



Device for supplying power to measuring sensors and
transmitting a synchronous clock signal thereto

Description

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The invention relates to a device in accordance with the precharacterizing clause of claim 1.

10 Low-voltage switchgear assemblies require measuring sensors which measure the voltage and the current within the switchgear assembly. These measuring sensors are at operating potential, with the result that the measurement methods generally used in switchgear assemblies are based on converting the output variable
15 of the sensors, via magnetic converters, into a measurement signal with no DC level, which is then digitized centrally and further-processed. Measurement methods which detect the measured variable directly on the primary side, for example shunts, or measurements
20 which are based on shunts, are hardly used.

The magnetic converters which are predominantly used for measuring current and voltage in three-phase systems have, on the secondary side, principle-based
25 nonlinearities and phase shifts in comparison with the input signal. This results, in particular in the case of vectorial evaluation of current and voltage in the three-phase systems, in measurement errors.

30 In order to carry out a precise measurement of current, voltage and temperature within, for example, starter modules (for starting motors), measurement modules have been developed which measure directly on the power side. The isolation from the measurement circuit takes
35 place only once the measurement data have been digitized.



- 2 -

In order to be able to calculate the power or a ground-fault current in the three-phase systems, sampling of the measured variables which is synchronous in time is required in all three phases. If, as is generally conventional, a quartz oscillator is used on each measurement module for clock generation, differences in the sampling time result from the tolerance of the quartz crystals and their uncorrelated phase angle with respect to one another. Since, in the case of use in low-voltage switchgear assemblies, a dielectric strength of a few kV is required for the measurement circuits with respect to one another, there is a not inconsiderable degree of complexity in terms of circuitry in order to distribute a centrally produced reference clock signal between three measurement modules in isolated fashion.

The object of the invention is to provide a device of the type mentioned at the outset in order to achieve synchronization of the measurement module clocks by means of arrangements which are already provided.

This object is achieved according to the invention by the features of claim 1.

According to the invention, a quartz-controlled clock generator is in this case provided, whose output signals are fed to the switched mode power supply, with the result that the clock frequency of the switched mode power supply output signals is the same for the primary sides of the transformers, the frequency being within the working range of the transformers.

In the device according to the invention, it is therefore possible to use the switched mode power supply which is already provided for supplying power to three measurement modules in isolated fashion in order

- 3 -

to achieve synchronization of the measurement module clocks via the same arrangement.

In accordance with an advantageous configuration of the invention, the secondary sides of the transformers can be connected to in each case one circuit arrangement, with which the edge signals of the clock frequency of the primary sides are recovered. This means that the signals which are output on the secondary sides of the transformers are brought into the original, primary-side form.

Furthermore, a further circuit arrangement is provided to which the edge signals can be fed and which feeds the frequency of the edge signals, multiplied, to the measuring sensors.

Further advantageous configurations of the invention and further improvements are described in the further dependent claims.

The invention as well as further advantageous configurations and improvements of the invention and further advantages will be explained and described in more detail with reference to the drawing, which schematically illustrates an exemplary embodiment of the invention and in which:

the single figure shows a schematic interconnection of the device according to the invention.

The device comprises a switched mode power supply 10, whose output signals are fed to a number of transformers 11, 12 and 13 which corresponds to the number of phases where measurements take place. The switched mode power supply 10 is designed using known technology, preferably using flyback topology. On the

- 4 -

secondary side, the output voltage of the transformers 11, 12 and 13 is rectified via diodes 14, 15 and 16 and in each case fed to a circuit arrangement 20, 21, 22, which stabilizes the rectified voltage and makes it
5 available as an output voltage between the terminals 23, 24; 25, 26; 27, 28; these output voltages are used for the power supply to sensors (not illustrated in any more detail).

10 An oscillator circuit arrangement 29 is associated with the switched mode power supply 10, and its output signals are fed to the switched mode power supply 10 in accordance with the arrow direction 30, with the result that the output signals of the switched mode power
15 supply which are fed to the primary side of the transformers 11, 12 and 13 are clocked.

Further circuit arrangements 17, 18, 19, in which the edge signals of the secondary-side output signals are
20 detected, are located between the secondary side of the transformers 11 to 13 and the circuit arrangements 20 to 22, with the result that the clock signals are again matched to those of the oscillator circuit arrangement 29. On the secondary side, the edge signal of the
25 primary clock is therefore recovered.

The signal information recovered in the circuit arrangements 17, 18 and 19 is fed, via signal lines 31, 32 and 33, on each measurement module for phase-locked
30 synchronization, to a PLL circuit arrangement 34, 35 and 36, as a result of which an output signal 37, 38 and 39 is produced whose frequency is a multiple of the input frequency and can therefore act as a clock signal of analog-to-digital converters of the measurement
35 modules.

The clock signals of the three measurement modules are therefore coupled to one another in phase-locked

fashion and therefore make it possible for the measured variables to be sampled in clock-synchronous fashion in all three measurement modules.

- 5 The abbreviation PLL means a phase-locked loop circuit arrangement.

The transformers 11, 12 and 13 can also be replaced by a series circuit comprising two part-transformers, as a
10 result of which the required dielectric strength is achieved. It is naturally also possible for only one single transformer to be provided which has three secondary windings, whose output signals are each
15 rectified via the diodes 14, 15 and 16 and further-processed by the other circuit arrangements.

Patent claims

1. A device for supplying power to measuring sensors and transmitting a synchronous clock signal thereto, in particular for a low-voltage assembly, having a switched mode power supply, whose output signals are transmitted to the measuring sensors via transformers used for isolation purposes, characterized in that a quartz-controlled oscillation circuit arrangement (quartz-controlled clock generator) is provided, whose output signals are fed to the switched mode power supply (10), with the result that the clock frequency of the switched mode power supply output signals is the same for the primary sides of the transformers (11, 12, 13), the frequency being within the working range of the transformers (11, 12, 13).

2. The device as claimed in claim 1, characterized in that at least two series-connected part-transformers are provided.

3. The device as claimed in claim 1, characterized in that a transformer is provided which has three secondary windings.

4. The device as claimed in one of the preceding claims, characterized in that the secondary sides of the transformers can be fed by means of rectifiers (14, 15, 16) to a second circuit arrangement (20, 21, 22), in which the rectified secondary-side signals can be or are stabilized.

5. The device as claimed in one of the preceding claims, characterized in that the secondary sides of the at least one transformer are connected to in each case one first circuit arrangement, with which the edge signals of the clock frequency of the primary side are recovered.

6. The device as claimed in one of the preceding claims, characterized in that a further circuit arrangement (34, 35, 36) is provided to which the edge
5 signals of the first circuit arrangements (17, 18, 19) can be fed and which feeds the frequency of these signals, multiplied, to the measuring sensors.