CT-1 Toroidal transformers

GENERAL

The current T/T's are made of an optimum quality magnetic core, which allows to detect leakage currents of a very low value even.

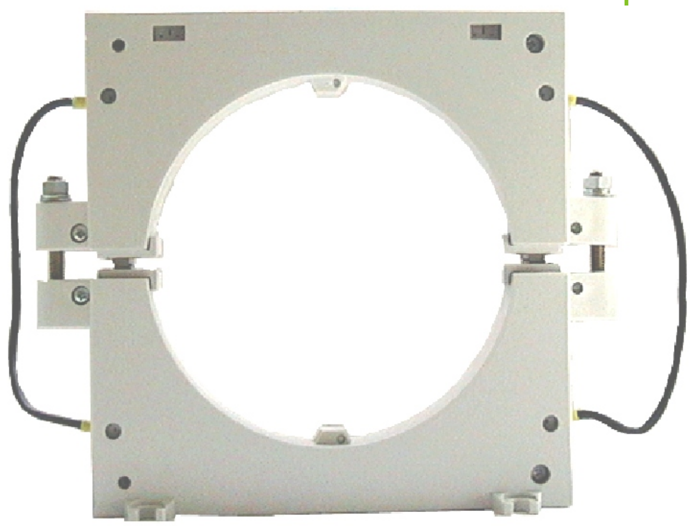
There are two windings coupled in the core, one to detect the signal of a leakage in the line (to be sent to the relay), and the other for performing the Test.

The Test is conducted over the coupling between the relay and the T/T in a complete manner. This is to say, the relay sense a signal which is sent to the testing winding. This signal generates a flow equivalent to a leakage, which is detected by other winding and resent to the relay, what makes it to trip.

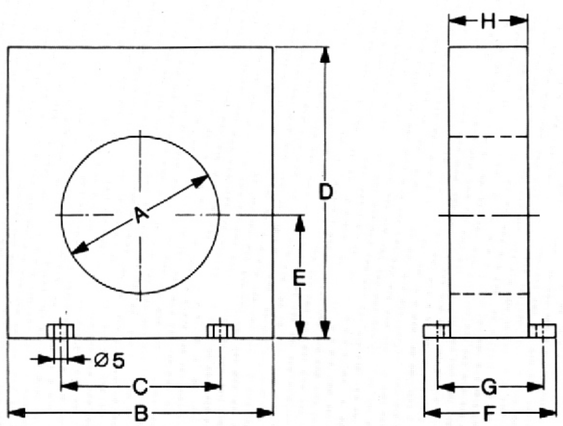
During the periodically conducted tests, this allows to verify not only the working shape of the relay but the integrity of the connections between the relay and the T/T.

All phases should pass through the inner part of the T/T, even the neutral if same is distributed.

The earthing wire shouldn't pass through the T/T.



DIMENSIONS



TYPE	Dimensions - mm							
	A	B	C	D	E	F	G	H
CT - 1/35	35	100	60	110	47	50	43	30
CT - 1/60	60	100	60	110	47	50	43	30
CT - 1/80	80	150	110	160	70	50	43	30
CT - 1/110	110	150	110	160	70	50	43	30
CT - 1/160	160	275	—	270	130	44	—	44
CT - 1/210	210	300	240	300	150	135	105	40
CTA - 1/60	60	140	—	135	56	33	—	33
CTA - 1/110	110	180	110	150	70	45	35	25
CTA - 1/160	160	275	—	279	134	44	—	44
CTA - 1/210	210	300	240	300	150	135	105	40

SPECIAL TOROIDAL TRANSFORMERS

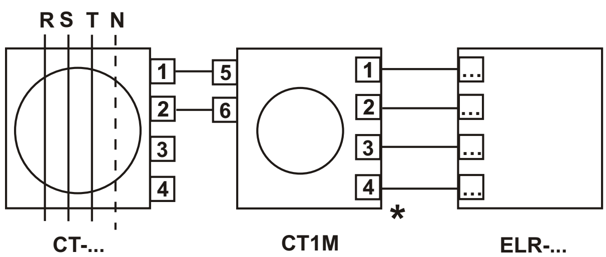
CT1M :

It's a multiplier for the current setting of those ELR's up to 250 A. It's placed between the ELR and the measuring T/T (It isn't a wire passing through transformer)

CT1S :

It's a summation T/T, which should be used, in those cases when the cables of the system to be protected are bigger than the inner diameter of the T/T's

In such a case Ct's should be used and installed in the line. The CT's are connected to the summation T/T's and these to the ELR.



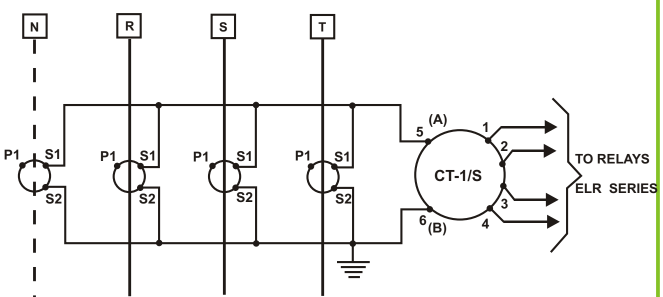
* In the ELR's with only 2 output terminals for T/T, don't connect 3 and 4 terminals of Ct1m multipliers.

APPLICATION NOTE FOR EARTH LEAKAGE RELAYS ELR SERIES

1) EARTH LEAKAGE RELAYS APPLICATION WITH CT's

UTIL**ISATION**
This application is particularly useful in those cases, in which it is impossible to embrace all conductors (supply bars) of the system, with one sole transformer.
In this case, It is possible to have Earth Leakage Protection, by using Ct's and one of our special toroid transformers (exclusively made by us, based on the winding rate of the Ct's), complying with the wiring diagram, described below. For this application the Ct's should have: the same transformation ratio (5A secondary), same power (10 VA at least) and class 0,5. On the other hand, it is important that the Ct's are mounted, in such a way that the script P1 is orientated upstream, towards the line to be protected, and the various secondaries exactly as per the diagram.

FUNC<u>TIONING</u>
When there is no earth leakage, the vectorial addition of the currents sensed by the Ct's, is equal to zero. Thence, there is no current flowing in the windings related to our terminals 5 and 6 (in our special toroid). There isn't any voltage generated in our terminals 1 and 2 therefore, which should make the ELR to trip.
When there is a leakage, otherwise, the vectorial addition of the currents sensed by the Ct's is different to zero. Thence , a voltage is generated through the terminals 1 and 2, making the ELR to trip.
For this application, it is advisable to have a tripping threshold of the ELR, not lower than a 1/100 of the rated current of the system to be protected.

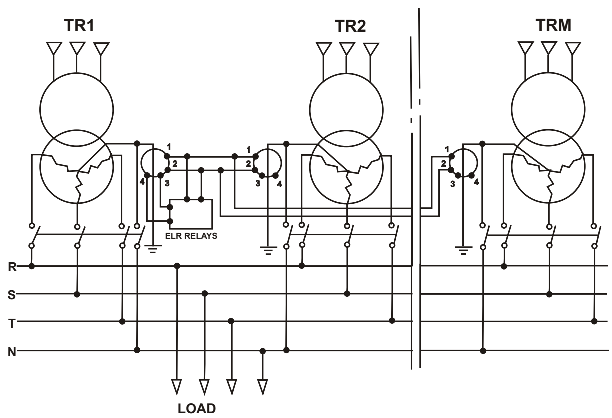


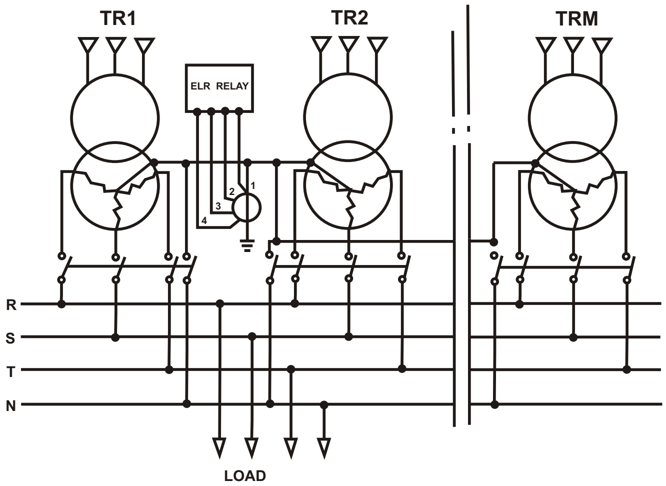
2) ELR's APPLICATION WITH GROUND WIRE OF TRANSFORMERS

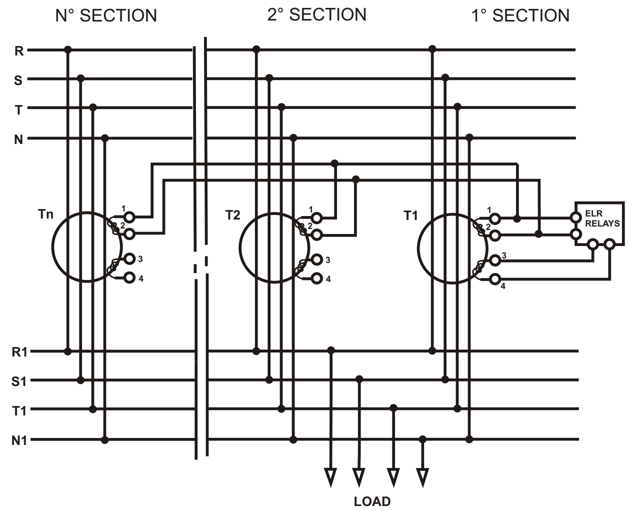
2.1. <u>UTILISATION</u>
This application is particularly indicated when the system is supplied through Transformers, working in parallel.
In fact, it could be impossible to protect the line with ELR's sited immediately downstream of the transformers. Since it wouldn't be possible to establish which part of the Current Leakage to Ground **(clg)** is borne by one or the other tranformer. This brings us to a point, in which is practically impossible to establish exactly the threshold of the tripping value of the relays.

EXAMPLE:
Suppose that we wish to protect an installation, which requires that the ELR should trip when the **clg** is equal to 5A. Should we install 2 ELR's with 5A threshold, it would certainly be required a higher value of **clg**, in order to make the ELR to trip. On top of the above, in case of an equal distribution of the current leakage between both transformers, it should be required a **clg** = 10A , in order to make the ELR's to trip. Otherwise, if we adjust the tripping threshold to 2.5A, it could be the case that one transformer is bearing ¾ of the **clg** and the other ¼ only. Thence the ELR of the first transformer would trip before the 5A of **clg** are reached. Other factor to be considered, is the eventual separation of a transformer from the parallel, during low load demand periods. In this case the eventual **clg** is totally reclosed through the earth of an unique transformer and the tripping threshold should be establish exactly as 5A, under these conditions. The solution of the problem is given in our diagram.

FUNC<u>TION</u>
Our diagram here below shows the solution, based in connecting the star centres of both transformers together to earth with an unique wire, which has passed through our toroidal transformer before.
It is based in the fact that any current leakage to ground can't be reclosed but through the star centres of the transformers. With the toroidal , positioned as per our diagram, it is measured therefore the total current leakage to ground.
Back to the above mentioned example, we should establish as 5A the tripping threshold value, with the assurance that the ELR will trip, when the **clg** goes above the 5A threshold.







3) APPLICATION OF ELR's ON VARIOUS LINES IN PARALLEL

3.1.USE

This application can be used whenever there are various connecting lines through two bar systems OMNIBUS.
In this case, the use of ELR's with their corresponding T/T's ,per each connecting line, it could give operation inconveniences; since the vectorial addition of the currents , on each connecting line, might not necessarily be equal to zero. It could be the case that, with 2 perfectly equal lines, there could be a difference of current distribution, due to a contact resistance difference (in phase R, for example), whilst the adsorbed current by the load might be equally distributed, in the other lines.
All this brings along that, there might be a leakage signal, at the toroidals terminals 1-2, which could be sufficient to make the ELR's to trip, without any earth leakage. With this kind of distribution, it is advisable to go to the wiring diagram, in which there are used as many T/T's as connecting lines, all of them orientated towards the 1 and 2 terminals of our ELR.

3.2.WORKING PRINCIPLES

when there is no leakage, although with a non uniform current distribution, as mentioned in the above paragraph 3.1, the originated signal at the first toroidal, is totally void by the leakage signal originated at the second toroidal, since the signal can't be but in opposition, and the ELR's terminals won't receive any signal and the ELR won't trip therefore.
Otherwise, when there is an earth leakage, independently of whatever it might be the current distribution, the signals summation, being measured by the various Tt's, meet at the 1 and 2 terminals of the ELR, which will trip therefore. This application is valid for a maximum of 6 Tt's connected in parallel.
In those cases, in which a higher number might be required,, it is advised to contact us.
For this application, it is advisable to have a tripping threshold not below 1/1000 of the nominal current of the system to be protected.

4) MEDIUM VOLTAGE LINES N APPLICATION

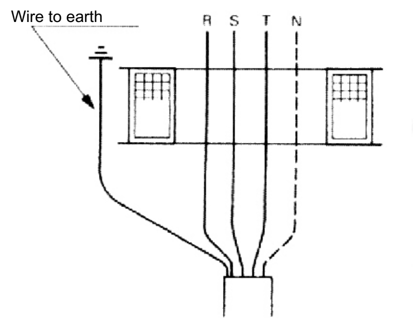


Fig.1

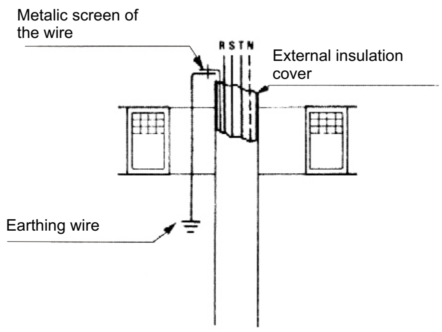


Fig.2

Should an ELR be used in MV lines, it is advisable to use the built-in filter for third harmonic version.
Note:
If there is an earthing circuit , it should be placed outside of the T/T (fig1).
When the cable is fitted with a metallic screen and it gets through the T/T, the earthing connection should be as (fig. 2)