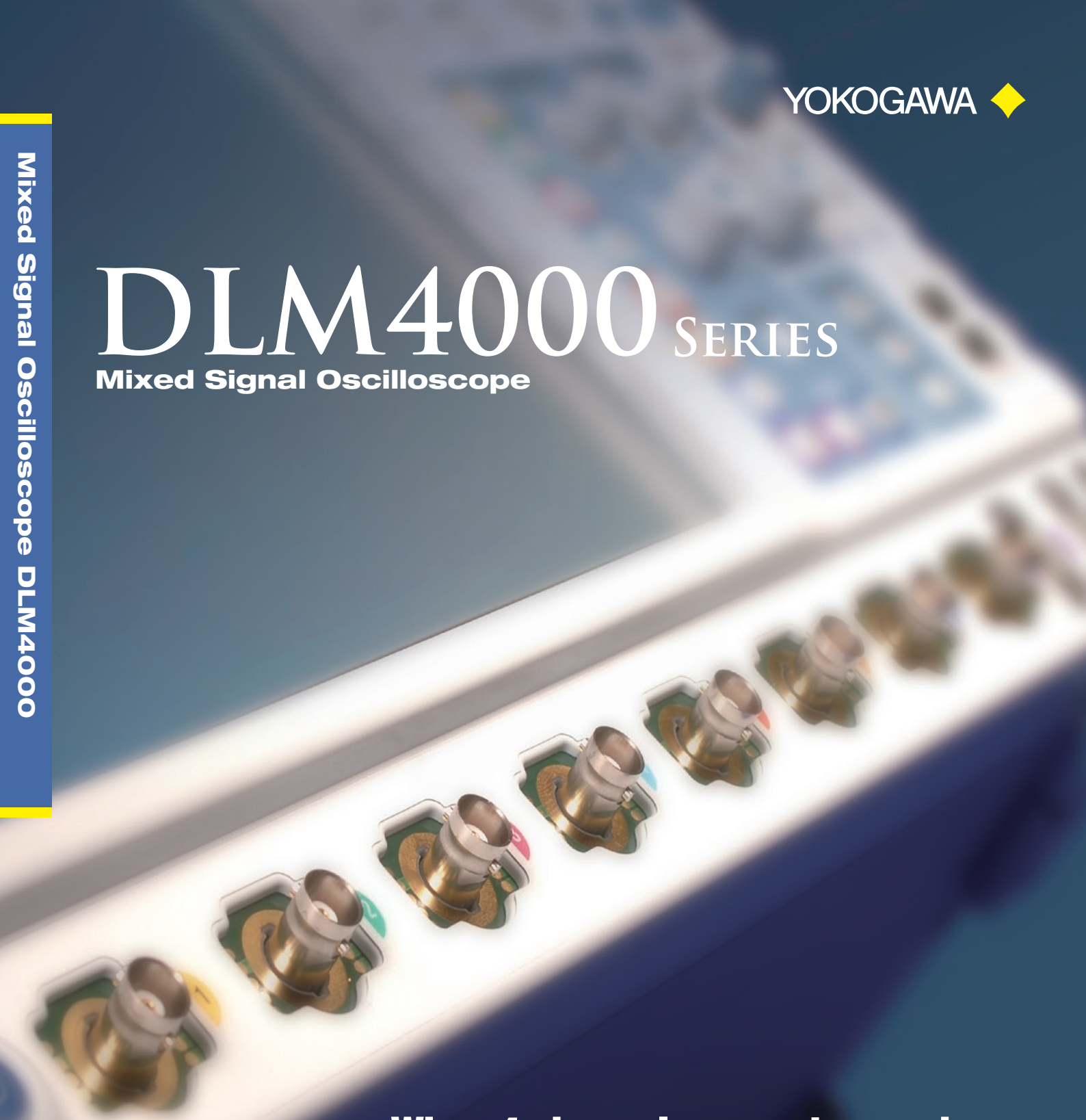
YOKOGAWA

Mixed Signal Oscilloscope DLM4000

DLM4000 SERIES

Mixed Signal Oscilloscope



When 4 channels are not enough …

DLM4000

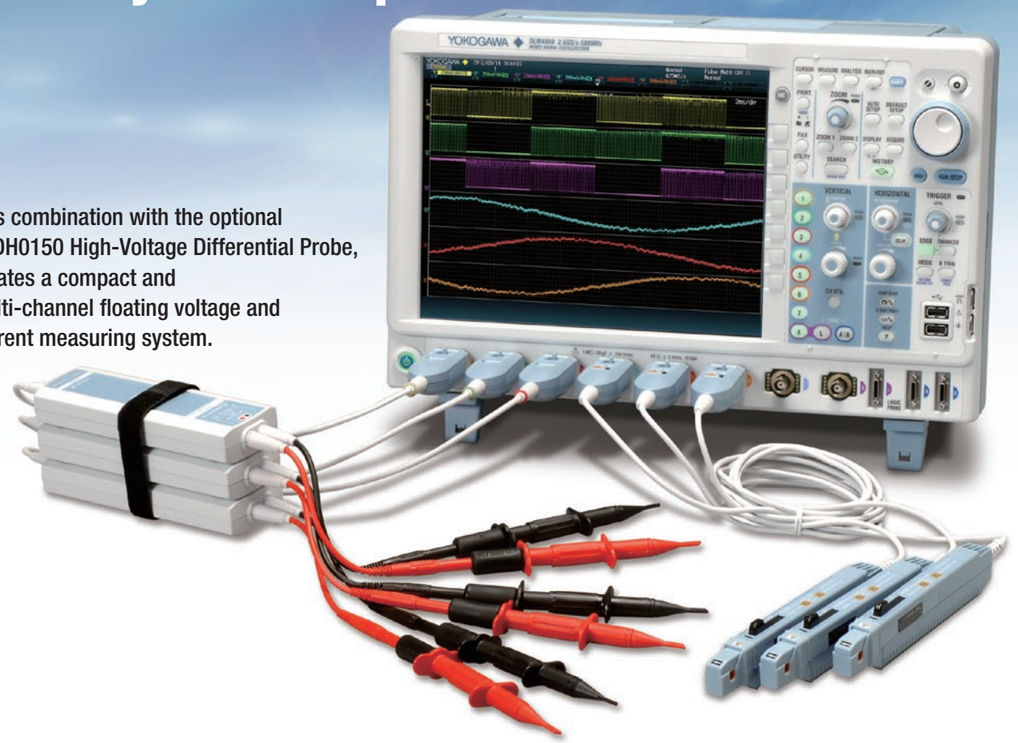
For more information, go to
tmi.yokogawa.com
Test & Measurement Instruments

3-Year Warranty

CE

Bulletin DLM4000-00EN

For today's challenging power electronics, automotive electronics and mechatronics: Only one scope will do – the world's only eight-channel oscilloscope - the DLM4000.

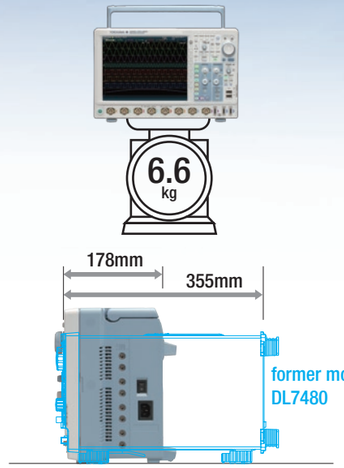


This combination with the optional PBDH0150 High-Voltage Differential Probe, creates a compact and multi-channel floating voltage and current measuring system.

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

12.1" LCD enables eight waveforms to be easily observed.

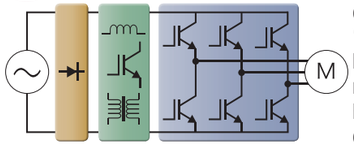
Portable



Modest 178 mm Depth
Half of the former model DL7480

Typical Demanding Applications for the Eight-Channel DLM4000

8ch Motor Control & Inverter Circuit Development



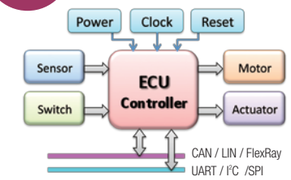
Key to efficient and reliable high-performance electric motors is the modern inverter design, or 'Intelligent Power Module'. Multi-channel, high-speed waveform measurement is an absolute necessity. Four channels are simply not enough. Boasting eight true analog inputs, the DLM4000 empowers today's engineer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

4ch Limitation of 4ch 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.

8ch Electronic Control Unit & Mechatronic Test



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, LIN and FlexRay. The DLM4000 can speed up the the R&D process. Four channels are not enough.

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

4ch Limitation of 4ch 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.

Typical General Applications for the Eight-Channel DLM4000

8ch Power Supply & Power Converter Test

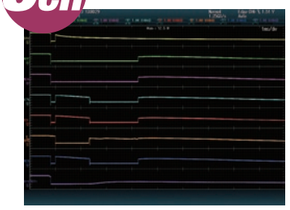
During the evaluation of a power supply design, it is necessary to measure noise, ripple, voltage margin and current , as well as timing margins and the jitter of the startup-shutdown sequences. As the number of waveforms in modern power supply designs is increasing, especially for intelligent digitally-controlled power supplies, battery management systems, and wireless power supply systems - a four-channel oscilloscope is not enough.

Example: Start-up sequence test of multi-output power supply or Converter
Primary /secondary voltage/current and power supply control signal

Recorder Limitation of Recorder

A modern multi-channel recorder provides enough channels and long record times; however, due to modest sample and update rates, the recorder is unlikely to be successful at measuring high-speed waveforms in the vicinity of CPUs & FPGA such as communication signals, high-frequency noise, and fast waveform anomalies.

8ch Troubleshooting, total system test



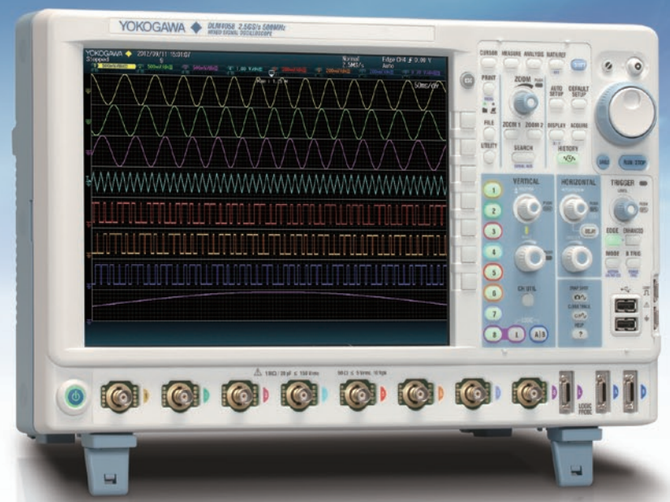
For laboratory and field troubleshooting, the ability to measureas many suspicious signals as possible enables quick solutions to be found.
The measurement time for system testing is often very limited.
The 8 channels of the DLM4000 provide the capability to measure more signals at one time, both now and to meet future needs.

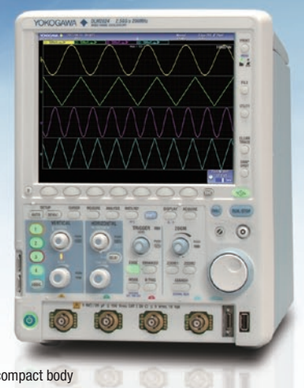
Example: Troubleshooting of infrequent problems
Comprehensive stability test of the whole system

4ch Limitation of two 4 channel Scopes

When four channels are not enough, it is common to connect two separate four channel scopes. This approach is not only cumbersome but inter-waveform timing can lack credibility and post-processing of the waveform data files is twice as much work. The sensible approach is an eight-channel MSO.

Features, Functionality, and Operability – satisfying the needs of today's engineers.





Portrait, compact body
DLM2000 Mixed signal oscilloscope series

Reliable capture, from fast-short pulses to long recordings

Use the DLM4000 like an eight-channel memory recorder or select faster sampling rates up to 1.25 GS/s across all channels!

For fast-short waveforms the comprehensive trigger suite captures the waveforms you need!

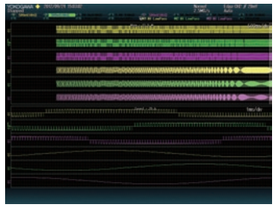
In addition to basic trigger functions such as Edge, State, and Pulse Width – Advanced trigger types are provided, including Edge OR between multiple channels, Serial Bus trigger in which A combination of two bus signals is possible, or an A and B combination of different trigger types.
This comprehensive trigger suite means you capture the correct waveforms - even for fast and complicated sets of waveforms containing combinations of analog, digital, and serial bus signals.

- **Edge trigger**
  - Edge
- **Enhanced triggers**
  - Edge OR
  - Edge (qualified)
  - State
  - Pulse width
  - State width
  - Serial: (optional) FlexRay/CAN/LIN/UART/I²C/SPI
    : (standard) user-defined
  - TV : NTSC/PAL/SDTV/ HDTV/user defined
- **B triggers**
  - A Delay B
  - A to B(n)
  - Dual bus (combination trigger of 2 serial busses)
- **Force Trigger**
  - Force a trigger manually

For long term recording, 'roll mode' gives you both realtime measurements and the waveform detail!

Selecting a long Time/Div setting automatically sets the DLM4000 into 'Roll Mode', which performs just like a recorder. During roll mode, powerful real-time waveform processing such as filtering, pulse counting and rotary counting can be executed simultaneously.
This means that the DLM4000 can observe a PWM and encoder waveform – analysis of these waveforms in realtime is normally challenging – but the DLM4000 does it.
Furthermore, checking the waveform by using the powerful zoom feature and parametric measurements is also possible during roll mode acquisition. This enables ongoing realtime waveforms to be analysed without interrupting or pausing the acquisition. Many oscilloscopes simply cannot do this.

During Roll Mode, real-time waveform processing such as PWM-filtering or pulse-counting means un-interrupted recording

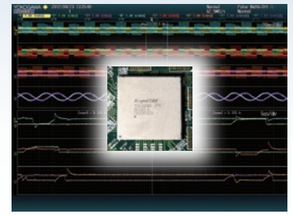


Best-in-class Deep Memory & Architecture

No-compromise ScopeCORE Architecture - the DLM4000 manages super-long record lengths with ease

Extra Deep Memory (125 Mega-Points) Enables Long-Duration Measurement

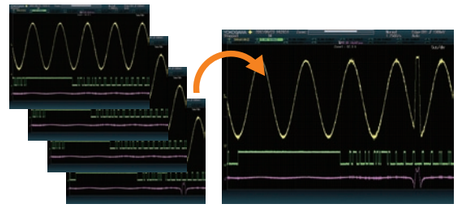
For-four channel measurements in Single shot mode, you can add the /M2 memory expansion option which provides a large memory of up to 125 Mpoints. Even at a fast sampling rate of 1.25 GS/s, records as long as 100 milli-seconds can be captured.
Yokogawa's proprietary ScopeCORE IC assures responsiveness even for long record lengths. ScopeCORE maintains a responsive waveform display even when parametric measurements and waveform calculations are used and defines the architecture and power of the DLM4000
In order to find and display the desired parts of the signal within the long memory, powerful waveform search and a unique dual-window zoom function are provided.



Dual-window zooming enables
two separate areas to be displayed.
(Center: ScopeCORE fast data processing IC)

You can replay waveforms later, so you'll never miss an abnormal waveform - History Function –

With the DLM4000 series, up to 20,000 previously captured waveforms can be saved in the automatically segmented acquisition memory without sacrificing acquisition rate. This History function, enables you to display just one or all of the previously captured waveforms (history waveforms) on screen. You can also perform cursor measurement, computation, and other operations on history waveforms. Using the History function, you can find and analyze rarely-occurring abnormal signals which may not cause a trigger to occur.



History search function

You can search the 20,000 previously captured waveforms for history waveforms that meet specified search criteria.
You can also perform cursor measurement and other types of analysis on the search results.

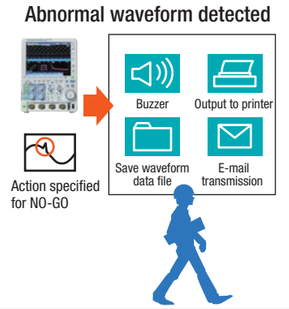
Replay function

Waveforms can be displayed one at a time, using the rotary knob. With the Replay function, history waveforms can be automatically played back, paused, fast-forwarded, and rewound.

Save time using unattended supervisory data acquisition

With built-in GO/NO-GO testing, unattended data acquisition becomes a powerful tool.

A GO/NO-GO test result can be determined using customizable trigger conditions including waveform zoning, parameter measurement, and other criteria. For either a GO or a NO-GO test result, an action can be executed such as sounding a buzzer, saving the current waveform, or sending a notification to a designated e-mail address.
Waveforms in which an abnormality occurred can be saved for confirmation and analysis at a later time.
Let the DLM4000 save you time.



Options and Accessories to Complete the Solution

For power device circuit voltage/current measurement

Eight analog input channels enables four pairs of voltage and current measurements, thereby supporting today's high-speed and sophisticated power electronics circuit development. Optional analysis functions and accessories support the comprehensive measurement of power electronic devices.

Power supply analysis function (/G4)

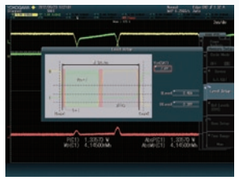
Power Analysis

- -Switching Loss
- -Safe Operating Area
- -Harmonic Analysis
- -Joule Integral

Power Measurement

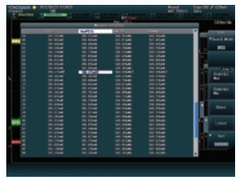
Automated measurement of power parameters such as active power, apparent power, power factor etc. (Calculation of three-phase power is also possible)

Example: Switching Loss Analysis



The built-in algorithm fine tunes Power Loss calculations.
User-specified parameters include device such as IGBTs and MOSFETs.

By dividing the long memory into segments, the SOA (safe operating area) can be analysed and, peak voltages between switching cycles can be compared by overlaying or one-by-one replay.



It is also possible to display a list of the switching loss of each cycle and save the results. By clicking a value in the list, the corresponding waveform will be directly displayed.

Easy Probing for Floating Signals –High-Voltage Differential Probe–

The High Voltage Differential Probe range includes models such as the compact PBDH0150 (1400Vpeak) as well as the 701926 (7kVpeak).

PBDH0150(701927)
150 MHz bandwidth
±1.4kV

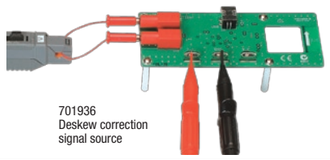
Wide Range of Current Measurement –Current probe–

The PBC100 and PBC050 high-bandwidth current probes measure DC to 100MHz and 50MHz at up to 30Arms. The 701931 is available for higher currents up to 500Arms. The current probe range covers a wide range of applications.

PBC100(701928) / PBC050(701929)
DC to 100 MHz / DC to 50 MHz
30 Arms

Enables Precise Power Measurement –Deskew correction signal source–

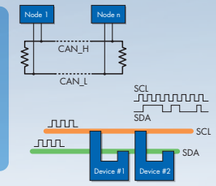
When measuring very fast switching devices, probe delay time correction (de-skew) is crucial. The 701936 signal source and auto de-skew feature makes de-skewing quick and and simple.



701936
Deskew correction
signal source

CAN, LIN, I²C, SPI, & UART(RS232) … Protocol Analysis

**The DLM4000 offers advanced serial-bus analysis – saving precious development time of ECUs and Embedded Systems. Eight analog input channels means that multiple analog, serial-bus, and logic waveforms can be easily and simultaneously observed whilst preserving their relative timing.
Up to four serial-buses can be analysed at the same time.**

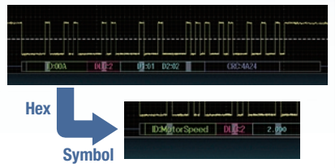


Serial bus analysis function (/F1, /F2, /F3, /F4, /F5, /F6) Triggering and real-time Decoding

Serial-Bus Auto-Setup Saves Time

Intelligent serial-bus auto-setup feature enables quick and easy setup. The bit-rate and voltage thresholds are set automatically.

Hardware-based Decoding



Serial-bus waveforms are processed in realtime by a dedicated processor. Decoded serial-bus data is displayed alongside the bus waveform in a user-selected format (Binary, HEX, or ASCII). Symbol display based on a user-defined symbol library is also easily setup.

Dual Bus Analysis

Many systems contain multiple serial buses. The DLM4000 analyzes four different serial-bus types simultaneously. A combination trigger of two different serial buses is also possible.

Analyzing High-speed Differential Signals –PBDH1000 Differential Probe–

The PBDH1000 differential probe features high input-resistance, wide bandwidth, and a wide input-voltage range. The PBDH1000 is perfect for measuring the noise or surge voltage of in-vehicle high-speed serial bus waveforms, including CAN and FlexRay.
A generous assortment of probe tip accessories assures flexible probing options.

PBDH1000(701924)
1.0GHz bandwidth
1 MΩ, approx 1.1pF

Probing Fast & Slow Logic Signals –PBL100 & PBL250 Logic Probe–

Logic signals are not always fast. In some cases, high input resistance is important. Yokogawa offers two types of logic probes, PBL100 (100 MHz, 1 MΩ), which has mimimal loading, and the PBL250 (250 MHz, 100 kΩ), ideal for probing high-speed logic waveforms.

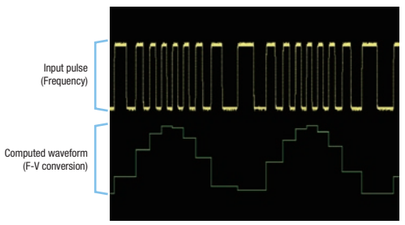
High-density IC and PCB Probing –701946 Miniature passive probe–

The 701946 is an ultra-compact passive probe for measuring high-speed waveforms on ICs and in high-density circuitry.
Various accessories maximise safety and performance.

PWM, F-V, FFT, Diff/Integ … For an Increasingly Mechatronic World

**The DLM4000 features advanced, powerful, and flexible waveform computation abilities.
An increasing number of mechatronics applications require measurements on the computational-result of a waveform, and not on the input waveform itself.
Examples include PWM control signals, pulse-signals from rotating-shaft applications, vibration-sensor data, and accelerometer waveforms.**

Examples of Standard Computations:
Real-time Low-Pass Filter, Add, Subtract, & Multiply Waveforms, Integral, Pulse Count, Rotary-Count of Encoder A/B Signal, XY Display, Power Spectrum



F-V conversion of frequency pulse (/G2 option)

User-Defined Math (/G2) Customizable User-Defined Equations

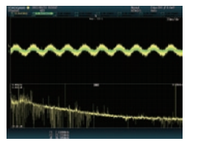
Example of the functions in /G2 option, User Define Math:

Duty cycle analysis for PWM waveform, F-V conversion, High-pass/Low-pass/Band-pass filtering, moving average, differential-integral, trigonometric, exponential-logarithm, arithmetic calculation of multiple channels, DA conversion of logic signals

User-defined math performs computation on input-waveforms and math-channel results; user-defined math can also use parametric measurement results within a computation expression.

Expansion of FFT Calculation

In addition to power spectrum, advanced FFT functions such as coherence and transfer function calculations are available for detailed frequency-domain analysis.



Advanced User-Interface

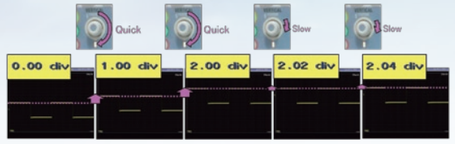
Comfortable Operation

Dedicated knobs assure analog-like, intuitive operation

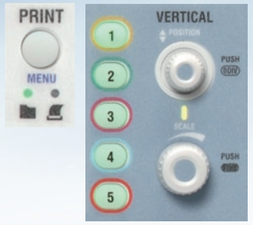
The push function for each knob enables fine adjustments to be made or puts the setting back to the default.

By pushing the knob, trigger level is set to the center of the waveform automatically.

Speed-sensitive knob behavior creates a natural response. The scope intelligently responds to the operator.



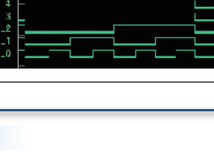
Multi-color LED for clarity



Built-in user guidance

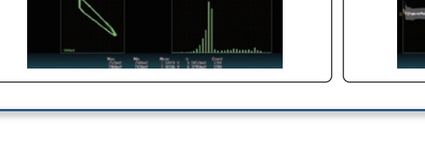
Graphical online help

The "?" button gets the operator fast and friendly online help. No more need to consult the user's manual.



Thumbnail can be viewed full-size

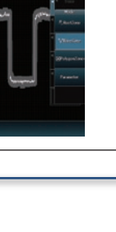
Thumbnails of waveform data, waveform image data, and Wave-Zone files can be displayed. The image and file names are shown so that you can view screen image contents while copying or deleting files.



Thumbnail can be viewed full-size

Multiple Languages

Select from 9 languages.



Flexible and Powerful Features

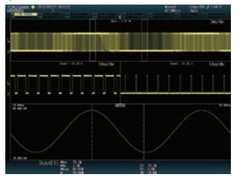
Advanced Waveform Parameter Measurement Functions

Statistical Analysis

Max/Mean/Freq/Rise/Fall/Delay....., 29 different parameters are available. Statistical processing of parameters, such as Min, Max, Mean and Standard deviation from multiple acquisitions, is also possible. The Yokogawa original “cycle statistic” and “history statistic” measurement functions in combination with its long memory and 8-channel inputs, helps the analysis of e periodic mechatronics and power electronics signals.

Trend and Histogram of Waveform Parameters

Waveform parameters can be displayed in list, trend and histogram formats. It ispossible to find a characteristic value in the list display and jump to the actual waveform by clicking it.

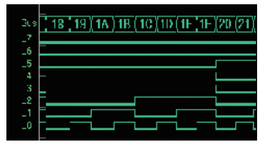


User-defined Waveform Parameters

Create customised waveform parameter measurements using the freeform equation editor. Calculation of three-phase power is also possible (/G4 option)

Logic Measurement

Parallel logic signals can be easily analysed using the Bus display and bit assignment functions. A State display is possible by using a clock edge to normalise the input bits. The optional DA calculation function is useful for evaluating AD/DA converters.

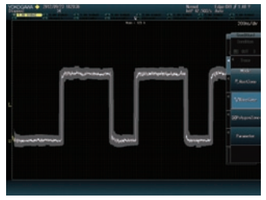


Variety of Display Formats

Many types of display format are supported such as XY, FFT, histogram.

Automated GO/NO-GO Judgment

GO/NO-GO judgment using polygon zoning or waveform parameters is possible without programming.



Broad Connectivity and Easier Control

GP-IB connection terminal (optional)
Control from a PC

Probe power terminal x8 (optional)
For current and differential probes that don't support the Yokogawa probe interface.

Ethernet (1000BASE-T)
Monitor & Control from a PC.
Network Data Transfer & Email.

USB-PC Connection terminal
Control from a PC.
Mount to PC as External storage.

GO/NO-GO Output terminal

USB 2.0 peripheral connection terminal x2
Supports USB storage, USB mouse and keyboards.

RGB video signal output terminal
Connection to an external monitor

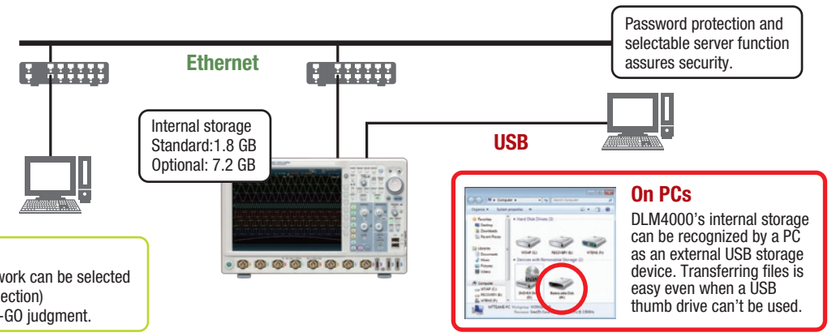
Trigger output

External trigger input

PC efficiency improvement

DLM4000 is not Windows based, so it’s safer when connecting to networks.

PC Connectivity Options



On PCs
- Display can be monitored on the browser.

On DLM4000
- A hard drive of the PC on the network can be selected as the save destination (FTP connection)
- Mail sending in automatic GO/NO-GO judgment.

On PCs
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.

Software Control

http://tmi.yokogawa.com/ea/products/oscilloscopes/oscilloscopes-application-software/

	Free Software	Optional Software (Trial version available)
Off-line waveform display and analysis	XviewerLITE –Basic check– Zoom, V-cursor, conversion to CSV format	Xviewer –Advanced Analysis– Advanced and useful functions are supported. Good for precise, off-line waveform analysis. • Waveform observation and analysis • Cursor, Parameteric Measure • Statistical Analysis • Multiple file display • Advanced waveform operations • Comment, marking, printing and making report • Optional Math computation feature • Remote monitor • Instruments communication function • Transferring waveform & image files
Waveform monitoring on a PC	XWirepuller Remote monitor and operation Transferring image files	
Data transfer to a PC		
Command control Custom software development	Control library “TMCTL” For Visual Studio DL-Term Interactive tool LabVIEW instrument driver	MATLAB Tool Kit Remote control from MATLAB and data file importing.

Models

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

Basic Specifications

Analog Signal input

Input channels		CH1 to CH8 (CH1 to CH7 when using logic input)
Input coupling setting		AC, DC, DC50 Ω, GND
Input impedance		1 MΩ ±1.0%, approximately 20 pF 50 Ω ±1.0% (VSWR 1.4 or less, DC to 500MHz)
Voltage axis sensitivity	1 MΩ	2 mV/div to 10 V/div (steps of 1-2-5)
setting range	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	1 MΩ	±1V (2 mV/div to 50 mV/div)
setting range		±10V (100 mV/div to 500 mV/div) ±100V (1 V/div to 10 V/div)
	50 Ω	±1V (2 mV/div to 50 mV/div) ±5V (100 mV/div to 500 mV/div)
DC accuracy*1		±(1.5% of 8 div + offset voltage accuracy)
Offset voltage accuracy*1	2 mV to 50mV/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 ±3div)*1*2

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

Isolation between channels		-34 dB@ analog bandwidth (typical value)
Residual noise level*3		The larger of 0.4 mV rms or 0.05 div rms (typical value)
A/D resolution		8bit (25LSB/div) Max. 12 bit (in High Resolution mode)
Bandwidth limit		FULL, 200 MHz, 100MHz, 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		Repeat / Single / Single Interleave
	Standard	1.25 M / 6.25 M / 12.5 MPoints
	/M1	6.25 M / 25 M / 62.5 MPoints
	/M2	12.5 M / 62.5 M / 125 MPoints
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 (excl. 8 ch input and logic input)
	/L16	24bit (16bit when 8 ch is used)
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 ±6V
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		Repeat / Single
	Standard	1.25 M / 6.25 MPoints
	/M1	6.25 M / 25 MPoints
	/M2	12.5 M / 62.5 MPoints

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
		LIN (optional)	CH1 to CH8
		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 10⁹ (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	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/10div (in zoom area)
	Scroll	Auto Scroll
	Search functions	Edge, Edge Qualified, State, Pulse Width, State Width I²C (option), SPI (option), UART (option), CAN (option), LIN (option), FlexRay (option)
History memory	Max. data	2,500 (record length 1.25 kPoints, with standard) 10,000 (record length 1.25 kPoints, with /M1 option) 20,000 (record length 1.25 kPoints, with /M2 option)
	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 & 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		Min, Max, Ave, Cnt, Sdev
Statistics modes		Continuous, Cycle, History
Trend/Histogram display of wave parameters		Up to 2 trend or histgram display of specied wave parameters
Computations (MATH)		+, -, ×, Filter (Delay, Moving Avg, IIR Lowpass, IIR Highpass), Integ, Count / Rotaly count, user defined math (optional)
Computable no. of traces		4 (Math1, to Math4)
Max. computable memory length		Standard model: 6.25 MPoints, /M1 memory expansion option: 25 MPoints, /M2 memory expansion option: 62.5 MPoints
Reference function		Up to 4 traces (REF1/to REF4) of saved waveform data can be displayed and analyzed
Action ON trigger	Modes	All Condition, Zone, Param, Rect, Polygon
	Actions	Buzzer, Print, Save, Mail, Go/Nogo out
XY		Displays XY1, to XY4 and T-Y simultaneously
FFT		Number of points: 1.25k, 12.5k, 125k, 250k 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 option)		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, The maximum record length that can be computed is as well as standard math functions
Power supply analysis (/G4 option)		
Power analysis		For Pwr1 and Pwr2, selectable from 4 analysis types Deskweing between the voltage and current waveforms can be executed automatically.
	Switching loss	Total loss / 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, Unm, 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

I²C Bus Signal Analysis Functions (/F2 & /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
I²C Trigger modes		Every Start, Address & Data, Non-Ack, General Call, Start Byte, HS Mode
Analyzable signals		All analog, logic and Math channels
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		300,000 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 & /F3 Options)

Trigger types	3 wire/4 wire After assertion of CS, compares data after arbitrary byte count and triggers.
Analyzable signals	All analog, logic and Math channels
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
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	300,000 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 & /F3 Options)

Bit rate	1200 bps, 2400 bps, 4800 bps, 9600 bps,19200 bps, user defined (an arbitrary bit rate from 1 k to 10 Mbps with resolution of 100 bps)
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)
Analyzable signals	All analog, logic and Math channels
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	300,000 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 Options)

Applicable bus	CAN version 2.0A/B, Hi-Speed CAN (ISO11898), Low-Speed CAN (ISO11519-2)
Analyzable signals	All analog and Math channels
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(enabled when loading physical values/symbol definitions)
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	100,000 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 Options)

Applicable bus	LIN Rev. 1.3, 2.0, 2.1
Analyzable signals	All analog and Math channels
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	100, 000 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 Options)

Applicable bus	FlexRay Protocol Version2.1
Analyzable signals	All analog and Math channels
Bit rate	10Mbps, 5Mbps, 2.5Mbps
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	5,000
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

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, external trigger output, GO-NOGO output, video output
Probe interface terminal (front panel)	8 terminals
Probe power terminal (side panel)	8 terminals (/P8 option)

Internal Storage

Capacity	Standard model: 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, keyboad

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, VXI-11, HTTP Client: FTP, SMTP, SNTP, LPR, DHCP, DNS

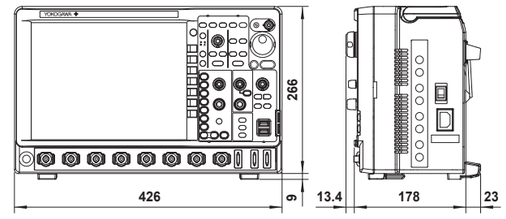
General Specifications

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. 6.6kg With no options
Operating temperature range	5 ℃ to 40 ℃

*1 Measured under standard operating conditions after a 30-minute warm-up followed by calibration.
Standard operating conditions: Ambient temperature: 23℃ ±5℃
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.

External Dimensions

Unit: mm



Model and Suffix Codes

Model	Suffix code	Description
DLM4038*1		Mixed Signal Oscilloscope: 8ch, 350 MHz
DLM4058*1		Mixed Signal Oscilloscope: 8ch, 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: 6.25Mpoints; Single mode: 25Mpoints (when interleave mode ON: 62.5Mpoints)
	/M2*2	Memory expansion During continuous measurement: 12.5Mpoints; Single mode: 62.5Mpoints (when interleave mode ON: 125Mpoints)
	/P8*3	Eight probe power connectors
	/C1	GP-IB Interface
	/C8	Internal storage (7.2 GB)
	/G2*4	User defined math
	/G4*4	Power supply analysis function (includes /G2)
	/F1*5	UART trigger and analysis
	/F2*5	I²C+SPI trigger and analysis
	/F3*5	UART+I²C+SPI trigger and analysis
	/F4*6	CAN+LIN trigger and analysis
	/F5*6	FlexRay trigger and analysis
	/F6*6	FlexRay+CAN+LIN trigger and analysis
	/E1*7	Four additional 701939 probes (8 in total)
	/E2*7	Attach four 701946 probes*8
	/E3*7	Attach eight 701946 probes*8

*1: Logic probes are not included. Please order the accessory logic probe 701988/701989 sold separately.
*2: Only one of these can be selected at a time.
*3: Specify this option when using current probes or differential probes that don't support probe interface.
*4: Only one of these can be selected at a time.
*5: Only one of these can be selected at a time.
*6: Only one of these can be selected at a time.
*7: Only one of these can be selected at a time.
*8: The 701939 probes are not included when this option is selected.

Logic probes

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

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.

Standard Main Unit Accessories

Part Name	Quantity
Power cord	1
Passive probe 701939 (500MHz, 1.3m)*1	4
Protective front cover	1
Soft carrying case for probes	1
Printer roll paper (for /B5 option)	1 roll
Rubber leg cap	1 set
User's manuals*2	1 set

*1: When /E1 option is selected, eight 701939 probes are included. When either /E2 or /E3 option is selected, no 701939 probe is included.
*2: Start guide as the printerd material, and User's manuals as CD-ROM are included.

Accessories (sold separately)

Name	Model	Description
Passive probe*1	701939	10MΩ(10:1)/500MHz/1.3m
Miniature passive probe	701946	10MΩ(10:1)/500MHz/1.2m
Active probe(PBA1000)	701912	1 GHz bandwidth, 100 kΩ(10:1), 0.9 pF
FET probe	700939	900 MHz bandwidth, 2.5 MΩ(10:1), 1.8 pF
100:1 high voltage probe	701944	400 MHz bandwidth, 1.2 m, 1000 Vrms
100:1 high voltage probe	701945	250 MHz bandwidth, 3 m, 1000 Vrms
Differential probe(PBDH1000)	701924	1 GHz bandwidth, 1 MΩ(50:1), max. ±25V
Differential probe(PBDH0150)	701927	150 MHz bandwidth, max. ±1400 V, 1 m extension lead
500MHz differential probe	701920	500 MHz bandwidth, max. ±12 V
200MHz differential probe	701922	200 MHz bandwidth, max. ±20 V
100MHz differential probe	700924	100 MHz bandwidth, max. ±1400 V
100MHz differential probe	701921	100 MHz bandwidth, max. ±700 V
High voltage 50MHz differential probe	701926	50 MHz bandwidth, max. 5000 Vrms
15MHz differential probe	700925	15 MHz bandwidth, max. ±500 V
Current probe(PBC100)*2	701928	100 MHz bandwidth, max. 30 Arms
Current probe(PBC050)*2	701929	50 MHz bandwidth, max. 30 Arms
Current probe*2	701930	10 MHz bandwidth, max. 150 Arms
Current probe*2	701931	2 MHz bandwidth, max. 500 Arms
Deskew correction signal source	701936	For deskew between voltage and current
Probe stand	701919	Round base, 1 arm
Printer roll paper	B9988AE	One lot: 10 rolls, 10 m each
MATLAB tool kit	701991	MATLAB plug-in software
Xviewer	701992-SP01	Viewer software (standard edition)
	701992-GP01	Viewer software (MATH edition)
GO/NO-GO cable	366973	GO/NO-GO signal output
Soft carrying case	701968	For DLM4000
Rack mount kit for DLM4000	701969-E	EIA standard-compliant
	701969-J	JIS standard-compliant

*1: As the accessories for 701939 probe, various adapters are available. Please refer to DL Series Accessories brochure.
*2: Current probes' maximum input current may be imited by the number of the probes used at a time.

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

Yokogawa's Approach to Preserving the Global Environment

- Yokogawa's electrical products are developed and produced in facilities that have received ISO14001 approval.
- In order to protect the global environment,Yokogawa's electrical products are designed in accordance with Yokogawa's Environmentally Friendly Product Design Guidelines and Product Design Assessment Criteria.

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