Specifications

Models

Model name (No.)	Max. sampling rate	Freq. bandwidth	Max. record length
DL9140 (701310)	5 GS/s	1 GHz	2.5 MW
DL9140L (701311)	5 GS/s	1 GHz	6.25 MW
DL9240 (701312)	10 GS/s	1.5 GHz	2.5 MW
DL9240L (701313)	10 GS/s	1.5 GHz	6.25 MW

Basic Specifications

Input channels: 4 (CH1 to CH4)
Input coupling: AC, DC, GND, DC50Ω
Input impedance: 1 MΩ ±1.0% approx. 20 pF (when using PB500 probe, 10 MΩ ±2.0%, approx. 14 pF)
50 Ω ±1.5%
Voltage axis sensitivity ranges: For 1 MΩ input: 2 mV/div to 5 V/div (steps of 1-2-5)
For 50 Ω input: 2 mV/div to 500 mV/div (steps of 1-2-5)
Maximum input voltage: For 1 MΩ input: 150 Vrms CAT I
For 50 Ω input: 5 Vrms or less and 10 Vpeak or less
DC offset max. setting range (When probe attenuation set to 1:1): For 1 MΩ input
2 mV/div to 50 mV/div: ±1 V
100 mV/div to 500 mV/div: ±10 V
1 V/div to 5 V/div: ±100 V
For 50 Ω input
2 mV/div to 50 mV/div: ±1 V
100 mV/div to 500 mV/div: ±5 V
Vertical (voltage) axis sensitivity
DC accuracy[1]: For 1 MΩ input: ±(1.5% of 8 div + offset voltage accuracy)
For 50 Ω input: ±(1.5% of 8 div + offset voltage accuracy)
Offset voltage axis accuracy[1]: 2 mV/div to 50 mV/div: ±(1% of setting + 0.2 mV)
100 mV/div to 500 mV/div: ±(1% of setting + 2 mV)
1 V/div to 5 V/div: ±(1% of setting + 20 mV)
Voltage standing-wave ratio (VSWR): 1.5 or less within frequency bandwidth
Frequency characteristics[1, 2]: For 50 Ω input — DL9140/DL9140L — DL9240/DL9240L
(Attenuation point of -3 dB when inputting a sinewave of amplitude ±2 div or equivalent)

0.5 V/div to 10 mV/div:	DC to 1 GHz	DC to 1.5 GHz
5 mV/div:	DC to 750 MHz	DC to 1 GHz
2 mV/div:	DC to 600 MHz	DC to 750 MHz

For 1 MΩ input (from the probe tip when using the dedicated passive probe (PB500))

5 V/div to 10 mV/div:	DC to 500 MHz	DC to 500 MHz
5 mV/div to 2 mV/div:	DC to 400 MHz	DC to 400 MHz

Residual noise level[3]: 0.4 mV rms or 0.05 div rms, whichever is larger (typical value[4])
A/D conversion resolution: 8-bit (25 LSB/div)
Maximum 13 bit (when in High-Res. mode)
Bandwidth limit: For each channel, select FULL, 200 MHz, 20 MHz, 8 MHz, 4 MHz, 2 MHz, 1 MHz, 500 kHz, 250 kHz, 125 kHz, 62.5 kHz, 32 kHz, 16 kHz, 8 kHz.
Limit implemented with analog (200 MHz, 20 MHz) and digital filters (IIR+ FIR).
Max. sampling rate — DL9140/DL9140L — DL9240/DL9240L
Real time sampling mode
Interleave mode ON: 5 GS/s — 10 GS/s
Interleave mode OFF: 2.5 GS/s — 5 GS/s
Repetitive sampling mode: 2.5 TS/s — 2.5 TS/s
Maximum record length: DL9140/DL9240 — DL9140L/DL9240L
2.5 MW — 6.25 MW
Time axis setting range: 500 ps/div to 50 s/div (steps of 1-2-5)
Time base accuracy[1]: ±0.001%
Time axis measurement accuracy[1]: ± (0.01% + 10 ps + 1 sample interval)
Max. acquisition rate[5]: When using 1.25 MW, 60 wareforms/sec/ch
When using 12.5 kW, 9000 wareforms/sec/ch
When using 2.5 kW, 25000 wareforms/sec/ch
Min. dead time (N single)[5]: 400 ns or less

Trigger Section

Trigger modes: Auto, Auto Level, Normal, Single, and N Single
Trigger source
CH1 to CH4: Signals applied to measurement input terminals[1]
LINE: Connected commercial power signal (only available with Edge trigger)
EXT: Signal input from EXT TRIG IN terminal
Trigger level range
CH1 to CH4: ±4 divisions from the screen center
EXT: ±2 V (1:1), ±20 V (10:1 when used with a probe)
Trigger level setting resolution
CH1 to CH4: 0.01 div
EXT: 5 mV (1:1), 50 mV (10:1 when used with a probe)
Window comparator: Channels CH1 to CH4, or individual channels
Center: ±4 divisions from the screen center
Width: ±4 divisions from Center
Trigger level accuracy
CH1 to CH4[1]: ±(0.2 div + 10% of trigger level)
EXT[1]: ±(50 mV + 10% of trigger level)

Trigger sensitivity (When hysterisis is small)

CH1 to CH4[1]	DC to 1 GHz	1 divp-p
EXT[1]	DC to 100 MHz	100 mVp-p
Edge OR	DC to 50 MHz	1 divp-p

Trigger types
Edge/State
Edge: Trigger occurs on the edge of a single trigger source.
Edge (Qualified): Trigger occurs on the edge of a single trigger source when Qualification condition is true.
Edge OR: Trigger occurs on the OR logic of the edge conditions set to multiple trigger sources.
State: Trigger occurs on ENTER/EXIT when the state condition is true.
Width
Pulse: Trigger occurs on a width of a single trigger source.
Pulse (Qualified): Trigger occurs on a width of a single trigger source when Qualification condition is true.
Pulse State: Trigger occurs on a width when the state condition is true.
Time width setting mode
More than: Trigger occurs upon change in condition when the condition remains true longer than time T1.
Less than: Trigger occurs upon change in condition when the condition remains true shorter than time T1.
Between: Trigger occurs upon change in condition when the condition remains true longer than time T1 and shorter than time T2.
Out of Range: Trigger occurs upon change in condition when the condition remains true shorter than time T1 and longer than time T2.
Time out: Trigger occurs when the condition is true for duration longer than time T1.
Specified time (T1/T2): 1 ns to 10 s, 500 ps resolution
Time accuracy: ±(0.2% of setting + 1 ns)
Event Interval
Event Cycle: Trigger occurs when the event cycle is within the specified time range.
Event Delay: After Event 1 occurs, trigger occurs on 1st occurrence of Event 2 that satisfies the timing constrains. The trigger process is reset if Event 1 or Event 2 occurs before the timing constrains are satisfied.
Event Sequence: After Event 1 occurs, trigger occurs on 1st occurrence of Event 2 that satisfies the timing constrains. The trigger process is reset if Event 1 occurs before the timing constrains are satisfied.
Time width setting mode: Function identical to the time width setting mode for Width
Specified time (T1/T2): 1.5 ns to 10 s, 500 ps resolution
Time accuracy: ±(0.2% of setting + 1 ns)
Event types: Events can be selected from any but the following: Edge, Edge Qualified, State, Pulse, Pulse Qualified, Pulse State, I²C, SPI, Serial, or TV, Edge OR.
Enhanced
TV: Trigger occurs on video signals of various broadcasting system formats
Mode: NTSC, PAL, HDTV, USER
Input CH: CH1-CH4
Sync Guard: Hsync 60 to 90% (steps of 1%)
Line: 5-1054 (NTSC), 2-1251 (PAL), 2-1251 (HDTV), 2-2048 (USER)
Field: 1/2/X
Frame Skip: 1/2/4/8
I²C: Triggers on I²C bus signals
Mode: NON ACK, Every Start, General Call, (Start byte/HS Mode), ADR&DATA
SPI: Triggers on SPI (serial peripheral interface) bus signals
Mode: 3 wire, 4 wire
Serial pattern: Triggers on general purpose serial communication signals.
Max. bit rate: 50 Mbps
Max. bit length: 128 bits

Display

Display: 8.4-inch (21.3 cm) color TFT liquid crystal display
Display screen size: 170.5 mm (width) × 127.9 mm (height)
Total number of pixels: 1024 × 768 (XGA)
Waveform display resolution: 800 × 640

Functions

Waveform Acquisition/Display Functions
Acquisition modes: Select from three acquisition modes: Normal, Envelope, and Average.
High resolution mode: Vertical resolution is increased to max. 13 bits.
Repetitive sampling mode: Allows switching between realtime and repetitive sampling in certain time axis settings.
Interpolate function: Interpolates actual sampled data by up to 1000 times (or

signal Xplorer™

up to 2000 times in High-Res. mode) and increases the time resolution (up to 2.5 TS/s)

Record length
- DL9140L/DL9240L: 2.5 kW, 62.5 kW, 12.5 kW, 25 kW, 62.5 kW, 125 kW, 250 kW, 625 kW, 1.25 MW, 2.5 MW, 6.25 MW
- DL9140/DL9240: 2.5 kW, 62.5 kW, 12.5 kW, 25 kW, 62.5 kW, 125 kW, 250 kW, 625 kW, 1.25 MW, 2.5 MW

Accumulation: Accumulates waveforms on the display. Choose Count/Time and Inten/Color.
Snapshot: Retains the current displayed waveform on the screen.
SNAP Clear: Clears Snaped traces
ACCUM Clear: Clears accumulated traces
History Clear: Clears History traces

Vertical/Horizontal Axis Settings

Turn channels ON or OFF: Independently on channels CH1 to CH4
Input filter: Limits bandwidths independently on channels CH1 to CH4
Roll mode: Roll mode display is enabled when the trigger mode is set to Auto, Auto Level, or Single at the following time axis setting: 100 ms/div to 50 s/div

Analysis Functions

Search and Zoom function: Zooms the displayed waveform along the time (Horizontal Zoom) and voltage (Vertical Zoom) axes. Independent zooming factors can be applied to two zoom areas.
- Voltage axis zoom factor: 1 to 10 times
- Time axis zoom factor: 1 time to 1data/div
- Auto scroll function: Automatically scrolls the zoom window along the time axis
- Search function: Searches the currently displayed waveform for a specified portion occurring beyond a specified time, and displays the zoomed result on screen
- Search types: Edge, Edge Qualified, State, Pulse, Pulse Qualified, Pulse State, Serial Pattern, I²C (optional), SPI (optional)

History memory/Single (N)
- Max data: DL9140L/DL9240L: 2000 (2.5 kW), when using history 1600 (2.5 kW), when in N single mode
  DL9140/DL9240: 1000 (2.5 kW), when using history 800 (2.5 kW), When in N single mode
- History search: Search for and display waveforms from the history memory that meet specified conditions.
- Search types: Rect, WAVE, Polygon, Parameter (Measure/FFT/XY)
- Replay: Automatically replays history waveforms.
- Display: Selected acquisition (#) or Average (Avg)

Cursor measurements: The following five cursors can be selected: Vertical, Horizontal, VT, Marker, Serial

Automatic measurement of Waveform Parameters function
- Performs automated measurement of the following waveform parameters.
- Items unrelated to cycle which will be derived out of all data in the range. MAX, MIN, HIGH, LOW, P-P, HIGH-LOW, +OVER, -OVER, RMS, MEAN, Sdev, IntegTY
- Items related to cycle which will be derived out of all data in the range. C.rms, C.mean, C.Sdev, C.IntegTY, (1/FREQ), FREQ, COUNT, BURST
- Items which will be derived from the first encounter from the beginning of the specified range. +WIDTH, -WIDTH, PERIOD, DUTY, RISE, FALL, DELAY

Telecom Test: Performs mask test and eye pattern measurement
- Mask test items: Wave Count, Wave Count%, Sample Point Count, Sample Point Count%
- Eye pattern items: Vtop, Vbase, σtop, σbase, Tcrossing1, Tcrossing2, σcrossing1, σcrossing2, Vcrossing, Crossing%, Eye Height, Eye Width, Q Factor, Jitter, Jitter6σ, Duty Cycle Distortion, Duty Cycle Distortion%, Ext Rate, Ext Rate%, Ext Rate dB, Rise/Fall

Computation functions: Computes up to eight traces (CH1-CH4/M1-M4) +, -/*, INTEG, COUNT (EDGE), COUNT (ROTARY), Through, Delay, Moving Avg, LowPass, High Pass

Reference functions: Display and analysis (computation and cursors) on up to four traces (M1-M4) of the saved waveform data. Waveforms including history can also be loaded for history searches or replay. Various parameters can be changed (however waveforms are not affected by T/Div changes).

Action-on-trigger: Automatically measured waveform parameters and waveform zones are determined, and the selected action is carried out each time conditions are met.
- Modes: OFF, All Condition, (GO/NOGO Zone/Param), GO/NOGO Telecom Test)
- Actions: Buzzer, Print, Save, Mail
- All condition: After EXEC is pressed, the specified action is performed upon each acquisition
- GO/NOGO zone: Determines whether or not the acquired waveform passes through the specified area
  - Zone types: RECT, Polygon, WAVE
- GO/NOGO parameter: Determines whether or not the specified parameter of the acquired waveform is within the specified range
- Param: Choose Measure, FFT, or XY
- GO/NOGO telecom test: Performs judgment using the conditions specified in the telecom test.

ANALYSIS: Selectable from XY, FFT, Wave Parameter, Accum Histogram and Serial Bus
- X-Y: displays XY1, XY2 and T-Y simultaneously
- FFT: supports up to 250 k points FFT
- Wave parameter: One wave parameter can be viewed in one of the following formats. (Histogram, Trend and List)
- Accum histogram: Histogram of the selected area can be displayed for continuous signal.
- Serial bus: Analysis results of I²C SPI can be displayed.

I²C Analysis Functions (Optional)

Applicable bus: I²C bus — bus speed: Max. 3.4 Mbit/s; Address mode: 7 bit/10 bit; SM bus: complies with System Management bus

Trigger function (Standard)
- Source: SCL: Ch1 to Ch4; SDA: Ch1 to Ch4
- Type: Address & data: trigger on combination of assigned address & data pattern; Non-Ack: trigger on non acq condition; Every start: trigger on start condition; General Call: trigger on general call and the following byte; Start byte / HS mode: trigger on Start byte and HS mode

Analysis
- Signal input: Ch1 to Ch4, M1 to M4 can be configured
- Display of analysis results: Display the analysis result using the following 2 methods
  * Simple analysis result: Hex data, R/W, start condition, Ack, Address or Data
  * List of detailed analysis results, R/W, Address or Data, start condition

  Displays No., Time, Binary, Hex and Ack

Search function
- Pattern search: Set the address pattern, data pattern and Acknowledge bit condition and Search the waveform.

Number of analysis data points: Max. 5 k byte
Analysis result save function: Save the list of the detailed analysis to a file in ASCII format

SPI Analysis Functions (Optional)

Trigger function
- Mode: 3 wire/4 wire
- Bit order: MSB/LSB

Analysis
- Signal input: Clock (SCK) : Ch1 to Ch4; Data1 (MOSI): Ch1 to Ch4; Data2 (MISO): Ch1 to Ch4; CS signal (SS): Ch1 to Ch4
- Display of analysis results: Display the analysis results using the following 2 methods
  * simple analysis result: Hex CS status
  * List of detailed analysis result Displays No., Time, Dt1, Dt2 and CS

Search function
- Pattern search: Set the waveform by specified data pattern (Frame pattern)

Number of analysis data points: Max. 5 k byte
Analysis result save function: Save the list of the detailed analysis to a file in ASCII format

Built-in Printer (/B5 Option)

Printing method: Thermal line-dot
Paper width: 112 mm
Effective print width: 104 mm (832 dots)

Auxiliary I/O Section

Rear panel I/O signal: Ext. trigger input, ext. trigger output, Trigger comparator output, GO/NO-GO I/O, video output

Probe interface terminal (front panel)
- No. of terminals: 4
- Supported probes: PBA2500

Probe power terminal (/P2 option, rear panel)
- No. of terminals: 2
- Supported probes: FET probe (700939), current probes (701932, 701933), and differential probes (701920, 701922)

Storage

Internal Storage Media
- Capacity: 32 MB
- Uses: Saving and loading waveforms and panel settings
- Memory type: Flash ROM

Internal Hard Drive (/C8 Option)

- Capacity/file system: 30 GB FAT32
- File name: Supports long file names of up to 256 ASCII characters

USB Peripheral Support

- Connector: USB type A connector (receptacle) × 2
- Electrical and mechanical specifications: Conforms to USB Revision 2.0
- Supported transmission standards: LS (Low Speed) mode (1.5 Mbps), FS (Full Speed) mode (12 Mbps)
- Supported devices: USB HID Class Ver1.1 compliant mouse/104 keyboard
  USB Printer Class Ver.1.0 compliant printers
  - EPSON: Ink Jet Printers
  - Canon: Ink Jet Printers
  - HP: PCL Ink Jet Printers

  USB Mass Storage Class Ver.1.1 compliant mass storage device
  USB HUB Device (1 unit only) support.
- * Please contact your local Yokogawa representative for model names of verified devices
- Max. No. of devices: 4

PC Card Interfaces

- Number of ports: 2 (front panel (1), rear panel (1))
- Supported cards: GPIB
  National Instruments NI PCMCIA-GPIB card
  Storage cards
  Flash ATA memory card (PC card TYPE II), PC card types, CF card + adapter card, and hard disk type PC cards

USB-PC Connections

- Connector: USB type B connector (receptacle) × 1
- Electrical and mechanical specifications: Conforms to USB Revision 2.0
- Supported transmission standards: HS (High Speed) mode (480 Mbps), FS (Full Speed) mode (12 Mbps)
- Supported class: Operates as a multifunctional device supporting two of the following protocols simultaneously.
  USBTMC-USB488 (USB Test and Measurement Class Ver.1.0)
  Accepts GPIB commands while using a USB bus
  Mass Storage Class Ver.1.1
  The DL's internal storage media and hard disk, PC card, and USB MSC can be accessed (read/write) from the PC (formatting is not supported).

Ethernet Communication (/C10 and /C8 Options)

- Connector type: RJ-45 connector
- Electrical and mechanical specifications: Conforms to IEEE802.3
- Transmission method: Ethernet (100BASE-TX/10BASE-T)
- Communication protocol: TCP/IP
- Supported services: SMTP client, DHCP, DNS, Microsoft network file sharing server and client SNTP client, Fire Wall

General Specifications

- Rated supply voltage: 100 to 120 VAC/200 to 240 VAC (switches automatically)
- Allowed supply voltage fluctuation range: 90 to 132 VAC/180 to 264 VAC
- Rated supply frequency: 50/60 Hz
- Allowable power supply frequency variation: 48 to 63 Hz
- Maximum power consumption: 300 VA
- Withstanding voltage (between power supply and case): 1.5 kVAC for one minute.
- External dimensions: 350 (W) × 200 (H) × 178 (D) mm (when printer cover is closed, excluding handle and protrusions)
- Weight (including printer): Approximately 6.5 kg.
- Battery backup: Setup data and clock are backed up with an internal lithium battery
  - Battery life: Approximately 5 years (at ambient temperature of 25°C)
- Operating temperature range: 5-40°C

1. Measured value under standard operating conditions after 30-minute warm-up and performing calibration.
   Standard operating conditions: Ambient temperature: 23 ±5°C; Ambient humidity: 55 ±10%; Error in supply voltage and frequency: Within 1% of rating
2. Value in the case of a repetitive signal
   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, interleave mode is OFF, accumulation is OFF, and the probe attenuation is set to 1:1.
4. Typical value represents a typical or average value. It is not strictly warranted.
5. The parallel acquisition architecture of the DL9000 series ensures no decrease in acquisition rate for multi-channel use.

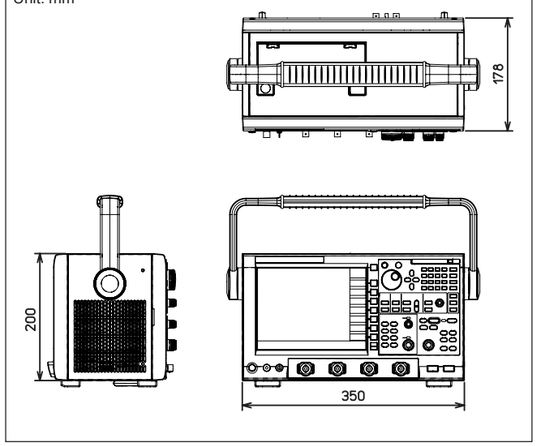
PBA2500 (Optional Accessory)

- Length: 1.2 m
- Bandwidth: DC to 2.5 GHz (-3 dB)
- Attenuation ratio: 1/10 ±2.0%
- Input resistance: 100 kΩ ±2.0%
- Input capacitance: Approx. 0.9 pF (typical)
- Dynamic range: ±7 V
- Operational range: ±15 V
- Offset range: ±10 V
- Max. input voltage: ±25 V DC + AC peak

PBL5000 (Optional Accessory)

- Length: 0.95 m
- Bandwidth: DC to 5 GHz (-3 dB)
- Attenuation ratio: 1/10 ±2.0%,1/20 ±2.0% (selectable by changing the resistance)
- Input resistance: 450 Ω ±1.0%, 950 Ω ±1.0%,
- Input capacitance: Approx. 0.25 pF (typical, with 450 Ω), 0.4 pF (typical, with 950 Ω)
- Max. input voltage: 20 V rms

Unit: mm



For detailed specifications, visit our homepage at
http://www.yokogawa.com/tm/DL9000

Model and Suffix Codes

Model	Suffix Codes	Description
701310		Digital Oscilloscope DL9140 4 ch, 1 GHz, max. 5 GS/s (2.5 GS/s/ch), 2.5 Mword/ch
701311		Digital Oscilloscope DL9140L 4 ch, 1 GHz, max. 5 GS/s (2.5 GS/s/ch), 6.25 Mword/ch
701312		Digital Oscilloscope DL9240 4 ch, 1.5 GHz, max. 10 GS/s (5 GS/s/ch), 2.5 Mword/ch
701313		Digital Oscilloscope DL9240L 4 ch, 1.5 GHz, max. 10 GS/s (5 GS/s/ch), 6.25 Mword/ch
Power cable	-D	UL/CSA standard
	-F	VDE standard
	-Q	BS standard
	-R	AS standard
	-H	GB standard
Help menu language	-HE	English Help
Options	/B5	Built-in printer
	/P2 [1]	Probe power connections on rear panel (2 outputs for current probes, differential probes)
	/C10 [2]	Ethernet interface
	/C8 [2]	Built-in HDD + Ethernet interface
	/F5 [3]	I²C + SPI bus analyzer

1: Please order /P2 option if you use either current probes or differential probes from Yokogawa. For 2.5 GHz active probe and 5 GHz low capacitence probe, this option is not necessary.
2: Choose either one
3: I²C and SPI triggers are standard.

Standard Accessories

Name	Q'ty
Power cable	1
PB500 (500 MHz passive probe)	4
Printer roll paper (when option/B5 is specified)	3
User's manual (1 set)	1
Front cover (transparent)	1

Accessories (Optional)

Name	Model	Specifications
PB500 (10:1 passive probe)	701943	10 MΩ, 500 MHz BW
PBA2500 (2.5 GHz active probe)	701913	2.5 GHz BW
PBL5000 (5 GHz low capacitance probe)	701974	5 GHz BW
DC block	701975	for 50 Ω input, SMA connector
FET probe (900 MHz)	700939	900 MHz BW
100:1 probe	700978	100 MHz BW
Differential probe	701921	DC to 100 MHz BW/ Max. ±700 V
Differential probe	701922	DC to 200 MHz BW/Max. ±20 V
Differential probe	700925	DC to 15 MHz BW/Max. ±500 V
Differential probe	700924	DC to 100 MHz BW/Max. ±1400 V
Differential probe	701920	DC to 500 MHz BW/Max. ±30 V
Current probe	701933	DC to 50 MHz BW, 30A peak
Current probe	701932	DC to 100 MHz BW, 30A peak
Printer roll paper	B9988AE	10 m roll, 10 rolls/1 unit
Rack mount kit	701984-01	EIA standard
Trigger comparator output cable	701976	for Trigger comparator OUT

Related Products

Note

- Before operating the product, read the user's manual thoroughly for proper and safe operation.
- If this product is for use with a system requiring safeguards that directly involve personnel safety, please contact the Yokogawa sales offices.

Yokogawa's Approach to Preserving the 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 Guideline and Product Design Assessment Criteria.

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