

EXTRA CHANNELS EXPAND THE SCOPE OF MSO APPLICATIONS

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hile much of the news coverage of new developments in oscilloscopes has focused on the high-end multi-gigahertz products, the fact is that over 50% of all oscilloscope

measurements are carried out at frequencies of 500MHz or lower. Applications in this sector cover a broad spectrum of industries and technologies, including many that fall outside the area that is traditionally regarded as the “electronics” industry.

Apart from sectors such as embedded microcontrollers and automotive electronics, general industrial applications now involve an increasing element of “mechatronics”, where physical parameters from mechanical elements such as motors and actuators interact with multiple control signals which can include analogue, digital and high-power content. Similarly, measurements on motor drives and inverters often have to deal with 3-phase electrical supplies, where each input or output involves at least three separate signals.

Against this background, an increasing number of oscilloscope users are finding that the traditional four channels that have been the norm for decades are no longer sufficient. Indeed, there are instruments available which provide eight or more channels, but these are normally oscillographic recorders which do not offer sufficiently high bandwidth and sampling rate. Some users have created 8-channel set-ups by combining two 4-channel oscilloscopes, but this approach requires the instruments to be synchronised: something that is only normally possible in tightly controlled laboratory conditions.

The following comments from actual users illustrate the challenges provided by existing 4-channel users in different industries:

“We develop motor control systems, and we typically need to look at three



Figure 1: The DLM4000 is suitable for various applications, from automotive to industrial

current channels and three high-voltage channels, as well as two channels for other parameters such as link voltages.”

“We need to observe the waveform details of more than four channels of engine control unit signals, along with sensor signals of spinning speed, pulse of fuel injector, crank angle, etc.”

Eight Channels Provide The Answer

To address these challenges, a new generation of 8-channel oscilloscopes (Figure 1) has been developed that offer comprehensive measurement capabilities for embedded, automotive, power and mechatronics applications.

The new range comprises two models, with bandwidths of 350 and 500MHz and a sampling rate of 1.25GS/s (gigasamples per second), expandable

to 2.5GS/s with interleaving. The channels can be allocated as eight analogue channels or seven analogue channels plus one 8-bit digital input. A future option will add 16 more channels of logic to allow seven channels of analogue plus a 24-bit digital input.

Not only do these oscilloscopes provide enough channels for analogue applications such as 3-phase voltage and current measurements, they also enable users to view the actual waveform shape of digital signals. This helps the digital debug process, as glitches are often caused by such things as noise and crosstalk which are invisible when viewing just ones and zeros.

The new instruments feature exceptionally long memory (up to 62.5M points per channel and 125M points in interleave mode), allowing both long recordings and multiple waveforms to be acquired. A history memory function, which does not reduce the oscilloscope’s high waveform acquisition rate, allows up to 20,000 previously captured waveforms to be saved in the acquisition memory, with any one or all of them displayed on screen for cursor measurements. Waveforms can be displayed one at a time, in order, or automatically played back, paused, fast-

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forwarded or rewound. The history memory in combination with the advanced waveform-search feature enables users to capture and see the details of anomalies on individual waveforms when their characteristics are still unknown.

Advanced measurement and analysis features include histogram and trending functions, digital filtering, zoom windows, user-defined mathematics and serial bus analysis.

The instruments incorporate a large (12.1-inch) high-resolution XGA display, and yet are housed in a compact body which is less than 18cm deep and weighs just 6.6kg. The display is enhanced by a fine grid, high luminance and viewing angle, and on-screen markers with simultaneous display of cursors and automatic parameters.

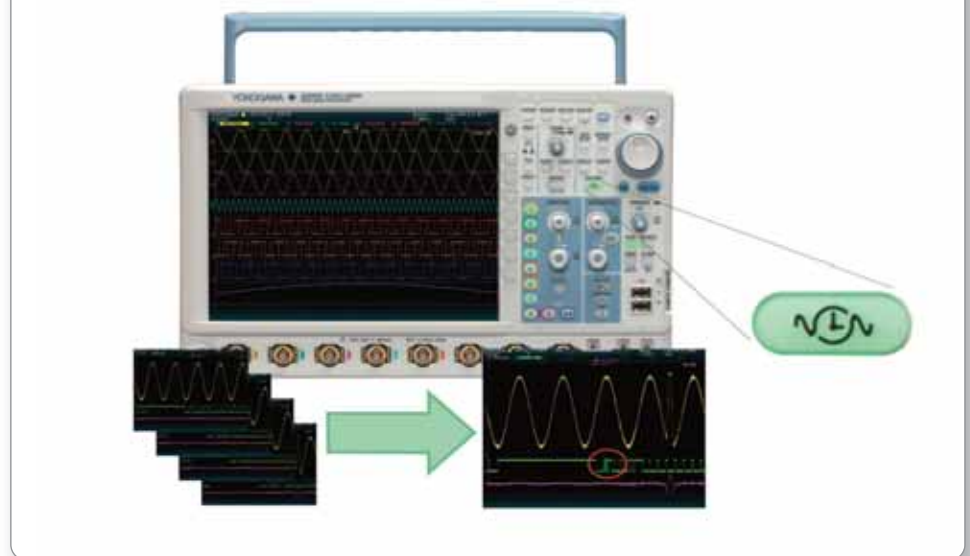
Other features include backlit buttons, additional knobs and jog shuttle, on-screen information in English, German, French, Italian and Spanish, two zoom windows with 80:20 or 50:50 zoom/main area split, and a choice of first-cycle or screen average mode for frequency measurement.

The instruments are offered with a variety of easy-to-configure triggers combining analogue and logic inputs such as edge, enhanced and B-triggers. These include dedicated trigger functions for FlexRay, CAN, LIN, UART, I2C and SPI serial bus patterns, as well as the ability to perform simultaneous analyses on two different buses operating at different speeds. This capability is enhanced by the extensive search facilities, allowing the user to look for specific data in the very long memory.

Application: Embedded Systems

As embedded control systems become more sophisticated and complicated, more I/O signals are used in the system and, because of noise introduced into the systems from inverters or other

Figure 2: DLM4000



power supplies, faster sampling and higher bandwidth are required in the measurement instruments used for observing the various signals.

In automotive engine control units, for example, it is necessary to capture actual system waveforms for developing and debugging the software of an engine control unit (ECU). Unfortunately, neither a 4-channel mixed-signal oscilloscope nor an oscillographic recorder can satisfy these requirements in terms of bandwidth, acquisition speed or channel count.

Now, however, by using the 8-channel oscilloscope with the 16-bit logic input, it is possible to carry out comprehensive and efficient measurements. Many waveforms can be captured without changing the probe connection and, by capturing logic and bus inputs as analogue signals, signal

quality effects such as surge and noise can be evaluated and compensated for to contribute to an overall improvement in system reliability. A further benefit in the automotive sector is that up to two CAN/LIN, FlexRay, I2C, SPI or UART (RS232) channels of data can be decoded and displayed in real-time.

Up to 62.5Mpoint per channel of memory enables long-term measurement even at the highest sampling rate. Slow phenomena from mechanical equipment and fast electric signals from the controller can be measured at the same time.

For longer time measurements and measurements combining various physical signals along with CAN bus data, it is possible to use a ScopeCorder such as the Yokogawa DL850 in combination with the 8-channel oscilloscope. ●

Figure 3: Embedded applications and ECU testing

