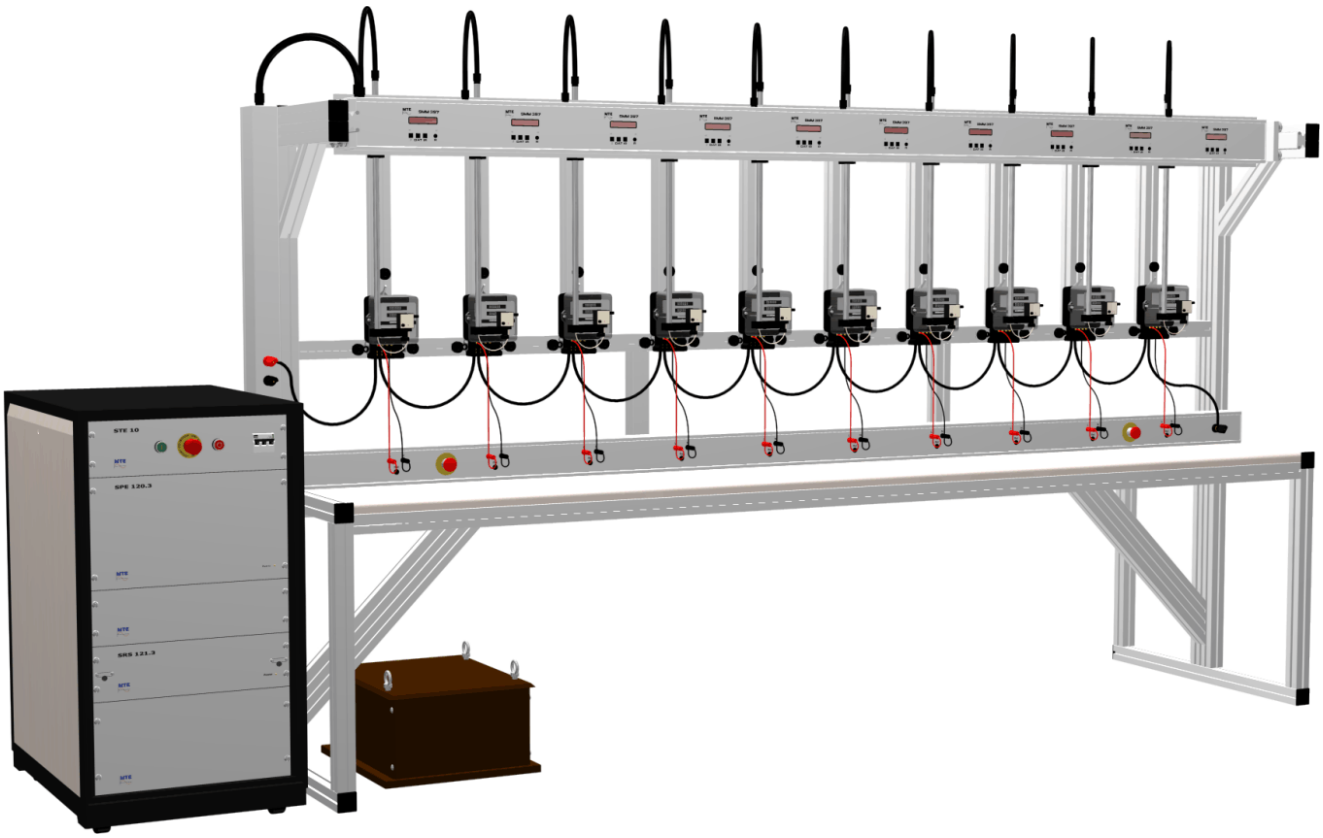
MTE Meter Test Equipment

Testing of single-phase meters with closed I-P links using voltage isolation transformers



With ever increasing frequency, meter manufacturers and meter operators are producing and using meters that do not allow the links between the current and voltage measuring circuits (I-P links) to be opened for test or calibration purposes. There are several reasons for this but the most important for manufacturers is the lower production cost of single-phase meters using resistive shunts for current measurement. To provide the facility to isolate the current and voltage paths of these meters would result in a significantly higher manufacturing cost. During normal operation, this isolation would not even be technically feasible. A second reason for not supplying meters with removable I-P links is that the presence of these links makes the possibility of fraud by customers more likely.

The same consideration also applies to non-CT operated three-phase meters.

These meters are therefore sometimes also manufactured with I-P links, which cannot be disconnected from outside the sealed meter case. In this case, again, the meter is less expensive to manufacture than if accessible disconnection links are provided inside the terminal cover.

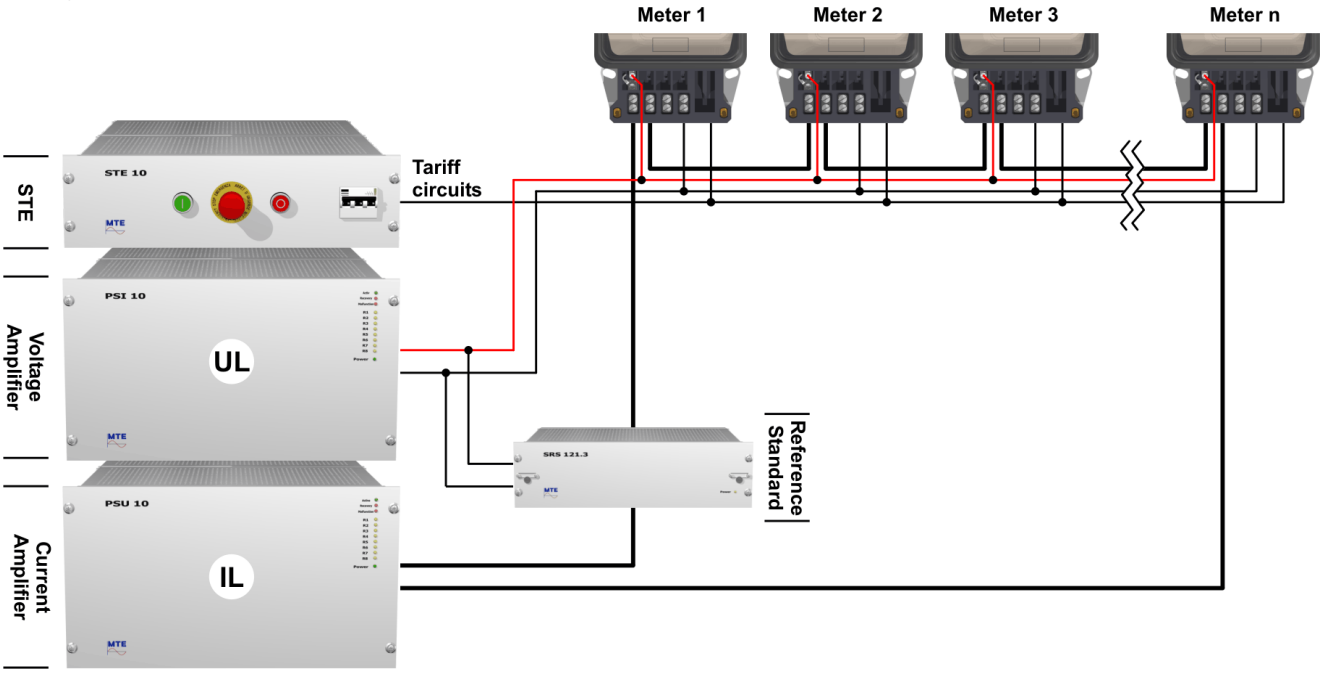
For meters designed for use with external transformers, the terminal block must provide access to all current and voltage terminals in order to be able to connect the required transformers.

The above reasons support the concept of providing whole current meters with closed I-P connections for both domestic and commercial use. This approach allows cost reduction in production and also reduces the likelihood of energy theft.

There are however, some important implications in this approach, for the specification of meter test equipment.

Basic arrangement of a meter test installation

During meter testing, an electronic source is normally used as a phantom load to provide test currents and voltages applied to both the meters under test and the reference meter. The term “phantom load” means that the current measuring element is supplied with the required current and the voltage element is supplied separately with the required test voltage. Modern electronic meter test installations configured in this way allow for automatic testing of the meters over their full working range. The current and voltage measurement circuits at each meter can be disconnected via links in the terminal block (I-P links). Thus it is possible to connect any number of meters with voltage in parallel and current in series for efficient testing of large numbers of meters. The same currents and voltages are applied to all of the meters under test.



Test requirements with closed I-P links

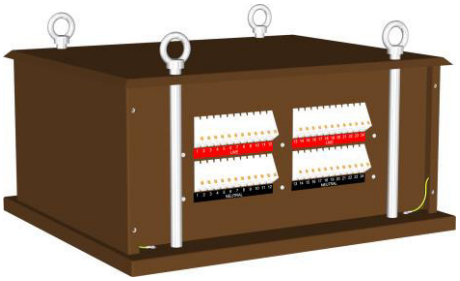
If the meters under test do not allow for opening of the I-P links, then there is an unwanted connection between voltage and current path at every meter position.

Because of these connections, the line (input) and load (output) of each current measurement element are forced to be at the same potential, an effective short-circuit path exists across the current measuring circuit of every meter under test, causing a large measurement error. It is therefore not possible to test multiple meters with closed I-P connections on a conventional meter test installation without additional facilities. To be able to test these types of meters, galvanic isolation must be provided between the current and voltage circuits of each meter under test. This isolation must ensure that the closed I-P links in the meters do not cause these unwanted short-circuits and the resultant measurement errors. With single phase meters, galvanic isolation can theoretically be carried out using either voltage or current isolation transformers.

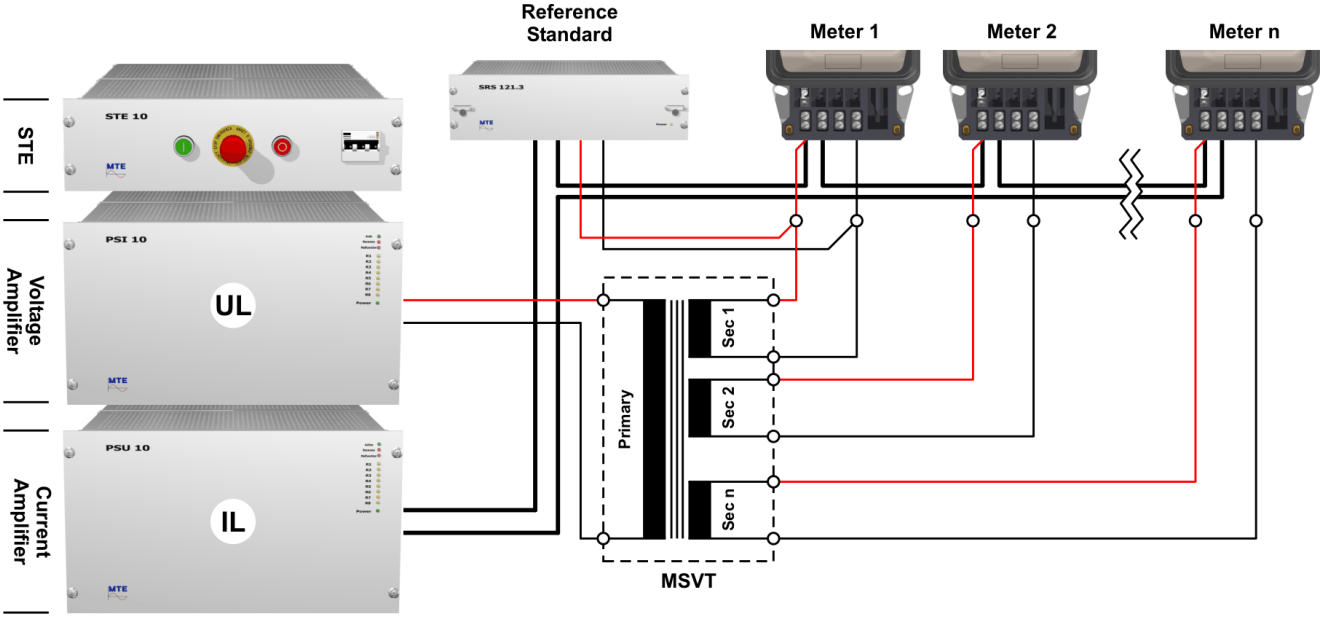
In this case, a connected I-P link does not cause a short-circuit, as this connection is now made on the secondary side of the transformer, thus avoiding any direct connection with the other meters in the circuit.

Voltage isolation for testing single-phase meters

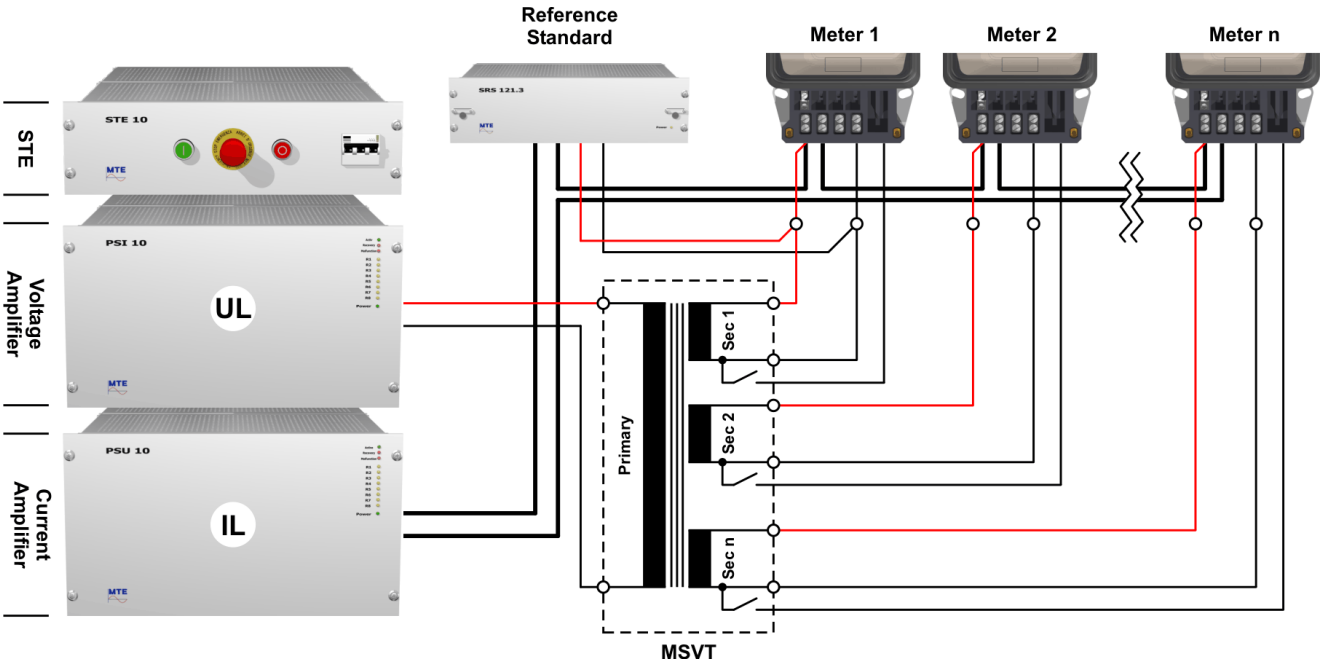
For the testing of multiple single-phase meters with fixed links between the voltage and current path (I-P links), galvanic isolation must be provided at each test position. In practice this is normally done by connecting the voltage circuit of every meter under test, through a high accuracy voltage transformer.



For reasons of cost a voltage transformer with several galvanically isolated secondary windings (known generally as a multi-secondary voltage isolation transformer or MSIVT) is used. The number of secondary windings is at least equal to the number of meters under test, plus an additional one for the reference meter connection. These voltage transformers are specifically manufactured and calibrated for this purpose and the accuracy is typically matched to within 0.1% for each secondary winding.



If multi-tariff meters are to be tested, the energising voltages for the tariff relays also must be galvanically isolated. In this case the voltage transformer requires the addition of a relay with a separate switching contact for each of the secondary windings. The exact connection of the transformer in this case depends on whether the control of the tariff relay in the meter is made by switching the live or the neutral connection.



As with most high accuracy voltage transformers, these MSIVTs are specified for only one nominal voltage.

If single-phase meters with different nominal voltages are to be tested on the same test equipment, additional transformers for the appropriate nominal voltages must be fitted.

Figure 1 shows an example of an upgraded existing three-phase meter test installation with measuring gantry and meter trolley.

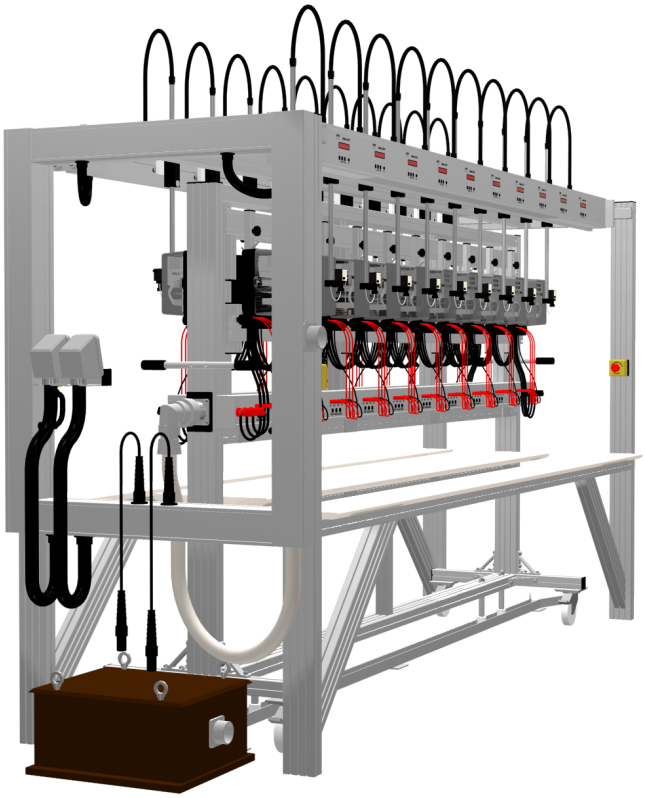


Figure 1

The upgrade consists of fitting a multi secondary voltage transformer for the appropriate number of test positions together with the additional wiring. This upgraded test system can still be used normally to test conventional meters. Figure 2 shows how a new meter trolley, specially designed for the testing of single phase meters with closed I-P links, is connected to the upgraded test system.

Typical examples of new meter test installations designed for meter testing with closed I-P links, have 20, 40, 60 or 80 test positions. They are supplied with either fixed test racks for 20 or 40 meters or in the form of a measurement gantry together with wheeled meter trolleys holding 20 or 40 meters. Unlike upgraded older systems, a new test system would be supplied with wiring already installed for future connection of a voltage isolation transformer. Therefore it is possible to add the facility to test single-phase meters with closed I-P links, as well as conventional meters, by fitting the required isolation transformer on site, at a relatively small additional cost.

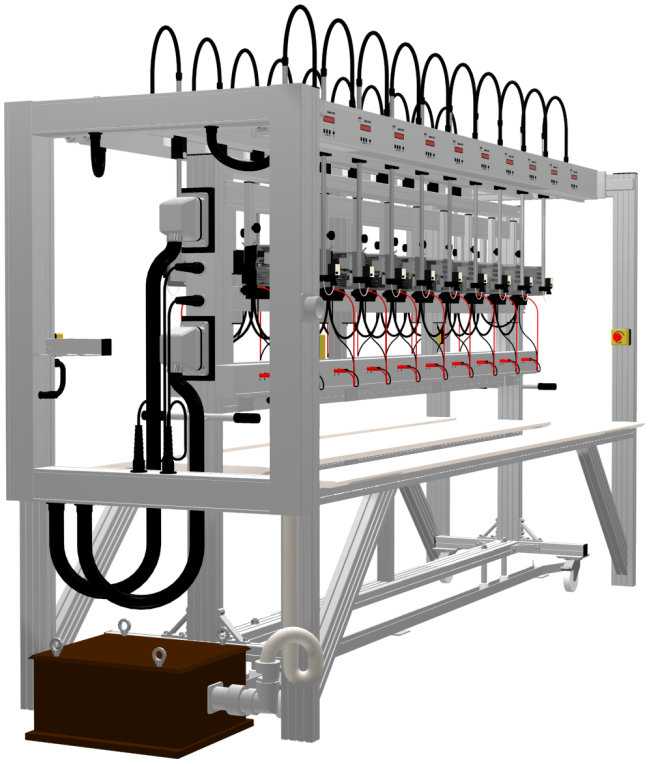


Figure 2

For additional information on testing of meters with closed I-P links, please contact MTE staff or representatives. Contact details can be found at the end of this brochure.