

Megger DET3TC with ICLAMP option The "ART" of earth electrode testing



The testing of earth systems has relied for many years on the tried and tested "Fall of Potential" and other related methods. These methods give reliable results, but can be time consuming. To measure an individual electrode's earth resistance requires the disconnection of the electrode being tested from

the rest of the earth system and any connection to a building's earth wiring. This can also involve downtime, or reduce the degree of protection to the installation.

Now Megger has a solution to this problem in the form of **A.R.T.**, the **Attached Rod Technique**.

When the earth tester injects a test current into an electrode which is still connected to the system, current not only flows down the electrode under test, but back into the building's system, and down any other electrodes connected in parallel.

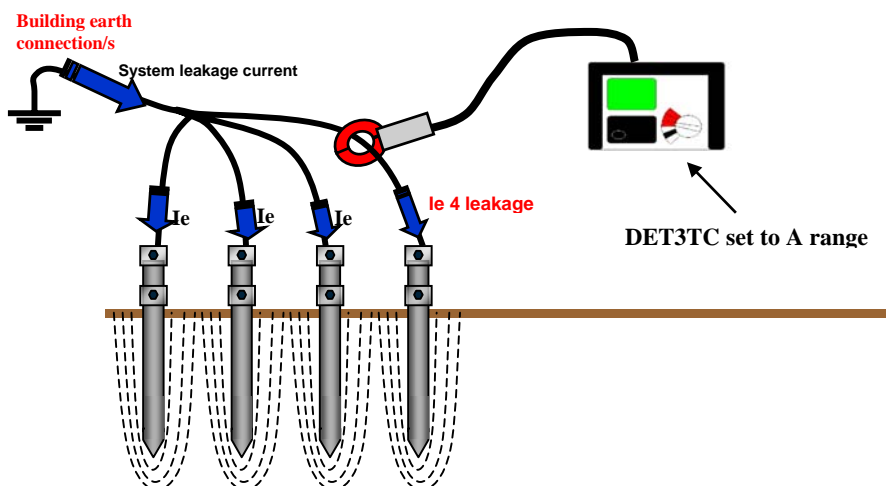
Megger's new **DET3TC** together with the optional **ICLAMP** utilises 'ART' to allow the instrument to measure only the current being injected into the electrode under test. The instrument uses this current to calculate the resistance of the electrode under test. No disconnection, no wasted time, no downtime, no irritation, no scraped knuckles!

Megger has made an "ART" of testing

Just a little aside

The **ICLAMP** has the ability to measure very small currents, so Megger used this ability to add yet another benefit. The **DET3TC** is equipped with an **earth leakage range**, allowing quick and easy

measurement of leakage current flowing into the earth system. So if you do need to disconnect an electrode for maintenance there are no nasty surprises!



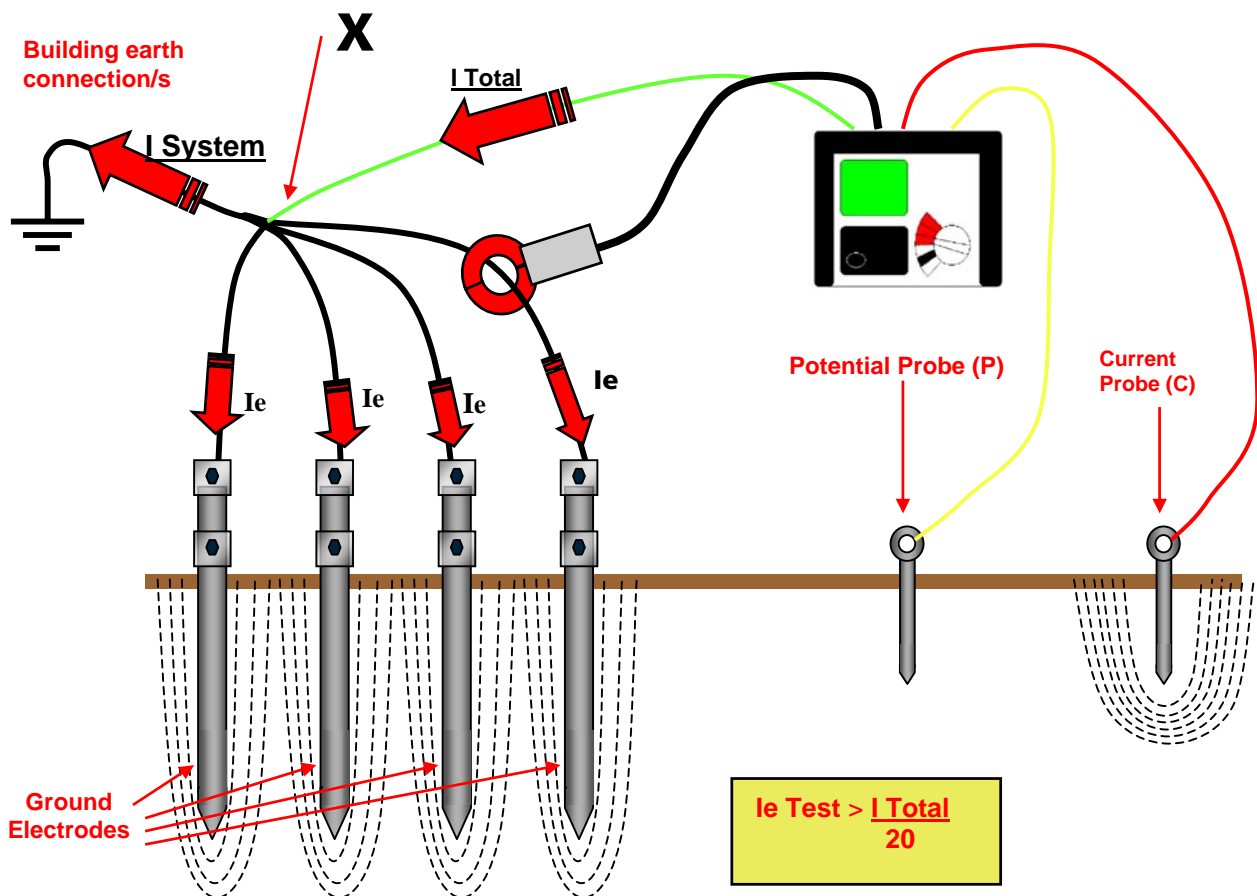
Megger gets down to earth with "ART"

So how does 'ART' work?

The **DET3TC** will perform the traditional 3-pole measurements like other earth testers. When in the normal 3P mode the **DET3TC** injects a test current at 128Hz (X to C terminals), so as not to clash with the generation frequency and its harmonics. The voltage measurement is then taken (X to P terminals) at this frequency, enabling the instrument to ignore other currents flowing in the earth system.

The rest is simply down to ohms law to calculate the resistance as displayed.

The addition of the **ICLAMP** enables only the test current in the individual electrode to be measured. As with the voltage measurement the **ICLAMP** measures the current only at the 128Hz the **DET3TC** generates, again allowing other currents flowing to be ignored.



The diagram above demonstrates the operation of 'ART'.

The ICLAMP has the ability to measure the current in an electrode down to 5% of the total test current flowing through the system. In other words the electrode measured can have a resistance up to 20 times that of the total system and still be

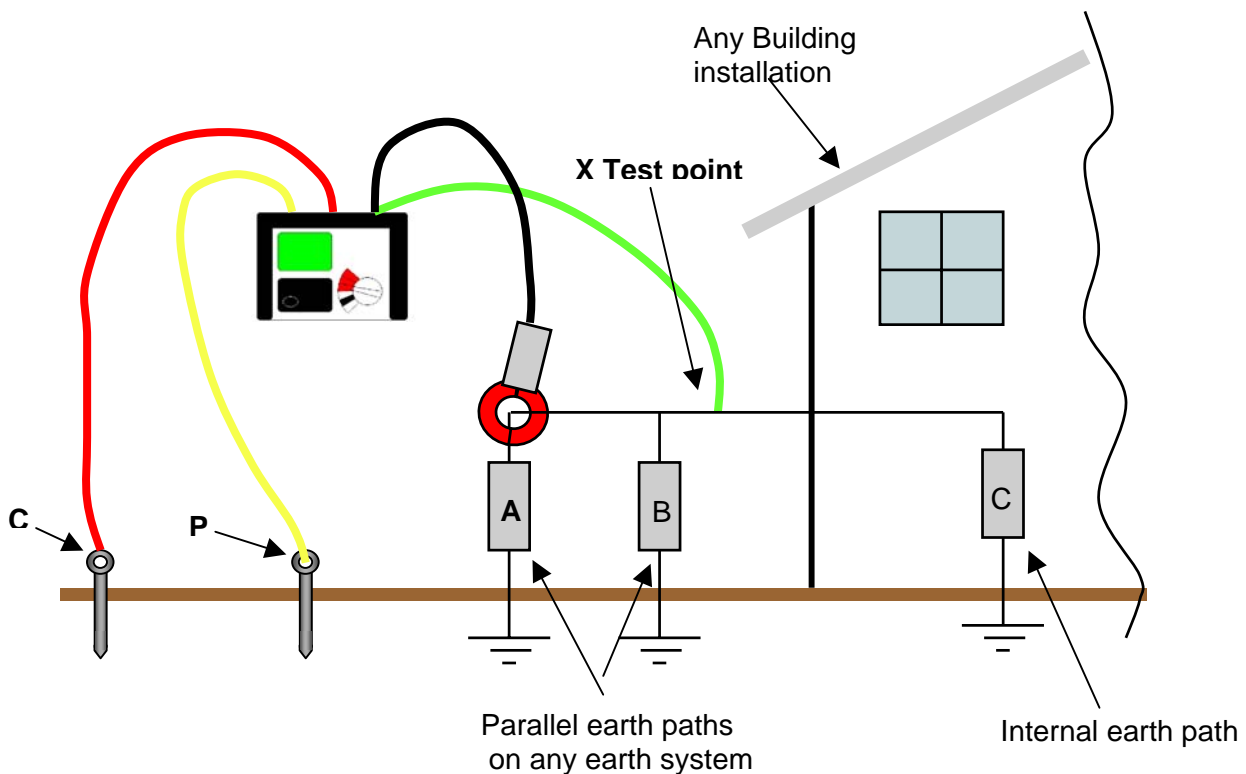
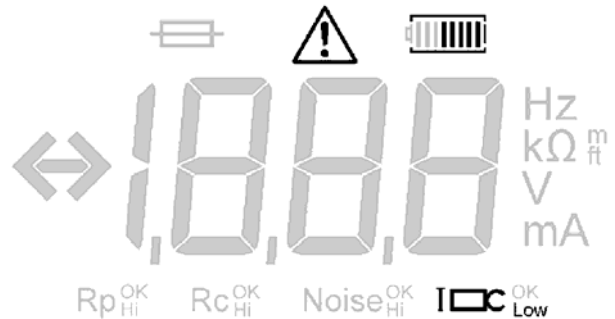
measured. Values higher than 20 times cannot be measured using 'ART', and so you will need to carry out a traditional 3-pole measurement.

See over leaf.

Don't underestimate the power of "ART"

Even if the test current flowing through the electrode under test is less than 5% of the total current generated by the **DET3TC** you can still get an idea of the electrode's resistance. Should this happen the instruments display will show the "clamp low" indication as shown.

If you take a reading of the complete system in standard 3P mode you know that the electrode you were trying to test is at least 20 times that. That is usually enough information to make a decision. In addition you can also measure the standing leakage current in each individual electrode. The **DET3TC** with **ICLAMP** is a flexible addition to your testing 'toolkit'



Imagine we were trying to measure the resistance of an earth path 'A' above.

Using the **ICLAMP** the low current symbol shown above appeared on the display. In this instance we cannot use **ART**.

You should still perform a standard 3-pole measurement on the complete system.

If the reading is 4.5 ohms. Because we know that the **ICLAMP** requires at least 1/20th of the test current, we now know that resistance 'A' must be at least 90 ohms.

Reading $4.5 \times 20 = 90$ ohms

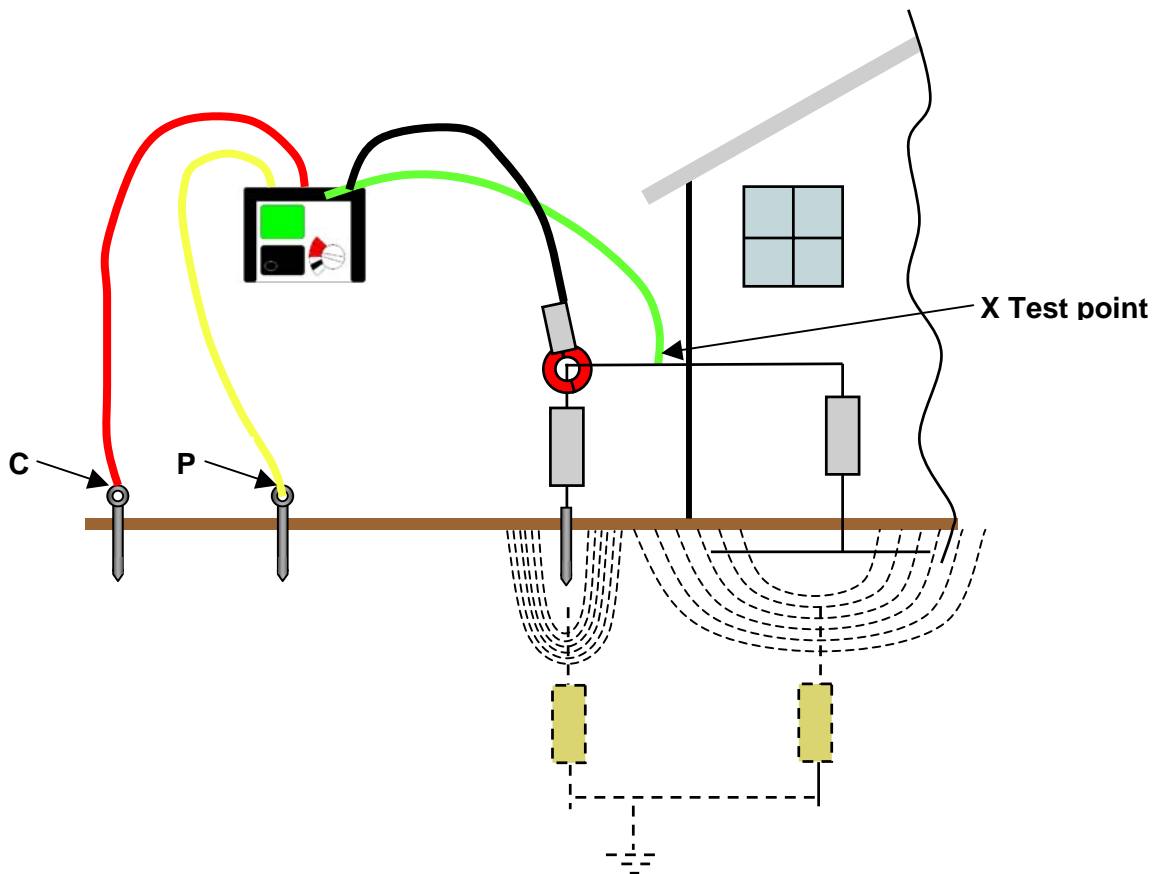
Enough information to know whether the earth path **A**, be it an electrode, connection to a mesh or whatever, needs attention.

The problem with Spheres of Influence

There is another factor to take into account, and that is the sphere of influence around the earth

electrode/s and the buildings earth paths, whether it's through water/gas pipes or metal framework.

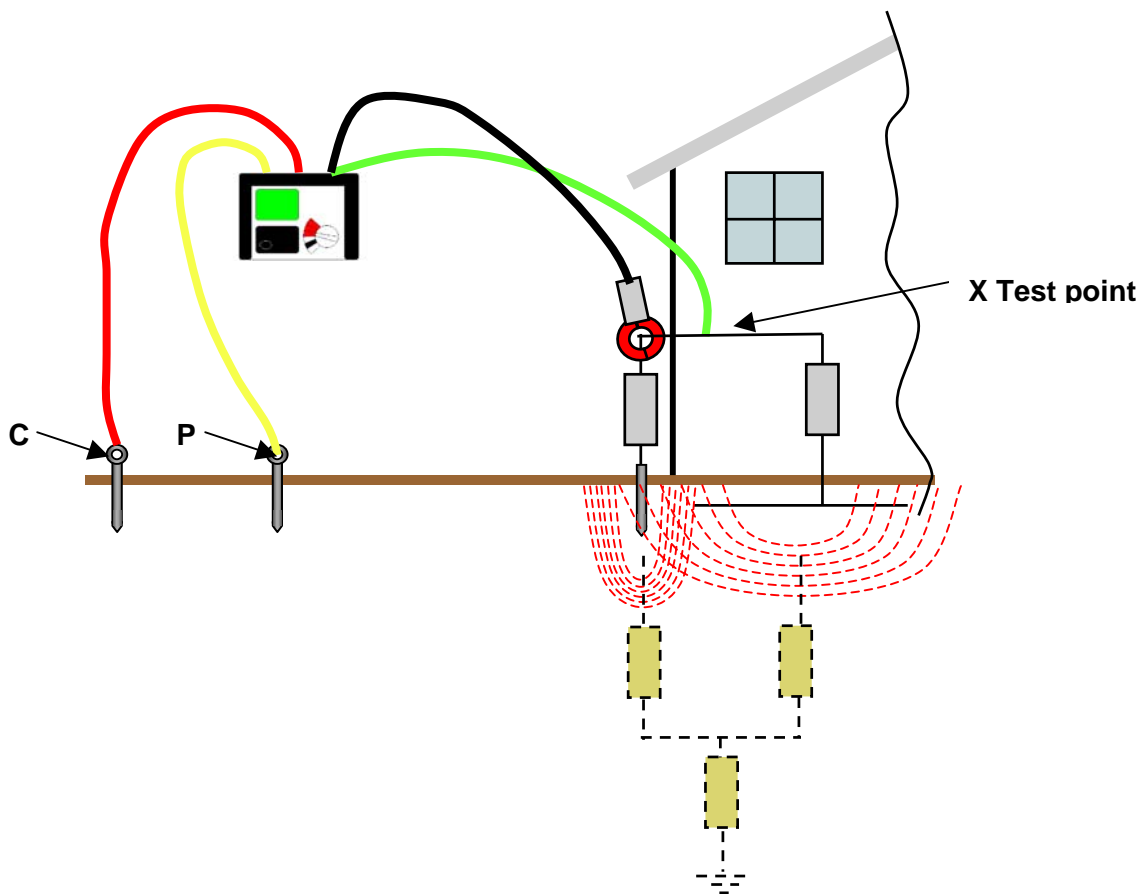
Consider the following diagram;



Here, the spheres of influence are outside each other, resulting in the equivalent circuit shown underneath. **ART** should, subject to the 20:1 rule, work fine.

Note: If you are unclear as to the meaning of “Sphere of Influence”, more information can be found in the Megger publication “Getting down to Earth”, part number 21500-072.

Now look at the next diagram.



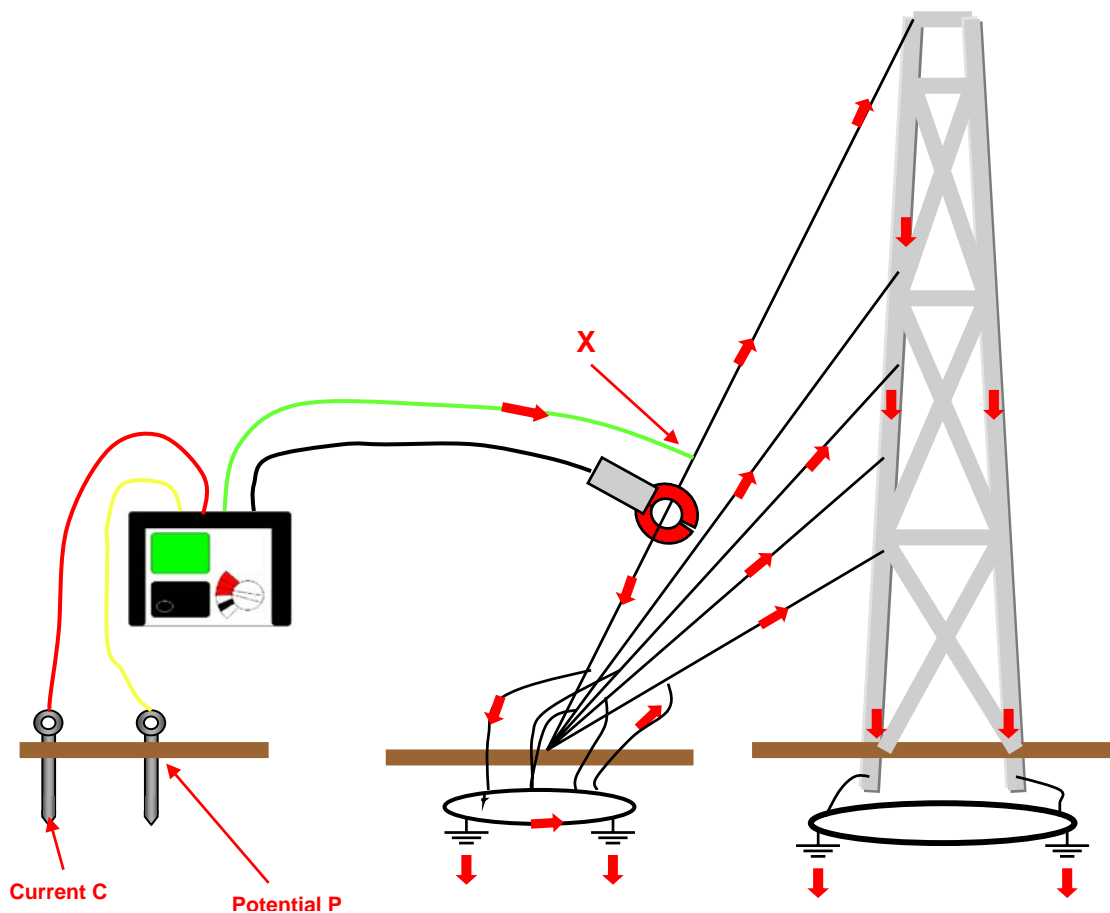
In this situation the electrode under test is very close to the building. The result is the sphere of influence of the electrode and that of the building are overlapping. Effectively we now have “earth coupling” occurring, hence the difference in equivalent circuit.

The overlap in the spheres of influence introduces additional impedances that make resolving the resistance of the electrode difficult using ART. The result will cause either be the “clamp low” symbol appearing or an unexpectedly high reading. If this happens proceed with the traditional 3-pole method with the electrode under test disconnected.

We all like "ART" but sometimes it's misunderstood

Like most modern and new forms of ART sometimes it's misunderstood, but hopefully we can prevent that happening to you.

Lets look at the following diagram and see if we can spot the error?



The error isn't at first obvious, I want to measure the earth resistance of the guy line with the clamp around it. But the guy lines on this tower are all shorted together. The current being measured by **ICLAMP** is flowing not just to ground at the anchor point, but back up the other guy lines and to

ground via the tower. This means the calculated resistance will be incorrect for the anchor point. Always consider where the test current is going to flow, all measured test current should flow through the required earth (soil) mass around the electrode under test.

The Best Application of “ART”

There are many applications where **ART** work extremely well.

These include:

- Field of earth / Earth Farms
- Pole mounted transformers
- Domestic TT (earth electrode) systems
- Single guy lines on towers
- Lightning protection electrodes

With a good understanding ‘**ART**’ will be an invaluable tool, saving both time and trouble.

Further information regarding Megger’s range of earth testers and their applications may be found at www.megger.com/det