MEASURE THE WINDING RESISTANCE OF A THREE-PHASE MOTOR WITH A RESISTANCE METER

The measurement of the winding resistance in a running three-phase motor with the ELETTROTEST Resistance Meter requires some precautions since the single phases can influence each other reciprocally.

Typically, a 2-channel resistance meter is used, with 3 inlets and 3 outlets for power supply (for decoupling) and two measurement channels (RHM1 and RHM2), each made up of two injection (INJ) and reading (SENSE) terminals.

The measurement requires injection on the load and reading in two possible points: on the load (measurement at 4 wires)
or directly on the instrument (measurement at 2
wires).
The choice of one measurement or another depends on the type of precision you want to have, as well as the connections available. In the case of a 2-wire measurement, the value to be read also includes the resistance of the connection cables, and in the case of a 4-wire measurement, the value to be read is only that of the load.

It is possible to analyse the different configurations according to the type of three-phase motor connection, with 4 highlighted here.

1. Starred connection
2. Starred connection with star centre available
3. Chain-linked connection
4. Special chain linked connection

1. Starred motor connection

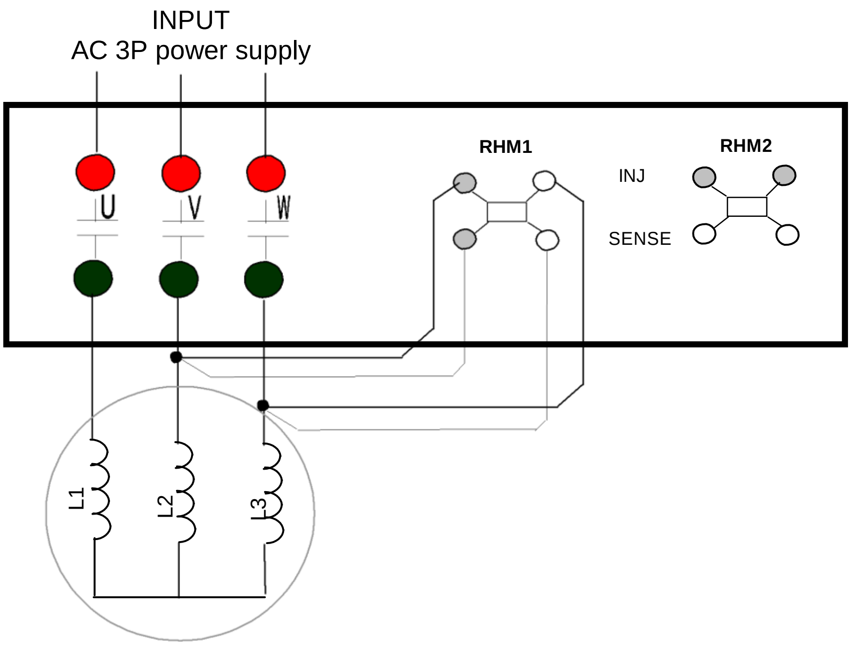

Fig. 1: Layout of measurement with 4-wire star load

In this configuration it is NOT possible to connect the two measurement channels simultaneously, as they would influence each other.

The measurement provides a sum of the single phases:

$$R_{HM1} = R_{L2} + R_{L3}$$

and in the event of a balanced load, the value is

$$R_{HM1} = 2 \cdot R_{L2} \quad \text{and} \quad R = R_{L1} = R_{L2} = R_{L3} = \frac{R_{HM1}}{2}$$

2. Star motor connection with star centre available

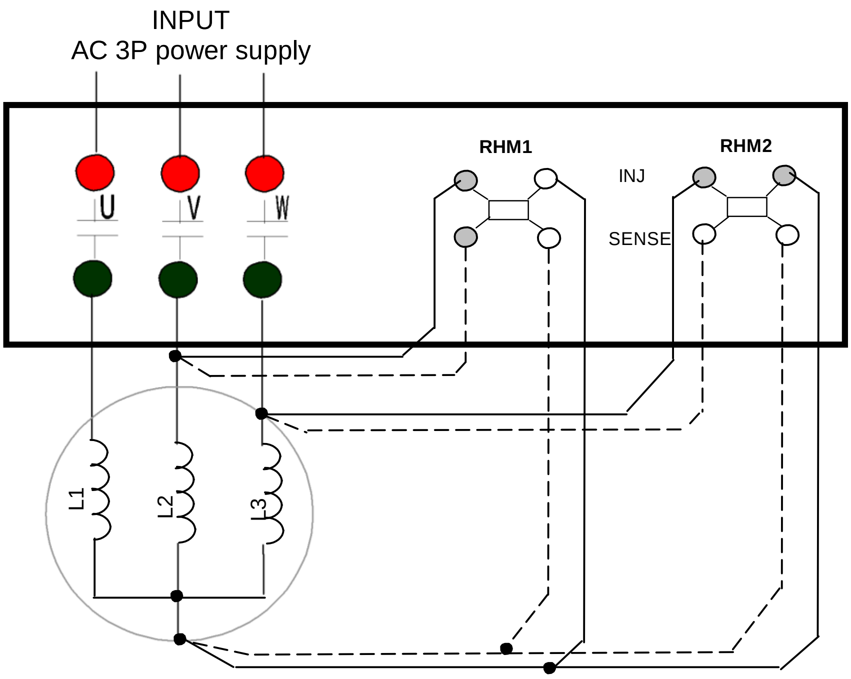

Fig. 2: Layout of measurement with star load and star centre available with 4 wires and two channels

In this configuration it is possible (though not required) to connect the two measurement channels simultaneously, using a common measurement point.

The measurement provides the resistance value of the phase in question (in the case described in figure 2)

$R_{HM1} = R_{L2}$ a $R_{HM2} = R_{L3}$

If the load is balanced, simply read the resistance of the phase and the others are equal.

3. **Chain-linked** connection

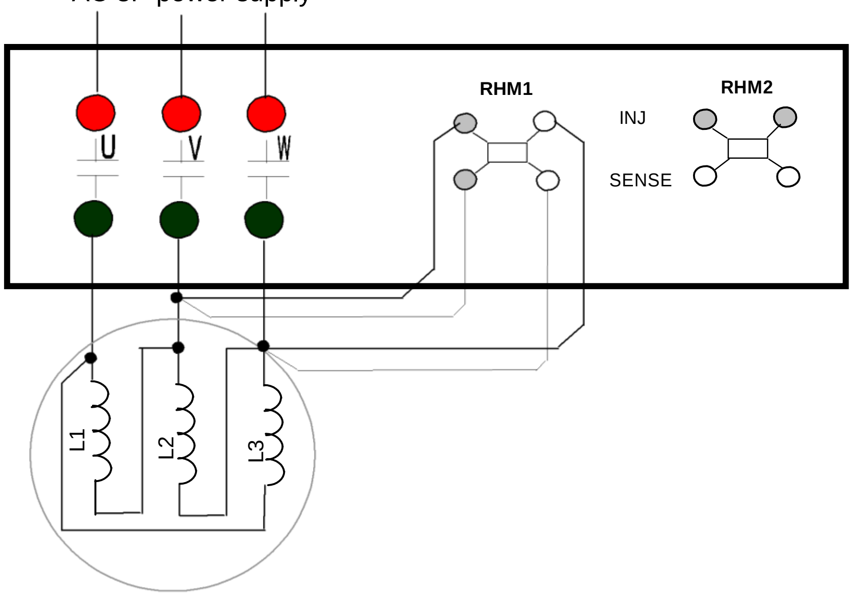

Fig. 3: Layout of measurement with 4-wire star load

In this configuration it is NOT possible to connect the two measurement channels simultaneously, as they would influence each other.

The measurement provides a very unique resistance value, since series and parallel resistors intervene.
In the case of figure 3 we have:

$$R_{HM1} = R_{L2} // (R_{L1} + R_{L3})$$

and in the event of a balanced load, the value is

$$R = R_{L1} = R_{L2} = R_{L3} = R_{HM1} \bullet \frac{3}{2}$$

4. Special Chain-linked Connection

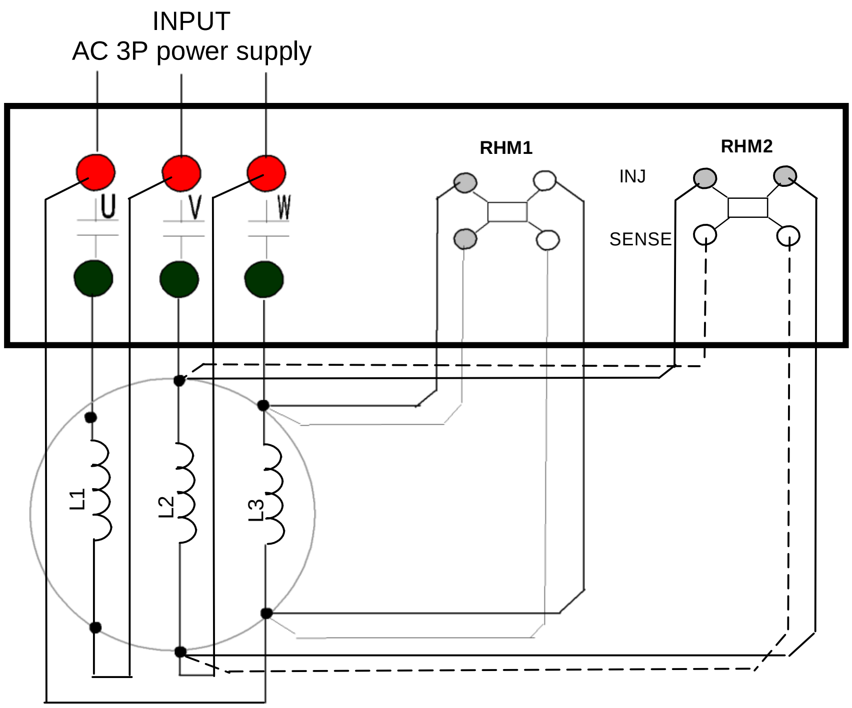

Fig. 4: Layout of measurement with 4-wire star load

In this configuration it is possible to connect two measurement channels simultaneously, each on one phase. The single phases are decoupled from each other by the resistance meter input system.
The load must have all the phases to be connected available as in figure 4.

The measurement provides a resistance value equal to that of the phase being measured
In the case of figure 4
we have:

$R_{HM1} = R_{L3}$ a $R_{HM2} = R_{L2}$