MEETING NEW STANDARDS IN STANDBY POWER MEASUREMENT

Stand-by power consumption is becoming a growing problem. Various standardisation bodies are trying to tackle the issues around it, and manufacturers are beginning to respond. By **Hafeez Najumudeen** from Yokogawa Europe

A variety of market trends are contributing to the direction and development of the latest generation of test and measurement products. Many segment

Today's developed world has become dependent on electric power, which has become the main fuel for driving the economy. Developments in electrification and computerisation have increased everyone's dependence on electricity and, thus, the conservation of energy has become a key motivation factor for all the world's nations.

In the recent past, as part of this drive to improve energy efficiency, a new phenomenon called "standby power" has come to everyone's attention. Standby power is the energy consumed by appliances when they are not performing their main function or when they are switched off.

This is not to be confused with the related issue of "off mode" power, which occurs when the product is connected to the main power supply and is switched off. In this mode the equipment does not offer any functionality.

A growing number of electrical devices – especially domestic appliances – are designed to draw power 24 hours a day, seven days a week. Many people are not aware of the fact that these modern-day home appliances consume power both for standby functions, like built-in clock, memory and displays for settings and other information, and when they are completely turned off. A classic example is the usage of DVD players at home. Typically, DVD players are used around only 5% to 10% of the time – the rest being in standby mode. Possibly only 15-20% of the power consumption is during actual operation and the remaining 80-85% of the power consumption is when the DVD player is in standby mode. Therefore, it is important for users to have a clear understanding of this fact and the financial benefit they can get during the overall life cycle of the products.

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INITIATIVES FOR SAVING POWER

Standby power and "off mode" power have become a global concern over the past decade. It is estimated that between 5% and 15% of residential electricity used in the Organisation for Economic Cooperation and Development (OECD) countries are attributed to standby power consumption. According to the International Energy Agency (IEA), this is the equivalent of about 240 million tonnes of carbon dioxide every year. This clearly indicates the importance of reducing the power consumption in standby and "off" modes.

There is an increasing penetration rate of equipment featuring standby and/or "off" mode in the EU. It is expected that by 2020 this will result in approximately 4.6 billion products featuring standby and/or "off" mode, which will contribute around 50TWh of electricity consumption per year when operating in these modes. This amount is equal to the total electricity consumption of a country like Greece or Portugal.

In order to achieve optimum energy efficiency, several initiatives have been initiated in the EU to establish standards for standby power levels, something that, in turn, requires the development of techniques for accurately measuring these low power levels. The IEA has launched a 1W standby initiative and is expected to decrease this threshold to 0.5W by 2013. The challenge of achieving this threshold can be seen when one considers that the typical standby/off-mode power consumption levels of today's household electrical appliances can be as much as several watts.

The IEA Selina project carried out a large-scale monitoring campaign to characterise the low-

THE IEA

THE INTERNATIONAL ENERGY AGENCY (IEA) (HTTP://WWW.IEA.ORG/) IS AN AUTONOMOUS ORGANISATION WHICH WORKS TO ENSURE RELIABLE, AFFORDABLE AND CLEAN ENERGY FOR ITS 28 MEMBER COUNTRIES AND BEYOND.

Founded in response to the 1973/4 oil crisis, the IEA's initial role was to help countries co-ordinate a collective response to major disruptions in oil supply through the release of emergency oil stocks to the markets.

While this continues to be a key aspect of its work, the IEA has evolved and expanded. It is at the heart of global dialogue on energy, providing authoritative and unbiased research, statistics, analysis and recommendations.

Today, the IEA's four main areas of focus are:

- **Energy security: Promoting diversity, efficiency and flexibility within all energy sectors.**
- **Economic development: Ensuring the stable supply of energy to IEA member countries and promoting free markets to foster economic growth and eliminate energy poverty.**
- **Environmental awareness: Enhancing international knowledge of options for tackling climate change.**
- **Engagement worldwide: Working closely with non-member countries, especially major producers and consumers, to find solutions to shared energy and environmental concerns.**

Figure 1: A new power measurement software package for the Yokogawa range of precision power analysers provides a complete solution for the testing of standby power in accordance with the latest IEC62301 Ed.2.0 (international) and EN50564:2011 (European) standards

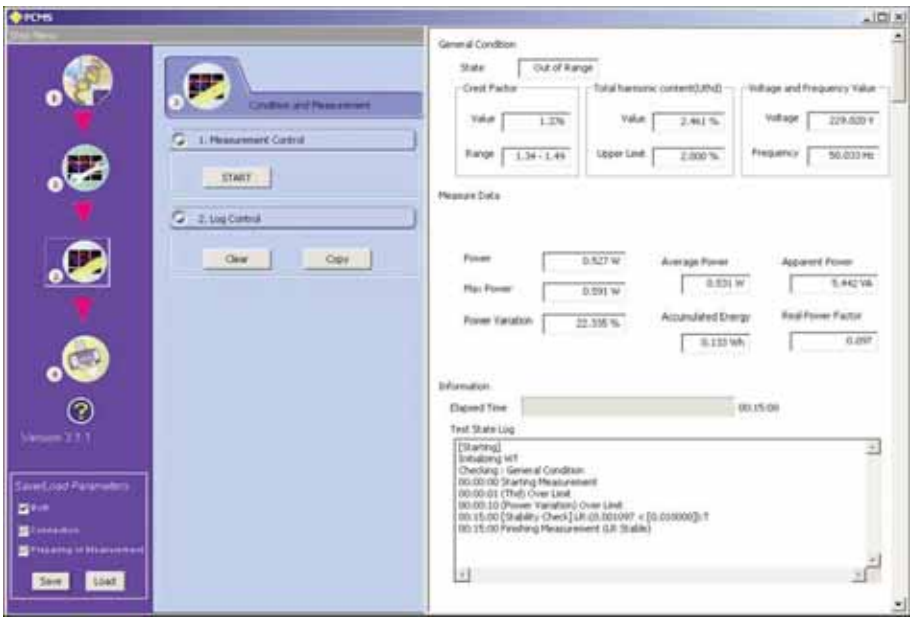
power modes of new appliances sold in the EU. It was found that 18.5% of the household equipment had a measured off-mode power that did not comply with the EU's 1W threshold target. This percentage is expected to increase to 41.5% if the threshold is brought down to 0.5W by 2013. With respect to the standby mode, it was found that 31% the household equipment did not comply with the 1W threshold, and this percentage is expected to increase to 66.4% if the threshold is brought down to 0.5W by 2013.

If the power consumption of these products could be reduced to between 0.5W (off mode) and 1.0W (standby mode), it is estimated that the resulting electricity consumption in standby/off mode in 2020 could be reduced to about 15TWh. This represents a reduction of approximately 35TWh, which is almost the same as the total electricity consumption of Denmark.

Unfortunately, many consumers are not aware of, or concerned about, the energy efficiency of the products they buy. When making purchases, they often consider other parameters before making their decisions. It is therefore down to the manufacturers to play the key role in developing an understanding of the importance of these thresholds and keeping the focus on the energy efficiency aspects. In addition, the ability to comply with the international standards and eco-friendly initiatives can differentiate these manufacturers in the marketplace and offer a competitive advantage.

Recognising the importance of standby power consumption and the energy efficiency issue, the International Electrotechnical Commission (IEC) has been actively preparing an international standard for the measurement and reduction of standby and "off" mode power. The committee has recently released the second edition of its International Standard IEC 62301 (Household electrical appliances – Measurement of standby power). The European CENELEC Technical Committee TC59X has also prepared a European Standard: EN 50564:2011 (Performance of household and similar electrical appliances), covering similar ground.

Figure 2: The power measurement display allows the user to view all the measurement details according to the standard and provides the option to copy the actual test conditions



These standards ensure that power efficiency is incorporated into all the key stages of a product's design and manufacture. In particular, they define the relevant test conditions and measurement methods for the accurate measurement of power in standby and "off" modes.

MEASUREMENT CONDITIONS

The IEC standard specifies methods of measurement of electrical power consumption and the reporting of the results for a range of electrical and electronic household and office equipment, particularly at the low power levels (of the order of a few watts or less) consumed in standby or "off" modes. The results from these tests may also be of assistance in determining the energy efficiency of products in conjunction with other, more specific, product standards.

A number of different measurement modes for determining power consumption are specified in the IEC and EN standard:

- **Sampling method:** In this mode an instrument is used to record power measurements at regular intervals throughout the measurement period. The measurement intervals should be not more than one second for the specified minimum

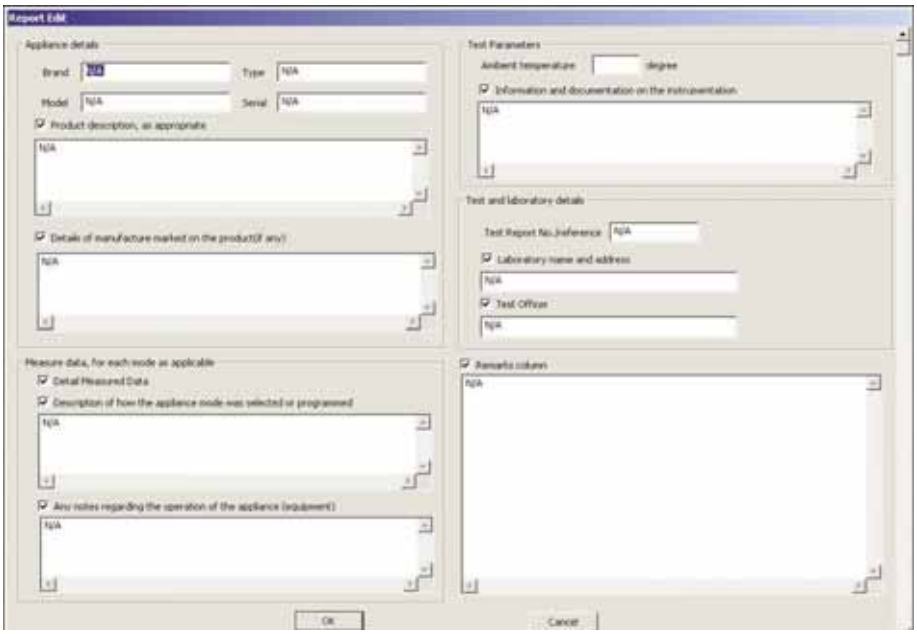


Figure 3: With 'Report text entry' users can enter comments and details in pre-formatted fields about the product under test and the test conditions

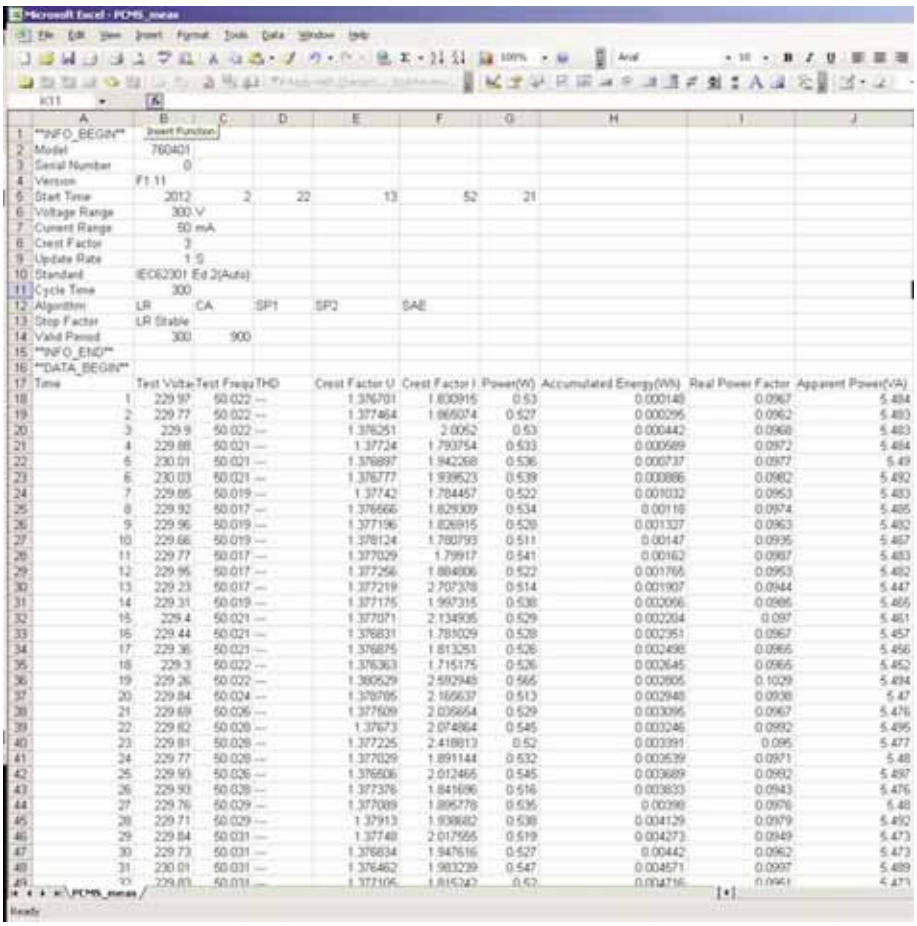


Figure 4: In 'CSV file generation' the raw data of the test is saved and enables the user to cross-verify the output of the report

period. The data from the first one-third of the total period is always discarded. The stability check is performed only with the second two-thirds of the total period. Sampling is the preferred method of measurement for all modes and product types under this standard. In addition, for modes where power varies in a cyclic fashion or is unstable, or for limited duration modes, sampling is the only measurement method permitted under the standard.

- **Average reading method:** This mode, which is used where the power value is stable and the mode is stable, involves averaging the instrument's power readings over a specified period or recording the energy consumption over a specified period and dividing by the time. When the stability cannot be achieved with comparison periods of 30 minutes duration each, the sampling method is used.
- **Direct meter reading method:** again used where the power value is stable on the power meter and the mode is stable. The product is allowed to operate for at least 30 minutes and, if it appears to be stable, then the power measurement reading is taken from the instrument.

The new IEC and EN standards delve deeper into the set-up procedures and stability requirements for all measurement methods. They also cover the measurement uncertainty requirements for power measuring instruments, especially for loads with high crest factor and low power factor.

POWER MEASUREMENT SOFTWARE

Recently has been made possible to carry out standby and "off mode" power testing to establish compliance with these standards. This revolves around new power consumption measurement software designed for use with the Yokogawa range of digital power analysers. The solution enables manufacturers to test the compliance of their products according to the IEC or EN standards.

The interpretation, calculation and implementation to comply with the IEC or EN standards can be a complex and time-consuming process for manufacturers. The new standby power consumption measurement software offers functions that include communications between the host PC and the relevant Yokogawa instrument, a user-friendly interface, measurement of power data as defined in the standards, report preparation and production, and saving to the appropriate storage medium.

Electrical parameters measured include total harmonic distortion, crest factor, voltage, frequency, power variation and accumulated energy. In addition, although they are not required by the standard, apparent power and power factor are also measured as reference values.

The software is easy to install and needs minimum training in order to carry out measurements. The software uses both the sampling method and the average reading method defined in the standards, and provides a measurement time check.

It offers two modes of operation: the "auto" and "manual" mode. In "auto" measurement mode, the software checks data stability every ten seconds, carries out the measurements in the shortest possible time and executes the algorithms according to the IEC62301 Ed.2.0 and EN50564:2011 standards. It reduces the complex calculations involved, and provides simple and easily understandable reports. A text entry function

Appliance(equipment) Details

<Product description>
N/A
<Details of manufacture marked on the product>
N/A

Item	Appliance	Equipment
Brand	N/A	YOKOGAWA
Model	N/A	760401
Type	N/A	Firmware Ver.F1.12
Serial Number	N/A	0
Rated voltage / frequency	230 V / 50 Hz	-
Voltage Range	-	300V
Current Range	-	50mA

Test Parameters

<Information and documentation on the instrumentation>
N/A

Item	Data
Name of mode	N/A
Mode category	Low power mode(Standby mode)
Cycle period	00:05:00
THD *(Upper Limit)	2.379 % (2.000 %)
Crest Factor *(Range)	1.375 - 1.383 (1.34 - 1.49)
Ambient temperature	
Other Ambient conditions	N/A
Test voltage / frequency	229.490 V / 50.002 Hz

Measured data, for each mode as applicable

<If applicable, technical justification of inappropriateness for intended use>
N/A
<Any notes regarding the operation>
N/A

Measured data

Item	Data
Measurement period	00:06:49 (User Stop)
Power variation *(Upper Limit)	19.884 % (5.000 %)
Max Power Value	0.689 W
Last Power Value	0.605 W
Accumulated energy	0.070 Wh
Average Power	0.613 W

Detail Measured data

Item	Data
Apparent Power	9.137 VA
Real Power Factor	0.066

Test and laboratory details

<Applicant name and address>
N/A
<Laboratory name and address>
N/A
<Test officer(s)>
N/A
<Approver>
N/A

Item	Data
Test report No./reference	N/A
Date of test	20 / 12 / 2011 09:57

Remarks column

N/A

Figure 5: The 'PDF Report' software not only provides options to input the test conditions and display the measured power values, but also includes all the necessary test measurement parameters (as per the standards) in a printable PDF format

allows information other than the measured values to be entered for incorporation in a report. The report is generated as a PDF file and the measurements are also available in .CSV format.

NOT A SIMPLE ISSUE

Standby power consumption is no longer a simple issue. Standby power has become a global concern over the past decade and the new IEC 62301 and EN 50564:2011 standards will help to ensure that power efficiency is incorporated into all the key stages of the design and manufacture of electrical appliances.

Determination of the relevant low power levels to ensure compliance with these standards requires accurate measurement and the combination of precision power analysis instruments with versatile power measurement software which will, in turn, help the industry develop products with lower standby power consumption, in compliance with the IEC standard. In doing so, they will not only help the manufacturers achieve energy efficiency but will also benefit the consumers, the economy and, last but not least, the environment. ●

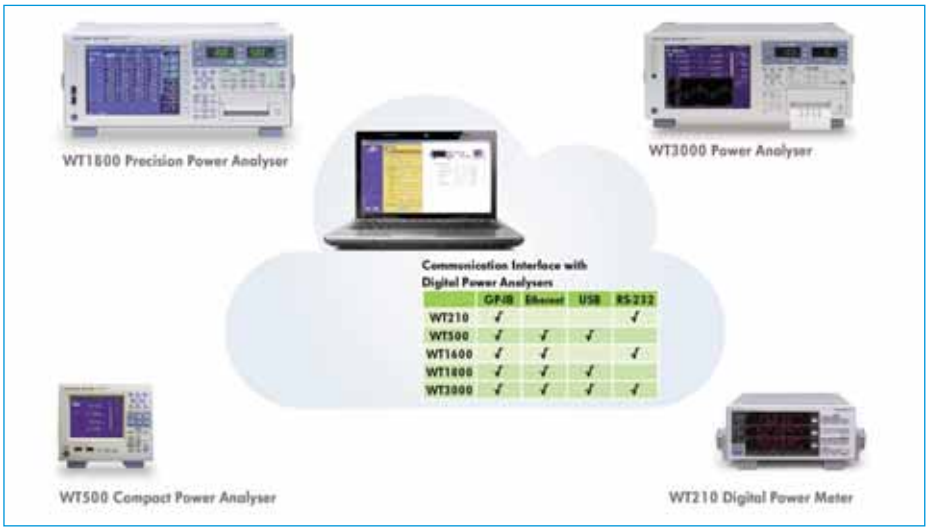


Figure 6: Interfaces available for the Yokogawa range of power analysers

SELINA

SELINA (HTTP://WWW.SELINA-PROJECT.EU/) STANDS FOR "STANDBY AND OFF-MODE ENERGY LOSSES IN NEW APPLIANCES", AND THE MAIN OBJECTIVE OF THE SELINA PROJECT WAS THE MARKET CHARACTERISATION OF THE STANDBY AND OFF-MODE ELECTRICITY CONSUMPTION OF NEW APPLIANCES IN THE MARKET.

This information has been collected by measurements in shops and by gathering manufacturers' data in each low power mode of operation.
Key goal of the project was to identify effective market transformation policies targeted at all key stakeholders involved in the manufacture, sales and operation of appliances with standby and off-mode losses. The project was also intended to identify policy recommendations to the EU with the strategic objective of a market transformation in the following areas:

- **Increase the share of energy-efficient appliances in the market and in households.**
- **Remove inefficient equipment from the market.**
- **Help in the design of future new policies that enforce limitations on standby and off-mode equipment consumption.**
- **Improve the awareness of retailers in equipment specification.**
- **Influence consumer behaviour in the selection and operation of equipment.**

ADDITIONAL REFERENCES

http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/488&type=HTML

Nederlands norm NEN-EN 50564 (en) ***Electrical And Electronic Household And Office Equipment – Measurement Of Low Power Consumption.*** **(Jun 2011)**

IEA (International Energy Agency): ***Things That Go Blip in The Night – Standby Power And How To Limit It*** **(2001)**