

The Story behind the Development of DLM3000 series Oscilloscope

Part 1

This article is reproduced from the column on Yokogawa Rental & Lease Corporation's website:
https://www.yrl.com/column/tm/hiwa_dlm3000-1.html

Engineer Interview

The Story behind the Development

TOP SECRET



Our staff member interviewed the development team to learn about their struggles in the design and development process and their uncompromising approach to design and quality, which are not often shared.

Long-selling portrait design oscilloscope DLM series continues to evolve with overflowing "love for oscilloscopes" and "team strength" (Part 1)

Yokogawa Test & Measurement Corporation

Yokogawa Test & Measurement Corporation continues to produce digital oscilloscopes with unique features, such as portrait, space-saving design and long memory.

In this issue, we interviewed members of Yokogawa Test & Measuring Corporation's digital oscilloscope development team to hear about the difficulties they had encountered during development and their thoughts on digital oscilloscopes.

In part 1, they talked about the features of YOKOGAWA oscilloscopes, challenges in designing a portrait chassis, and probe development that has changed significantly following the change in user profile.



DLM3000
Mixed Signal Oscilloscope

< Part 1 >

1. What is a Yokogawa's Oscilloscope?
2. Challenges that continue because of its compactness (about the chassis)
3. Significant Changes in Needs and Probes (about probes)

< Part 2 >

4. Faster and faster (about circuit design)
5. As users change, the required "usability" is also changing. (about the user interface)
6. The DLM3000 is full of productivity-increasing features. (recommended features by development engineers)

1. What is a Yokogawa's Oscilloscope?

--- First, could you tell me about the “portrait, space saving design” of YOKOGAWA's Oscilloscope?



Makoto Endo
Manager
Software Design Group
Development & Engineering Department 1
Technical Development Division
Yokogawa Test & Measurement Corp.

Endo: Yokogawa Electric Corporation first entered the digital oscilloscope market in 1988, and the DL1200 released the following year was the first model of the portrait, space-saving designed oscilloscope. Over the past 30 years, we have worked to reduce the size and enhance the functions of our products. The latest model, the DLM3000, is the first in the series to feature a touch screen, in addition to conventional functions such as logic analyzer and serial bus protocol analysis.

--- Another feature of YOKOGAWA's Oscilloscopes is its "long memory".

Endo: The maximum memory length of the first portrait design model DL1200 was 128kB, which was a revolutionary long memory at the time. I think you can see that our predecessors were quick to recognize the user benefits of long memory. In recent years, other companies have followed suit, but it is still a major feature of YOKOGAWA's Oscilloscopes.

--- I hear that the needs for Oscilloscopes have changed since the DL1200 was launched.

Endo: In the past, the main users of oscilloscopes were electronic device manufacturers. However, with the subsequent changes in industrial structure and technology in Japan, there has been a shift, since around 2000, to users in the automotive industry and heavy electric machinery manufacturers, who deal with so-called mechatronics and power electronics. Among customers in the mechatronics fields, the “long memory”, which I mentioned earlier, has been very popular because it allows them to measure an entire series of operations. I guess you could say that the times have finally caught up with YOKOGAWA's Oscilloscopes (laughs).



DL1200
Digital Oscilloscope

2. Challenges that continue because of its compactness (about the chassis)

--- The DLM3000 is attractive because it is compact and "does not get in the way even when placed on a bench".



Hidenori Ono
Team Leader
Mechanical Design Group
Common Technology Department
Technical Development Division
Yokogawa Test & Measurement Corp.

Ono: Yes, customers appreciate that the DLM3000 allows effective use of the work area on a bench, which tends to be cramped, and that it is lightweight at 4.2 kg, making it easy to carry around. However, there is actually quite a regional difference in customers' evaluation of the design. Japanese customers are almost certain to find it attractive, but we have heard that in regions overseas where they have relatively ample workspace, they don't mind using a large, heavy oscilloscope on a dedicated stand.

--- Are there any difficulties with a compact chassis?

Ono: The design of the chassis is difficult because it is smaller than a regular Oscilloscope. But, the latest DLM3000 series has a 7.5° angle on the front panel to improve usability of the touch panel. This is quite a nuisance.

The top surface is also tilted backward, which reduces the internal volume considerably, and the angled front panel makes the chassis shape no longer rectangular, which creates a large dead space. This makes it very difficult to fit circuit boards and other components inside. It always seems like we have to make do with what we can get away with. (wry smile)



Left) A side view of the DLM3000. The front panel is angled and the top panel is tilted backward.

Right) The footprint is about 2/3 the size of an A4 size paper.

--- I hear that the layout of switches, dials and buttons on the panel is also important.

Ono: Some customers have been using our oscilloscopes for a long time and their "hands" remember where the dials and buttons are. When we changed the layout on a previous model with the best of intentions, we received complaints from long-time users.

We realized that for these so-called YOKOGAWA fans, the slightest difference in layout would affect operability, and since then we have made it a point to pay close attention to it.



Changing zoom ratio

The DLM3000 is the first model to use a touchscreen. However, since users often repeat operations such as fine adjustment and measurement on oscilloscopes, if all operations are performed using a touchscreen, user operability would be lowered. The key point in the mechanism design is to integrate the best aspects of touchscreen and hard keys in a well-balanced manner.

Ease of use is a difficult subject for which there is no absolute right answer, but we continue to pursue day by day "What is a comfortable operation", which tends to be ambiguous, by verbalizing it neatly and incorporating it into the design.

The screen can be operated intuitively like a smartphone, and the traditional hard keys are also available.

3. Significant Changes in Needs and Probes (about probes)

--- I hear that the probes have changed a lot as the user base of oscilloscopes has changed.



Isamu Sato

Hardware Development Group 2
Development & Engineering Department 1
Technical Development Division
Yokogawa Test & Measurement Corp.

Sato: When so-called small-current electronic circuits were the main thing, the voltage and current were often not so high, and the requirements for probes, including temperature environment, were not so strict. So, the standard attached probes and clip-type probes were good enough.

However, oscilloscope are now used in the development of mechatronics and power electronics. There are more and more situations where high-voltages of several thousand volts and big-currents of several hundred amperes are measured and where measurements are made over a wider range of temperatures than ever before. And probes that can handle high voltages, high currents, and wide temperature range are required.

Sato: Our customers in the automotive industry need probes that can be used for measurements in harsh temperature environments, such as extremely cold or desert regions, as well as polar regions. Since ECUs (Electronic Control Units) are increasingly being placed in harsh environments such as the engine compartment, the demand for probes that can withstand high temperatures for measurements is increasing every day. On the other hand, in the field of small current electronic circuits, where oscilloscopes have been conventionally used, there are demands for probes with higher accuracy that can handle higher frequency bands, low voltage, and small current.



Left) 701926 Differential Probe, max. differential voltage is 5000Vrms/7000 Vp-p.

Right) 701918 Current Probe, for small current measurement from 1 mA

--- What are the challenges in probe development in the midst of such changing demands?

Sato: It's all about "how accurately we can lead a signal to a measurement circuit". If the input to a measuring instrument becomes unstable due to temperature, voltage/current, bandwidth, or how the probe is connected to the DUT, the probe is not fulfilling its role adequately. We believe the key to developing probes is to design a probe that can transmit signals from the DUT to the oscilloscope's measurement circuit as accurately as possible in a variety of changing environments.

Interviewer's Note



Among most stationary measuring instruments having a rectangular chassis, the DLM series has the most distinctive form!

Behind the development of these oscilloscopes that are compact and easy to use even in a cramped environment was the constant struggle of figuring out ways to arrange parts in the limited space of the chassis.

And the probe is a behind-the-scenes helpmate! Although attention tends to focus on the functions of the measuring instrument, for accurate measurements, the probe must receive signals accurately and transmit them to the instrument accurately.

The interview told us that one of the reasons why the instrument has been loved by many fans for more than 30 years is its user-oriented design.