Application Note

Motor/Inverter Evaluation and Offline Simultaneous Analysis

IS8000 Integrated Software Platform

1. Introduction

The development and manufacturing of consumer electronics, air conditioning products, motor vehicles, and other goods, includes product planning, designing, manufacturing, and shipping inspection, during which a variety of tests are carried out before commercialization. As part of the process, a long-term continuous operation test may be performed to confirm the reliability of the products under development. It confirms whether or not the quality target values set during the design phase are achieved. If a quality problem is found in the measured results, improvement work including reviewing the design is necessary. It is also important to check if there is any abnormality in the product while analyzing in detail the waveform and power data when operating the product for a long period with the environmental conditions set. Careful verification work is required.

2. Challenges

Since the data volume of the measurement values calculated by a power meter is extremely small, the data is commonly saved continuously to a PC using data collection software. On the other hand, when transferring waveform data to a PC, a large amount of high-speed sampled data cannot be transferred to PC due to the limited transfer rate of the communication interface. In such cases, the file names of the power meter data and the waveform data are set in association with each other to facilitate the report creation process. It is a requirement to carefully name the files, making sure to provide the correct time and date or conditions to the file names.

If an engineer wants to measure the waveform data continuously without omission, the data may be saved directly to the internal hard disk drive (HDD) built in the waveform measurement instrument and transferred to a PC after the data acquisition is completed. After the measurement, the data is checked while checking the correlation between the power data and the waveform data. In any of the ways described above, the waveform data and power meter data need to be acquired from the corresponding instruments.

In long-term measurement, it is necessary to carefully check if there is a problem with the waveform or power values while performing a continuous measurement. Ideally, it is desirable to check the power meter data while checking the waveform shape continuously. However, since a high-speed sample rate is required to correctly capture a high-speed switching signal such as an inverter that includes a carrier frequency, a large amount of high-speed sampled data cannot be transferred to a PC. If the sample rate is lowered, the problem occurs that the correct waveform cannot be captured.

It would be efficient if an engineer could check the waveform for any abnormal data and see if there is a problem by comparing the waveform with the power values during measurement, but during the continuous measurement, the data is being written to a file and the file cannot be opened. Thereby, the data is unable to be analyzed. A post-analysis may be performed after long-term data observation, but the work efficiency is very low. Simultaneity between high-speed data transfer and data analysis has become an issue.

3. IS8000 Solution

- Integrated file management by project file saving
- Improved efficiency by DL950 10 Gbit high-speed data transfer
- Analysis of divided file data during continuous waveform saving
- IEEE1588* time synchronization of DL950 and WT5000
- Data checking and operation by online monitor
- Automatic report creation using waveform and power meter data

4. IS8000 Solution (Detailed descriptions)

4.1 Integrated file management by project file saving

The IS8000 integrated measurement platform can manage individual files as one project file. This eliminates the need to save a waveform data file and a power data file with the same name in order to associate them with each other or the need to manage files by creating a folder for each measurement data and storing a waveform file and a power data file in that folder.
A data file can be divided into segments by specifying the length of time. The data for an entire measurement period and the date of the period to be analyzed during the measurement can be saved as separate files. For example, when measuring for 24 hours, the user can divide the file into one-hour segments and analyze the data of the segments where the measuring process is finished while continuing the measurement.

After the measurement is completed, the file for the entire measurement period and the divided files can be managed as a project file. Measurement using two DL950s or measurement using the DL950 and WT5000 can also be managed as one project file. There is no need to associate file names even in the measurement with the DL950 and WT5000 which strongly supports the improvement of development efficiency.

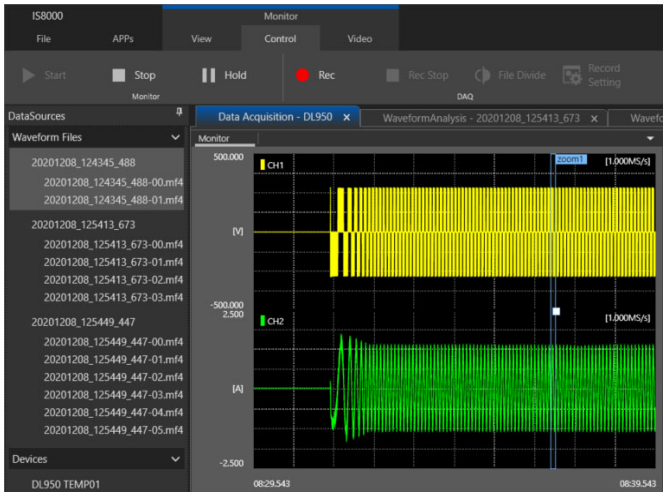

Figure 1. Integrating a project file and divided files

4.2 Improved work efficiency by DL950 10Gbit data transfer

With the 10G Ethernet interface option (/C60), the ScopeCorder DL950 provides 10 Gbps high-speed data transfer*. While the conventional model DL850E provides PC streaming at 100 kS/s (16ch), the DL950 offers 100 times faster data transfer at 20 MS/s (8ch), allowing measured data to be displayed on the PC software in real time. In inverter measurement, the switching frequency is a high-speed signal and needs to be captured at a high speed. The DL950 transfers data continuously to a PC at up to 20 MS/s, so that the data can be output without interrupting the test. There is no need to wait minutes just for data transfer to complete.
Furthermore, by combining with the WT5000 high-precision power analyzer, it is possible to achieve the industry's first performance and function that enable high-precision power measurement with power traceability in synchronization with high-speed waveform data.

*HiSLIP communication: High-Speed LAN Instrument Protocol, which enables data transfer that is theoretically 10 times faster than 1000BASE-T (1Gbps).

* DL950 10 Gbps Ethernet (/C60 option) is required

*The transfer rate for USB 3.0 communication is 64 MB/s.

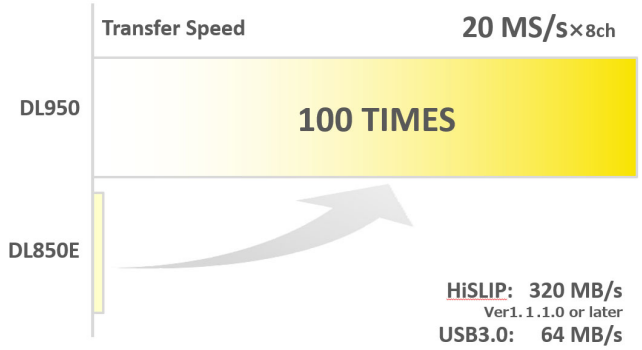

Figure 2. Data transfer comparison between DL850E and DL950

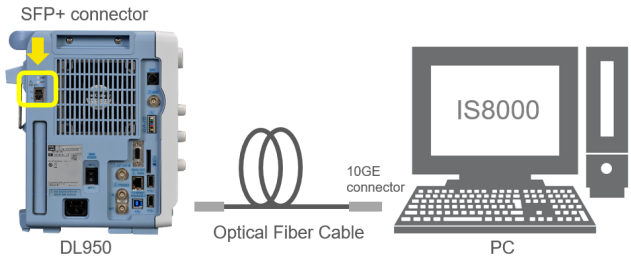

Figure 3. The connection between a DL950 and a PC

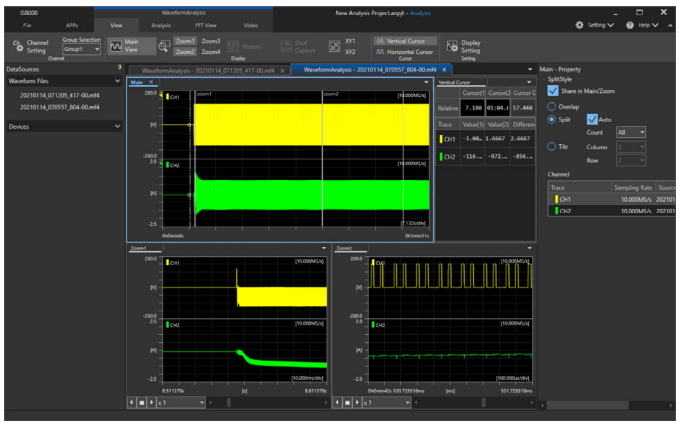

Figure 4. DL950 10MS/s×8ch data transfer measurement screen

4.3 Analysis of divided file during continuous data saving

Generally, the data is continuously written to a file during waveform data recording. In some cases, the user may want to display the waveform that has been measured on the screen while continuing long-term testing. Checking the reliability of data and analyzing it at the same time requires the user to wait until the end of the test, resulting in poor work efficiency.
The IS8000 integrated measurement platform removes this inconvenience. The measurement data is usually stored as one file, but the IS8000 integrated measurement platform allows the measurement file to be divided and saved while continuing the measurement. The divided files can be checked even in the middle of measurement (offline analysis). The data can be handled as one project file after measurement, and so there is no inconvenience of divided files.
When acquiring data from a waveform measurement instrument and power meter, the measured data are usually stored in their respective file formats. This makes it not easy to display the measured data with their time or time axis information synchronized.

The IS8000 integrated measurement platform can manage individual files as one project file. This eliminates the need to save a waveform data file (CAN data may be included.) and a power data file with the same name to associate them with each other or the need to manage files by creating a folder for each measurement data and storing a waveform file and a power data file in that folder.
The advantage of the project file is that it allows the user to divide a file by a specified length of time. To analyze a particular waveform during measurement, the user can divide the file at that point. After the measurement is completed, the file of the whole measurement period and the divided files can be managed as one file.
Measurement using two DL950s or measurement using the DL950 and WT5000 can also be managed as one project file.
There is no need to associate file names, even in measurement with the DL950 and WT5000 or multi-unit measurement, which strongly supports the improvement of development efficiency.

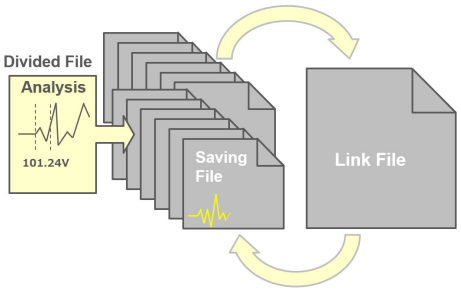

Figure 5. Integrating a project file and divided files

4.4 IEEE1588 WT/DL time-synchronized display

There are cases where power values are verified by displaying them using the waveform calculation function of a waveform measurement instrument, but highly accurate power values with traceability with a measured waveform cannot be obtained. The IS8000 integrated measurement software platform enables easy synchronized measurement by connecting the DL950 and WT5000 at the same time using IEEE 1588-time synchronization. The synchronization error of the DL950 and WT5000 is approximately 10 micro-seconds.
The power parameters of the WT5000 can be displayed on the same time axis on a PC along with the continuous waveform data of eight channels simultaneously acquired at up to 20 MS/s by the DL950. This makes it possible to display the trend of power meter data in time series together with the waveform data, allowing detection of slight fluctuations in power. It, therefore, becomes possible to check the waveform abnormality data occurring at a certain time from the power fluctuations and find the problem.

* IEEE1588 standard: a precision time protocol (PTP) used to synchronize time between devices connected on a network. PTP=Precision Time Protocol
* DL950 IEEE1588 master function(/C40 option) is required.
* The synchronization error of two DL950 is within 150 ns.
* DL950 10 Gbps Ethernet (/C60 option) is required.
* IS8000 multi-unit synchronization option (/SY1) is required for synchronized measurement of two or more units.

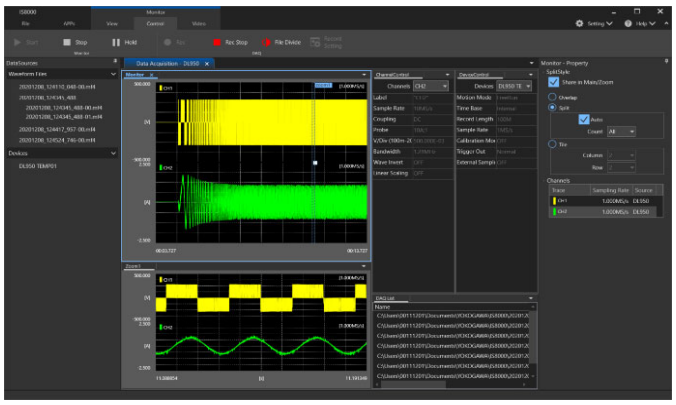

Figure 6. Waveform data monitor screen

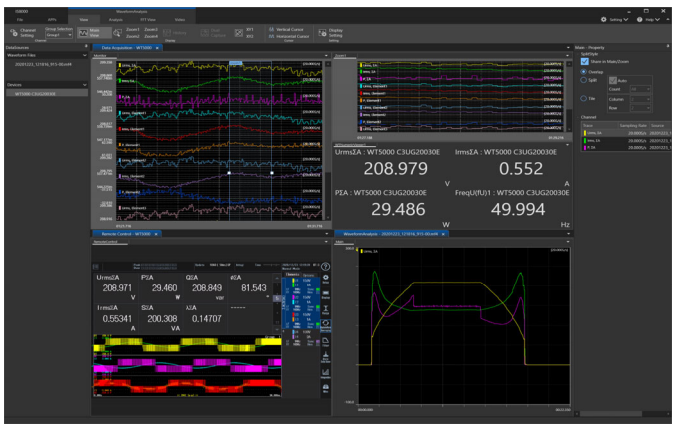

Figure 7. Power data and waveform data sync screen

4.5 Data checking and operation by online monitor

The online monitor operation allows measurement instruments to be controlled remotely from a PC via a communication interface.
The touch panel screen (control screen) of the DL950 ScopeCorder or WT5000 Power Analyzer main unit is displayed on the PC screen. A user can freely change the settings or check the measured waveform and power meter data from a PC at a remote location in the same manner as operating the measurement instrument.
There is no need to newly learn the operations of software that are different from those of the instrument main unit. The user can simply check the settings and waveform display to make sure there is no problem, then begin collecting the waveform or power meter data.
The waveform on the DL950 located away from the control room can be checked on the PC, which enables efficient data collection without the trouble of going back and forth between the test room and control room to save the waveform data or change the setting conditions.

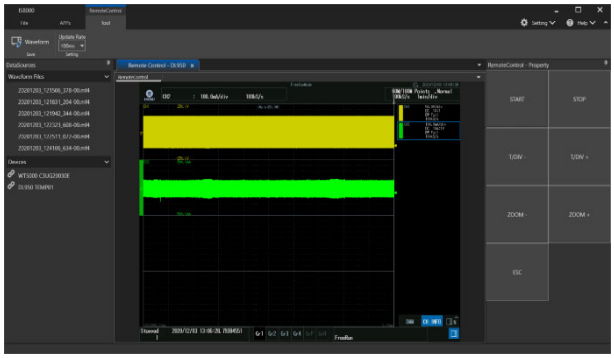

Figure 8. DL950 remote control screen

Figure 9. WT5000 remote control screen

4.6 Automatic report creation using waveform and power meter data

The automatic report creation option (/RP1) allows report creation and output on a PC.A user can easily create a report by setting the report layout (with image display) using the report creation wizard function. From the files measured or saved by the DL950 ScopeCorder or the WT5000 Precision Power Analyzer, the user can choose measurement conditions, waveform output, measurement results, or other data. The report can be output to PDF or EXCEL.

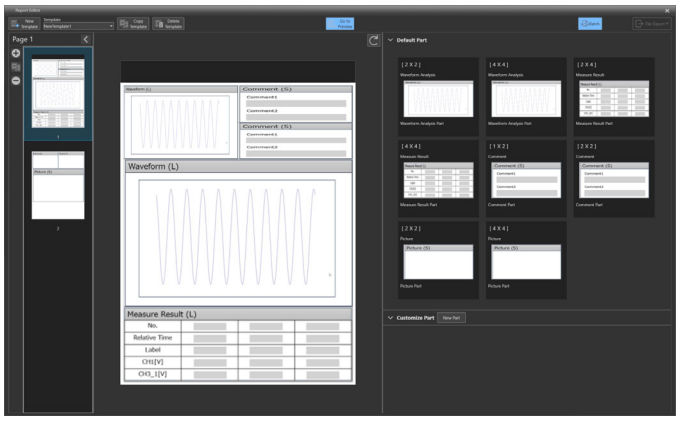

Figure 10. Report template edit screen

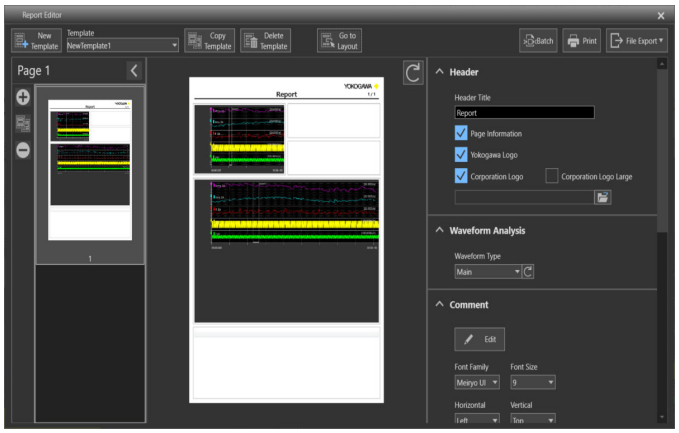

Figure 11. Report creation screen

YOKOGAWA TEST & MEASUREMENT CORPORATION
Global Sales Dept. /Phone: +81-42-690-8810 E-mail: tm@cs.jp.yokogawa.com
Facsimile: +81-42-690-8826

YOKOGAWA CORPORATION OF AMERICA	Phone: +1-800-888-6400	E-mail: tmi@us.yokogawa.com	
YOKOGAWA EUROPE B.V.	Phone: +31-88-4641429	E-mail: tmi@nl.yokogawa.com	
YOKOGAWA TEST & MEASUREMENT (SHANGHAI) CO., LTD.	Phone: +86-21-6239-6363	E-mail: tmi@cs.cn.yokogawa.com	Facsimile: +86-21-6880-4987
YOKOGAWA ELECTRIC KOREA CO., LTD.	Phone: +82-2-2628-3810	E-mail: TMI@kr.yokogawa.com	Facsimile: +82-2-2628-3899
YOKOGAWA ENGINEERING ASIA PTE. LTD.	Phone: +65-6241-9933	E-mail: TMI@sg.yokogawa.com	Facsimile: +65-6241-9919
YOKOGAWA INDIA LTD.	Phone: +91-80-4158-6396	E-mail: tmi@in.yokogawa.com	Facsimile: +91-80-2852-1442
YOKOGAWA ELECTRIC CIS LTD.	Phone: +7-495-737-7868	E-mail: info@ru.yokogawa.com	Facsimile: +7-495-737-7869
YOKOGAWA AMERICA DO SUL LTDA.	Phone: +55-11-3513-1300	E-mail: eproc@br.yokogawa.com	
YOKOGAWA MIDDLE EAST & AFRICA B.S.C(c)	Phone: +973-17-358100	E-mail: help.ymatmi@bh.yokogawa.com	Facsimile: +973-17-336100