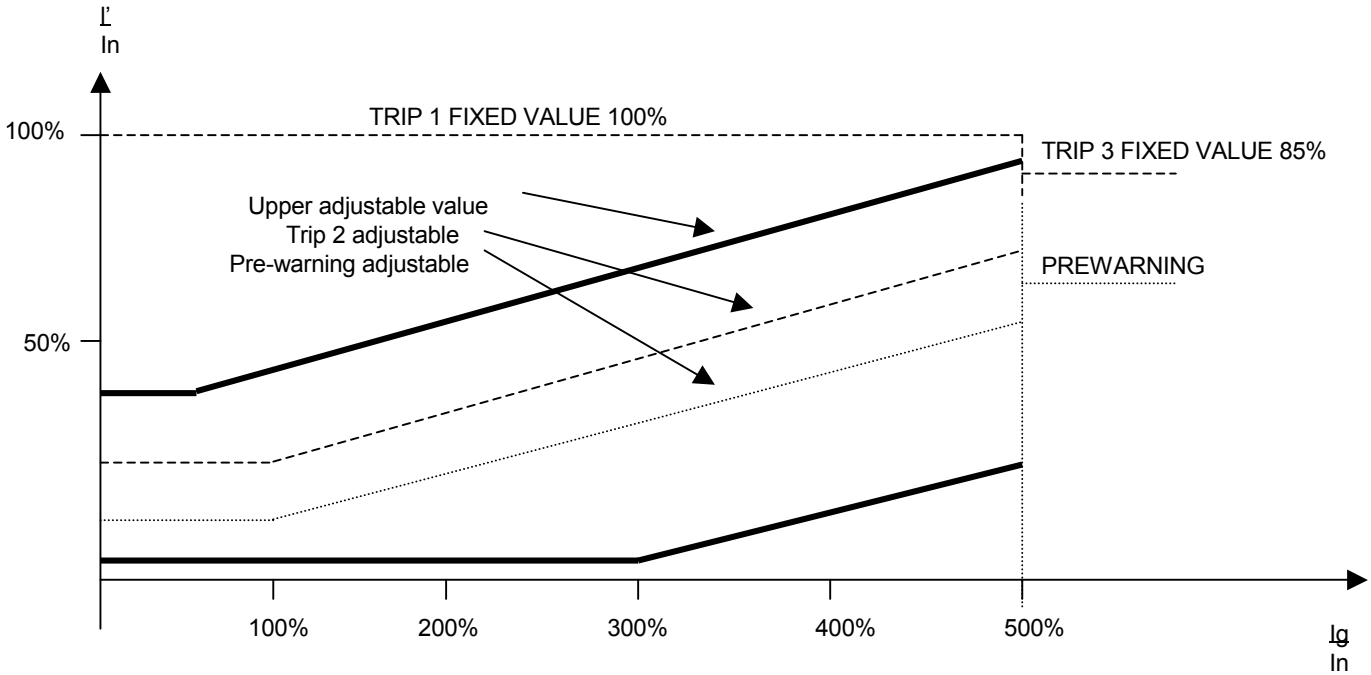
Only phase L1 is shown



It is essential that:

- The current transformers CT1 and CT2 are of the same make and of the same type.
- The saturation point of the CTs is 8 times better than the nominal generator current.

1.2.2. MDR-1 programmable trip curve



The trip curve shows that if the generator current (Ig) exceeds the nominal value (In) MDR-1 will start compensating for the differential current (I') simply by moving the trip and warning setpoint values upwards as the generator current increases. This will compensate for the previously mentioned measuring imbalances.

2. Conclusion

The most obvious conclusion is of course always to use MDR-1, as this is the best unit. However the economical aspect have to be considered, as MDR-1 is more expensive than RMC-131D and CRM-1.

Generally:

Use RMC-131D if:

- The generator is fairly small.
- There are no heavy consumers whose start current makes the generator current exceed the nominal value even for a short time (island operation).

Use CRM-1 diff. if:

- A DELOMATIC system is part of the delivery.
- The generator is fairly small.
- There are no heavy consumers whose start current makes the generator current exceed the nominal value even for a short time (island operation)

Use MDR-1 if:

- There are heavy consumers whose start current makes the generator current exceed the nominal value, even for a short time.
- The generator is fairly big.

The above is meant only as a guidance. Other aspects may be considered regarding the use of a differential current protection unit.