

1. Scope

These inspection standards apply to the DL7100/DL7200 of digital oscilloscopes (product codes: 701410, 701420, 701430 and 701440).

2. Inspection Items

* Test of Insulation Resistance	(Subsection 5.1)
* Test of Withstanding Voltage	(Subsection 5.2)
* Test of Accuracy of Time Base	(Subsection 5.3)
* Test of Trigger Sensitivity	(Subsection 5.4)
* Test of Frequency Bandwidth	(Subsection 5.5)
Test of Accuracy of Vertical Axis	(Subsection 5.6)
Test of Accuracy of Offset Voltage	(Subsection 5.7)

3. Functional Inspection Items

Visual Inspection and Specifications Cross-check	(Subsection 6.1)
Test of Performance of Components	(Subsection 6.2)
* Test of I/O Signals	(Subsection 6.3)
* Test of Optional Logic Input (Option Code: /N1, /N2, /N3, /N4)	(Subsection 6.4)
* Test of Communication Functions	(Subsection 6.5)
Test of Optional Built-in Printer (Option Code: /B5)	(Subsection 6.6)
Test of Optional PC Card (Option Code: /C9, C10)	(Subsection 6.7)
Test of Optional Ethernet Communication Port (Option Code: /C10)	(Subsection 6.8)
Test of CAN Bus Trigger Function (Option Code: /F7)	(Subsection 6.9)

Note: The items marked with an asterisk (*) are subject to inspection by test certificate only.

4. Equipment Used

• Insulation resistance tester:	Yokogawa's 2407 or equivalent
• Withstanding voltage tester:	KIKUSUI's TOS-8750 or equivalent
• Digital oscilloscope:	Yokogawa's DL1500 or equivalent
• Oscilloscope calibrator:	Wavetek Yokogawa's 9500 or equivalent
• High-speed output module:	Wavetek Yokogawa's 9520
• Function generator:	Yokogawa's FG120 or equivalent
• Digital multimeter:	Yokogawa's 7562 or equivalent
• Arbitrary waveform generator:	Yokogawa's AG1200 or equivalent
• 50- lead-through terminator:	Yokogawa's 700976 or equivalent
• Probe: Yokogawa's 700996 or equivalent	
• BNC cable (50- characteristic impedance):	Yokogawa's 366925 or equivalent
• Printing paper:	Yokogawa's B9850NX or equivalent
• Centronics printer	
• Centronics cable	
• SCSI hard drive	
• SCSI cable	
• SCSI terminator	
• 3.5-inch floppy disk:	Yokogawa's 705900 or equivalent
• VGA monitor	
• Memory card:	FUJISOKU's JT20MA3-BD (recommended)
• Ethernet cable (category 3 or better, straight)	
• Hub	

5. Inspection Methods, Standards, and Conditions

- Normal test conditions:
 - Temperature: 23°C ±2°C
 - Relative humidity: 55% ±10%
 - Errors in power supply voltage/current and frequency: Within ±1% of each rating
 - Warm-up time: At least 30 minutes
- Calibration must be carried out prior to testing the DC-mode accuracy of the vertical axis.

5.1 Test of Insulation Resistance

Using an insulation resistance tester, apply the following DC voltage to the unit under test (UUT) to ensure that the UUT satisfies the following judgment criteria.

Test Point	Judgment Criteria
Between the power supply terminal and the casing	10-M minimum for a supply of 500 V DC

Note: During testing, leave the UUT's power switch turned on.

5.2 Test of Withstanding Voltage

Using a withstanding voltage tester, apply the following AC voltage to the UUT to ensure that the UUT satisfies the following judgment criteria.

Test Point	Judgment Criteria
Between the power supply terminal and the casing	A leakage of 10-mA maximum for a supply of 1.5 kV AC/1 min

Note: During testing, leave the UUT's power switch turned on.

5.3 Test of Accuracy of Time Base

- Connect the output of the calibrator to the UUT's signal-input terminal.
- Equipment Settings:
 - UUT: INITIALIZE
 - Channel under test: Mode = on; V/div = 50 mV/div; Coupling = DC50
 - Time: T/div = 2 μs/div
 - Display = Single
 - Data length = 10 k
 - Measure: Mode = on; Trace = Channel under test; Item = Freq
 - Calibrator: Freq = 500.2 MHz; Amp = 300 mVp-p; Sine wave
- Input a sine wave with a frequency accuracy level of 5 ppm or higher. Then, using the beat method, check that the frequency of the aliasing waveform satisfies the following judgment criteria.
- Judgment criteria: ±0.005%

5.4 Test of Trigger Sensitivity

- Connect the output of the calibrator to the UUT's signal-input terminal.
- Equipment Settings:
 - UUT: Channel under test: Mode = on; Position = 0 div; Probe = 1:1; V/div = 500 mV/div; Coupling = DC50
 - Time: T/div = 1 ns/div
 - Display = Single
 - ACQ: Mode = Average; Average weight = 4
 - Data length = 1 k
 - Enhanced Trigger: Type = Pattern; Level = 0 V; Set Pattern = Rising edge (for channel under test), X (for other channels)
 - Calibrator: Freq = 500 MHz; Amp = 500 mVp-p, Sine wave
- Input a sine wave to ensure that the UUT is triggered correctly.
- If the UUT is not triggered, change the Trigger Level setting to within ±250 mV and retest the UUT to ensure that it is correctly triggered.
- Judgment criteria:
 - 500 mV/div: (Display) 1 div_{p-p} (DC to 500 MHz)

5.5 Test of Frequency Bandwidth

- Connect the output of the calibrator to the UUT's signal-input.
- Equipment Settings:
 UUT: Channel under test: Mode = on; Probe = 1:1; Coupling = DC50
 Time: T/div = 2 ns/div
 ACQ: Mode = Average; Average weight = 4
 Data length = 1 k
 Trig: Type = Simple; Source = Channel under test
 Measure: Mode = on; Trace = Channel under test; Item = Sdev; Range = -5.00 div to 5.00 div
- Input a signal wave to ensure that the UUT satisfies the following judgment criteria.

V/div Range	Input Level	Input Frequency	Judgment Criteria
1 V	5 Vp-p	500 MHz	-3 dB (at 500 MHz)
200 mV	1.2 Vp-p	500 MHz	-3 dB (at 500 MHz)
50 mV	0.3 Vp-p	500 MHz	-3 dB (at 500 MHz)
5 mV	30 mVp-p	400 MHz	-3 dB (at 400 MHz)
2 mV	12 mVp-p	400 MHz	-3 dB (at 400 MHz)

5.6 Test of Accuracy of Vertical Axis (DC-mode Accuracy)

- Connect the output of the calibrator to the UUT's signal-input terminal under test.
- Equipment Settings:
 UUT: Channel under test: Mode = on; Probe = 1:1; Coupling = DC1M ; Display = Single
 Time: T/div = 1 ms/div
 ACQ: Mode = Box Average
 Measure: Mode = on; Trace = Channel under test; Item = Avg; Range =
 -5.00 div to 5.00 div
- Have the calibrator output a voltage signal to ensure that the UUT satisfies the following judgment criteria.

Range	Input Voltage	Judgment Criteria
10 V/div	40 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
10 V/div	0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
10 V/div	-40 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
5 V/div	20 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
5 V/div	0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
5 V/div	-20 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
2 V/div	8.0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
2 V/div	0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
2 V/div	-8.0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
1 V/div	4.0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
1 V/div	0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
1 V/div	-4.0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 20 \text{ mV}^{*1})$
500 mV/div	2.0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 2 \text{ mV}^{*1})$
500 mV/div	0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 2 \text{ mV}^{*1})$
500 mV/div	-2.0 V	$\pm(1.5\% \text{ of } 8 \text{ div} + 2 \text{ mV}^{*1})$
200 mV/div	800 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 2 \text{ mV}^{*1})$
200 mV/div	0 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 2 \text{ mV}^{*1})$
200 mV/div	-800 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 2 \text{ mV}^{*1})$
100 mV/div	400 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 2 \text{ mV}^{*1})$
100 mV/div	0 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 2 \text{ mV}^{*1})$
100 mV/div	-400 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 2 \text{ mV}^{*1})$
50 mV/div	200 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
50 mV/div	0 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
50 mV/div	-200 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
20 mV/div	80 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
20 mV/div	0 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
20 mV/div	-80 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
10 mV/div	40 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
10 mV/div	0 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
10 mV/div	-40 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
5 mV/div	20 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
5 mV/div	0 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
5 mV/div	-20 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
2 mV/div	8.0 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
2 mV/div	0 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$
2 mV/div	-8.0 mV	$\pm(1.5\% \text{ of } 8 \text{ div} + 0.2 \text{ mV}^{*1})$

Note 1: offset voltage accuracy when offset setting value is 0

5.7 Test of Accuracy of Offset Voltage

- Connect the output of the calibrator to the UUT's signal-input terminal under test.
- Equipment Settings:
 UUT: Channel under test: Mode = on; Probe = 1:1; V/div = 5 mV/div
 Time: T/div = 5 ms/div
 ACQ: Mode = Box Average
 Trig: Type = Simple
 Measure: Mode = on; Trace = Channel under test; Item = Avg
- Have the calibrator output a voltage signal to ensure that the UUT satisfies the following judgment criteria.

Offset Voltage Setting	Input Voltage	Judgment Criteria
1 V	1 V	$\pm(1\% \text{ of setpoint} + 0.2 \text{ mV})$
-1 V	-1 V	$\pm(1\% \text{ of setpoint} + 0.2 \text{ mV})$

6. Functional Checkups

6.1 Visual Inspection and Specifications Cross-check

- Visually check the UUT to ensure that the unit is free from any serious damage or contamination.
- Perform a specifications cross-check.

6.2 Test of Performance of Components

1) Keys on Operation Panel

- Check that the UUT correctly acquires input from each key.

2) LCD

- Check that the LCD presents the correct screen.

3) Built-in Floppy Drive

- Provide the following two types of disks.
 Disk 1: An initialized 1.44-MB 2HD disk
 Disk 2: An initialized 1.2-MB 2HD disk
- For each of these floppy disks, check that panel setup data can be correctly saved, loaded and deleted. Also check that the floppy disk can be normally installed and removed.
- After the last round of loading, check that there are no files left on the floppy disk.

6.3 Test of I/O Signals

6.3.1 External Trigger Input and Trigger Output (EXT TRIG IN and TRIG OUT)

- Using a power divider, connect the output of the calibrator to the signal-input terminal of CH1 and the EXT TRIG IN terminal fitted with a 50- terminator.
- Connect the TRIG OUT terminal to the signal-input terminal of CH2.
- Equipment Settings:
 UUT: CH1: Mode = on; Probe = 1:1; V/div = 20 mV/div
 CH2: Mode = on; Probe = 1:1; V/div = 2 V/div; Coupling = DC1M
 Display = Dual
 Time: T/div = 10 ns/div
 ACQ: Mode = Normal; Data length = 10 k
 Trig: Type = Simple; Source = Ext; Position = 10%
 Calibrator: Freq = 100 MHz; Amp = 90 mVp-p, Sine wave
- Input a signal waveform to ensure that the UUT is triggered correctly and confirm that the sine waveform can be stably observed on the UUT.
- If the UUT is not triggered, change the Trigger Level setting within $\pm 50 \text{ mV}$ and retest the UUT to ensure that it is correctly triggered.
- Judgment criteria:
 Sensitivity: 100 mVp-p (at DC to 100 MHz)

6.3.2 External clock input (EXT CLOCK IN)

- Using a power divider, connect the output of the function generator to the signal-input terminals of CH1 and CH3.
- Connect the output of the calibrator to the EXT CLOCK IN terminal fitted with a 50- terminator.
- Equipment Settings:
 UUT: CH1: Mode = on; Probe = 1:1; V/div = 50 mV/div; Coupling = DC1M
 CH3: Mode = on; Probe = 1:1; V/div = 50 mV/div; Coupling = DC1M
 Display = Dual
 Time base: EXT
 ACQ: Mode = Normal; Data length = 10 k
 Trig: Type = Simple; Source = CH1; Level = 0 mV
 Calibrator: Freq = 20 MHz; Amp = 1 Vp-p, Sine wave
 Function generator: Freq = 10 kHz; Amp = 300 mVp-p, Sine wave
- Input signal waveforms to ensure that there are no remarkable spikes resulting from missing bits and the sine waveforms are observed correctly on the UUT.

6.3.3 CAL Output for Probes (CAL OUT)

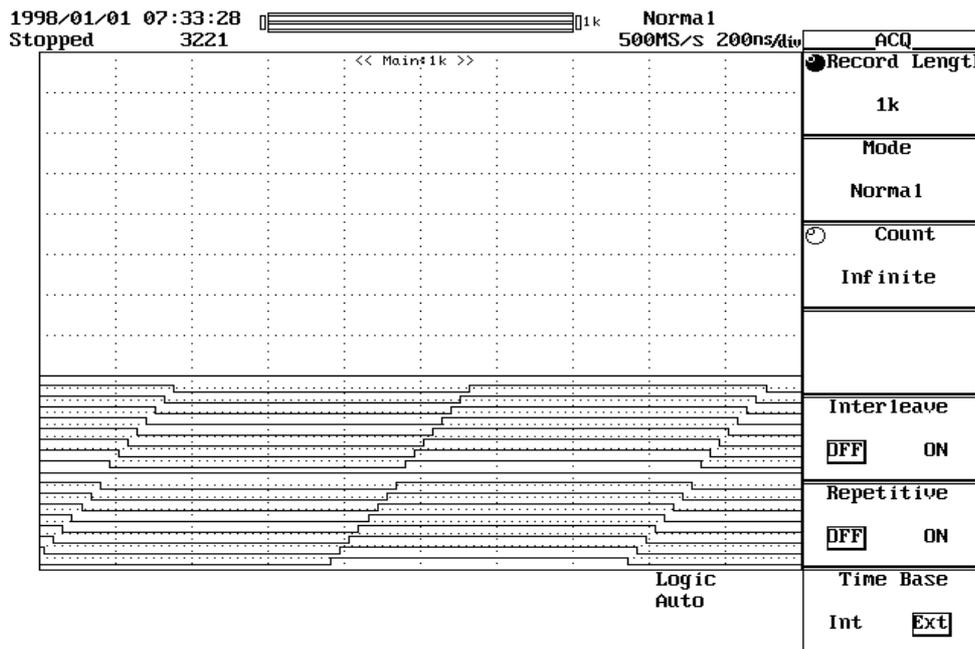
- Using the probe, connect the Probe comp. terminal to the signal-input terminal of CH1.
- Equipment Settings:
 UUT: Auto Setup
- Check that the CAL OUT waveform is correctly output.

6.3.4 RGB Video Signal Output

- Connect the VGA monitor to the RGB VIDEO OUT terminal to ensure that the monitor displays the same screen as the LCD.

6.4 Test of Optional Logic Input (Option Code: /N1, /N2, /N3, /N4)

- Connect the output of the logic jig to the input terminal of the logic probe under test.
- Equipment Settings:
 UUT: ACQ: POD under test; Threshold Level = User
 Display = Single
 ACQ: Mode = Normal; Data length = 1 k
 Trig: Type = Logic; Edge = none; Pattern: PODA bit 7 = H, all other bits = X
- Check that the waveforms as shown below are observed on the UUT.



6.5 Test of Communication Functions

6.5.1 GP-IB Interface

- Using a controller capable of GP-IB control, check that the settings of each UUT's function can be correctly remote-controlled and that data is acquired normally.

6.5.2 Serial (RS-232) Interface

- Using a controller capable of serial (RS-232) control, check that the settings of each UUT's function can be correctly remote-controlled and that data is acquired normally.

6.5.3 Centronics Interface

- Using a printer capable of Centronics control, set the UUT in the STOP state and press the COPY key to check that the printer prints the same image as the one on the LCD screen.

6.5.4 SCSI Interface

- Connect a hard drive or magneto-optical drive compliant to the SCSI interface standard which applies to the UUT. Then, check that the drive can be initialized and that data can be saved and normally loaded as explained in the instruction manual.

6.6 Test of Optional Built-in Printer (Option Code: /B5)

- Set the UUT in the STOP state and press the COPY key to check that the printer prints the same image as the one on the LCD screen.

6.7 Test of Optional PC Card (Option Code: /C9)

- Insert a 20-MB memory card into a PC-card slot in the rear panel of the UUT.
- Check that panel setup data can be correctly saved, loaded, and deleted to and from the memory card.

6.8 Test of Optional Ethernet Communication Port (Option Code: /C10)

- Connect the Ethernet port of the UUT to a controller via a hub and check that a file can be transferred from the UUT via Ethernet normally.

6.9 Test of CAN Bus Trigger Function (Option Code: /F7)

- Check that a trigger is started at a point equivalent to the Start of Frame field by assuming the Probe Comp. signal to be a CAN signal.