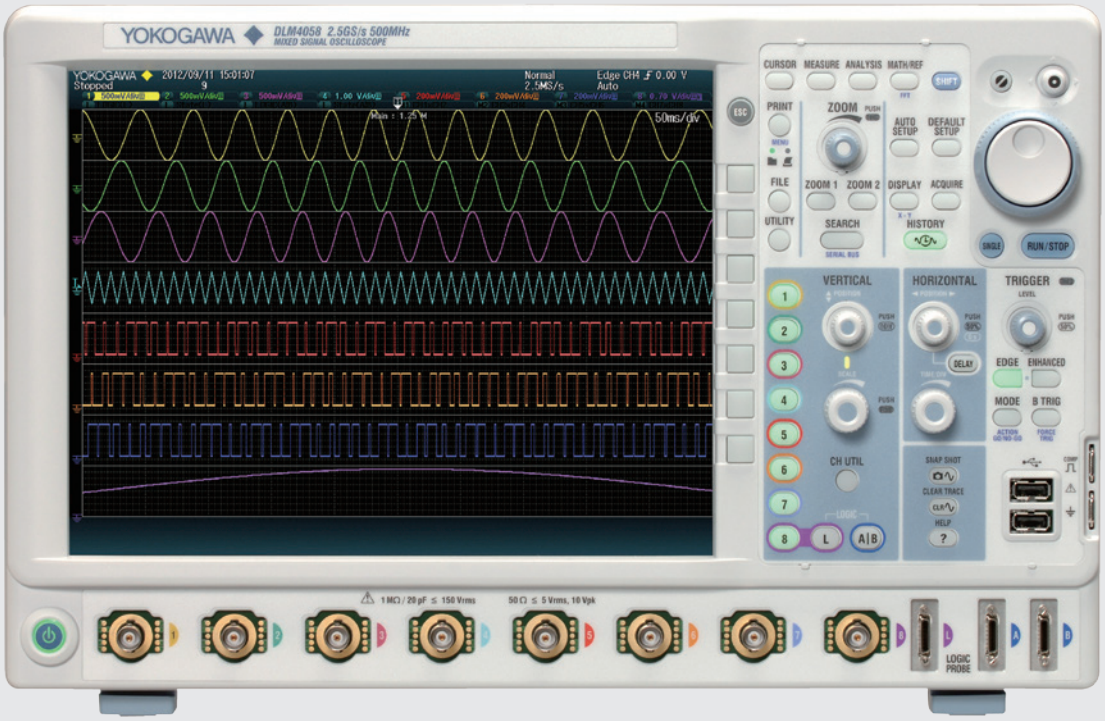
Test&Measurement

YOKOGAWA



When 4 channels are not enough...

DLM4000 Series
Mixed Signal Oscilloscope

Bulletin DLM4000-01EN

The DLM4000 is the world's first 8 channel oscilloscope providing comprehensive measurement and analysis capabilities for embedded, automotive, power and mechatronics applications.

Representing decades of experience in providing quality test and measuring tools, the DLM4000 is designed to satisfy the wide ranging needs of engineers today and in the future.

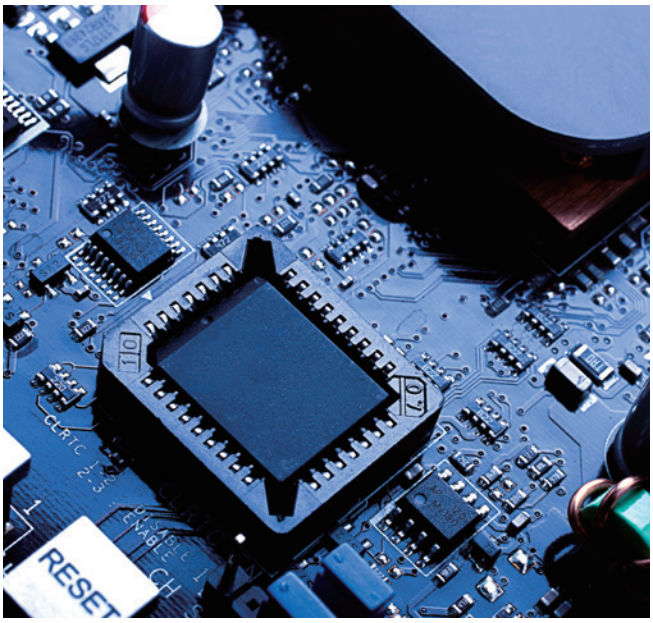
The hardware optimized architecture in the DLM4000 enables measurements and signal processing to be carried out in real time. This means that signals from multiple channels are promptly captured and measurements are always performed and updated at high speed.

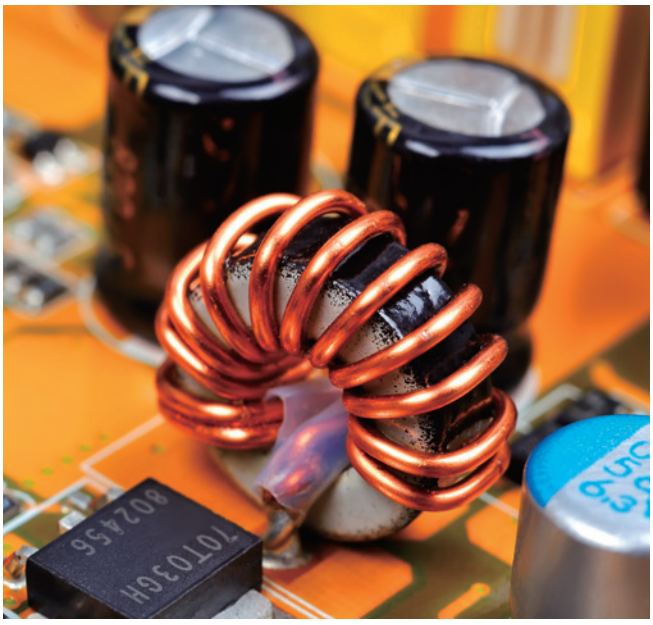
The DLM4000 is:

Versatile – The number of analog and digital channels, their flexibility and the wealth of measurement and analysis features enable the DLM4000 to solve the broadest range of test requirements.

Intuitive – Via the straightforward interface, users can automatically or manually split the display to separate individual channel waveform while maintaining their full dynamic range. The details of signals can therefore be quickly analyzed irrespective of the number of channels in use.

Capable – As intelligent control permeates more and more sectors of the industry from consumer electronics to industrial drives, the signals that engineers need to look at for testing become faster and more complex. The DLM4000 delivers the features and performance that engineers need in an advanced oscilloscope.



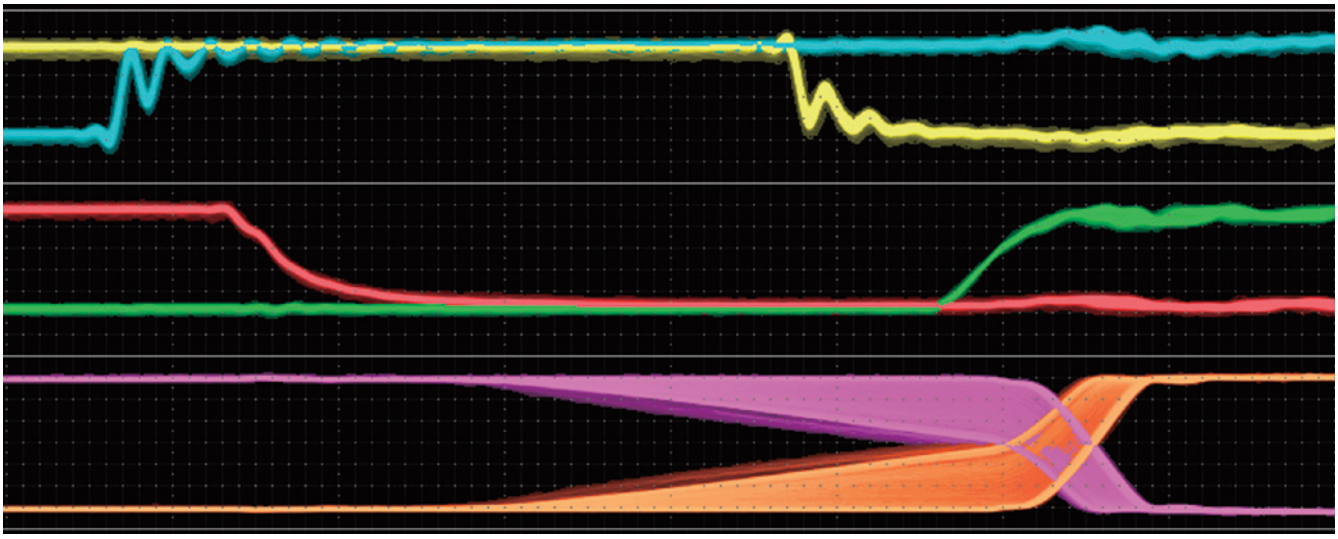


Why choose Yokogawa

Our passion for measurement
Yokogawa believes that precise and effective measurement lies at the heart of successful innovation – and has focused its own R&D on providing the tools that researchers and engineers need to address their challenges both great and small.

Our heritage
Yokogawa has been developing measurement solutions for almost 100 years, consistently finding new ways to give R&D teams the tools they need to gain the best insights from their measurement strategies. Our oscilloscope design has been led by customers looking for ease-of-use and functionality.

Our commitment
Yokogawa takes pride in its reputation for quality, both in the products we deliver – often adding new features in response to specific client requests – and the level of service and advice we provide to our clients, helping to devise measurement strategies for even the most challenging environments.

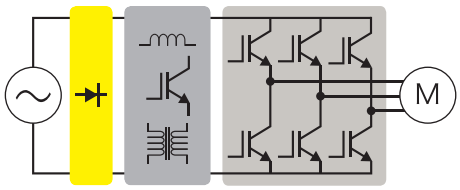


Superior functionality

For today's challenges in embedded, automotive, power and mechatronics. The DLM4000 – Eight-channel, 500 MHz bandwidth oscilloscope.

Motor control & inverter circuit development

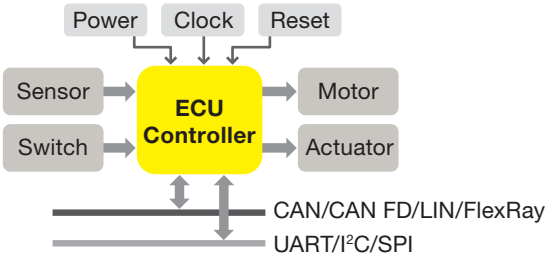
8ch The key to efficient and reliable high-performance electric motors is the modern inverter design, or 'Intelligent Power Module'. Multi-channel, high-speed waveform measurement is an absolute necessity. Four channels are simply not enough. Boasting eight true analog inputs, the DLM4000 empowers today's engineer with a convenient and comprehensive measurement system.



Example: 3 voltage & 3 current measurements of a 3-phase motor
Measurement of the gate-drive signals of six IGBTs within the inverter

Electronic control unit & mechatronic test

8ch Numerous I/O analog, digital, and serial-bus waveforms surrounding the Electronic Control Unit (ECU) must be measured. The DLM4000 offers ample channel-count and architecture to monitor eight analog channels and up to 24-bits of logic input while simultaneously performing protocol analysis such as UART, I²C, SPI, CAN, CAN FD, LIN and FlexRay. The DLM4000 can speed up the R&D process when four channels are not enough.



Example: Analog I/O and serial bus controller signals
Stringent real time test of digital waveforms in the analog domain.

4ch Limitation of 4 ch scope

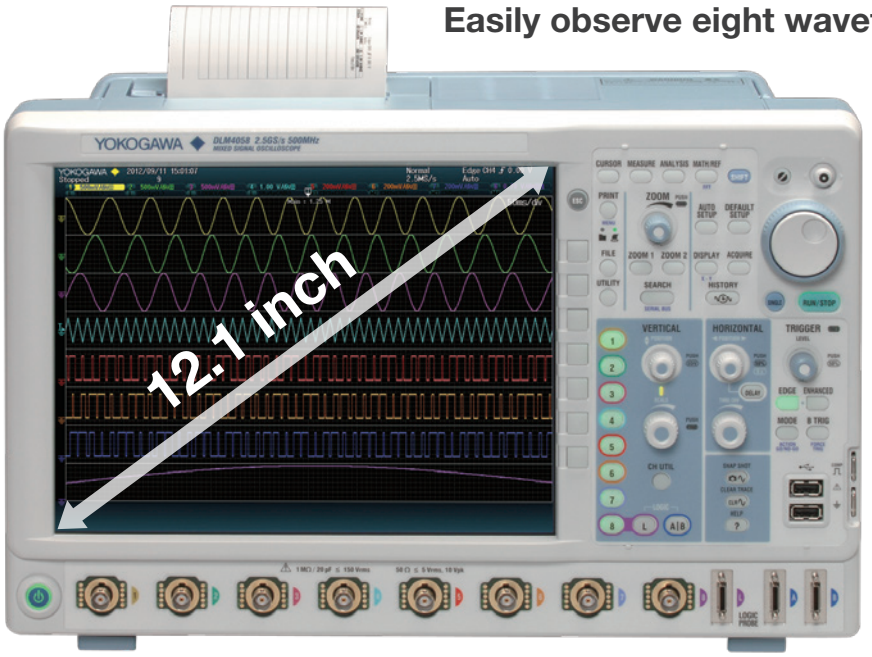
Whole-system measurement is impossible with a four-channel scope; the real difficulty is measuring the timing between IGBT gate signals within the inverter. Voltage and current measurements between 3 phases and the IO of the motor driver IC is a very challenging test with a four-channel scope. The truly practical solution is an eight-channel MSO.

4ch Limitation of 4 ch MSO

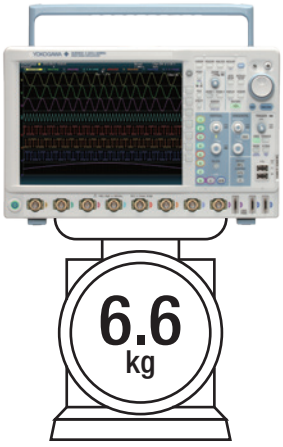
The additional logic inputs of a four-channel MSO mixed-signal oscilloscope provides enough channels, but this method has a blind-spot. Digital waveform analysis using logic inputs alone cannot reveal anomalies such as voltage drift, noise, distortion or ringing, and measure rise-fall times. ECU testing requires stringent examination of all digital waveforms – and analog input channels are the best tool for the job.

5 **The portable eight-channel DLM4000 is the daily instrument of choice.**

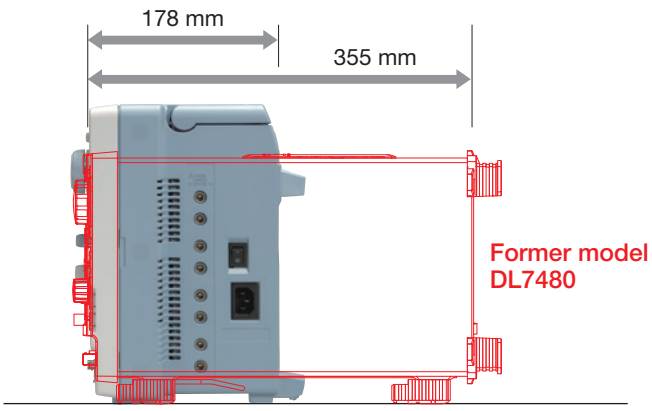
12.1 inch LCD
Easily observe eight waveforms



Portable



Modest 178 mm depth
Half of the former model DL7480



Long waveform memory Up to 250 MPoints

The two advantages of a long waveform memory are the abilities to capture for long periods of time and to maintain high sample rates. Thus achieving higher effective measuring bandwidths for all time base settings.

<Basic Formula>

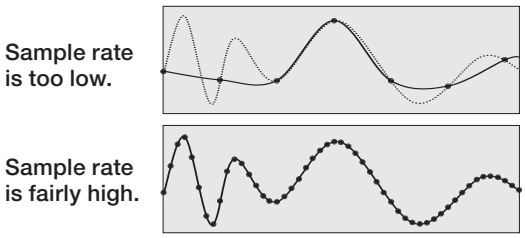
Measuring time = Memory length/Sample rate

With the maximum memory installed (/M3 option), in single shot mode, a 10 kHz signal lasting for more than one hour can be captured. The same memory can capture a 200 millisecond signal at a sampling rate of 1.25 GS/s.

Relationship between measuring time and sample rate in 250 Mpoint

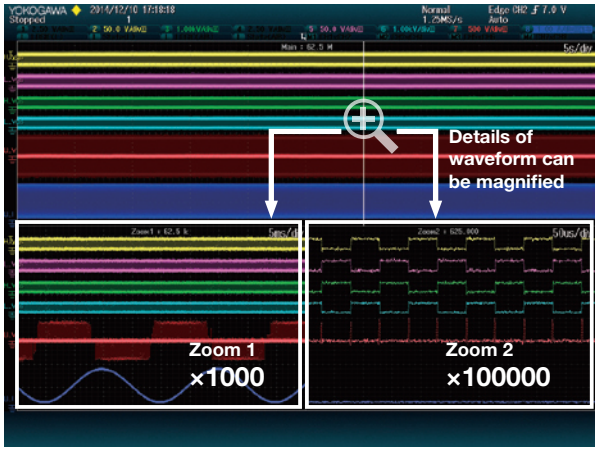
Sample rate	Maximum measuring time
1.25 GS/s	0.2 s
125 MS/s	2 s
12.5 MS/s	20 s
1.25 MS/s	200 s
125 kS/s	2000 s
62.5 kS/s	5000 s

Caution is needed when using an oscilloscope that does not have enough memory, which can cause lack of sample rate and will possibly fail to capture waveforms accurately.



Two fully independent zoom windows

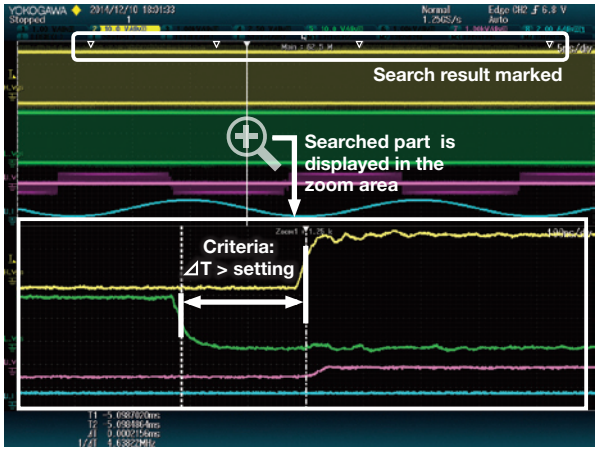
Enabling two fully independent zoom windows allows users to analyze the cause and effect of abnormal behaviors over all input channels. Users can also view and compare the details and timing of different serial buses operating at different speeds.



Detailed waveform measured for 50 seconds are shown in 50 milliseconds and 500 microseconds span.

Advanced waveform search functions

Single waveform acquisitions of up to 250 MPoints can be searched using various criteria.



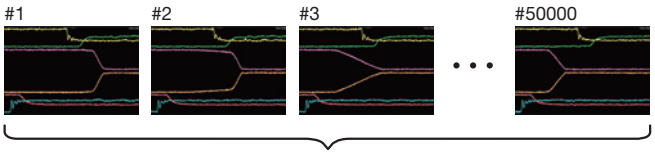
Waveform search using “State width”

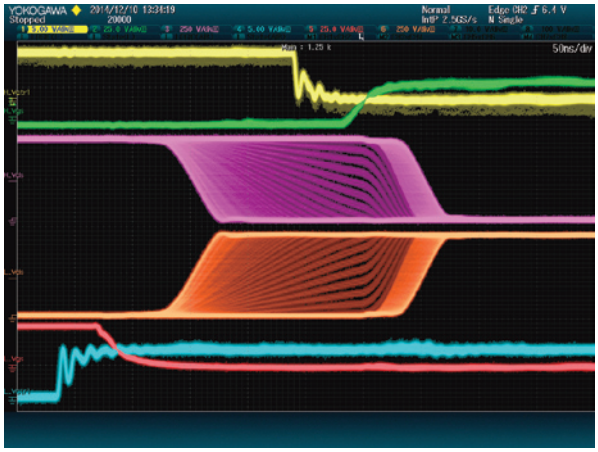
7

History function

Automatically capture and replay up to 50000 waveforms

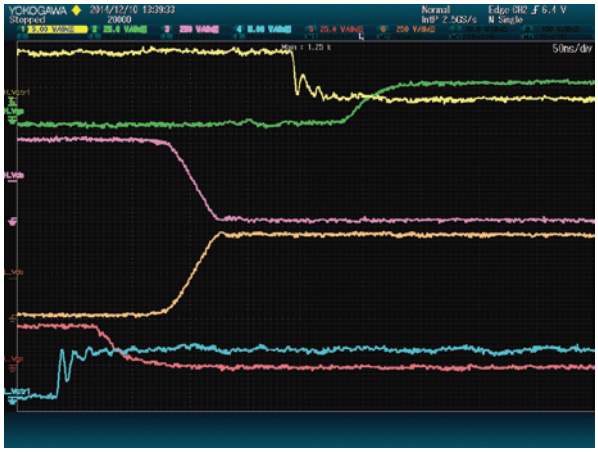
The DLM4000 can capture and replay up to 50000 individual acquisitions (/M3 option). These can be displayed one at a time or as an accumulation. Using the search and measurement functions, abnormal signals can therefore be quickly isolated, analyzed and precisely categorized without needing to carefully configure triggers to capture rare events.





Accumulate display mode

Extract abnormal waveform



Single acquisition display mode

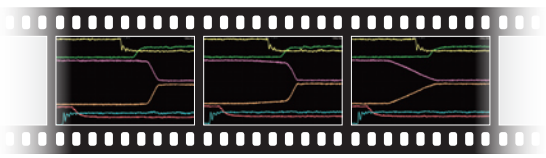
History search function

Search up to 50000 waveform history records based on detailed search parameters using the history search function.

Searching for waveforms that pass through or do not pass through a rectangular zone placed on screen.

Replay function

Automatically play back, pause, fast forward, and rewind waveform history records.



Application specific analysis options

Serial bus analysis function

UART (RS232) /I²C/SPI/CAN/CAN FD/LIN/FlexRay/SENT

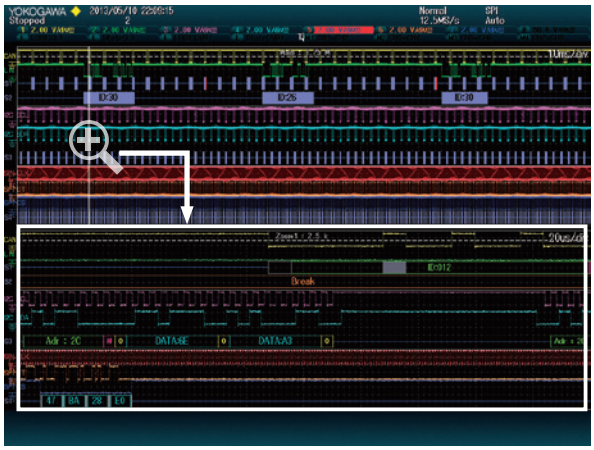
Dedicated trigger and analysis options are available for various serial buses of both in-vehicle and embedded systems. A wide variety of trigger combinations can be set, including ID and Data combinations, which can also be combined with conventional edge triggers.

Serial bus auto-setup saves time

An intelligent serial bus auto-setup detects bit-rate and voltage threshold automatically and enables the DLM4000 to be quickly configured.

Up to 4 buses simultaneously

Analysis can be performed at high speed simultaneously on up to four different buses operating at different speeds. This is enhanced by the extensive search facilities, allowing the user to look for specific data in the very long memory. The dual-zoom facility means that different buses can be viewed and debugged alongside each other.



CAN, LIN, SPI, I²C can be viewed simultaneously by using zoom.

Four bus decode and list display

Related Accessories

Differential probe PBDH1000 (701924)

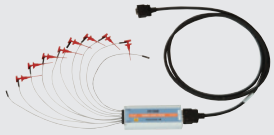
DC to1.0 GHz bandwidth1 MΩ, approximately 1.1 pF
Maximum differential input voltage range: ±25 V

Differential probe (701920)

DC to 500 MHz bandwidth
100 kΩ, approximately 2.5 pF
Maximum differential input voltage range: ±12 V

Logic probe PBL100/PBL250 (701988/701989)

100 MHz/250 MHz toggle frequency 1 MΩ, 10 pF/100 kΩ, 3 pF



Power supply analysis function (/G3, /G4 option)

The /G3 and /G4 options enable switching loss, joule integral (I^2t), SOA (safe operating area), harmonics based on EN61000-3-2, and other power parameters to be measured and analyzed.

Switching loss analysis

The switching loss of the voltage and current input waveforms can be computed (U(t) × I(t)) over long time periods. The turn-on/off loss, the loss including the continuity loss, and the loss over many cycles of the 50 Hz/60 Hz power line can be calculated and analyzed.

Switching loss and SOA analysis of power devices

Power measurement

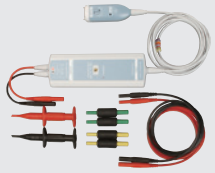
The DLM4000 can also be used as a power meter by providing automated measurement of power parameters for up to two pairs of voltage and current waveforms, such as the active power, apparent power and power factor. These values can then be statistically processed and calculated.

Power parameter measurement of three-phase motor

Related Accessories

Differential probe PBDH0150 (701927)

DC to 150 MHz
1000 Vrms/ ±1400 Vpeak



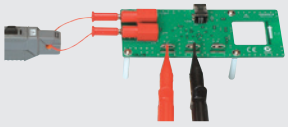
Differential probe (701926)

DC to 50 MHz
5000 Vrms/7000 Vpeak

Current probe PBC100/PBC050 (701928/701929)

DC to 100 MHz (701928)
DC to 50 MHz (701929)
30 Arms

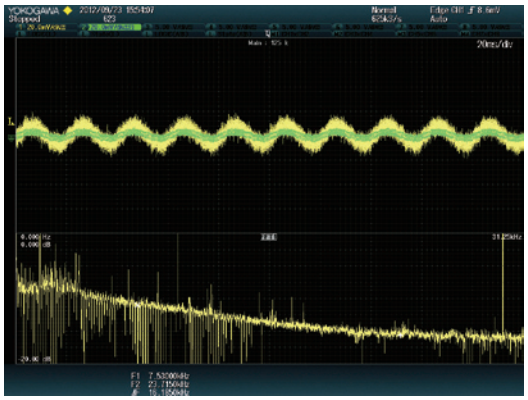
Deskew correction signal source (701936)



Features and benefits

Waveform computation

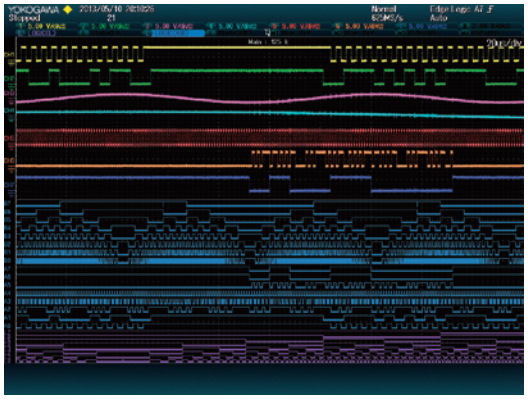
The DLM4000 provides powerful and flexible math functions such as arithmetic, filtering and FFT.
Up to 4 math channels are available.



FFT analysis of high frequency noise

Logic signal measurement and analysis

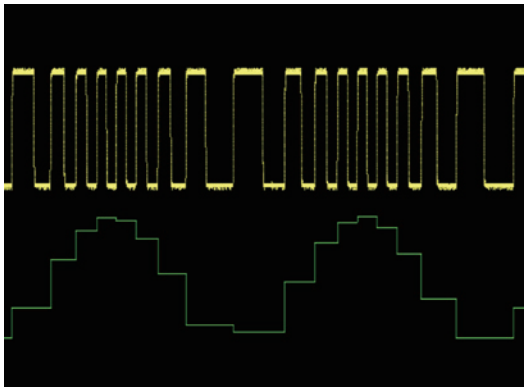
The flexible MSO inputs are included as standard. This enables the DLM4000 to be converted to a 7 analog and 8 digital input MSO. With the /L16 option, up to 24 logic signals can be measured. Bus/State display and optional DA calculation function, which is useful for evaluating AD/DA converters, are also provided.



Comprehensive waveform display (7 ch + 24 bits)

User defined math (/G2, /G4 option)

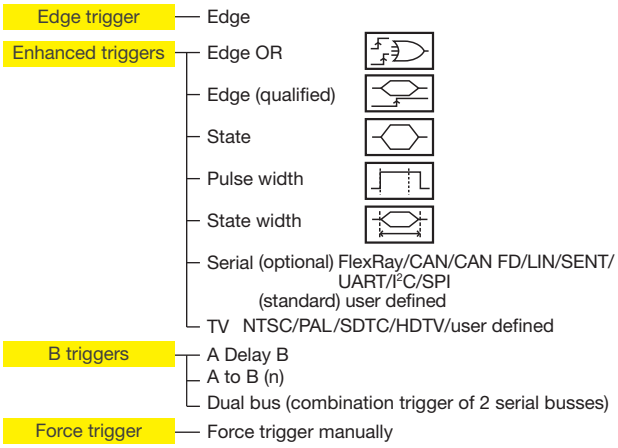
Equations can be arbitrarily created using a suite of operators such as trigonometric and logarithmic operators, integration and differentiation, pulse width operators, phase measurement and digital to analog conversion.



F-V conversion of encoder pulse signal

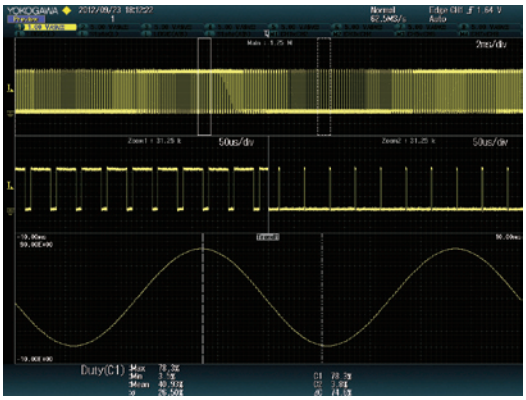
Reliable triggering

When just a specific event or abnormal waveform needs to be captured, the flexible and reliable triggering of the DLM4000 is the solution. In addition to basic trigger functions such as Edge, State, and Pulse Width – Advanced trigger types are provided, including Edge OR between multiple channels, Serial Bus trigger in which A combination of two bus signals is possible, or an A and B combination of different trigger types.



Automatic parameter measurement and statistical analysis

30 waveform parameters from a total of 29 different types can be displayed simultaneously with a high update rate. In addition to the basic statistical analysis of repetitively measured parameters, the Yokogawa original “cycle statistic” and “history statistic” measurement functions helps the advanced analysis of periodic mechatronic signals. To observe the fluctuations of measured parameters, it is possible to display them as trends. Period-to-period changes can then be easily seen. The variation of parameters can also be displayed as histograms thus providing a visual method of assessing them statistically.



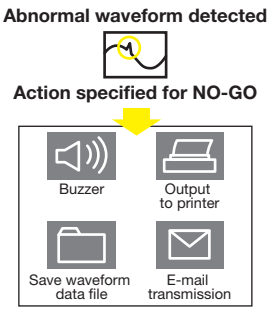
Trend of waveform parameters

Variety of display formats

Many types of display format are supported such as split, dual-zoom, XY, FFT, histogram etc.

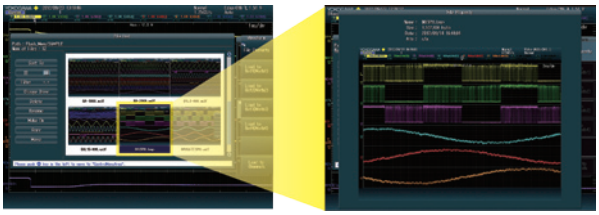
Automatic GO/NO-GO function

The GO/NO-GO function can be used to test the results of parameter measurements, trigger conditions and other criteria and automatically save or print data, send an e-mail etc. Save time using unattended supervisory data acquisition.



Thumbnails of saved files

The image and file names are shown so that you can view screen image contents while copying or deleting files. A file can be enlarged to confirm the data.

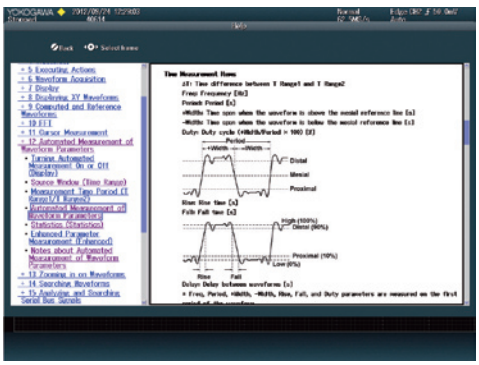


Thumbnails of saved files

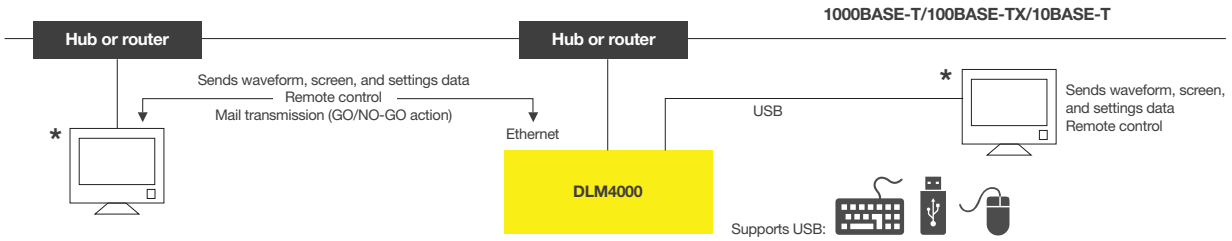
Thumbnail can be viewed full-size

Built-in user’s manual

View detailed graphical explanations of the oscilloscope’s functions by pressing the “?” key. Functions and operations can be shown on screen without having to consult the user’s manual.



PC connectivity and software tools

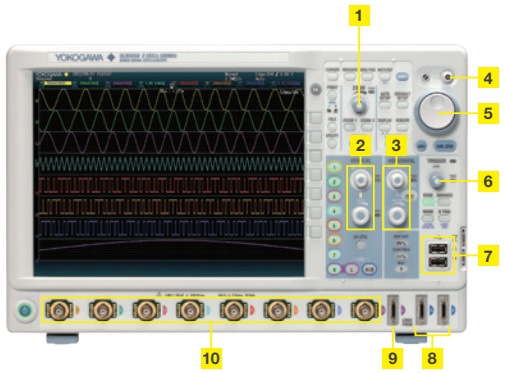


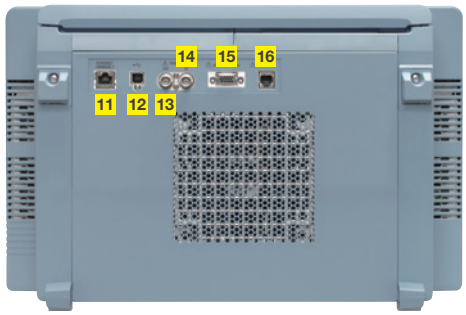
*DLM4000's internal storage can be recognized by a PC as an external USB storage device. Transferring files is easy even when a USB thumb drive can't be used.

A comprehensive suite of software tools to support and complement complex measurement tasks.

	Free	Trial version available
Off-line waveform display and analysis	**XviewerLITE** *Basic display and measurement* Provides zooming, vertical cursors and data conversion to CSV format.	**Xviewer** *Advanced analysis* Xviewer can display acquired waveforms, transfer files and control instruments remotely. In addition to simply displaying the waveform data, Xviewer features many of the same functions that the DLM4000 offers; zoom display, cursor measurements, calculation of waveform parameters, complex waveform math and FFT. Binary waveform data can easily be converted to CSV, Excel or Floating Point Decimal format.
Waveform monitoring on a PC **Data transfer to a PC**	**Xwirepuller** The DLM4000 can be simply controlled using a PC and mouse via an Ethernet, USB, or GP-IB interface. When the software program starts, a simulation of the oscilloscope appears on the PC display.	
Command control **Custom software development**	**LabVIEW drivers** By using the LabVIEW driver written for the DLM4000, a developer can dramatically reduce the amount of work required to enable a PC to control the instrument from within the LabVIEW environment.	**MATLAB toolkit** The MATLAB® tool kit can be used to control the DLM4000 and to transfer data via GP-IB, USB or Ethernet from within MATLAB.
	Control libraries The TMCTL DLL (Dynamic Link Library) enables Microsoft Visual studio programs, such as Visual C++ and Visual Basic, to be quickly developed to communicate between the PC and the DLM4000. It supports GPIB, USB and Ethernet interfaces.	
	Command line tool The DLTerm command line tool can be used with the TMCTL library to develop communication programs. Prototype code can be rapidly created to automate sequences of capture, measurement and analysis tasks before writing a fully custom software routine.	
	Symbol editor Physical value symbol definition files for CAN and CAN FD serial bus analysis can be created and edited. CANdb files can also be imported.	

Broad connectivity and easy control





1. Dedicated Zoom Knob
2. Vertical Position and Scale Knob
3. Horizontal Position and Scale Knob
4. Four-Direction Selector Button
   Select key moves the cursor up/down/left/right
5. Jog Shuttle and Rotary Knob
6. Dedicated Trigger Level Knob
7. USB peripheral connection terminal × 2
8. Logic input connector 16 bit (optional)
9. Channel 8, convertible to 8 bit Logic Input
10. Eight Analog Input Channels
11. 1000 BASE-T Ethernet
12. USB-PC connection terminal
13. External trigger output
14. External trigger input
15. RGB video output terminal
16. GO/NO-GO output terminal
17. Probe power supply terminal × 8 (optional)
18. GP-IB connection terminal (optional)

Specifications

Models

Model name	Frequency bandwidth	Input channels
DLM4038	350 MHz	(Standard) 8 analog channels or 7 analog channels + 8 bit logic (/L16 option) 8 analog channels + 16 bit logic or 7 analog channels + 24 bit logic
DLM4058	500 MHz	

Analog Signal input

Input channels		
Analog input	CH1 to CH8 (CH8 is mutually exclusive with logic input Port L)	
Input coupling setting	AC, DC, DC50 Ω, GND	
Input impedance		
Analog input	1 MΩ	±1.0%, approximately 20 pF
	50 Ω	±1.0% (VSWR 1.4 or less, DC to 500 MHz)
Voltage axis sensitivity setting range	1 MΩ	2 mV/div to 10 V/div (steps of 1-2-5)
	50 Ω	2 mV/div to 500 mV/div (steps of 1-2-5)
Max. input voltage	1 MΩ	150 Vrms
	50 Ω	Must not exceed 5 Vrms or 10 Vpeak
Max. DC offset setting range	1 MΩ	2 mV/div to 50 mV/div ±1 V 100 mV/div to 500 mV/div ±10 V 1 V/div to 10 V/div ±100 V
	50 Ω	2 mV/div to 50 mV/div ±1 V 100 mV/div to 500 mV/div ±5 V
Vertical-axis (voltage-axis)		
DC accuracy[*1]	±(1.5% of 8 div + offset voltage accuracy)	
Offset voltage accuracy[*1]	2 mV to 50 mV/div	±(1% of setting + 0.2 mV)
	100 mV to 500 mV/div	±(1% of setting + 2 mV)
	1 V to 10 V/div	±(1% of setting + 20 mV)

Frequency characteristics (–3 dB attenuation when inputting a sinewave of amplitude ±3 div)[*1*2]

		DLM4038	DLM4058
1 MΩ (when using passive probe)	100 mV to 100 V/div	350 MHz	500 MHz
	20 mV to 50 mV/div	300 MHz	400 MHz
50 Ω	10 mV to 500 mV/div	350 MHz	500 MHz
	2 mV to 5 mV/div	300 MHz	400 MHz

Isolation between channels	Maximum bandwidth: –34 dB (typical value)	
Residual noise level[*3]	The larger of 0.4 mV rms or 0.05 div rms (typical value)	
A/D resolution	8 bit (25 LSB/div) Max. 12 bit (in High Resolution mode)	
Bandwidth limit	FULL, 200 MHz, 100 MHz, 20 MHz, 10 MHz, 5 MHz, 2 MHz, 1 MHz, 500 kHz, 250 kHz, 125 kHz, 62.5 kHz, 32 kHz, 16 kHz, 8 kHz (can be set for each channel)	
Maximum sample rate	Real time sampling mode	Interleave OFF 1.25 GS/s Interleave ON 2.5 GS/s
	Repetitive sampling mode	125 GS/s

Maximum record length (Points)	Repeat	Single	Single Interleave
Standard	1.25 M	6.25 M	12.5 M
/M1	6.25 M	25 M	62.5 M
/M2	12.5 M	62.5 M	125 M
/M3	25 M	125 M	250 M

Ch-to-Ch deskew	±100 ns
Time axis setting range	1 ns/div to 500 s/div (steps of 1-2-5)
Time base accuracy[*1]	±0.002%

Logic Signal Input

Number of inputs	Standard	8 bit × 1 Port L (mutually exclusive with CH8 input)
	/L16	8 bit × 3 Port L (mutually exclusive with CH8 input), Port A, Port B
Maximum toggle frequency*1		Model 701988: 100 MHz, Model 701989: 250 MHz
Compatible probes		701988, 701989 (8 bit input) (701980, 701981 are available)
Min. input voltage		701988: 500 mVp-p, 701989: 300 mVp-p
Input range		Model 701988: ±40 V, Model 701989: threshold ±6 V
Max. nondestructive input voltage		±40 V (DC + ACpeak) or 28 Vrms (when using 701989)
Threshold level setting range		Model 701988: ±40 V (setting resolution of 0.05 V) Model 701989: ±6 V (setting resolution of 0.05 V)
Input impedance		701988: Approx. 1 MΩ/approx. 10 pF 701989: Approx. 100 kΩ/approx. 3 pF
Maximum sampling rate		1.25 GS/s

Maximum record length (Points)

	Repeat	Single	Single Interleave (A, B)
Standard	1.25 M	6.25 M	12.5 M
/M1	6.25 M	25 M	62.5 M
/M2	12.5 M	62.5 M	125 M
/M3	25 M	125 M	250 M

Triggers

Trigger modes	Auto, Auto Level, Normal, Single, N-Single		
Trigger type, trigger source			
A triggers	Edge	CH1 to CH8, Logic, EXT, LINE	
	Edge OR	CH1 to CH8	
	Edge Qualified	CH1 to CH8, Logic, EXT	
	State	CH1 to CH8, Logic	
	Pulse width	CH1 to CH8, Logic, EXT	
	State width	CH1 to CH8, Logic	
	TV	CH1 to CH8	
	Serial Bus	I²C (optional)	CH1 to CH8, Logic
		SPI (optional)	CH1 to CH8, Logic
		UART (optional)	CH1 to CH8, Logic
		FlexRay (optional)	CH1 to CH8
		CAN (optional)	CH1 to CH8
		CAN FD (optional)	CH1 to CH8
		LIN (optional)	CH1 to CH8
		SENT (optional)	CH1 to CH8, Logic
		User defined	CH1 to CH8
AB triggers	A Delay B	10 ns to 10 s (Edge, Edge Qualified, State, Serial Bus)	
	A to B(N)	1 to 10^9 (Edge, Edge Qualified, State, Serial Bus)	
	Dual Bus	Serial Bus only	
Force trigger		Force a trigger manually	
Trigger level setting range		CH1 to CH8 ±4 div from center of screen	
Trigger level setting resolution		CH1 to CH8 0.01 div (TV trigger: 0.1 div)	
Trigger level accuracy*1		CH1 to CH8 ±(0.2 div + 10% of trigger level)	
Window Comparator		Center/Width can be set on individual Channels from CH1 to CH8	

Display

Display*4	12.1 inch TFT color liquid crystal display, 1024 × 768 (XGA)

Functions

Waveform acquisition modes	Normal, Envelope, Average	
High Resolution mode	Max. 12 bit (the resolution of the A/D converter can be improved equivalently by placing a bandwidth limit on the input signal)	
Sampling modes	Real time, interpolation, repetitive sampling	
Accumulation	Select OFF, Intensity (waveform frequency by brightness), or Color (waveform frequency by color). Accumulation time: 100 ms to 100 s, Infinite	
Roll mode	Enabled at 100 ms/div to 500 s/div (depending on the record length setting)	
Zoom function	Two zooming windows can be set independently (Zoom1, Zoom2)	
	Zoom factor	×2 to 2.5 points/10 div (in zoom area)
	Scroll	Auto Scroll
	Search functions	Edge, Edge Qualified, State, Pulse Width, State Width, I²C (optional), SPI (optional), UART (optional), CAN (optional), CAN FD (optional), LIN (optional), FlexRay (optional), SENT (optional)
History memory	Max. data (record length 1.25 k Points) Standard: 2500, /M1: 10000, /M2: 20000, /M3: 50000	
	History search	Select Rect, Wave, Polygon, or Parameter mode
	Replay function	Automatically displays the history waveforms sequentially
	Display	Specified or average waveforms
Cursor	Types	ΔT, ΔV, ΔT & ΔV, Marker, Degree
Snapshot	Currently displayed waveform can be retained on screen	

Computation and Analysis Functions

Parameter measurement	Max, Min, P-P, High, Low, Amplitude, Rms, Mean, Sdev, IntegTY+, IntegTY, +Over, –Over, Pulse Count, Edge Count, V1, V2, ΔT, Freq, Period, Avg Freq, Avg Period, Burst, Rise, Fall, +Width, –Width, Duty, Delay
Statistical computation of parameters	Max, Min, Mean, σ, Count
Statistics modes	Continuous, Cycle, History
Trend/Histogram display of wave parameters	Up to 2 trend or histogram display of specified wave parameters
Computations (MATH)	+, –, ×, Filter (Delay, Moving Avg, IIR Lowpass, IIR Highpass), Integ, Count (Edge, Rotary), user defined math (optional)
Computable no. of traces	4 (Math1 to Math4)
Max. computable memory length	Standard: 6.25 MPoints, /M1: 25 MPoints, /M2: 62.5 MPoints, /M3: 125 MPoints
Reference function	Up to 4 traces (REF1/REF4) of saved waveform data can be displayed and analyzed
Action-on-trigger	Actions: Buzzer, Print, Save, Mail
GO/NO-GO	Modes: Rect, Wave, Polygon, Parameter Actions: Buzzer, Print, Save, Mail
XY	Displays XY1, to XY4 and T-Y simultaneously
FFT	Number of points: 1.25 k, 12.5 k, 25 k, 125 k, 250 k Window functions: Rectangular, Hanning, Flat-Top FFT Types: PS (LS, RS, PSD, CS, TF, CH are available with /G2 or /G4 option)
Histogram	Displays a histogram of acquired waveforms
User-defined math (/G2 and /G4 options)	The following operators can be arbitrarily combined in equations: +, –, ×, /, SIN, COS, TAN, ASIN, ACOS, ATAN, INTEG, DIFF, ABS, SQRT, LOG, EXP, LN, BIN, DELAY, P2 (power of 2), PH, DA, MEAN, HLBT, PWHH, PWLL, PWHL, PWLH, PWXX, FV, DUTYH, DUTYL, FILT1, FILT2 The maximum record length that can be computed is the same as the standard math functions.

Power supply analysis (/G3 and /G4 options)

Power analysis	For Pwr1 and Pwr2, selectable from 4 analysis types. Deskweing between the voltage and current waveforms can be executed automatically.	
	Switching loss	Measurement of total loss and switching loss, power waveform display, Automatic measurement and statistical analysis of power analysis items (Wp, Wp+, Wp–, Abs. Wp, P, P+, P–, Abs.P, Z)
	Safety operation area	SOA analysis by X-Y display, using voltage as X axis, and current as Y axis is possible
	Harmonic analysis	Basic comparison is possible with following standard Harmonic emission standard IEC61000-3-2 edition 2.2, EN61000-3-2 (2000), IEC61000-4-7 edition 2
	Joule integral	Joule integral (I²t) waveform display, automatic measurement and statistical analysis is possible
Power Measurement	Automated measurement of power parameters for up to four pairs of voltage and current waveforms. Values can be statistically processed and calculated.	
	Measurement parameters	Urms, Umn, Udc, Urmn, Uac, U+pk, U–pk, Up–p, Irms, Imn, Idc, Irmn, Iac, I+pk, I–pk, Ip–p, P, S, Q, Z, λ, Wp, Wp+, Wp–, Abs.Wp, q, q+, q–, Abs.q, Avg Freq (voltage, current)

I²C Bus Signal Analysis Functions (/F2 and /F3 Options)

Applicable bus	I²C bus Bus transfer rate: 3.4 Mbit/s max. Address mode: 7 bit/10 bit
	SM bus Complies with System Management Bus
Analyzable signals	CH1 to CH8, Logic input, or M1 to M4
I²C Trigger modes	Every Start, Address & Data, Non-Ack, General Call, Start Byte, HS Mode
Analysis results displays	Analysis no., time from trigger position (Time (ms)),1st byte address, 2nd byte address, R/W, Data, Presence/absence of ACK, information
Auto setup function	Auto setting of threshold value, time axis scale, voltage axis scale, and display of analysis results
Analyzable no. of data	300000 bytes max.
Search function	Searches data that matches specified address pattern, data pattern, and acknowledge bit condition
Analysis results save function	Analysis list data can be saved to CSV-format files

SPI Bus Signal Analysis Functions (/F2 and /F3 Options)

Trigger types	3 wire, 4 wire After assertion of CS, compares data after arbitrary byte count and triggers.
Analyzable signals	CH1 to CH8, Logic input, M1 to M4
Byte order	MSB, LSB
Auto setup function	Auto setting of threshold value, time axis scale, voltage axis scale, and display of analysis results
Analyzable no. of data	300000 bytes max.
Decode bit length	Specify data interval (1 to 32 bits), decode start point, and data length
Analysis results displays	Analysis no., time from trigger position (Time (ms)), Data 1, Data 2
Auxiliary analysis functions	Data search function
Analysis result save function	Analysis list data can be saved to CSV-format files

UART Bus Signal Analysis Functions (/F1 and /F3 Options)	
Bit rate	1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps, user defined (an arbitrary bit rate from 1 k to 10 Mbps with resolution of 100 bps)
Analyzable signals	CH1 to CH8, logic input, or M1 to M4
Data format	Select a data format from the following 8 bit (Non Parity), 7 bit Data + Parity, 8 bit + Parity
UART Trigger modes	Every Data, Data, Error (Framing, Parity)
Auto setup function	Auto setting of bit rate, threshold value, time axis scale, voltage axis scale, and display of analysis results
Analyzable no. of frames	300000 frames max.
Analysis results displays	Analysis no., time from trigger position (Time(ms)), Data (Bin, Hex) display, ASCII display, and Information.
Auxiliary analysis functions	Data search
Analysis result save function	Analysis list data can be saved to CSV-format files

CAN Bus Signal Analysis Functions (/F4, /F6, /F7 and /F8 Options)	
Applicable bus	CAN version 2.0A/B, Hi-Speed CAN (ISO11898), Low-Speed CAN (ISO11519-2)
Analyzable signals	CH1 to CH8, M1 to M4
Bit rate	1 Mbps, 500 kbps, 250 kbps, 125 kbps, 83.3 kbps, 33.3 kbps User defined (an arbitrary bit rate from 10 kbps to 1 Mbps with resolution of 100 bps)
CAN bus Trigger modes	SOF, ID/Data, ID OR, Error (Error Frame, Stuff, CRC), Message and signal (enabled when loading physical values/symbol definitions)
Auto setup function	Auto setting of bit rate, recessive level, threshold value, time axis scale, voltage axis scale, and display of analysis results
Analyzable no. of frames	100000 frames max.
Analysis results displays	Analysis no., time from trigger position (Time (ms)), Frame type, ID, DLC, Data, CRC, presence/absence of Ack, information
Auxiliary analysis functions	Data search and field jump functions
Analysis result save function	Analysis list data can be saved to CSV-format files

CAN FD Bus Signal Analysis Functions (/F7 and /F8 Options)		
Applicable bus		CAN FD (ISO 11898-1:2015 and non-ISO)
Analyzable signals		CH1 to CH8, M1 to M4
Bit rate	Arbitration	1 Mbps, 500 kbps, 250 kbps, User Define (an arbitrary bit rate from 20 kbps to 1 Mbps with resolution of 100 bps)
	Data	8 Mbps, 5 Mbps, 4 Mbps, 2 Mbps, 1 Mbps, 500 kbps, User Define (an arbitrary bit rate from 250 kbps to10 Mbps with resolution of 100 bps)
CAN FD bus Trigger modes		SOF, ID/DATA, ID OR, FDF, ESI, Error (Error Frame, Stuff, Fixed Stuff, CRC), Message and signal (enabled when loading physical values/ symbol definitions)
Auto setup function		Auto setting of bit rate, recessive level, threshold value, time axis scale, voltage axis scale, and display of analysis results
Analyzable no. of frames		50000 frames max.
Analysis results displays		Analysis no., time from trigger position (Time (ms)), Frame type, ID, DLC, Data, CRC, presence/absence of Ack, information
Auxiliary analysis functions		Data search and field jump functions
Analysis result save function		Analysis list data can be saved to CSV-format files

LIN Bus Signal Analysis Functions (/F4, /F6, /F7 and /F8 Options)	
Applicable bus	LIN Rev. 1.3, 2.0, 2.1
Analyzable signals	CH1 to CH8, M1 to M4
Bit rate	19.2 kbps, 9.6 kbps, 4.8 kbps, 2.4 kbps, 1.2 kbps User defined (an arbitrary bit rate from 1 kbps to 20 kbps with resolution of 10 bps)
LIN bus Trigger modes	Break Synch, ID/Data, ID OR, and Error trigger
Auto setup function	Auto setting of bit rate, threshold value, time axis scale, voltage axis scale, and display of analysis results
Analyzable no. of frames	100000 frames max.
Analysis results displays	Analysis no., time from trigger position (Time (ms)), ID, ID-Field, Data, CheckSum, information
Auxiliary analysis functions	Data search and field jump functions
Analysis result save function	Analysis list data can be saved to CSV-format files

FlexRay Bus Signal Analysis Functions (/F5, /F6 and /F8 Options)	
Applicable bus	FlexRay Protocol Version 2.1
Analyzable signals	CH1 to CH8, M1 to M4
Bit rate	10 Mbps, 5 Mbps, 2.5 Mbps
FlexRay bus Trigger modes	Frame Start, Error, ID/Data, ID OR
Auto setup function	Auto setting of bit rate, threshold value, time axis scale, voltage axis scale, and display of analysis results
Analyzable no. of frames	5000 frames max.
Analysis results displays	Analysis no., time from trigger position (Time(ms)), Segment (Static or Dynamic), Indicator, FrameID, PayLoad length, Cycle count, Data, Information
Auxiliary analysis function	Data search
Analysis result save function	Analysis list data can be saved to CSV-format files

SENT Signal Analysis Functions (/F9 Option)		
Applicable standard		J2716 JAN2010 and older
Analyzable signals		CH1 to CH8, logic input, or M1 to M4
Clock period		1 us to 100 us with resolution of 0.01 us
Data type	Fast channel	Nibbles/User Defined
	Slow channel	Short/Enhanced
SENT trigger modes		Every Fast CH, Fast CH Status & Communication, Fast CH Data, Every Slow CH, Slow CH ID/Data, Error
Auto setup function		Auto setting of clock period, nibble number, pause pulse, threshold value, time axis scale, voltage axis scale, and display of analysis results
Analyzable no. of frames		100000 frames max.
Analysis results displays		
	Fast channel	Analysis no., time from trigger position (Time (ms)), Sync/Cal period, Tick, Status & Comm, Data, CRC, frame length, information
	Slow channel	Analysis no., time from trigger position (Time (ms)), ID, Data, CRC, information
Auxiliary analysis functions		Data search and trend functions
Analysis result save function		Analysis list data and trend data can be saved to CSV-format files

GP-IB (/C1 Option)	
Electromechanical specifications	Conforms to IEEE std. 488-1978 (JIS C 1901-1987)
Protocol	Conforms to IEEE std. 488.2-1992

Auxiliary Input	
Rear panel I/O signal	External trigger input/output, GO/NO-GO output, video output
Probe interface terminal	8 terminals (front panel)
Probe power terminal	8 terminals (side panel), (/P8 option)

Internal Storage (Standard model /C8 Option)	
Capacity	Standard: Approx. 1.8 GB, /C8 option: Approx. 7.2 GB

Built-in Printer (/B5 Option)	
Built-in printer	112 mm wide, monochrome, thermal

USB Peripheral Connection Terminal	
Connector	USB type A connector × 2 (front panel)
Electromechanical specifications	USB 2.0 compliant
Supported transfer standards	Low Speed, Full Speed, High Speed
Supported devices	USB Mass Storage Class Ver. 1.1 compliant mass storage devices USB HID Class Ver.1.1 compliant mouse, keyboard

USB-PC Connection Terminal	
Connector	USB type B connector × 1
Electromechanical specifications	USB 2.0 compliant
Supported transfer standards	High Speed, Full Speed
Supported class	USBTMC-USB488 (USB Test and Measurement Class Ver. 1.0)

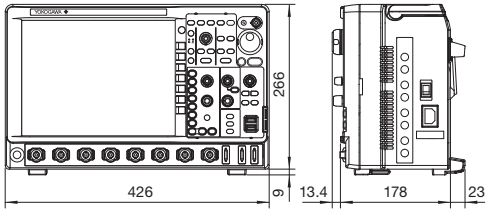
Ethernet	
Connector	RJ-45 connector × 1
Transmission methods	Ethernet (1000BASE-T/100BASE-TX/10BASE-T)
Supported services	Server: FTP, HTTP, VXI-11 Client: FTP, SMTP, SNTP, LPR, DHCP, DNS

General Specifications	
Rated supply voltage	100 to 240 VAC
Rated supply frequency	50 Hz/60 Hz
Maximum power consumption	250 VA (when printer is used)
External dimensions	426 (W) × 266 (H) × 178 (D) mm (when printer cover is closed, excluding protrusions)
Weight	Approx. 6.6 kg, With no options
Operating temperature range	5°C to 40°C

*1 Measured under standard operating conditions after a 30-minute warm-up followed by calibration.
Standard operating conditions: Ambient temperature: 23°C ±5°C Ambient humidity: 55 ±10% RH
Error in supply voltage and frequency: Within 1% of rating
*2 Value in the case of repetitive phenomenon. The frequency bandwidth of a single-shot phenomenon is the smaller of the two values, DC to sampling frequency/2.5 or the frequency bandwidth of the repetitive phenomenon.
*3 When the input section is shorted, the acquisition mode is set to Normal, accumulation is OFF, and the probe attenuation is set to 1:1.
*4 The LCD may include a few defective pixels (within 4 ppm over the total number of pixels including RGB).

External dimensions

unit: mm



Model and Suffix code

Model	Suffix code	Description
DLM4038[*1]		Mixed Signal Oscilloscope: 8 ch, 350 MHz
DLM4058[*1]		Mixed Signal Oscilloscope: 8 ch, 500 MHz
Power cord	-D	UL/CSA standard
	-F	VDE standard
	-Q	BS standard
	-R	AS standard
	-H	GB standard
	-N	NBR standard
Language	-HE	English Message and Panel
	-HC	Chinese Message and Panel
	-HK	Korean Message and Panel
	-HG	German Message and Panel
	-HF	French Message and Panel
	-HL	Italian Message and Panel
	-HS	Spanish Message and Panel
Option	/L16	Logic 16bit
	/B5	Built-in printer
	/M1[*2]	Memory expansion During continuous measurement: 6.25 Mpoints; Single mode: 25 Mpoints (when interleave mode ON: 62.5 Mpoints)
	/M2[*2]	Memory expansion During continuous measurement: 12.5 Mpoints; Single mode: 62.5 Mpoints (when interleave mode ON: 125 Mpoints)
	/M3[*2]	Memory expansion During continuous measurement: 25 Mpoints; Single mode: 125 Mpoints (when interleave mode ON: 250 Mpoints)
	/P8[*7]	Eight probe power connectors
	/C1	GP-IB Interface
	/C8	Internal storage (7.2 GB)
	/G2[*3]	User defined math
	/G3[*3]	Power supply analysis function
	/G4[*3]	Power supply analysis function (includes /G2)
	/F1[*4]	UART trigger and analysis
	/F2[*4]	I^2C + SPI trigger and analysis
	/F3[*4]	UART + I^2C + SPI trigger and analysis
	/F4[*5]	CAN + LIN trigger and analysis
	/F5[*5]	FlexRay trigger and analysis
	/F6[*5]	FlexRay + CAN + LIN trigger and analysis
	/F7[*5]	CAN+CAN FD+LIN trigger and analysis
	/F8[*5]	FlexRay+CAN+CAN FD+LIN trigger and analysis
	/F9	SENT trigger and analysis
	/E1[*6]	Four additional 701939 probes (8 in total)
	/E2[*6]	Attach four 701946 probes[*8]
	/E3[*6]	Attach eight 701946 probes[*8]

Standard Main Unit Accessories
Power cord (1 set), Passive probe 701939 (500 MHz, 1.3 m)[*9] 4 set, Protective front cover (1 set), Soft carrying case for probes (1 set), Printer roll paper (for /B5 option) 1 roll, Rubber leg cap (1 set), User's manuals[*10]

*1: Logic probes are not included. Please order the accessory logic probe 701988/701989 sold separately.
*2 to 6: Only one from the each note can be selected at a time.
*7: Specify this option when using current probes or differential probes that don't support probe interface.
*8: The 701939 probes are not included when this option is selected.
*9: When /E1 option is selected, eight 701939 probes are included. When either /E2 or /E3 option is selected, no 701939 probe is included.
*10: Start guide as the printed material, and User's manuals as CD-ROM are included.

NOTICE
● Before operating the product, read the user's manual thoroughly for proper and safe operation.

This is a Class A instrument based on Emission standards EN61326-1 and EN55011, and is designed for an industrial environment.
Operation of this equipment in a residential area may cause radio interference, in which case users will be responsible for any interference which they cause.

Additional Option License for DLM4000*

Model	Suffix code	Description
709820	-G2	User defined math
	-G3	Power supply analysis function
	-G4	Power supply analysis function (includes G2)
	-F1	UART trigger and analysis
	-F2	I^2C + SPI trigger and analysis
	-F3	UART + I^2C + SPI trigger and analysis
	-F4	CAN + LIN trigger and analysis
	-F5	FlexRay trigger and analysis
	-F6	FlexRay + CAN + LIN trigger and analysis
	-F7	CAN + CAN FD + LIN trigger and analysis
	-F8	FlexRay + CAN + CAN FD + LIN trigger and analysis
	-F9	SENT trigger and analysis
	-X1	F4 -> F7/F6 -> F8 (add CAN FD)

*: Separately sold license product (customer-installable).

Logic probes

Model	Product	Description
701988	Logic probe (PBL100)	1 MΩ input resistance, max. toggle frequency 100 MHz, 8 inputs
701989	Logic probe (PBL250)	100 kΩ input resistance, max. toggle frequency 250 MHz, 8 inputs

Accessories (sold separately)

Model	Product	Description
701939	Passive probe[*1]	10 MΩ (10:1) /500 MHz/1.3 m
701946	Miniature passive probe	10 MΩ (10:1) /500 MHz/1.2 m
702906	Passive probe (wide temperature range)	10 MΩ (10:1) /200 MHz/2.5 m –40°C to 85°C
701912	Active probe (PBA1000)	1 GHz bandwidth, 100 kΩ (10:1), 0.9 pF
700939	FET probe	900 MHz bandwidth, 2.5 MΩ (10:1), 1.8 pF
701944	100:1 high voltage probe	400 MHz bandwidth, 1.2 m, 1000 Vrms
701945	100:1 high voltage probe	250 MHz bandwidth, 3 m, 1000 Vrms
701924	Differential probe (PBDH1000)	1 GHz bandwidth, 1 MΩ (50:1), max. ±25 V
701927	Differential probe (PBDH0150)	150 MHz bandwidth, max. ±1400 V, 1 m extension lead
701920	500 MHz differential probe	500 MHz bandwidth, max. ±12 V
701922	200 MHz differential probe	200 MHz bandwidth, max. ±20 V
700924	100 MHz differential probe	100 MHz bandwidth, max. ±1400 V
701921	100 MHz differential probe	100 MHz bandwidth, max. ±700 V
701926	High voltage 50 MHz differential probe	50 MHz bandwidth, max. 5000 Vrms
700925	15 MHz differential probe	15 MHz bandwidth, max. ±500 V
701917	Current probe	50 MHz bandwidth, max. 5 Arms, High-sensitivity
701918	Current probe	120 MHz bandwidth, max. 5 Arms, High-sensitivity
701928	Current probe (PBC100)[*2]	100 MHz bandwidth, max. 30 Arms
701929	Current probe (PBC050)[*2]	50 MHz bandwidth, max. 30 Arms
701930	Current probe[*2]	10 MHz bandwidth, max. 150 Arms
701931	Current probe[*2]	2 MHz bandwidth, max. 500 Arms
701936	Deskew correction signal source	For deskew between voltage and current
701919	Probe stand	Round base, 1 arm
B9988AE	Printer roll paper	One lot: 10 rolls, 10 m each
366973	GO/NO-GO cable	GO/NO-GO signal output
701968	Soft carrying case	For DLM4000
701969-E	Rack mount kit for DLM4000	EIA standard-compliant
701969-J	Rack mount kit for DLM4000	JIS standard-compliant

*1: Please refer to DL Series Accessories brochure for 701939 adapters.
*2: Current probes' maximum input current may be limited by the number of the probes used at a time.

Accessory Software

Model	Product	Description
701991	MATLAB tool kit	MATLAB plug-in software
701992-SP01	Xviewer	Viewer software (standard edition)
701992-GP01		Viewer software (MATH edition)

YOKOGAWA

YMI-KS-MI-SE01

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