ABOUT PRECISE POWER METERS AS ETALON IN A POWER TRANSDUCER TEST SYSTEM

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The article describes the requirements for the power meters when are used as reference in a test equipment for measuring, qualifying and calibration of the various power transducers (voltage, current, reactive and active power or energy). The emphasis is on the integration of the power meter in a system being developed in the laboratory of semiconductor circuit engineering

1. INTRODUCTION

Measurement transducers of electrical quantities - power energy, voltage and current in single and three phase power systems are very common in appliance of power engineering. The testing and qualifying process is at main importance. The test systems are needed in the factories for initial testing and calibration of the transducers, and also in approving laboratories. The opportunity for the simultaneous test of the several transducers at the same time is increasing the efficiency of the approving process.

The main component of the power transducers test systems is the reference meter, used as etalon for measuring the test conditions. The requirements for the reference meter, its application in test system being developed in our laboratory are the points of main concern in this article.

2. BUILDING TEST SYSTEM

Typical test system consists of load device, reference meter and host controller, as is shown in fig.2. The outputs of the tested transducers are compared with results from the reference meter in the host controller module, which also gives the test conditions to the load device.

When we using as reference the transducer from the same type as tested units, it is possible to compare output of the each unit with its output as is shown below:

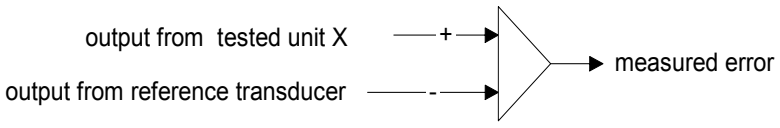

fig. 1

This is applicable when the test system is designed for test of particular type of transducers, but when we use a precise meter the data must be read via communication interface of the chosen power meter.

Frequently used power transducers outputs are:

1) Frequency: the output is square wave with frequency proportional to the input quantity. This output is used mainly in energy meters, but also in some specific current and voltage transducers.

2) Analog value - current: some transducers have current outputs with range [-5mA; 5mA] (or [0; 5mA] when the measured quantity is always positive). This is old fashioned kind of output but still in use.

3) Analog value - voltage: some transducers output DC voltage proportional to the input quantity.

4) Digital: most of electronic power and energy meters have communication interface for reading the measured values and for writing calibration data. There are various interfaces, but most common in use is asynchronous serial interface, sometimes opto-coupled.

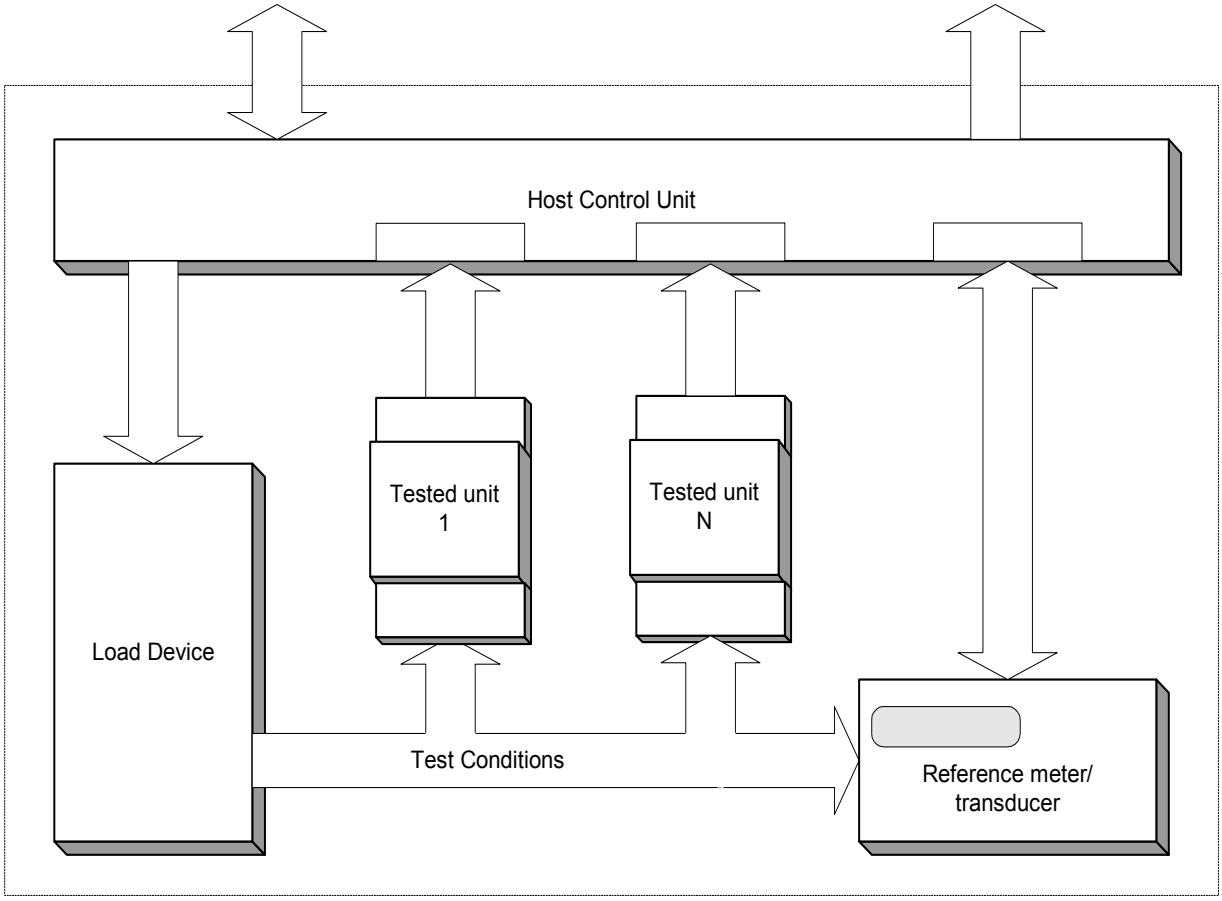

fig. 2

However, it is most common that the reference meter has different kind of output than tested transducers, so the host controller must put together the immediate data from tested units and test conditions measured with reference meter, read via communication interface with time stamp.

3. REFERENCE METER REQUIREMENTS

When the power meter is used as reference (etalon), it must satisfy the following requirements:

1) Precision**:** most of measured transducers have a precision class 2, 1, 0.5, in some cases 0.2 and 0.1, so the reference with class 0.05 will be sufficient for the all widely spread transducers. However, the precise power meters are not cheap, but the test system becomes more universal.

2) Three phase metering: The reference power meter must measure three phase voltage and currents, active and reactive power, power factor and the phase frequency with suitable precision. It must have auto/or manual range switch, allowing measuring of small, medium and large currents (from hundred mA up to hundred A).

3) Frequency output: The most common case is testing of energy meters with class 0.5, 1.0 and 2.0, single or three phases. These meters usually have a led, pulsing proportional of measured power, so frequency output with changeable multiplier is an advantage, allowing facile test with counting the pulses from measured unit and reference.

4) Communication interface: RS232 serial interface is most common and easy for realization, but there are new possibilities - USB, firewire, etc. Using the standard interface allows easy integration of the reference meter in the system only with software driver update, which makes test system very flexible and adaptive to the particular needs.

5) Gated input: In some cases the measurement must be done after setting of the test conditions, so the gate input is needed. It allows synchronized measure of stabilized test conditions. Use of the communication interface for this purpose will cause delay which may corrupt measurement accuracy.

When used in portable systems the weight and durability of the precise meter are also a factor.

4. DESINGING THE REFERENCE METER

A power meter developed in the laboratory is planned for use in the test system, it is build for a previous application, and needs little modifications in view of communication capabilities. Its structure diagram is shown in fig. 3

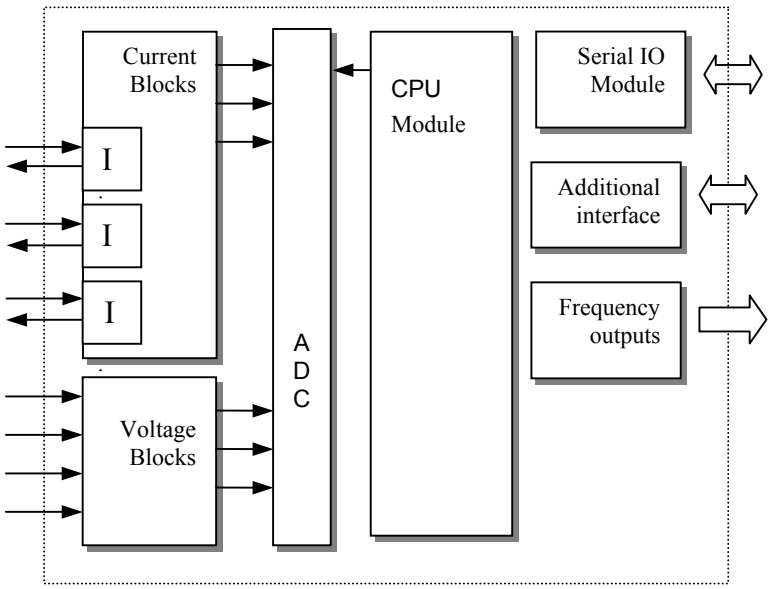

fig. 3

The four frequency output must be added – three for every phase power and one for total power, with variable multiplier rate. The communication interface must be flexible – standard asynchronous with selectable bit rate and ASCII character set used instead of values binary codes. A display with some of the measured values and parameters is also desirable.

5. CONCLUSION

The precise power meter extends the application area of the test system. Its precision is of most importance together with flexible communication interface. Wide-range digital meter with precision of 0.05% - 0.02% are generally used. The reference can measure all the various parameters required almost simultaneously, allowing all test to be carried out using a single instrument. It can also be installed in any existing meter test station without any additional capital outlay for other modernization.

6. REFERENCES

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