

# The Story behind the Development of DLM3000 series Oscilloscope

## Part 2

This article is reproduced from the column on Yokogawa Rental & Lease Corporation's website:  
[https://www.yrl.com/column/tm/hiwa\\_dlm3000-2.html](https://www.yrl.com/column/tm/hiwa_dlm3000-2.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.

< 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)

### 4. Faster and faster (about circuit design)

--- The measurement circuit is the core of an oscilloscope. What are the difficulties in design and development?



**Toshinori Kouyama**  
Hardware Development Group 1  
Development & Engineering Department 1  
Technical Development Division  
Yokogawa Test & Measurement Corp.

**Kouyama:** With the increase in the speed of measurement signals, the requirements for circuits have become stricter. Oscilloscopes handle extremely high-speed signals, and naturally, the internal circuitry is required to operate at high speed. The latest model, the DLM3000, has improved sampling performance over its predecessor, so we had to greatly increase data processing capacity throughout the internal circuitry. In addition, the trigger function, which was achieved mainly with analog circuits in previous models, has been fully digitized in the DLM3000 to improve performance and expand the variety. The requirements for circuits to realize these improvements were tough, and many circuits had to be redesigned from the ground up.

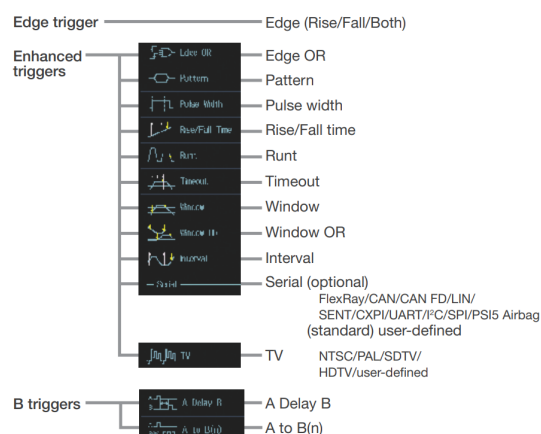
Also, a very important factor for oscilloscopes is good response. "Being unable to see what they want to see when they want see" can be a big stress for users, so we worked hard on how to shorten the lead time to display data while achieving fast internal data processing.

### --- What were the difficulties in developing the triggers?

**Kouyama:** For example, there are various standards for serial bus communication used in automobiles, and each has a different communication method. Most of them communicate data by changing the signal level from High to Low and from Low to High at regular intervals, but some methods convey information by changing the width of the pulse signal. We have also newly developed a trigger (interval trigger) in which the edge of the target signal is used as trigger conditions and time judgment start conditions. In order to correctly recognize such a wide variety of signals, the accuracy of judgment has been improved by performing time processing in units of 2.5 GS/s (400 ps). To accommodate these requirements, the development of the trigger function took about a year in total.

### --- A year just for the trigger! What motivates you to do your job in the face of all these challenges, Mr. Kouyama?

**Kouyama:** Actually, I like oscilloscopes. As a development engineer, I am mainly responsible for the logic of high-density integrated circuits (LSI) in digital circuits, which cannot be measured directly by an oscilloscope. But measurement with an oscilloscope is essential for overall check after implementation. In other words, we ourselves are also oscilloscope users. So, we can imagine how our customers feel when they use our products. We think that if we are having trouble using our oscilloscopes, our users should be having trouble, too... We come up with so many ideas for functions and features that could solve those issues, and sometimes we feel like secretly incorporating them into the products we're working on (laughs).



The DLM3000 has a variety of trigger functions combining analog and logic inputs.

## 5. As users change, the required "usability" is also changing. (about the user interface)

### --- The DLM3000 is the first in the series to feature a touch screen, has that changed anything?



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

**Endo:** As Ono was talking about it earlier, if all operations are performed using only the touchscreen, user operability would be lowered. So, I think it's important to have a good balance between a touchscreen and hard keys.

### --- Did the change in user base affect the user interface?

**Endo:** Yes. This may have more of an impact. It was quite a long time ago, just at a time when the user base was shifting from low voltage electric system to mechatronic system, that we developed a new oscilloscope.

As if to say “an oscilloscope is an engineer's sword”, we developed a product that “you can do whatever you want with” and that was supposed to be preferred by professionals and confidently launched it into the world. It turned out that the product was so difficult to use that even our experienced sales representatives said, “It's too difficult to do a product demonstration”. As a result, the product was not well-accepted by the growing number of mechatronics customers at the time, and although it was an excellent product, we struggled in business.

Based on the lessons learned from that experience, we made the user interface for subsequent products easy to use and easy to understand even for beginners, while placing the advanced functions one step further back, so that users could “find useful functions” as they used the product more and more.

Some of our core customers are very pleased with the professional model that I mentioned earlier, and we still receive requests for a successor model. It's indeed an “engineer's sword” (laughs).

### --- Do you think the number of beginner-level customers who were not familiar with oscilloscopes before but just started using them recently will increase?



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



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



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

**Endo:** Yes. Like the automotive industry we've been talking about, the lighting industry, which is shifting from fluorescent lights to LEDs, is another industry that has recently started to use digital oscilloscopes, I believe.

**Sato:** Many people who have recently started using digital oscilloscopes don't understand how to probe properly, and they are very pleased when we teach them how at our seminars.

**Ono:** I often hear that the seminars are well-received. In this respect, I think that being able to cover everything from development to following up on how to use the product is a strength of a domestic manufacturer.

## 6. The DLM3000 is full of productivity-increasing features. (recommended features by development engineers)

--- You mentioned that the DLM3000 has a variety of trigger functions. Are there any other features that you recommend?



**Hiroshi Yagyu**  
Product Planning Group 1  
Marketing Department  
Technical Development Division  
Yokogawa Test & Measurement Corp.

**Yagyu:** I'm in charge of catalogs, and one thing I'm a little disappointed about is that the functions and features we recommend and emphasize in product catalogs don't seem to be used very often by users. As Kouyama and Ono have said, our oscilloscopes have many useful functions that were developed based on user requests ...

Let me take this opportunity to introduce them to you!

**Everyone:** (laughs)

**Endo:** From that point of view, it would be the "history function".

**Yagyu:** Right. I put it in the first part of the product catalog ....

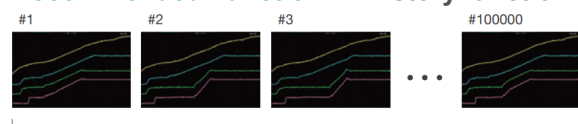
**Everyone:** (laughs)

**Endo:** For some reason, this function is not well known, but it saves up to 100,000 previously captured waveforms in the memory. It's easy to search waveforms by setting search conditions such as zone and waveform, so you can easily recall past waveforms later and compare normal and abnormal waveforms.

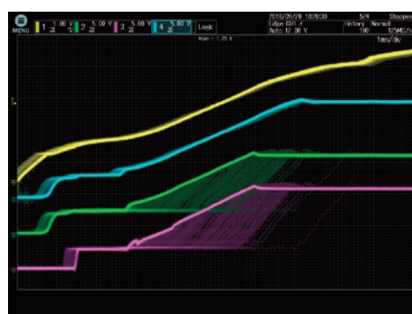
In recent years, our competitors have been offering similar features, but none of them have made it to this extensive, including search capabilities. This is the No.1 function that I highly recommend to use.

**Kouyama:** I recommend the snapshot function. This function allows you to save the displayed image to the memory, just like taking a picture with a camera, and then read it out as a file. So, you can refer to it later without having to print it out and you can compare waveforms easily.

### Recommended Function 1 "History function"

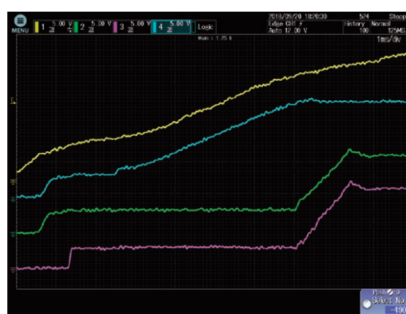


View individual captures to identify the relationship between channels at a specified moment in time.



All waveform display mode

Extract abnormal waveform



One waveform display mode

### Recommended Function 2 "Snapshot function"



Press this key ...



Using snapshots (white waveforms)

- Recommended Function 1 "History function": Up to 100,000 previously captured waveforms (history waveforms) can be stored in the acquisition memory, allowing users to view the waveforms again from earlier. The search function offers various search methods.
- Recommended Function 2 "Snapshot function": Press the camera symbol key in the lower right corner of the screen to leave a white trace of the currently displayed waveform on the screen.

**Endo:** Speaking of increasing productivity, the auto setup function for serial bus measurement is effective. It's an intelligent function that fully auto-sets trigger and decode display settings in a few seconds.

**Kouyama:** Even we find it very useful. If we configure the settings normally, it takes at least a minute or two. If you are not sure how to operate it, it will take a few minutes.

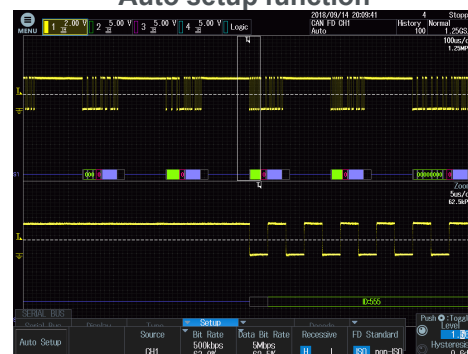
**Sato:** Since it's a useful function, it was hard to verify its operation during the development stage.

**Everyone:** (laughs)

**Endo:** The big advantage of this feature is that it allows users to make a "guess" even when they don't know what type of serial bus will be applied to the instrument. I once heard that one of our sales representatives tried to give a customer a demonstration of serial bus measurement with the ScopeCorder DL850, but somehow it didn't go well. So, he used the auto-setup feature of the DLM3000 and found out the cause, then the demonstration of the DL850 went well. He was so impressed by the value of this feature.

It's a very useful feature, and we hope that users will use it more and more.

### Recommended Function 3 "Auto setup function"



CAN FD Analysis screen  
after executing Auto-Setup

Recommended Function 3 "Auto setup function": No tedious initial settings such as bit rate or voltage level are required. The DLM3000 automatically analyzes the input signal and set the optimal settings. Not only does this greatly reduce setup time, but also it prevents setting errors.

### --- Finally, please share your thoughts on the oscilloscope.

**Endo:** I happened to be assigned to the oscilloscope development department after I joined the company. But oscilloscopes are an essential tool in the development of electronic devices, and now that I have been involved in oscilloscope development for almost 30 years, I feel glad that I have done it.

**Sato:** Nothing is more interesting than properly measuring a correct waveform. Also, we develop, evaluate, and look after our products. Development is often painful, but I think I'm able to continue enjoying it because I love it.

**Ono:** Because oscilloscopes are general-purpose instruments, I think they must be balanced in terms of usability and performance. I'm a mechanical designer, so in addition to that, I also have to meet the demands from the manufacturing department regarding ease of assembly. I find it interesting to design oscilloscopes while balancing all these requirements.

**Kouyama:** As I told earlier, I like oscilloscopes, so I'm glad to be involved in oscilloscope development. It's especially great when I find out that the logic I came up with works well. But even I was a little surprised when I heard that a student who recently came to our company for a job interview had his own oscilloscope. (laughs)

**Yagyu:** As the person in charge of catalogs, I want to make it easier to understand the appeal of oscilloscopes that the development team worked so hard to create. YOKOGAWA's oscilloscopes are produced by the team and the team is working hard together to sell them. We really hope that customers touch the actual instrument and experience its functions and usability.



--- Thank you for sharing your valuable story.



At Yokogawa Test & Measurement headquarter

### Interviewer's Note



I was surprised that the DLM3000 was not simply an update of the previous model, but it was redesigned from the ground up. I felt that because they are oscilloscope users, the desire to create a better and easier-to-use product was the driving force behind their efforts to work on the high-level technical requirements.

Oscilloscopes' high functionality yet simplicity of use is an ingenious feature that comes from the fact that oscilloscopes are used in many industries and by a wide range of users from beginners to experts.

The way they talked about their experiences in the development gave me the impression that they enjoyed even the challenges they faced. YOKOGAWA Test & Measurement Corporation is a company where a team of people work together to create one ideal oscilloscope. The interview made me rediscover the appeal of the DLM oscilloscopes

Note: The headquarters of Yokogawa Test & Measurement Corporation have moved to the Keio Hachioji Myojin-cho Building in Hachioji City, Tokyo, in January 2021.



#### DLM3000 series

- A4 sized, Portrait design compact chassis
- 2/4-channel model
- 200 MHz / 350 MHz / 500 MHz
- 2.5 GS/s all channels
- Maximum record length: 500M points
- Storage: 300 MB (Standard) / 60 GB (Option)
- 8.4-inch TFT XGA touch screen



DLM3000 series  
Web site

# YOKOGAWA

<https://tmi.yokogawa.com/>

YMI-N-MI-M-E03

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