DL750/DL750P
ScopeCorder
USER'S MANUAL

Part 1 Part 2

GiGAZoom ENGINE™

YOKOGAWA
Yokogawa Electric Corporation

IM 701210-05E
3rd Edition

Product Registration

Thank you for purchasing YOKOGAWA products.

YOKOGAWA provides registered users with a variety of information and services.
Please allow us to serve you best by completing the product registration form accessible from our homepage.

http://www.yokogawa.com/tm/

Thank you for purchasing the DL750/DL750P ScopeCorder.
This user's manual contains useful information about the instrument's functions and operating procedures and lists the handling precautions of the DL750/DL750P. It mainly focuses on the DL750. The user's manual is divided into two parts, Part 1 and Part 2. For details on the information covered in Part 1 and Part 2 as well as other DL750/DL750P manuals, see "Manuals That Come with the DL750/DL750P" on the next page. To ensure correct use, please read this manual thoroughly before beginning operation. After reading the manual, keep it in a convenient location for quick reference whenever a question arises during operation.

Notes

- The contents of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions. The figures given in this manual may differ from those that actually appear on your screen.
- Every effort has been made in the preparation of this manual to ensure the accuracy of its contents. However, should you have any questions or find any errors, please contact your nearest YOKOGAWA dealer.
- Copying or reproducing all or any part of the contents of this manual without the permission of Yokogawa Electric Corporation is strictly prohibited.
- The TCP/IP software of this product and the document concerning the TCP/IP software have been developed/created by YOKOGAWA based on the BSD Networking Software, Release 1 that has been licensed from University of California.

Trademarks

- Microsoft, Internet Explorer, MS-DOS, Windows, Windows NT, and Windows XP are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- Adobe, Acrobat, and PostScript are trademarks of Adobe Systems Incorporated.
- Zip is either a registered trademark or trademark of Iomega Corporation in the United States and/or other countries.
- UNIX is either a registered trademark or trademark of The Open Group in the United States and/or other countries.
- Piezotron is a registered trademark of Kistler Instrument Corporation.
- ICP is a registered trademark of PCB Piezotronics Incorporated.
- ISOTRON is a registered trademark of ENDEVCO Corporation.
- GIGAZoom ENGINE are pending trademark of Yokogawa Electric Corporation.
- For purposes of this manual, the TM and ® symbols do not accompany their respective trademark names or registered trademark names.
- Other company and product names are trademarks or registered trademarks of their respective holders.

Revisions

- 1st Edition: February 2005
- 2nd Edition: May 2005
- 3rd Edition: December 2005

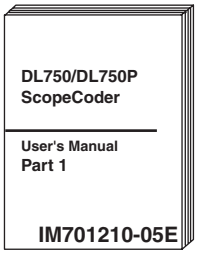
3rd Edition : December 2005 (YK)

Manuals That Come with the DL750/DL750P

DL750/DL750P Manuals

The following manuals are provided for the DL750/DL750P. Use them according to your application.

User's Manual Part 1

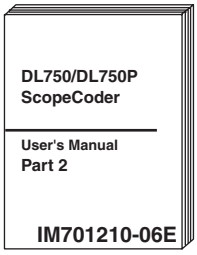


This manual. Contains chapters 1 to 9 of the DL750/DL750P User's Manual. Mainly describes the basic operations of the DL750/DL750P up to waveform acquisition.

[Contents]

- **Chapter 1** **Names and Functions of Parts**
- **Chapter 2** **Explanation of Functions**
- **Chapter 3** **Making Preparations for Measurements**
- **Chapter 4** **Common Operations**
  Operations and functions of keys and the jog shuttle, entering values and strings, operations on the USB keyboard/USB mouse, initializing settings, auto setup, calibration, and help function
- **Chapter 5** **Horizontal and Vertical Axes**
- **Chapter 6** **Triggering**
- **Chapter 7** **Acquisition and Display**
  Record length, acquisition mode, sequential store, dual capture, realtime recording to the internal hard disk, voice memo, and acquisition memory backup
- **Chapter 8** **Waveform Display and Information Display**
- **Chapter 9** **Recording in Recorder Mode (Realtime Recording) (DL750P Only)**
- **Index** Common to Part 1 and Part 2.

User's Manual Part 2

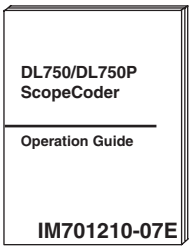


Contains chapters 10 to 19 and appendix of the DL750/DL750P User's Manual. Mainly describes operations after waveform acquisition and optional functions.

[Contents]

- **Chapter 10** **Waveform Computation**
- **Chapter 11** **Waveform Analysis/Search**
  Displaying of history waveforms, history search, search & zoom, cursor measurements, automated measurement of waveform parameters, statistical processing, and GO/NO-GO determination
- **Chapter 12** **Printing the Screen Image Data**
- **Chapter 13** **Saving and Loading Data**
- **Chapter 14** **External Trigger I/O, External Clock Input, and Video Signal Input**
- **Chapter 15** **Using the DSP Channel (Optional)**
- **Chapter 16** **Ethernet Interface (Optional)**
- **Chapter 17** **Other Operations**
  Changing the menu/message language, turning the click sound ON/OFF, changing the USB keyboard language, checking the USB keyboard, setting the screen color/brightness, setting the backlight, and locking the keys
- **Chapter 18** **Troubleshooting, Maintenance, and Inspection**
- **Chapter 19** **Specifications**
- **Appendix**
- **Index** Common to Part 1 and Part 2.

Operation Guide

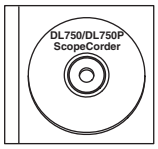


Familiarizes the first-time user with the basic operations of the DL750/DL750P.
Latter half of the guide summarizes key points of each setup menu. Use this as a guide when setting up the DL750/DL750P.

[Contents]

- **Flow of DL750/DL750P Operation**
- **Front Panel Controls**
- **Parts of the Screen**
- **Basic Key & Jog Shuttle Operations**
- **Main Functions of the DL750/DL750P**
- **Operating the DL750/DL750P**
  Making preparations before observation, displaying waveforms, changing the waveform display conditions, changing the trigger settings, measuring waveforms, zooming the waveform along the time axis, and printing/saving waveforms
- **Setup Menu Items**

Communication Interface User's Manual

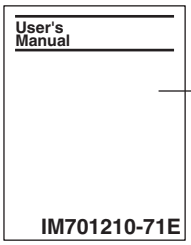


B8023YZ

A manual in PDF format that is stored in the accompanying CD-ROM. Describes the functions of each communication interface on the DL750/DL750P and commands.

[Contents]

- **Chapter 1 Overview of the GP-IB Interface**
- **Chapter 2 Overview of the Serial (RS-232) Interface**
- **Chapter 3 Overview of the USB Interface**
- **Chapter 4 Overview of the Ethernet Interface (Optional)**
- **Chapter 5 Before Programming**
- **Chapter 6 Commands**
- **Chapter 7 Status Reports**
- **Chapter 8 Sample Programs**
- **Appendix**
- **Index**



Handling of the Communication Interface User's Manual CD-ROM

Describes the handling precautions of the Communication Interface User's Manual CD-ROM.

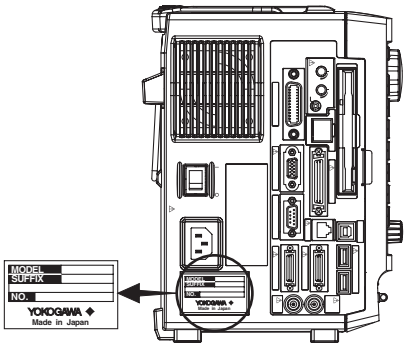
Checking the Contents of the Package

Unpack the box and check the contents before operating the instrument. If some of the contents are not correct, or if any items are missing or damaged, contact the dealer from whom you purchased them.

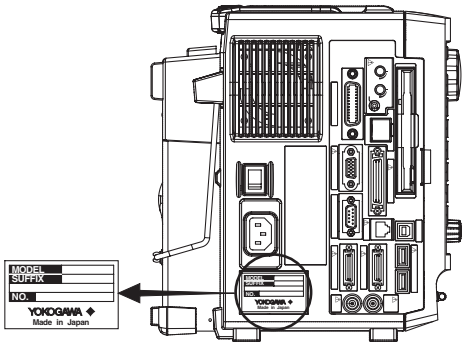
DL750/DL750P

Check that the model name and suffix code given on the name plate on the left side panel of the CDM Signal Generator match those on your order. When contacting the dealer from which you purchased the instrument, please give them the instrument number.

DL750



DL750P



MODEL	Suffix Code	Description
701210 (DL750) 701230 (DL750P)		The input module is not included with the instrument. See the next page for information on the input module.
Power cord	-D	UL/CSA Standard power cord (Part No.: A1006WD) [Maximum rated voltage: 125 V; Maximum rated current: 7A]
	-F	VDE Standard Power Cord (Part No.: A1009WD) [Maximum rated voltage: 250 V; Maximum rated current: 10 A]
	-Q	BS Standard Power Cord (Part No.: A1054WD) [Maximum rated voltage: 250 V; Maximum rated current: 10 A]
	-R	AS Standard Power Cord (Part No.: A1024WD) [Maximum rated voltage: 250 V; Maximum rated current: 10 A]
	-H	GB Standard Power Cord (Part No.: A1064WD) [Maximum rated voltage: 250 V; Maximum rated current: 10 A]
Default language	-HE	English
	-HJ	Japanese
	-HC	Chinese
	-HK	Korean
	-HG	German
	-HF	French
	-HL	Italian
	-HS	Spanish
Built-in media drive	-J1	Floppy disk drive*1
	-J2	Zip drive*1(DL750 only)
	-J3	PC card drive*1
Options	/M1	Memory extension to 10 MW/CH*2 (250 MW maximum)
	/M2	Memory extension to 25 MW/CH*2 (500 MW maximum)
	/M3	Memory extension to 50 MW/CH*2 (1 GW maximum)
	/C8	Internal hard disk 30 GB (FAT32)
	/C10	Ethernet interface
	/DC	12 VDC Power (10 to 18 VDC) (DL750 only)
	/G2	User-defined computation
	/G3	DSP channel
	/P4	Four probe power outputs

*1 For the built-in media drive on the DL750, select one from three types (two types for the DL750P).
*2 Choose one from /M1, /M2, and /M3.

No. (Instrument Number)

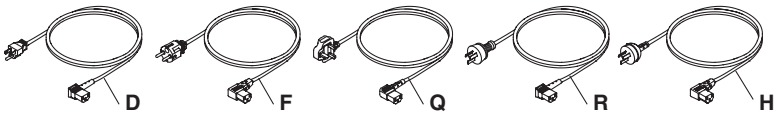
When contacting the dealer from which you purchased the instrument, please give them the instrument number.

Standard Accessories

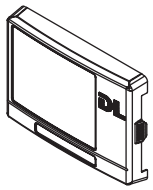
The standard accessories below are supplied with the instrument. Check that all contents are present and undamaged.

Power Cord (one of the following power cords is supplied according to the instrument's suffix codes)

UL/CSA Standard A1006WD — D
VDE Standard A1009WD — F
BS Standard A1054WD — Q
AS Standard A1024WD — R
GB Standard A1064WD — H

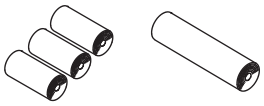


Front panel protection cover (transparent) B8023EA



Soft case B9946EB

Printer roll paper
For the DL750* B9988AE 3 rolls
For the DL750P* 701966 1 roll

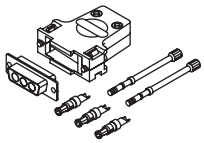


*** Either one is included depending on the model**

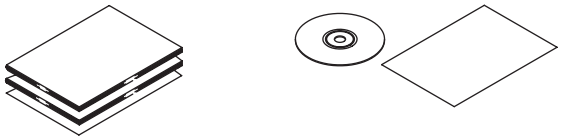
Roll paper flange (DL750P only) B8024CA 2 pieces

AAA Alkaline batteries (for acquisition memory backup) A1070EB 4 cells

DC power connector (for the /DC model) B8023WZ



- **User's Manual Part 1**
- **User's Manual Part 2**
- **Operation Guide**
- **Communication Interface User's Manual (CD-ROM) B8023YZ**
- **Handling of the CD-ROM**



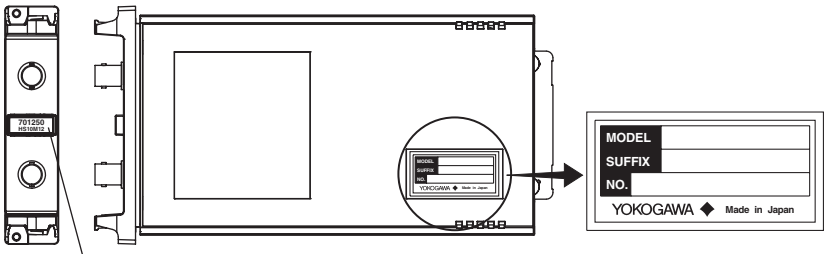
Cover panels B8023EN 8 pieces

Rubber feet B9989EX 4 pieces (1 sheet)

Input Modules (Sold Separately)

Check that the MODEL indicated on the input module is what you ordered.

MODEL	Name	Abbreviation
701250	High-Speed 10 MS/s, 12-Bit Isolation Module	HS10M12
701251	High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module	HS1M16
701255	High-Speed 10 MS/s, 12-Bit Non-Isolation Module	NONISO_10M12
701260	High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS)	HV (with RMS)
701261	Universal (Voltage/Temp.) Module	UNIVERSAL
701262	Universal (Voltage/Temp.) Module (with AAF)	UNIVERSAL (AAF)
701265	Temperature, High Precision Voltage Isolation Module	TEMP/HPV
701270	Strain Module (NDIS)	STRAIN_NDIS
701271	Strain Module (DSUB, Shunt-Cal)	STRAIN_DSUB
701275	Acceleration/Voltage Module (with AAF)	ACCL/VOLT
701280	Frequency Module	FREQ



Top row: MODEL
Bottom row: Abbreviated name

This user's manual refers to the input modules by MODEL (abbreviation).
For example, the High-Speed 10 MS/s, 12-Bit Isolation Module is indicated as 701250 (HS10M12). However, the module may be indicated only by the model (701250) if a description about the same module is given immediately before it.

Optional Accessories (Sold Separately)

The optional accessories below are available for purchase separately. Check that all contents are present and undamaged. For information and ordering, contact your nearest YOKOGAWA dealer.

Name	Model	Safety standard*1	Description
1. Isolated probe	700929	1000 Vrms CAT II	10:1 safety probe, for the 701250/701251
2. Current probe	700937	300 Vrms CAT I	DC to 50 MHz bandwidth,Used by connecting to the probe power terminal
3. Current probe	701930	300 Vrms CAT III	DC to 10 MHz bandwidth,Used by connecting to the probe power terminal
4. Current probe	701931	300 Vrms CAT III	DC to 2 MHz bandwidth,Used by connecting to the probe power terminal
5. Current probe	701933	300 Vrms CAT I	DC to 50 MHz bandwidth, Used by connecting to the probe power terminal
6. Differential probe	700924	1000 Vrms CAT III*2	Switchable between 1000:1 and 100:1 Measurable voltage: 1400 Vpeak (1000 Vrms)
7. 10:1 Passive Probe for the DL750/DL750P	701940	-	For non-isolated input on the 701255: 600 V or less For isolated input other than above: 42 V or less
8. 1:1 BNC safety adapter lead	701901	1000 Vrms CATII	Used with the 701954, 701959, 758922, 758929, or 758921 sold separately
9. Alligator clip (dolphin type)	701954	1000 Vrms CAT III	2 pieces in one set (red/black)
10. Safety mini-clip (hook type)	701959	1000 Vrms CAT II	2 pieces in one set (red/black)
11. Alligator clip adapter	758922	300 Vrms CAT II	2 pieces in one set
12. Alligator clip adapter	758929	1000 Vrms CAT II	2 pieces in one set
13. Fork terminal adapter	758921	1000 Vrms CAT II	2 pieces in one set (red/black), for 4-mm screws
14. Cable*3	366926	-	For measuring low voltage of less than or equal to 42 V
15. Banana-alligator clip cable	366961	-	For measuring low voltage of less than or equal to 42 V for the 701261, 701262, or 701265
16. High-speed logic probe	700986	-	42 V or less, 8-bit non-isolated/response speed of 1 μs
17. Isolated logic probe	700987	250 Vrms CAT II	8 bits, each channel isolated, response speed of 20 ms (for AC)
18. Measurement lead for isolated logic	758917	1000 Vrms CAT II	2 pieces in one set, used with the 758922 or 758929 adapter sold separately
19. Conversion adapter	366928	-	42 V or less,BNC (jack) to RCA (plug)
20. GO/NO-GO cable	366973	-	For GO/NO-GO determination I/O function
21. Earphone microphone PUSH switch	701951	-	For recording and playing voice memo/with a comment
22. Speaker cable	701952	-	For playing voice memo/comment
23. Safety BNC cable (1 m)	701902	1000 Vrms CAT II	
24. Safety BNC cable (2 m)	701903	1000 Vrms CAT II	
25. Safety BNC-to-banana adapter	758924	500 Vrms CAT II	
26. Bridge head	701955	-	NDIS, bridge resistance: 120 Ω
	701956	-	NDIS, bridge resistance: 350 Ω
	701957	-	DSUB, bridge resistance: 120 Ω, shunt-cal support
	701958	-	DSUB, bridge resistance: 350 Ω, shunt-cal support
27. Soft carrying case	701963	-	For the DL750 with three pockets
	701967	-	For the DL750P with three pockets
28. DC power cord (Cigarette lighter plug type)	701970	-	For the DC power supply model (/DC)
29. DC power cord (Alligator clip type)	701971	-	For the DC power supply model (/DC)

Sold in units of 1 piece.

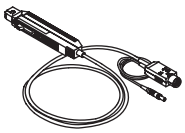
*1 The actual voltage that can be used is the lower voltage of the specifications of the DL750/DL750P and the cable.

*2 Be sure to connect the GND lead provided with the 700924 to the functional ground terminal of the DL750/DL750P. A measurement of 1400 Vpeak is possible by connecting the GND lead to the DL750/DL750P.

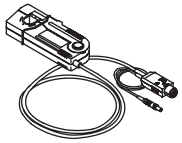
*3 Use cables (366926) that YOKOGAWA has been shipping since February 4, 1998. Cables (366926) shipped before this date cannot be used in combination with the DL750/DL750P input modules.

1. Isolated probe 700929

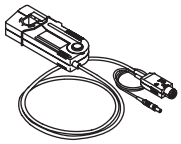
2. Current probe 700937



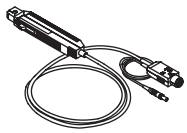
3. Current probe 701930



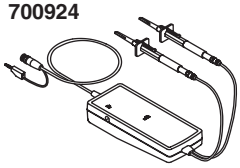
4. Current probe 701931



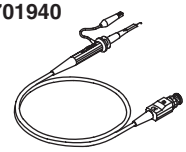
5. Current probe 701933



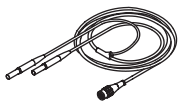
6. Differential probe 700924



7. 10:1 Passive Probe for the DL750/DL750P 701940

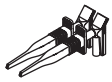


8. 1:1 BNC safety dapter lead 701901*

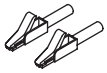


9. Alligator clip (dolphin type) 701954

10. Safety mini-clip (hook type) 701959



11. Alligator clip adapter (Rated voltage 300 V) 758922

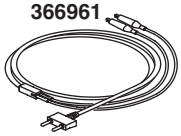


12. Alligator clip adapter (Rated voltage 1000 V) 758929

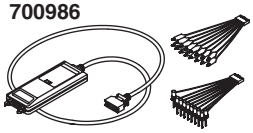
13. Fork terminal adapter 758921

14. Cable 366926

15. Banana-alligator clip cable 366961

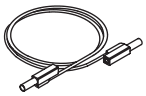


16. High-speed logic probe 700986



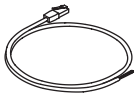
17. Isolated logic probe 700987

18. Measurement lead for isolated logic 758917*

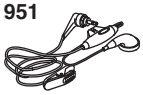


19. Conversion adapter 366928

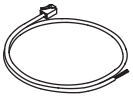
20. GO/NO-GO cable 366973



21. Earphone microphone with a PUSH switch 701951



22. Speaker cable 701952

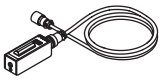


23. Safety BNC cable (1 m) 701902

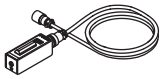
24. Safety BNC cable (2 m) 701903

25. Safety BNC-to-banana adapter 758924

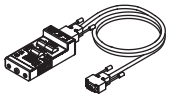
26. Bridge head 701955 (NDIS, 120 Ω)



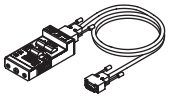
26. Bridge head 701956 (NDIS, 350 Ω)



26. Bridge head 701957 (DSUB, 120 Ω)



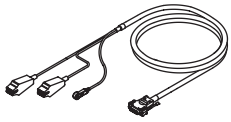
26. Bridge head 701958 (DSUB, 350 Ω)



27. Soft carrying case 701963 (for the DL750) 701967 (for the DL750P)

28. DC power cable (Cigarette lighter plug type) 701970

29. DC power cable (Alligator clip type) 701971



* Used by combining the alligator clip (dolphin type 701954), safety mini-clip (hook type: 701959), alligator adapter (758922 or 758929), and/or the fork terminal adapter (758921) accessories sold separately.

Spare Parts (Sold Separately)

The spare parts below are available for purchase separately. Check that all contents are present and undamaged.

For information about the spare parts and ordering, contact your dealer.

Name	Part No.	Minimum Q'ty	Note
Printer roll paper (for the DL750)	B9988AE	10	Thermo-sensitive paper, 111 mm × 10 m
Printer roll paper (for the DL750P)	701966	6	Thermo-sensible paper, 210 mm × 20 m

Safety Precautions

This instrument is an IEC safety class I instrument (provided with a terminal for protective earth grounding).
The general safety precautions described herein must be observed during all phases of operation. If the instrument is used in a manner not specified in this manual, the protection provided by the instrument may be impaired. Yokogawa Electric Corporation assumes no liability for the customer's failure to comply with these requirements.

The followingsymbols are used on this instrument.


Warning: handle with care. Refer to the user's manual or service manual. This symbol appears on dangerous locations on the instrument which require special instructions for proper handling or use. The same symbol appears in the corresponding place in the manual to identify those instructions.


Protective grounding terminal


Functional ground terminal (do not use this terminal as a protective ground terminal.)


Alternating current

ON (power)


OFF (power)

Be sure to observe with the precautions below. Not complying might result in injury or death.

WARNING

- **Use the Correct Power Supply**
  Before connecting the power cord, ensure that the source voltage matches the rated supply voltage of the instrument and that it is within the maximum rated voltage of the provided power cord.
- **Use the Correct Power Cord and Plug**
  To prevent the possibility of electric shock or fire, be sure to use the power cord supplied by YOKOGAWA. The main power plug must be plugged into an outlet with a protective earth terminal. Do not disable this protection by using an extension cord without protective earth grounding.
- **Connect the Protective Grounding Terminal**
  Make sure to connect the protective earth to prevent electric shock before turning ON the power. The power cord that comes with the instrument is a three-prong type power cord. Connect the power cord to a properly grounded three-prong outlet.
- **Do Not Impair the Protective Grounding**
  Never cut off the internal or external protective grounding wire or disconnect the wiring of the protective grounding terminal. Doing so poses a potential shock hazard.
- **Do Not Operate with Defective Protective Grounding or Fuse**
  Do not operate the instrument if the protective grounding or fuse might be defective. Also, make sure to check them before operation.
- **Do Not Operate in an Explosive Atmosphere**
  Do not operate the instrument in the presence of flammable liquids or vapors. Operation in such an environment constitutes a safety hazard.
- **Do Not Remove Covers**
  The cover should be removed by YOKOGAWA's qualified personnel only. Opening the cover is dangerous, because some areas inside the instrument have high voltages.
- **Ground the Instrument before Making External Connections**
  Securely connect the protective grounding before connecting to the item under measurement or to an external control unit. If you are going to touch the circuit, make sure to turn OFF the circuit and check that no voltage is present.
- **Precautions to Be Taken When Using the DC Power Supply**
- Make sure to perform protective earth grounding to prevent electric shock.
- Connect the DC power cord after checking that the power switch of the instrument is turned OFF. If you connect the power cord with the power switch turned ON, sparks may be emitted and can lead to fire.
- **Precautions to Be Taken When Using the Modules**
- Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
- To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL750/DL750P.
- To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical protection function and the mechanical protection function will not be activated.
- Avoid continuous connection under an environment in which the allowable surge voltage or greater voltage may occur.

- **Precautions to Be Taken When Using the Probes**
- When measuring high voltages using the 701250 (HS10M12) or the 701251 (HS1M16), use isolated probes (700929),1:1 safety cable (combination of 701901 and 701954), or differential probes (700924).
- Be sure to connect the GND lead of the differential probe (700924) to the functional ground terminal of the DL750/DL750P. High voltage may appear at the BNC connector of the differential probe. Be sure to connect the GND lead to the DL750/DL750P before connecting the probe to the parameter to be measured.
- When using the 701255 (NONISO_10M12), be sure to fasten the module screws. Fastening the module screws activates the protection function and the non-isolation function. It is extremely dangerous if you do not fasten the screws. In addition, when measuring high voltage above 42 V, be sure to use the Passive Probe for the DL750/DL750P (701940).
- The BNC part of the Passive Probe for the DL750/DL750P (701940) is made of metal. Therefore, use the probe at 42 V or less for isolated inputs (701250 (HS10M12), 701251 (HS1M16), 701260 (HV(with RMS)), etc.) for safety reasons. (Do not connect voltage above 42 V to both the High and Low sides.) For non-isolated inputs (701255 (NONISO_10M12), etc.), fasten the module screws as described before.
- When applying high voltage using the 701260 (HV(with RMS)), use the 1:1 safety cable (combination of 701901 and 701954) or the isolated probe (700929).
- The measurement category of the 701260 (HV (with RMS)) is 400V-CAT II for the low side and 700V-CAT II for the high side. Use caution because the overvoltage tolerance differs between the low and high sides.

Conventions Used in This Manual

Unit

k: Denotes 1000. Example: 100 kS/s (sampling rate)
K: Denotes 1024. Example: 720 KB (storage capacity of a floppy disk)

Displayed Characters

- Bold characters used in the procedural explanations indicate characters that are marked on the panel keys or the characters of the soft keys displayed on the screen menu.
- The SHIFT + xxx key refers to first pressing the SHIFT key (the indicator above the SHIFT key lights), and then pressing the xxx key. The menu marked in purple below the pressed key appears on the screen.

Safety Markings

The following markings are used in this manual.

*Improper handling or use can lead to injury to the user or damage to the instrument.*This symbol appears on the instrument to indicate that the user must refer to the user's manual for special instructions. The same symbol appears in the corresponding place in the user's manual to identify those instructions. In the manual, the symbol is used in conjunction with the word "WARNING" or "CAUTION."

WARNING Calls attention to actions or conditions that could cause serious or fatal injury to the user, and precautions that can be taken to prevent such occurrences.

CAUTION Calls attentions to actions or conditions that could cause light injury to the user or damage to the instrument or user's data, and precautions that can be taken to prevent such occurrences.

Note Calls attention to information that is important for proper operation of the instrument.

Subheadings

On pages that describe the operating procedure in chapters 3 through 9 of Part 1 and chapters 10 through 18 in Part 2, the following symbols are used to distinguish the procedure from their explanations.

Procedure Follow the numbered steps. All procedures are written with inexperienced users in mind; experienced users may not need to carry out all the steps.

Explanation This section describes the setup items and the limitations regarding the procedures. A detailed description of the function is not provided in this section. For details on the function, see chapter 2.

Functions Described in This Manual and the DL750/ DL750P Version

The contents of this manual describe the DL750/DL750P version 6.20 or later. The table below shows the relationship between the DL750/DL750P versions and the new functions and supported modules. If the DL750/DL750P is not of the newest version, you will not be able to use all the functions covered in this manual. Check the DL750/DL750P version by referring to Soft Version on the overview screen that appears by selecting the MISC key > Overview soft key. For details on the procedure, see section 18.4 in the User's Manual Part 2. For up-to-date information about the DL750/DL750P versions and the procedure for upgrading your DL750/DL750P, check the following Web page.
http://www.yokogawa.com/tm/DL750/

DL750/DL750P Versions and New Functions

Version	Suffix Code	New Functions	Reference Page/ Section/Chapter
1.09 or later	Standard	• Voice memo and voice comment	*Pages 2-36* and *2-64*, *sections 7.9* and *13.19*
2.02 or later	Standard	• Wave window trigger	*Page 2-26* and *section 6.17*
		• Cycle statistical processing	*Page 2-57* and *section 11.7*
		• Chinese menu and message support	*Section 17.1*
	/G3	• DSP channels	*Page 2-50*, *chapter 15*, and *appendix 6*
3.01 or later	Standard	• Numeric monitor display	*Page 2-39* and *section 8.13*
		• Added exponential window to FFT computation/increased number of points in FFT computation (up to 100 kpoints).	*Page 2-47*, *section 10.5*, *page app-21*
		• Normal statistical processing/statistical processing of history memory	*Page 2-57* and *section 11.7*
		• Increased the number of parameters for automated measurement/statistical processing of waveform parameters (Up to 24000 increased to up to 48000)	*Sections 11.6* and *11.7*
		• Added waveform data save formats for action-on-trigger and GO/NO-GO determination (select from binary, ASCII, and floating)	*Pages 2-29* and *2-58*, and *Section 13.7*
		• Support for inverted display on the strain module	*Page 2-14* and *section 5.12*
		• Support for current probe (701931)	*Page 2-9* and *section 3.6*
	/G3	• Support for enhanced trigger (OR trigger and window trigger) on DSP channels	*Pages 2-22* and *2-26*, *chapter 15*
		• Knocking filter	*Section 15.6*
3.10 or later	Standard	• Added Korean to the menu languages. Added Korean, German, French, and Italian to message languages.	*Section 17.1*
4.01 or later	Standard	• Changed the number of screens that can be captured on the dual capture function	*Page 2-34 and section 7.6*
		• Selection of the traces to be displayed on the dual capture function	*section 7.6*
		• Mail transmission using the dual capture trigger function	*section 7.6*
		• Automated measurement of waveform parameters on the dual capture function	*section 11.6*
		• Added the action on stop function.	*section 7.8*
		• Parameter search of the history memory function	*section 11.3*
		• Added H&V cursor measurement to T-Y waveforms	*section 11.5*
	Standard, /G3	• Filter Hz display	*Sections 10.5* and *15.3*
	/C10	• SNTP function	*Sections 3.5* and *16.8*
		• WebDAV server function	*Section 16.11*
		• Mail attachment function of image data	*Section 16.5*
	/DC	• Added the DC power supply option (DL750 only)	*Section 3.4*
4.02 or later	Standard	• START/STOP key response time	*Section 7.1*
5.01 or later	Standard	• Recording in recorder mode (DL750P only)	*Chapter 9*
		• Connection of USB storage device to the USB PERIPHERAL interface (DL750P only)	*Section 13.3*
		• Creation of PDF files of the printed image (DL750P only)	*Section 13.13*
		• Support for current probe (701933)	*Page 2-9* and *section 3.6*
		• Added 16 divided windows to the display format	*Section 8.1*
		• Added the output format to the built-in printer (Zoom Print) and changed the name of the function Long copy to Fine print	*Section 12.2*
		• Added the linear scaling display format	*Section 5.11*
6.01 or later	Standard	• Creation of PDF files of the reprint image in X-Y Recorder Mode (DL750P only)	*Section 9.9*
		• Creation of PDF files of the printed image (X-Y waveform) (DL750P only)	*Section 13.3*
	Standard, /G2	• Overall value display of the power spectrum computation (FFT)	*Section 10.13, 10.5, 11.6, and page App-19*

Version	Suffix Code	New Functions	Reference Page/ Section/Chapter
6.02 or later	Standard	• Connection of USB storage device to the USB PERIPHERAL interface (DL750)*	*Section 13.3*
6.20 or later	Standard	• Added waveform icons to the title of the CH/DSP/LOGIC/EVENT setup menus.	*Section 5.1*
		• Added All ON of Variable (Var.) to the all channel setup menu.	*Section 5.13 (section 5.9)*
		• Added ACQ Count to the action-on-trigger/action-on-stop setup menu.	*Sections 6.18 and 7.8*
		• Added bandwidth limit to the channel information during temperature/strain measurement.	*Section 8.13*
		[Recording in recorder mode (DL750P only)] • Added an Extra Area ON/OFF function when the format is set to Dual, Triad, or Quad in the print settings of Chart Recorder mode. • Added the Fine setting to Gauge in the print settings of Chart Recorder mode. • Added A4 print to the print length during reprint in Chart Recorder mode. • Selection of the print font size (Print Font) in the print settings of X-Y Recorder mode.	*Section 9.4* *Section 9.4* *Section 9.8* *Section 9.7*
		• Support for phase shift even when external clock is selected.	*Section 10.4*
		[Printing on the built-in printer (DL750P only)] • Added A4 print to the output format. • Added an Extra Area ON/OFF function when the format is set to Dual, Triad, or Quad in the print settings of fine print, zoom print, and A4 print. • Added the Fine setting to Gauge in the print settings of fine print, zoom print, and A4 print.	*Section 12.2* *Section 12.2* *Section 12.2*
		• Creation of PDF files of the print image when all waveform display (Display Mode: All) is selected in the history memory function (DL750P only).	*Section 13.13 (section 11.1)*
		• Added a function for switching the screen display font size (large or small).	*Chapter 17*
	/G2	• Added DUTYH and DUTYL to the user-defined computation.	*Section 10.5*

* Applicable to DL750s on which “USB Storage: Yes” is displayed on the overview screen that appears when you press the MISC key followed by the Overview soft key.

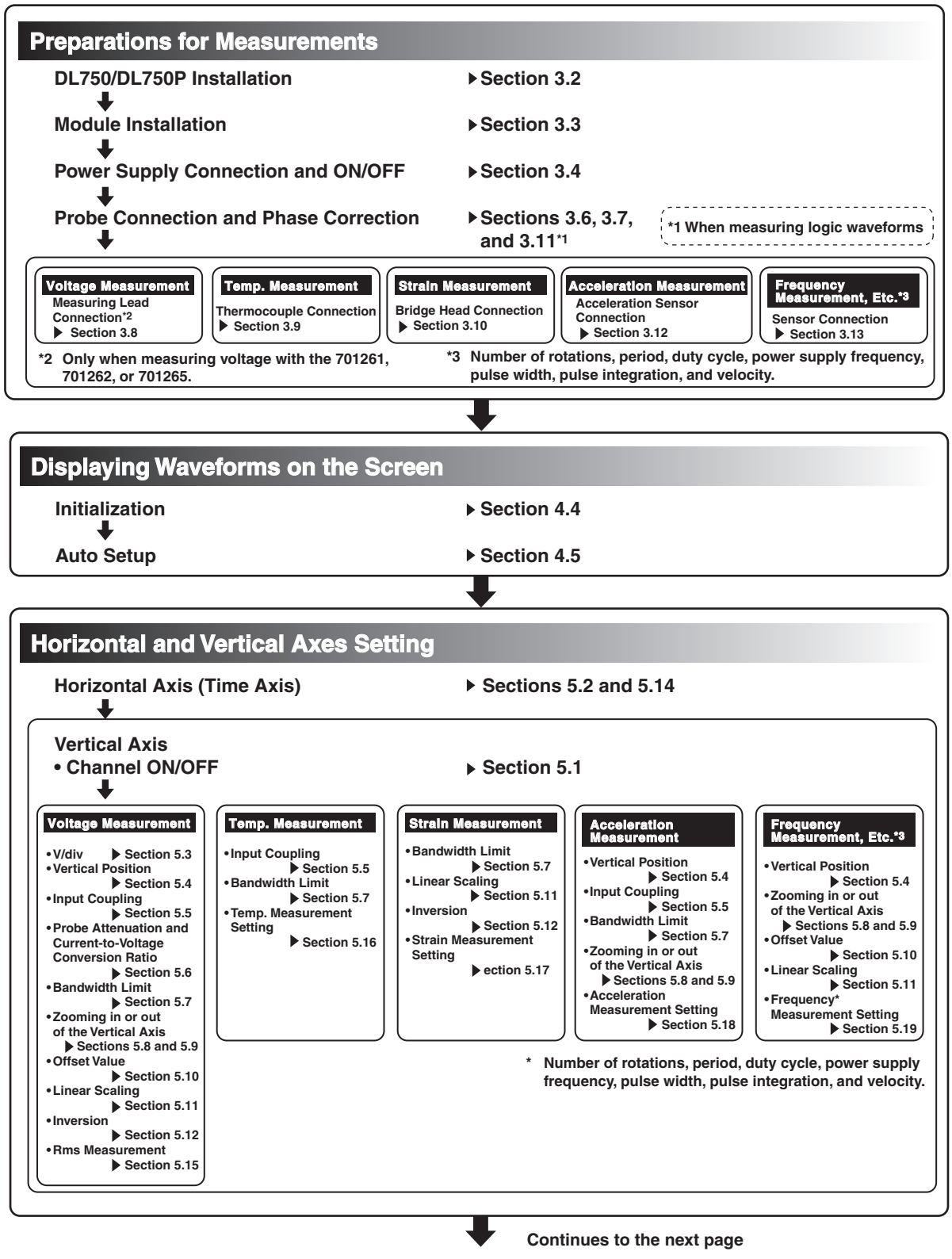
DL750/DL750P Versions and Supported Modules

Version	Supported Modules Reference Page Vertical Axis Settings	Specifications Concerning Horizontal/	Reference Section
1.07 or later	701250 High-Speed 10 MS/s, 12-Bit Isolation Module	*Page 19-18*	*Sections 5.1 to 5.15*
	701251 High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module	*Page 19-20*	*Sections 5.1 to 5.15*
	701265 Temperature, High Precision Voltage Isolation Module	*Page 19-29*	*Sections 5.1*, *5.2*, *5.5*, *5.7*, *5.13*, *5.14*, and *5.16*
2.02 or later	701255 High-Speed 10 MS/s, 12-Bit Non-Isolation Module	*Page 19-22*	*Sections 5.1 to 5.15*
	701260 High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS)	*Page 19-24*	*Sections 5.1 to 5.15*
	701270 Strain Module (NDIS)	*Page 19-31*	*Sections 5.1*, *5.2*, *5.7*, *5.11 to 5.14*, and *5.17*
	701271 Strain Module (DSUB, Shunt-Cal)	*Page 19-33*	*Sections 5.1*, *5.2*, *5.7*, *5.11 to 5.14*, and *5.17*
3.01 or later	701275 Acceleration/Voltage Module (with AAF)	*Page 19-35*	*Sections 5.1*, *5.2*, *5.4*, *5.5*, *5.7 to 5.9*, *5.13*, *5.14*, and *5.18**
	701280 Frequency Module	*Page 19-37*	*Sections 5.19*, *5.1*, *5.2*, *5.4*, *5.8 to 5.11*, *5.13*, and *5.14*
5.01 or later	701261 Universal (Voltage/Temp.) Module	*Page 19-26*	*Sections 5.1*, *5.2*, *5.4*, *5.5*, *5.7 to 5.9*, *5.13*, and *5.14*
	701262 Universal (Voltage/Temp.) Module (with AAF)	*Page 19-26*	*Sections 5.1*, *5.2*, *5.4*, *5.5*, *5.7 to 5.9*, *5.13*, and *5.14*

* Reference section for acceleration measurement.

Flow of Operation

The figure below provides an overview of the flow of operations described in this manual. For a description of each item, see the relevant chapter or section.



From the previous page

Trigger

- Trigger Type* (Simple/Enhanced) ▶Sections 6.5 to 6.17
- Trigger Source, Trigger Slope, Trigger Level, Etc ▶Sections 6.5 to 6.17
- Trigger Mode ▶Sections 6.1 and 7.5
- Trigger Position ▶Section 6.2
- Trigger Delay ▶Section 6.3

*Simple trigger
- Input signal trigger ▶Sections 6.5 and 6.9
- External trigger ▶Section 6.6
- Line trigger ▶Section 6.7
- Time trigger ▶Section 6.8

Enhanced trigger
- A → B(N) trigger ▶Section 6.10
- A Delay B trigger ▶Section 6.11
- Edge on A trigger ▶Section 6.12
- OR trigger ▶Section 6.13
- B > Time, B < Time, and B Time Out trigger ▶Section 6.14
- Periodic trigger ▶Section 6.15
- Window trigger ▶Section 6.16
- Wave window trigger ▶Section 6.17

Waveform Acquisition

- Record length ▶Section 7.2
- Acquisition mode ▶Sections 7.3 and 7.4
- Starting/Stopping waveform acquisition ▶Section 7.1

- Dual capture ▶Section 7.6
- Realtime recording to the internal hard disk (optional) ▶Section 7.7
- Voice memo ▶Sections 3.14 and 7.9
- Acquisition memory backup ▶Section 7.10

Displaying Waveforms and Information

- Setting Waveform Display Conditions ▶Sections 8.1 to 8.4 and 8.8
- Zooming on the Waveform ▶Section 8.5
- X-Y Waveform Display ▶Section 8.6
- Snapshot and Clear Trace ▶Section 8.7
- Setting Information Display Conditions ▶Sections 8.9 to 8.13

Recording in Recorder Mode (DL750P Only)

- Loading the Roll Paper ▶Section 9.1
- Selecting the Recorder Mode ▶Section 9.2
- Recording T-Y Waveforms ▶Sections 9.3 to 9.5
- Recording Numeric Values ▶Section 9.6
- Recording X-Y Waveforms ▶Section 9.7
- Reprinting on the Built-in Printer ▶Section 9.8
- Creating a PDF File of the Reprint Image ▶Section 9.9

The functions below that are not covered in the flow of operations in this section are not explained in this manual. For their descriptions, see the User's Manual Part 2 (IM701210-06E).

- Computation, analysis, and searching of waveforms
- Printing of screen image data
- Saving and loading of data
- External trigger I/O, external clock input, video signal output, etc.
- DSP channels (option)
- Ethernet communications (option)

Contents

User's Manual Part 1

Chapter 3 Making Preparations for Measurements

Chapter 4 Common Operations

Chapter 5 Horizontal and Vertical Axes

Voltage Measurement (On the 701250, 701251, 701255, 701260, 701261, 701262, 701265, or 701275)

User's Manual Part 2 (See IM701210-06E for the chapters listed below.)

Chapter 19 Specifications

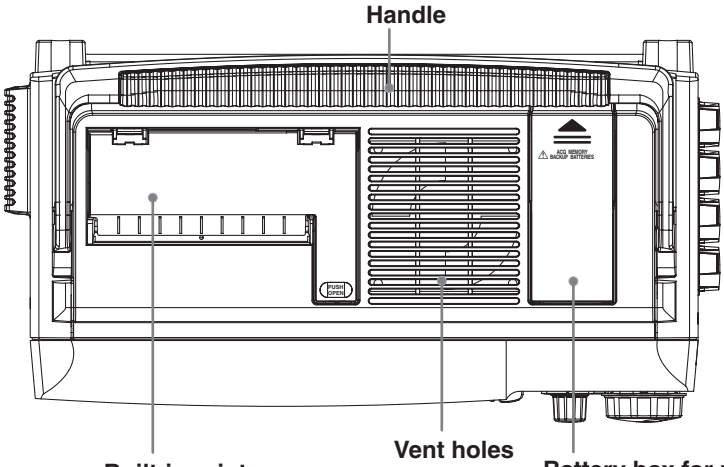
Appendix

Index

1.1 Top Panel, Front Panel, Right Side Panel, and Left Side Panel

Top Panel

DL750

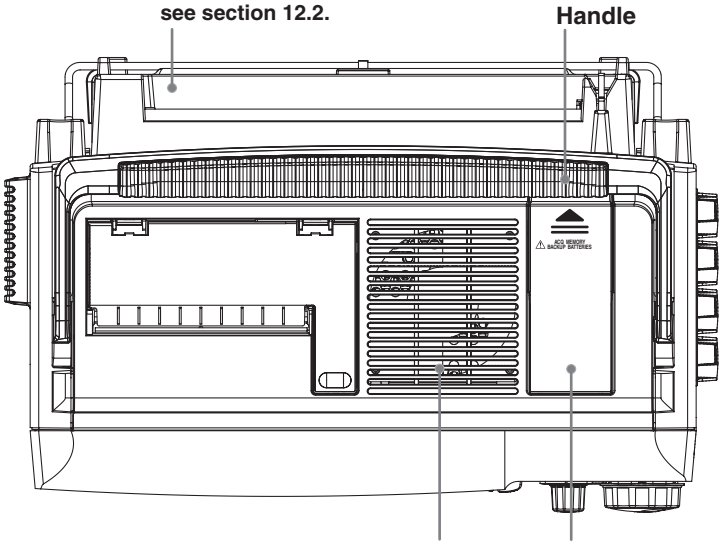


Built-in printer
Prints the displayed information.
For the procedure in setting the roll paper, see section 12.1.
For the printout procedure, see section 12.2.

Battery box for memory backup
Stores batteries used to back up the contents of the acquisition memory when the power is OFF.
For the procedure in installing the batteries, see section 7.10.

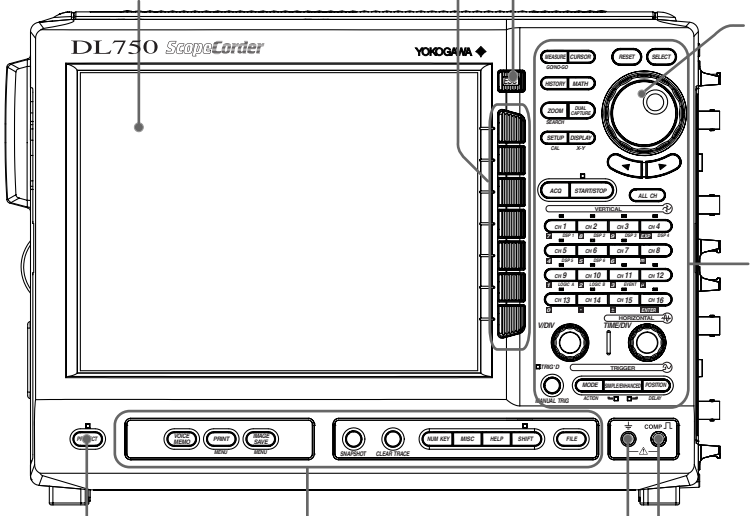
DL750P

Built-in printer
Prints the displayed information.
For the procedure in setting the roll paper, see section 9.1.
For the printout procedure, see section 12.2.



Front Panel

DL750



LCD
For a description of the displayed information, see chapter 8.

Soft keys
Used to select items on the soft key menu that appears when setting up the DL750.

ESC key
Used to clear the soft key menu and pop-up menu.

Jog shuttle
Used to change settings and move the cursor. Turn the shuttle ring to change the amount of change according to its angle.

Setup and execution keys/knob
See page 1-7 for a description.

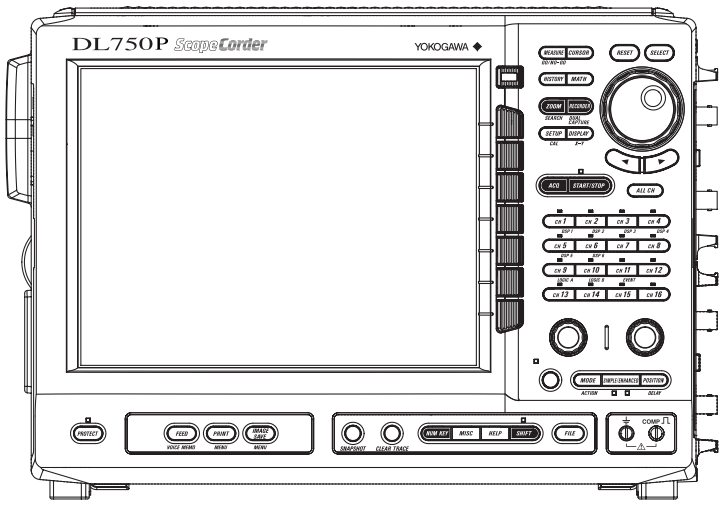
Setup and execution keys
See page 1-9 for a description.

PROTECT key
Locks the keys. See section 17.6.

Probe compensation signal output terminal (1 kHz/1 V_{P-P})
Outputs the probe compensation signal.
For the probe compensation procedure, see section 3.7.

Functional ground terminal
Connect the ground cable when compensating the probe.

DL750P



The name and function of each part are the same as the DL750.

Right Side Panel

DL750

Acquisition memory backup ON/OFF
Turns ON/OFF the battery power for backing up the acquisition memory.
For a description of the acquisition memory backup function, see section 7.10.

Input module installation slot
Eight slots on each row, top and bottom.
For the installation and removal procedure of the input module, see section 3.3.

Input channel arrangement

CH1	CH3	CH5	CH7
CH2	CH4	CH6	CH8
CH9	CH11	CH13	CH15
CH10	CH12	CH14	CH16

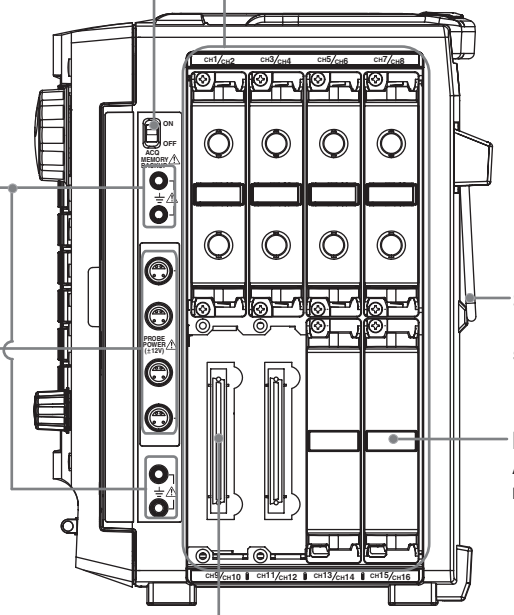
Functional ground terminal
Used to connect the ground line from the high-voltage differential probe or when enhancing the grounding of the measurement system.
For the probe connection procedure, see section 3.6.

Probe power supply terminal
Used to supply power (±12 V) to the probes when using current probes.
For the probe connection procedure, see section 3.6.

Stand
For the setup procedure, see section 3.2.

Empty slot protection cover
Attached to the slots that are not used.

Input module connector



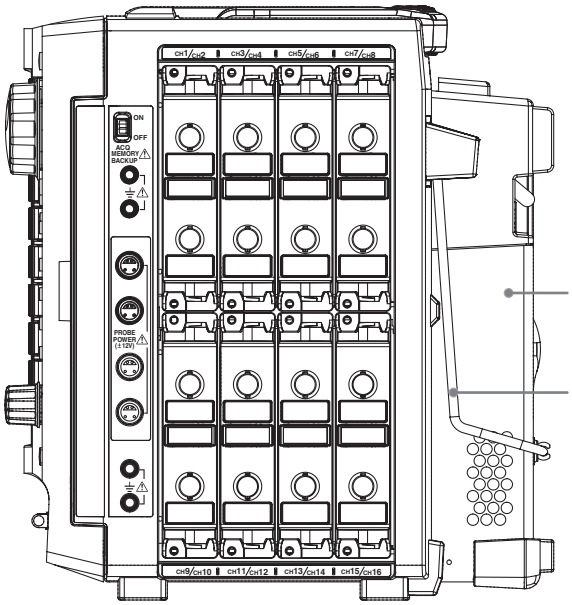
DL750P

Input channel arrangement

CH1	CH3	CH5	CH7
CH2	CH4	CH6	CH8
CH9	CH11	CH13	CH15
CH10	CH12	CH14	CH16

Built-in printer

Stand

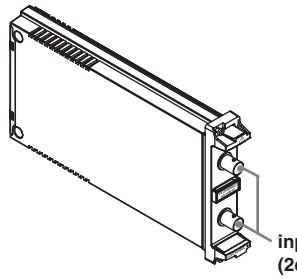


The name and function of each part are the same as the DL750.

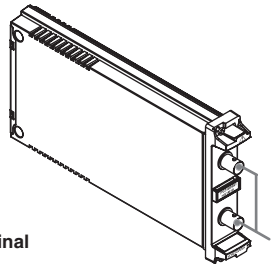
Input Module

The following 11 input modules are available.

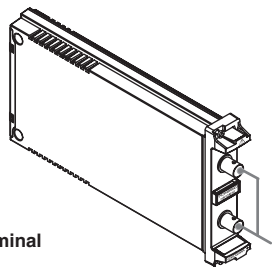
High-Speed 10 MS/s, 12-Bit Isolation Module HS10M12 (model: 701250)



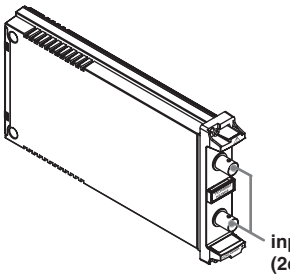
701251 High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module HS1M16 (model: 701251)



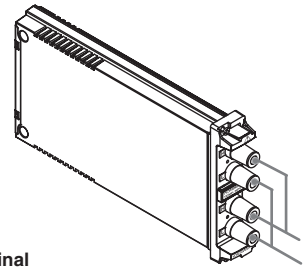
High-Speed 10 MS/s, 12-Bit Non-Isolation Module NONISO_10M12 (model: 701255)



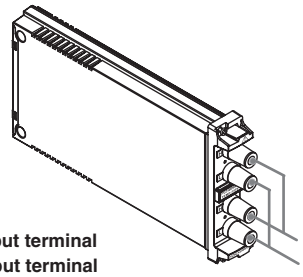
High-Voltage 100kS/s, 16-Bit Isolation Module (with RMS) HV (with RMS) (model: 701260)



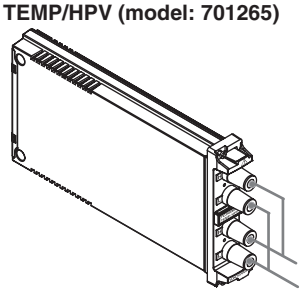
Universal (Voltage/Temp.) Module UNIVERSAL (model: 701261)



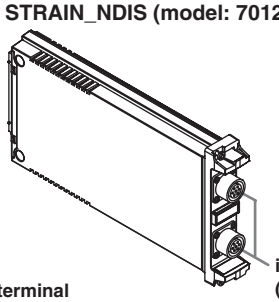
Universal (Voltage/Temp.) Module (with AAF) UNIVERSAL (AAF) (model: 701262)



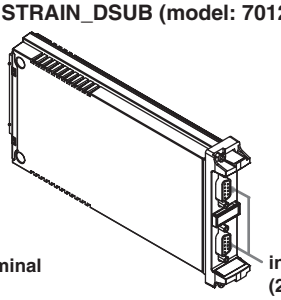
Temperature, High Precision Voltage Isolation Module TEMP/HPV (model: 701265)



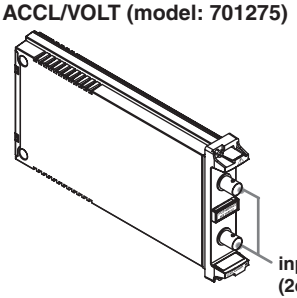
Strain Module (NDIS) STRAIN_NDIS (model: 701270)



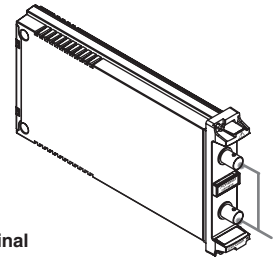
Strain Module (DSUB, Shunt-Cal) STRAIN_DSUB (model: 701271)



Acceleration/Voltage Module (with AAF) ACCL/VOLT (model: 701275)

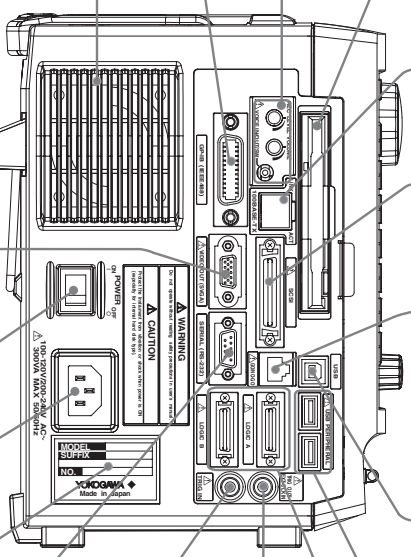


Frequency Module FREQ (model: 701280)



Left Side Panel

DL750



Voice memo function terminal
Used when recording voice while data acquisition is in progress using the voice memo function and recording voice along with screen image data. For a description of their use, see sections 7.9 and 13.19.

GP-IB connector
Used when carrying out communications via the GP-IB interface.
For a description of the communication function, see the *Communication Interface User's Manual*.

Vent holes

Video signal output terminal
Outputs the displayed image using SVGA RGB signals. For a description on how to use the terminal, see section 14.4.

Power switch
For the power ON/OFF operation, see section 3.4.

Power connector
For details on connecting the power, see section 3.4.

Name plate

RS-232 interface
Used when carrying out communications with a PC via the RS-232 interface.
For a description of the communication function, see the *Communication Interface User's Manual*.

Trigger input terminal
Used when inputting external trigger signals.
For a description of how to use the terminal, see section 14.1.

Trigger output/external clock input terminal
Used when outputting trigger signals externally or inputting clock signals.
For a description of how to use the terminal, see sections 14.2 and 14.3.

Floppy disk drive, Zip disk drive, (DL750 only) or PC card drive
Used when saving data to a floppy disk, Zip disk, or PC card.
For a description of their use, see section 13.1.

Ethernet port (100BASE-TX)
Used when connecting to a LAN.
For a description of how to use the port, see section 16.1.

SCSI interface connector
Used when connecting to a SCSI device such as a SCSI hard disk.
For a description of how to use the connector, see section 13.4.

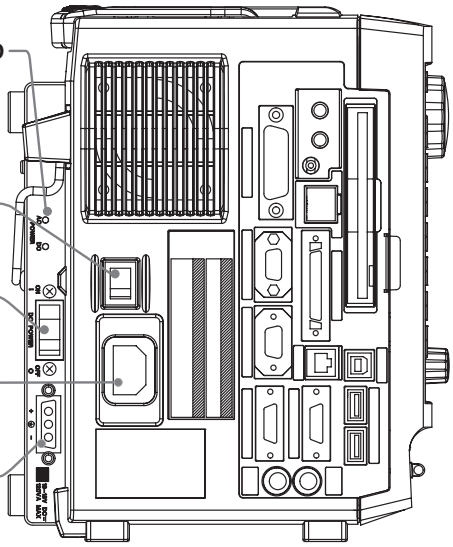
GO/NO-GO I/O connector and external start/stop input connector
Outputs the GO/NO-GO determination I/O signals.
Also used to externally control the start/stop of the DL750.
For a description of how to use the terminal, see sections 11.10 and 14.5.

USB connector for connecting to a PC
Used when connecting a PC with a USB interface. For a description of how to use the connector, see communication interface user's manual.

USB connector for connecting peripheral devices
Used when connecting a USB keyboard, USB printer, USB mouse, or USB storage device.
For a description of how to use the connector, see sections 4.3 and 12.3.

Logic signal input connector
Used when measuring logic signals.
For a description of how to use the connector, see section 3.11.

DC Power Supply Model (DL750 only)



Power supply status LED
Displays the status of the AC power supply or DC power supply.
For details on the status indicator, see section 3.4.

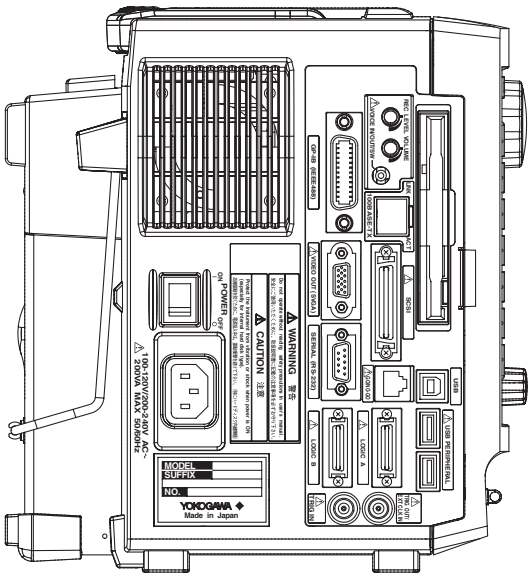
Power switch (AC)
For the power ON/OFF operation, see section 3.4.

Power switch (DC)
For the power ON/OFF operation, see section 3.4.

AC power connector
For details on connecting the power, see section 3.4.

DC power connector
For details on connecting the power, see section 3.4.

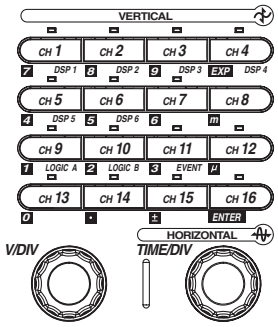
DL750P



The name and function of each part are the same as the DL750.

1.2 Panel Keys and Knobs

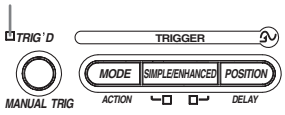
VERTICAL/HORIZONTAL Group Keys and Knobs



- **CH1 to CH16 Keys (Chapter 5)**
  Displays a menu used to turn ON/OFF the display of each channel and set the vertical position, coupling, probe type, offset voltage, bandwidth limit, expansion or reduction of the vertical axis, linear scaling, and waveform labels. In addition, by pressing this key before operating the V/DIV knob, the channel that is to be controlled by the V/DIV knob can be selected. The indicator above each CH key illuminates when the corresponding channel is ON.
  In addition, pressing the SHIFT key followed by a CH key displays a menu corresponding to the purple characters marked below and to the right of each key. (CH1 to CH6: DSP1 to DPS6, CH9: LOGIC A, CH10: LOGIC B, CH11: EVENT)
  Pressing the NUM KEY (see page 1-9) followed by a CH key causes the gray value marked below and to the left of each key to be entered.
- **V/DIV Knob (Section 5.3)**
  You can set the voltage sensitivity using this knob. Before turning this knob, you press a key from CH1 to CH16 to select the target channel. If you change the setting while the waveform acquisition is stopped, the setting takes effect when you restart the waveform acquisition.
  If you select a DSP channel (optional) by pressing the SHIFT key followed by one of the CH1 to CH6 keys before turning this knob, you can change the Value/Div setting of the DSP channel.
- **TIME/DIV Knob (Section 5.2)**
  This knob is used to set the time axis scale. If you change the setting while the waveform acquisition is stopped, the setting takes effect when you restart the waveform acquisition.

TRIGGER Group Keys

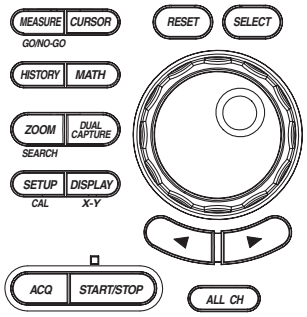
TRIG'D indicator
Illuminates when a trigger is activated.



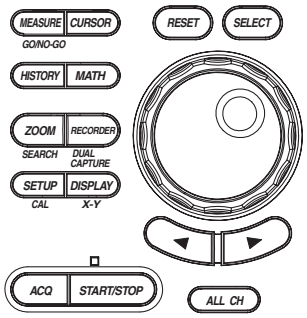
- **MANUAL TRIG Key (Section 6.19)**
  Press the key to forcibly activate a trigger.
- **(SHIFT+) MODE Key (Sections 6.1 and 6.18)**
  Displays a menu used to select the trigger mode. Pressing the SHIFT key followed by the MODE key displays a menu related to action-on-trigger or action-on-log-end.
- **SIMPLE/ENHANCED Key (Sections 6.4 to 6.17)**
  Displays a trigger setup menu. If the indicator below and to the left of the key is illuminated, simple trigger is enabled; if the indicator below and to the right of the key is illuminated, enhanced trigger is enabled.
- **(SHIFT+) POSITION Key (Sections 6.2 and 6.3)**
  Sets the trigger position. Pressing the SHIFT key followed by the POSITION key allows you to set the trigger delay.

Other Keys

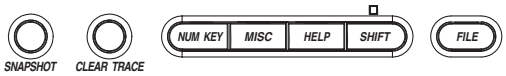
DL750



DL750P



- **(SHIFT+) MEASURE Key (Sections 11.6 and 11.7)**
  Displays a menu used when performing automated measurement of waveform parameters. Pressing the SHIFT key followed by the MEASURE key displays a menu related to GO/NO-GO determination.
- **CURSOR Key (Section 11.5)**
  Displays a menu used when performing cursor measurements.
- **HISTORY Key (Sections 11.1 to 11.3)**
  Displays a menu used to recall data using the history memory function.
- **MATH Key (Sections 10.1 to 10.5)**
  Displays a menu used when performing waveform computation.
- **(SHIFT+) ZOOM Key (Sections 8.5 and 11.4)**
  Displays a menu related to the zoom display of waveforms. Pressing the SHIFT key followed by the ZOOM key displays a menu related to data search (search & zoom function).
- **DUAL CAPTURE Key (Section 7.6)**
  Displays a menu related to the dual capture function.
- **RECORDER Key (Chapter 9)**
  Available only on the DL750P. Displays a menu related to the recorder mode.
- **(SHIFT+) SETUP Key (Sections 4.4 to 4.6)**
  Displays a menu used to initialize the settings to factory defaults, perform auto setup, which automatically sets the DL750/DL750P according to the input signal, store or recall setting parameters, and so on. Pressing the SHIFT key followed by the SETUP key displays a menu related to calibration.
- **(SHIFT+) DISPLAY Key (Sections 8.1 to 8.4, 8.6, 8.8 to 8.13)**
  Displays a menu related to the screen display. Pressing the SHIFT key followed by the DISPLAY key displays a menu related to the X-Y display.
- **ACQ Key (Sections 5.14, 7.2 to 7.4, and 7.7)**
  Displays a menu used to set the waveform acquisition mode.
- **START/STOP Key (Section 7.1)**
  Starts/Stops waveform acquisition according to the trigger mode. Waveform acquisition is in progress when the indicator above the key is illuminated.
- **ALL CH Key (Section 5.13)**
  Displays a pop-up window containing a list of settings similar to those displayed on the menu when one of the CH1 to CH16 or DSP1 to DSP6 (optional) keys is pressed.
- **RESET Key**
  Resets the value to the initial value.
- **SELECT Key**
  Confirms the menu item that you selected using the jog shuttle.
- **Arrow Keys (◄► Keys)**
  Moves the numeric entry digit (cursor) left or right.



- **SNAP SHOT Key (Section 8.7)**
  Leaves the current displayed waveform on the screen in black and white. Waveforms acquired using the snap shot function can be saved and loaded.
- **CLEAR TRACE Key (Section 8.7)**
  Clears the waveform acquired using the snap shot function and accumulated waveforms.
- **NUM KEY Key (Section 4.2)**
  Press this key to use the CH1 to CH16 keys as number input keys.
- **MISC Key (Sections 3.5, 13.6, 16.2 to 16.10, 17.1 to 17.5)**
  Displays menus for setting the communication interface, setting the environment, checking the system status, setting the SCSI ID number, accessing the self-diagnostic function, turning ON/OFF the LCD backlight, etc.
- **HELP Key (Section 4.7)**
  Turns ON/OFF the help window that provides description about the procedure.
- **SHIFT Key**
  Pressing the key once causes the indicator above the key to illuminate and activate the function marked below the key in purple. Pressing the key again clears the shifted condition.
- **FILE Key (Sections 13.5, 13.7 to 13.12, 13.14 to 13.17, and 16.3)**
  Displays a menu used to save various data to, recall various data, or execute file operations on a storage medium such as a floppy disk, zip disk, PC card, external SCSI device (option).

Note

Pressing the SHIFT key followed by the CLEAR TRACE key clears the remote mode using the communication interface. For details, see the *Communication Interface User's Manual* (IM 701210-18E).

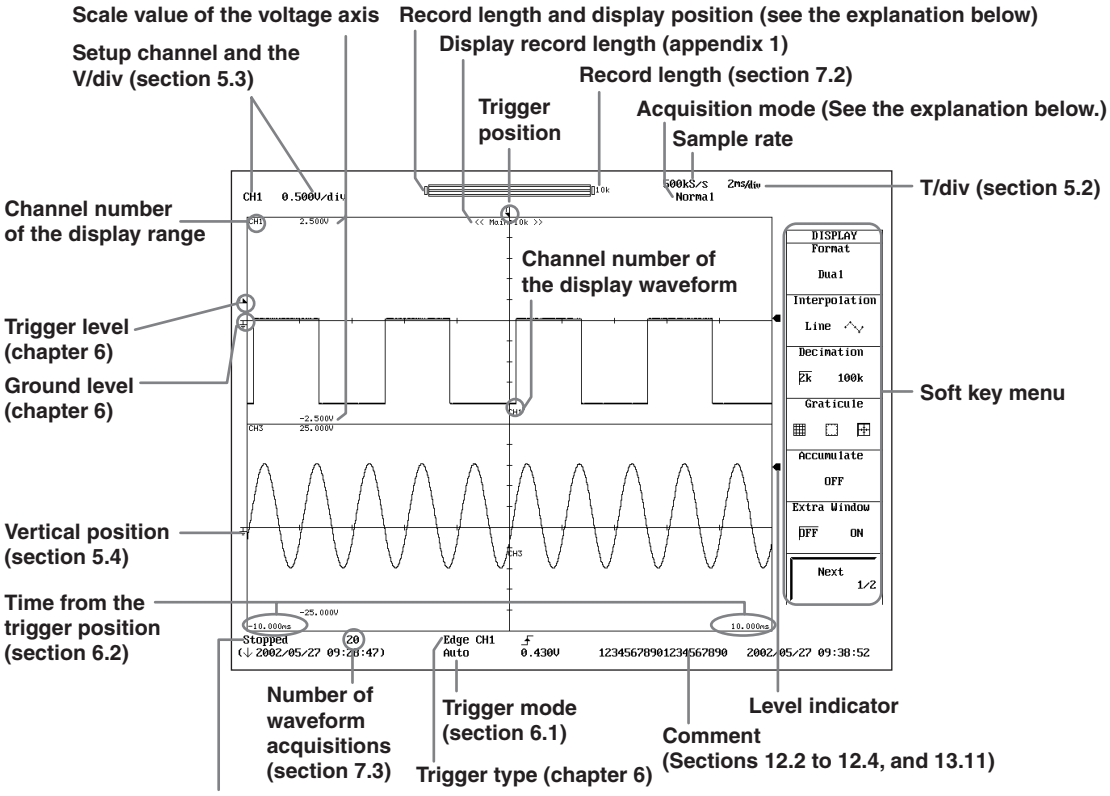
DL750

DL750P

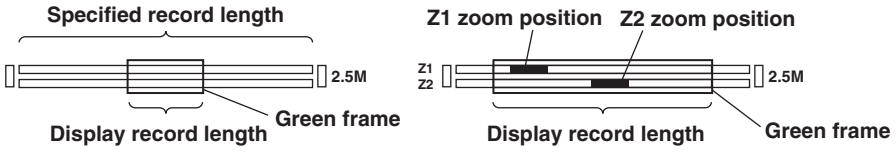
- **PROTECT Key (Section 17.6)**
  Pressing this key causes the LED above the key to illuminate, and the front panel keys to be disabled. Pressing the key again clears the condition.
- **VOICE MEMO Key (Section 7.9)**
  Displays a menu related to the voice memo function.
  On the DL750P, (SHIFT+)FEED key is used to display the VOICE MEMO menu.
- **FEED Key (Section 9.1)**
  Available only on the DL750P. Pressing this key feeds the paper on the built-in printer.
- **(SHIFT+) PRINT Key (Sections 12.2 to 12.4, and 16.4)**
  Executes the printing of the screen image data. Pressing the SHIFT key followed by the PRINT key displays a menu used when printing the screen image to the internal printer, USB printer, or network printer.
- **(SHIFT+) IMAGE SAVE Key (Sections 13.11, 13.12, and 16.3)**
  Stores the screen image data to the storage medium. Pressing the SHIFT key followed by the IMAGE SAVE key displays a menu related to the saving of the screen image data.

1.3 Display Screens

Normal Waveform Display



Displaying the Record Length and Display Position



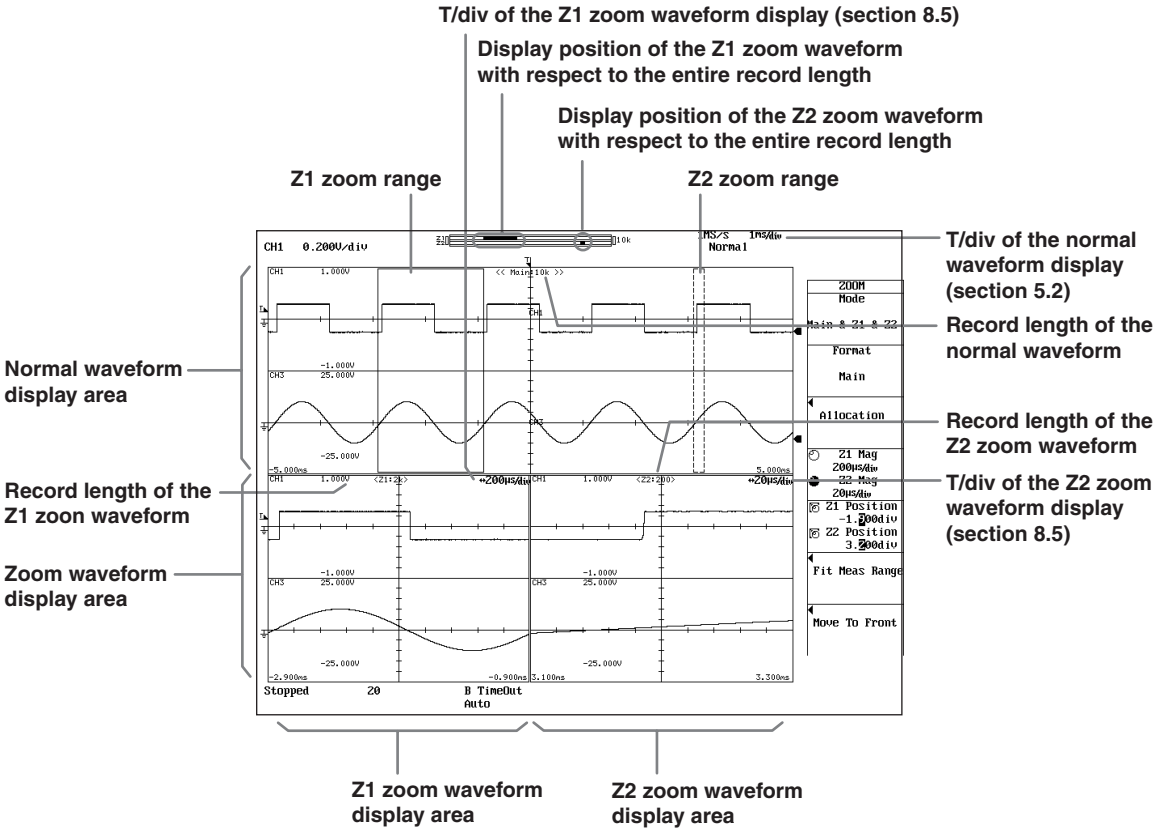
Acquisition Mode Indication

Normal: Normal mode
Env: Envelope mode
Avg: Average mode
BoxAvg: Box average mode

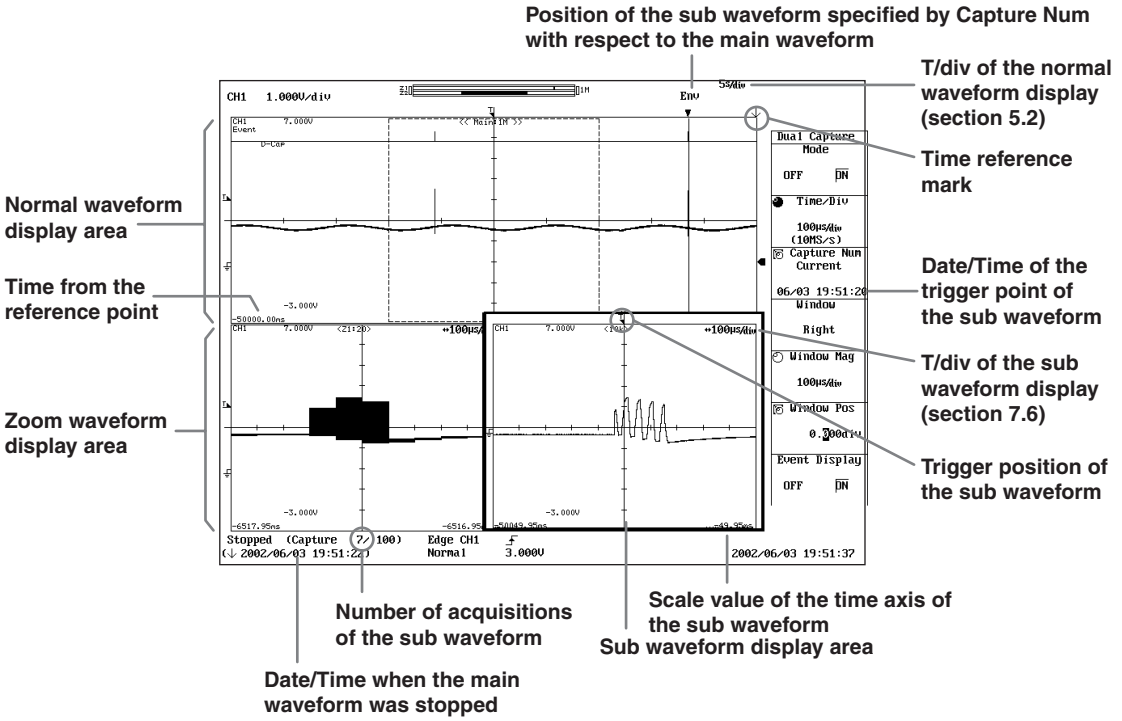
Note

In some cases, the LCD on the DL750/DL750P may include few defective pixels. For details, see section 19.4, “Display.”

Zoom Waveform Display

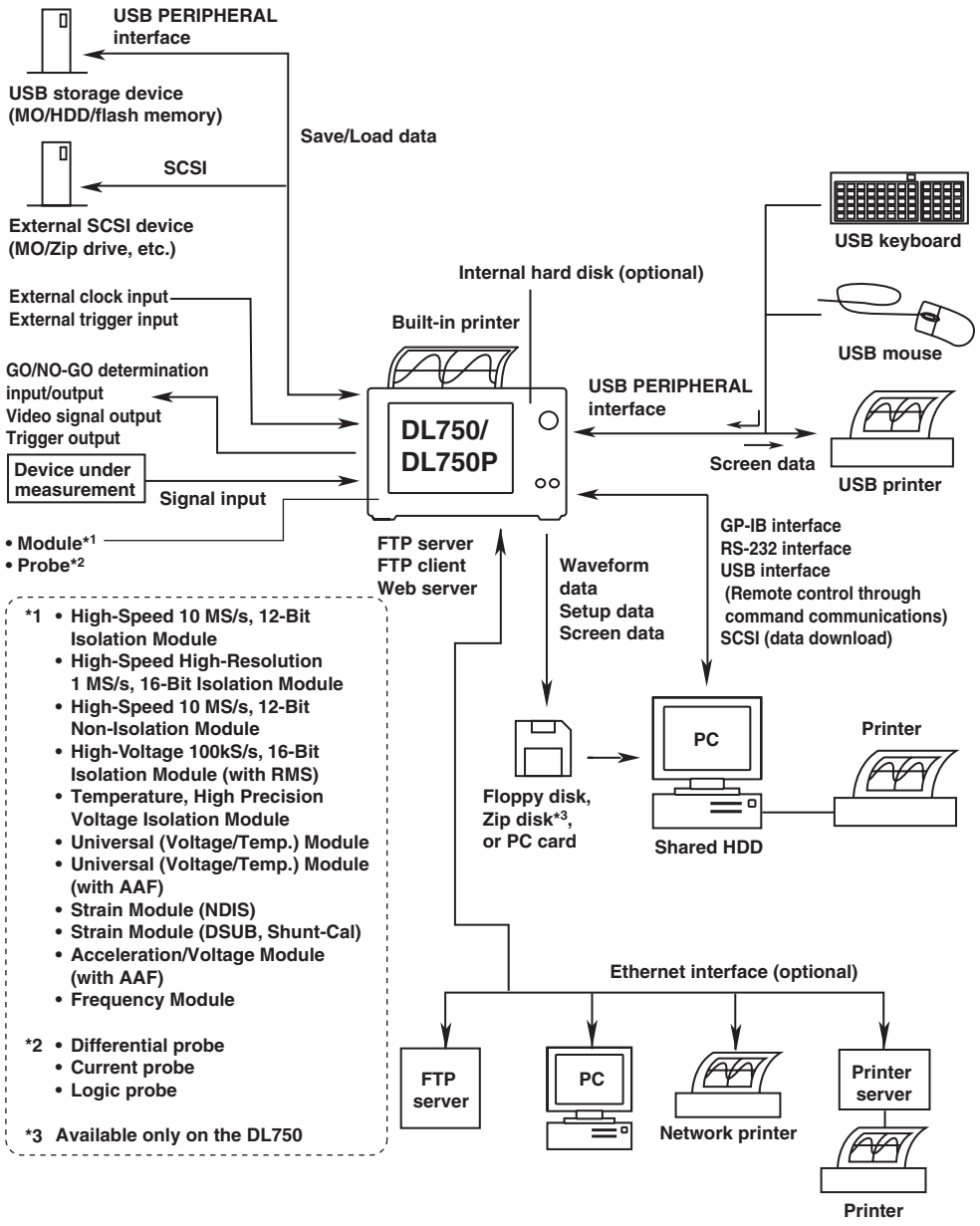


Dual Capture Display

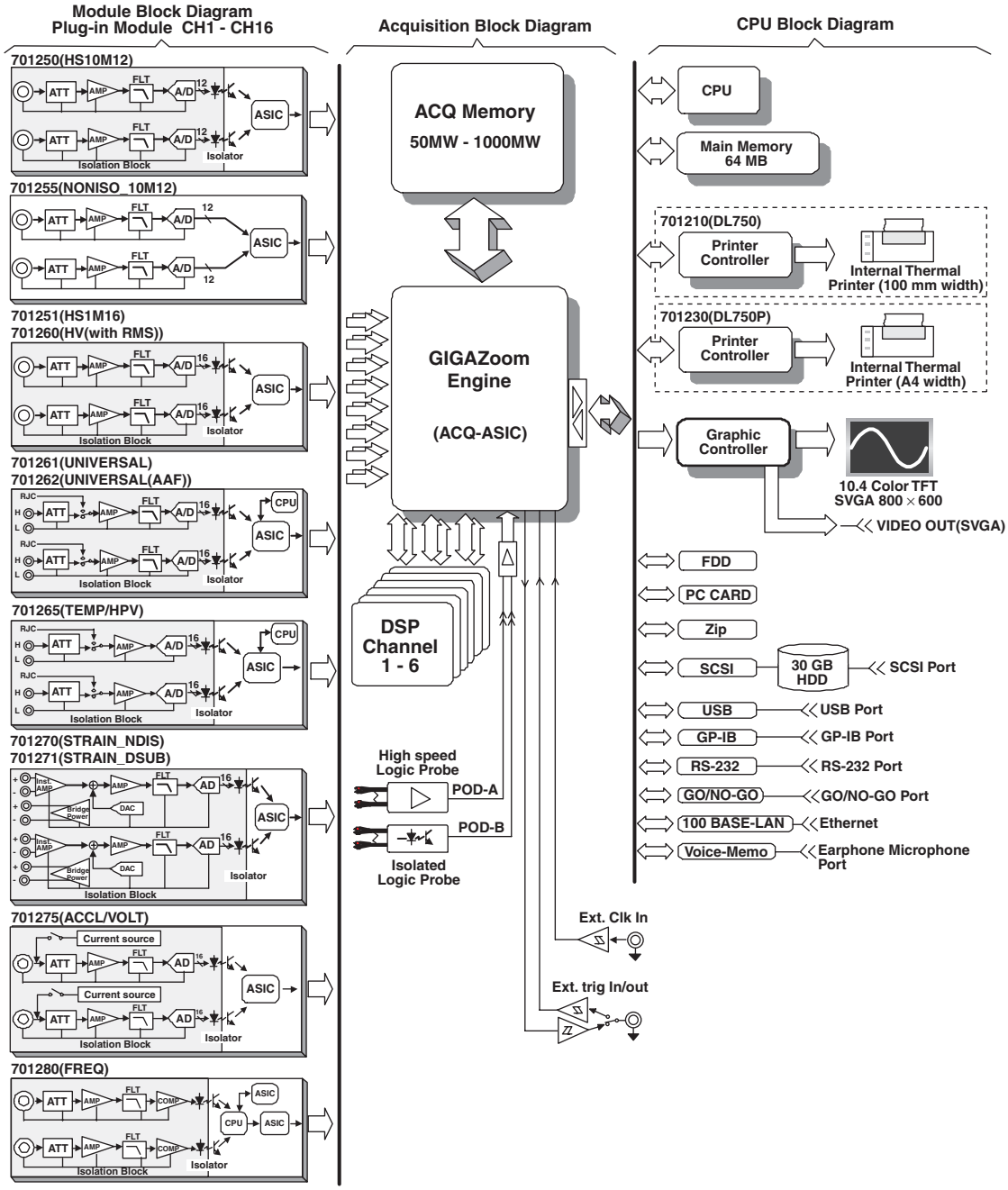


2.1 System Configuration/Block Diagram

System Configuration



Block Diagram of the DL750/DL750P



Signal Flow on the DL750/DL750P

The flow of the signal applied to the input signal varies depending on the module. Here, the High-Speed 10 MS/s, 12-Bit Isolation Module (HS10M12(701250)) is used as an example for the explanation. (For details on the flow of the signal of each module, see the block diagram.)

The signal applied to the two input terminals is first processed by the input section of each module.

On the HS10M12(701250), the input signal is attenuated/amplified by the attenuator and amplifier and its bandwidth is limited using the filter. The signal is then A/D converted, passed through the isolator and ASIC, and output to the main unit.

At the A/D converter, the input signal is sampled at a sample rate of 10 MS/s (10 million times per second) and converted to digital data.

The 16 channels of digital data collected at the CPU board pass through the GIGAZoom Engine (ACQ-ASIC) and stored in the ACQ Memory. The digital data stored in the ACQ Memory is compressed at high speeds by the GIGAZoom Engine (ACQ-ASIC), passed through the Graphic controller, and displayed on the SVGA TFT color display.

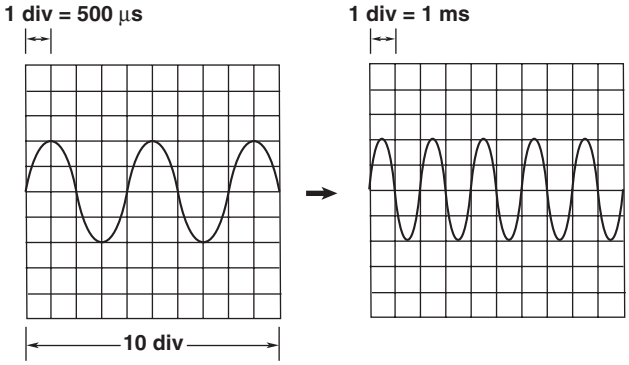
The DSP channel (optional) performs realtime computation between arbitrary channels using the A/D conversion data of an analog input channel (or the computed result of a DSP channel) as a computation source. Using DSP channels, the DL750/DL750P can acquire waveforms of up to 16 channels + 6 DSP channels + 16-bit digital data, simultaneously.

2.2 Setting the Horizontal and Vertical Axes

Horizontal Axis <Section 4.2>

Setting the Time Axis

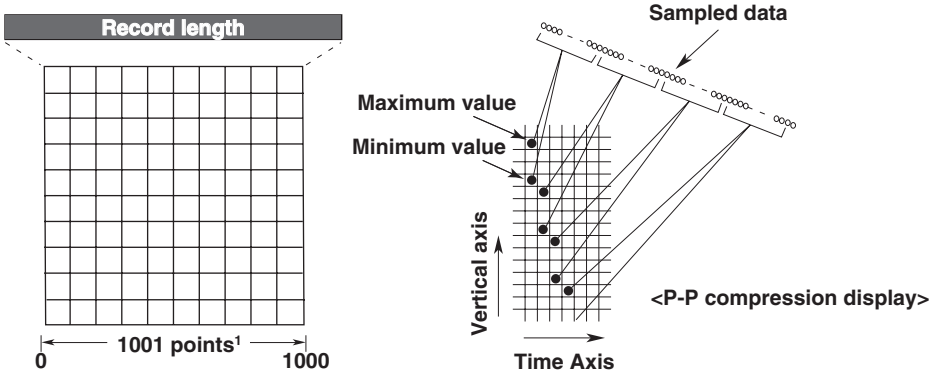
When using the internal clock[1], the time axis is set in terms of the time per one grid square (1 div). The selectable range is 500 ns/div to 30 s/div, 1 min/div to 30 min/div, 1 hour/div to 12 hour/div, and 1 day/div to 3 day/div. The transition between seconds, minutes, hours, and day is automatically performed. Since the display span along the horizontal axis is 10 divisions, the time span of the displayed waveform is equal to "the time axis setting × 10."



1. Internal clock and external clock (time base selection)
   Under the initial setting, the sampling timing of waveform data is controlled by the clock signal generated from the time base circuit within the DL750/DL750P (see section 1.3).
   The timing can also be controlled by a clock signal applied externally. External clock signals are input through the external clock input terminal on the left panel facing the DL750/DL750P. This external clock input is useful for observing a signal whose period varies or for observing waveforms by synchronizing to the clock signal of the signal being measured.

Display in the Time Axis Direction

There are 10 divisions along the time axis, and 1001 points (logical number of points, not the dots on the screen) are used to draw the waveforms. Therefore, if the display record length (see page 2-31) is exactly 1 kW (the number of acquired data points is 1001), the waveform is displayed using 1001 points. However, if the display record length is greater than or equal to 2 kW, the maxim and minimum values are determined (P-P compression) and aligned at the same time position (total number of points: 2002) to draw the waveform.



1. 1001 points is a logical number of points. On the screen the data is compressed to 651 dots (751 dots when the zoom waveform area is expanded) and displayed.

- **Zooming Horizontally and Drawing Waveforms**
  The DL750/DL750P is capable of expanding (zooming) the waveform horizontally (see page 2-41). When the zoom rate of the waveform is increased, the number of displayed points decreases. The waveform is displayed P-P compressed until the number of display points falls to 2002 points. When the number of displayed points falls below 1001, the waveform can no longer be displayed using continuous lines. In this case, the display data is interpolated using the display interpolation function (see page 2-37) so that the number of displayed points is 1001 points.

- **Dot Display**
  By default, the display interpolation function works automatically. However, you can also disable the display interpolation in which case the waveform is displayed using dots. In this setting, up to 2002 points or 100100 points (select either 2 k or 100 k points) of the acquired data are displayed without using P-P compression. For example, if the number of displayed points is set to 100 k and the display record length is 10 kW (the number of acquired data points is 10010 points), all the points of the waveform are drawn by aligning 10 points vertically at the same time axis positions. If the number of acquired data points exceeds 2002 or 100100, the data is decimated down to 2002 or 100100 points (select either 2 k or 100 k points) for displaying the waveform.

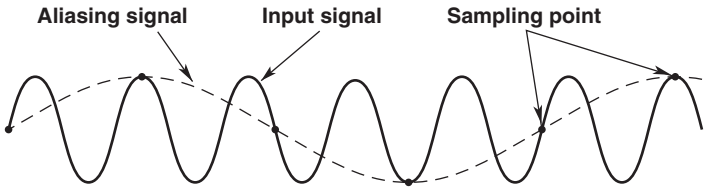
Relationship between the Time Axis Setting and Sample Rate/Record Length

If you change the time axis setting, the sample rate and the record length acquired to the acquisition memory also change. For details, see appendix 1, “Relationship between the Time Axis Setting, Sample Rate and Record Length.”

Sample Rate

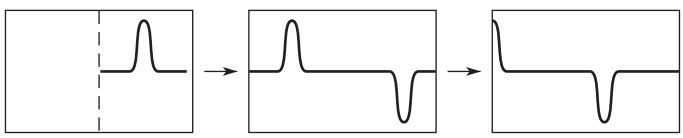
If you change the time axis setting, the sample rate (the maximum sample rate varies depending on the module) changes. The DL750/DL750P can only display waveforms correctly up to one-half the frequency of the sample rate (the number of samples per second, unit is S/s) as defined by the Nyquist sampling theorem.[1]

1. If the sample rate is comparatively low with respect to the input signal frequency, the harmonics contained in the signal are lost. In this case, some of the harmonics will appear at low frequencies due to the effects described by the Nyquist sampling theorem. This phenomenon is called aliasing. You can prevent aliasing by acquiring waveforms with the acquisition mode set to envelope.



Time Axis Setting and Roll Mode Display

If the trigger mode is set to Auto, Auto Level, Single, or Log and the time axis is set greater than or equal to 100 ms/div, the waveform is displayed in roll mode. In roll mode, the displayed waveform is not updated using triggers (update mode). Rather, the oldest data is deleted as new data is acquired, and the waveform is shifted from right to left on the screen.

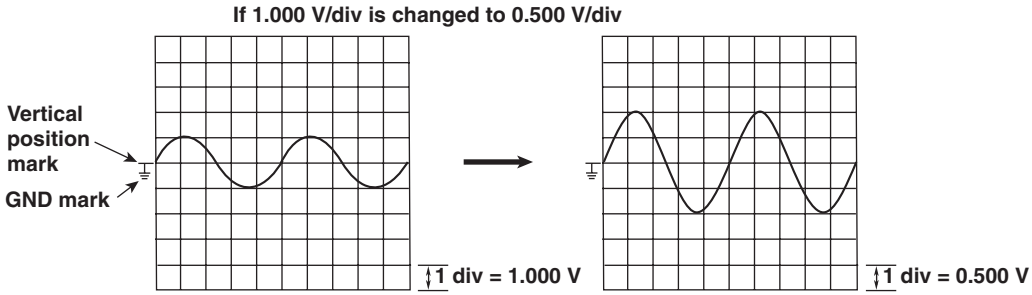


Roll mode display allows waveforms to be observed in the same way as on a pen recorder. It is useful in observing signals with a long period or signals that change slowly. It is also useful in detecting glitches (spikes in the waveform) that occur intermittently.

Vertical Axis (Voltage Axis) <Section 5.3>

Setting the Voltage Sensitivity

The vertical sensitivity setting is used to adjust the displayed amplitude of the waveform for easy viewing. The vertical sensitivity (V/div) is set by assigning a voltage value to one grid square (1 div) on the screen. The vertical sensitivity changes by switching the input section to an attenuator with different values of attenuation. The sensitivity is changed in steps as in "1 V/div to 2 V/div to 5 V/div."

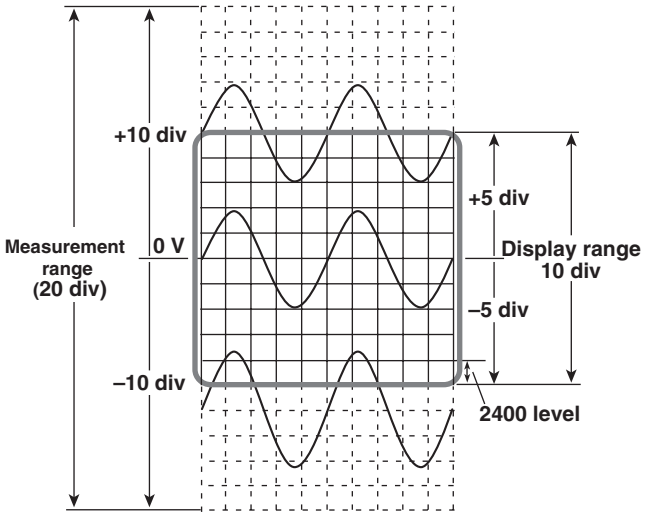


Measurement Range and Display Range

The measurement range of the DL750/DL750P is ±10 divisions (20 divisions of absolute width (span) around 0 V.

The display range of the screen is ±5 divisions (10 divisions of span). The following functions can be used to move the displayed waveform and display the waveform outside the display range by expanding/reducing the displayed waveform.

- Move the vertical position -> See page 2-6.
- Set the offset voltage -> See page 2-6.
- Zoom in or out of the vertical axis (expand/reduce) -> See page 2-7.



Note

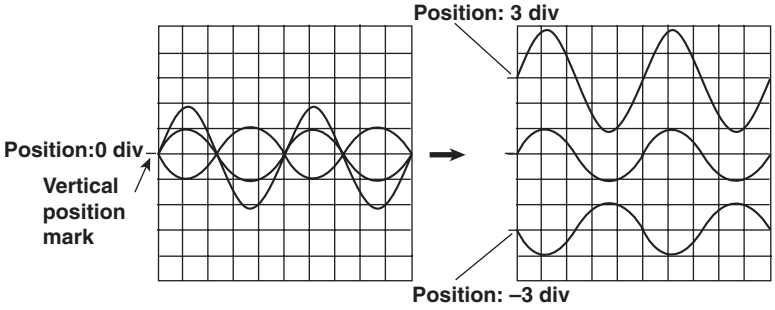
- **For Measuring the Voltage with High Accuracy**
  To measure the voltage with high accuracy, set the voltage sensitivity so that the input signal is measured with as large amplitude as possible.
- **Measurement Resolution**
  The measurement resolution varies depending on the module. For example, the 701250 (HS10M12) and 701255 (NONISO_10M12) sample the input signal using a 12-bit A/D converter at a resolution of 150 levels per division. The 701251 (HS1M16), 701260 (HV (with RMS)), 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), 701265 (TEMP/HPV), and 701275 (ACCL/VOLT) sample the input signal using a 16-bit A/D converter at a resolution of 2400 levels per division.

Moving the Vertical Position of Waveforms <Section 5.4>

Since the DL750/DL750P can display the input waveforms of the analog input channels (CH1 to CH16), DSP channels (DSP1 to DSP6, optional), and computation channels (Math1 to Math8), the waveforms may overlap making them difficult to be observed. In this case, you can change the display position of waveforms along the vertical axis (vertical position) for easier viewing.

The vertical position can be moved within a range of ± 5 div.

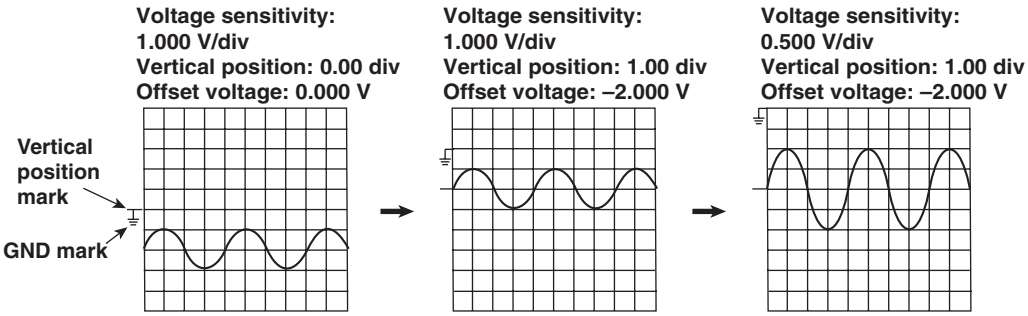
The voltage sensitivity (V/div) switches around the vertical position mark.



Offset Value <Section 5.10>

You can add an offset value to move the waveform to a vertical position that allows easier viewing. When observing a voltage riding on top of a predetermined voltage, an offset value can be applied to eliminate the predetermined voltage so that only the changes in the signal can be observed with higher voltage sensitivity.

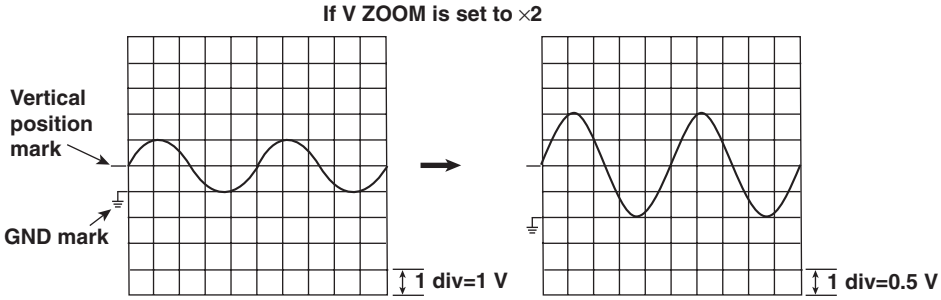
The offset value does not affect the cursor measurement values, the result of the automated measurement of waveform parameters, and the computed values.



Zooming in or out of the Vertical Axis (Expand/Reduce) <Sections 5.8 and 5.9>

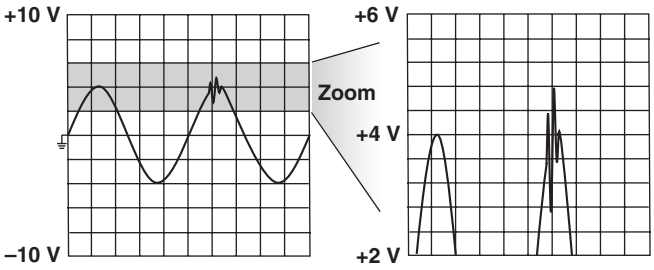
Zooming in or out by Setting the Magnification

The waveform display can be expanded/reduced vertically by a factor in the range ×0.1 to ×100 (×0.25 to ×100 for 50 V/div, ×0.5 to ×100 for 100 V/div, ×1 to ×100 for 200 V/div on the 701260 (HV (with RMS)); ×0.5 to ×50 when measuring acceleration on the 701275 (ACCL/VOLT); and ×0.33 to ×100 on the 701280(FREQ)). The waveform display can be zoomed around the vertical position. The waveform display can be zoomed around the vertical position.



Zooming Vertically According to the Upper and Lower Limits of the Display Range

You can zoom in on the desired section of the observed waveform by specifying the upper and lower limits of the vertical axis to change the display range to a narrower range for each displayed waveform. Conversely, you can widen the display range to view waveforms outside the display range.



Input Coupling <Section 5.5>

If you wish to observe just the amplitude of an AC signal, it is best to remove the DC component from the input signal. On the other hand, there are times when you wish to check the ground level or observe the entire input signal (both the DC and AC components). In these cases, you change the input coupling setting. By changing the input coupling, the input method used to input the signal to the vertical control circuit (voltage axis) is switched.
Select from the following types of input coupling.

DC

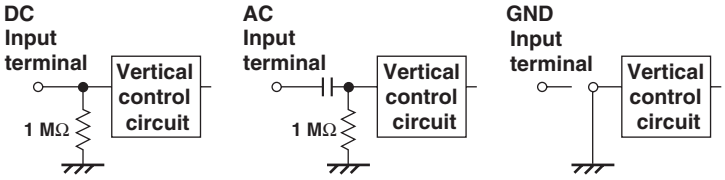
The input signal is directly coupled to the attenuator of the vertical control circuit. Select DC when you wish to observe the entire input signal (DC and AC components).

AC (Only When Observing the Voltage)

The input signal is coupled to the attenuator of the vertical control circuit through a capacitor. Select AC when you wish to observe only the amplitude of the AC signal, eliminating the DC components from the input signal.

GND

Input signal is coupled to the ground not to the attenuator of the vertical control circuit. By selecting GND, you can check the ground level on the screen.



TC (Only When Observing the Temperature)

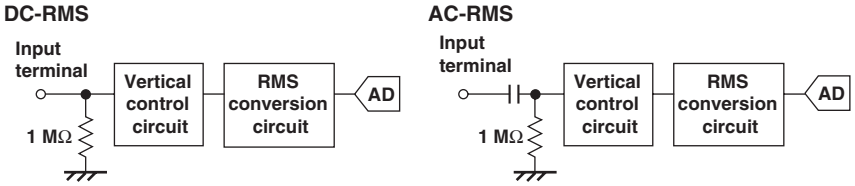
Select TC when observing the temperature on the 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), or 701265 (TEMP/HPV).

DC-RMS

Using the 701260 (HV (with RMS)), both the DC and AC components of the signal are converted to rms values and displayed. A RMS conversion circuit is connected to the vertical control circuit of the same input coupling circuit used when the coupling is set to “DC.”

AC-RMS

Using the 701260 (HV (with RMS)), only the AC component of the signal is converted to rms values and displayed. A RMS conversion circuit is connected to the vertical control circuit of the same input coupling circuit used when the coupling is set to “AC.”



ACCL (Only When Measuring Acceleration)

Select ACCL when measuring acceleration on the 701275 (ACCL/VOLT).

Probe Type <Section 5.6>

For voltage (current) measurement, a probe is normally used in connecting the circuit being measured to the measurement input terminal. Using a probe has the following advantages.

- Prevents disturbing the voltage and current of the circuit being measured.
- Inputs the signal with no distortion.
- Expands the voltage range that can be measured by the DL750/DL750P.

When using a probe, the attenuation or current-to-voltage conversion ratio setting on the module must be set equal to the probe attenuation on the DL750/DL750P so that the measured voltage can be read directly.

The probe attenuation of each probe (accessory sold separately) is set as follows:

- Voltage probe (700929): 10:1
- Current probe (700937/701933): 10 A:1 V
- Current probe (701930/701931): 100 A:1 V
- Voltage differential probe (700924): 1000:1, 100:1
- 10:1 passive probe for the DL750/DL750P: 10:1

The DL750/DL750P has the following attenuation settings: 1:1, 10:1, 100:1, 1000:1, 10 A:1 V[1], and 100 A :1 V[2]. If you are using a probe other than the ones provided as accessories (sold separately), set the attenuation ratio on the DL750/DL750P according to the attenuation of the probe.

1. Output voltage rate: 0.1 V/A
2. Output voltage rate: 0.01 V/A

Note

Use a probe that matches the input capacity of each module. Otherwise, the capacity cannot be adjusted.

Bandwidth Limit <Section 5.7>

The bandwidth can be limited on each module. By limiting the bandwidth, you can eliminate the noise components from the input signal for waveform observation.

Linear Scaling <Section 5.11>

When measuring the voltage (current), strain, or frequency (number of Rotations/period/duty cycle/power supply frequency/pulse width/pulse integration/velocity) on the frequency module, there are two methods of linear scaling: “AX+B” and “P1-P2.”

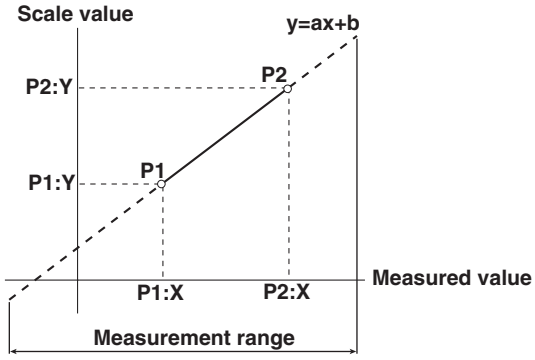
AX+B

The results obtained from the following computation based on the specified scaling coefficient A and offset B are displayed as cursor measurement values and automated measurement values of waveform parameters. You can also assign a unit to the result of linear scaling. Y=AX+B

P1-P2

Specify arbitrary scale values (P1:Y and P2:Y) for the measured values of two arbitrary points (P1:X and P2:X). The scale conversion equation (y = ax + b) is derived from these four values.

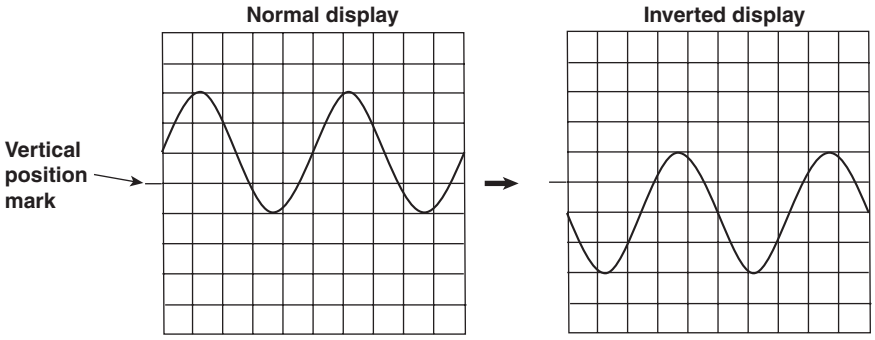
- Range of measured values (P1:X, P2:X): Same as the measurement range
- Range of scale values (P1:Y, P2:Y): –9.9999E+25 to +9.9999E+25
- Initial setting of scale values: P1:X +0.0000E+00, P1:Y +0.0000E+00
  P2:X +1.0000E+00, P2:Y +1.0000E+00



In addition, the current input value can be loaded into P1:X or P2:X.

Inverted Display <Section 5.12>

When measuring voltage or strain, the waveform can be displayed with the vertical axis inverted around the vertical position as shown below.



Pulse/Rotate Function <Section 5.14>

When the time base is set to external clock, one data sample is captured to the acquisition memory when one pulse of the external clock signal is input. You can specify the number of pulses of the external signal (in other words, the number of data samples captured in the acquisition memory) that will correspond to one mechanical rotation (one cycle). The selectable range is from 1 to 24000 pulses. For example, if the pulse/rotate setting is set to 100 pulses, then 10 rotations of data samples will be acquired when the record length is set to 1 kWord. When the pulse/rotate setting is set to 1 pulse, one data sample will correspond to one rotation (one cycle).

The pulse/rotate setting affects only the X-axis (horizontal) measurement values in cursor measurements and the time axis display on the screen. For example, if the pulse/rotate setting is 100 pulses and the record length is 1 kWord, 1 division will be equal to 1 rotation. In this case, moving the cursor by 1 division during cursor measurements causes the horizontal measured value to increase or decrease by “1.”

RMS Measurement <Section 5.15>

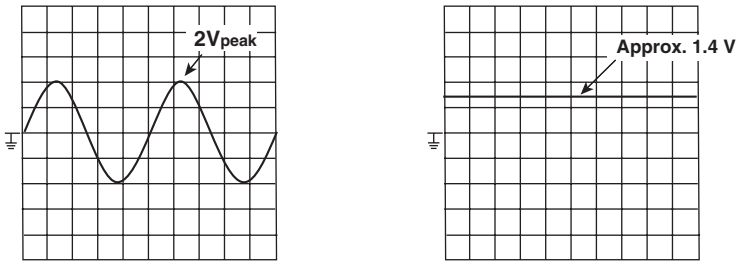
If the module of the selected channel is a High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS), the rms value of the input signal can be observed.

AC-RMS

This setting is used when you want to observe only the rms values of the AC signal, eliminating the DC components from the input signal.

Example

When the rms value of a 2-V_{peak} sinusoid input signal is measured, a DC waveform at approximately 1.4 V is displayed (see right figure).



The rms value is derived from the following equation:

$$\sqrt{\frac{1}{T}\int_0^T u(t)^2\,dt}$$ **Where u(t) is the input signal and T is one period of the input signal.**

If u(t) = $V_m \sin\omega t$ (where V_m is the peak value and ω is the angular velocity (= 2 πf, where f is the frequency of the sinusoid signal)), the rms value, V_{rms}, is derived from

$$V_{rms} = \sqrt{\text{The average of } u(t)^2 \text{ over one cycle}} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi} (V_m \sin wt)^2\,dwt} = \frac{V_m}{\sqrt{2}}$$

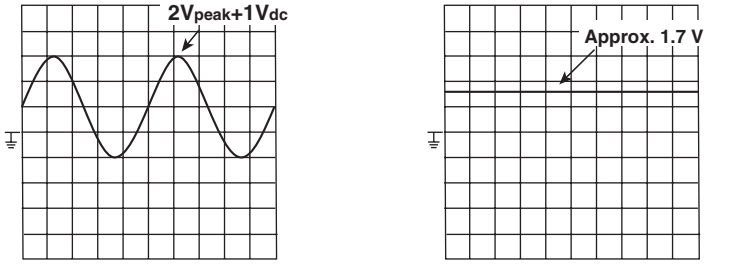
As in the above example, when V_m is 2 V, the rms value, V_{rms}, is approximately 1.4 V.

DC-RMS

This setting is used when you want to observe the rms values of both the DC and AC components of the input signal.

Example

When the rms value of a 2-V_{peak} sinusoid input signal riding on top of a 1-V DC component is measured, a DC waveform at approximately 1.7 V is displayed (see right figure).



If the DC component is expressed as V_{dc} and the AC component as u(t) = $V_m \sin\omega t$, the rms value, V_{rms} (+DC), of the sinusoid input signal riding on top of the DC component is derived from the following equation:

$$V_{rms(+DC)} = \sqrt{\frac{1}{2\pi}\int_0^{2\pi} (V_m \sin wt + V_{dc})^2\,dwt} = \sqrt{\left(\frac{V_m}{\sqrt{2}}\right)^2 + (V_{dc})^2}$$

As in the above example, when V_{dc} is 1 V and V_m is 2 V, the rms value, V_{rms} (+DC), is approximately 1.7 V.

Temperature Measurement <Section 5.16>

Thermocouple Types

The following types of thermocouples can be used.
K, E, J, T, L, U, R, S, B, N, W, and Au7Fe

Selectable Temperature Units

You can select °C, K, or °F.

Reference Junction Compensation (RJC)

- The voltage generated by a thermocouple depends on the temperature of the spot of measurement and the reference junction temperature. In this case, the function used to compensate the temperature on the measurement instrument side to the cold junction is referred to as reference junction compensation.
- You can turn ON/OFF the internal RJC circuit on the DL750/DL750P.
  ON: Use this setting to enable the reference junction compensation by the internal RJC circuit.
  OFF: Use this setting when checking the temperature measurement value, or when using an external reference junction (0°C).

Burnout

Specify the behavior when the thermocouple input detects a burnout.
ON: Fix the measured value to the upper limit of the measurement range of each thermocouple when a burnout is detected.
OFF: Burnouts are not detected.

Strain Measurement <Section 5.17>

Strain can be measured by connecting a strain gauge bridge (bridge head) or a strain gauge transducer to the strain module.

Relationship between the Strain (μSTR) and the Transducer Output (mV/V)

The DL750/DL750P allows the unit to be changed between "the strain unit (μSTR: $\times 10^{-6}$ strain)" and "the output unit of the strain gauge transducer (mV/V)[1]." The default setting is "strain (μSTR)." The following relationship exists between μSTR and mV/V.

(mV/V) = 0.5×(μSTR)/1000

Example

500 (μSTR) -> 0.5×500(μSTR)/1000 = 0.25 (mV/V)

Gauge Factor (K) when mV/V Is Selected

K = 2

You can set the gauge factor to an arbitrary value on the DL750/DL750P. However, if there are no specifications on the strain gauge transducer, set K to 2.

If K is not 2, e is derived within the DL750/DL750P using the following equation.

e = (4/K)×(V/E)

e: Measured value of the strain gauge transducer [mV/V]
V: Voltage measured on the bridge [V]
E: Voltage applied to the bridge [V]
K: Gauge factor

When you switch the unit, the unit of all related parameters of the channel is switched accordingly.

- Upper and lower limits
- Trigger level
- Values of automated measurement of waveform parameters and cursor measurements, etc.

In addition, the 701271 Strain Module (STRAIN_DSUB) supports shunt calibration. [2]

1. Unit corresponding to the output of the strain gauge transducer. A value expressing the transducer output per volt applied to the bridge in mV. You can set the bridge voltage (excitation: voltage applied to the bridge) from 2 V, 5 V, and 10 V. However, since the mV/V value is a converted value, the measured value is basically constant.
2. Shunt calibration refers to the act of correcting the gain of the strain measurement by connecting a known resistance (shunt calibration resistance) to the strain gauge in parallel.

For a description of the basic defining equation of strain, see appendix 10. For details on shunt calibration, see appendix 11.

Acceleration Measurement <Section 5.18>

The Acceleration Module (with AAF) (701275 (ACCL/VOLT)) measures acceleration using the output signal from the acceleration sensor. Direction connection is possible to a built-in amplifier type acceleration sensor. (Direct connection is not possible to a charge output type acceleration sensor that does not have a built-in amplifier. For details on the connection of the acceleration sensor, see section 3.12.)

Note

The 701275 (ACCL/VOLT) can also measure voltage.

Current Supply to Acceleration Sensors

The 701275 (ACCL/VOLT) can supply 4 mA of current to the acceleration sensor when measuring acceleration.

Note

If you supply current to the acceleration sensor before it is connected to the item under measurement, the internal circuit of the acceleration sensor may be damaged. Be sure to supply current after connecting the acceleration sensor.

Filter

If you set the bandwidth limit to Auto, the anti-aliasing filter (AAF) and low-pass filter are enabled depending on the sample rate to eliminate high-frequency noise from the input signal. Using the anti-aliasing filter when measuring voltage allows elimination of aliasing noise resulting from FFT computation, digital filter computation of DSP channels, etc. For details on the bandwidth limit, see section 5.7.

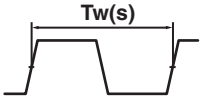
Note

The filter is effective not only during acceleration measurement but also during voltage measurement.

Frequency (Number of Rotations, Period, Duty Cycle, Power Supply Frequency, Pulse Width, Pulse Integration, and Velocity) Measurement <Section 5.19>

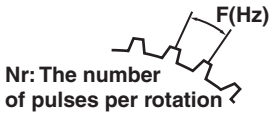
The Frequency Module (701280 (FREQ)) measures frequency, number of rotations, period, duty cycle, power supply frequency, pulse width, pulse integration, and velocity.

- **Frequency**
  Frequency (Hz) = 1/Tw (s)
  Measurable range: 0.01 Hz to 200 kHz

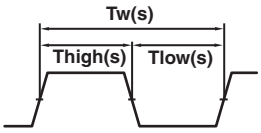


- **Period**
  Period (s) = Tw (s)
  Measurable range: 5 μs to 50 s

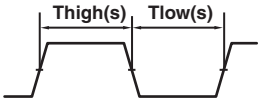
- **RPMs/RPSs**
  RPMs = Frequency (Hz)/the number of pulses per rotation (Nr) × 60
  Measurable range: 0.01 rpm to 100000 rpm
  RPSs = Frequency (Hz)/the number of pulses per rotation (Nr)
  Measurable range: 0.001 rps to 2000 rps



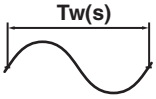
- **Duty Cycle**
  Duty cycle (%) = Thigh (s)/Tw (s)
  Or, duty cycle (%) = Tlow (s)/Tw (s)
  Measurable range: 0% to 100%



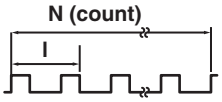
- **Pulse Width**
  Pulse width (s) = Thigh (s)
  or pulse width (s) = Tlow (s)
  Measurable range: 2 μs to 50 s



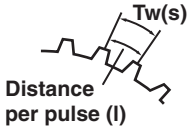
- **Power Supply Frequency**
  Power supply frequency (Hz) = 1/Tw (s)
  Resolution: 0.0 1Hz
  Measurable range: (50 Hz, 60 Hz, or 400 Hz) ± 20 Hz



- **Pulse Integration (Distance/Flow Rate)**
  Pulse integrated value = N (count) × physical amount per pulse (I)
  Set the physical amount per pulse (I) to distance or flow rate. A suitable user-defined unit can be assigned to the specified physical amount.
  Measurable range: Up to 2×10^9 counts



- **Velocity**
  Velocity (km/h) = Distance per pulse l (km)/Tw (s) × 3600
  Velocity (m/s) = Distance per pulse l (m)/Tw (s)
  The distance and unit can be user defined (angular velocity, etc.).
  Measurable range: F (=1/Tw) = 0.01 Hz to 200 kHz

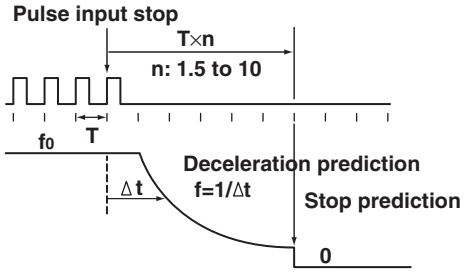


Deceleration Prediction and Stop Prediction

The 701280 (FREQ) automatically performs internal computation and displays waveforms by predicting the deceleration curve and stop point even when the input pulse is suddenly cut off. This function allows the measurement of waveforms of deceleration behavior that is close to the actual physical phenomenon in applications in which the deceleration behavior of an object that have inertia is measured such as in the brake test of automobiles.

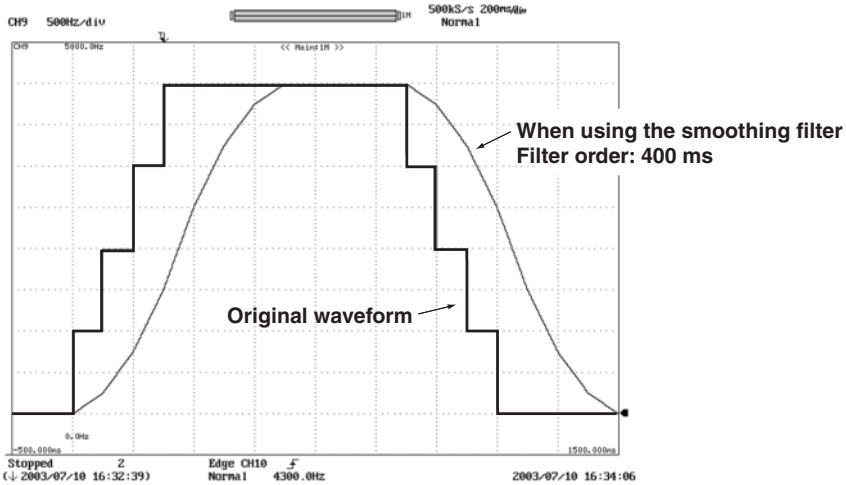
- **Deceleration Prediction**
  The deceleration curve is computed according to the following equation using the elapsed time after the pulse input stops (Δt).
  Frequency (f) = 1/elapsed time (Δt)
  The deceleration prediction starts after a pulse period (T) of the pulse one period before the pulse input stopped elapses after the pulse input stopped.

- **Stop Prediction**
  The function determines the stop point at a certain time after the pulse input stops, and the frequency is set to 0. The time from the point when the pulse input stops to the point when the function determines that the object has stopped can be set to ×1.5, ×2, ×3, ... , ×9, and ×10 (10 settings) of the pulse period (T) of the pulse one period before the pulse input stopped.

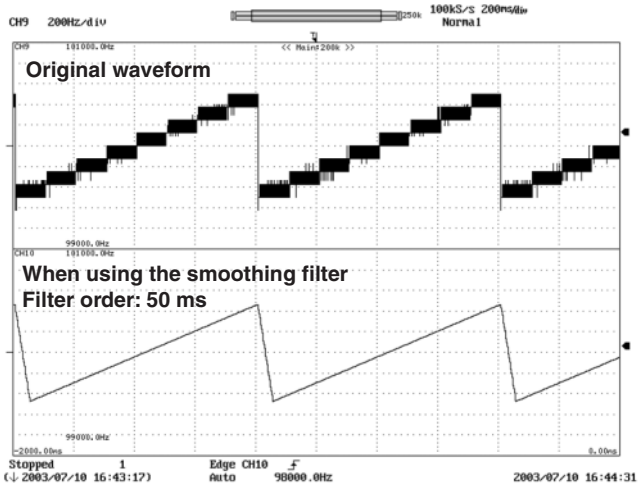


Filter

- **Smoothing Filter (Moving Average)**
  The frequency module can display waveforms by taking the moving average of the data in realtime. The order of moving average can be set in terms of time in the range of 0.1 ms to 1 s (up to 25000 order). The order of moving average is equal to the specified time divided by 40 μs.
  Below are the characteristics of the smoothing filter.
  - Converts a waveform that changes in steps to a smooth waveform
  - Improves the resolution by reducing the measurement jitter. The resolution improves when measuring especially high frequencies or when expanding the display using the offset function. Consequently, highly accurate measurements can be made.
  - Can be used on all measurement parameters of the frequency module.



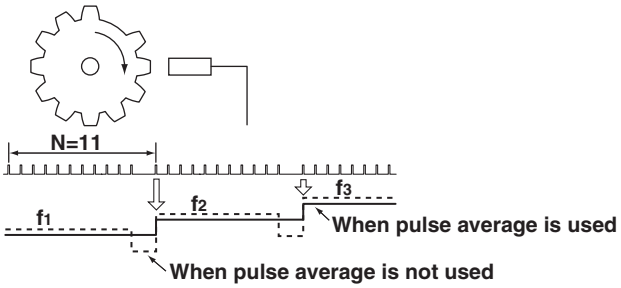
• When using the offset function (see this page) and making measurements by expanding near 100 kHz



• Value/div: 200 Hz/div
• Upper display limit: 101 kHz
• Lower display limit: 99 kHz

The accuracy improves when the smoothing filter is used.

- **Pulse Average**
  Measures the input pulse by dividing the pulse by the specified number of pulses (1 to 4096 pulses). Below are the characteristics of the pulse average.
  - If pulse dropouts are present or pulse interval is fluctuating within one period, measurements can be made by eliminating the effects from the dropout or fluctuation (fluctuating component of the waveform used to measure the frequency or period).
  - The measured result is displayed as a value per input pulse even when pulse average is used. Therefore, there is no need to perform scaling again.
  - Can be used when measuring frequency, number of rotations, power supply frequency, pulse integration, and velocity.



Offset Function

The 701280 (FREQ) allows you to set the center of observation (offset value) and expand the area around the offset value for close observation. You can measure the fluctuation around a certain frequency. You can set the offset value up to 1000 times the Value/div value (up to 200 kHz).

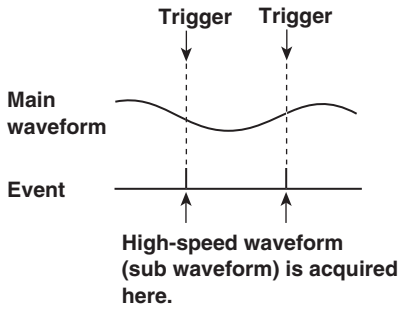
Logic Waveforms <Section 5.20>

Logic waveforms can be measured by connecting logic probes to the logic signal input connectors (two connectors marked LOGIC A and LOGIC B) on the left side panel. A-1 to A-8 (8 bits) and B-1 to B8 (8 bits) can be input to the LOGIC A and LOGIC B ports, respectively.

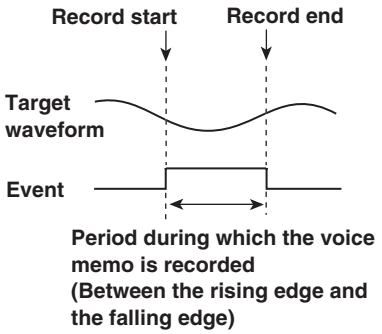
Event Waveforms <Section 5.21>

The times when triggers are activated with the dual capture function and the period during which voice memos are recorded can be displayed as events.

• Events during dual capture



• Events on voice memos



2.3 Setting the Trigger

Trigger Type <Chapter 6>

The trigger on the DL750/DL750P can be classified into two main types: simple trigger and enhanced trigger.

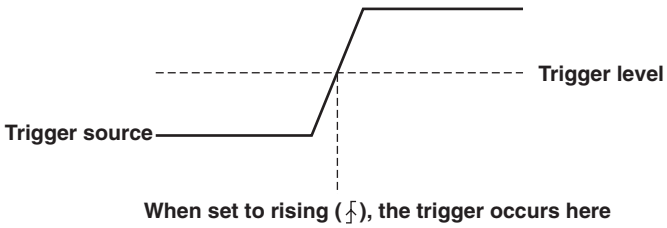
Simple Trigger

This function activates a trigger on a single trigger source.

- **Input Signal Trigger**

  A trigger is activated when the trigger source (input signal of CH1 to CH16, DSP1 to DSP6 (optional), LOGIC A, or LOGIC B) reaches or exceeds the preset trigger level (rising) or falls to or below the trigger level (falling) or both.[1]

  1. "A trigger is activated" refers to the condition in which trigger conditions are satisfied and a waveform is displayed.



- **External Trigger**

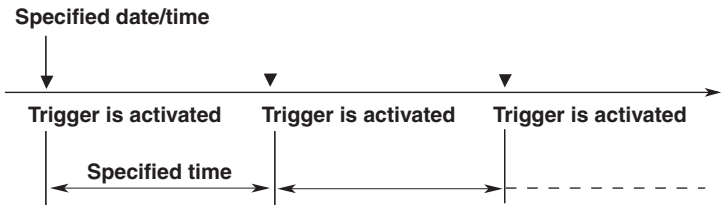
  A trigger is activated using the external signal applied to the EXT TRIG IN terminal on the side panel of the DL750/DL750P.

- **Line Trigger**

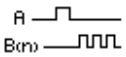
  A trigger is activated using the rising edge of the power signal that is being supplied to the DL750/DL750P. Waveforms can be observed by synchronizing to the commercial power supply frequency (50 Hz or 60 Hz).

- **Timer Trigger**

  A trigger is activated at specified time intervals (1 min to 24 hours) from a specified time.

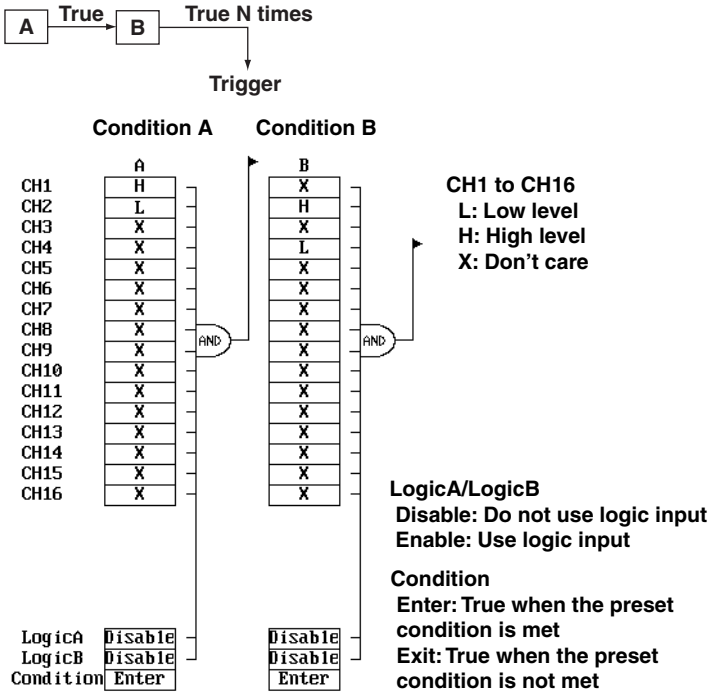


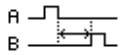
Enhanced Trigger



A -> B(N) Trigger

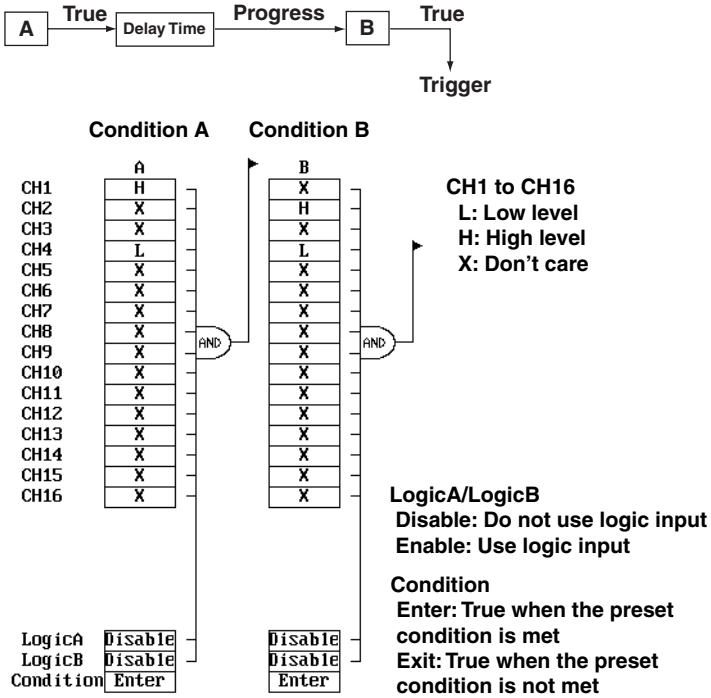
A trigger is activated the n[th] time condition B becomes true after condition A has become true.

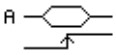




A Delay B Trigger

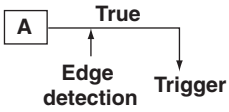
A trigger is activated the 1[st] time condition B becomes true after condition A has become true and a preset time has elapsed.

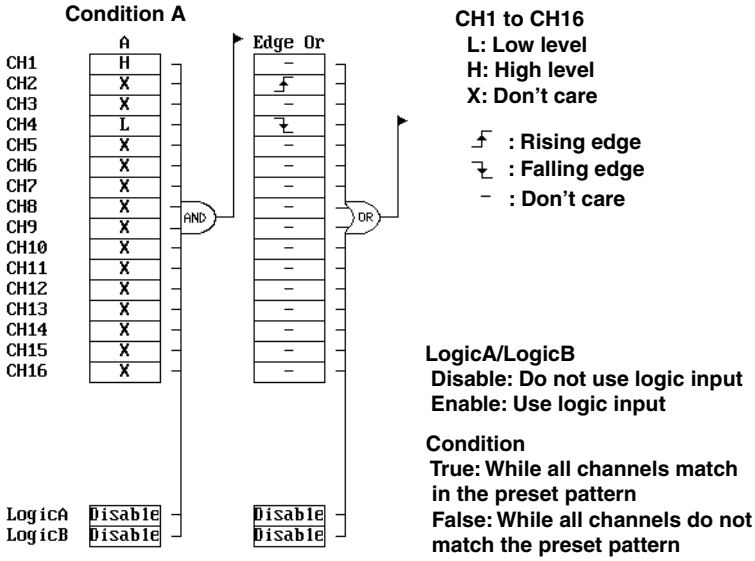


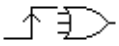


Edge on A Trigger

A trigger is activated when an edge trigger is detected on any of the channels set to edge trigger while condition A is true.

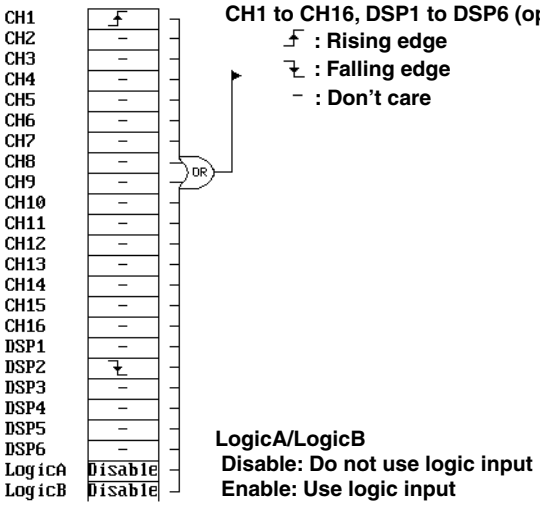






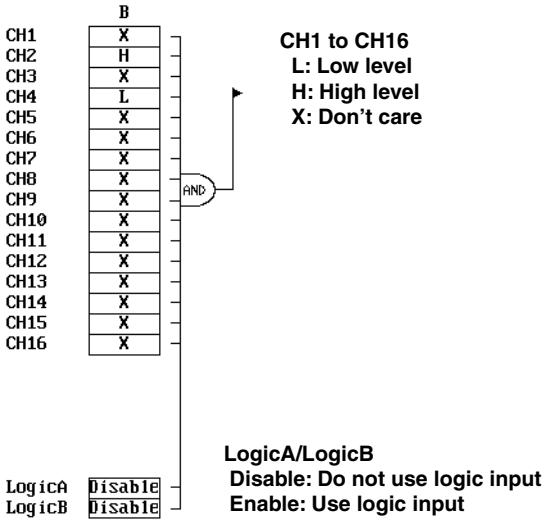
OR Trigger

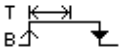
A trigger is activated when any of the channels set to edge trigger meets the condition. For example, a trigger can be activated on the rising edge of CH1 or CH2.



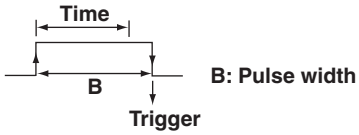
B > Time Trigger, B < Time Trigger, and B TimeOut Trigger

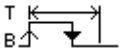
A trigger is activated on the falling or rising edge of the pulse when the pulse width (width over which condition B is met) exceeds (or drops below) the preset time. In the case of a Time out trigger, a trigger is activated when the preset time elapses.



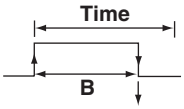


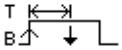
- **B > Time Trigger**



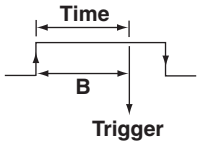


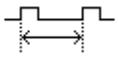
- **B < Time Trigger**





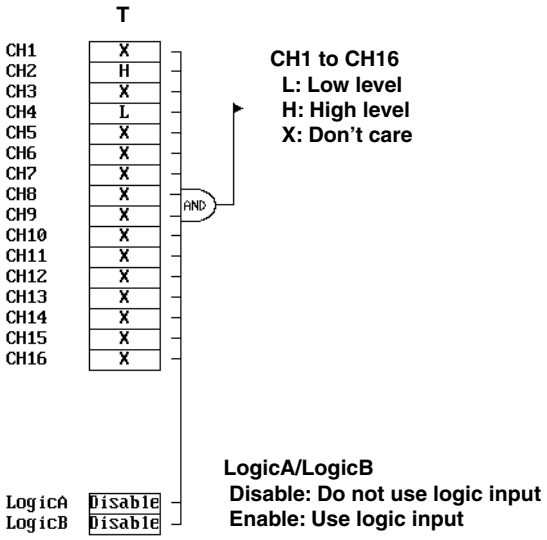
- **B TimeOut Trigger**





Period Trigger

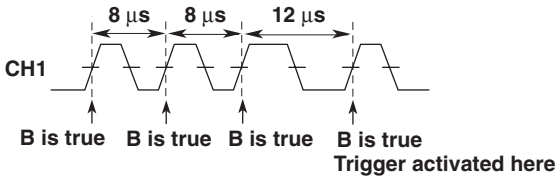
A trigger is activated by measuring the pulse period (period from the time condition T is met to the next time when condition T is met).



- **T > Time**

  A trigger is activated when condition B is met the second time (T), if the time when condition B is met the second time is longer than a specified time (Time).

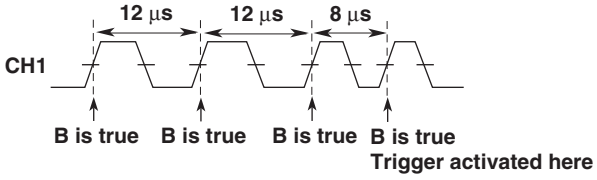
  When condition B: CH1=H and Time=10 μs



- **T < Time**

  A trigger is activated when condition B is met the second time (T), if the time when condition B is met the second time is shorter than a specified time (Time).

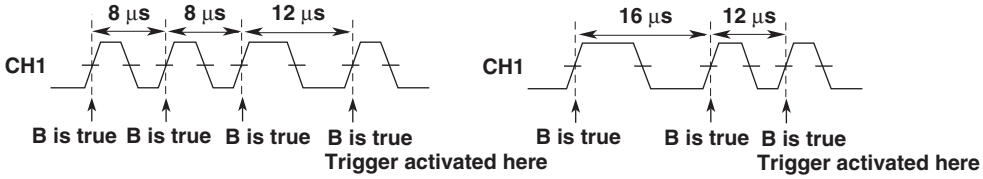
  When condition B: CH1=H and Time=10 μs



- **T1 < T < T2**

  A trigger is activated when condition B is met the second time (T), if the time when condition B is met the second time is within a specified time range (T1 and T2).

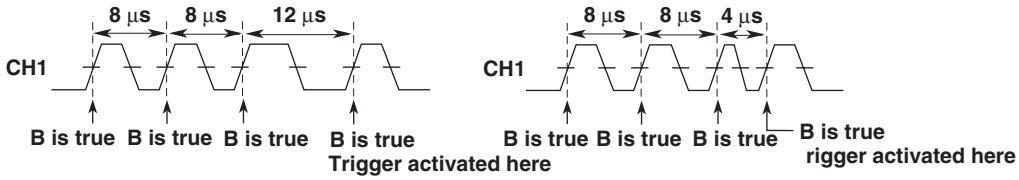
When condition B: CH1=H, Time1=10 μs, and Time2=14 μs



- **T < T1, T2 < T**

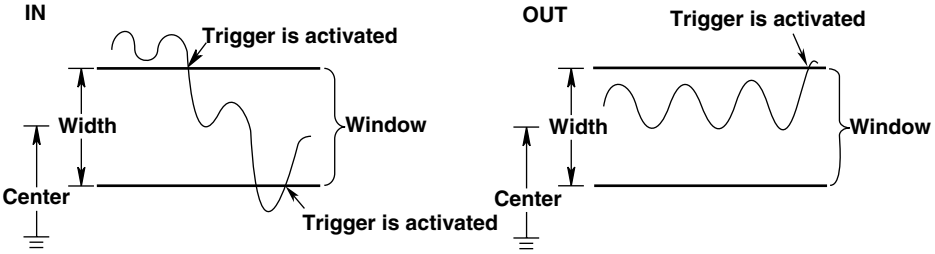
  A trigger is activated when condition B is met the second time (T), if the time when condition B is met the second time is outside a specified time range (T1 and T2).

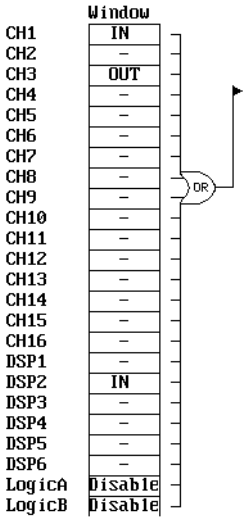
When condition B: CH1=H, Time1=6 μs, and Time2=10 μs



Window Trigger

A certain voltage range (window) is set and a trigger is activated when the trigger source level enters this voltage range (IN) or exits from this voltage range (OUT)

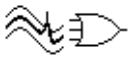




CH1 to CH16, DSP1 to DSP6 (optional)
IN: Enters the window
OUT: Exits from the window
– : Don't care

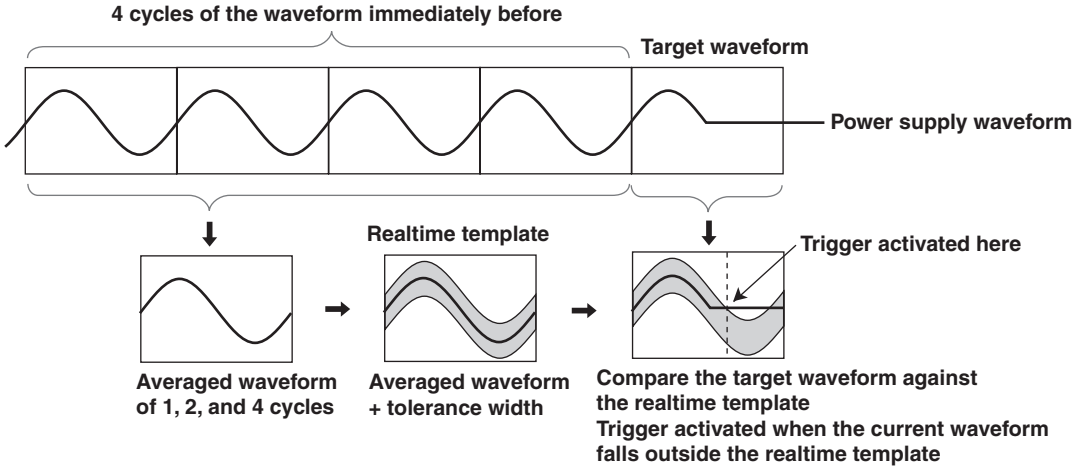
LogicA/LogicB
Disable: Do not use logic input
Enable: Use logic input

Edge trigger is used for the logic input.
: Don't care
: Falling edge
– : Rising edge

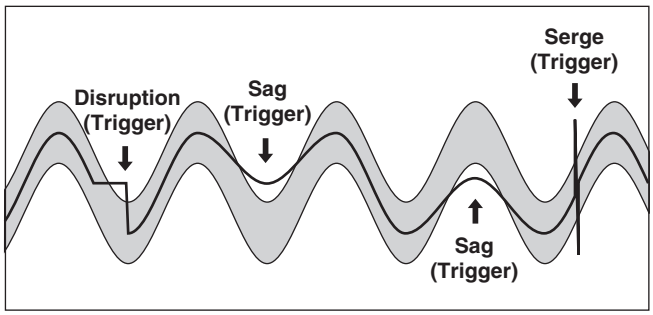


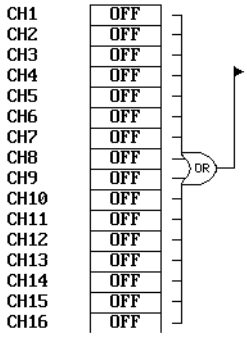
- **Wave Window Trigger**

  This trigger is used to monitor the power supply waveform. It detects abnormalities in the power supply (disruption, sag, serge, frequency fluctuation, voltage drop, etc.). A reference waveform (realtime template) is created by setting a tolerance (window width) to a waveform derived by averaging 1 to 4 cycles of waveforms before a cycle the current waveform. The current waveform is compared against the realtime template. If the current waveform falls outside the realtime template, a trigger is activated.

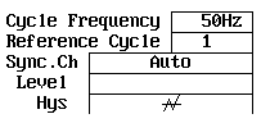


Wave window trigger example





CH1 to CH16
ON: Use as a trigger source
OFF: Not use as a trigger source



Cycle Frequency: Power supply frequency of the measured item
Reference Cycle
Sync. Ch : Synchronization channel[1] for starting triggers
Level: Level of the synchronization channel
Hys: Hysteresis of the synchronization channel

1. Synchronization channel: Because waveform determination is performed per cycle in wave window trigger, synchronization signal must be retrieved from the reference channel, and the start and end points of comparison must be detected. This reference channel is called a synchronization channel. Sync.Ch is used to specify the synchronization channel, and Level is used to specify the start level of the synchronization channel. Normally, Sync.Ch is set to Auto (the channel with the smallest number among the modules that can perform wave window trigger). However, if the trigger is not activated adequately, specify an appropriate channel.

Trigger Mode <Section 6.1>

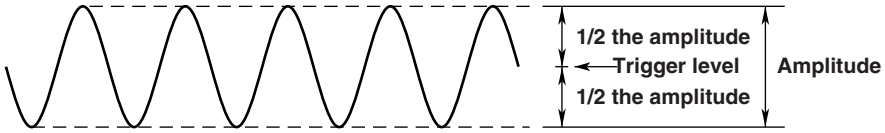
Sets the conditions for updating the displayed waveforms. The following six trigger modes are available.

Auto Mode

If a trigger occurs within a specified amount of time (approximately 50 ms, referred to as the timeout period), the displayed waveforms are updated. If a trigger is not activated within the timeout period, the displayed waveforms are automatically updated.

Auto Level Mode

Within the timeout period (approximately 1 s), the waveforms are displayed in the same fashion as in the auto mode. If a trigger is not activated within the timeout period, then the center value of the amplitude of the trigger source is detected, and the trigger level is changed to that value. A trigger is activated using the new value, and the displayed waveforms are updated.



Normal Mode

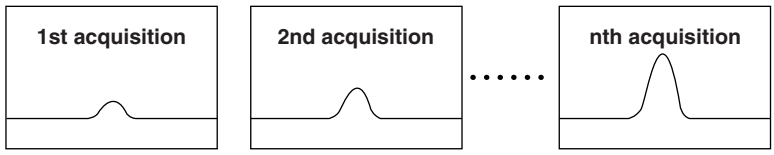
The displayed waveforms are updated only when a trigger occurs. The displayed waveforms are not updated if a trigger does not occur.

Single Mode

When a trigger is activated, displayed waveforms are updated only once, then acquisition stops. This mode is useful when you are observing a single-shot signal.

Single (N) Mode (Sequential Store Function)

This mode is selected when using the sequential store function (see section 7.5). Waveforms are acquired and stored in different memory areas each time a trigger is activated the specified number of times. Then, acquisition is stopped, and all the acquired waveforms are displayed. Acquired waveforms can be displayed together, or they can be displayed individually. This mode is useful when you wish to detect sudden abnormalities in a waveform.

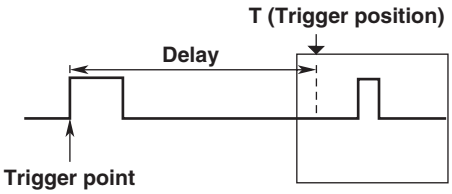


Log Mode

In this mode, the trigger settings are disabled. The specified record length of data is acquired once when acquisition is started, and the displayed waveforms are updated.

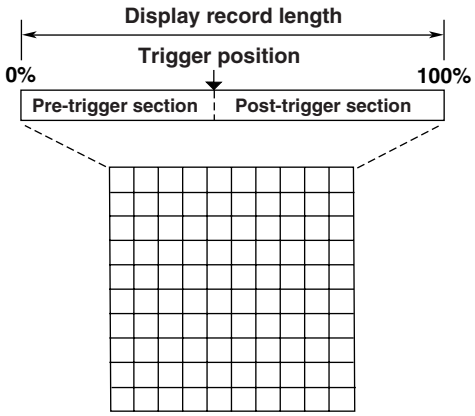
Trigger Delay <Section 6.3>

Normally, the waveform around the trigger point is displayed. However, by setting a trigger delay, you can display the waveform that is acquired a specified time after the trigger point. The selectable range of trigger delay is 0 to 10 s.



Trigger Position <Section 6.2>

The trigger position specifies the position of the waveform captured in the acquisition memory to be displayed on the screen. The point at which the trigger occurred is called the trigger point. If the trigger delay described in the previous section is set to 0 s, the trigger point and the trigger position match. By moving the trigger position, you can observe the pretrigger section of the waveform before the trigger point.



Trigger Source, Trigger Slope, and Trigger Level <Sections 6.5 to 6.16>

Trigger Source

Trigger source refers to the target channel on which trigger conditions are specified. You can set external trigger signals and commercial power supply as trigger sources.

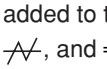
Trigger Slope

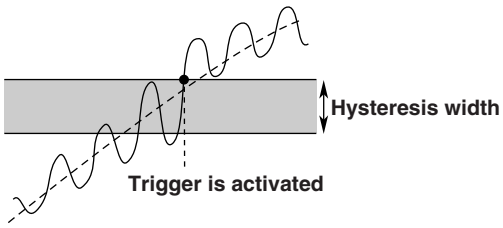
Trigger slope defines how the trigger source is to cross a specified level for activating the trigger. Select the trigger slope from ⨍ (rising), ⨏ (falling), and ⨍⨏ (both rising and falling).

Trigger Level

Trigger level refers to the voltage level that is used to determine the trigger slope (rising/falling edge of the signal) or other items.

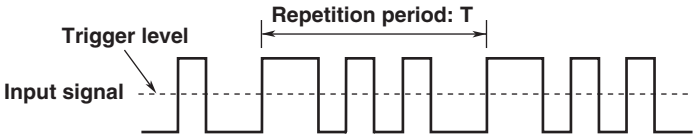
Trigger Hysteresis <Sections 6.5 to 6.16>

If noise is present in the trigger source and there is insufficient trigger level width, the trigger point fluctuates each time a trigger is activated. This causes the displayed waveforms to be unstable. To solve this problem, a specified margin (hysteresis) is added to the trigger level. You can select the trigger hysteresis from the following:  , , and . The hysteresis width varies depending on the input module.

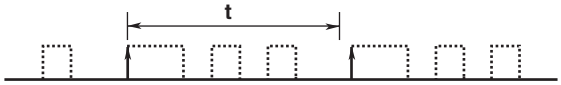


Trigger Hold-off <Section 6.4>

The trigger hold-off function temporarily stops the detection of the next trigger once a trigger has been activated. This function is useful when observing a pulse train signal, such as a PCM code and you wish to display the waveform in sync with repetitive cycles; or when using the history memory function described later and you want to change the waveform acquisition period.



Trigger signal limited by hold off time t (when the trigger slope is set to rising edge)



Action-on-Trigger <Section 6.18>

A specified action can be carried out each time a trigger occurs or when the waveform is displayed after acquiring the specified record length of data or when measurement is stopped after the measurement is started.

- **Print the Screen Image Data (PRINT)**
  Prints the screen image data to a specified printer.
- **Save the Screen Image Data (Image)**
  Saves the screen image data to the save destination specified in the IMAGE SAVE menu.
- **Save Waveform Data (Save to File)**
  Saves the waveform data in binary, ASCII, or floating format to the save destination specified in the FILE menu.
- **Beep Sound (Buzzer)**
  Sounds a buzzer.
- **Send Mail**
  Sends an e-mail message to a specified address. (when the Ethernet interface option is installed)

Manual Trigger <Section 6.19>

You can activate a trigger by pressing the MANUAL TRIG key on the front panel

2.4 Setting Waveform Acquisition Conditions and Display Conditions

Record Length <Section 7.2>

The term “record length” normally refers to the number of data points acquired per channel in the acquisition memory. “Displayed record length” refers to the number of these data points that are actually displayed on the screen. The sample rate and record length vary depending on the time axis setting. The DL750/DL750P allows you to select the record length from the following: 1 kW, 2.5 kW, 5 kW, 10 kW, 25 kW, 50 kW, 100 kW, 250 kW, 500 kW, 1 MW, 2.5 MW, 5 MW, 10 MW, 25 MW, 50 MW, 100 MW, 250 MW, 500 MW, and 1 GW. (The maximum record length that can be selected varies depending on the memory option.)

When the M3 option is installed, the entire data length of up to 1 GW (1 CH) can be displayed instantaneously.

The length of time that can be recorded on 1 GW of memory is as follows:

Sample Rate	In Seconds	In Minutes	In Hours	In Days
10 MS/s	100	1.67	0.028	0.001
1 MS/s	600	10	0.167	0.007
100 kS/s	9000	150	2.5	0.10
10 kS/s	72000	1200	20	0.83
1 kS/s	864000	14400	240.0	10
200 S/s	2592000	43200	720.0	30

In most cases the displayed record length is identical to the (acquisition) record length. For certain time-axis settings, however, the lengths become different. For details, see appendix 1, “Relationship between the Time Axis Setting, Sample Rate and Record Length.”

Acquisition Mode <Sections 7.3 and 7.4>

When storing sampled data in the acquisition memory, it is possible to perform processing on data and display waveforms based on the processed data. The following four types of data processing are available.

Normal Mode

In this mode, sampled data is stored in the acquisition memory without processing.

Averaging Mode

Averaging is a process in which waveforms are acquired repeatedly to obtain the average of waveform data at the same time point (the same time in relation to the trigger point).

The DL750/DL750P takes the linear or exponential average of the waveform data and writes the results into the acquisition memory. The averaged data is then used to generate the display. You can set the attenuation constant to a value between 2 and 256 (in 2^n steps), and the averaging count to a value between 2 and 65536.

Exponential averaging (when set to infinite)

$$An = \frac{1}{N}\{(N-1)A_{n-1}+X_n\}$$

An: nth averaged value
Xn: nth measured value
N: Attenuation constant (2 to 256, 2^n steps)

Simple average (when set to 2 to 65536)

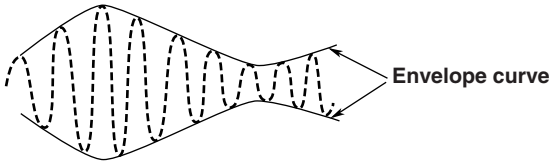
$$A_N = \frac{\sum_{n=1}^{N} X_n}{N}$$

Xn: nth measured value
N: Average count
(acquisition count, 2^n steps)

The averaging process is useful in eliminating random noise.

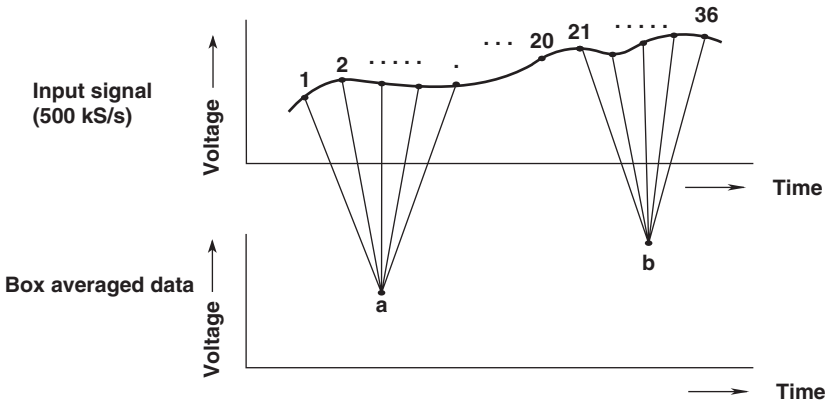
Envelope Mode

In normal mode and averaging mode, the sample rate (the number of times data is acquired per second in the acquisition memory) drops if T/div is increased. (See Appendix 1 “Relationship between the Time Axis Setting, Sample Rate and Record Length.”)
However, in the envelope mode, the maximum and minimum values are determined at every time interval from the data sampled at the maximum sample rate of each input module. The time interval used to determine the value is equal to twice the sample rate of the normal mode. The maximum and minimum values are paired and stored in the acquisition memory.
Envelope mode is useful when you want to avoid aliasing, since the sample rate is kept high irrespective of the time axis setting. It is also useful when you want to detect glitches (pulse signals which rise very fast) or display an envelope of a modulating signal.



Box Average Mode

The rolling average of the data sampled at the maximum sample rate of the 701250 (HS10M12) and 701255 (NONISO_10M12) is determined. The resultant data is stored in the acquisition memory and used to generate the display. Box averaging is useful for eliminating small amount of noise on the input signal. It can also remove noise from a single-shot signal.



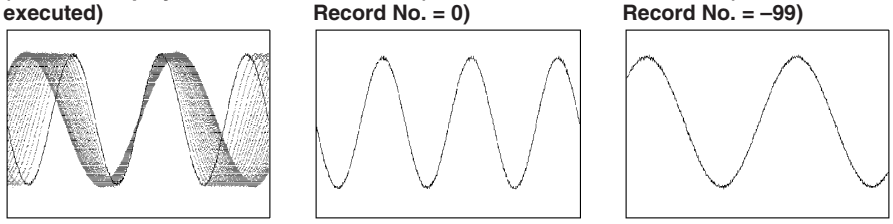
Sequential Store Function <Section 7.5>

In the case of the history memory function, the waveform data of each block is updated in order until the measurement is stopped. However, in the sequential store function, you specify the waveform acquisition count (number of blocks), and the measurement stops when the specified count is reached. The updating of the waveform display is carried out after acquiring the entire waveform data. To acquire waveforms using this function, set the trigger mode to Single(N). The maximum Single(N) count is equal to N that is explained in the history memory function. The stored waveform data can be recalled using the history memory function.

The figure below shows an example when data is sequentially stored 100 times.

Display example when the acquisition count is 100

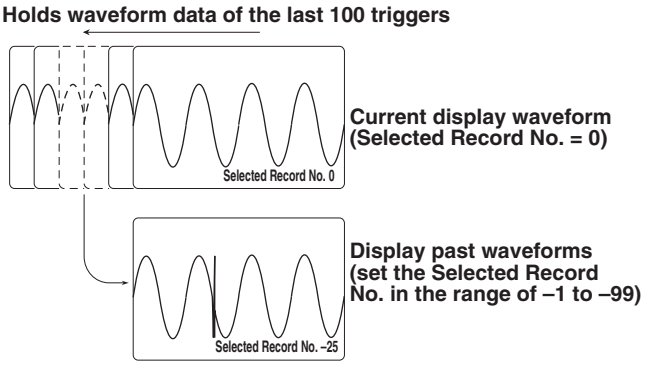
- **Displaying all waveforms (when all display is executed)**
- **Display the newest waveform (When Selected Record No. = 0)**
- **Display the oldest waveform (When Selected Record No. = –99)**



History Memory Function <Section 11.1>

If the record length is set short on the DL750/DL750P, the memory is divided into blocks, and waveform data is saved to the individual blocks each time a trigger occurs. If N represents the maximum number of blocks determined by the record length, the oldest waveform data block is cleared when the number of activated triggers exceeds N. If you stop the measurement, you can recall the waveform data stored in each block and display the data on the screen. The record length of a single waveform (one channel and one acquisition) is the same as the maximum display length. Once the specified number of waveforms have been stored, you can display any of the waveforms individually or all of them together. This function is useful when capturing the changes in the waveform over time.

The following figure indicates an example when N = 100.

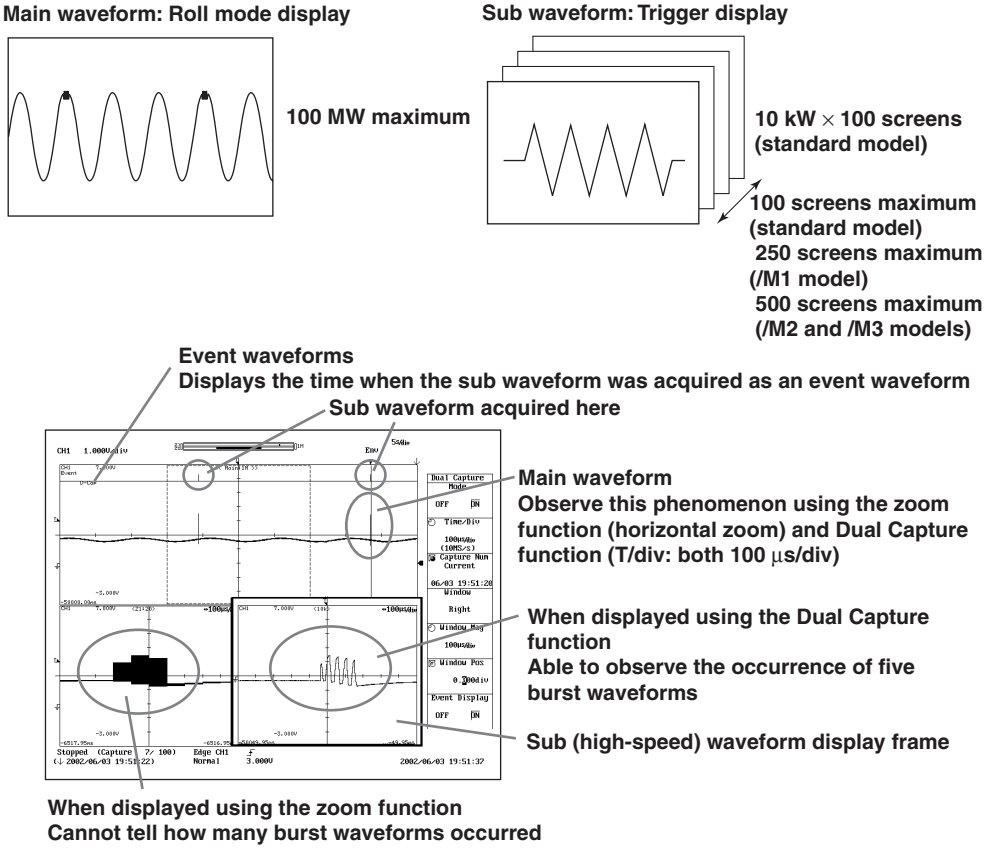


You can also search a particular waveform from the past waveforms that are held (history search function).

For details, see “History Search Function” in section 2.7.

Dual Capture Function <Section 7.6>

This function enables waveform acquisition in low-speed roll mode (main waveform) along with high-speed waveforms (sub waveform) using a different sampling interval. It is useful when capturing at high speeds abnormal phenomenon that occurs suddenly during long-term observation (low-speed sampling). When the waveform data is saved, the sub waveform is saved along with the main waveform. Likewise, when the main waveform is loaded, the sub waveform is also loaded. This function is valid when the acquisition mode is set to normal, envelope, or box average.
In addition, the acquired waveform data can be recalled from a memory different from the history memory.



The dual capture function can be used in the following two trigger modes.

- **Auto Mode**

  For the main waveform, measurement is performed from the time sampling is started until there is a request to end the sampling. For the sub waveform, up to 100* sets can be stored. When this number is exceeded, the oldest sub waveforms are deleted as new ones are stored, so that only the 100* newest sub waveforms are stored at any given time.

  *: 250 sub waveforms on the /M1 model. 500 sub waveforms on the /M2 and /M3 models.

- **Log Mode**

  For the main waveform, the waveform is acquired from the time sampling is started up to the specified record length. (The acquisition stops also when 10 divisions of waveform are displayed.) For the sub waveform, up to 100* sets can be stored.
  In addition, you can view the past sub waveform data while acquiring the waveform.

  *: 250 sub waveforms on the /M1 model. 500 sub waveforms on the /M2 and /M3 models.

Note

If waveforms are acquired exceeding the record length specified on the main side in Auto mode, there is a possibility that the waveform acquired on the sub side will not exist on the main side.

Realtime Recording to the Internal Hard Disk (Option) <Section 7.7>

The data can be recorded in realtime to the internal hard disk (option). The stored data can be recalled. The realtime recording area is allocated on the internal hard disk in advance (the default value is 50% of the entire capacity of the internal hard disk). You can set the realtime recording area in the range of 30% to 70% of the entire capacity of the internal hard disk when you format the internal hard disk (see section 13.5).

The time axis settings, the maximum record length, and the maximum sampling rate that allow realtime recording vary depending on the number of channels to be recorded in realtime as follows.

Channels Used	Time Axis Range	Maximum Record Length	Maximum Sample Rate
18 CH or more	20 s/div to 3 day/div	25 MW	5 kS/s
12 to 17CH	20 s/div to 3 day/div	50 MW	5 kS/s
6 to 11CH	6 s/div to 3 day/div	50 MW	10 kS/s
4 to 5CH	3 s/div to 3 day/div	100 MW	20 kS/s
3CH	2 s/div to 3 day/div	250 MW	50 kS/s
2CH	1 s/div to 3 day/div	500 MW	100 kS/s
1CH	1 s/div to 3 day/div	1 GW	100 kS/s

The following two modes of realtime recording operation are available.

Single: Starts realtime recording with the start of waveform acquisition and stops realtime recording when the specified record length is reached.

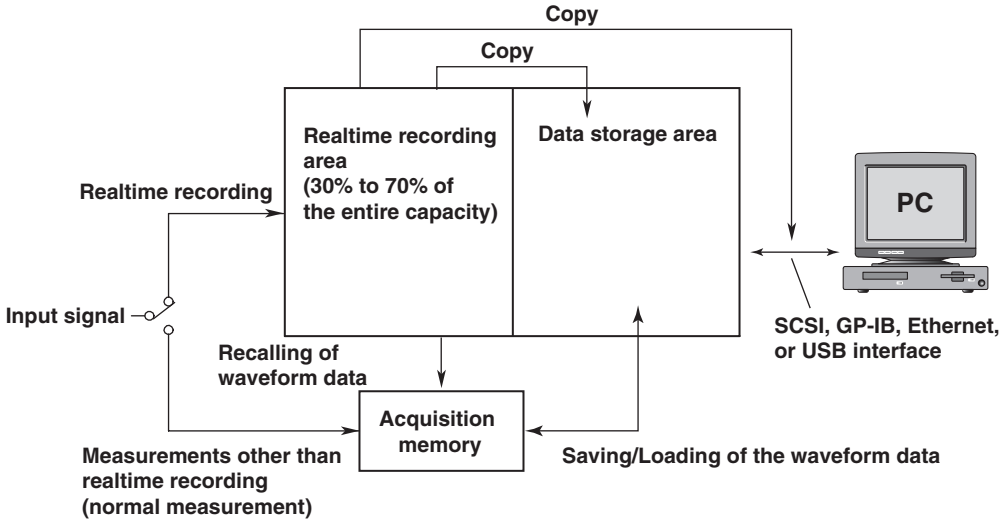
Continue: Starts realtime recording with the start of waveform acquisition and stops realtime recording when the specified record length is reached. This sequence is repeated the specified number of times (count).

If you select Single, the following two trigger modes are available. If you select Continue, only Log is valid.

Auto: Acquisition is started by pressing START. If the specified record length is exceeded, old data is overwritten. Acquisition continues until you press STOP.

Log: Acquisition is started by pressing START. When the specified record length is reached, acquisition stops.

How the Internal Hard Disk (Optional) Is Used



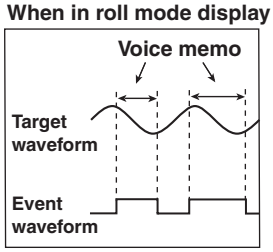
Action-on-Stop <Section 6.18>

A specified action can be carried out when the waveform is displayed after acquiring the specified record length of data or when measurement is stopped after the measurement is started.

- **Print the Screen Image Data (PRINT)**
  Prints the screen image data to a specified printer.
- **Save the Screen Image Data (Image)**
  Saves the screen image data to the save destination specified in the IMAGE SAVE menu.
- **Save Waveform Data (Save to File)**
  Saves the waveform data in binary, ASCII, or floating format to the save destination specified in the FILE menu.
- **Beep Sound (Buzzer)**
  Sounds a buzzer.
- **Send Mail**
  Sends an e-mail message to a specified address (when the Ethernet interface option is installed).

Voice Memo Function <Sections 3.14 and 7.9>

When in roll mode display



Voice memo is also saved as waveform data when the waveform data is saved.

Voice memos can be recorded while waveforms are being acquired (when in roll mode display). The recording and playing of voice memos are done by connecting an optional earphone microphone with a PUSH switch (sold separately). By connecting a speaker, the voice memo can also be played through a speaker. The recorded voice memo can be saved along with the waveform data. The voice memo can be played by loading the saved waveform data.

The voice memo function can perform the following operations.

Record:	Record mode is enabled by turning ON the PUSH switch of the earphone microphone. The maximum record time is 100 s.
Save/Load:	To save the voice memo, save the waveform data that has the voice memo recorded (waveform data in binary format or realtime recorded waveform data). The voice memo is loaded by loading the saved waveform data allowing it to be played.
Play:	When waveform data that has a voice memo recorded is selected, the recorded voice memo is played.

Note

- The voice memo remains only on the newest waveform data that has been stored in the acquisition memory. If you restart data acquisition without saving the waveform data, the voice memo that was attached to the previous waveform will be cleared.
- Voice memos are backed up by the backup function of the acquisition memory.

Backing Up the Acquisition Memory <Section 7.10>

If the ACQ MEMORY BACKUP switch on the right side panel of the DL750/DL750P is turned ON, the history memory data in the acquisition memory, the sub window data of the dual capture function, and the voice memo data are backed up even if the power supply is cut off. The data held in the acquisition memory is backed up immediately before the power is turned OFF. This function protects the data in the acquisition memory from sudden power failures.

Alkaline dry cells or nickel hydride rechargeable batteries (four AAA batteries) are required for the backup. The backup time varies depending on the operating environment. For reference values of the backup time, see section 19.5, “Function.”

Display Format and Waveform Mapping <Sections 8.1 to 8.4, 8.8 to 8.13>

Display Format

Waveforms can be displayed in divided windows to facilitate the viewing of multi-channel waveforms and computed waveforms. The screen can be divided into the following types.
Single (no division), Dual (two divisions), Triad (three divisions), Quad (four divisions), Octal (eight divisions), Hexadecimal (16 divisions).

Waveform Mapping

You can select the mapping of the input channels to the divided windows from the following.

Auto: The input channels that are turned ON are assigned in order by the channel numbers.

Fixed: The input channels are assigned in order by channel number regardless of whether the channels are ON/OFF.

User: The channels can be assigned arbitrarily to the divided windows regardless of whether the channels are ON/OFF.

Display Interpolation <Section 8.2>

In areas where less than 1000 points of data exist in the 10 divisions along the time axis (referred to as interpolation areas), a continuous waveform cannot be displayed because there is not enough sampled points. In this case, waveform is displayed by interpolating between data points. You can select the interpolation method from the following:

Linear Interpolation

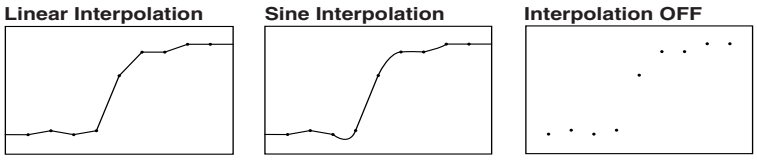
Linearly interpolates between two dots.

Sine Interpolation

Generates interpolation data using the function sin(x)/x then interpolates between two dots using the resulting sine curve. Sine interpolation is suitable for observing sine waves or similar waves.

Interpolation OFF

Displays discrete dots without performing interpolation.



All-Point Display and Decimation Display <Section 8.2>

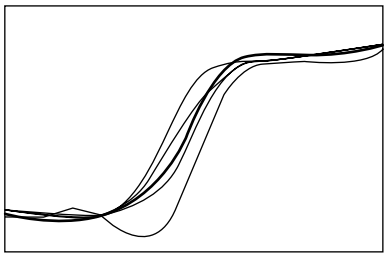
If the interpolation is OFF, waveforms are displayed using dots. In this setting, up to 2002 points or 100100 points (select either 2 k or 100 k points) of the acquired data are displayed without using P-P compression (see page 2-12). For example, if the number of displayed points is set to 100 k and the display record length is 10 kW (the number of acquired data points is 10010 points), all the points of the waveform are drawn by aligning 10 points vertically at the same time axis positions. If the number of acquired data points exceeds 2002 or 100100, the data is decimated down to 2002 or 100100 points (select either 2 k or 100 k points) for displaying the waveform.

Graticule <Section 8.3>

You can change the type of graticule that is displayed to suit your needs. For example, you can show a grid on the screen or show only the frame.

Accumulated Display <Section 8.4>

This mode holds each waveform on the screen for a time that is longer than the update cycle, so that newer waveforms appear overlapped on older waveforms. If you select Persist, the waveforms are accumulated using different colors. Accumulated display is useful when you want to observe jitters and temporary turbulence in waveforms.



Note

Accumulated display is also possible on waveforms that are recalled using the history memory function.

Extra Window <Section 8.11>

This area displays data such as cursor measurement values and values resulting from automated measurement of waveform parameters. The extra window is useful when reading of the values is difficult because waveforms are overlapping them.

Scale Values <Section 8.9>

The upper and lower limits (scale values) of the vertical and horizontal axis of each channel can be displayed.

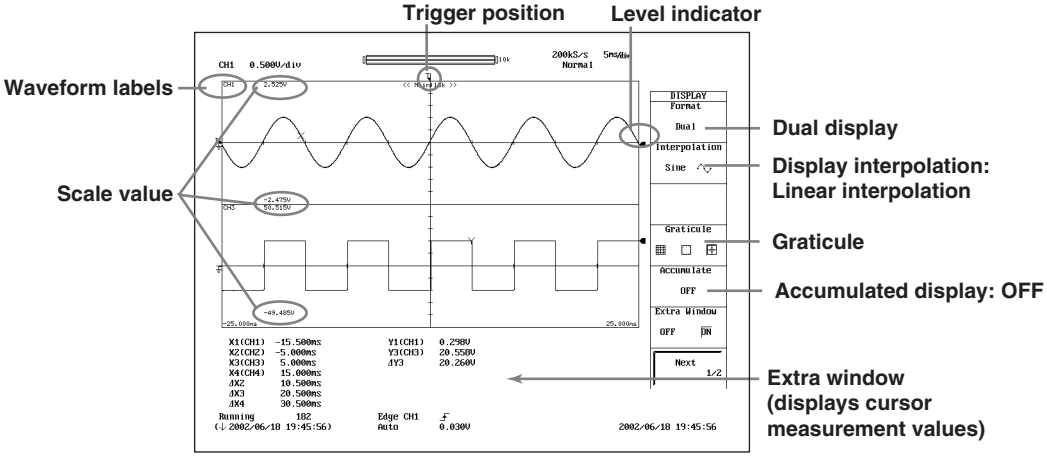
Waveform Labels <Section 8.10>

A waveform label can be assigned arbitrarily to the input waveform of each channel using up to eight characters.

Level Indicators and Numeric Values <Section 8.12>

Level indicator: The levels of each waveform is displayed using indication marks to the right of the waveform display frame.

Numeric values: Displays the measured value of each channel when in roll mode.



Translucent Mode Display <Section 8.8>

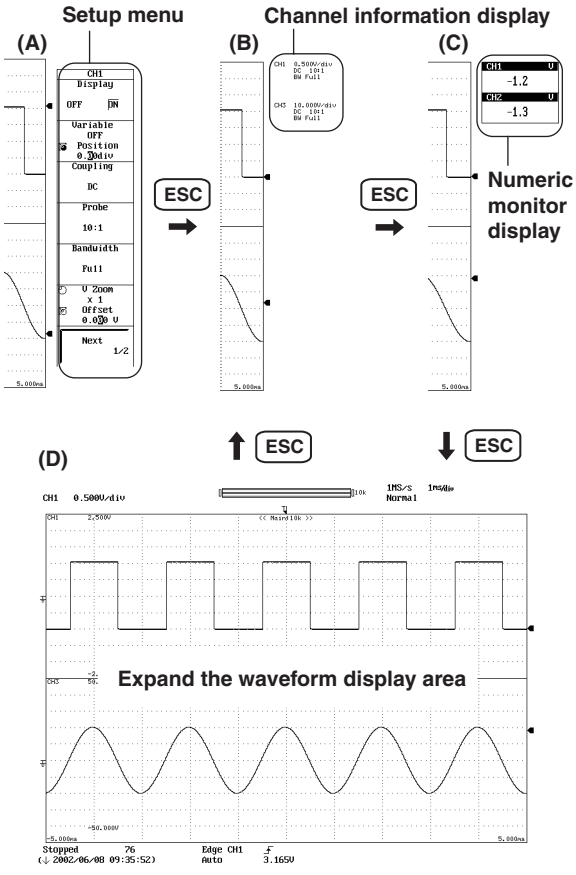
The pop-up menu is shown translucent so that the display under the pop-up menu can be seen.

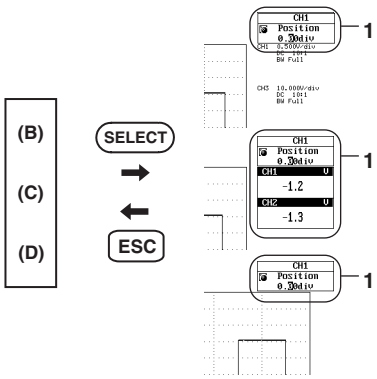
Displaying the Channel Information and Expanding the Waveform Display Area <Section 8.13>

Pressing the ESC key once when the setup menu is displayed shows the channel information. The items that are displayed as channel information are as follows: However, some items may be skipped when the number of displayed channels increases.

- When measuring voltage: V/div setting, input coupling, probe attenuation (type), and bandwidth limit.
- When measuring temperature: Temperature/div setting, thermocouple type, and bandwidth limit.
- When measuring the strain: µSTR/div (or [mV/V]/div) setting, measurement range, and bandwidth limit.
- When measuring acceleration: Acceleration/div setting, gain, input coupling, and bias setting.
- When measuring frequency: Value/div setting, measurement mode setting, and preset setting.
- DSP channel (optional): Value/div setting and computing equation.

Pressing the ESC key once when the channel information is displayed clears the channel information and shows the numeric monitor.
Pressing the ESC key once when the numeric monitor is displayed expands the waveform display area horizontally to cover the entire screen.
In addition, a setup menu of a single parameter may appear at the right corner of the screen when you press the SELECT key when the channel information or waveform monitor is displayed or when the waveform display area is expanded. The parameter controlled by the jog shuttle immediately before the channel information or numeric monitor was displayed or before the waveform display area was expanded is displayed here. This setup menu appears when you press the SELECT key only if there are items that can be controlled by the jog shuttle in the previous menu.





1. If there are two parameters in a single setup menu such as the Z1 Position and Z2 Position settings of the zoom rate (see section 8.5), the parameter controlled by the jog shuttle switches each time you press the SELECT key. The jog shuttle icon (or) is usually white, but it sometimes turns yellow. Yellow indicates that two parameters are selected simultaneously (controlled by the jog shuttle). Taking Z1 Position and Z2 Position as an example, pressing the SELECT key once selects Z1 Position. Pressing the SELECT key again selects Z2 Position. Pressing the SELECT key once more turns the icon yellow and the jog shuttle controls Z1 Position and Z2 Position. If you press the SELECT key yet again, the icon returns to a white color, and the jog shuttle controls only Z1 Position.

X-Y Waveform Display <Section 8.6>

The voltage relationship between signals can be observed by assigning the voltage of the input signal of the specified channel on the horizontal axis (X-axis) and the voltage of another input signal (signal that has the display turned ON) on the vertical axis (Y-axis). Simultaneous observation of X-Y waveforms and normal T-Y waveforms (waveform display using voltage axis and time axis) is possible.
The channels that are assigned to the X and Y axes depending on the X-axis mode are as follows:

X-Axis Mode	X-Y Waveform	X-Axis	Y-Axis
Single		CH1 to CH16, DSP1 to DSP6, Math1 to Math8	All channels that are turned ON
Quad	XY1	CH1 to CH8, DSP1 to DSP3, Math1 to Math4	CH1 to CH8, DSP1 to DSP3, Math1 to Math4
	XY2	CH1 to CH8, DSP1 to DSP3, Math1 to Math4	CH9 to CH16, DSP4 to DSP6, Math5 to Math8
	XY3	CH9 to CH16, DSP4 to DSP6, Math5 to Math8	CH1 to CH8, DSP1 to DSP3, Math1 to Math4
	XY4	CH9 to CH16, DSP4 to DSP6, Math5 to Math8	CH9 to CH16, DSP4 to DSP6, Math5 to Math8

DSP1 to DSP6 are optional.

Using the X-Y waveform display function, you can measure the phase angle between two sine wave signals. For example, the waveform that appears when two sine waveforms are shown on the X-Y display is called a Lissajous waveform. From this waveform, the phase angle can be obtained.

Lissajous waveform

Phase angle 0°			
Phase angle 45°			
Phase angle 90°			
Frequency ratio (X:Y)	**1:1**	**1:2**	**1:3**

Zooming in on the Waveform Horizontally <Section 8.5>

The displayed waveform can be expanded along the time axis. This function is useful when the waveform acquisition time is set long and you wish to observe a particular section of the waveform in detail. Zooming is not possible if the number of displayed points on the screen is less than or equal to 10 (less than or equal to 50 for FFT waveforms). The zoom position is set in units of divisions of the grid.

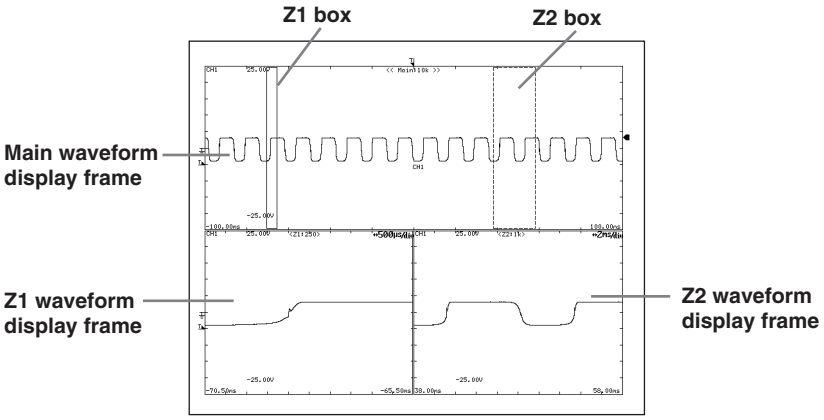
Display Format When the Waveform Is Zoomed

Zoomed waveforms of two locations can be displayed simultaneously (dual zoom). Below are the display methods of zoom waveforms.
Main: Main waveform display frame
Z1, Z2: Zoom waveform display frame

<Main>		<Main>	<Z1>
<Z1>	<Z2>	<Z1> or <Z2>	<Z2>

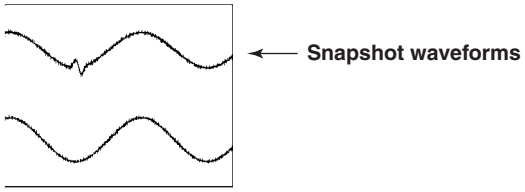
<Z1> or <Z2>

When displaying Main (main waveform) and Z1 or Z2 (zoomed waveform) simultaneously, a zoom box indicating the zoom position is displayed within the main waveform display frame. The center of the zoom area corresponds to the center of the zoom box.



Snapshot <Section 8.7>

When the trigger mode is set to a mode other than single, the displayed waveforms are periodically updated or displayed in roll mode.
By using the snapshot function, you can temporarily hold the waveform that would be cleared when the screen is updated (snapshot waveform) on the screen. The snapshot waveform is displayed in white, allowing for easy comparison against the updated waveform. The snapshot waveform is a screen image waveform. You can save, load, and print the screen image data, but cursor measurements, automated measurement of waveform parameters, zoom, and computation cannot be performed on it.



Clearing Traces <Section 8.7>

You can clear the snapshot waveform, and restart averaging and accumulation with one key operation.

Pressing the CLEAR TRACE key temporarily clears the measured waveforms from the screen. Pressing the ESC key redisplays them.

2.5 Recording in Recorder Mode (Realtime Recording) (DL750P Only)

The DL750P is equipped with an A-4 size printer. If Chart Recorder mode is selected in the RECORDER menu and waveform acquisition is started, T-Y waveforms (T-Y waveform recording) or numeric values can be recorded in realtime. In addition, if X-Y Recorder mode is selected and waveform acquisition is started and stopped, the X-Y waveform over the interval in which waveform was acquired can be recorded (X-Y waveform recording).

Chart Recorder Mode <Sections 9.2 to 9.6>

Print Style

In Chart Recorder mode, the print style can be selected from the following two styles.

T-Y Waveform Recording

In T-Y waveform recording, recording is performed at the specified chart speed (10 mm/h to 20 mm/s). The scale used in T-Y waveform recording is fixed to 10 mm per division on the horizontal axis (time axis). The scale on the vertical axis (voltage axis) can be set to 10 mm per division or [1 division of the 10 equally divided chart recording zone] per division.The recording can also be stopped automatically after recording a specified length (shot recording).

Numeric Value Recording

Numeric values can be recorded at the specified time interval (1 s to 60 min). Up to 16 channels can be recorded. If waveform acquisition is started on more than 16 channels, 16 channels are recorded in the following order: CH1 to CH6, DSP1 to DSP6 (option), LOGIC A, and LOGIC B.

Acquisition Mode during Chart Recorder Mode

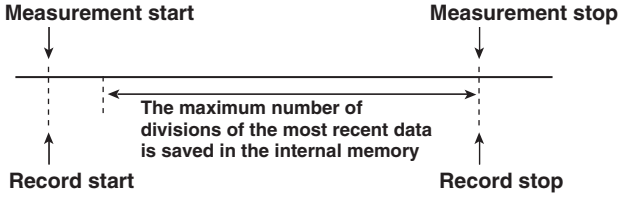
During Chart Recorder mode, the acquisition mode is set to envelope. The acquisition mode cannot be changed with the ACQ key as with the normal operation.
However, the acquisition mode can be changed to normal with the MISC menu. Select normal mode if you are using the acquired waveform as numeric data such as in an analysis.

Selectable Trigger Modes in Chart Recorder Mode

The following four trigger modes can be selected.

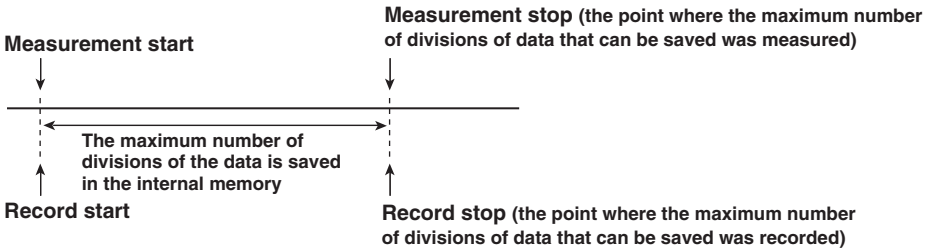
Auto

Recording on the built-in printer starts at the same time measurement is started by pressing the START/STOP key. Recording continues until measurement is stopped by pressing the START/STOP key again. The maximum number of divisions of the most recent data that can be saved (see page 2-45) is saved in the internal memory.



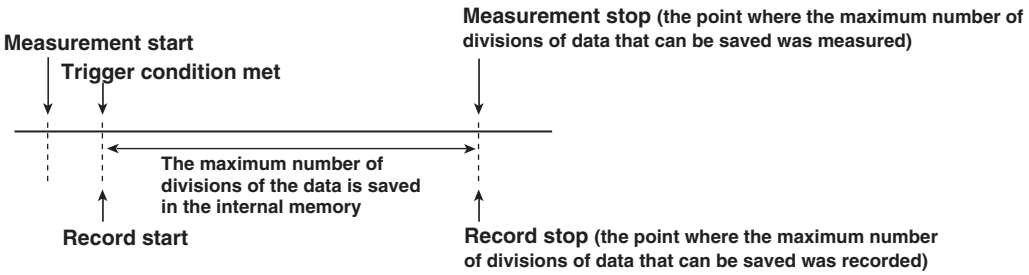
Log

Recording on the built-in printer starts at the same time measurement is started by pressing the START/STOP key. Measurement and recording stops automatically when the maximum number of divisions of measured values that can be saved is recorded. The maximum number of divisions of measured data that can be saved is saved in the internal memory.



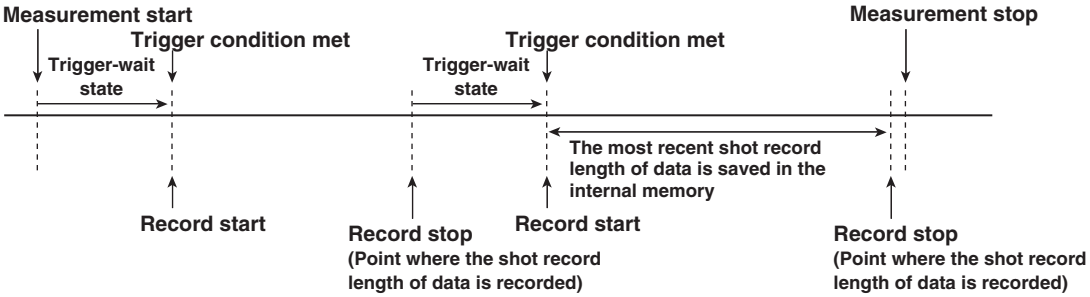
Single (Only during T-Y Waveform Recording)

Recording on the built-in printer starts when the trigger condition is met after measurement is started by pressing the START/STOP key. The data is saved to the internal memory at the same time recording is started. Measurement and recording stops when the maximum number of divisions of measured values that can be saved is recorded. The maximum number of divisions of measured data that can be saved is saved in the internal memory.



Repeat (Only during T-Y Waveform Recording)

Recording on the built-in printer starts when the trigger condition is met after measurement is started by pressing the START/STOP key. The data is saved to the internal memory at the same time recording is started. Recording stops when the shot record length of measured values is recorded. Then, the DL750P enters the trigger-wait state. The most recent shot record length of measured data is saved to the internal memory.



Saving Data in the Internal Memory

In Chart Recorder mode, up to 1000 divisions of the recorded data are automatically saved in the internal memory. The required section of the data that has been cleared from the screen can be redisplayed after the recording is finished by using functions such as search & zoom (limited to the data in the range defined by "Number of Data Points That Can Be Saved" below). As with the normal data (data when the recorder mode is OFF), cursor measurements, automated measurement of waveform parameters, normal statistical processing*, search & zoom, and display setting modification in the DISPLAY menu can be performed on the redisplayed data. The redisplayed data can also be saved as waveform data in the same fashion as normal data.
Furthermore, the redisplayed data can be reprinted by changing the print conditions or a PDF file of the reprint image can be created (see "Reprinting on the Built-in Printer" or "Creating a PDF File of the Reprinted Image" on page 2-46).

* Cycle statistical processing and statistical processing of history data cannot be performed in Chart Recorder mode.

Number of Data Points That Can Be Saved

If the chart speed is slow, the number of data points that can be saved in the internal memory is reduced. For example, if the chart speed is 10 mm/h, up to 100 divisions of data (up to 4 days of data) are saved. If the chart speed is 20 mm/s, up to 1000 divisions of data (up to 8 minutes 20 seconds of data) are saved. The maximum number of divisions that can be saved for each chart speed is as follows:

Chart Speed	Maximum Number of Divisions That Can Be Saved
20 [mm/s] to 1 [mm/s]	1000
100 [mm/min] to 2 [mm/min]	1000
1 [mm/min]	500
100 [mm/h]	1000
50 [mm/h]	500
25 [mm/h]	250
20 [mm/h]	200
10 [mm/h]	100

For the relationship between the chart speed and sample rate, see appendix 15.

Functions That Cannot Be Used in Chart Recorder Mode

When making measurements in Chart Recorder mode, history memory, GO/NO-GO determination, dual capture, and waveform computation cannot be used. (The HISTORY, GO/NO-GO, DUAL CAPTURE, and MATH keys cannot be used.)
In addition, items set with the ACQ key cannot be changed.

Compatibility with the Measured Data

The measured data in Chart Recorder mode is not compatible with the measured data when the recorder mode is OFF. The measured/saved data in Chart Recorder mode cannot be loaded with the recorder mode turned OFF, and vice versa. The measured data on the DL750 and the measured data on the DL750P (when the recorder mode is OFF) are compatible.)

X-Y Recorder Mode <Section 9.7>

X-Y Waveform Recording

In X-Y waveform recording, the X-Y waveform starts to be displayed when waveform acquisition is started. If reprint is executed from the Reprint Setup menu after the record length of waveform (fixed to 1 MW) is acquired or after stopping waveform acquisition, the X-Y waveform acquired up to the point immediately before the measurement was stopped is recorded on paper.
The scale of the X-Y waveform recording is 10 mm per division for both X- and Y-axes, and the waveform recording area is ±10 divisions (20 divisions). The screen also shows the X-Y waveform. Recording to paper can also be started automatically when waveform acquisition is stopped (auto print).

Acquisition Mode during X-Y Recorder Mode

The acquisition mode is automatically set to normal during X-Y record mode. The acquisition mode cannot be changed with the ACQ key as with the normal operation.

Saving Data in the Internal Memory

In X-Y recorder mode, up to 1 MW of data is automatically saved in the internal memory. Also, a PDF file of the reprint image can be created.

Functions That Cannot Be Used during X-Y Recorder Mode

When making measurements in X-Y Recorder mode, history memory, GO/NO-GO determination, dual capture, and waveform computation cannot be used. (The HISTORY, GO/NO-GO, DUAL CAPTURE, and MATH keys cannot be used.)
In addition, items set with the ACQ key cannot be changed.

Compatibility with the Measured Data

The measured data in X-Y Recorder mode is not compatible with the measured data when the recorder mode is OFF. The measured/saved data in X-Y Recorder mode cannot be loaded with the recorder mode turned OFF, and vice versa. The measured data on the DL750 and the measured data on the DL750P (when the recorder mode is OFF) are compatible.)

Reprinting on the Built-in Printer (Only during T-Y Recording) <Section 9.8>

After the T-Y recording in Chart Recorder mode is finished, the data stored in the internal memory can be recalled and reprinted by changing the print conditions.

Creating a PDF File of the Reprint Image (Only during T-Y Recording) <Section 9.9>

After the waveform recording in Chart Recorder mode or X-Y Reorder Mode is finished, the data stored in the internal memory can be recalled and a PDF file of the reprint image can be created.
In X-Y Recorder Mode, the most recent 1 MW of data stored in the internal memory are output to the PDF file. If data exceeding 1 MW is recalled, the waveform displayed on the screen and the waveform recorded on the printer may differ from the waveform output to the PDF file.

2.6 Waveform Computation

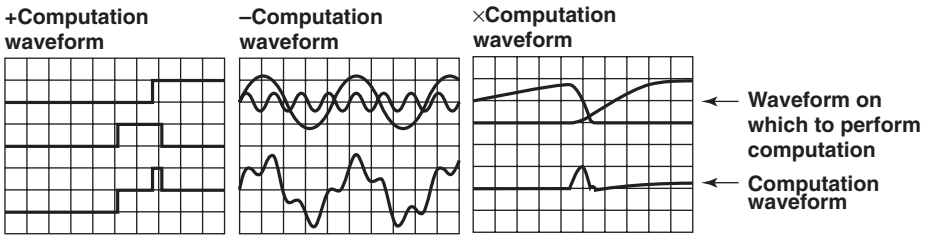
Various computations can be performed on up to 800 kW of data on the DL750/DL750P. (If a waveform greater than 800 kW is displayed, computation cannot be performed over all the data at once.) The computed results become Math1 to Math8 waveforms.

Addition, Subtraction, Multiplication, and Division <Section 10.1>

Addition, subtraction, multiplication, and division can be performed between two arbitrary waveforms of CH1 to CH16 and Math1 to Math8. These computations are useful in the following cases.

Addition and subtraction: Comparison with the standard signal, confirmation of the signal logic, phase comparison, etc.

Multiplication and division: Confirmation of the power waveform by applying the voltage and current signals, etc.

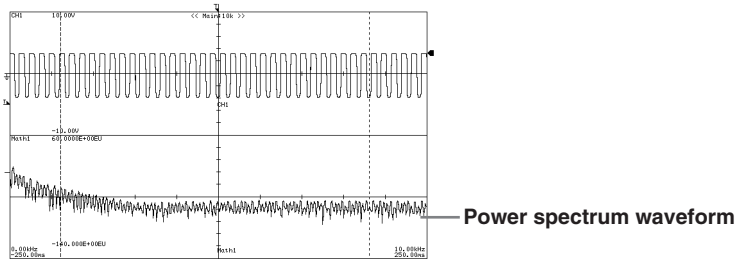


Binary Computation <Section 10.2>

The specified waveform is converted to a digital waveform of 0s and 1s with respect to the specified threshold level. The computation can be performed on CH1 to CH16 and Math1 to Math7.

Power Spectrum Display <Section 10.3>

The power spectrum of the input signal can be displayed by taking the FFT (Fast Fourier Transform). This is useful when you wish to check the frequency distribution of the input signal.



You can select the FFT window from the following three types.

Rectangular (Rect)

Best suited to transient signals, such as an impulse wave, which attenuate completely within the time window.

Hanning and FlatTop

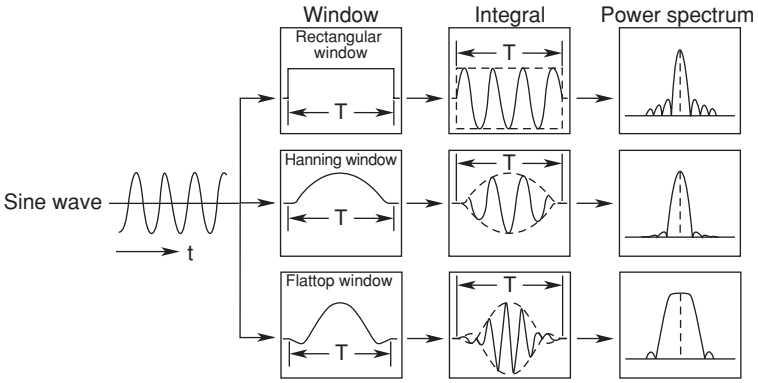
The Hanning and flattop windows allow continuity of the signal by gradually attenuating the parts of the signal located near the ends of the time window down to the 0 level. Hence, it is best suited to continuous signals. With the Hanning window, the frequency resolution is high as compared with the flattop window. However, the flattop window has a higher level of accuracy. When the waveform being analyzed is a continuous signal, select the proper window for the application.

Exponential Window

The exponential window eliminates noise components from the signal. It can be selected only when the user-defined computation option is installed. It is effective against frequency response test signals generated through impulse excitation.

For details on each window, see page app-21.

FFT is performed on 1000, 2000, 5000, 10000, 20000, 50000 or 100000 points of measured data. The data is converted to half the specified number of points and displayed.



Rectangular window : $W(t)=u(t)-u(t-T)$ U(t) : Step function

Hanning window : $W(t)=0.5-0.5\cos(2\pi \frac{t}{T})$

Flattop window : $W(t)=\{0.54-0.46\cos(2\pi \frac{t}{T})\}\frac{\sin\{2\pi(1-2t/T)\}}{2\pi(1-2t/T)}$

FFT Function

Given that the complex function resulting after the FFT is G = R + jI, the power spectrum can be expressed as follows.

Power spectrum=$10 \log \left(\frac{R^2+I^2}{2}\right)$
R: Real Part, I: Imaginary Part
Reference value (0 dB) of the logarithmic magnitude (Log mag): 1 $Vrms^2$

Phase Shift (Phase Mode) <Section 10.4>

You can shift the phase of CH1 to CH16, Math1 to Math7, and DSP1 to DSP6 (optional) waveforms and display the resultant waveforms or perform computation using the phase-shifted data.

User-Defined Computation (Optional) <Section 10.5>

You can define computing equations by combining the following operators:
+, -, *, /, SHIFT (phase shift), ABS (absolute value), SQRT (square root), LOG (logarithm), EXP (exponent), NEG (negation), SIN (sine), COS (cosine), TAN (tangent), ATAN (arctangent), PH (phase), DIF (differentiation), DDIF (2nd order differentiation), INTG (integral), IINTG (double integral), BIN (binarization), P2 (square), P3 (cube), F1 ($\sqrt{|C1^2 + C2^2|}$), F2 ($\sqrt{|C1^2 - C2^2|}$), FV (inverse of the pulse width PHWW), PWHH (pulse width), PWHL (pulse width), PWLH (pulse width), PWLL (pulse width), PWXX (pulse width), DUTYH (duty ratio), DUTYL (duty ratio), FILT1 (digital filter), FILT2 (digital filter), HLBT (hilbert), MEAN (moving average), LS- (linear spectrum), PS- (power spectrum), PSD- (power spectrum density), CS- (cross spectrum), TF- (transfer function), CH- (coherence function), variable (T), and constants (K1 to K8). In addition, you can average or compute the peak value on the computed data. The following four operations are available.

Linear Averaging

The values are summed linearly the number of average counts (the number of acquisitions, 2 to 128, 2^n steps) and divided by the average count. The resultant waveform is displayed. For the equation, see “Acquisition Mode” on page 2-31.

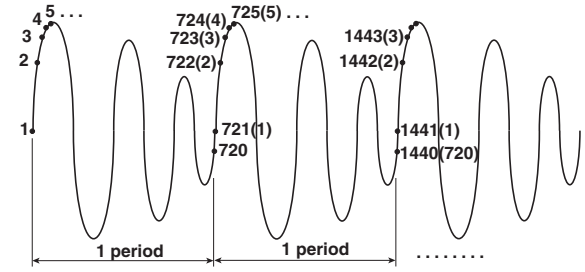
Exponential Averaging

The average is determined by attenuating the effects of past data according to the specified attenuation constant (2 to 256, in 2^n steps). The resultant waveform is displayed. For the equation, see section “Acquisition Mode” on page 2-31.

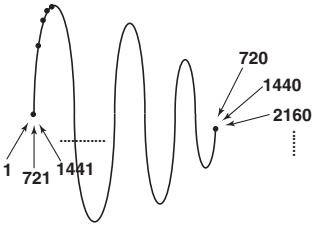
Cycle Averaging

Divides one period of computed data into the specified number of data points (Cycle Count). This is done across multiple periods of data from the start to the end position of the computation. Then, the average of the data points at the same position across multiple periods is determined. The resulting waveform is displayed. The following figure shows the result of the cycle average when Cycle Count is set to 720.

<Computed data>



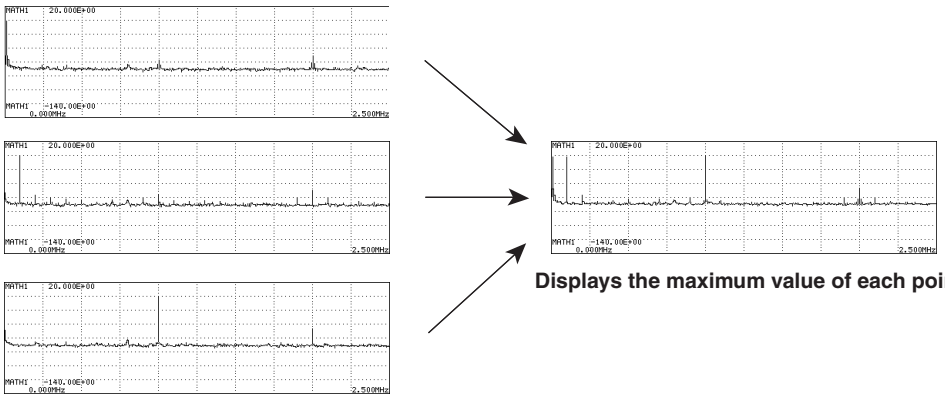
<Result of cycle average>
Determines the simple average of the computed data at the same position across multiple periods and displays the waveform.



Peak Computation

Determines the maximum value at each point of the computed data and displays the waveform. For each computation, the new computed value is compared with the past value and the larger value is kept.

3 sets of FFT data



Displays the maximum value of each point

Scaling of Computed Waveforms <Chapter 10>

The DL750/DL750P normally performs auto scaling when displaying computed waveforms. However, you can also select manual scaling. When auto scaling, the upper and lower limits suitable for displaying the waveform are determined from the first computed waveform and other parameters. If you select manual scaling, you can arbitrarily set the upper and lower limits of the computed waveform display.

DSP Channels <Chapter 15>

What DSP Channels Are

DSP (Digital Signal Processor) channels are used to perform computations between channels and filter computations in realtime using the output data of the input module as the source. Below are the characteristics of DSP channels.

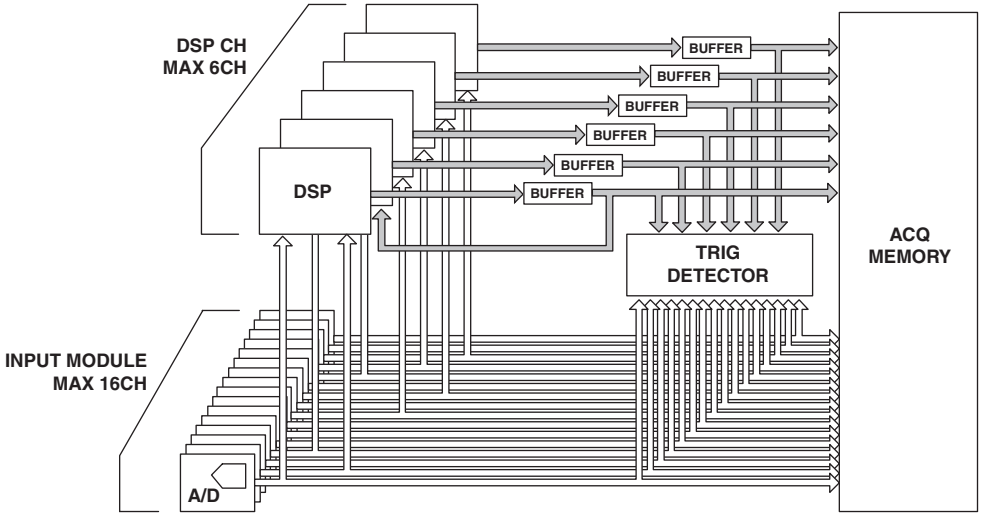
- Performs relatively simple computations such as the addition, subtraction, multiplication, and division (+, –, ×, and ÷) between channels, 4 types of digital filters, differentiation, and integration.
- The computation source of DSP channels is 16 bits. However, internally, the value is converted into a floating-point decimal number for performing computations. The computed result is converted into 16-bit data assigned by the range value (Value/Div), and then stored to the memory. (For a description of the computation format, see appendix 6.) The display is based on 2400 LSB/div (same as the 16-bit analog module).
- There are four selectable digital filter formats (sharp, Gauss, IIR (Butterworth), and moving average) and three selectable digital types (LPF, HPF, and BPF). The characteristics of each filter are indicated below.

Filter Format	Characteristics	Filter Type	Computation Type
SHARP	Steep attenuation slope (–40 dB per octave) Linear phase and constant group delay Ripple exists in the passband Stop band is comb-shaped	LPF[1] HPF[1] BPF[1]	FIR
GAUSS	Gentle attenuation slope Linear phase and constant group delay No ripple in the passband There is no overshoot in the step response. Low order and small delay	LPF	FIR
MEAN (Moving Average)	Comb-shaped characteristics Linear phase and constant group delay There is no overshoot in the step response.	LPF	FIR
IIR (Butterworth)	Attenuation slope is between SHARP and GAUSS Not linear phase and group delay not constant No ripple in either passband or stopband Close to the characteristics of an analog filter Cutoff frequency can be set lower than SHARP/GAUSS	LPF HPF BPF	IIR

1. LPF, HPF, and BPF denote low-pass filter, high-pass filter, and bandpass filter, respectively.

- The cutoff frequency, center frequency, and pass band of the digital filter are set in terms of percentages of the fs (sampling frequency).
- The sampling frequency varies depending on the T/div and record length settings. The maximum sample rate is 100 kS/s (6 channels simultaneously). At sample rates above 100 kS/s, data is automatically re-sampled at 100 kS/s. In envelope mode, data is always sampled at 100 kS/s. (Note that the sampling frequency of the digital filter always follows the behavior described above.)
- High speed because computation is performed at the stage before the waveform is acquired (stage before the data enters the acquisition memory).
- Displays waveforms in realtime even during roll mode display.
- Various computation parameters such as the cutoff frequency of the digital filter can be changed while waveform is being acquired.
- Triggers can be activated on the computed result.
- Same record length as analog channels (achieves long memory).
- 16 analog channels + 6 computed waveform channels of DSP channels = 22 channels can be displayed simultaneously.

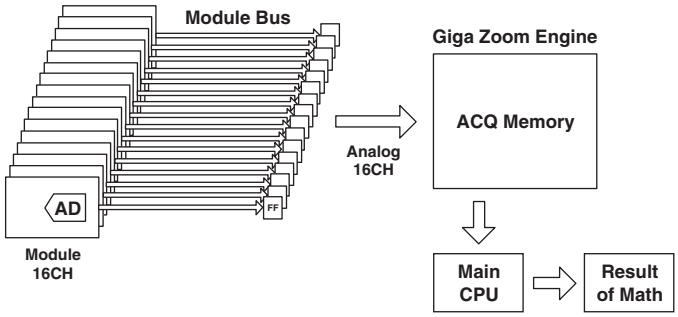
- The computed result of a DSP channel can be defined as a computation source of another DSP channel. However, in this case, the computation delay is accumulated. To avoid recursive reference in the computation, the channel that you can specify as a computation source is a DSP channel with a smaller channel number than itself. (Example: The selectable DSP channel on DSP channel 2 is DSP channel 1; the selectable DSP channels on DSP channel 3 are DSP channels 1 and 2.)
- The computation delay is equal to 4 samples + the computation delay of the digital filter. For details on the computation delay of the digital filter, see appendix 6.
- The range (Value/Div) of the DSP channel is automatically set to the optimum range by evaluating the range value of the input source and the computing equation when you press the Optimize Value/Div soft key. (However, since the range does not track the input value or the computed result, you must adjust the Value/Div setting using the V/DIV knob as described below.)
- You can change the range value (Value/Div) of the DSP channel using the V/DIV knob.
- A total of 123 Value/Div ranges between 500.0E+18 and 10.00E–21 (1-2-5 steps) are supported to accommodate the dynamic range of the computed result.
- The input and output of DSP channels are 16-bit binary data (if the input is 12 bits, it is converted to 16 bits). For details on the internal processing, see "Computation Flow and Internal Computation Format of DSP Channels" in appendix 6.



Difference between Normal Computed Waveforms (Math1 to Math8) and DSP Channels (DSP1 to DSP6)

Normal Computed Waveforms (Math1 to Math8)

- Since the computation is performed after acquiring the waveform, the interval of continuous measurements is long.
- Computation is not possible during roll mode display.
- Since the computed result is stored in the main memory of the main CPU, there is a limitation on the record length.
- Triggers cannot be activated on the computed result.
- Various computing equations are supported, because a general-purpose CPU is used.

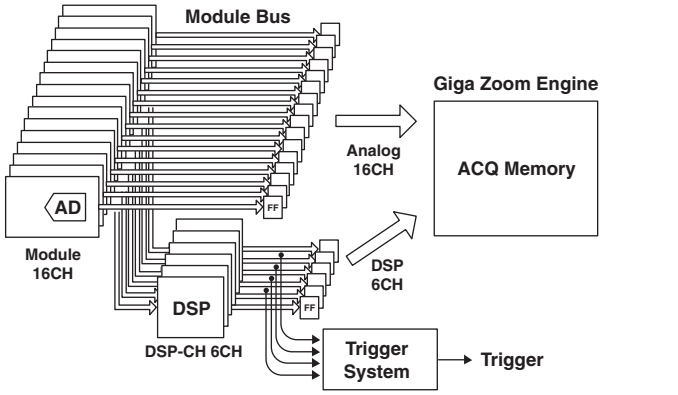


DSP Channels (DSP1 to DSP6)

- Realtime computation can be performed while waveforms are being acquired.
- Computed results can be monitored even during roll mode display.
- There is no limitation on the record length. The record length can be set to the same length as normal analog input channels.

  Example The record length of CH1 of the analog input channel is 10 MW and the record length of the DSP channel is 10 MW.

  The selectable DSP channel on DSP channel 2 is DSP channel 1; the selectable DSP channels on DSP channel 3 are DSP channels 1 and 2.)
- Triggers can be activated on the computed result.
- Computation rate is 100 kS/s.
- Addition, subtraction, multiplication, and division (with or without coefficients), filtering, differentiation, integration, and knocking filtering can be performed.
- Can be used in all acquisition modes (including the dual capture function).
- Acquisition rate is fast, because there is no processing after waveform acquisition.



2.7 Waveform Analysis/Search

Displaying History Waveforms <Section 11.1>

Past waveform data (history waveforms) stored in the acquisition memory can be displayed when waveform acquisition is stopped. You can display a specified history waveform from the data (up to 2000 waveforms, or the number of triggers) stored in the acquisition memory.

The number of waveforms N that can be acquired and held as history waveforms varies from 1 to 2000 depending on the record length and acquisition mode settings. The waveform currently displayed on the screen (newest waveform) is counted as the 1st waveform, and up to N–1 waveforms in the past can be displayed.

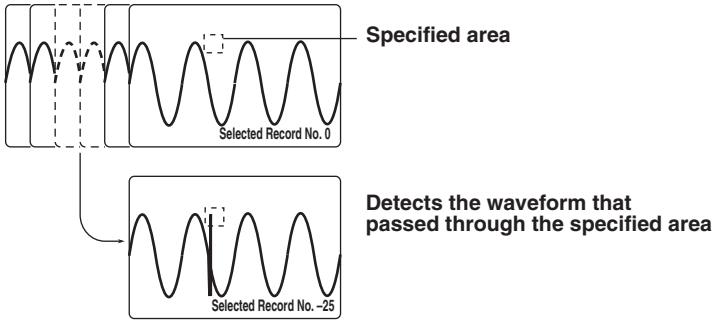
History Search Function <Sections 11.2 and 11.3>

You can search waveforms that match specified conditions from the waveform data in the history memory.

Search by Zone

From the waveforms stored in the history memory, waveforms that passed or not passed a specified area (zone) can be searched.

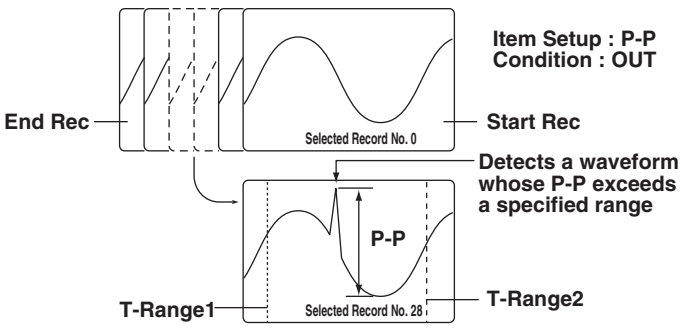
Waveform stored in the history memory



Search by Waveform Parameters

From the waveforms stored in the history memory, waveforms that meet or do not meet the specified parameter conditions can be searched.

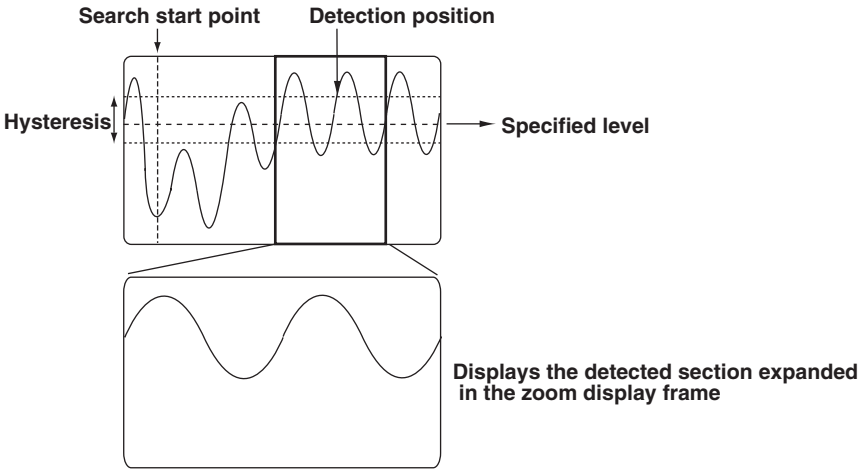
Waveform that was saved using the history memory function



Search and Zoom Function <Section 11.4>

Edge Search

Searches the position where the signal went over (rising) or below (falling) the specified level the specified number of times from the search start position. The waveform expanded around the found position can be displayed in the zoom window. The search target is CH1 to CH16, DSP1 to DSP6, LOGIC A, and LOGIC B.



Search condition: Set the edge to rising and count to 2

Auto Scroll

The zoom position automatically moves in the specified direction. You can scroll through the zoomed waveform and stop the scrolling at the desired position.

Voice Search

Searches the start point of the voice memo that has been recorded using the voice memo function (see section 7.9). Playing the voice memo that has been found is also possible.

Cursor Measurement <Section 11.5>

The following cursors are available for analyzing the values of each waveform data.

H (Horizontal) Cursors

Two broken lines (H cursors) are displayed on the X-axis (horizontal axis). The voltage of each H cursor and the voltage difference between the H cursors are measured.

V (Vertical) Cursors

Two broken lines (V cursors) are displayed on the Y-axis (vertical axis). The time from the trigger position to each V cursor and the time difference between the V cursors are measured. The voltage value of the signal at each cursor position, and the voltage difference between the cursors are also measured.

H&V Cursors

H cursors and V cursors are displayed simultaneously.

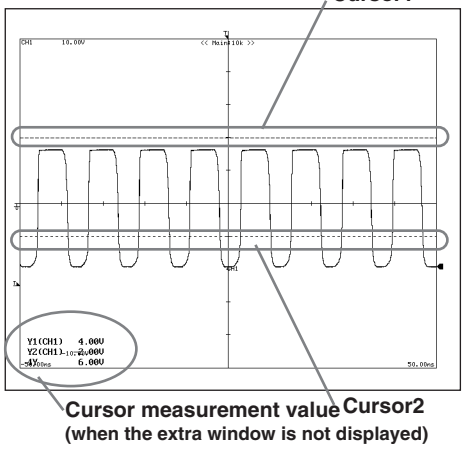
Marker Cursors

Four markers are displayed on the specified waveform. The voltage and the time from the trigger position of each marker as well as the voltage difference and time difference between markers are measured.

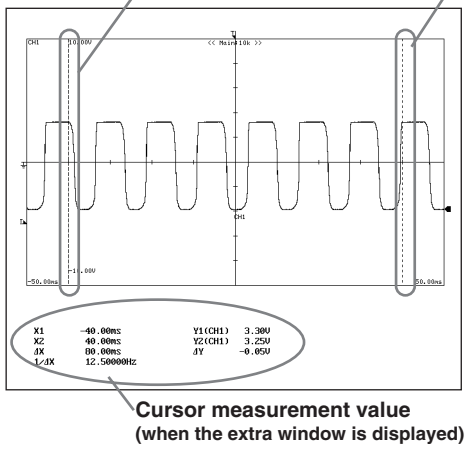
Degree Cursors

Measures the angle between two angle cursors with respect to a reference angle corresponding to the width between the zero point and the end point, which are measurement references.

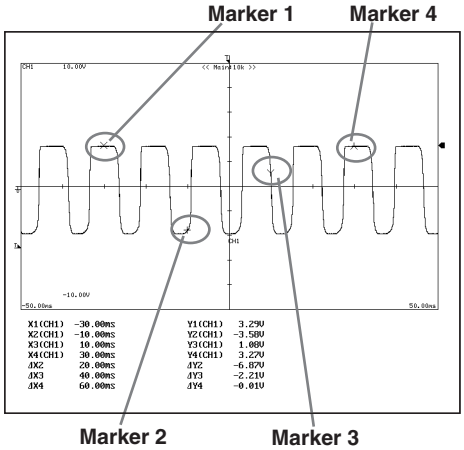
H cursor



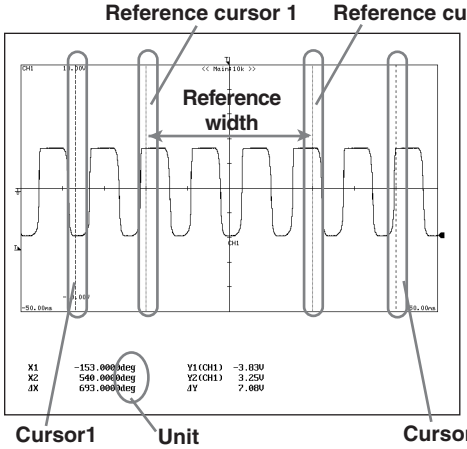
V cursor



Marker cursor

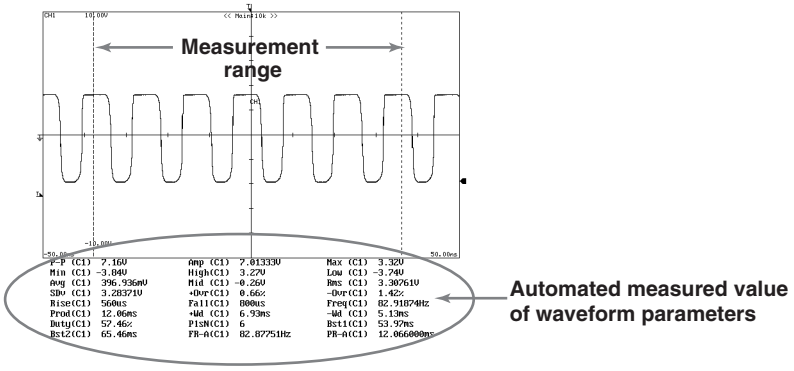


Angle cursor



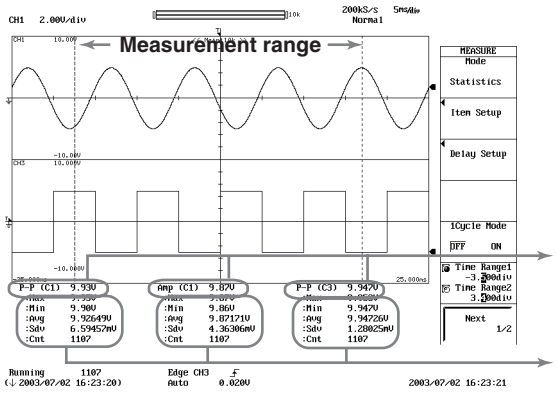
Automated Measurement of Waveform Parameters <Section 11.6>

Automated measurement can be performed on parameters such as the rise time and pulse width on the specified channel. There are 29 measurement parameters. Up to 24 parameters from the selected parameters of all channels can be displayed.
The measurement range is up to 10 MW from the measurement start point (Time Range1).



Statistical Processing <Section 11.7>

Statistical processing is performed on the measured values of automated waveform parameters described on the previous page. The following five statistics are determined on the three measured values of automated measurement parameters.
The number of measured values used to determine the maximum value, minimum value, average value, standard deviation, and statistical processing.



The following three statistical processing modes are available.

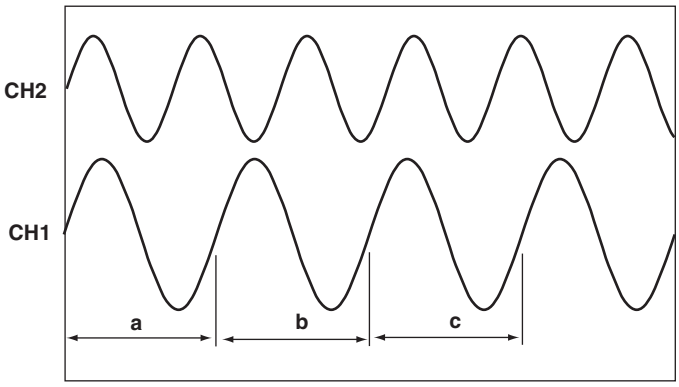
Normal Statistical Processing

Statistical processing is performed on all acquired waveforms while acquiring waveforms.

Cycle Statistical Processing

Divides the displayed waveform using a cycle that is automatically calculated and determined and performs statistical processing on the values obtained through the automated measurement of waveform parameters over the determined cycle.
Statistical processing is performed from the oldest measured data of the displayed waveform. Statistical processing of up to 48000 measured values of automated waveform parameters is possible. If statistical processing is performed on 1 parameter, statistical processing of up to 48000 cycles is possible.

Example in which CH1 is selected as the waveform used to determine the cycle



Automated measurement parameters are measured in each range, a, b, and c, and statistical processing is performed on the automated measurement parameters in the order a, b, and c.
The automated measurement parameters of other channels are also measured using ranges a, b, and c.
Automated measurement can also be made using the cycle of each waveform as the range.

Statistical Processing of History Data

Performs automated measurement of waveform parameters on the waveform that is acquired using the history memory function and performs statistical processing.
Statistical processing is performed from the oldest waveform.

GO/NO-GO Determination <Sections 11.8 to 11.10>

The GO/NO-GO function is useful when you want to inspect signals and track down abnormal symptoms on a production line making electronic equipment. The function determines whether the waveform is within the preset range and performs a specific action for a GO or NO-GO result. There are two types of determinations.

- Zone: Method in which a waveform zone is set on the screen
- Parameter: Method in which a waveform parameter range is specified

The following five types of actions can be performed for GO or NO-GO result.

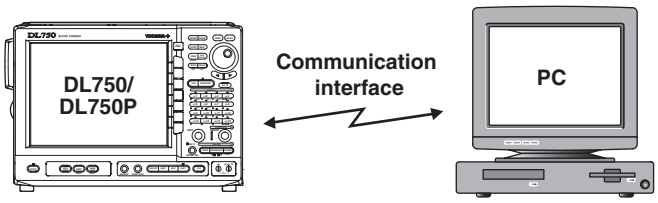
- **Print the Screen Image Data (PRINT)**
  Prints the screen image data to a specified printer.
- **Save the Screen Image Data (Image)**
  Saves the screen image data to the save destination specified in the FILE menu.
- **Save the Waveform Data (Save to File)**
  Saves the waveform data in binary, ASCII, or floating format to the save destination specified in the FILE menu.
- **Beep Sound (Buzzer)**
  Sounds a buzzer.
- **Send Mail**
  Sends an e-mail message to a specified address. (when the Ethernet interface option is installed)

In addition, the determination result can be output externally using signals.

2.8 Communications

Command (GP-IB, Serial (RS-232), USB and Ethernet Communications) <Communication Interface User's Manual>

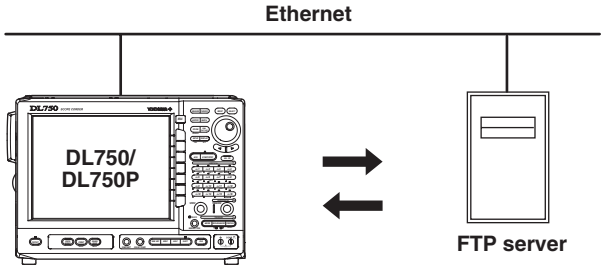
The DL750/DL750P comes standard with GP-IB, serial (RS-232), and USB interfaces. The Ethernet interface is available as an option.
Through communication functions, you can output waveform data to a PC for data analysis or control the DL750/DL750P using an external controller to carry out waveform measurements.



Saving/Loading Data to a Network Drive (FTP Client Function) <Chapter 16>

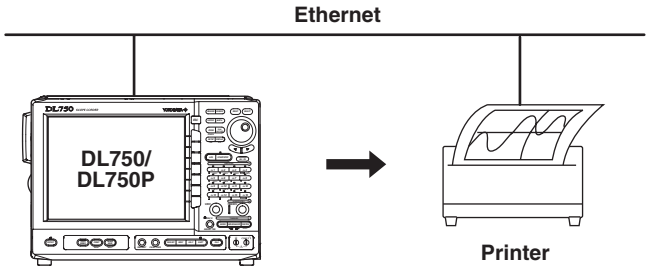
Waveform[1] data, screen image data, and setup data can be saved, deleted, or copied on an FTP server[2] on the network in the same fashion as the built-in floppy disk, built-in Zip disk (DL750 only), built-in PC card, internal hard disk (optional), or external SCSI device.

1. The following types of waveform data cannot be loaded from a network drive.
   - Waveform data that is 50 MB or more in size.
   - Waveform data saved on the all waveform display (All) of the history memory function.
2. PC or workstation on which the FTP server function is running.



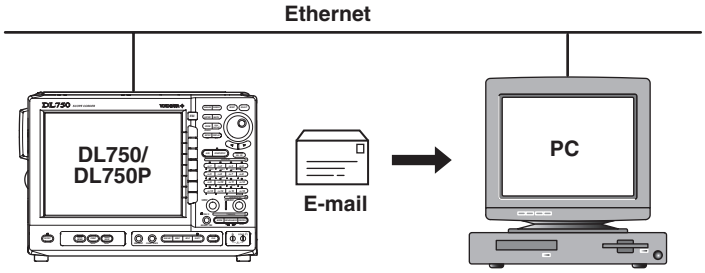
Printing Screen Image Data on a Network Printer <Section 16.4>

The screen image data can be printed on a network printer in the same way as the built-in printer or USB printer.



Transmitting E-mail Messages (SMTP Client Function) <Section 16.5>

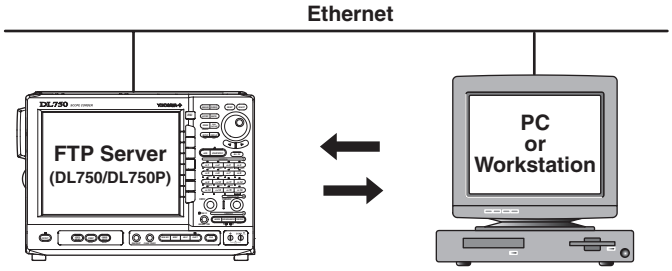
The information of the DL750/DL750P can be transmitted periodically in an e-mail message to a specified mail address. You can also transmit information such as the trigger time as an action for the GO/NO-GO determination or action-on-trigger.



Accessing the DL750/DL750P from a PC or Workstation (FTP Server Function) <Section 16.6>

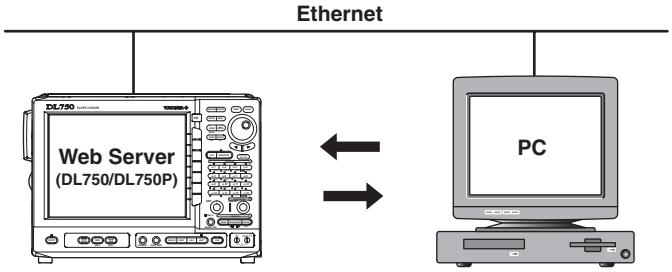
The files on the built-in floppy disk, built-in Zip disk (DL750 only), built-in PC card, internal hard disk (optional), or external SCSI device on the DL750/DL750P can be retrieved by accessing the DL750/DL750P from an FTP client[1] on the network.

1. PC or workstation on which the FTP client function is running.



Web Server Function <Section 16.7>

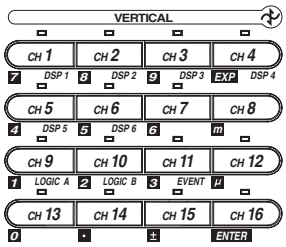
The DL750/DL750P can function as a Web server. By using the Web page of the DL750/DL750P, file transfer, monitoring of displayed waveforms, basic DL750/DL750P key control, and retrieval of waveform data are possible.



2.9 Other Useful Functions

Entering Values Directly from the NUM Keys <Section 4.2>

For items with or icon on the menu, you can press the NUM KEY and enter values using the CH1 to CH16 keys of the VERTICAL group as 0 to 9, . (decimal point), ±, m (milli), μ (micro), and ENTER keys. The gray value or character marked below and to the left of each key can be entered.



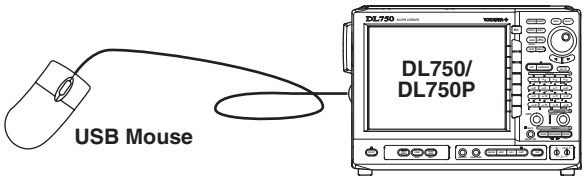
Example: When entering 1.5 mV
Press the keys in the following sequence:
CH9 (1), CH14 (.), CH6 (5), CH8 (m),
and CH16 (ENTER).

Entering Values and Strings from a USB Keyboard <Section 4.2>

You can connect a USB keyboard for entering file names, comments, and other information. In addition, the functions of each key on the front panel of the DL750/DL750P are assigned to the keys on the keyboard. Thus, the keyboard can be used to carry out operations that are the same as the key operations on the DL750/DL750P. For the key assignments, see appendix 8, “Table of Key Assignments of the USB Keyboard.”

Operations Using a USB Mouse <Section 4.2>

You can use a USB mouse to operate the DL750/DL750P as you would using the front panel keys. In addition, you can point to a desired item on a menu and click the item. This is analogous to pressing a soft key corresponding to a menu and pressing the SELECT key.



Initialization <Section 4.4>

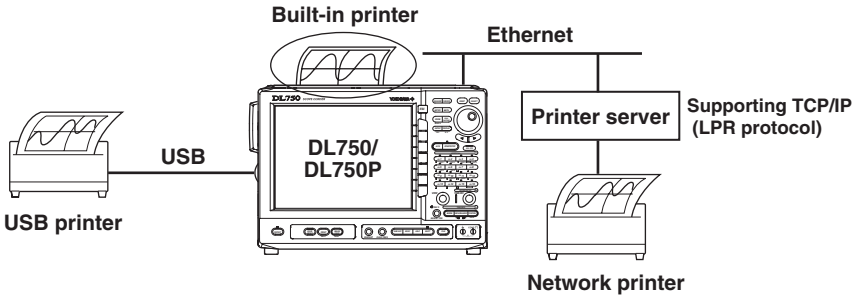
The settings of each key can be reset to their initial conditions. However, date and time settings, communication settings, and SCSI ID setting are not initialized. To reset the communication-related and SCSI ID settings to factory default, turn ON the power while holding down the RESET key. Release the RESET key after a beep sound is heard. (Date and time settings cannot be reset.)

Auto Setup <Section 4.5>

This function automatically sets the voltage axis, time axis, trigger settings, and other settings to suit the input signal. This is useful when the characteristics of the input signal are unknown. However, the auto setup function may not work depending on the input signal.

Printing the Screen Image Data <Chapter 12>

The screen image data can be printed on the built-in printer (option), USB printer, or network printer (when the Ethernet interface option is installed).



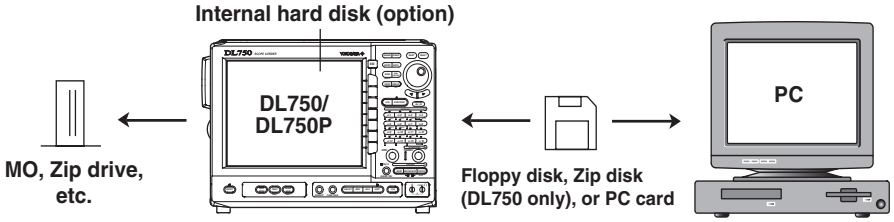
Note

There is a function that enables comments to be entered using a keyboard that appears on the screen or a USB keyboard and displayed on the screen. You can enter a comment describing the displayed waveform before printing the screen image data. This is useful in identifying the printed matter.

Saving and Loading Various Data on the Storage Medium <Chapter 13>

The DL750/DL750P allows various data to be stored to and loaded from the following storage media.

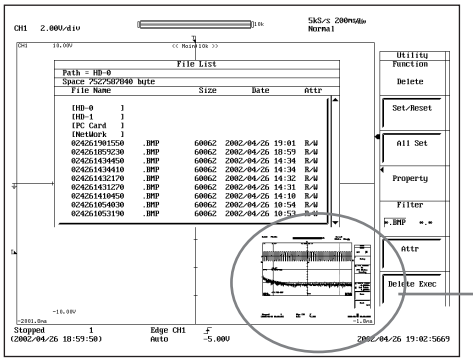
- Floppy disk, Zip disk (DL750 only), or PC card (one type is selected at the time of purchase)
- Internal hard disk (option)
- External USB storage device (MO disk, hard disk, or flash memory)
- External SCSI device (MO disk, Zip disk, etc.)
- Network drive (when the Ethernet interface option is installed)



Saving the Screen Image Data and Displaying the Thumbnails of the Stored Screen Image Data

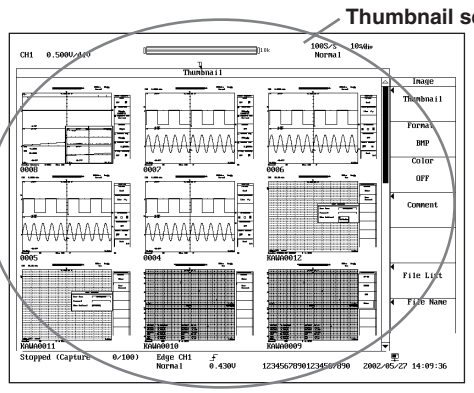
The screen image data can be stored to a specified storage medium. As necessary, a voice comment can be saved along with the data. The data can be stored in PNG, JPEG, BMP, and PostScript formats allowing the data to be pasted on a document created with a DTP application.
In addition, the thumbnails (reduced and simplified image) of the screen image data saved to the storage medium can be displayed on the DL750/DL750P screen. This feature is useful for checking the contents of the stored screen image data.

- **Thumbnail Display on the FILE Menu**

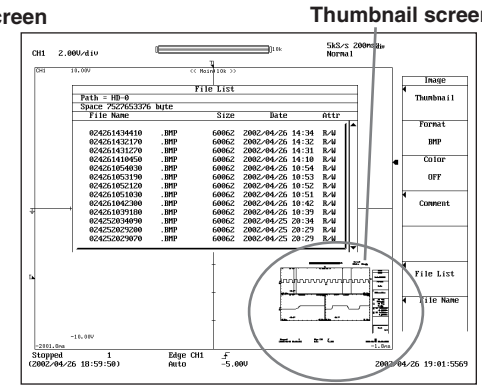


Selecting a file from the File List and pressing SELECT displays the thumbnail screen of the selected screen image data

- **Thumbnail Display on the IMAGE SAVE Menu**



Pressing the Thumbnail soft key displays a thumbnail screen of the screen image data saved to the specified format.



Selecting a file from the File List and pressing SELECT displays the thumbnail screen of the selected screen image data

Saving and Loading Setup Data, Waveform Data, and Snapshot Waveform Data

The setup data, waveform data, and snapshot waveform data can be saved to or loaded from a specified storage medium.
When a waveform that has a voice memo recorded is saved, the voice memo is saved along with the waveform data.

Saving the Results of the Automated Measurement of Waveform Parameters

The results of the automated measurement of waveform parameters can be saved to a specified storage medium.

Creating a PDF File of the Print Image (DL750P Only) <Section 13.13>

By setting the output destination in the DL750P PRINT menu to “PDF,” a PDF file of the print image (image similar to fine print (see section 12.2)) can be created. A print image of the specified range and magnification is created to the specified file name on the specified storage medium simply by pressing the PRINT key.

Voice Comment Function <Sections 3.14 and 13.19>

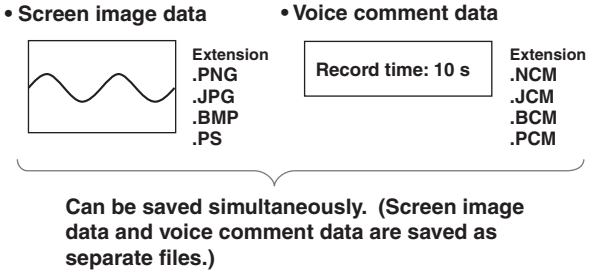
A voice comment can be attached to screen image data to be saved. The maximum length of voice comment that can be attached to a single screen image data is 10 s. The saved voice comment can be played from the File List window[1] of the IMAGE and FILE menus.
The voice comment function can perform the following operations.

Record: There are two record methods.
- Record a voice comment before saving the screen image data by pressing the PUSH switch on the earphone microphone connected to the DL750/DL750P.
- Record a voice comment by pressing a button on the dialog box that appears when the screen image data is saved.

Save: Saves the voice comment along with the screen image data.

Play: When screen image data with a voice comment is selected on the File List window[1] of the IMAGE or FILE menu, the voice comment is played along with the thumbnail display.

1. For a description of the File List window, see section 13.12, “Displaying Thumbnails of the Saved Screen Image Data.”



Note

A voice recorded when waveform acquisition is stopped becomes a voice comment.

Operating the instrument Using a Free Software Program

The instrument can be controlled from a PC using Wirepuller, a free software program, when connected via the GP-IB, USB, or Ethernet interface. The software program can be downloaded from the following Web pages.

- English version http://www.yokogawa.com/tm/tm-softdownload.htm
- Japanese version http://www.yokogawa.co.jp/tm/F-SOFT/

Connecting the DL750/DL750P and the PC via the SCSI <Section 13.18>

You can connect a PC to the SCSI of the DL750/DL750P and download the files on the internal hard disk (optional) to the PC.

You cannot upload or delete files on the internal hard disk. If you do, the internal hard disk may become unusable.

In addition, the following limitations exist.

While connected to the PC, the File List window of the DL750/DL750P may not be displayed properly. If the connected PC enters sleep, standby, or rest mode, the DL750/DL750P will not be able to access the internal hard disk. Before connecting the PC to the DL750/DL750P, disable such modes on the PC.

3.1 Handling Precautions

Safety Precautions

If you are using this instrument for the first time, make sure to thoroughly read the "Safety Precautions" given on page Part 1:viii to Part 1:x.

Do not Remove the Case

Do not remove the case from the instrument. Some parts of the instrument use high voltages, which are extremely dangerous. For internal inspection or adjustment, contact your nearest YOKOGAWA dealer.

In Case of Irregularity

If you notice smoke or unusual odors coming from the instrument, immediately turn OFF the power and unplug the power cord. If such an irregularity occurs, contact your dealer or the nearest YOKOGAWA representative.

Power Cord

Nothing should be placed on the power cord; also, it should be kept away from any heat sources. When unplugging the power cord from the outlet, never pull by the cord itself. Always hold and pull by the plug. If the power cord is damaged, contact your dealer for replacement. Refer to page Part 1:v for the part number when placing an order.

General Handling Precautions

Never Place Anything on Top of the Instrument

Never place other instruments or objects containing water on top of the instrument, otherwise a breakdown may occur.

Do not Cause Shock to the Input Section

Shock to the input connectors or probes may turn into electrical noise and enter the instrument via the signal lines.

Do not Damage the LCD

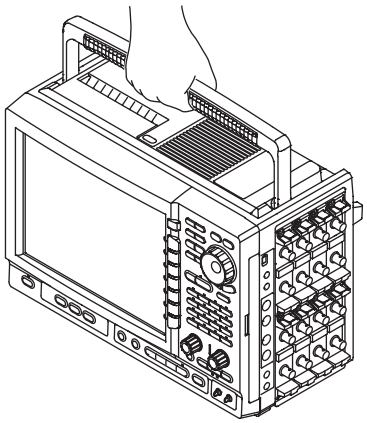
Since the LCD screen is very vulnerable and can be easily scratched, do not allow any sharp objects near it. Also it should not be exposed to vibrations and shocks.
When not using the instrument for a long period, unplug the power cord from the AC outlet.

When the Instrument Is not going to Be Used for a Long Period

Unplug the power cord from the AC outlet.

When Moving the Instrument

Remove the power cord and connecting cables. Always carry the instrument by the handles as shown below or carry it with both hands.



Cleaning

When cleaning the case or the operation panel, first remove the power cord from the AC outlet. Then, wipe with a dry, soft, clean cloth. Do not use volatile chemicals such as benzene or thinner for cleaning, as this may lead to discoloration or deformation.

3.2 Installing the Instrument

Installation Conditions

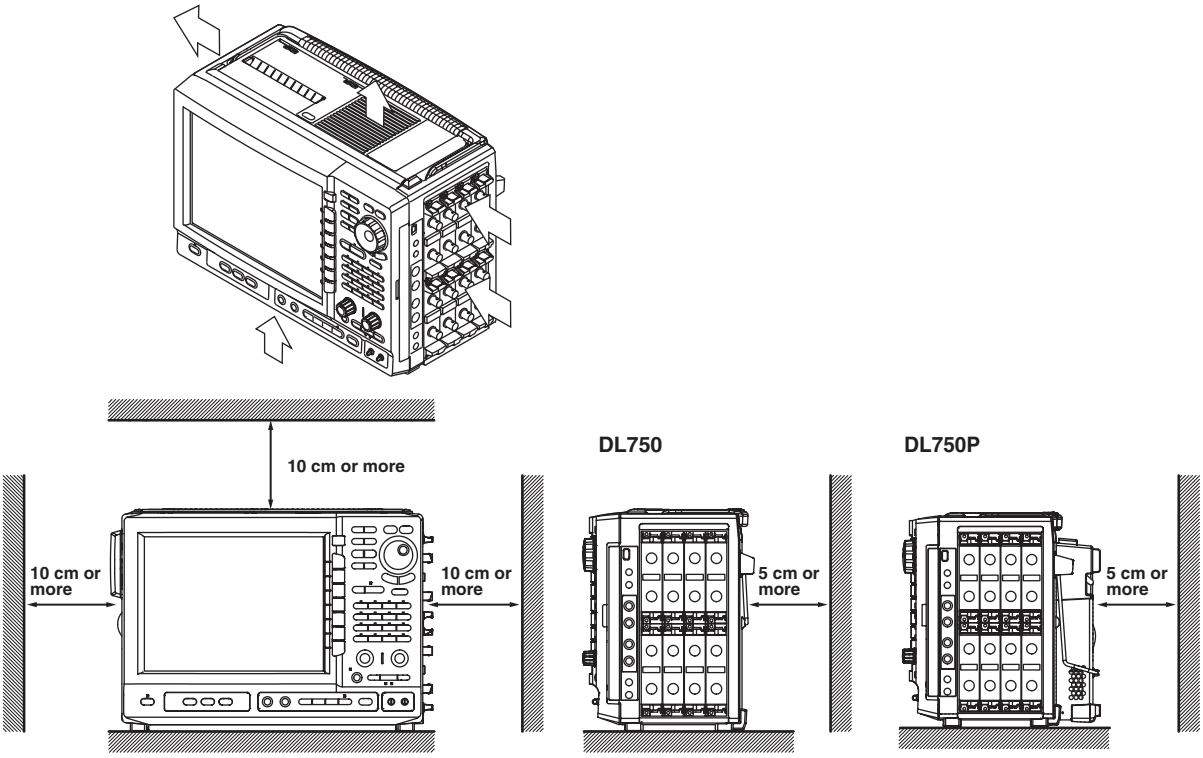
Install the instrument in a place that meets the following conditions.

Flat, Even Surface

Set the instrument in the proper direction (see page 3-4) and in a level and stable place. Note that the instrument can be tilted on the stand if the instrument is set with the rear panel facing down. If placed in an uneven or unstable place, printing quality may deteriorate.

Well-Ventilated Location

Vent holes are situated on the bottom side of the instrument. In addition, vent holes for the cooling fans are also situated in the left side and the bottom. To prevent internal overheating, allow for enough space around the instrument (see the figure below) and do not block the vent and inlet holes.



When connecting the various cables or when opening or closing the built-in printer cover, take extra space in addition to the space indicated above for the operation.

Ambient Temperature and Humidity

Ambient temperature: 5 to 40°C
Ambient humidity: 20 to 85% RH (when not using the printer)
35 to 85% RH (when using the printer)
} No condensation

Note

- To ensure high measurement accuracy, operate the instrument in the 23 ± 5°C temperature range and 55 ± 10% RH.
- Condensation may occur if the instrument is moved to another place where the ambient temperature is higher, or if the temperature changes rapidly. In such cases, allow the instrument adjust to the new environment for at least an hour before using the instrument.

Do Not Install the Instrument in the Following Places.

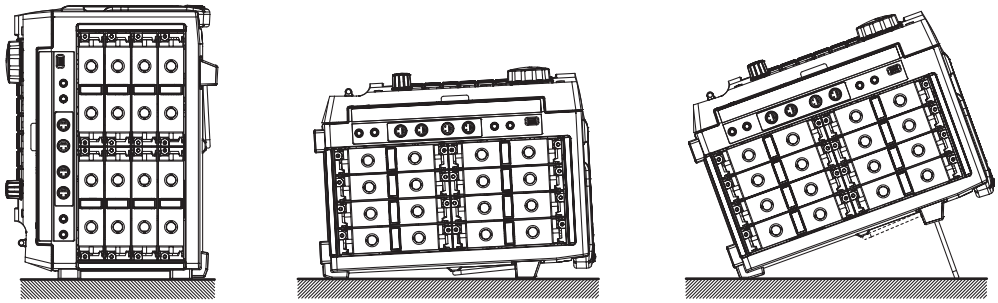
- In direct sunlight or near heat sources.
- Where an excessive amount of soot, steam, dust, or corrosive gas is present.
- Near strong magnetic field sources.
- Near high voltage equipment or power lines.
- Where the level of mechanical vibration is high.
- In an unstable place.

Installation Position

Place the instrument in a horizontal position or with the rear panel facing down. When using the stand, pull it until it locks (see the lower left figure). To retract it, press the stand backward while pressing it inward.

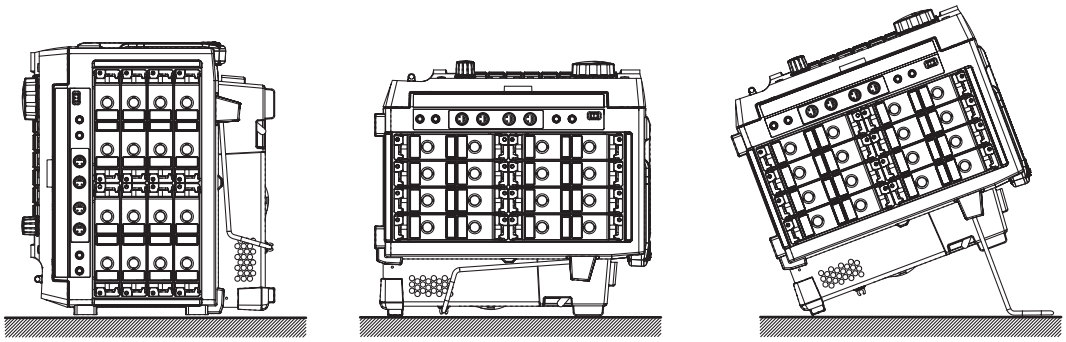
DL750

Installed horizontally **Installed with the rear panel facing down** **Installed using the stand**



DL750P

Installed horizontally **Installed with the rear panel facing down** **Installed using the stand**



CAUTION

Do not use the Zip drive when the instrument is placed on the stand, as it may damage the data on the Zip disk.

Rubber Feet

If the instrument is installed in a horizontal position as shown in the figure above, rubber stoppers can be attached to the feet to prevent the instrument from sliding. One set (four pieces) of rubber feet are included in the package.

3.3 Installing Input Modules

WARNING

- To prevent electric shock and damage to the instrument, make sure to turn OFF the power before installing or removing the input module.
- Check that the input cable is not connected to the input terminals before installing or removing the input module.
- To prevent electric shock and to satisfy the specifications, make sure to put the accessory cover plate on the slots that are not being used.
  Using the instrument without the cover plate allows the dust to enter the instrument and may cause malfunction due to the rise in temperature inside the instrument.
- If the input module happens to come out of the slot while it is in use, it may cause electric shock or cause damage to the instrument as well as the input module. Make sure to screw the input module in place at the two locations (top and bottom).
- Do not put your hand inside the slot, because there are protrusions along the module guide that may injure your fingers.
- **In Using the Modules**
  - Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
  - To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL750/DL750P.
  - To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical protection function and the mechanical protection function will not be activated.
  - Avoid continuous connection under an environment in which the allowable surge voltage may occur.
  - When using the 701250 (HS10M12) or the 701251 (HS1M16) to measure high voltage, use the isolated probe (700929), 1:1 safety cable (combination of 701901 and 701954), or the differential probe (700924).
  - Be sure to connect the GND lead of the differential probe (700924) to the functional ground terminal of the DL750/DL750P. High voltage may appear at the BNC connector of the differential probe. Be sure to connect the GND lead to the DL750/DL750P before connecting the probe to the parameter to be measured.
  - When using the 701255 (NONISO_10M12), be sure to fasten the module screws. Fastening the module screws activates the protection function and the non-isolation function. It is extremely dangerous if you do not fasten the screws. In addition, when measuring high voltage above 42 V, be sure to use the Passive Probe for the DL750/DL750P (701940)
  - The BNC part of the Passive Probe for the DL750/DL750P (701940) is made of metal. Therefore, use the probe at 42 V or less for isolated inputs (701250 (HS10M12), 701251 (HS1M16), 701260 (HV (with RMS)), 701275 (ACCL/VOLT), 701280 (FREQ), etc.) for safety reasons. (Do not connect voltage above 42 V to both the High and Low sides.) For non-isolated inputs (701255 (NONISO_10M12), etc.), fasten the module screws as described before.
  - When applying high voltage using the 701260 (HV (with RMS)), 1:1 safety cable (combination of 701901 and 701954) or the isolated probe (700929).
  - The measurement category of the 701260 (HV (with RMS)) is 400V-CATII on the low side and 700V-CATII on the high side. Use caution because the overvoltage tolerance differs between the low and high sides.
  - When applying high voltage to the 701280 (FREQ), use the isolated probe (700929).

Types of Input Modules

The following nine types are available.

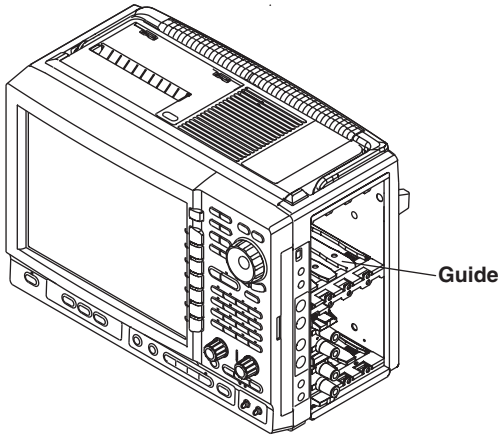
- High-Speed 10 MS/s, 12-Bit Isolation Module: 701250 (HS10M12)
- High-Speed 10 MS/s, 12-Bit Non-Isolation Module: 701255 (NONISO_10M12)
- High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS): 701260 (HV (with RMS))
- Universal (Voltage/Temp.) Module: 701261 (UNIVERSAL)
- Universal (Voltage/Temp.) Module (with AAF): 701262 (UNIVERSAL (AAF))
- Temperature, High Precision Voltage Isolation Module: 701265 (TEMP/HPV)
- Strain Module (NDIS): 701270 (STRAIN_NDIS)
- Strain Module (DSUB, Shunt-Cal): 701271 (STRAIN_DSUB)
- Acceleration/Voltage Module (with AAF): 701275 (ACCL/VOLT)
- Frequency Module: 701280 (FREQ)

Precautions to Be Taken When Installing or Removing Input Modules

- Switching the installed input module with a different module and turning ON the power initializes the settings on that channel. To save the settings, specify the destination media and save the values (see section 13.8, “Saving/Loading Setup Data”).

Installation Procedure of Modules

1. Check that the power switch on the left side panel is OFF.
2. Check the channel number indicated above the slots for installing the input modules on the right side panel of the instrument. Then, install the module along the guide.
   Holding the handles on the top and bottom of the input module, press hard until it clicks in place.
   If there is a cover plate on the slot in which to install the module, remove the cover plate, first.
3. Make sure to screw the two locations, top and bottom, of the input module firmly into place.
4. Turn ON the power switch.
5. Check to see that the correct input module name is displayed at the corresponding channel number in the overview screen. If it is not correct, remove the module according to the steps in “Removal” shown below, and reinstall the module according to steps 1 to 3 shown above.
   For the procedure in displaying the overview screen, see to section 18.4, “Checking the System Conditions (Overview).”

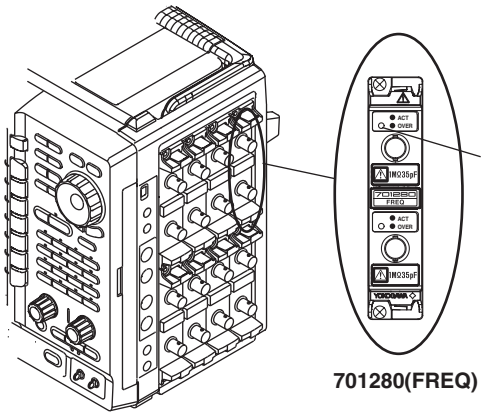


Removal

1. Check that the power switch is OFF.
2. Loosen the screws holding the input module in place.
3. Holding the handles on the top and bottom of the input module, pull out the module.

LEDs on the Frequency Module

On the front panel of the frequency module (701280 (FREQ)) are LEDs for each channel. These LEDs allow you to check the input condition of the pulse.



LED
Illuminated in green: When pulse is applied
Illuminated in red: When the input voltage level is over range.
Off: When pulse is not applied

701280(FREQ)

Note

- The LEDs on the frequency module illuminates in green when pulse is applied and red when the input voltage level is over range. It is independent of the start/stop condition of waveform acquisition of the DL750/DL750P.
- If the frequency module preset (see section 5.19) is set to “EM Pickup (electromagnetic pickup),” the LED does not illuminate in red even when the input voltage level is over range.

3.4 Connecting the Power Supply and Turning the Power Switch ON/OFF

Before Connecting the Power

Make sure that you observe the following points before connecting the power. Failure to do so may cause electric shock or damage to the instrument.

WARNING

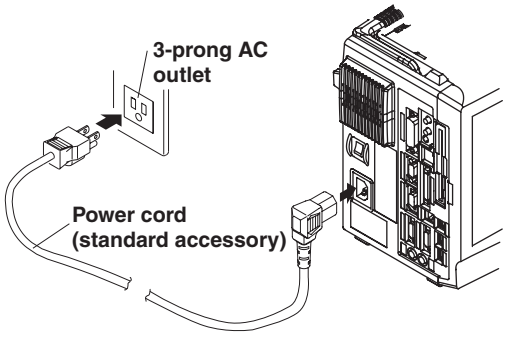
- Before connecting the power cord, ensure that the source voltage matches the rated supply voltage of the instrument and that it is within the maximum rated voltage of the provided power cord.
- Connect the power cord after checking that the power switch of the instrument is turned OFF.
- To prevent the possibility of electric shock or fire, be sure to use the power cord for the instrument that was supplied by YOKOGAWA.
- Make sure to perform protective earth grounding to prevent the possibility of electric shock. Connect the power cord to a three-pin power outlet with a protective earth terminal.
- Do not use an extension cord without protective earth ground. Otherwise, the protection function will be compromised.
- If an AC outlet that matches the power cord provided is unavailable and protective grounding cannot be furnished, do not use the instrument.

Connecting the Power Cord

1. Check that the power switch is turned OFF.
2. Connect the power cord plug to the power connector on the left side panel.
3. Connect the plug on the other end of the power cord to the outlet that meets the conditions below. The AC outlet must be of a 3-prong type with a protective earth ground terminal.

Item	
Rated supply voltage[1]	100 to 120 VAC/200 to 240 VAC
Permitted supply voltage range	90 to 132 VAC/180 to 264 VAC
Rated supply voltage frequency	50/60 Hz
Permitted supply voltage frequency range	48 to 63 Hz
Maximum power consumption	Approx. 200 VA (Reference value: 135 VA when the built-in printer is not used and 16 channels are running)

1. The DL750/DL750P can use a 100-V or a 200-V system for the power supply. The maximum rated voltage of the power cord varies depending on its type. Check that the voltage supplied to the DL750/DL750P is less than or equal to the maximum rated voltage of the provided power cord (see page Part 1:iv) before using it.



Connecting the DC Power Supply to the DC Power Supply Model (/DC)

WARNING

- Connect the DC power cord after checking that the power switch of the instrument is turned OFF. If you connect the power cord with the power switch turned ON, sparks may be emitted and can lead to fire.
- To prevent the possibility of electric shock or fire, be sure to use a power cord and power connector that YOKOGAWA specifies.
- Make sure to perform protective earth grounding to prevent electric shock.

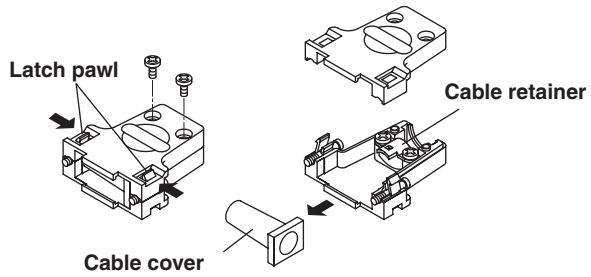
CAUTION

- There is a polarity to the DC power connector. Check the polarity when making a connection. If you have trouble connecting it, do not force it; check the connector direction.
- To prevent shorting the power supply, remove the power cord from the power supply when the power supply is not in use.

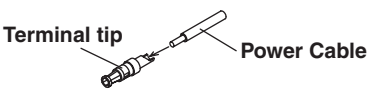
Creating the Power Cord

Create a power cord using the power connector that comes with the package. For the power cord, use a cable that is between AWG12 (conductive cross-sectional area of 3.3 mm^2) and AWG14 (conductive cross-sectional area of 2.1 mm^2) with an outer diameter less than or equal to 3.6 mm.
There are two types of terminal tips. Use the tip with a small diameter for the protective grounding terminal.

1. Remove the two screws from the DC power connector.
2. Press the latch pawl in the direction of the arrow as shown and remove the connector case. Take out the cable cover that is stored in the connector.

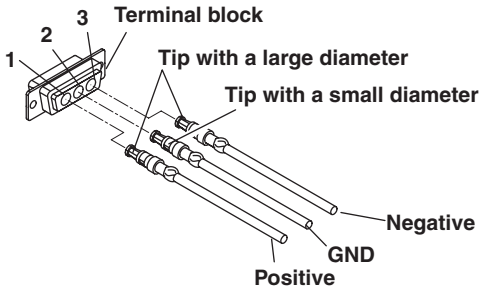


3. Remove the two cable retainer screws.
4. Run the cable through the cable cover.
5. Solder the power cable to the three terminal tips provided. Solder the protective grounding cable to the tip with the small diameter.

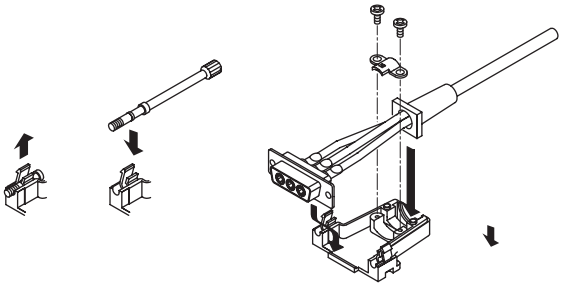


6. Insert the terminal tips into the terminal block as shown in the figure. The connector numbers and power polarities are listed below.

Terminal No.	Signal
1	Positive
2	Protective ground
3	Negative



7. Replace the attachment screws as necessary. You can remove the attachment screws by pulling the screws in the direction of the arrow.
8. Attach the cable[25,]
to the connector. Set the chip mount flange and cable cover flange in the connector case grooves. Secure the cable in place using the cable retainer.

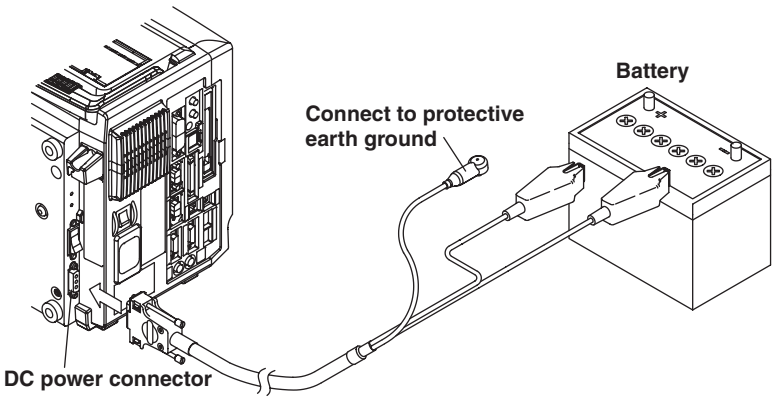


9. Put the connector case on and fasten it with screws.

Connecting to the Power Supply

Connect the power cord as shown in the figure below. The power supply must meet the following conditions:

Item	
Rated supply voltage	12 VDC
Permitted supply voltage range	10 to 18 VDC (at the DL750/DL750P connector end)
Maximum power consumption	Approx. 120 VA Max. (Reference value: 80 VA when the built-in printer is not used and 16 channels are running)



Note

- If both AC power and DC power are supplied, AC power takes precedence.
- If both AC power and DC power are supplied and AC power is cut off, the power instantaneously switches to DC power.

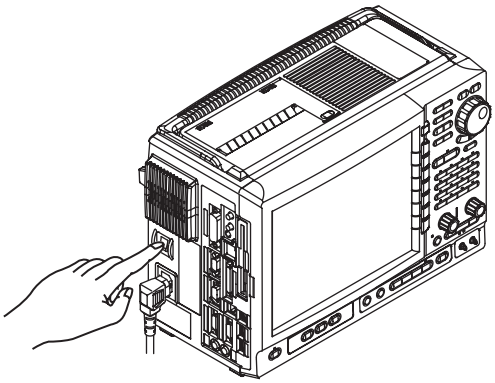
Turning ON/OFF the Power Switch

Items to Be Checked before Turning ON the Power

- The instrument is properly installed.: See section 3.2, “Installing the Instrument.”
- The power cord is properly connected.: See section 3.4, “Connecting the Power Supply.”

Turning ON/OFF the Power Switch

Pressing the power switch located on the left side panel to the “ON(|)” side, turns the power ON. Pressing it to the “OFF(O)” side turns the power OFF.



Turning ON/OFF the DC Power (/DC)

Items to Be Checked before Turning ON the Power

- The instrument is properly installed.: See section 3.2, "Installing the Instrument."
- The power cord is properly connected.: See section 3.4, "Connecting the Power Supply."

Turning ON/OFF the Power Switch

Pressing the power switch located on the left side panel to the "ON(|)" side, turns the power ON. Pressing it to the "OFF(O)" side turns the power OFF.

Note

If AC power is supplied and the main power switch to the AC power is ON, AC power is used.

Status Display of the DC Power Supply

The power supply status is indicated on the LED on the left side panel.

AC LED

LED Status	Description
Illuminated in green	Operating on AC power

DC LED

LED Status	Description
Illuminated in green	Operating on DC power (AC power is not connected) Operating on AC power, and the DC supply voltage is within the operating range (10 to 18 VDC)
Illuminated in red	Operating on DC power, and the DC supply voltage is outside the operating range
Illuminated in orange	DC power is turning ON/OFF repeatedly (internal protection circuit is tripping) Power is not supplied in this condition. This status is automatically cleared after 10 to 20 seconds.
Illuminated in red	Internal circuit operation failure. Repair is necessary.
Off	Operating on AC power, and the DC supply voltage is within the operating range (10 to 18 VDC) or the DC power is not supplied

Power Up Operation

Self-test and calibration start automatically when the power switch is turned ON. The operation takes approximately 30 seconds; if the check results are satisfactory, the normal waveform display screen will appear.

Note

- Allow at least 10 s when turning ON the power switch after turning it OFF.
- If self-test and calibration do not start when the power is turned ON, or if the normal waveform display screen does not appear, turn OFF the power switch and check the following points.
  - Check that the power cord is plugged in properly.
  - Check that the correct voltage is being supplied from the AC outlet. (See the previous page.)
  - If the power switch is turned ON while the RESET key is pressed, all settings will be reset to the factory settings. For details, See section 4.4, “Initializing Settings.”

  If the instrument still fails to power up when the power switch is turned ON after checking these points, contact your nearest YOKOGAWA dealer.
- If you repeat the operation of turning the power switch ON and OFF on the optional DC power supply model, the DL750/DL750P will stop supplying power due to the tripping of the internal protection function. If you stop the operation of turning the power switch ON and OFF for 10 to 20 seconds, the internal protection function is cleared, and the DL750/DL750P starts supplying power again. The DC power supply LED illuminates in orange while power is not being supplied.
- It may take a few seconds for the startup screen to appear.

For Accurate Measurements

- Allow the instrument to warm up for at least 30 minutes after turning ON the power switch.
- After warm-up is complete, perform calibration (see section 4.6). If the auto calibration is turned ON, the calibration is automatically executed when the T/div setting is changed or when the waveform acquisition is started.

Power Down Operation

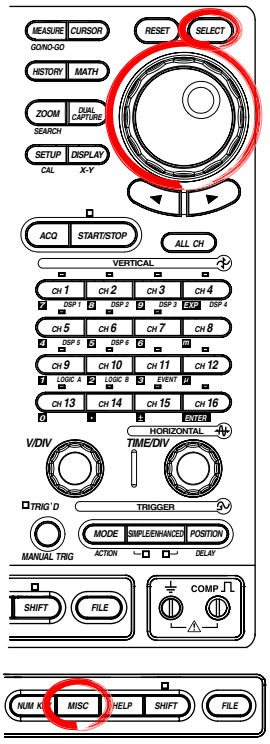
Settings made prior to turning OFF the power are retained (even if the power cord is removed). This allows display of waveforms using those saved settings the next time the power is turned ON.

Note

The settings are stored using an internal lithium battery. The battery lasts for approximately 5 years if it is used at an ambient temperature of 23°C. When the lithium battery voltage falls below a specified level, a message is displayed on the screen (error 907) when the power switch is turned ON. If this message appears frequently, the battery must be replaced quickly. The user cannot replace the battery. For battery replacement, contact your nearest YOKOGAWA dealer.

3.5 Setting the Date and Time

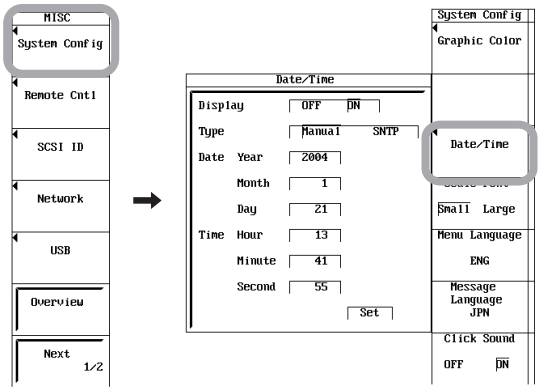
Procedure



1. Press **MISC**.
2. Press the **System Config** soft key.
3. Press the **Date/Time** soft key. The date/time setting dialog box appears.

Turning ON/OFF the Date/Time Display

4. Use the **jog shuttle** and **SELECT** to set the **Display** ON or OFF.



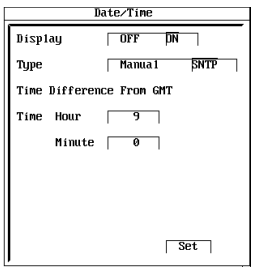
Setting the Time and Date Manually (Manual)

5. Use the **jog shuttle** and **SELECT** to set the Type to Manual.
6. Use the **jog shuttle** and **SELECT** to set the Date Year.
7. Likewise, set the Month, Day, Time Hour, Minute, and Second.
8. Use the **jog shuttle** to move the cursor to Set and press **SELECT.** The date/time specified in steps 4 and 5 are applied.

Setting the Date and Time Using the SNTP Server (Optional)

To obtain the time from the SNTP server, you must first connect to the network, and then to the SNTP server. For details, see section 16.2, "Setting up the TCP/IP," and section 16.8, "Setting the Time Difference from GMT (Greenwich Mean Time)/Setting SNTP."

9. Proceed to step 4, then use the **jog shuttle** and **SELECT** to set the Type to SNTP.



10. Use the **jog shuttle** and **SELECT** to set the time difference from GMT (Greenwich mean time).
11. Likewise, set the Minute.
12. Use the **jog shuttle Set** to move the cursor to Set.
13. Press **SELECT** to obtain the time from the SNTP server. The time and date calculated from the entered GMT time difference is set.

Explanation

Date (Year/Month/Date)

Set the year, month and day.

Time (Hour/Minute/Second)

Set the time using a 24-hour clock.

Setting the Time Using the SNTP Server

You can use the SNTP server time to set the date and time on the instrument.
This function is available on models with the Ethernet interface installed.
For information on SNTP and GMS, see section 16.8, "Setting the Time Difference from GMT (Greenwich Mean Time)/Setting SNTP."
The difference from GMT set here is linked to the setting in section 16.8, "Setting the Time Difference from GMT (Greenwich Mean Time)/ Setting SNTP."

Note

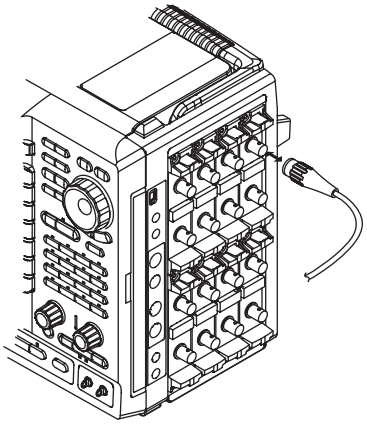
- The date and time information is backed up with the internal lithium battery even if the power is turned OFF.
- Leap year information is also retained.
- If you are using the Web server function (when the Ethernet interface option is installed), you must set the time offset from GMT (Greenwich Mean Time) in addition to the date and time. For the setup procedure, see section 16.8.

3.6 Connecting Probes

Connecting Probes

Connect the probes (or other input cables such as BNC cables) to any of the input terminals of the following modules. The input impedance is 1 MΩ±1% and approximately 35 pF.

- High-Speed 10 MS/s, 12-Bit Isolation Module: 701250 (HS10M12)
- High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module: 701251 (HS1M16)
- High-Speed 10 MS/s, 12-Bit Non-Isolation Module: 701255 (NONISO_10M12)
- High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS): 701260 (HV (with RMS))
- Acceleration/Voltage Module (with AAF): 701275 (ACCL/VOLT)
- Frequency Module: 701280 (FREQ)



WARNING

- When connecting the item to be measured, be sure to turn OFF the power to the item. Connecting or disconnecting the measuring lead while the item being measured is turned ON is very dangerous.
- **In Using the Modules**
  - Do not apply input voltage exceeding the maximum input voltage, withstand voltage, or allowable surge voltage.
  - To prevent the possibility of electric shock, be sure to furnish protective earth grounding of the DL750/DL750P.
  - To prevent the possibility of electric shock, be sure to fasten the module screws. Otherwise, the electrical protection function and the mechanical protection function will not be activated.
  - Avoid continuous connection under an environment in which the allowable surge voltage may occur.
  - Use only specified cables. Using cables that do not meet the safety specifications is extremely dangerous (especially when using high voltages (42 V or higher).
  - When using the 701250 (HS10M12) or the 701251 (HS1M16) to measure high voltage, use the isolated probe (700929), 1:1 safety cable (combination of 701901 and 701954), or the differential probe (700924).
  - When applying high voltage using the 701260 (HV (with RMS)), 1:1 safety cable (combination of 701901 and 701954) or the isolated probe (700929).

- The BNC part of the Passive Probe for the DL750/DL750P (701940) is made of metal. Therefore, use the probe at 42 V or less for isolated inputs (701250 (HS10M12), 701251 (HS1M16), 701260 (HV (with RMS)), 701275 (ACCL/VOLT), 701280 (FREQ), etc.) for safety reasons. (Do not connect voltage above 42 V to both the High and Low sides.) For non-isolated inputs (701255 (NONISO_10M12), etc.), fasten the module screws.
- The measurement category of the 701260 (HV (with RMS)) is 400V-CATII on the low side and 700V-CATII on the high side. Use caution because the overvoltage tolerance differs between the low and high sides.
- When applying high voltage to the 701280 (FREQ), use the isolated probe (700929).

• **In Using the High Voltage Differential Probes**
Be sure to connect the GND lead of the differential probe (700924/700925) to the functional ground terminal on the right side panel of the DL750/DL750P. Otherwise, high voltage may appear at the BNC connector making it dangerous.

• Applying a voltage exceeding the value indicated below may damage the input section. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.

  • **High-Speed 10 MS/s, 12-Bit Isolation Module (701250)**
  Maximum input voltage (at a frequency of 1 kHz or less)
    - Combined with the isolated probe 700929 (10:1)[1]
      600 V (DC+ACpeak)
    - Safety cable (1:1) (combined with 701901+701954)[5] or direct input[9]
      250 V (DC+ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
    - Combined with the isolated probe 700929 (10:1)[2] or safety cable (1:1) (combined with 701901+701954)[8]
      400 Vrms (CAT I), 300 Vrms (CAT II)
    - Direct input[10]
      42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)

  • **High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module (701251)**
  Maximum input voltage (at a frequency of 1 kHz or less)
    - Combined with the isolated probe 700929 (10:1)[1]
      600 V (DC+ACpeak)
    - Safety cable (1:1) (combined with 701901+701954)[5] or direct input[9]
      140 V (DC+ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
    - Combined with the isolated probe 700929 (10:1)[2] or safety cable (1:1) (combined with 701901+701954)[8]
      400 Vrms (CAT I), 300 Vrms (CAT II)
    - Direct input[10]
      42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)

  • **High-Speed 10 MS/s, 12-Bit Non-Isolation Module (701255)**
  This module is non-isolated. Be sure to fasten the module screws when measuring a voltage above 42 V on this module. In addition, use the dedicated non-isolated passive probe (10:1) (701940).
  Maximum input voltage (at a frequency of 1 kHz or less)
    - Combined with the passive probe (701940) (10:1)
      600 V (DC+ACpeak)
    - Direct input[9]
      250 V (DC+ACpeak)

- **High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS) (701260)**
  Maximum input voltage (at a frequency of 1 kHz or less)
  - Combined with the isolated probe 700929 (10:1)[1]
    1000 V (DC+ACpeak)
  - Safety cable (1:1) (combined with 701901+701954)[5] or direct input[9]
    850 V (DC+ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
  - Combined with the isolated probe 700929 (10:1)
    1000 Vrms (CAT II) on the H side[3], 400 Vrms (CAT II)[4] on the L side
  - Safety cable (1:1) (combined with 701901+701954)
    700 Vrms (CAT II) on the H side[6], 400 Vrms (CAT II) on the L side[7]
  - Direct input[10]
    42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)

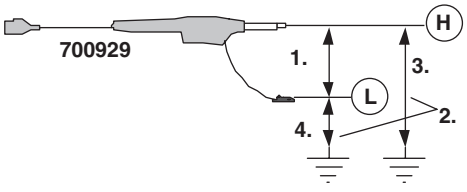
- **701275 (ACCL/VOLT)**
  Maximum input voltage (at a frequency of 1 kHz or less)
  - Combined with the passive probe (701940) (10:1)[11] or direct input[9]
    42 V (DC+ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
  - Combined with the passive probe (701940) (10:1)[12] or direct input[10]
    30 Vrms (CAT I and CAT II)

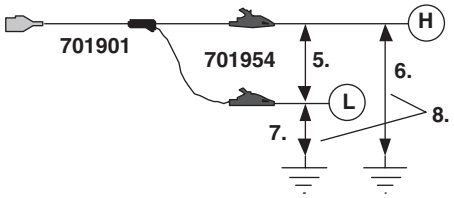
- **701280 (FREQ)**
  Maximum input voltage (at a frequency of 1 kHz or less)
  - Combined with the isolated probe 700929 (10:1)[1]
    420 V(DC+ACpeak)
  - Safety cable (1:1) (combined with 701901+701954)[5] or direct input[9]
    42 V (DC+ACpeak)

  Maximum allowable common mode voltage (at a frequency of 1 kHz or less)
  - Combined with the isolated probe 700929 (10:1)[2]
    300 Vrms (CAT I and CAT II)
  - Safety cable (1:1) (combined with 701901+701954)[8] or direct input[10]
    30 Vrms (CAT I and CAT II)

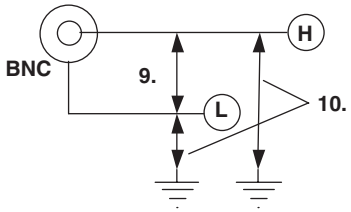
Combined with the 700929



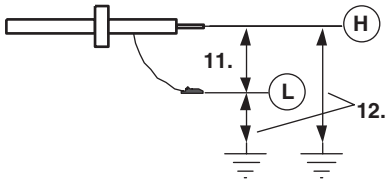
Combined with the 701901+701954



Direct input
(cable not complying with the safety standard)



Combined with the 10:1 Passive Probe (701940)



Precautions to Be Taken When Connecting Probes

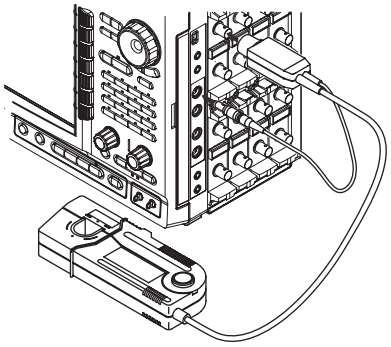
- When connecting a probe to the instrument for the first time, perform phase correction of the probe as described in section 3.7, “Compensating the Probe (Phase Correction).” Failure to do so will cause unstable gain across different frequencies, thereby preventing correct measurement. Make the phase correction on each channel to which the probe is to be connected.
- You cannot perform phase correction of the probe on the frequency module (701280(FREQ)). Perform phase correction of the probe on another module before connecting the probe to the 701280(FREQ).
- If the object to be measured is connected to the instrument directly, without using a probe, a correct measurement cannot be performed due to the input impedance.
- Precautions to Be Taken When Using Voltage Probes Other Than Isolated Probes (700929)
  - Correct measured values cannot be displayed if the probe’s attenuation is not 1:1, 10:1, 100:1, or 1000:1.
- Follow the instructions given in section 5.6, “Setting the Probe Type” to set the probe attenuation (type) to match the actual value using the soft key menu. If they do not match, measured values cannot be read correctly.

Connecting Current Probes

When using current probes made by YOKOGAWA*, use the probe power supply (optional) on the right side panel of the DL750/DL750P.

* Current probes made by YOKOGAWA: 700937, 701930, 701931, and 701933

For details on the connection procedure, see the manual that came with the current probe.

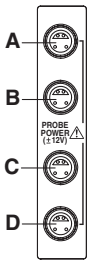


CAUTION

Do not use the probe power supply terminals (optional) on the right side panel of the DL750/DL750P for purposes other than supplying power to the current probes. Also, be sure to use only the number of probes allowed. Otherwise, the DL750/DL750P or the devices connected to them may get damaged.

Precautions to Be Taken When Using Current Probes

When connecting the current probe to the probe power supply terminal on the right side panel, make sure that the current does not exceed the range shown below. Otherwise, the DL750/DL750P operation may become unstable due to the activation of the excessive current protection circuit of the power supply.



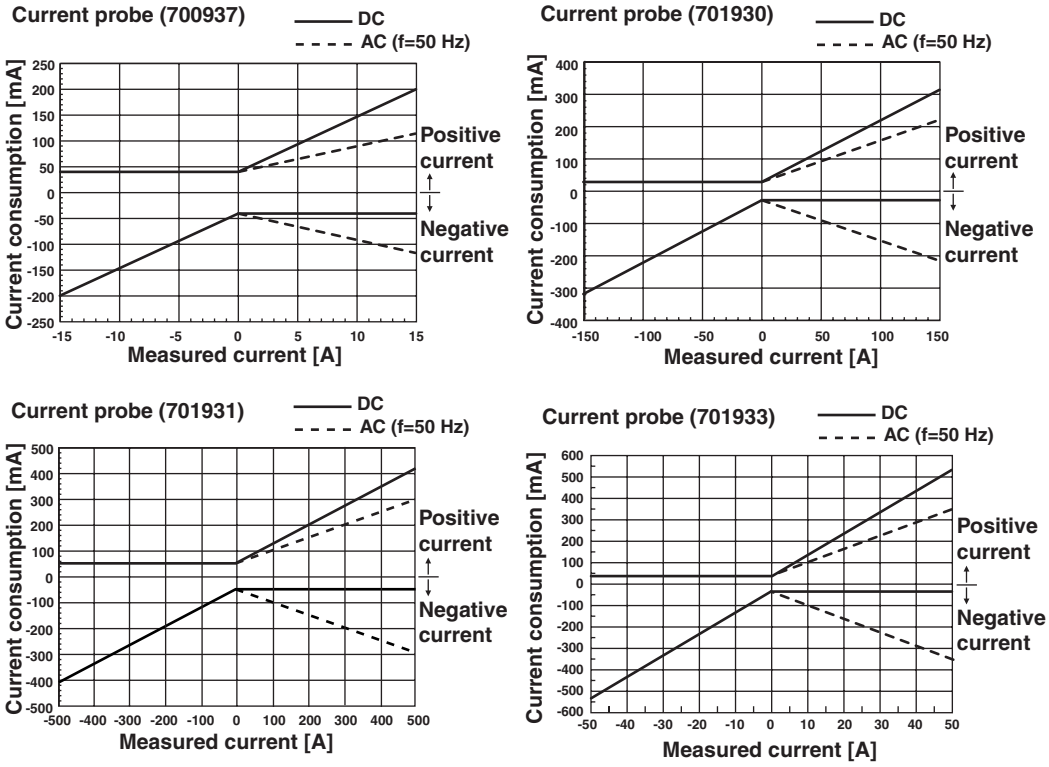
When each terminal is assigned names A through D

(Total current consumption of A through D) ≤ 800 mA

Specifications of the Probe Power Supply Terminals (Optional)

Item	
Number of probes that can be used	4
Probes that can be used	Current probe (700937, 701930, 701931, and 701933)
Number of current probes that can be used	700937 (15 A): Up to 4 701930 (150 A): Up to 2 701931 (500 A): 1 701933 (30 A): Up to 2
Supply voltage	±12 V 2 outputs (up to a total of 800 mA)

When using the current probe, the number of probes that can be used is limited by the current generated by the device under measurement (current measured by the current probe). The characteristics of the measured current versus the current consumption of an active probe that can be connected to the DL750/DL750P are shown below.

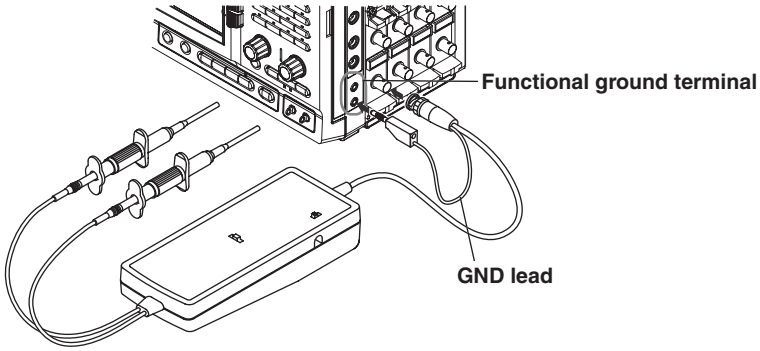


For details on the usage conditions of each probe, see "Relationship between the current being measured and probe's current consumption" on the following Web page.

http://www.yokogawa.com/tm/probe/

Connecting Differential Probes (700924)

When using differential probes (700924) made by YOKOGAWA, connect the BNC output connector to the input terminal of the oscilloscope. In addition, be sure to connect the GND lead to the functional ground terminal of the DL750/DL750P. If necessary, use the auxiliary grounding lead extension. A measurement of 1400 Vpeak is possible by connecting the GND lead to the DL750/DL750P.
For details on the connection procedure, see the manual that came with the differential probe.



WARNING

In Using the High Voltage Differential Probes

Be sure to connect the GND lead of the differential probe (700924/700925) to the functional ground terminal on the right side of the DL750/DL750P.
Otherwise, high voltage may appear at the BNC connector making it dangerous.
Be sure to connect the GND lead to the DL750/DL750P before connecting the probe to the item to be measured.

3.7 Compensating the Probe (Phase Correction)

When making measurements using a probe on the following modules, be sure to perform phase correction of the probe first.

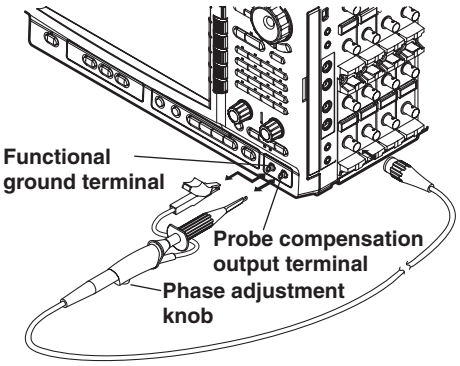
- High-Speed 10 MS/s, 12-Bit Isolation Module: 701250 (HS10M12)
- High-Speed High-Resolution 1 MS/s, 16-Bit Isolation Module: 701251 (HS1M16)
- High-Speed 10 MS/s, 12-Bit Non-Isolation Module: 701255 (NONISO_10M12)
- High-Voltage 100 kS/s, 16-Bit Isolation Module (with RMS): 701260 (HV (with RMS))
- Acceleration/Voltage Module (with AAF): 701275 (ACCL/VOLT)
- Frequency Module: 701280 (FREQ)

CAUTION

Never apply an external voltage to the probe compensation output terminal, as damage to the instrument may result.

Procedure

1. Turn ON the power switch.
2. Connect the probe to the input terminal to which the signal is to be applied.
3. Connect the probe's tip to the probe compensation output terminal on the front panel and connect the earth wire to the functional earth terminal.
4. Perform auto setup according to the procedure described in section 4.5, "Performing Auto Setup."
5. Insert a flat-head screwdriver to the phase adjustment knob and turn the variable capacitor to make the displayed waveform a correct rectangular wave.



Explanation

Necessity of Phase Correction of the Probe

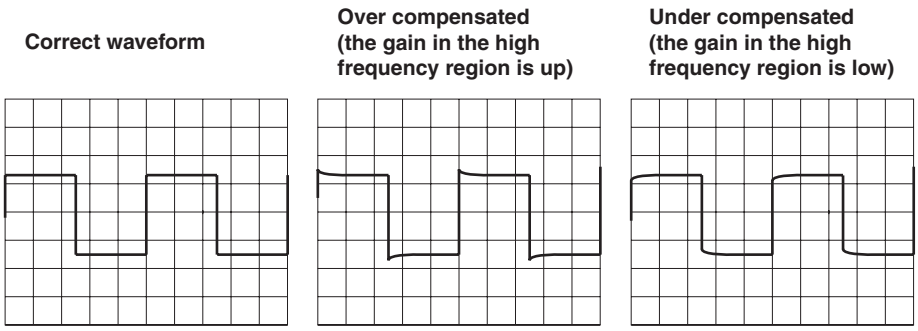
If the input capacity of the probe is not within the adequate range, the gain across different frequencies will not be uniform. Consequently, waveforms cannot be displayed correctly. In addition, the input capacitance varies depending on the probe. Thus, the variable capacitor (trimmer) provided on the probe must be adjusted. This adjustment is called phase correction.

When using the probe for the first time, make sure to perform phase correction. Furthermore, the appropriate input capacitance varies according to which channel is used, so probe compensation is required when the probe is switched from one channel to another.

Compensation Signal

The COMP signal output terminal outputs the following rectangular wave signal.
Frequency: 1 kHz±1%
Amplitude: 1 V±10%

Differences in the Waveform Due to the Phase Correction of the Probe



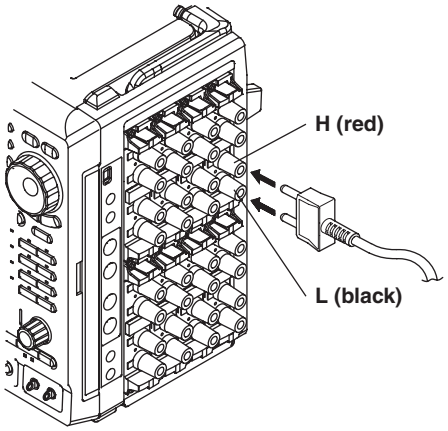
Precautions to Be Taken When Using the Probe on the Frequency Module (701280 (FREQ))

You cannot perform phase correction of the probe on the frequency module. When connecting a probe to the frequency module, perform phase correction of the probe on another module beforehand.

3.8 Connecting Measuring Leads

Connecting Measuring Leads

Connect measuring leads of bipolar banana plug terminal to the input terminal (binding post terminal) when measuring the voltage on the 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), or 701265 (TEMP/HPV) as shown below.

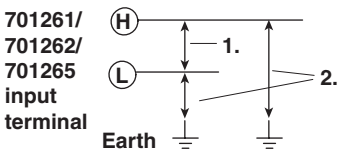


WARNING

- When connecting the item to be measured, make sure to turn OFF the power to the item. Connecting or disconnecting the measuring lead while the item being measured is turned ON is very dangerous.
- To prevent electric shock, make sure to use the measuring lead suitable for the voltage range being measured on the input terminals of the 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), or 701265 (TEMP/HPV).
- Applying a voltage exceeding the value indicated below may damage the input section. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.

  For 701261, 701262, or 701265

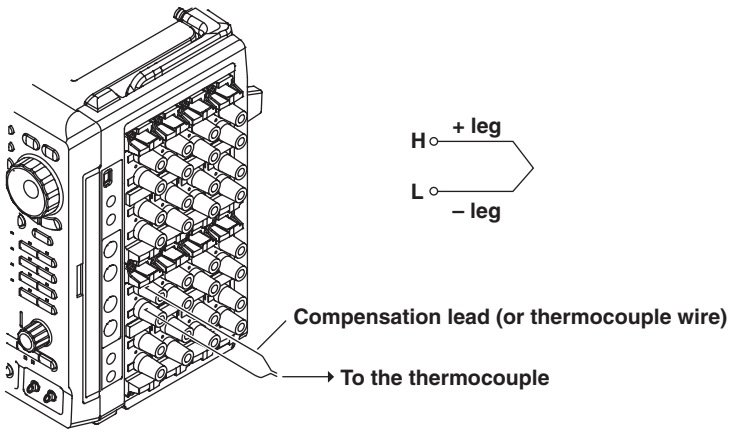
  Maximum input voltage (across the input terminals, H and L[1], at a frequency of 1 kHz or less)
  42 V (DC+ACpeak)
  Maximum allowable common mode voltage (across the input terminals, H or L, and earth[2], at a frequency of 1 kHz or less)
  42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)
- Do not connect a plug-in type terminal with exposed conducting parts to the input terminal to be used as a measuring lead. It is very dangerous, if the connector comes loose.



3.9 Connecting Thermocouples

Connecting Thermocouples

If you are connecting the compensation lead of the thermocouple to the input terminal (binding post terminal) of the 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), or 701265 (TEMP/HPV), loosen the terminal knob, pass the lead through the terminal, and tighten the knob.



CAUTION

- The 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), or 701265 (TEMP/HPV) is isolated from the DL750/DL750P. However, applying a voltage exceeding the value below may damage the input section. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.
  Maximum input voltage (across the input terminals, H and L, at a frequency of 1 kHz or less)
  42 V (DC+ACpeak)
  Maximum allowable common mode voltage (across the input terminal L and earth at a frequency of 1 kHz or less)
  42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)
- Correct measurements cannot be made if the positive and negative legs of the thermocouple are reversed.
- Immediately after connecting the thermocouple, the heat balance may be disturbed at the input terminal section and may cause measurement errors. Therefore, wait about ten minutes before making a measurement.
- In an environment where the air from the air conditioning is directly applied to the input terminals or where there are effects from a heat source, the heat balance may be disturbed at the input terminal section and cause measurement errors.
  When making measurements in this type of environment, take preventive measures such as changing the position.

3.10 Connecting a Bridge Head (Only on Strain Modules)

Strain is measured by connecting a strain gauge bridge (bridge head) or a strain gauge transducer to the strain module.
This section will mainly describe the procedures and precautions related to the connection of the bridge head (Model 701955/701956/701957/701958). For the connection of other strain gauge bridges or strain gauge transducers, see the respective manuals.

CAUTION

Only connect a strain gauge bridge (bridge head) or a strain gauge transducer to the strain module. Connecting other devices or applying a voltage that exceeds the values indicated below to the strain module may damage the input section.

- Maximum input voltage (between Input+ and Input–)
  10 V (DC+ACpeak)
- Maximum allowable common mode voltage (between each terminal and earth ground)
  42 V (DC+ACpeak) (CAT I and CAT II, 30 Vrms)

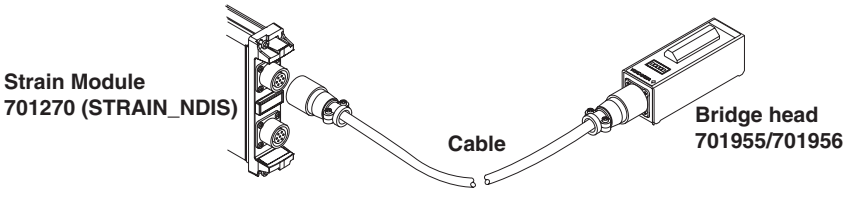
Connecting the Strain Gauge

The bridge head (701955/701956/701957/701958) supports six types of connection methods: single-gauge method, single-gauge three-wire method, adjacent-side two-gauge method, opposite-side two-gauge method, opposite-side two-gauge three-wire method, and four-gauge method. For details, see the manual that came with the bridge head (701955/701956/701957/701958).
If you are using a strain gauge bridge or a strain gauge transducer other than the bridge head (701955/701956/701957/701958), see the respective manuals.

Connecting the Strain Module and the Bridge Head

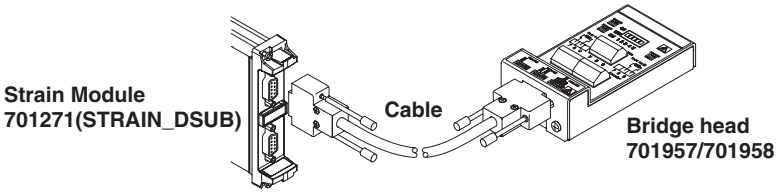
When Using the Strain Module (701270) and the Bridge Head (701955/701956)

Using the cable that came with the bridge head (701955/701956), connect the Strain Module (701270) and the bridge head.



When Using the Strain Module (701271) and the Bridge Head (701957/701958)

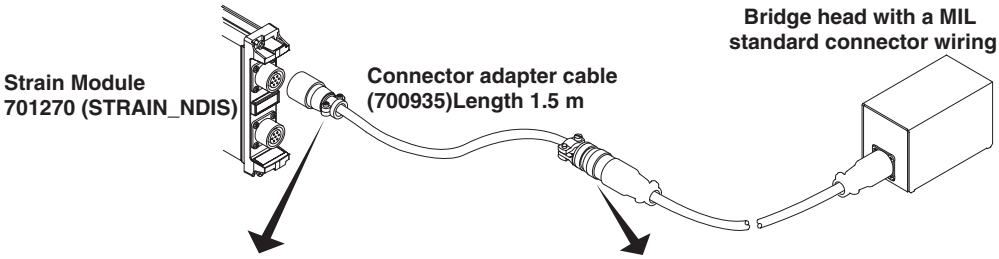
Using the cable that came with the bridge head (701957/701958), connect the Strain Module (701271) and the bridge head.



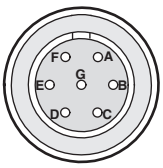
When Using a Bridge Head with a MIL Standard (MIL-C-26482) Connector Wiring

The connector on the Strain Module (701270) is a NDIS connector[1]. Use a connector adapter cable (700935) by YOKOGAWA to make a MIL-NDIS conversion and connect to the Strain Module (701270).

1. A connector recommended by JSNDI (The Japanese Society for Non-destructive Inspection)

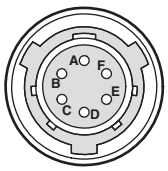


Pin arrangement of an NDIS connector



A: Bridge+ (positive bridge voltage)
B: Input- (negative measurement signal)
C: Bridge- (negative bridge voltage)
D: Input+ (positive measurement signal)
E: Floating common
F: Sense+
(positive bridge voltage sensing)
G: Sense–
(negative bridge voltage sensing)

Pin arrangement of a MIL standard connector



A:Signal+
B:Signal–
C:Excitation+
D:Excitation–
E:NC (no connection)
F:NC (no connection)

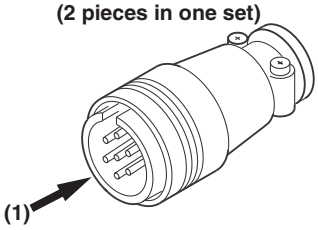
Terminal relationship

NDIS		MIL
A	——	C
B	——	B
C	——	D
D	——	A

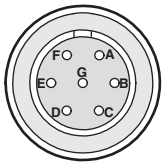
When Using the A1002JC Connector by YOKOGAWA

You can create your own cable by using the YOKOGAWA A1002JC connector that is compatible with the strain module and use the cable to connect a strain gauge bridge or a strain gauge transducer to the strain module.

A1002JC NDIS connector
(2 pieces in one set)



Pin arrangement
When viewed along arrow (1)



A:Bridge+ (positive bridge voltage)
B:Input- (negative measurement signal)
C:Bridge- (negative bridge voltage)
D:Input+ (positive measurement signal)
E:Floating common
F:Sense+ (positive bridge voltage sensing)
G:Sense- (positive bridge voltage sensing)

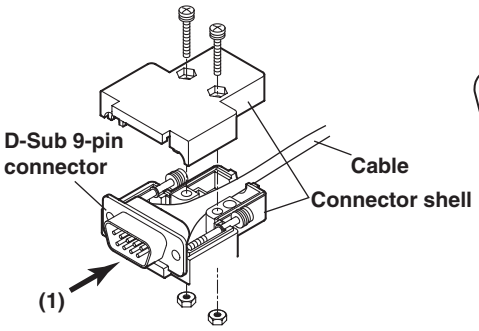
Note

- The connector shell is connected to the case potential (earth) of the DL750/DL750P.
- Signals A through G are isolated inside the module.
- When creating your own cable, we recommend that you use a shielded cable in order to shut out external noise.

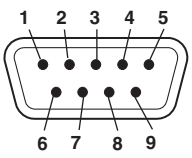
CAUTION

Take extra care when wiring the connectors. If the wiring is shorted or incorrect, it can damage the DL750/DL750P or other instruments that are connected to the DL750/DL750P.

Pin Arrangement of the D-Sub Connector



When viewed along arrow (1)



1:Floating common
2:Sense- (positive bridge voltage sensing)
3:Shuntcal- (negative shunt signal)
4:Shuntcal+ (positive shunt signal)
5:Sense+ (positive bridge voltage sensing)
6:Bridge- (negative bridge voltage)
7:Input- (negative measurement signal)
8:Input+ (positive measurement signal)
9:Bridge+ (positive bridge voltage)

3.11 Connecting Logic Probes

CAUTION

- Applying a voltage exceeding the value indicated below may damage the logic probe or the DL750/DL750P. If the frequency is above 1 kHz, damage may occur even when the voltage is below this value.
  Maximum input voltage (at a frequency of 1 kHz or less)
  High-Speed Logic Probe (700986): 42 V (DC+ACpeak)
  Isolated Logic Probe (700987): 250 Vrms (except ACpeak is less than or equal to 350 V and DC is less than 250 V)
- On the high-speed logic probe, the 8 input lines on each POD have a common earth. In addition, the earth for the instrument and the earth for each POD are also common. Do not connect inputs which have different common voltages, as doing so may cause damage to the DL750/DL750P, logic probe, or other connected instruments.
- Each input terminal of the isolated logic probe is isolated from all other input terminals and the isolated logic probe is isolated from the DL750/DL750P.
- Make sure to turn off the instrument before connecting or disconnecting the 26-pin connector from the logic input connector.
- Do not stack the isolated logic probes during use. Also, allow enough space around the probes to avoid a temperature increase inside the probes.

Logic Input Connector

Connect the logic probe (700986 or 700987) to either of the logic signal input connectors (marked LOGIC A and LOGIC B).

About the Logic Probe

Types of Logic Probes

There are two types of probes available for connecting to the logic input connector of the DL750/DL750P.

- High-Speed Logic Probe (700986)
- Isolated Logic Probe (700987)

Types of Measuring Leads That Can Be Used

Use the following leads to connect to the point of measurement.

- **Types of Connecting Leads That Can Be Used on the High-Speed Logic Probe (700986)**
  The following two types are available.
  - Connecting lead (alligator clip, parts No. B9879PX)
    This lead is mainly used for connecting contact circuits. The lead consists of 8 signal lines (red) and 8 earth lines (black).
  - Connecting lead (IC clip, parts No. B9879KX)
    This lead is mainly used for connecting electronic circuits. The lead consists of 8 signal lines (red) and 2 earth lines (black).

- **Types of Measuring Leads That Can Be Used on the Isolated Logic Probe (700987)**

  Use the following measuring lead.

  - For measuring voltages of 42 V or more: Measuring lead for isolation logic (758917)

    An alligator adapter (758922), alligator adapter (758929), or alligator clip (dolphin type, 701954) is needed to make measurements.

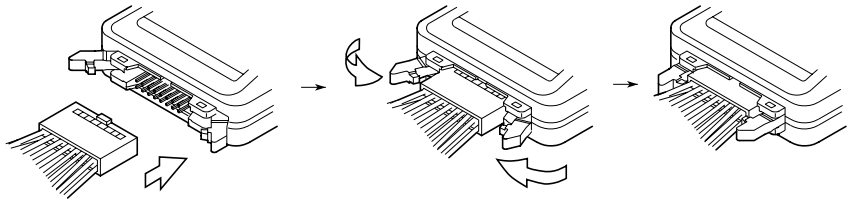
Note

Do not alter the connecting leads. Doing so may cause the leads from satisfying the specification.

Connecting Logic Probes

High-Speed Logic Probe (700986)

1. Attach the accessory connecting lead (IC clip or alligator clip) to the logic probe, and lock the connector by clamping the lever inwards. To release the connecting lead from the logic probe, pull both levers outwards. Proceed to step 3.

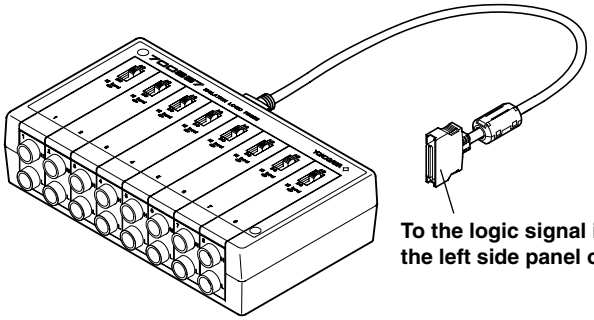


Isolated Logic Probe (700987)

1. Connect the measuring lead to the input terminal of the logic probe.
2. Set the input switch. The threshold level is set to 50 VAC ± 50% (Hi: 80 to 250 VAC, Lo: 0 to 20 VAC) and 6 V ± 50% (Hi: 10 to 250 VDC, Lo: 0 to 3 VDC) when set to “AC” and “DC,” respectively.

Connecting the Logic Probe to the Logic Signal Input Connector

3. Turn OFF the DL750/DL750P.
4. Connect the end with the 26-pin connector (clamp filter with ferrite core, parts No. A1190MN) of the logic probe to the logic signal input connector of the DL750/DL750P
5. Turn ON the DL750/DL750P.



To the logic signal input connector on the left side panel of the DL750/DL750P

Note

- Each bit is displayed as “L level” when the logic probe is not connected to the instrument.
- For the specifications of the logic probe, see section 19.13, “Logic Probe Specifications.”
- The logic input display is turned OFF by default. For the procedure in turning ON/OFF the display, see section 5.1, “Turning Channels ON/OFF.”

3.12 Connecting Acceleration Sensors

An acceleration sensor is connected when measuring acceleration on the 701275 (ACCL/VOLT). For a details on acceleration sensors, see the respective manuals.

CAUTION

- Applying a voltage that exceeds the values indicated below to the 701275 (ACCL/VOLT) may damage the input section.
  Maximum input voltage: 42 V (DC+ACpeak)
- When connecting acceleration sensors, do it without the bias current being supplied to the sensor. Otherwise, damage to the internal circuitry of the acceleration sensors may result.
- The DL750/DL750P only supports acceleration sensors that are driven by constant current with driving current of 4mA and driving voltage of 22 V.

Connecting Acceleration Sensors

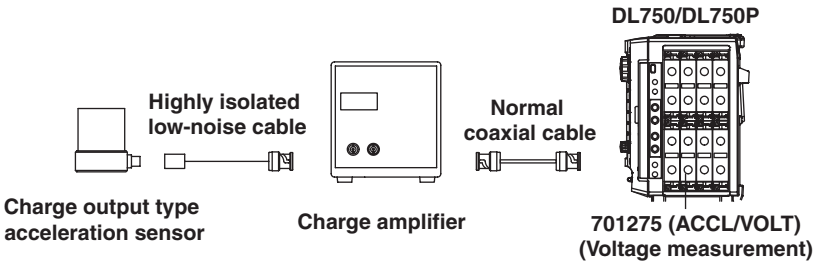
When Connecting Built-in Amplifier Type Acceleration Sensors

The DL750/DL750P allows built-in amplifier type (low impedance) acceleration sensors to be directly connected. To connect built-in amplifier type acceleration sensors, use BNC cables. Use cables that are appropriate for the acceleration sensors being used. Connect the acceleration sensors with the bias current turned OFF. After connection, turn ON the supply current to the acceleration sensors for making measurements.

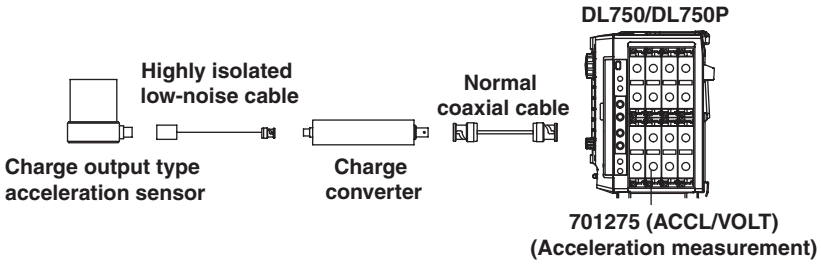
When Connecting Charge Output Type Acceleration Sensors

Since the charge output type (high impedance) acceleration sensors do not have built-in amplifier circuit, they cannot be directly connected to the DL750/DL750P. Use either of the following two methods to connect the sensors.

- **Using the Charge Amplifier**
  Connect the charge output type acceleration sensor to a charge amplifier using a highly isolated low-noise cable. The acceleration signal (charge signal) that has been converted to a voltage signal by the charge amplifier is input to the DL750/DL750P using a normal coaxial cable. The DL750/DL750P measures the signal in the voltage measurement mode. The measured data can be converted to acceleration values using the scale conversion function of the DL750/DL750P.



- **When using the charge converter**
  Connect the charge output type acceleration sensor to a charge converter using a highly isolated low-noise cable. By driving the charge converter using a constant current from the DL750/DL750P, voltage signals similar to those of the built-in amplifier type acceleration sensor can be obtained. The DL750/DL750P measures the signals in the acceleration measurement mode and supplies bias current to the charge converter. Set the input sensitivity of the DL750/DL750P according to the charge converter gain and the sensitivity of the charge output type acceleration sensor.
  The DL750/DL750P only supports charge converters that are driven by constant current with driving current of 4 mA and driving voltage of 22 V.



Note

The unit of measurement of acceleration on the DL750/DL750P is m/s^2. The sensitivity is sometimes expressed in units of mV/G depending on the acceleration sensor. In such case, convert the unit.(1 G = 9.81 m/s^2)

Precautions

- Do not apply shock outside the specifications (see the manual for the acceleration sensor) to the acceleration sensors. Doing so can damage the sensors.
- Do not impose drastic temperature changes on the acceleration sensors. Temperature changes may affect the output value of the acceleration sensors.
- By default, the bias current on the acceleration sensors is turned OFF. Be sure to turn it ON before using the acceleration sensors. Bias current is valid only when measuring acceleration. When measuring other parameters, it is automatically turned OFF. The ON/OFF setting of the bias current is retained even when you turn OFF the DL750/DL750P.

3.13 Connecting Sensors to the Frequency Module

Sensors and Signal Output Sources That Can Be Connected

The table below shows the sensor and signal output source that can be connected. Appropriate input presets are provided for each sensor and signal output source. For the setup procedure of presets, see page 5-40.

Sensor and Signal Output Source	Preset Name
5-V logic signal, 5-V output sensor, and sensor with TTL output	Logic 5V
3-V logic signal and 3-V output sensor	Logic 3V
12-V driven relay/sequence circuit and 12-V driven sensor	Logic 12V
24-V driven relay/sequence circuit and 24-V driven sensor	Logic 24V
Sensor/Encoder that outputs positive and negative voltages and sensor that outputs sine waves	ZeroCross
100-VAC power supply (connected via the isolated probe (700929))	AC100V
200-VAC power supply (connected via the isolated probe (700929))	AC200V
Power-generating electromagnetic pickup	EM Pickup
Open collector output (0 to 5 V output) and contact output	Pull-up 5V*

* For the internal equivalent circuit for “Pull-up 5V,” see page 5-50.

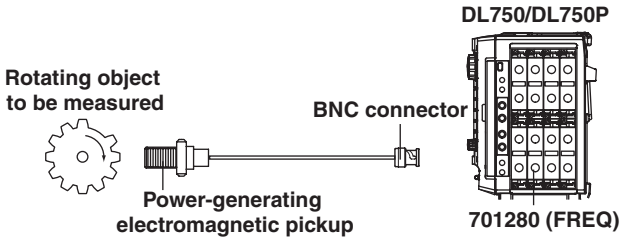
Precautions to Be Taken When Connecting to Sensors or Signal Output Sources

CAUTION

- The maximum input voltage for direct input is indicated below. Applying a voltage exceeding this value can damage the input section. If you are applying high voltage that exceeds 42 V, be sure to use the isolated probe (700929).
  Maximum input voltage: 42 V (DC+ACpeak) (CAT I and CAT II)
- The minimum input voltage is 0.2 Vpp. At voltage amplitude less than 0.2 Vpp, the measured values may be unstable.
- Attach/Remove the sensors after confirming that the rotating object to be measured is stopped.
- Set the preset to electromagnetic pickup (EM Pickup) only when using the electromagnetic pickup.

Connecting the Electromagnetic Pickup

- The DL750/DL750P allows power-generating electromagnetic pickup to be connected directly. The DL750/DL750P does not support electromagnetic pickups that require external power supply or those that require a terminator at the output.
- To connect electromagnetic pickups, use BNC cables. Use cables that are appropriate for the electromagnetic pickups being used.
- When the input is set to electromagnetic pickup, determination is not made on whether the input voltage level exceeds the specified input voltage range. Therefore, the LEDs (see page 3-7) do not illuminate even when the input voltage level is over range.

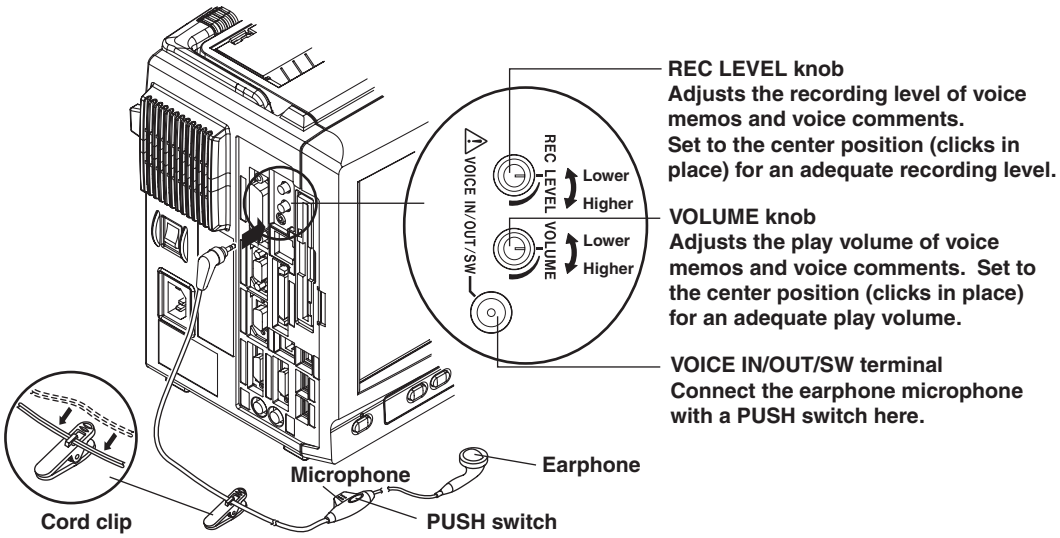


3.14 Connecting the Earphone Microphone with a PUSH Switch and Connecting the Speaker

The optional earphone microphone with a PUSH switch (701951) must be connected to use the voice memo function (see section 7.9) and voice comment function (section 13.19). The recorded voice memo and voice comment can be played through an external speaker by using an optional speaker cable (701952) that is sold separately.

Connecting the Earphone Microphone with a PUSH Switch (701951)

Insert the ϕ2.5 plug of the earphone microphone with a PUSH switch to the VOICE IN/OUT/SW terminal of the DL750/DL750P left side panel.



Specifications of the Earphone Microphone with a PUSH Switch

Dynamic Inner Earphone

Input impedance:	32 Ω
Frequency range:	100 to 20 kHz
Maximum input:	40 mW

Electric Condenser Microphone

Output impedance:	1.6 kΩ
Frequency characteristics:	100 to 10 kHz
Directional characteristics:	Omnidirectional
Code:	1.2 m, ϕ2.5, with 4-pin plug
Weight:	Approx. 16 g

Earphone Microphone Jack Input/Output

Jack:	4-pin jack
Microphone input:	Electric condenser microphone, input impedance of approx. 5 kΩ
Earphone output:	Dynamic, impedance of 32 Ω
Switch input:	10-kΩ pull-up (3.3 V)

Note

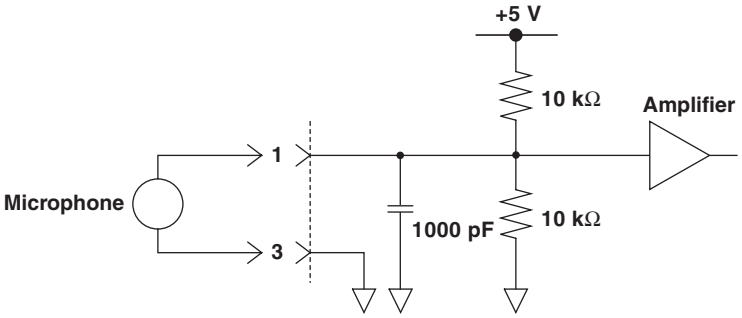
- The specifications above apply to the optional earphone microphone with a PUSH switch (701951) that is sold separately. Operation of other earphone microphones are not guaranteed.
- There is no protection circuit, because it is a dedicated input. Be sure to use the dedicated earphone microphone by YOKOGAWA.

Handling Precautions of the Earphone Microphone with a PUSH Switch

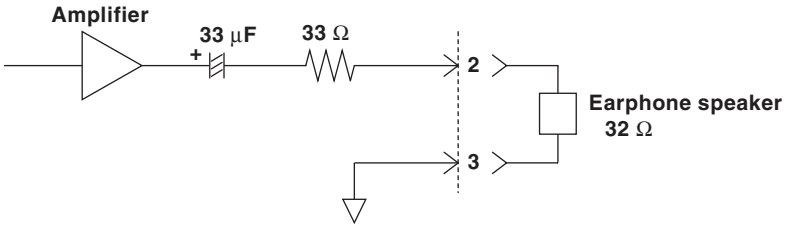
- Do not place the earphone microphone in a humid environment. Do not spill water on the earphone microphone. This may cause a malfunction.
- Do not place the earphone microphone under direct sunlight, near a heater, or in hot or dusty environments.
- Do not apply strong shock. Do not pull on the cord.

Circuit Diagrams of the Input/Output Section of the Earphone Microphone with a PUSH Switch

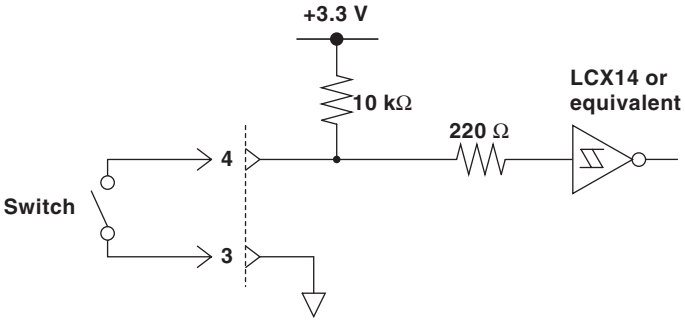
Microphone Input



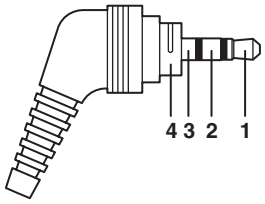
Earphone Output



Switch Input



- **Plug polarity signal**



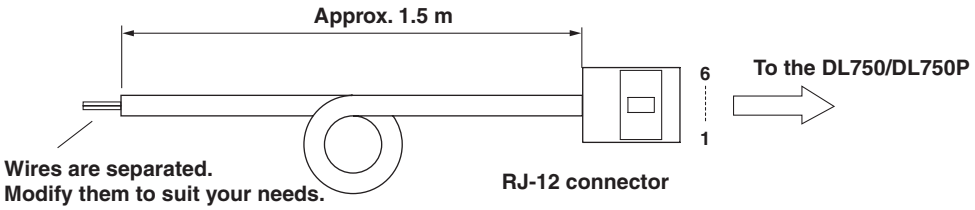
1 Microphone input
2 Earphone output
3 GND
4 Switch input

Note

- The circuit diagrams above apply to the optional earphone microphone with a PUSH switch (701951) that is sold separately. Operation of other earphone microphones are not guaranteed.
- There is no protection circuit, because it is a dedicated input. Be sure to use the dedicated earphone microphone by YOKOGAWA.

Specifications of the Optional Speaker Cable (701952) (Sold Separately) and Connection Procedure

Use the speaker cable (701952) only to connect the DL750/DL750P to a speaker. For details on the connection of the speaker cable and the speaker, follow the instructions that came with the speaker.



Wire Color	Pin No.	Signal Name
Blue	5	GND
White	6	SPEAKER

CAUTION

Do not short the speaker output signal or apply an external signal. Such act can lead to malfunction or fire.

Note

- For a speaker, use a commercially sold speaker with an impedance of 8 Ω.
- Depending on the speaker, a large sound may be produced even if the speaker volume of the earphone microphone is set properly. When using a speaker for the first time, set the speaker volume to the smallest setting. Some sound will be produced even if the volume is set to the minimum setting. If the sound is still large even with the smallest volume setting, turn the REC LEVEL knob on the left side panel at the time of recording to lower the recording level.

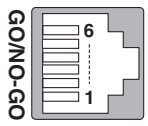
Speaker Output Terminal (GO/NO-GO) Specifications

The terminal is shared with the GO/NO-GO I/O terminal of the DL750/DL750P side panel.

Type

Modular jack (RJ-12). For the cable, use the optional speaker cable (701952) that is sold separately.

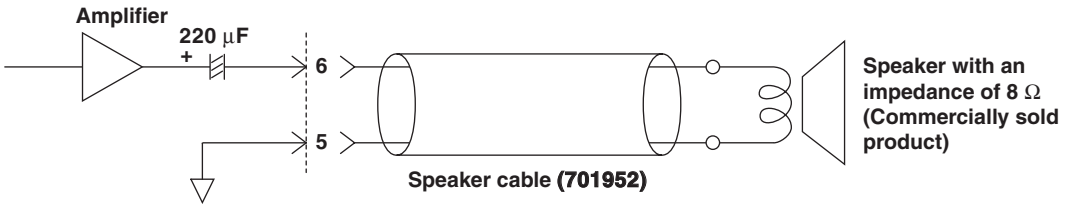
Pin Arrangement



Connector on the DL750/DL750P

Pin No.	Signal Name
1	NC (no connection)
2	START IN
3	GO OUT
4	NOGO OUT
5	GND
6	SPEAKER

Circuit Diagram



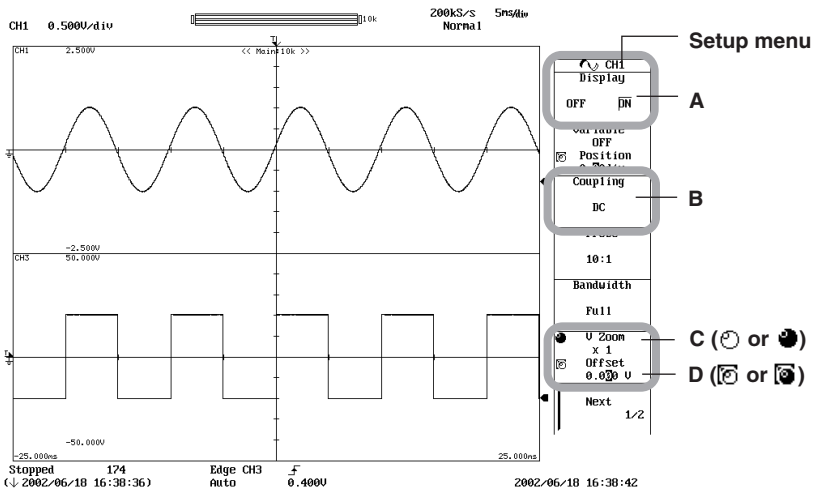
4.1 Operations and Functions of Keys and the Jog Shuttle

This section describes the basic operations of the keys and jog shuttle on the DL750/ DL750P.

Basic Key Operations

Displaying the Setup Menu of Panel Keys

1. Press a key. The menu corresponding to the key appears.
2. Press the soft key corresponding to each item.



A: Press the corresponding soft key to switch the selection items.

B: Press the corresponding soft key to display the selection menu.
Press the soft key corresponding to the selection to confirm the selection.

C: Press the corresponding soft key to set the item under jog shuttle control.
Turn the jog shuttle to change the setting.

D: Press the corresponding soft key to set the item under jog shuttle control.
Turn the jog shuttle to set the value.
Press the arrow keys to move along the digits.
You can directly enter the value using the NUM KEY or USB keyboard.

Note

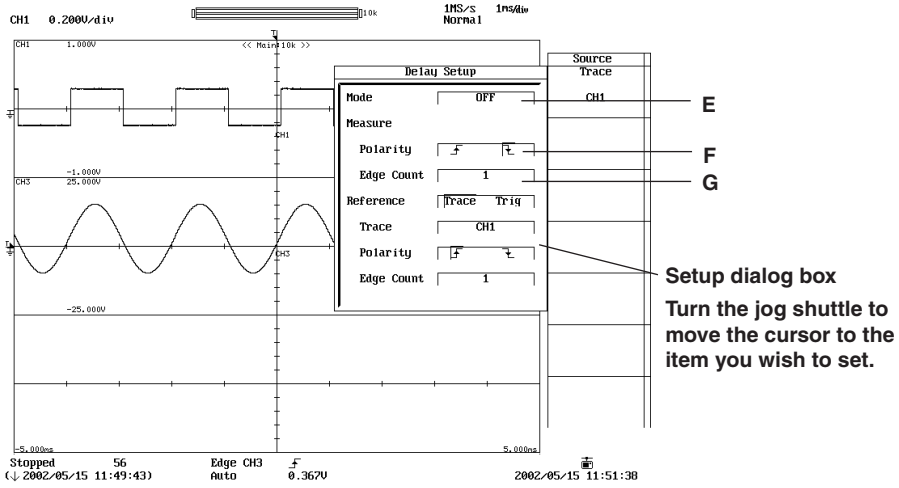
If the screen menu shows Next 1/2, you can press the soft key corresponding to Next 1/2 to show the 2/2 menu. To show the 1/2 menu again, press the soft key corresponding to Next 2/2.

Displaying the Setup Menu Marked in Purple on the Panel

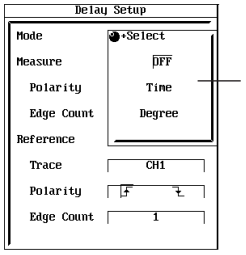
1. Press the **SHIFT** key. The indicator above SHIFT illuminates in green to indicate the shifted state. Functions marked in purple on the panel become active.
2. Press the key corresponding to the setup menu you wish to display.

Operations on the Setup Dialog Box

1. Show the setup dialog box using basic key operations or other similar means.
2. Turn the **jog shuttle** to move the cursor to the desired item.
3. Press **SELECT**. The behavior that results when you press **SELECT** varies depending on the item as described below. This manual refers to the above operation as "**jog shuttle + SELECT**."

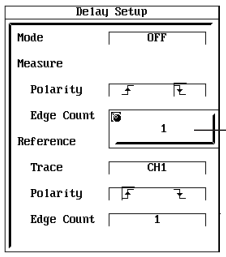


When Mode is selected



Selection menu

When Edge Count is selected



Value entry box

E: Press SELECT to display the selection menu.
Turn the jog shuttle to move the cursor to the item you wish to set.
Press SELECT to confirm the selection.

F: Press SELECT to switch the selection items.

G: Press SELECT to display the value entry box. Turn the jog shuttle to set the value.
Press the arrow keys to move along the digits.
You can directly enter the value using the NUM KEY or USB keyboard.

Clearing the Menu and Setup Dialog Box Displays

1. Press **ESC**. The setup menu or setup box shown on top is cleared from the screen.

Note

- In the operating procedures in this manual, the step for clearing the setup menu and setup box is not indicated.
- When the setup menu is cleared, the main information on the displayed channels is shown. For details, see section 8.13.

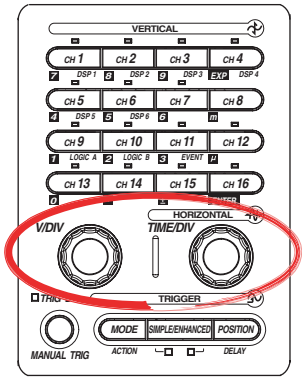
4.2 Entering Values and Strings

Entering Values

Entering Values Directly Using the Dedicated Knob

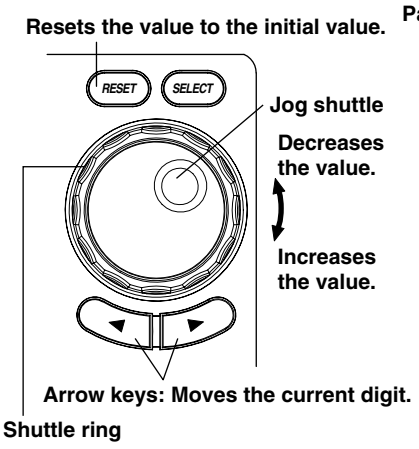
The dedicated knobs indicated below can be used to directly enter values by turning the knob.

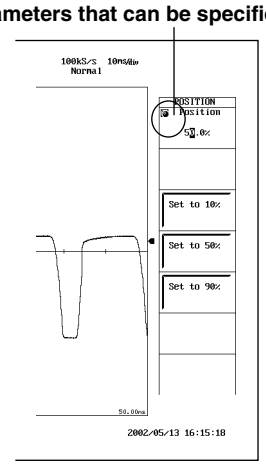
- V/DIV knob
- TIME/DIV knob



Entering Values Using the Jog Shuttle

After selecting the setup item using the soft key, use the jog shuttle to change the value. The outer shuttle ring can be used step through the values in large increments. On some items, the arrow keys below the jog shuttle can be used to move among the digits.





Note

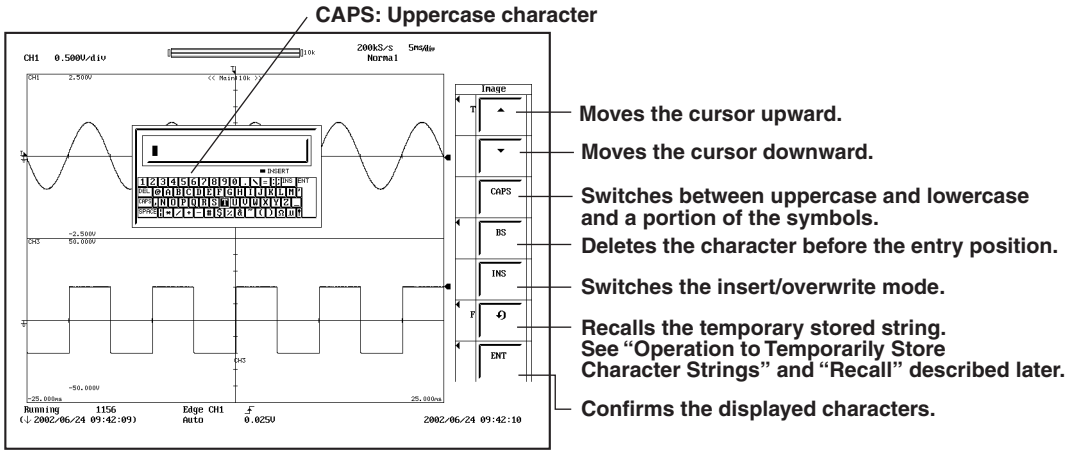
The items that can be changed using the jog shuttle are reset to their initial values when the RESET key is pressed.

Entering Strings

The keyboard displayed on the screen is used to enter character strings such as file names and comments. The jog shuttle, SELECT, and arrow keys are used to operate the keyboard to enter the character strings.

Operating the Keyboard

1. Turn the **jog shuttle** to move the cursor to the character to be entered. You can also press the soft keys corresponding to ▲ and ▼ to move the cursor vertically.
2. Press **SELECT**. The character is confirmed. If a character string is already been entered, move the cursor to the position in the string at which you want to enter a character.
3. Repeat steps 1 and 2 to enter all the characters in the string.
4. Selecting ENT on the keyboard and pressing **SELECT** confirms the string and the keyboard disappears. You can also press the ENT soft key to confirm the string and clear the keyboard. At the same time, the confirmed string is temporarily stored. If you wish to clear the entire string that you have entered, press **RESET** before confirming the string.



Note

When using the user-defined computation (option), a keyboard for setting the computation appears. The basic operation is the same, but see section 10.5 for details.

- **Operation of Temporarily Storing the Character Strings**

The strings that are previously confirmed are sequentially sent to the subsequent memories. When the number of confirmed strings exceeds eight, the strings are deleted in order starting from the oldest string. Symbols 0 to 7 are used in the explanation as a matter of convenience, but numbers 0 to 7 do not appear on the actual screen.

Symbol indicating the memory storing the string	0	1	2	.....	7
When string "AA" is confirmed first	Stores AA				
When string "BB" is confirmed next	Stores BB	Moves and stores AA			
When string "CC" is confirmed next	Stores CC	Moves and stores BB	Moves and stores AA		
.....					
When string "HH" is confirmed next	Stores HH	Moves and stores GG	Moves and stores FF	.....	Moves and stores AA
When string "JJ" is confirmed next	Stores JJ	Moves and stores HH	Moves and stores GG	.....	Moves and stores BB Deletes AA

- **Recalling Strings**

  Note that the string that is displayed in the entry box of the keyboard is overwritten when a string is recalled using the procedure in step 1 below.

  1. Every time the ↶ soft key is pressed, strings that are temporary stored (strings that have been entered previously) appear in order in the input box of the keyboard. When the eight strings that are temporarily stored are displayed, the most recent string is displayed again.
  2. Make appropriate corrections to the recalled string and confirm it according to steps 1 to 4 that were described in "Operating the Keyboard" on the previous page. At this point, the confirmed string is temporarily stored.

- **Keys Other Than the Character Keys**

  DEL: Deletes the character at the cursor.
  INS: Switches the insert/overwrite mode. When in insert mode, the INSERT indicator on the keyboard illuminates.
  SPACE: Enters a space.
  ENT: Confirms the displayed characters.
  CAPS: Switches between uppercase and lowercase.

Number of Characters and Types That Can Be Used in the Settings

Setup Item	Number of Characters	Characters That Can Be Used	Reference Section
Date/Time	Specified number	0 to 9	3.5
Waveform labels	1 to 8	All characters (including spaces)	8.10
Unit of linear scaling	0 to 4	All characters (including spaces)	5.11
File name	1 to 16	A to Z, %, _, (,)	13.7 to 13.11, 7.7
Comments for files	0 to 160	All characters (including spaces)	13.7 to 13.10, 7.7
Comments for screen images	0 to 20	All characters (including spaces)	13.11
Comments for printing	0 to 20	All characters (including spaces)	12.2
Message of annotation	0 to 80	All characters (including spaces)	9.4, 12.2
Comments for PDF files	0 to 20	All characters (including spaces)	13.13
Title, author, and sub title of PDF files	0 to 30	All characters (including spaces)	13.13, 9.9
Keyword of PDF files	0 to 90	All characters (including spaces)	13.13, 9.9
E-mail address	0 to 40	ASCII characters (including spaces)	16.5
Comments for e-mail	0 to 30	All characters (including spaces)	16.5
User name, login name, and password	0 to 15	ASCII characters (including spaces)	16.3, 16.6, 16.7

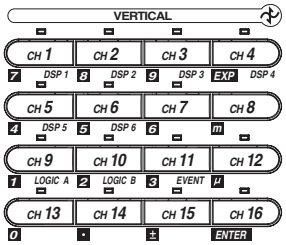
Note

- The multiple @ characters cannot be entered consecutively.
- File names are not case-sensitive. Uppercase and lowercase are distinguished in comments. In addition, the following five file names cannot be used due to limitations of MS-DOS.
  AUX, CON, PRN, NUL, CLOCK, COM1 to COM9, LPT1 to LPT9

Entering Values from the NUM KEY

When entering values for items with or icon, press the NUM KEY to display an area for directly entering values (black area). You can enter CH1 to CH16 keys of the VERTICAL group to enter values. The gray value marked below and to the left of each key can be entered.

When value entry using the NUM KEY is active, is indicated at the upper left corner of the screen.



Example: To enter 1.5 mV,
press CH 9, CH 14, CH 6, CH 8, and CH 16.

To clear the area for entering values, to escape, press the NUM KEY or CH16 (ENTER) again.

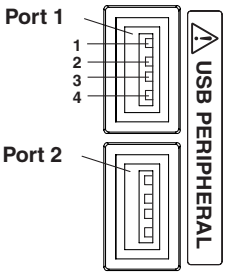
4.3 USB Keyboard/USB Mouse

Entering Values from a USB Keyboard

You can connect a USB keyboard for entering file names, comments, and other information. In addition, the functions of each key on the front panel of the DL750/DL750P are assigned to the keys on the keyboard (see appendix 8). Thus, the keyboard can be used to carry out operations that are the same as the key operations on the DL750/DL750P.

USB PERIPHERAL Connector

To connect a USB keyboard to the DL750/DL750P, connect a USB cable to the USB PERIPHERAL connector on the left side panel. There are two USB PERIPHERAL connectors (ports).



Pin No.	Signal Name
1 VBUS:	+5 V
2 D–:	–Data
3 D+:	+Data
4 GND:	Ground

Keyboards That Can Be Used

Keyboards that can be used depend on the type of USB Keyboard language that you selected in section 17.3 (English or Japanese). The following keyboards conforming to USB Human Interface Devices (HID) Class Ver1.1 can be used.

- When the USB Keyboard language is English: 104 keyboard and 89 keyboard
- When the USB Keyboard language is Japanese: 109 keyboard and 89 keyboard

Note

For USB keyboards that have been tested for compatibility, contact your nearest YOKOGAWA dealer.

Connection Procedure

When connecting a USB keyboard, directly connect the keyboard to the DL750/DL750P using a USB cable as shown below. You can connect the USB cable regardless of the power ON/OFF state of the DL750/DL750P (supports hot-plug). Connect the type A connector of the USB cable to the DL750/DL750P; connect the type B connector to the keyboard. When the power switch is ON, the keyboard is detected and enabled approximately 6 s after it is connected.

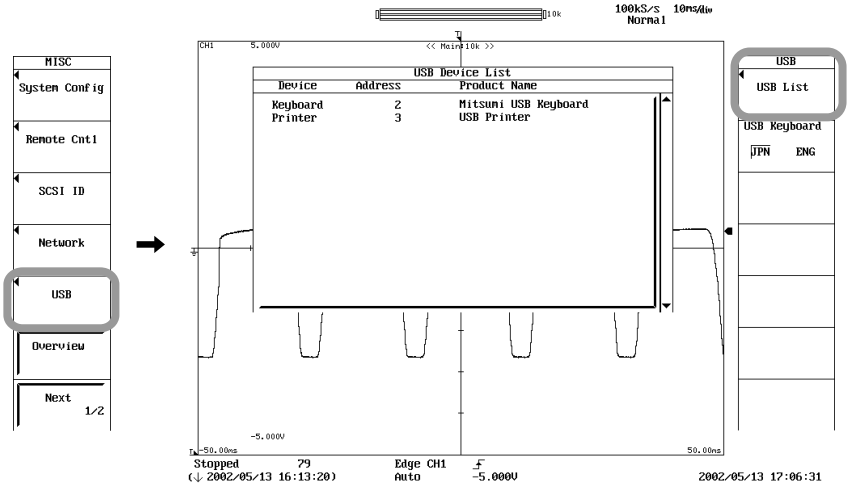
Note

- Connect the keyboard directly without going through a USB hub.
- Do not connect USB devices other than USB keyboard, USB mouse, printer, and USB storage device to the USB PERIPHERAL connector.
- Do not connect multiple keyboards.
- Holding down a key on the keyboard does not enter the character or value repetitively.
- Do not connect and disconnect multiple USB devices repetitively. To do so, allow at least 10 s between connection and disconnection.
- Do not connect or disconnect the USB cable after the power is turned ON until key operation is ready (approximately 20 to 30 s).

Confirming the Keyboard That Is Connected

To confirm the keyboard that is connected to the DL750/DL750P, carry out the procedure below.

1. Press **MISC**.
2. Press the **USB** soft key.
3. Press the **USB List** soft key to display the USB Device List. Check the USB keyboard that is connected.



Entering File Names, Comments, and Other Items

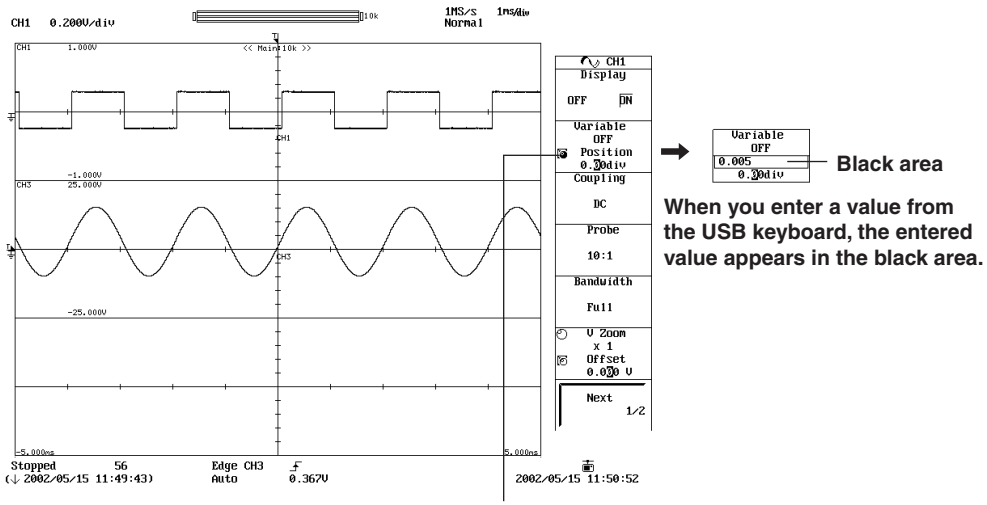
When a keyboard is displayed on the screen, you can enter the file name, comment, and other items using a USB keyboard. The character that is entered through each key of the keyboard varies depending on the keyboard type. For details, see appendix 8.

Executing Functions Corresponding to the Front Panel Keys of the DL750/DL750P

The functions corresponding to the front panel keys of the DL750/DL750P are assigned to the keys on the USB keyboard. By pressing the keys on the keyboard, you can operate the DL750/DL750P in a similar fashion. The assignment of functions varies depending on the keyboard type. For details, see appendix 8.

Entering Values Directly from a USB Keyboard

You can directly enter values from a USB keyboard for items with or icon on the DL750/DL750P menu.



Press the soft key corresponding to the item, enter the value from the USB keyboard, and press the Enter key. The entered value is applied.

- **When a Prefix Unit Is Displayed**
  For voltage (V) and time (s) items, you can also enter the prefix unit from the USB keyboard.

  Example
  Entering “1” “0” “m” for “Offset” is equivalent to entering “10 mV,” and the screen displays “0.01 V.” If you enter the prefix unit from a USB keyboard, you do not have to press the “Enter” key.

  Below are the prefix units that can be entered.

Input Key	Prefix Unit
K or k	10^{3} (kilo)
m	10^{-3} (milli)
U or u	10^{-6} (micro)
N or n	10^{-9} (nano)
P or p	10^{-12} (pico)

- **When Displayed in Exponential Notation**
  You can also enter the menu items displayed in exponential notation from the USB keyboard.

  Example
  Entering “2”, “.”, “3”, “E”, “1”, “Enter” for the menu item displaying “0.0000E+00” causes the value to be displayed as “2.3000E+01”.

Operations Using a USB Mouse

You can use a USB mouse to operate the DL750/DL750P as you would using the front panel keys. In addition, you can point to a desired item on a menu and click the item. This is analogous to pressing a soft key corresponding to a menu and pressing the SELECT key.

USB PERIPHERAL Connector

The USB mouse is connected to the USB PERIPHERAL connector on the left side panel of the DL750/DL750P. For details on the USB PERIPHERAL connector, see page 4-7.

USB Mouse That Can Be Used

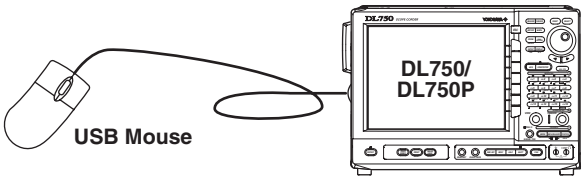
A USB mouse (with a wheel) conforming to USB HID Class Ver.1.1. can be used.

Note

- For USB mouse devices that have been tested for compatibility, contact your nearest YOKOGAWA dealer.
- Some items cannot be specified when using a mouse without a wheel.

Connection Procedure

When connecting a USB mouse, directly connect the mouse to the USB PERIPHERIAL connector using a USB cable as shown below. You can connect/disconnect the USB mouse connector regardless of the power ON/OFF state of the DL750/DL750P (supports hot-plug). When the power switch is ON, the mouse is detected and enabled approximately 6 s after it is connected.



Note

- Do not connect USB devices other than USB keyboard, USB mouse, and USB printer to the USB PERIPHERAL connector.
- There are two USB PERIPHERAL connectors on the DL750/DL750P. However, do not connect mouse devices to both connectors at the same time.
- Do not connect and disconnect multiple USB devices repetitively. To do so, allow at least 10 s between connection and disconnection.
- Do not connect or disconnect the USB cable after the power is turned ON until key operation is ready (approximately 20 to 30 s).

Confirming the USB Mouse That Is Connected

The procedure for confirming the USB mouse that is connected to the DL750/DL750P is the same as the procedure for confirming the USB keyboard. See page 4-8.

USB Mouse Operation

- **Operations Similar to the Front Panel Keys on the DL750/DL750P (Top Menu)**

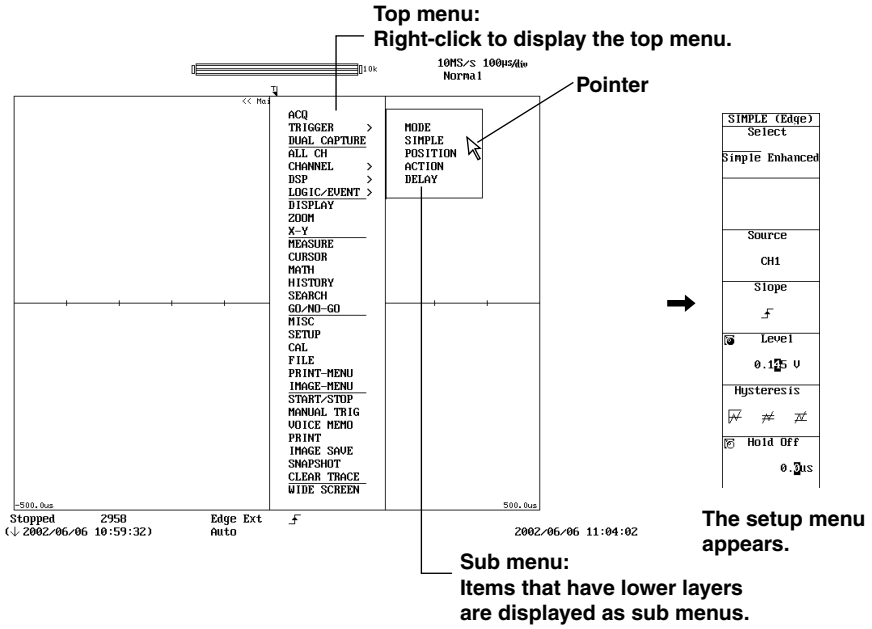
  Displaying the Top Menu

  Right-click on the screen. The front panel keys on the DL750/DL750P are displayed as the top menu.

  Selecting Items on the Top Menu

  Point to the item you wish to select and left-click the item. The setup menu corresponding to the selected item is displayed on the right side of the screen. The top menu is cleared from the screen.

  Pointing to an item with a sub menu (items with a > mark displayed to the right) displays the sub menu. As with the top menu, point to the item you wish to select and left-click the item.



Note

- The following keys do not appear on the top menu.
  ESC, RESET, SELECT, HELP, and arrow keys
- The top menu also displays characters that are indicated in purple on the front panel.
- The TRIGGER sub menu contains the following TRIGGER group keys.
  MODE, SIMPLE/ENHANCED, POSITION, ACTION, and DELAY
- There is no WIDE SCREEN key on the front panel.
- To display the PRINT menu or the IMAGE-SAVE menu, select PRINT-MENU or IMAGE-MENU. To execute the PRINT or IMAGE SAVE operation, select PRINT or IMAGE SAVE.

Clearing the Top Menu

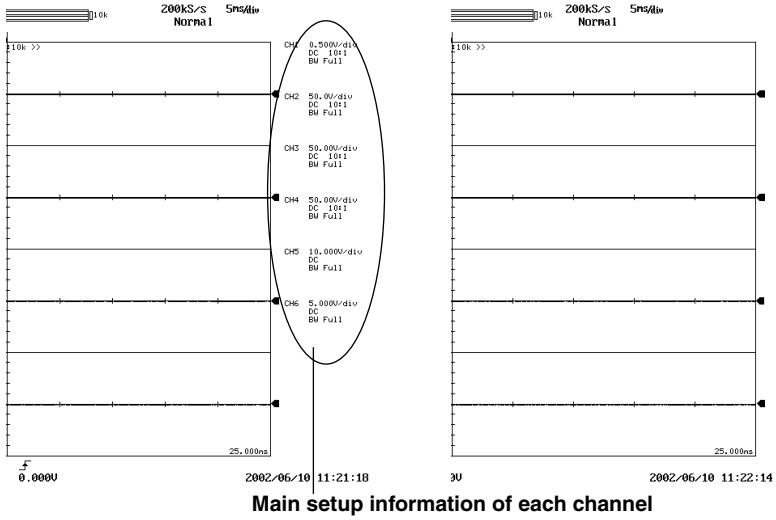
Displaying the main setup information of each channel on the right side of the screen after clearing the top menu

Left-click on an area outside the top menu. The top menu is cleared, and the main setup information of the channel that is currently displayed is shown on the right side of the screen.

- **Expanding the Waveform Display Area after Clearing the Top Menu**
  Left-click WIDE SCREEN on the top menu. The top menu is cleared, and the waveform display area is displayed expanded.

Displaying the main setup information of each channel on the right side of the screen after clearing the top menu

Expanding the waveform display area after clearing the top menu



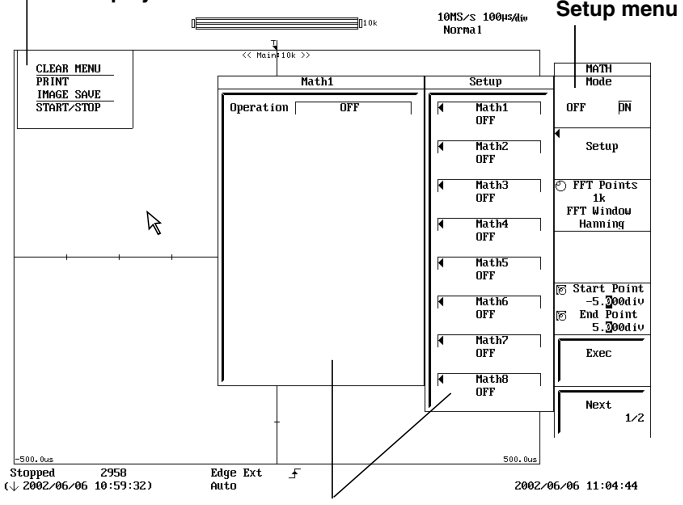
Main setup information of each channel

Displaying the Shortcut Dialog Box

As shown in the following figure, a shortcut menu is provided in addition to the setup menu so that certain items can be executed even while a dialog box or a window is open. The shortcut menu appears when you right-click on the screen while a dialog box or a window is open. In this case, the top menu is not displayed.

Shortcut menu
Right-click when a dialog box or a window is displayed to show the shortcut menu.

Setup menu



Dialog box other than the setup menu

- **Setup Menu Operation (Similar to the Soft Key Operation)**

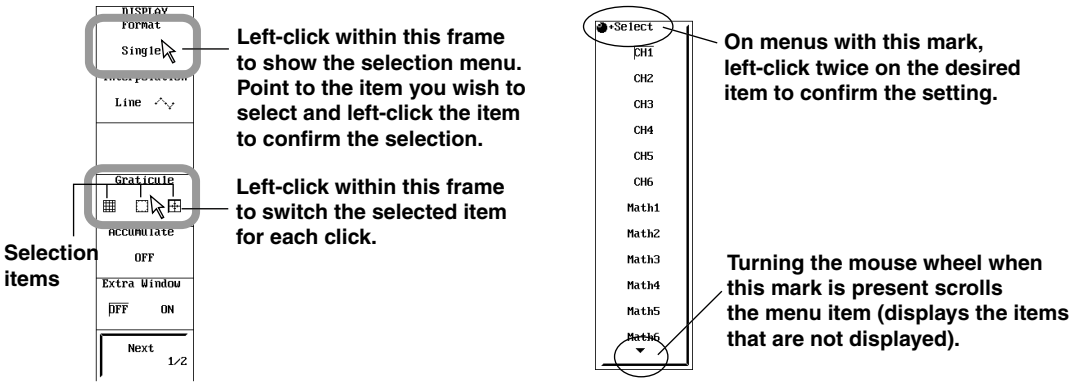
  Selecting an Item on the Setup Menu

  Left-click the item you wish to select on the setup menu.

  If another menu appears when you select an item, move the pointer to the new frame displaying the item you wish to select and left-click the item.

  If an item such as ON or OFF appears when you select an item, move the pointer to the new frame containing the item and left-click the item. This operation switches the item.

  For menus in which items are selected using the jog shuttle and SELECT, left-click the desired item. Left-click again to confirm the new setting and close the selection dialog box. For items that you can scroll, turn the mouse wheel to scroll.



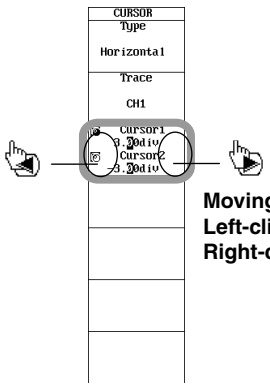
  Clearing the Menu Screen

  Left-click an area outside the menu screen.

- **Setting Values**

  For menu items with a or icon, the numeric value can be entered as follows:

  - To select a menu item with a or icon, left-click the center of the menu item. If there are two setup items in a single menu item, you can repetitively left-click to select either item.
  - Turn the mouse wheel downward to increase the value.
  - Turn the mouse wheel upward to decrease the value.
  - To move to a different digit, left-click to the left or right of the value. At this point, the pointer changes to or . If you point to the left of the value and left-click, the current digit moves to the left; if you point to the right of the value and left-click, the current digit moves to the right. The current digit moves one digit at a time for each left-click.
  - To reset the value to default, right-click on the desired menu item.



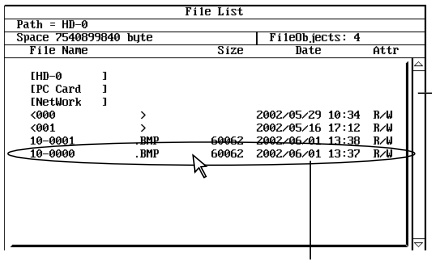
- **Selecting Toggle Box Items on the Dialog Box**
  - Left-click the item you wish to select. The item is selected. Click the selected item again to deselect it.
  - To close the dialog box, point to an area outside the dialog box and left-click.

Left-click the item you wish to select.

Note

When closing an error dialog box, also point to an area outside the error dialog box and left-click.

- **Selecting a File, Directory, or Medium Drive on the File List Window**
  - Left-click a file, directory, or medium drive name to select it.
  - If a scroll bar is shown on the file list window, you can turn the mouse wheel to scroll the file list.
  - To cancel the selection, point to an area outside the file list window and left-click. The selection is cancelled, and the file list window closes.



Scroll bar

Move the pointer to the file, directory, or storage medium drive you wish to select and left-click.

- **Setting V/DIV and TIME/DIV**

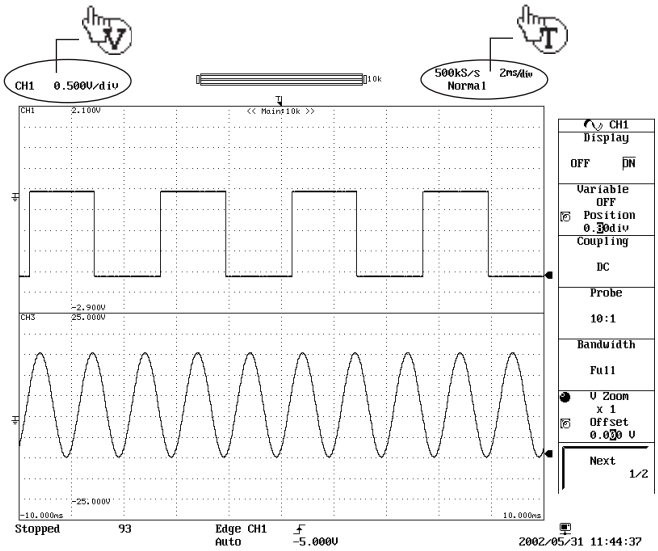
  Setting V/DIV

  When the waveform of a channel measuring a voltage is displayed, point near the V/DIV value displayed at the upper left corner of the screen. At this point, the pointer changes to . Turning the mouse wheel upward increases the V/div value; turning it downward decreases the V/DIV value.

  Setting TIME/DIV

  Point near the TIME/DIV value displayed at the upper right corner of the screen. At this point, the pointer changes to . Turning the mouse wheel upward increases the TIME/DIV value; turning it downward decreases the TIME/DIV value.

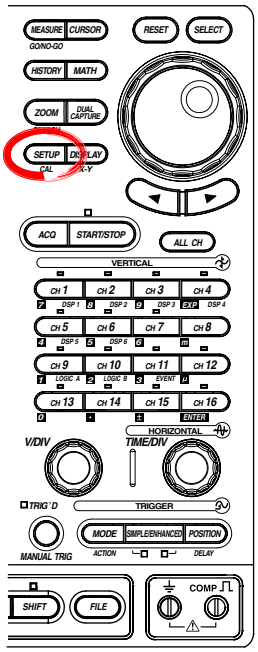
Moving the pointer to the position indicated below changes the pointer display.
You can change the V/DIV or TIME/DIV setting by turning the wheel in this condition.



4.4 Initializing Settings

<For a description of this function, refer to page 2-61.>

Procedure

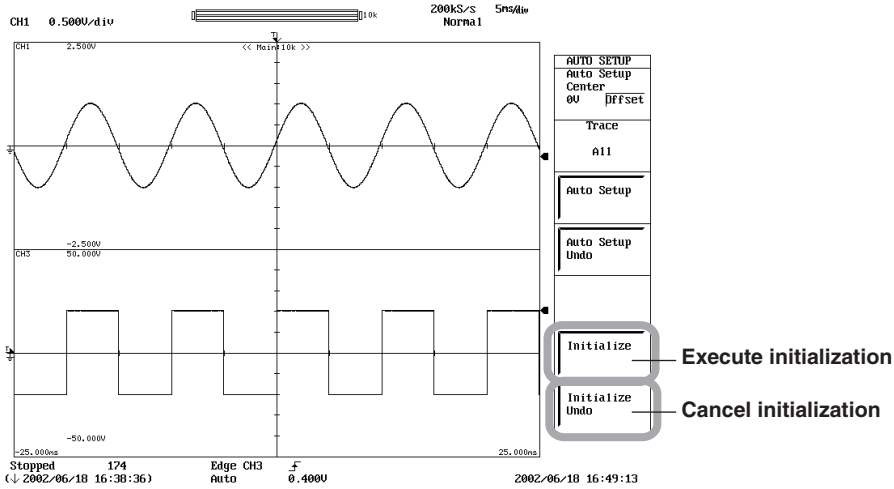


Executing Initialization

1. Press **SETUP**.
2. Press the **Initialize** soft key. The settings are initialized.

Canceling Initialization

3. Press the **Initialize Undo** soft key. The settings return to the conditions that existed immediately before initialization.



Note

When you turn OFF the power switch, the settings that existed immediately before initialization are cleared. Therefore, the “Undo” operation is not possible in this case.

Explanation

The values specified using the keys can be reset to the factory default values. This is useful when you wish to clear previous settings or start the measurement from scratch.

Initialization

Initialization refers to the act of resetting the settings to factory default.
For a list of the factory default settings, see appendix 7, “List of Initial Values.”

Settings That Cannot Be Initialized

- Date and time settings
- Settings related to communications and Ethernet interface
- SCSI ID number setting
- Menu/message language setting
- USB keyboard language setting
- Setting the time difference from GMT
- Setting the motor rotation of the internal hard disk

Canceling Initialization

If you initialize the settings by mistake, you can press the Undo soft key to set the DL750/DL750P back to the settings that existed before the initialization.

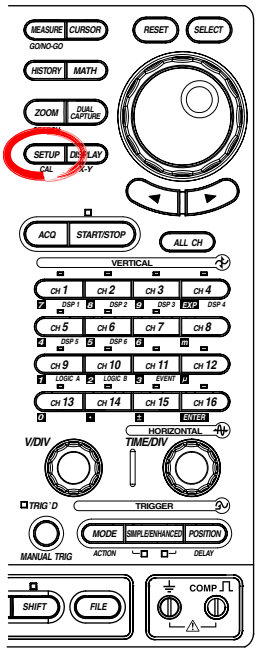
Initializing All the Settings

Turning ON the power switch while holding down RESET initializes settings related to communications and Ethernet interface and SCSI ID settings also. If you initialize the DL750/DL750P in this fashion, the settings cannot be set back to their original condition.

4.5 Performing Auto Setup

<For a description of this function, refer to page 2-62.>

Procedure

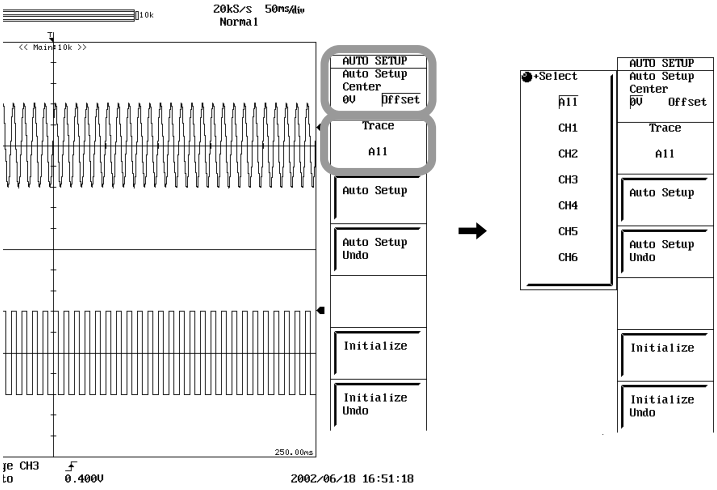


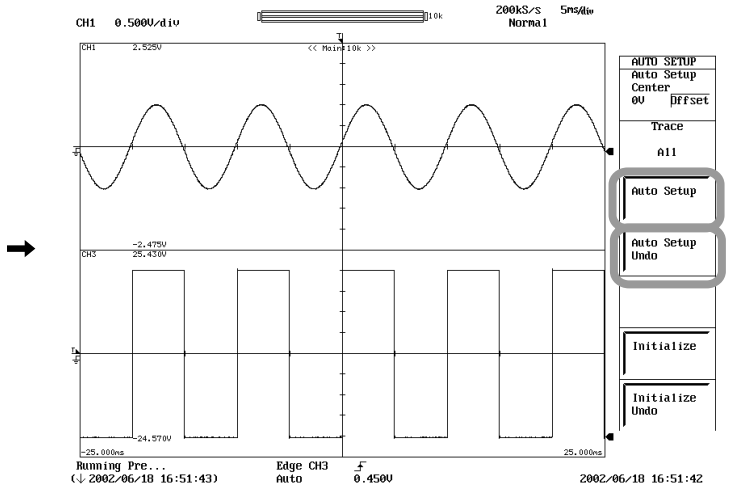
Executing Auto Setup

1. Apply the signal to be measured.
2. Press **SETUP**.
3. Press the **Auto Setup Center** soft key to select 0 V or Offset.
4. Press the **Trace** soft key. The channel selection menu appears. The menu does not appear for channels without modules.
5. Turn the jog shuttle to select the target channel.
6. Press the **Auto Setup** soft key. Auto setup is executed.
   When auto setup is executed, waveform acquisition starts automatically.

Canceling Auto Setup

7. Press the **Auto Setup Undo** soft key. The settings are set back to the original condition.





Explanation

The auto setup function automatically sets the settings such as V/div, T/div, and trigger level that are appropriate for the input signal.

Center Position after Auto Setup

0 V: Sets the center to 0 V. This is useful when you wish to view the relative relationship between the ground level and the waveform.

Offset: Sets the center to the offset value. This is useful when you wish to view the shape of the waveform by maximizing the amplitude.

Target Channel

Auto setup is performed on all channels or on the specified channel.

Applicable Modules

701250 (HS10M12), 701251 (HS1M16), 701255 (NONISO_10M12), 701260 (HV (with RMS)), 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), and 701275 (ACCL/VOLT)

Canceling Auto Setup

Pressing the Undo soft key sets the DL750/DL750P back to the conditions that existed immediately before auto setup. However, when you turn OFF the power switch, the settings that existed immediately before auto setup are cleared. Therefore, the “Undo” operation is not possible in this case. The settings that existed immediately before auto setup are cleared if you execute initialization after auto setup.

Applicable Waveforms for Auto Setup

Frequency:	Approx. 50 Hz to 1 MHz
Absolute value of the input voltage:	Maximum value is between approximately 20 mV (1:1) and ((maximum range)×10)
Type:	Repetitive waveform (that is not complex) When the input coupling is set to DC

Note

The auto setup function may not work properly if the waveform includes DC components or high-frequency components.

Setup Data after Executing Auto Setup

Waveform acquisition/display conditions	
START/STOP	START
Acquisition mode	Normal
Number of acquisitions	Infinite
Record length	10 k
Time base	Int
Accumulate mode	OFF
Zoom target	Channels that are turned ON
Vertical-axis settings	
V/div	Value that causes the absolute value of the input waveform to be 1.6 to 4.5 divisions
Offset voltage	0 V or the center value between the maximum and minimum values of the input signal
Coupling	DC
Bandwidth limit	FULL
Display ON/OFF	Turns ON channels whose absolute value of the input voltage is greater than or equal to 20 mV (1:1)
Position	0 division
Variable mode	OFF
V Zoom	×1
Scaling	OFF
Horizontal-axis settings	
T/div	Value that the displays 1.6 to 4 periods of the waveform with the shortest period of the auto setup target waveforms
Trigger settings	
Trigger mode	Auto
Trigger type	Simple
Trigger source	Channel whose waveform amplitude is greater than or equal to 1 division with the longest period
Trigger level/slope	Center level between the maximum and minimum values/ rising
Trigger coupling	DC
Hysteresis	(high sensitivity)
Hold off time	0.0 ns
Trigger position	50.0%
Trigger delay	0.0 µs
Computation settings	
Math	OFF
Other settings	
Realtime output	OFF
Dual Capture Accumulation	OFF
LOGIC A and LOGIC B display	OFF
EVENT display	OFF

Items other than those listed above are not applicable for auto setup.

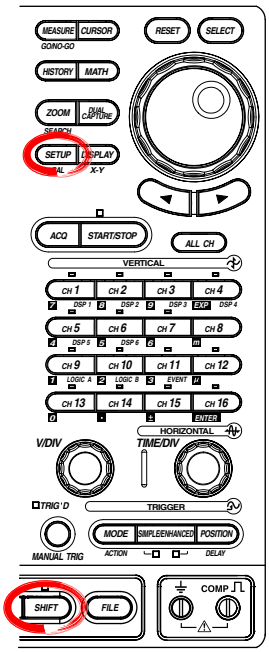
Note

If none of the input waveforms are detected on the target module, the waveform acquisition is not started.

4.6 Performing Calibration

Calibrate the DL750/DL750P when observing voltages.

Procedure

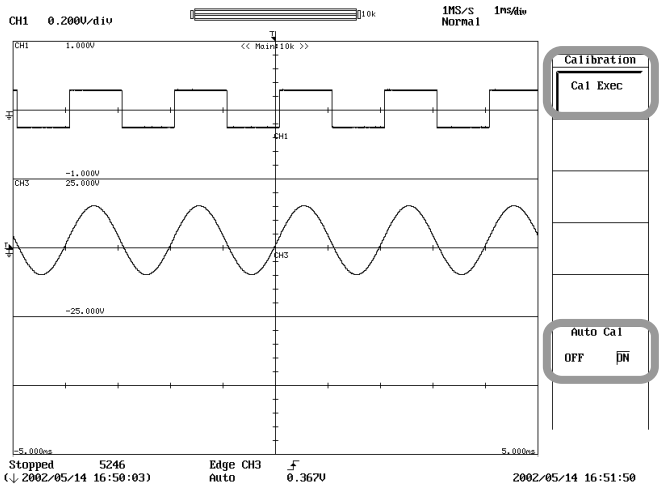


Executing Calibration

1. Press **SHIFT+SETUP**.
2. Press the **Calibration** soft key to execute calibration.

Perform Auto Calibration

3. Press the **AutoCal** soft key to select ON.



Explanation

Calibration

The following parameters are calibrated. Perform calibration when you wish to measure waveforms with high accuracy.

- Ground level offset
- A/D converter gain

Precautions to Be Taken When Perform Calibration

- Always allow the instrument to warm up for at least 30 minutes after the power is turned ON before starting calibration. If calibration is performed immediately after the power is turned ON, the calibration may be inaccurate due to drift caused by fluctuation in the temperature of the instrument.
- Calibration must be performed when the temperature of the instrument is stable and is between 5°C and 40°C (preferably at 23°C±5°C).

Note

The calibration described above is performed automatically when power is turned ON or when the Cal Exec soft key in the Calibration menu is pressed.

Auto Calibration

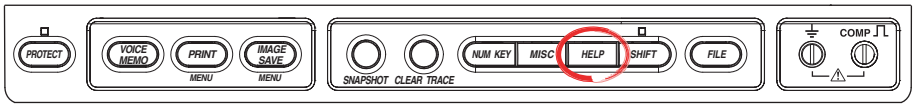
If AutoCal is set to ON, auto calibration is performed the first time the time axis setting (T/div) is changed or the first time measurement is started after the time shown below passes.

After turning ON the power

- 3 minutes pass
- 10 minutes pass
- every 30 minutes from here on after

4.7 Using the Help Function

Procedure



Displaying the Help Window

1. Press **HELP**.
2. Press the key or soft key that you wish to review.

Clearing the Help Window

3. Press **HELP** again.

Explanation

Displaying the Help Window

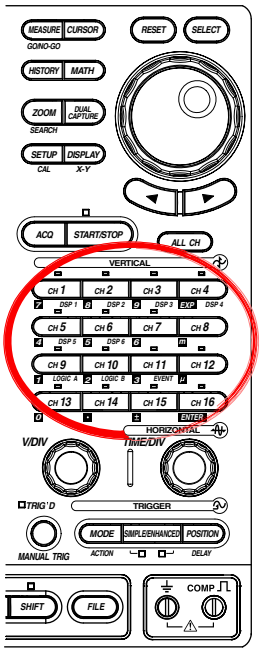
When you press HELP, a help window containing information about the soft key menu or jog shuttle menu that was displayed immediately before HELP was pressed appears. A help window does not open on some keys.
If you press a key while the help window is displayed, a help window containing information about the key appears.

Clearing the Help Window

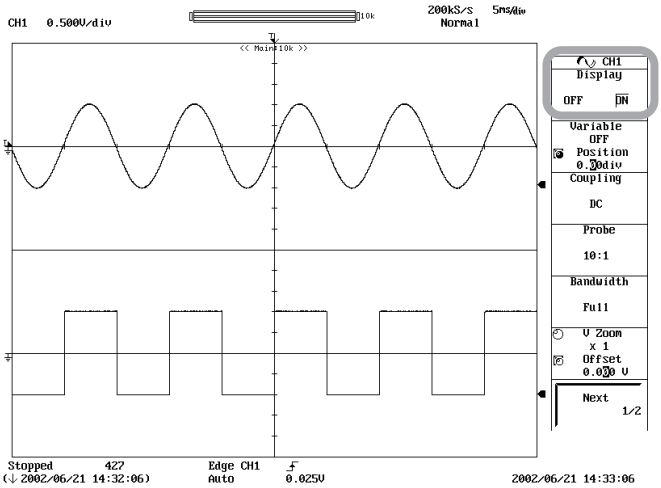
If you press HELP again while a help window is displayed, the help window closes.

5.1 Turning Channels ON/OFF

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel.
   To select a logic waveform, press **SHIFT+CH9 (LOGIC A)** or **SHIFT+CH10 (LOGIC B)**.
   To select an event waveform, press **SHIFT+CH11 (EVENT)**.
   To select a DSP channel (optional), press **SHIFT + CH1 (DSP1)** through **SHIFT + CH6 (DSP6)**.
2. Press the **Display** soft key to select ON or OFF. You can also turn ON/OFF the channel by pressing **CH1** to **CH16** twice.

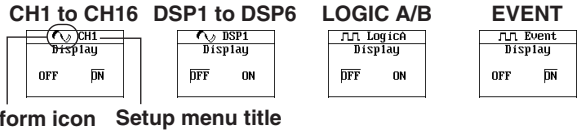


Explanation

Input waveforms of CH1 to CH16, LOGIC A, and LOGIC B, DSP1 to DSP6 (optional), and event waveforms can be displayed simultaneously.
For channels (CH1 to CH6) that are turned ON, the LED above the key illuminates.

Note

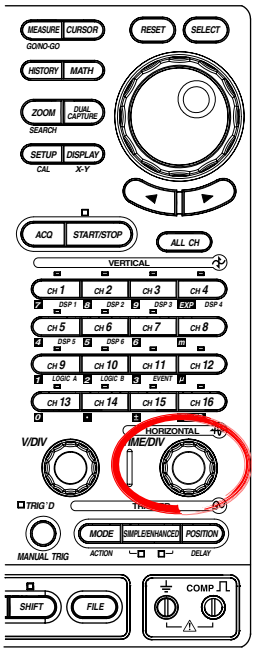
- The screen can be split into up to eight display areas using the DISPLAY menu (section 8.1). Scale values (section 8.9) and waveform labels (section 8.10) can also be displayed.
- If waveforms are loaded from the history memory or from a storage medium such as a floppy disk, Zip disk, or PC card, the input waveform cannot be displayed. To compare waveforms, use the snapshot function.
- Channels that do not have input modules installed cannot be turned ON.
- A waveform icon is displayed to the left of the title of the CH1 to CH16, DSP1 to DSP6, LOGIC A/B, and EVENT setup menus. The icon color is set to the color of each waveform (see section 17.4). The icon shape varies depending on the displayed setup menu as follows:



5.2 Setting T/div

<For a description of this function, refer to page 2-3.>

Procedure



1. Turn the TIME/DIV knob to set the T/div value.

Note

- If the TIME/DIV knob is turned while the waveform acquisition is stopped, the new T/div value is displayed within the parentheses at the upper right corner of the screen. The new T/div value becomes valid the next time acquisition is started.
- For details on the relationship between T/div and the sample rate, see appendix 1, “Relationship between the Time Axis Setting, Sample Rate and Record Length.”
- For a description of the T/div setting of the sub waveform of the dual capture function, see section 7.6.

Explanation

Set the time per division on the screen grid.

Selectable T/div Range

500 ns/div to 3 day/div

Maximum Sample Rate

The maximum sample rate varies depending on the input module as follows.

Input Module	Maximum Sample Rate
701250 (HS10M12)	10 MS/s (5 MS/s)
701251 (HS1M16)	1MS/s
701255 (NONISO_10M12)	10 MS/s (5 MS/s)
701260 (HV (with RMS))	100 kS/s
701261 (UNIVERSAL)	100 kS/s (when measuring voltage), 500 Hz (data update rate when measuring temperature)
701262 (UNIVERSAL (AAF))	100 kS/s (when measuring voltage), 500 Hz (data update rate when measuring temperature)
701265 (TEMP/HPV)	500 Hz (data update rate)
701270 (STRAIN_NDIS)	100 kS/s
701271 (STRAIN_DSUB)	100 kS/s
701275 (ACCL/VOLT)	100 kS/s
701280 (FREQ)	25 kHz (data update rate)

Values inside the parentheses are those when the DSP channel (optional) is ON.

Note

The maximum sample rate of a DSP channel (optional) is 100 kS/s.

T/div and Roll Mode

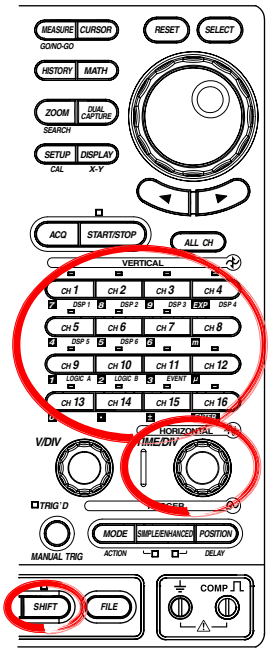
The display switches to roll mode if T/div is set to 100 ms/div to 3 day/div under the following conditions.

- Acquisition mode is set to a mode other than averaging.
- The trigger mode is set to auto, auto level, single, or log.
- The time base is set to the internal clock signal.

5.3 Setting V/div

<For a description of this function, refer to page 2-3.>

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel.
2. Turn the V/DIV knob to set the V/div value.

Explanation

V/div Setting (When Variable Is OFF)

The V/div (vertical sensitivity) setting is used to adjust the displayed amplitude of the waveform for easy viewing. Set the voltage per division on the screen grid. V/div is set using 1-2-5 steps (1 V/div -> 2 V/div -> 5 V/div). When Variable is set to OFF, the Position, V Zoom, and Offset settings are valid.

Note

- The displayed waveforms do not change, if you turn the V/DIV knob while the waveform acquisition is stopped. The new V/div value becomes valid the next time the waveform acquisition is started.
- Rotating the V/DIV knob while acquisition is stopped has no affect on cursor measurement and automated measurement of waveform parameters. The displayed values are for the V/div setting that existed when the measurement was made.

- **Selectable Range of V/div**

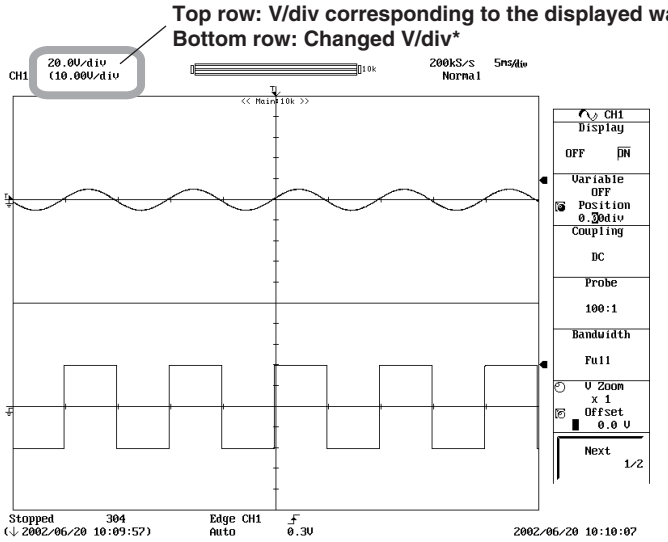
  The selectable range varies depending on the input module as follows.

Input Module	Selectable Range
701250 (HS10M12)	5 mV/div to 20 V/div
701251 (HS1M16)	1 mV/div to 20 V/div
701255 (NONISO_10M12)	5 mV/div to 20 V/div
701260 (HV (with RMS))	20 mV/div to 200 V/div
701265 (TEMP/HPV)	0.1 mV/div to 10 V/div
701275 (ACCL/VOLT)	5 mV/div to 10 V/div

The above values are given for a probe attenuation of 1:1. They will be 10 times the value shown when the probe attenuation is 10:1, 100 times the value shown when the probe attenuation is 100:1, and 1000 times the value shown when the probe attenuation is 1000:1.

- **V/div Display**

  If the V/DIV knob is turned while the waveform acquisition is stopped, the top row displays the V/div corresponding to the displayed waveform and the bottom row displays the new V/div. The new V/div value becomes valid the next time waveform acquisition is started.



*** If the V/div corresponding to the displayed waveform and the changed V/div are the same, only the bottom row is displayed.**

V/div Setting (When Variable Is ON)

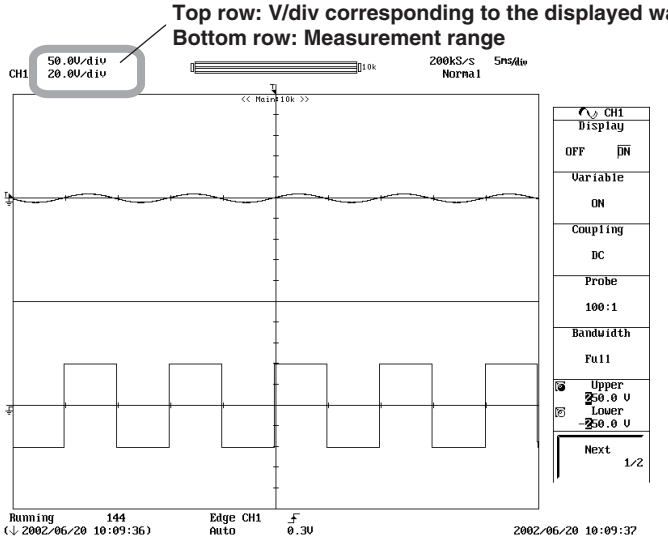
Changing of the V/div signifies a change in the measurement range. When Variable is set to ON, the Upper and Lower settings become valid.

Note

If you rotate the V/DIV knob while acquisition is stopped and change the Upper and Lower values, the displayed waveforms also change.

- **V/div Display**

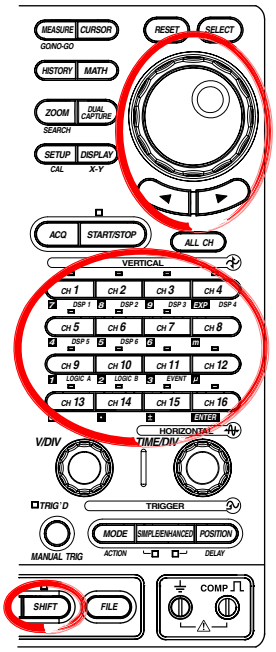
  If the V/DIV knob is turned while the waveform acquisition is stopped, the top row displays the V/div corresponding to the displayed waveform and the bottom row displays the measurement range.



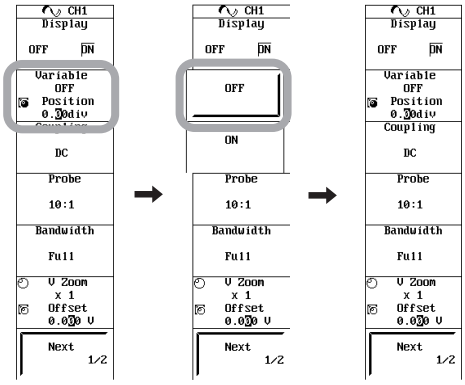
5.4 Setting the Vertical Position of Waveforms

<For a description of this function, refer to page 2-6.>

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel. Proceed to step 2.
   To select a logic waveform, press **SHIFT+CH9 (LOGIC A)** or **SHIFT+CH10 (LOGIC B)**. Proceed to step 4.
   To select an event waveform, press **SHIFT+CH11 (EVENT)**. Proceed to step 4.
   To select a DSP channel (optional), press **SHIFT + CH1 (DSP1)** through **SHIFT + CH6 (DSP6)**.
2. Press the **Variable/Position** soft key. The Variable selection menu appears.
3. Press the **OFF** soft key. Check that Position is selected (◙).
4. Turn the **jog shuttle** to set the vertical position.



Explanation

Range of Movement

The vertical position can be moved within a range of ± 5 divisions from the center of the waveform display frame.

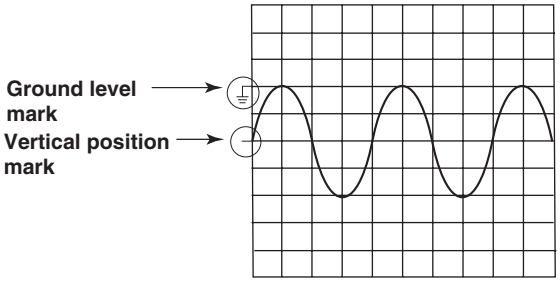
Resolution

0.01 division

Confirming the Vertical Position

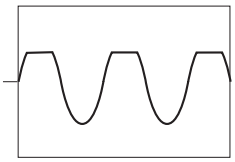
For input waveforms and computed waveforms, the ground level and vertical position are marked on the left of the waveform display frame.

500 mV/div, Offset: –1 V, Position: 0 div



Note

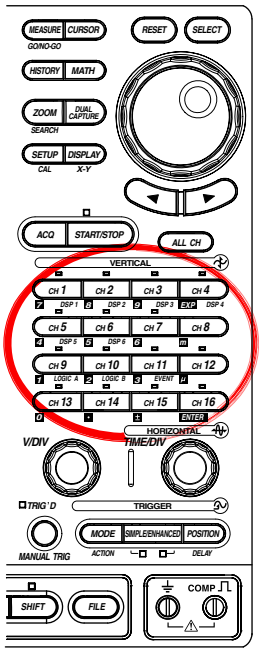
Data that exceeds of the effective display range (see section 2.2) from changing the vertical position, offset voltage, or upper and lower limits (when Variable is ON) is handled as overflow data. Overflow data appears chopped as shown in the figure below.



5.5 Setting the Input Coupling

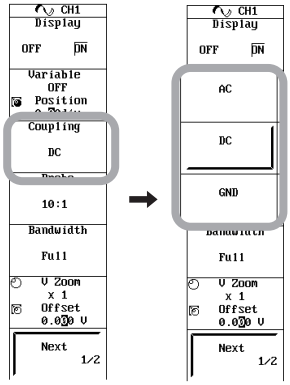
<For a description of this function, refer to page 2-8.>

Procedure

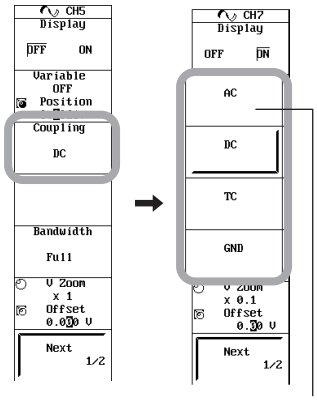


1. Press a key from **CH1** to **CH16** keys to select the desired channel.
2. Press the **Coupling** soft key. The coupling selection menu appears.
3. Press the soft key corresponding to the desired coupling.
   When observing temperature using the 701265 (TEMP/HPV), select TC.
   For the setup procedure of temperature measurements, see section 5.16.

Input module:
701250(HS10M12)/701251(HS1M16)/
701255(NONISO_10M12)



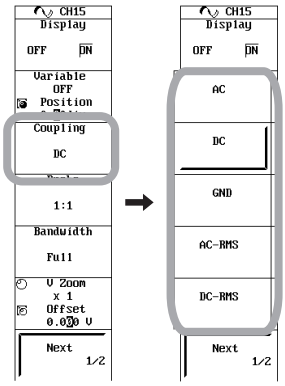
Input module:
701261(UNIVERSAL)/
701262(UNIVERSAL(AAF))/
701265(TEMP/HPV)



AC is not available on the 701265.

When observing rms values using the 701260 (HV (with RMS)), select AC-RMS or DC-RMS.
For the setup procedure of rms measurements, see section 5.15.
Select ACCL when measuring acceleration on the 701275 (ACCL/VOLT). For the setup procedure of acceleration measurements, see section 5.18.

Input module:
701260(HV(with RMS))



Explanation

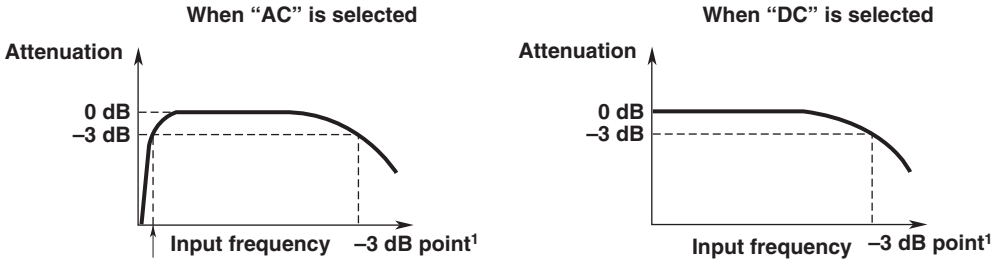
Selecting the Input Coupling

Select how the input signal is coupled to the vertical control circuit from the following:

AC: Acquires only the AC component of the input signal.
DC: Acquires and displays all the components (DC and AC) of the input signal. Selectable only when observing voltage.
GND: Checks the ground level.
TC: Select this type when observing temperature.
AC-RMS: Converts and displays only the AC component of the input signal.
DC-RMS: Converts and displays both DC and AC components of the input signal.
ACCL: Select this type when measuring acceleration.

Input Coupling and Frequency Characteristics

The frequency characteristics when AC and DC are selected are shown below. Note that low-frequency signals and signal components are not acquired if AC is selected as indicated in the figure below.



The lower frequency –3 dB point when using AC coupling*

1. The value varies for each input module. For details, see chapter 19.12, "Module Specifications."

Notes for the 701261, 701262, 701265, 701275, and 701280

- If the input coupling is changed from TC to DC or DC to TC while the waveform acquisition is stopped on the 701261 (UNIVERSAL), 701262 (UNIVERSAL (AAF)), or 701265 (TEMP/HPV), the waveforms are no longer drawn. If you set the input coupling to the original setting, the waveforms are redrawn.
- If the input coupling is changed from ACCL to some other setting or some other setting to ACCL while the waveform acquisition is stopped on the 701275 (ACCL/VOLT), the waveforms are no longer drawn. If you set the input coupling to the original setting, the waveforms are redrawn.
- If you change the contents of the function of the FV setting while the waveform acquisition is stopped on the 701280 (FREQ), the waveforms are no longer drawn. If you set the contents of the function to the setting that was present during measurement, the waveforms are redrawn.

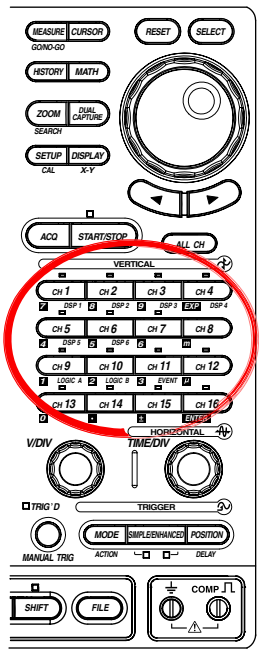
CAUTION

- If the input coupling is AC and the frequency of the input signal is less than 1 Hz, the DL750/DL750P does not attenuate the signal at the input terminal to 1/10, even if a probe with 10:1 attenuation and input resistance of 10 MΩ is used. Make sure not to input a voltage that has a signal component less than 1 Hz that exceeds the maximum input voltage of each module.
- Do not apply a voltage exceeding the maximum input voltage or maximum allowable common mode voltage of the input modules. This may cause damage to the input section.

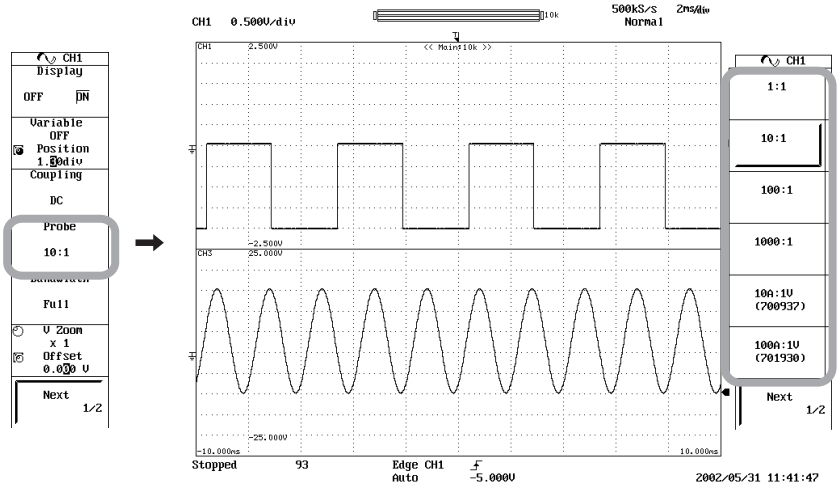
5.6 Setting the Probe Type

<For a description of this function, refer to page 2-9.>

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel.
2. Press the **Probe** soft key. The probe selection menu appears.
3. Press the soft key corresponding to the desired type (attenuation).



Explanation

Select the appropriate probe type for each channel from the following:
1:1, 10:1, 100:1, 1000:1, 10 A:1 V, and 100 A:1 V
1:1 to 1000:1 represent the probe attenuation for voltage probes.
10 A:1 V and 100 A:1 V represent the output voltage rate of current probes.

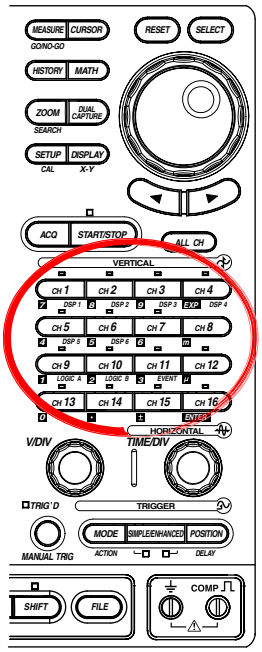
Note

If the probe type is not set correctly, the voltage and scale values of the input signals will not be displayed correctly. For example, if you set the attenuation to 1:1 when using a 10:1 probe, the displayed value for the waveform amplitude will be 1/10 the true value.

5.7 Setting the Bandwidth

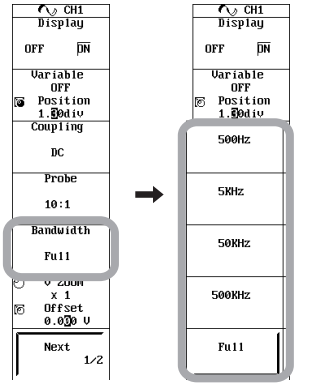
<For a description of this function, refer to page 2-9.>

Procedure

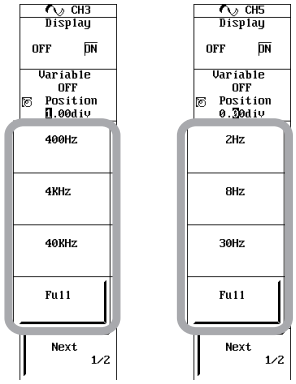


1. Press a key from **CH1** to **CH16** keys to select the desired channel.
2. Press the **Bandwidth** soft key. The bandwidth selection menu appears.
3. Press the soft key corresponding to the desired bandwidth. (The possible choices vary depending on the module.)
4. As necessary, repeat steps 1 to 3.

701250(HS10M12)/
701255(NONISO_10M12)

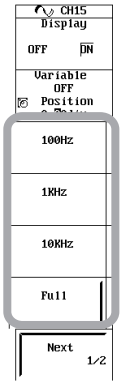


701265(TEMP/HPV)
701261(UNIVERSAL)*1/
701262(UNIVERSAL(AAF))*1

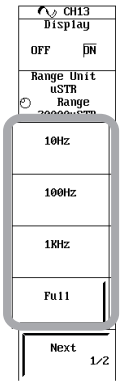


***1 When measuring voltage**

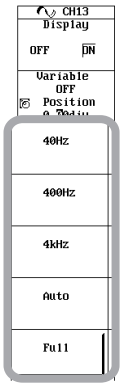
701260
(HV(with RMS))



701270(STRAIN_NDIS)/
701271(STRAIN_DSUB)



701275(ACCL/VOLT)
701261(UNIVERSAL)*2/
701262(UNIVERSAL(AAF))*2



***2 When measuring temperature**

Auto is not available on the701261.

Note

The bandwidth is set for each channel. Set the bandwidth for all necessary channels.

Explanation

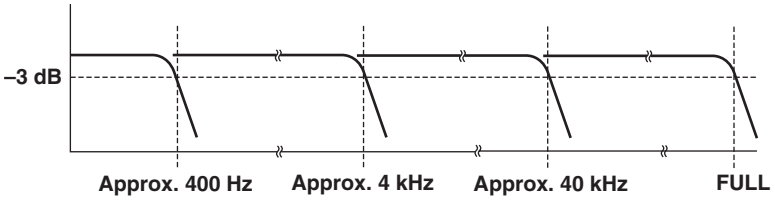
Selecting the Bandwidth Limit

High frequency components can be eliminated from the input signal. The bandwidth varies depending on the input module as follows. For the bandwidth limit of the 701280 (FREQ), see page 5-51.

Input Module	Bandwidth
701250 (HS10M12) 701255 (NONISO_10M12)	500 Hz, 5 kHz, 50 kHz, 500 kHz, and Full
701251 (HS1M16)	400 Hz, 4 kHz, 40 kHz, and Full
701260 (HV (with RMS))	100 Hz, 1 kHz, 10 kHz, Full
701261 (UNIVERSAL)*1 701262 (UNIVERSAL (AAF))*1 701265 (TEMP/HPV)	2 Hz, 8 Hz, 30 Hz, and Full
701270 (STRAIN_NDIS)/ 701271 (STRAIN_DSUB)	10 Hz, 100 Hz, 1 kHz, Full
701261 (UNIVERSAL)*2 701262 (UNIVERSAL (AAF))*2 701275 (ACCL/VOLT)	40 Hz, 400 Hz, 4 kHz, Auto, Full

*1 When measuring temperature
*2 When measuring voltage. Auto is not available on the 701261.

For example, frequency bandwidths of 400 Hz, 4 kHz, and 40 kHz are available on the 701251 (HS1M16). The frequency characteristics when bandwidth is limited are shown below. When Full is selected, the maximum bandwidth of the input module is used.



Bandwidth Limit on the 701262 (UNIVERSAL (AAF)) and 701275 (ACCL/VOLT)

If you set the bandwidth limit on the 701262 (UNIVERSAL (AAF)) when measuring voltage or the 701275 (ACCL/VOLT) to Auto, the anti-aliasing filter and low-pass filter settings are set to values shown below according to the sample rate.

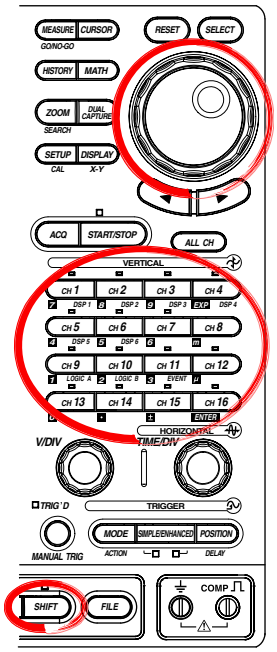
Sample Rate	Anti-aliasing Filter	Low-pass filter
200 kS/s or greater	40 kHz	OFF
100 kS/s	40 kHz	OFF
50 kS/s	20 kHz	OFF
20 kS/s	8 kHz	OFF
10 kS/s	4 kHz	4 kHz
5 kS/s	2 kHz	4 kHz
2 kS/s	800 Hz	4 kHz
1 kS/s	400 Hz	400 Hz
500 S/s	200 Hz	400 Hz
200 S/s	80 Hz	400 Hz
100 S/s	40 Hz	40 Hz
50 S/s	20 Hz	40 Hz
5 S/s to 20S/s	20 Hz	40 Hz
2 S/s or less	20 Hz	40 Hz
Ext sample	40 kHz	OFF

For example, for sample rates between 100 kS/s to 50 kS/s, the cutoff frequency of the anti-aliasing filter is set to 40% of the sample rate.

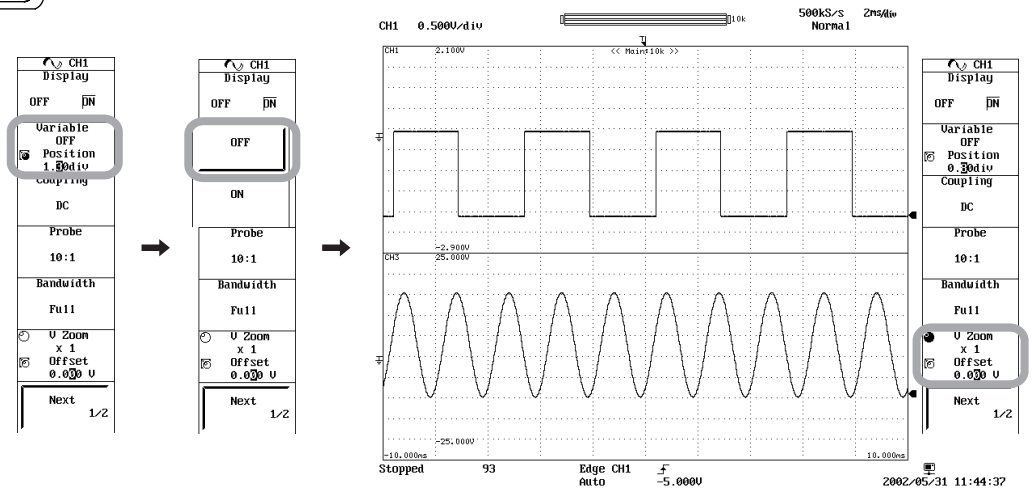
5.8 Zooming Vertically by Setting the Zoom Rate

<For a description of this function, refer to page 2-7.>

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel.
   To select a logic waveform, press **SHIFT+CH9 (LOGIC A)** or **SHIFT+CH10 (LOGIC B)**.
   To select an event waveform, press **SHIFT+CH11 (EVENT)**.
   To select a DSP channel (optional), press **SHIFT + CH1 (DSP1)** through **SHIFT + CH6 (DSP6)**.
2. Press the **Variable** soft key to select OFF.
3. Press the **V Zoom/Offset** soft key (the **V Zoom** soft key for logic input) to set the jog shuttle control to V Zoom.
4. Turn the **jog shuttle** to set the zoom rate.



Note

- Pressing the RESET key while the jog shuttle control is set to V Zoom sets the zoom rate to ×1.
- When zooming in on the waveforms vertically using V Zoom, the V/div indication (upper left corner of the screen) shows the V/div corresponding to the displayed waveform in the top row and the value being entered using the V/DIV knob in the bottom row.

Explanation

The displayed waveform can be enlarged/reduced vertically. This is useful when you wish to change the vertical axis setting after displaying waveforms. This function can be used when the Variable setting is OFF.

Selecting the Trace to Zoom On

Select a single waveform from CH1 to CH16, LOGIC A, LOGIC B, DSP1 to DSP6 (optional), and EVENT.
However, zooming is not possible if the selected waveform is turned OFF.

Zoom Rate: V Zoom

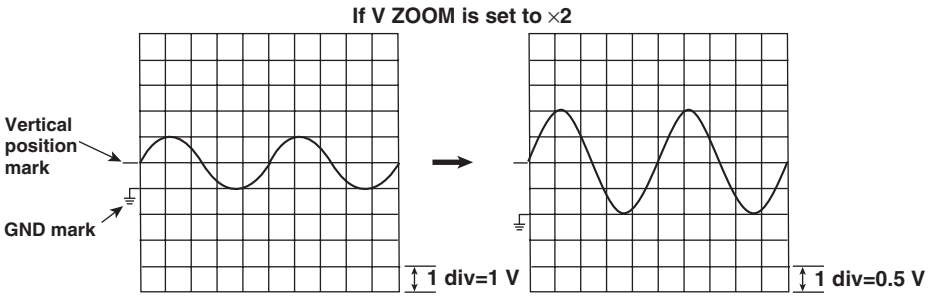
The following zoom rates are available.
×0.1, ×0.111, ×0.125, ×0.143, ×0.167, ×0.2, ×0.25, ×0.33, ×0.4, ×0.5, ×0.556, ×0.625, ×0.667, ×0.714, ×0.8, ×0.833, ×1, ×1.11, ×1.25, ×1.33, ×1.43, ×1.67, ×2, ×2.22, ×2.5, ×3.33, ×4, ×5, ×6.67, ×8, ×10, ×12.5, ×16.7, ×20, ×25, ×40, ×50, and ×100

However, the range of zoom rates that can be specified varies for the following cases.

- **On the 701260 (HV (with RMS))**
  When set to 50 V/div: ×0.25 to ×100
  When set to 100 V/div:×0.5 to ×100
  When set to 200 V/div:×1 to ×100
- **When measuring acceleration on the 701275 (ACCL/VOLT)**
  ×0.5 to ×50
- **On the 701280 (FREQ)**
  ×0.33 to ×100

Zoom Position

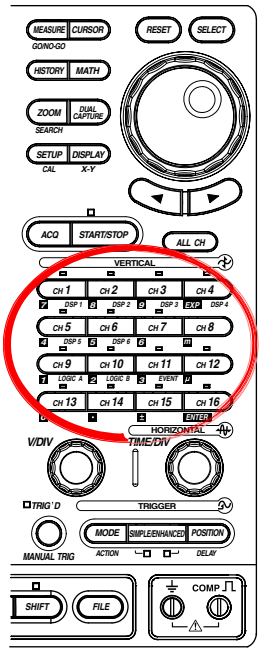
The waveform is zoomed around the vertical position.



5.9 Zooming Vertically According to the Upper and Lower Limits of the Display Range

<For a description of this function, refer to page 2-7.>

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel.
   To select a DSP channel (optional), press **SHIFT + CH1 (DSP1)** through **SHIFT + CH6 (DSP6)**.
2. Press the **Variable/Position** soft key. The Variable selection menu appears.
3. Press the **ON** soft key.

Setting the Upper Limit

4. Press the **Upper/Lower** soft key to set the jog shuttle control to Upper.
5. Turn the **jog shuttle** to set the upper limit.

Setting the Lower Limit

6. Press the **Upper/Lower** soft key to set the jog shuttle control to Lower.
7. Turn the **jog shuttle** to set the lower limit.

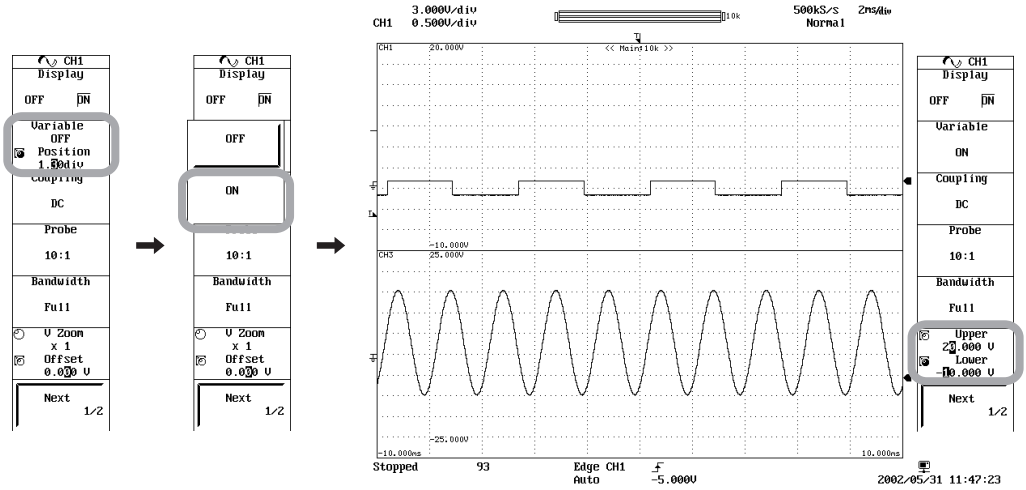
Setting the Upper and Lower Limits Simultaneously

8. Press the **Upper/Lower** soft key to set the jog shuttle control to both Upper and Lower.
9. Turn the **jog shuttle** to set the upper and lower limits without changing the spacing between the two.

Note

Pressing RESET sets the maximum and minimum values of the measurement range to the upper and lower limits.

- When observing voltage — Upper: 10 times +V/div, Lower: 10 times –V/div
- When observing strain — Upper: +FS, Lower: –FS
- When measuring acceleration — Upper: 5000/(gain × sensitivity), Lower: –5000/(gain × sensitivity)
- When measuring frequency and other parameters on the frequency module — Upper: (Offset value) + (Value/div × 30), Lower: (Offset value) – (Value/div × 30)

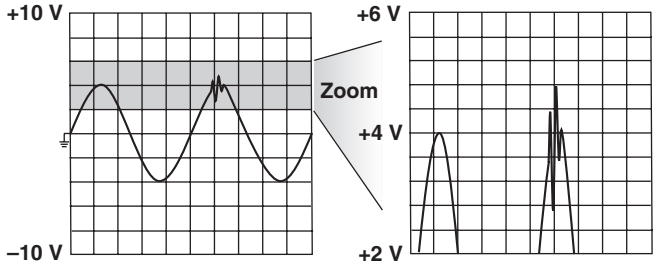


Explanation

Zooming Vertically According to the Upper and Lower Limits of the Display Range: Variable

You can select whether to zoom vertically according to the upper and lower limits of the display range.

- **ON**
  You can zoom in on the desired section of the observed waveform by specifying the upper and lower limits of the vertical axis according to the displayed waveform. Conversely, you can widen the display range to view waveforms outside the display range. The A/D conversion resolution and accuracy remain the same as those for the original waveform, when the waveform is expanded/reduced with Variable turned ON.



- **OFF**
  Does not zoom vertically using the upper and lower limit settings. In this case, the vertical position (section 5.4), vertical zoom by setting the zoom rate (section 5.8), and offset voltage (section 5.10) can be changed.

Selectable Range of Upper and Lower Limits

Up to the smaller of the two values ±(100 times the specified V/div) or 2000 V. Make sure the upper limit value (Upper) is greater than the lower limit value (Lower).

- Below are the ranges on the 701270 (STRAIN_NDIS) and 701271 (STRAIN_DSUB) according to the range unit.
  When the range unit is μSTR: ±30000 μSTR
  When the range unit is mV/V: ±15 mV/V
- Up to ±2000000 unit on the 701275 (ACCL/VOLT).
- Up to (offset value) ± (Value/div × 30) on the 701280 (FREQ).
  - When measuring the frequency: –1500 Hz to 1700 Hz
  - When measuring RPMs: –300krpm to 350 krpm
  - When measuring RPSs: –5000 rps to 7000 rps
  - When measuring the period: –150 s to 200 s
  - When measuring the duty cycle: –500% to 700%
  - When measuring the pulse width: –150 s to 200 s
  - When measuring the pulse integration: –2.5E+22 to 2.5E+22
  - When measuring the velocity: –2.5E+22 to 2.5E+22
- Up to ±(100 times the specified Value/div) on the optional DSP channel.

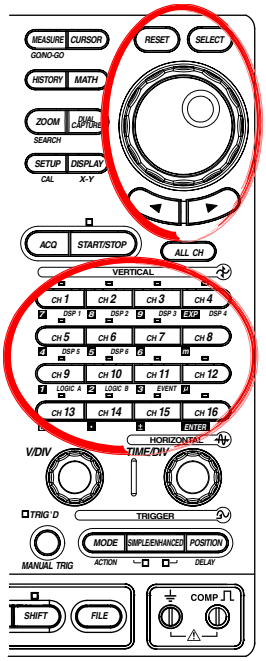
Note

Changing V/div using the V/DIV knob after setting the upper and lower limits does not change the V/div setting on the screen, but changes the measurable range. If you set the measurable range smaller than the specified upper and lower limits and start the waveform acquisition, the section of the waveform exceeding the measurable range may not be displayed. The measurable range is approximately ±10 divisions (around 0) when Variable is OFF.

5.10 Setting the Offset Value

<For a description of this function, refer to page 2-6.>

Procedure

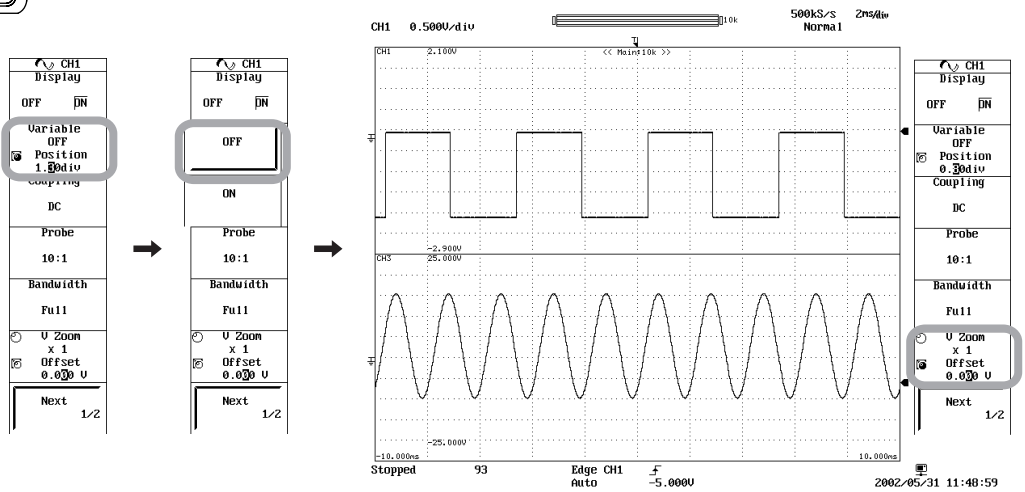


Setting the Offset Value

1. Press a key from **CH1** to **CH16** keys to select the desired channel.
2. Press the **Variable** soft key to select OFF.
3. Press the **V Zoom/Offset** soft key to set jog shuttle action to Offset.
4. Turn the **jog shuttle** to set the offset value.

When Resetting the Offset Value to 0 V

5. Press **RESET** to set the offset voltage to 0 V.



Explanation

The offset value is valid when measuring voltage, or frequency and other parameters on the frequency module.

Selectable Range of Offset Value

When measuring voltage: ±5 div
On the frequency module, the range varies depending on the measured parameter.

- When measuring the frequency: ±(Value/div value) × 1000 or 200 kHz
- When measuring RPMs: ±(Value/div value) × 1000 or 50 krpm
- When measuring RPSs: ±(Value/div value) × 1000 or 1000 rps
- When measuring the period: ±(Value/div value) × 1000 or 50 s
- When measuring the duty cycle: ±(Value/div value) × 1000 or 100%
- When measuring the pulse width: ±(Value/div value) × 1000 or 50 s
- When measuring the pulse integration: ±(Value/div value) × 1000 or 1.0000E+22
- When measuring the velocity: ±(Value/div value) × 1000 or 1.0000E+22

Resetting the Offset Value

Pressing RESET resets the offset value to 0.

Notes When Setting the Offset Value

- When measuring voltage, the offset voltage is effective even when the acquisition is stopped. When measuring frequency and other parameters on the frequency module, the changes you make on the offset value are invalid when the acquisition is stopped. The new offset value takes effect on the next measurement.
- If you change the probe attenuation when measuring voltage, the offset changes proportionally to reflect the new attenuation rate.
- When measuring voltage, changing the voltage sensitivity does not change the offset value. If the change would cause the offset to go outside the range, the offset moves to the nearest range limit at the current voltage sensitivity. If you then return to the original sensitivity, the offset returns to its original setting as well (provided that you have not explicitly changed the value in the meantime).

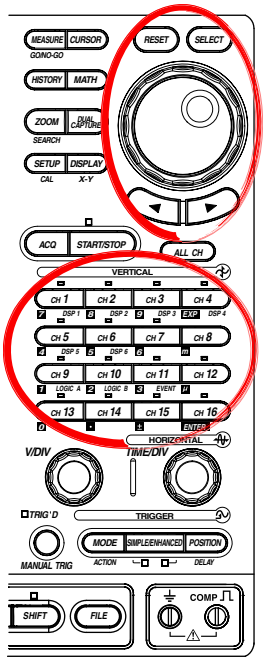
Note

Changing the offset voltage allows the waveform position to be changed with respect to the vertical position. (The center for the vertical zoom can be changed.)

5.11 Using the Linear Scaling Function (AX+B, P1-P2)

<For a description of this function, refer to page 2-10.>

Procedure



Selecting Linear Scaling

1. Press a key from **CH1** to **CH16** keys to select the desired channel.
2. Press the **Next 1/2** soft key.
3. Press the **Linear Scale** soft key. A Linear Scale setup dialog box appears.
4. Use **SELECT**, **jog shuttle**, and **SELECT** to set Mode to AX+B or P1-P2.

- **When AX+B Is Selected**

5. Use **SELECT** and the **jog shuttle** to set A (scaling coefficient).
6. Use **SELECT** and the **jog shuttle** to set B (offset voltage).

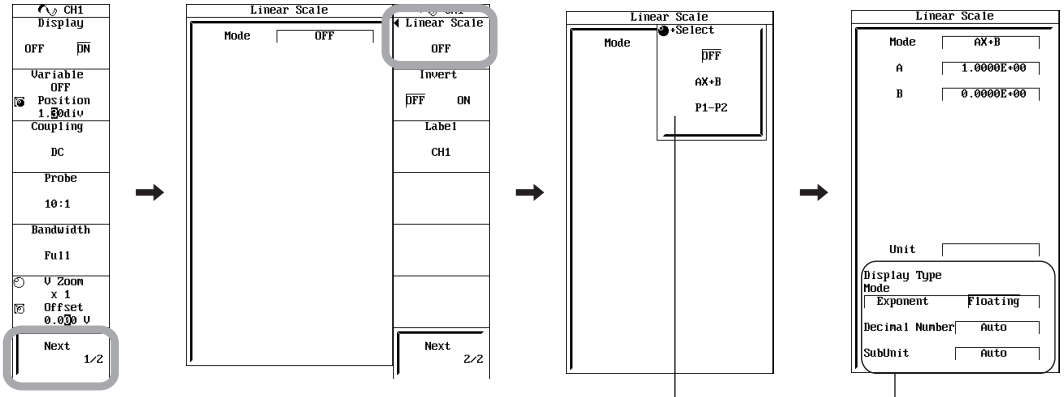
- **Setting the Unit**

7. As necessary, enter the Unit according to the procedures given in section 4.2.

   When measuring voltage on the voltage module or strain on the strain module, proceed to step 8.

- **Setting the Display Type**

8. Use **SELECT** and the **jog shuttle** to set Mode under Display Type to Exponent or Floating.
9. If Floating was selected in step 8, use **SELECT** and the **jog shuttle** to set Decimal Number and SubUnit.
   Select the number of digits to the right of the decimal from Auto, 0 to 3.
   Select the sub unit from Auto, p, n, µ, m, None, k, M, G, and T.



When measuring voltage on the voltage module or strain on the strain module, the setup items for display type is displayed.

On the 701271 (STRAIN_DSUB), "Shunt" is displayed. The Shunt item is used to perform shunt calibration on the strain module. For the setup procedure of Shunt, see section 5.17.

- **When P1-P2 Is Selected**

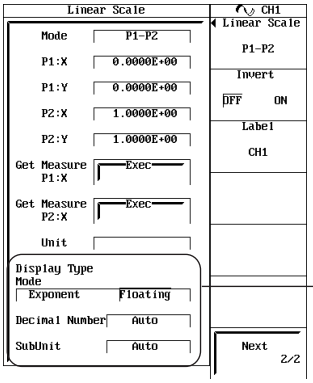
5. Use **SELECT** and the **jog shuttle** to set the P1:X value. Or, turn the **jog shuttle** to select Get Measure P1:X and then press **SELECT** to read the measured value into P1:X.
6. Use **SELECT** and the **jog shuttle** to set the P1:Y value.
7. Use **SELECT** and the **jog shuttle** to set the P2:X value. Or, turn the **jog shuttle** to select Get Measure P2:X and then press **SELECT** to read the measured value into P2:X.
8. Use **SELECT** and the **jog shuttle** to set the P2:Y value.

- **Setting the Unit**

9. As necessary, enter the Unit according to the procedures given in section 4.2. When measuring voltage on the voltage module or strain on the strain module, proceed to step 10.

- **Setting the Display Type**

10. Use **SELECT** and the **jog shuttle** to set Mode under Display Type to Exponent or Floating.
11. If Floating was selected in step 8, use **SELECT** and the **jog shuttle** to set Decimal Number and SubUnit.
    Select the number of digits to the right of the decimal from Auto, 0 to 3.
    Select the sub unit from Auto, p, n, μ, m, None, k, M, G, and T.



When measuring voltage on the voltage module or strain on the strain module, the setup items for display type is displayed.

Note

- Linear scaling is not possible when observing temperature or acceleration.
- Linear scaling is not available for the following waveforms.
  Snapshot waveforms
  Accumulated waveforms (excluding the newest waveform)
- Linear scaling is set for each channel.
- The scaling coefficient A and offset value B that you entered are held even if you turn OFF the linear scaling function.
- Computation is performed using the linear scaling results.

Explanation

There are two linear scaling methods available: AX+B and P1–P2.

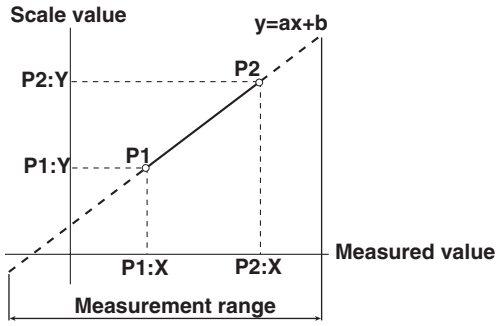
Selecting the Linear Scaling Method

Select the linear scaling method from the following:

- **OFF**
  No linear scaling.

- **AX+B**
  The results obtained from the following computation based on the specified scaling coefficient A and offset B are displayed as cursor measurement values and automated measurement values of waveform parameters. You can also assign a unit to the result of linear scaling.
  Y = AX + B (where X is the measured value and Y is the linear scaling result)

- **P1–P2**
  Specify arbitrary scale values (P1:Y and P2:Y) for the measured values of two arbitrary points (P1:X and P2:X). The scale conversion equation (y = ax + b) is derived from these four values.
  - Range of measured values (P1:X, P2:X): Same as the measurement range.
  - Range of scale values (P1:Y, P2:Y): –1.0000E+25 to +1.0000E+25
  - Initial setting of scale values: P1:X=+0.0000E+00, P1:Y=+0.0000E+00
    P2:X=+1.0000E+00, P2:Y=+1.0000E+00



Setting AX+B

- **Setting Scaling Coefficient A and Offset Value B**
  Selectable range of A and B: –9.9999E+30 to +9.9999E+30
  Initial setting of A: +1.0000E+00
  Initial setting of B: +0.0000E+00

Setting P1–P2

- **Reading Measured Values: Get Measure**
  Regardless of whether the waveform acquisition is started or stopped, the current value (value indicated by the level indicator) can be read into P1:X or P2:X.

Setting the Unit

Alphanumeric characters that can be entered: Up to 4 characters

Display Type

When measuring voltage on the voltage module or strain on the strain module, select the display type for the linear scaling result from the two choices below.

Exponent: Exponential display.

Floating: Decimal display. Use Decimal Number to select the number of digits to the right of the decimal from Auto, 0 to 3. Use SubUnit to select the sub unit from Auto, p, n, μ, m, None, k, M, G, and T.

- Decimal Number: When a setting between 0 and 3 is selected, the selected number of digits is displayed to the right of the decimal point. When Auto is selected, the value is displayed using 5 digits total (example: 1.0000 and 250.00). The initial setting is Auto.
- SubUnit: If a setting other than Auto is selected, the value is displayed using the specified sub unit. If Auto is selected, the most suitable unit for the value is automatically set. The initial setting is Auto. If the value cannot be displayed using a decimal value, exponential display is enabled.

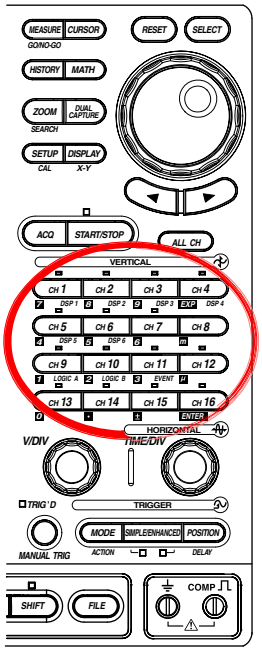
Displaying the Scale Value

The linearly scaled values of the upper and lower limits of the vertical axis of each channel can be displayed. For details, see section 8.9.

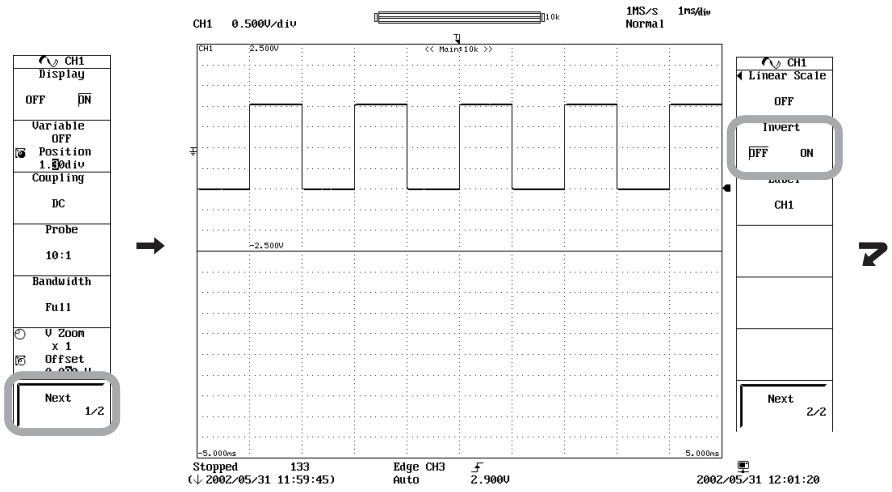
5.12 Inverting Waveforms

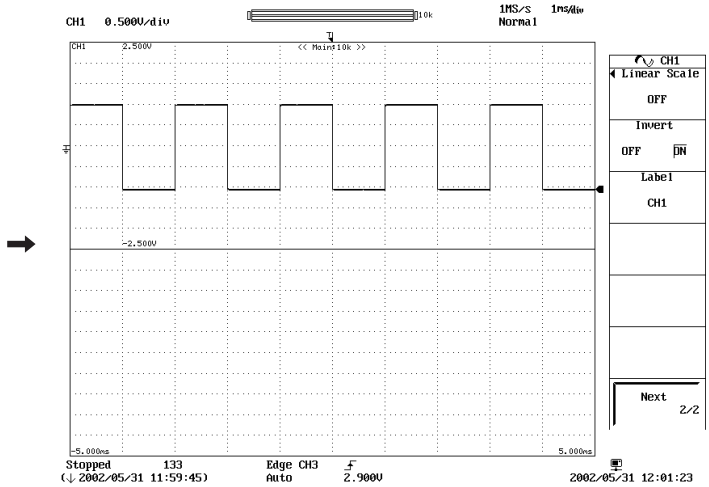
<For a description of this function, refer to page 2-10.>

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel.
2. Press the **Next 1/2** soft key.
3. Press the **Invert** soft key to select ON.





Explanation

Channel to Be Inverted

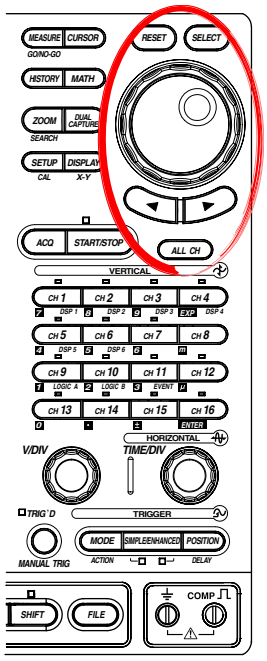
The input signals to channels CH1 to CH16 can be inverted independently.
The waveform is inverted around the vertical position.

Notes When Inverting Waveforms

- Cursor measurements, automated measurement of waveform parameters, and computation are performed on the inverted waveform.
- The trigger function is executed on the original waveform even if the waveform is inverted.
- When measuring strain, inversion is not possible on waveforms after measurements. The invert ON/OFF change takes effect on the next measurement.

5.13 Displaying the All Channel Setup Menu

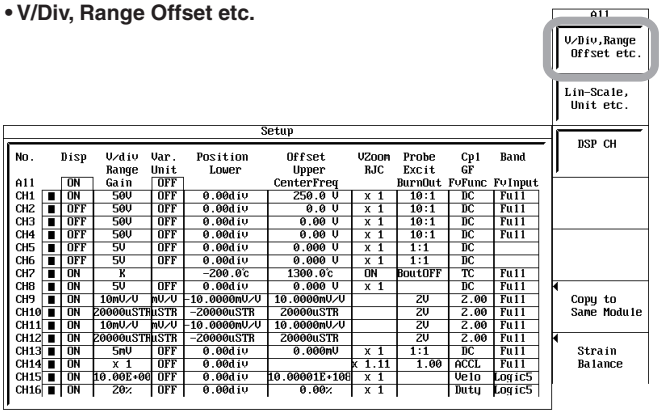
Procedure



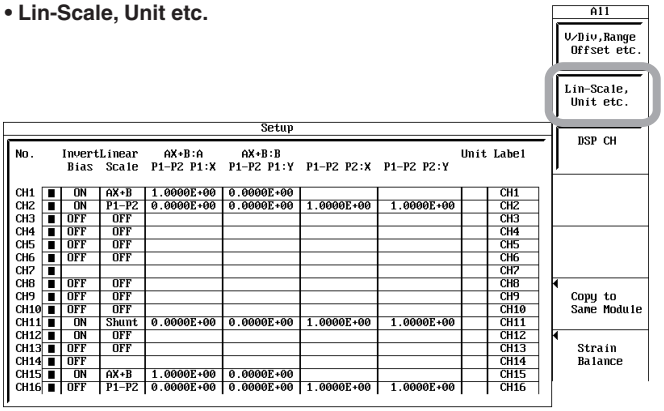
Displaying the All Channel Setup Menu

1. Press **ALL CH**.
2. Press the **V/Div**, **Range Offset etc.**, **Lin-Scale**, **Unit etc.**, or **DSP CH** (optional) soft key to show the setup menu.
3. Turn the **jog shuttle** or press the arrow keys to move the cursor to the desired parameter.
4. Press **SELECT** to display the setup menu for the selected parameter.
5. Use the **jog shuttle**, **SELECT**, and arrow keys to set each parameter.

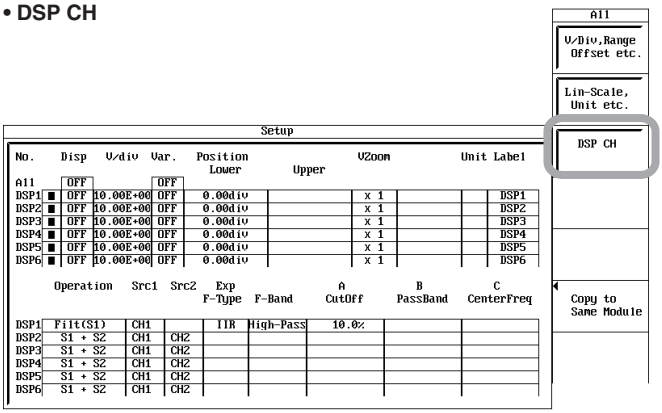
• V/Div, Range Offset etc.



• Lin-Scale, Unit etc.



• DSP CH

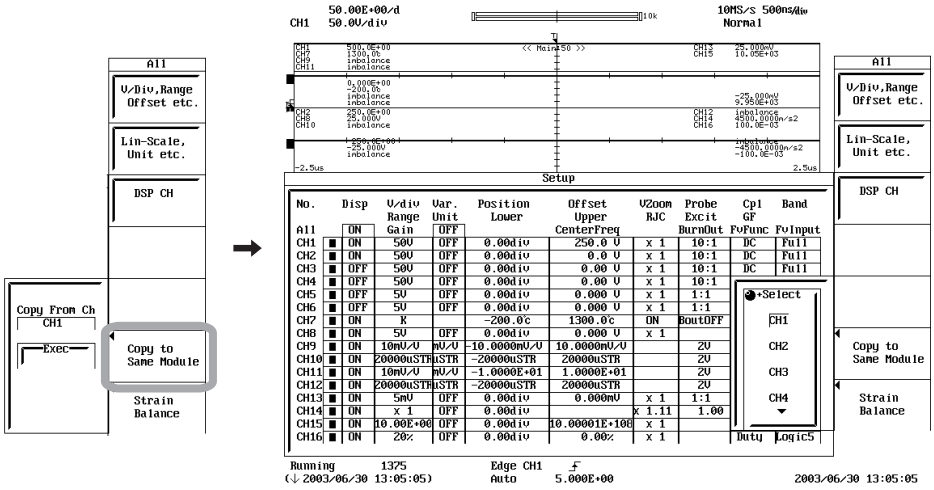


Copying to the Same Type of Modules

2. Press the **Copy to Same Module** soft key. The Copy From Ch screen appears.
3. Turn the **jog shuttle** to select Copy From Ch and press **SELECT**.
4. Use the **jog shuttle and SELECT** to select the copy source channel.
5. Turn the **jog shuttle** to select Exec and press **SELECT**. All of the settings are copied to all the channels of the same type of modules as the copy source.

Note

Waveform colors and labels are not copied.



Turning ON/OFF the All the Channels

2. Use the **jog shuttle** or arrow keys to move to the Disp box for All and press **SELECT**. You can turn ON/OFF all the channels simultaneously.

Turn ON/OFF all the channels(CH1 to CH16) simultaneously.

No.	Disp	V/div Range Gain	Var. Unit	Position Lower	Offset Upper CenterFreq	VZoom RJC	Probe Excit BurnOut	Cpl GF FvFunc	Band FvInput
All	ON		OFF						
CH1	ON	50V	OFF	0.00div	250.0 V	x 1	10:1	DC	Full
CH2	OFF	50V	OFF	0.00div	0.0 V	x 1	10:1	DC	Full
CH3	OFF	50V	OFF	0.00div	0.00 V	x 1	10:1	DC	Full
CH4	OFF	50V	OFF	0.00div	0.00 V	x 1	10:1	DC	Full
CH5	OFF	5V	OFF	0.00div	0.000 V	x 1	1:1	DC	
CH6	OFF	5V	OFF	0.00div	0.000 V	x 1	1:1	DC	
CH7	ON	K		-200.0c	1300.0c	ON	BoutOFF	TC	Full
CH8	ON	5V	OFF	0.00div	0.000 V	x 1		DC	Full
CH9	ON	10mV/V	mV/V	-10.0000mV/V	10.0000mV/V		2V	2.00	Full
CH10	ON	20000uSTR	uSTR	-20000uSTR	20000uSTR		2V	2.00	Full
CH11	ON	10mV/V	mV/V	-10.0000mV/V	10.0000mV/V		2V	2.00	Full
CH12	ON	20000uSTR	uSTR	-20000uSTR	20000uSTR		2V	2.00	Full
CH13	ON	5mV	OFF	0.00div	0.000mV	x 1	1:1	DC	Full
CH14	ON	x 1	OFF	0.00div		x 1.11	1.00	ACCL	Full
CH15	ON	10.00E+00	OFF	0.00div	10.00001E+10E	x 1		Velo	Logic5
CH16	ON	20%	OFF	0.00div	0.00%	x 1		Duty	Logic5

Turn ON/OFF all the DSP channels(DSP1 to DSP6) simultaneously.

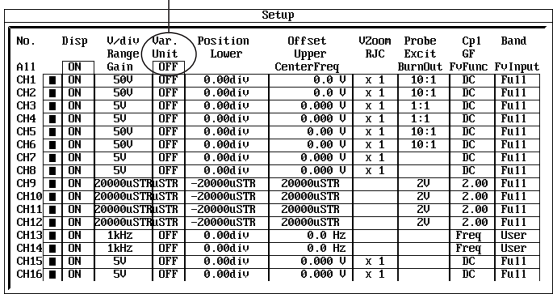
No.	Disp	V/div	Var.	Position Lower	Upper	VZoom			Unit Label
All	OFF		OFF						
DSP1	OFF	10.00E+00	OFF	0.00div		x 1			DSP1
DSP2	OFF	10.00E+00	OFF	0.00div		x 1			DSP2
DSP3	OFF	10.00E+00	OFF	0.00div		x 1			DSP3
DSP4	OFF	10.00E+00	OFF	0.00div		x 1			DSP4
DSP5	OFF	10.00E+00	OFF	0.00div		x 1			DSP5
DSP6	OFF	10.00E+00	OFF	0.00div		x 1			DSP6

	Operation	Src1	Src2	Exp F-Type	F-Band	A CutOff	B PassBand	C CenterFreq
DSP1	Filt(S1)	CH1		IIR	High-Pass	10.0%		
DSP2	S1 + S2	CH1	CH2					
DSP3	S1 + S2	CH1	CH2					
DSP4	S1 + S2	CH1	CH2					
DSP5	S1 + S2	CH1	CH2					
DSP6	S1 + S2	CH1	CH2					

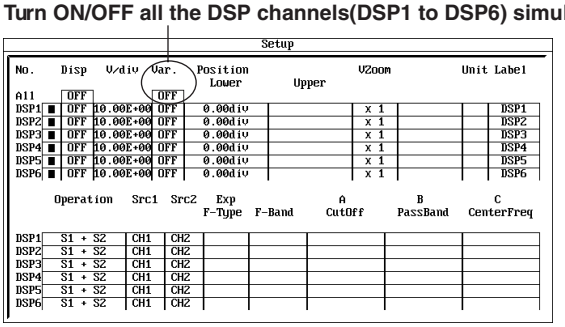
Turning Variable ON/OFF on All Channels

2. Use the **jog shuttle** or arrow keys to move to the All box of Var. and press **SELECT**. You can turn ON/OFF Variable (zooming vertically according to the upper and lower limits of the display range) of all channels (except those in which strain modules installed) simultaneously.

Turn ON/OFF all the channels(CH1 to CH16) simultaneously.



Turn ON/OFF all the DSP channels(DSP1 to DSP6) simultaneously.

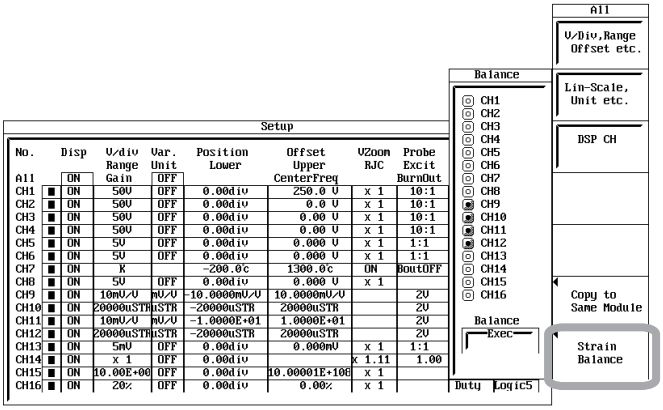


Note

The range unit of the strain module is displayed in the Var. Unit box of the channel in which a strain module is installed. The range unit does not change even if Var. All is turned ON/OFF.

Executing the Balancing of the Strain Module

2. Press the **Strain Balance** soft key. The Balance screen appears.
3. Use the **jog shuttle and SELECT** to set the channel on which to execute balancing.
4. Turn the **jog shuttle** to select Exec and press **SELECT**. Balancing is executed.



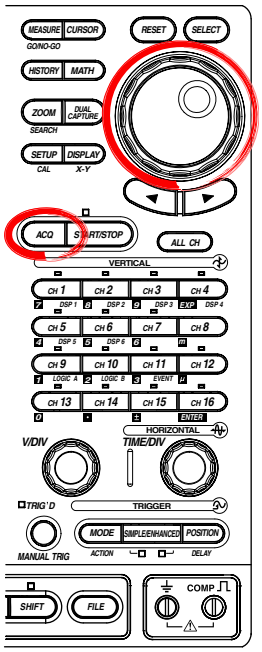
Explanation

You can display the setup menu of all the channels over the entire screen to set the channels. The parameters that you can set are the setup parameters of the channel key and waveform color.

5.14 Setting the Time Base (Internal Clock/External Clock)

<For a description of this function, refer to page 2-11.>

Procedure

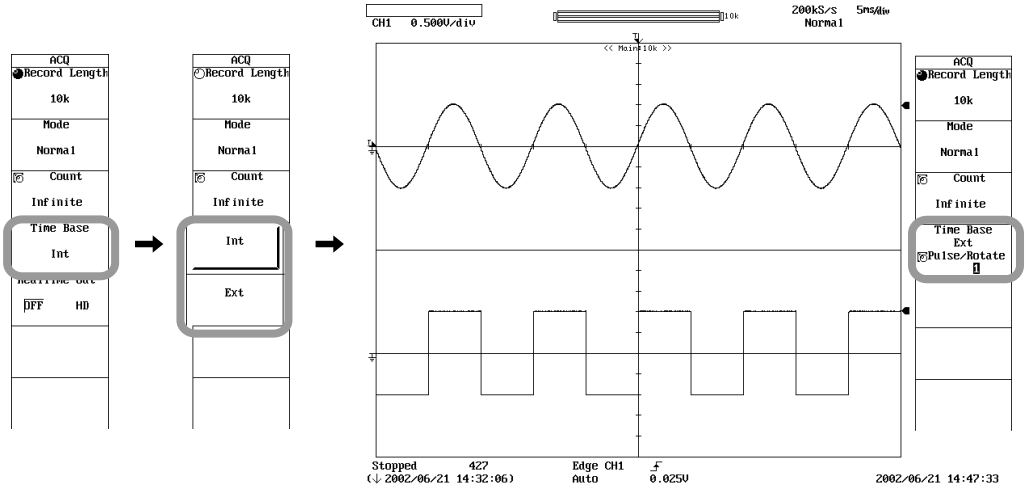


Selecting the Time Base

1. Press **ACQ**.
2. Press the **Time Base** soft key and then select Int or Ext.
   If you select Ext, the Pulse/Rotate setup menu appears.

Setting Pulse/Rotate (When Time Base Is Set to Ext)

3. Press the **Pulse/Rotate** soft key.
4. Turn the **jog shuttle** to set the number of pulses (of the external clock signal) for the pulse/rotate function. Pressing **RESET** resets the value to 1.



Explanation

Selecting the Time Base

Select from the following:

Int: Internal clock signal (TIME/DIV know is valid).

Ext: Clock signal applied to the external clock input terminal (TIME/DIV knob is invalid).

When Selecting Ext

Apply a clock signal of the following specifications to the TRIG OUT/EXT CLK IN terminal (shared with the trigger output terminal) on the left side panel.

Item	Specifications
Connector type	RCA jack
Frequency range	See Note below
Input level	TTL (0 to 5 V)
Valid edge	Rising edge
Minimum pulse width	400 ns or more for high and low levels
External clock frequency range	1 MHz maximum.
Rise/Fall time of the clock	2 μs or less

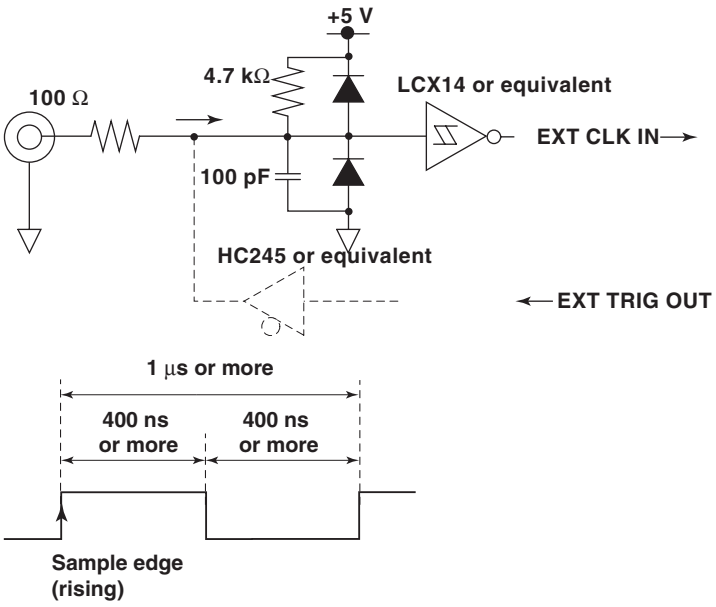
Note

- The upper limit frequency of the external clock is as follows:

701250/701251/701255:	1 MHz
701260/701270/701271/701275:	100 kHz
701280:	25 kHz
701261/701262:	When measuring voltage: 100 kHz When measuring temperature: 500 Hz
701265:	500 Hz
DSP channels:	100 kHz

- If the external clock frequency exceeds the upper limit frequency of the module, sampling is executed at the upper limit frequency.

External Clock Input Circuit Diagram and Timing Chart



CAUTION

Applying a voltage exceeding the maximum allowable input voltage to the TRIG OUT/EXT CLK IN terminal may damage the input section.

Setting Pulse/Rotate

You can specify the number of pulses of the external signal that is to correspond to one mechanical rotation (one cycle).
Range of the number of pulses: 1 to 24000

Notes When Sampling Using the External Clock Signal

- You cannot set the acquisition mode to envelope or box average.
- You cannot display waveforms in roll mode.
- No function is provided for frequency-dividing the clock signal.
- Since the time axis setting cannot be changed, change the record length setting or zoom in on the time axis if you want to change the display range of the time axis.
- The time measured by the cursor measurement or automated measurement of waveform parameters is expressed in terms of the number of pulses of the clock signal. No unit is displayed.
- Realtime recording to the internal hard disk cannot be selected.
- Saving data using the dual capture function is not possible.
- The following trigger settings are invalid.
  - Trigger delay
  - Hold off
  - B > Time, B < Time, and B Time Out trigger
  - Period trigger

Maximum Sample Rate of Each Module

If the sample rate of the DL750/DL750P is set higher than the maximum sample rate of the module, the data is updated only at the maximum sample rate of the module. Consequently, all of the data within the data update interval of the module are the same data.The maximum sample rate of each module is as follows:

Maximum Sample Rate of Each Module

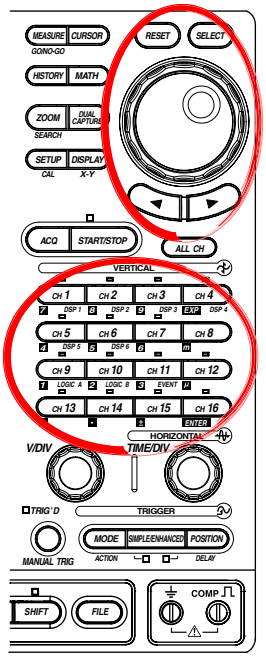
Module	During Internal Clock	During External Clock
701250/701255:	10 MHz	1 MHz
701251:	1 MHz	1 MHz
701260/701270/701271/ 701275/:	100 kHz	100 kHz
701261/701262 (measuring voltage):	100 kHz	100 kHz
(measuring temperature):	500 Hz	500Hz
701280:	25 kHz	25 kHz
701265:	500 Hz	500 Hz
DSP channel:	100 kHz	100 kHz

5.15 Observing RMS Values

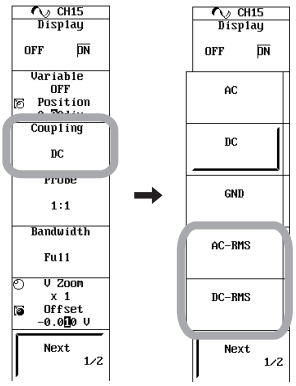
<For a description of this function, refer to page 2-12.>

This section describes the procedure when measuring the RMS value on the 701260 (HV(with RMS)) .

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel (select a channel with the 701260 (HV (with RMS)) installed).
2. Press the **Coupling** soft key followed by the **DC-RMS** or **AC-RMS** soft key.



Explanation

Selecting the Input Coupling

In addition to the same input coupling selections that are available on other voltage modules, you can also select the waveform observation mode (Coupling: AC, DC, or GND) which directly displays the waveform of the input signal and the RMS observation mode (Coupling: AC-RMS or DC-RMS) which displays the rms values of the input signal. For details on the rms measurement, see page 2-12. For details on the input coupling circuit of AC-RMS/DC-RMS, see page 2-8.

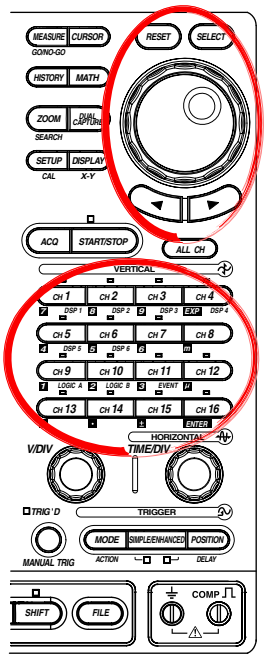
Notes When Observing Rms Values

If an AC component that is less than 40 Hz is acquired in the RMS observation mode, ripples are produced as a result of the RMS conversion circuit characteristics and correct rms values cannot be displayed. DC signals are correctly observed.

5.16 Setting the Temperature Measurement

<For a description of this function, refer to page 2-13.>

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel (select a channel with the 701261 (UNIVERSAL)/701262 (UNIVERSAL (AAF))/701265 (TEMP/HPV) installed).
2. Press the **Coupling** soft key followed by the **TC** soft key.

Selecting the Thermocouple Type

3. Press the **Type** soft key to select the thermocouple from K to Au7Fe.

Setting the Display Range

4. Press the **Upper** soft key.
5. Turn the **jog shuttle** to set the upper limit.
6. Likewise, set Lower.

Selecting the Temperature Unit

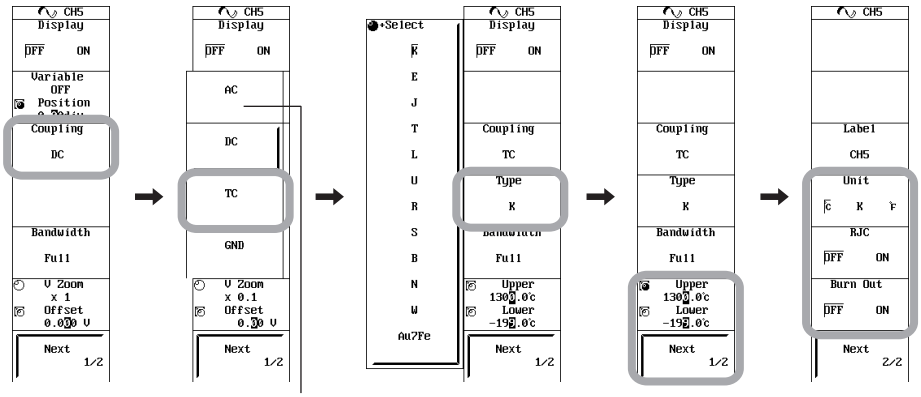
7. Press the **Next 1/2** soft key.
8. Press the **Unit** soft key to select °C, K, or °F.

Setting the RJC

9. Press the **RJC** soft key to select OFF or ON.

Setting Burnout

10. Press the **Burn Out** soft key to select OFF or ON.



AC is not available on the 701265.

Explanation

Thermocouple Type

Select the type to match the thermocouple that you are using.
Select the thermocouple type from the following.
When the input terminal is open, the displayed value is set to a value less than or equal to the lower limit of the measurement range.

Type	Measurement Range
K	–200 to 1300°C
E	–200 to 800°C
J	–200 to 1100°C
T	–200 to 400°C
L	–200 to 900°C
U	–200 to 400°C
R	0 to 1700°C
S	0 to 1700°C
B	400 to 1800°C
N	0 to 1300°C
W	0 to 2300°C
Au7Fe	0 to 300 K

Temperature Unit

Select the temperature unit from °C, K, or °F. The default setting is °C.

Setting the Display Range

To display the measured waveform, the upper and lower limits need to be set according to the input.

- **Selectable Range**
  - –5432 to 5432°C (resolution: 0.1°C)
  - –5432 to 5432 K (resolution: 0.1 K)
  - –5432 to 5432°F (resolution: 0.1°F)

  The minimum span is 2 °C (or 2 K).

Setting the RJC

The DL750/DL750P normally performs reference junction compensation with the built-in RJC circuit when measuring temperature with the thermocouple. When checking the temperature measurement value, or when using an external reference junction (0°C), the internal reference junction compensation needs to be disabled.
The DL750/DL750P allows you to select whether to use the internal reference junction compensation.
Normally, this is set to ON.

Note

If a voltage corresponding to a certain temperature t is applied at the input with the RJC turned OFF and the measured temperature is not correct, the instrument may be damaged. Contact your nearest YOKOGAWA dealer.

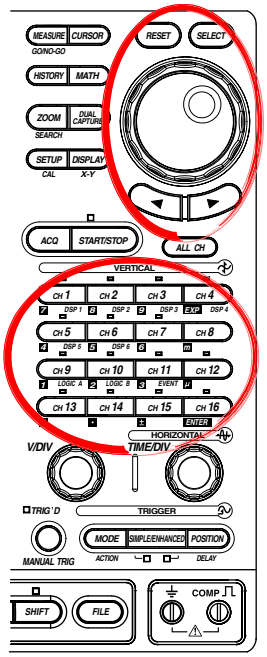
Burnout Setting

If the thermocouple measurement input detects a burnout, the measured value is fixed to the upper limit of the measurement range of each thermocouple. This function is used to accurately detect a burnout in the thermocouple. By default, this setting is turned OFF (do not detect burnouts).

5.17 Setting the Strain Measurement

<For a description of this function, refer to page 2-14.>

Procedure



1. Press a key from **CH1** to **CH16** keys to select the desired channel (select a channel with the Strain Module (701270 (STRAIN_NDIS) or 701271 (STRAIN_DSUB)) installed).

Selecting the Measurement Range

2. Press the **Range Unit** soft key, and then press the **µSTR** (the unit of strain) or **mV/V** (the unit of the output value of the strain gauge transducer) soft key.

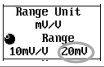
Note

Be sure to execute balancing when you change the measurement range.

- **When µSTR Is Selected**
  3. Use the **jog shuttle** to select the Range from 500 µSTR to 20000 µSTR.
- **When mV/V Is Selected**
  3. Use the **jog shuttle** to select the Range from 0.25 mV/V to 10 mV/V.

Note

If the range unit is set to mV/V, a numeric value is displayed at the right side of the range display. This value is the maximum input at the current bridge voltage converted to volts. It indicates the maximum input voltage at the selected range.



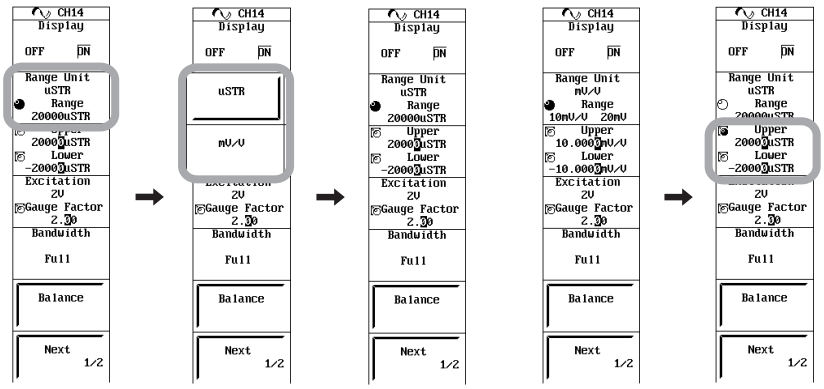
Setting the Display Range

4. Press the **Upper/Lower** soft key to set the jog shuttle control to Upper.
5. Turn the **jog shuttle** to set the upper limit.
6. Likewise, set Lower.

Note

Pressing RESET sets the upper and lower limits to the maximum and minimum values of the measurement range.

When Range Unit is µSTR **When Range Unit is mV/V**



Setting the Gauge Factor

7. Press the **Excitation/Gauge Factor** soft key to set the jog shuttle control to Gauge Factor.
8. Use the **jog shuttle** to set the gauge factor in the range of 1.90 to 2.20.

Selecting the Bridge Voltage

9. Press the **Excitation/Gauge Factor** soft key.
10. Press the **2 V**, **5 V**, or **10 V** soft key to select the Excitation (bridge voltage).

Note

- The bridge voltage can be set to 5 V or 10 V only when the following conditions are met.
  - When the bridge resistance is 350 Ω or more
  - Strain gauge transducer supports the bridge voltage of 5 V or 10 V.
- Be sure to execute balancing when you change the bridge voltage.

Execute balancing

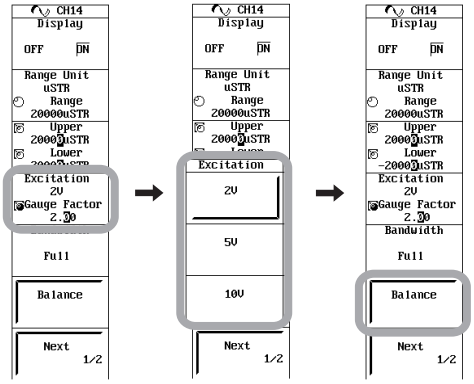
11. Press the **Balance** soft key. Balancing is executed.

Note

Perform balancing by connecting a bridge box or strain gauge transducer and without applying a load to the strain gauge.

Setting the Bandwidth, Linear Scaling, and Waveform Label

For the setup procedure of bandwidth, linear scale, and waveform label, see section 5.7, 5.11, and 8.10, respectively.



Executing Shunt Calibration (only on the 701271(STRAIN_DSUB))

To execute shunt calibration, the strain corresponding to the shunt resistor to be used must be calculated in advance. For the calculation procedure, see appendices 10 and 11.

Be sure to execute balancing before executing shunt calibration.

12. Press the **Next 1/2** soft key.
13. Press the **Linear Scale** soft key. A Linear Scale setup dialog box appears.
14. Use **SELECT**, **jog shuttle**, and **SELECT** to set Mode to Shunt.

- **Reading the Connected Shunt Resistance and Calibrating**

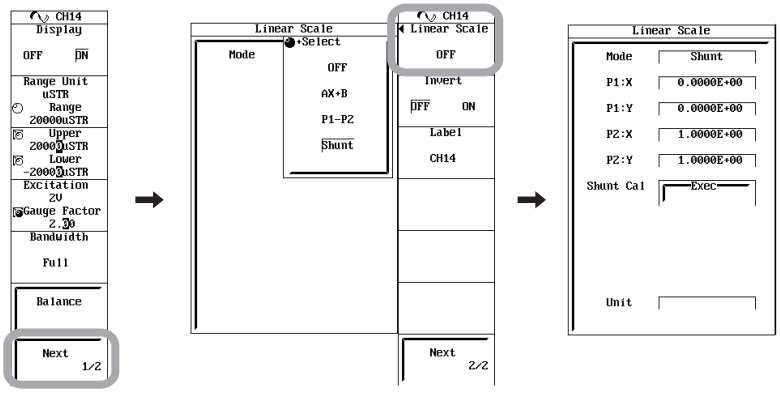
15. Use **SELECT** and the **jog shuttle** to set a strain corresponding to the calculated shunt resistance in P2:Y.
16. As necessary, enter the Unit according to the procedures given in section 4.2.
17. Use the **jog shuttle** and **SELECT** to select Exec. The current input value is reflected in P2:X.

Note

- In a normal shunt calibration, set only P2:Y (P1:Y is 0).
- Scale the strain value using a shunt resistor. P1:X is the input value when a shunt resistor is not connected. P1:Y is the strain value corresponding to P1:X. P2:X is the input value when a shunt resistor is connected. P2:Y is the strain value corresponding to the shunt resistance. The line connecting points P1 and P2 is used to perform scaling.
- When Shunt Cal Exec is executed, the relay circuit for shunt calibration built into the strain module is turned ON/OFF to automatically set P1:X and P2:X to the input value when the shunt resistor is connected and the input value when the shunt resistor is not connected, respectively.
- If you change P1:X, P1:Y, P2:X, or P2:Y, the linear scaling setting is also changed.
- Executing Shunt Cal Exec changes P1:X and P2:X to the current input values.

Inverting the Waveforms

For details on the inverted display, see section 5.12.



Explanation

Select the Range Unit

The unit can be changed between "the strain unit ($\times 10^{-6}$ strain): μSTR" and "the output unit of the strain gauge transducer: mV/V." The default value is μSTR. The following equation is used to derive mV/V.

mV/V = 0.5×(μSTR/1000)

Selecting the Range

Select from the following:

- **When μSTR Is Selected**
  500 μSTR, 1000 μSTR, 2000 μSTR, 5000 μSTR, 10000 μSTR, and 20000 μSTR
  For a description of the measurement range, see chapter 19.12, "Module Specifications."
- **When mV/V Is Selected**
  0.25mV/V, 0.5mV/V, 1mV/V, 2.5mV/V, 5mV/V, and 10mV/V
  For a description of the measurement range, see chapter 19.12, "Module Specifications."
  The value that is indicated at the right side of the range display is the maximum input at the current bridge voltage converted to volts. It indicates the maximum input voltage at the selected range.

Setting the Display Range: Upper/Lower

You can change the upper and lower limits of the display range according to the input for easier viewing of the measured waveforms.

Selectable range: –3.0000E+04 to +3.0000E+04 (when set to μSTR)
–1.5000E+01 to +1.5000E+01 (when set to mV/V)

Be sure the upper limit value (Upper) is greater than the lower limit value (Lower).

Selecting the Bridge Voltage: Excitation

You can select the voltage to be applied to the bridge head.

- 2 V: When the bridge head resistance (bridge resistance) is 120 Ω to 1000 Ω
- 5 V[1]: When the bridge resistance is 350 Ω to 1000 Ω
- 10 V[1]: When the bridge resistance is 350 Ω to 1000 Ω

The bridge voltage cannot be changed while waveform acquisition is in progress.

1. The bridge voltage can be set to 5 V or 10 V only when the following conditions are met.
   - The bridge resistance is 350 Ω or more
   - Strain gauge transducer supports the bridge voltage of 5 V or 10 V.

Setting the Gauge Factor

You can set the gauge factor of the strain gauge.
Selectable range: 1.90 to 2.20 (the resolution is 0.01)
The gauge factor is a unique constant defined for the strain gauge. It is usually described in the manual for the strain gauge. The gauge factor cannot be changed while waveform acquisition is in progress.

Gauge Factor (K) when mV/V Is Selected

You can set the gauge factor to an arbitrary value on the DL750/DL750P. However, if there is no specifications on the strain gauge transducer, set the gauge factor to 2.00. If the gauge factor is not 2.00, e is derived within the DL750/DL750P using the following equation.

$e = (4/K) \times (V/E)$

e: Measured value of the strain gauge transducer [mV/V]
V: Voltage measured on the bridge [V]
E: Voltage applied to the bridge [V]
K: Gauge factor

Setting the Bandwidth

See section 5.7, “Setting the Bandwidth.”

Execute Balancing

The unbalanced portion of the bridge resistance is automatically compensated. The execution of balancing takes a few seconds.
Balance range: ±10000 μSTR (when set to μSTR)
± 5mV/V (when set to mV/V)

Inverting the Waveforms

See section 5.12, “Inverting Waveforms.”

Precautions to Be Taken When Making Strain Measurements

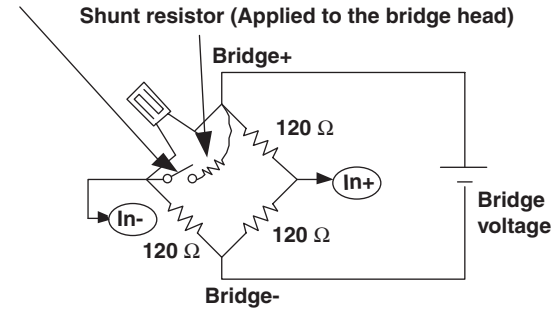
- Be sure to execute balancing when making strain measurements.
- Select a bridge voltage of 5 V or 10 V when the bridge resistance is 350 Ω or more. If a bridge voltage of 5 V or 10 V is applied when the bridge resistance is less than 350 Ω, correct measurements will not be made.
- When using a strain gauge transducer, use a bridge voltage in the recommended voltage range of the transducer.
- Correction cannot be executed if a strain gauge bridge (bridge head) or a strain gauge transducer is not connected to the channel on which balancing is to be executed.
- If balancing fails on any of the specified channels, an error message and information on the failed channel is displayed.
- If the power is turned ON, a new strain gauge is connected, or the measurement range, bridge voltage, or gauge factor is changed, balancing must be performed again before making measurements.
  The scale value indicates “imbalance” immediately after power-up or when the range is changed. In such case, execute balancing.
- When you switch the unit, the unit of all related parameters of the channel is switched accordingly (upper and lower limits, trigger level, measured values of automated measurement parameters, cursor measurement values, etc.).

Shunt Calibration (Only on the 701271(STRAIN_DSUB))

The 701271 Strain Module (STRAIN_DSUB) supports shunt calibration.
Shunt calibration is used to correct the gain of strain measurements by inserting a known resistance (shunt calibration resistance (shunt resistance)) in parallel with the strain gauge. It is a type of scaling. The Strain Module (701271(STRAIN_DSUB) supports shunt calibration and contains a built-in relay circuit for shunt calibration.
To execute shunt calibration, a bridge head that supports shunt calibration (701957/701958) is needed.

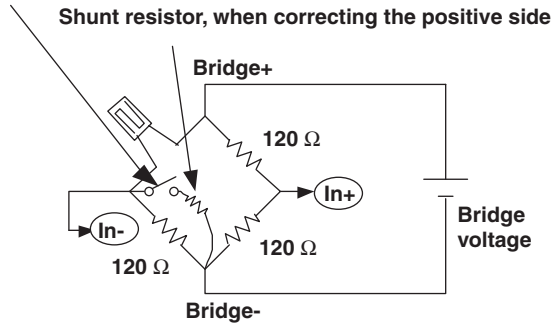
• When correcting the gain on the negative side (normal)

Shunt calibration relay circuit (Built into the strain module. Turns ON/OFF automatically when shunt calibration is executed.)



• When correcting the gain on the positive side

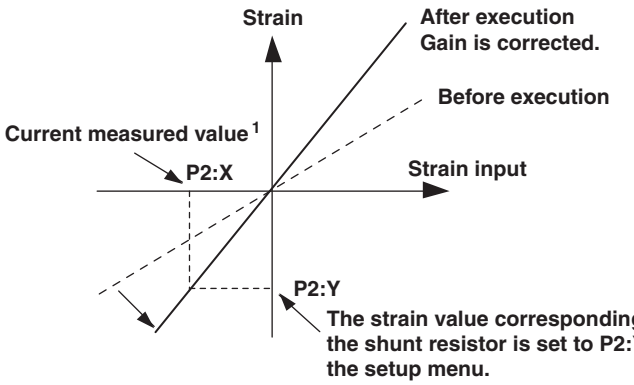
Shunt calibration relay circuit (Built into the strain module. Turns ON/OFF automatically when shunt calibration is executed.)



In addition to the normal shunt calibration (when the shunt calibration relay circuit is ON), the DL750/DL750P allows the setting of a zero point when the relay circuit is OFF. This function is useful when the strain value is not 0 after the execution of balancing.

P1:X: If (Shunt Cal) Exec is executed, the input value when the relay circuit is OFF is applied.
P1:Y: Set the value (usually 0) when the relay circuit is OFF.
P2:X: If (Shunt Cal) Exec is executed when the relay circuit is ON, the input value when the relay circuit is ON is applied.
P2:Y: Set the strain value corresponding to the shunt resistance when the relay circuit is ON.

• Shunt calibration



1. Automatically obtained when shunt calibration is executed.

For details on shunt calibration, see appendix 11.

Note

- When executing shunt calibration, select an appropriate range so that the measured values do not exceed the range when the shunt calibration relay circuit is ON. The DL750/DL750P attempts shunt calibration within the current specified range.
- If shunt calibration fails (the measured value exceeds the range, for example), an error message is displayed. In such case, change the range and execute shunt calibration again.

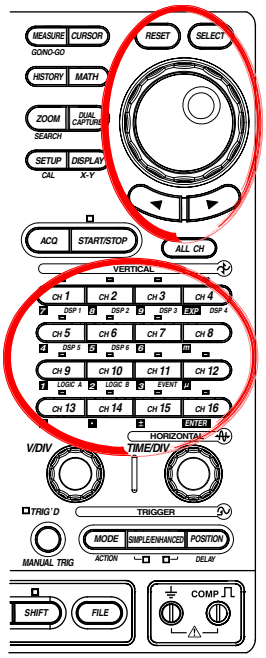
5.18 Setting the Acceleration Measurement

<For a description of this function, refer to page 2-15.>

CAUTION

Before connecting the acceleration sensor, check that the bias current to the sensor is OFF (see step 8 below). Otherwise, damage to the internal circuitry of the acceleration sensors may result.

Procedure



1. Press one of the keys from **CH1** to **CH16** to select the desired channel (select a channel with the 701275(ACCL/VOLT) installed).
2. Press the **Coupling** soft key followed by the **ACCL** soft key.

Setting the Gain

3. Press the **Gain** soft key and select a value in the range of ×0.1 to ×100.

Setting the Sensitivity

4. Press the **Next 1/2** soft key.
5. Press the **Sensitivity** soft key.
6. Turn the **jog shuttle** and set the sensitivity of the acceleration sensor in the range of 0.10 mV/Unit to 2000.00 mV/Unit.

Setting the Unit

The default value is m/s^2. Change the unit as necessary.

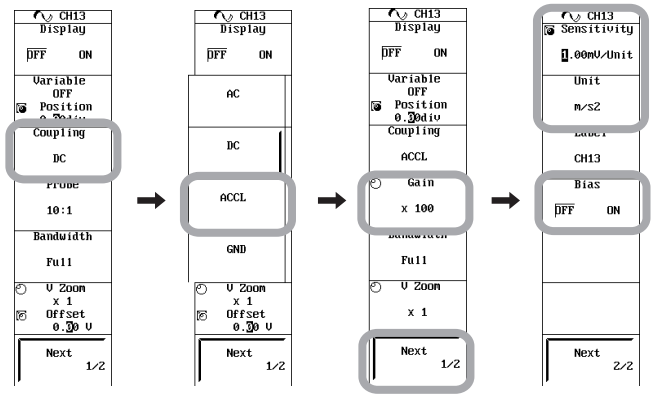
7. Press the **Unit** soft key to display a software keyboard, and enter the unit according to the procedure given in section 4.2.

Connecting the Acceleration Sensor

8. Press the **Bias** soft key to select OFF.
9. Connect the acceleration sensor according to the procedures given in section 3.12.

Setting the Bias Current Supply

10. Press the **Bias** soft key to select ON.



Setting the Bandwidth Limit and Waveform Label

For the setup procedure of the bandwidth limit, see section 5.7. For the setup procedure of the waveform label, see section 8.10.

Explanation

Setting the Gain

Set the ratio of the output signal with respect to the input signal in the range of ×0.1 to ×100.
The default value is ×1.

Setting the Sensitivity

Set the sensitivity of the acceleration sensor in the range of 0.10 mV/Unit to 2000.00 mV/Unit.

Setting the Unit

Set the unit of the acceleration to be displayed on the screen using up to 4 characters. The default setting is m/s^2. Change the unit as necessary.
Up to 8 character strings assigned to the unit are stored. The stored strings can be recalled using the soft key. In addition, the stored strings can be used on the acceleration modules of other channels. This function is useful when you are assigning the same unit to multiple channels. The stored strings are not cleared even when the power is turned OFF.

Setting the Bias Current Supply to the Acceleration Sensor

When Bias is turned ON, a 4-mA bias current is supplied to the acceleration sensor. Do not connect the acceleration sensor with Bias turned ON.

Setting the Bandwidth Limit

See section 5.7, “Setting the Bandwidth Limit.”

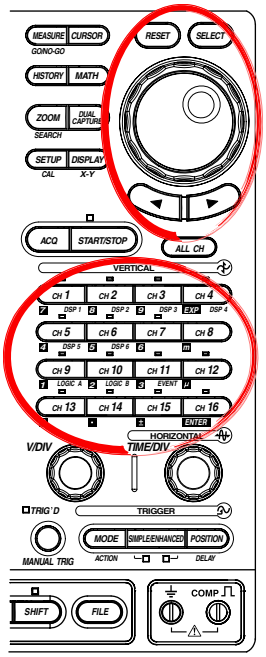
5.19 Setting the Frequency (Number of Rotations, Period, Duty Cycle, Power Supply Frequency, Pulse Width, Pulse Integration, and Velocity) Measurement

<For a description of this function, refer to page 2-16.>

Procedure

1. Press one of the keys from **CH1** to **CH16** to select the desired channel (select a channel with the 701280(FREQ) installed).

Setting the Input

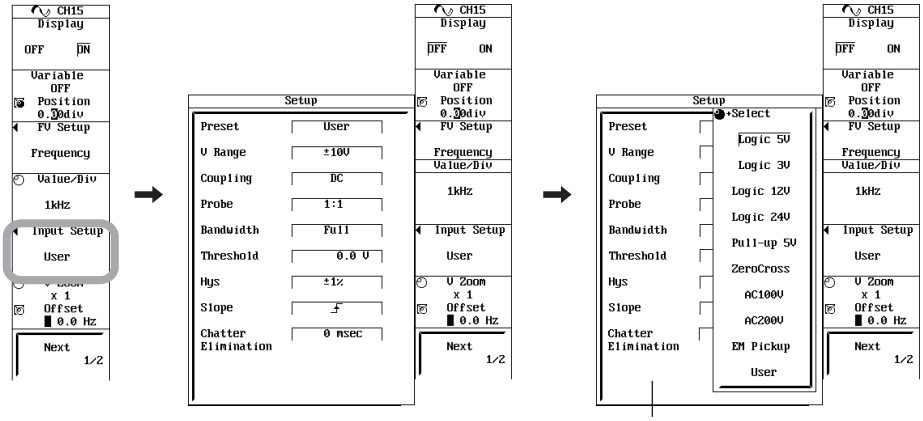


Setting the Preset

2. Press the **Input Setup** soft key. A setup dialog box opens.
3. Use the **jog shuttle** and **SELECT** to select Preset according to the type of sensor that is connected to the frequency module. When you select a preset (Logic 5V to EM Pickup), the input is set to a value appropriate for the signal. (Some items need to be manually entered.)
   If you select User (user-defined), all the setup items can be set arbitrarily. For a description of the setup items, see the next page.

Typical Applications and Signal Examples of Each Preset

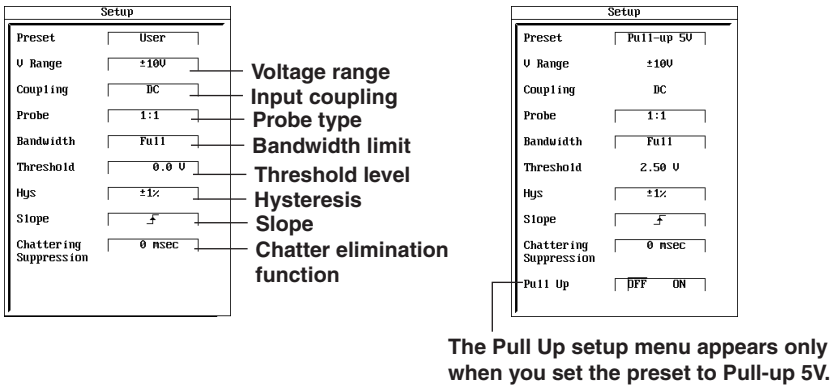
Preset	Application and Signal Example
Logic 5V	5-V logic signal, 5-V output sensor, and sensor with TTL output
Logic 3V	3-V logic signal and 3-V output sensor
Logic 12V	12-V driven relay/sequence circuit and 12-V driven sensor
Logic 24V	24-V driven relay/sequence circuit and 24-V driven sensor
ZeroCross	Sensor/Encoder that outputs positive and negative voltages and sensor that outputs sine waves
AC100V	When measuring a supply voltage of 100 VAC using the isolated probe (700929)
AC200V	When measuring a supply voltage of 200 VAC using the isolated probe (700929)
EM Pickup	Power-generating electromagnetic pickup
Pull -up 5V	Open-collector output sensor and contact circuit



The Pull Up setup menu appears only when you set the preset to Pull-up 5V.

As necessary, set the items of the preset (Logic 5V to EM Pickup) that you selected in steps 2 and 3. If you select User (user-defined), set all the setup items arbitrarily. All operations are done using the jog shuttle and SELECT.

- **When changing the voltage range setting**
  Select the V Range (voltage range) from ±1 V, ±2 V, ±5 V, ±10 V, ±20 V, and ±50 V. You can change the setting only when you set the preset to ZeroCross or User.
- **When changing the input coupling setting**
  Set the coupling to DC or AC. You can change the setting only when you set the preset to User.
- **When changing the probe type setting**
  Select Probe and set the probe type to 1:1 or 10:1. You can change the setting only when you set the preset to Logic 5V (3V/12V/24V), Pull-up 5V, ZeroCross, or User.
- **When changing the bandwidth limit setting**
  Select the bandwidth limit from 100 Hz, 1 kHz, 10 kHz, 100 kHz, or Full. You can change the setting on all presets. However, if the preset is set to AC100V or AC200V, the bandwidth limit cannot be set to Full.
- **When changing the threshold level setting**
  Set the threshold. You can change the setting only when you set the preset to User.
- **When changing the hysteresis setting**
  Select Hys (hysteresis) from ±1%, ±2.5%, and ±5%. You can change the setting on all presets.
- **When changing the slope setting**
  Set the slope to ⎍ (rising) or ⎎ (falling). You can change the setting only when you set the preset to Logic 5V (3V/12V/24V), Pull-up 5V, or User.
- **Setting the Chatter Elimination Function**
  Select Chatter Elimination and set the chatter elimination time in the range of 0 ms to 1000 ms. You can change the setting on all presets.
- **Setting the pull-up**
  Set Pull Up to ON or OFF if you set the preset to Pull-up 5V.



When Measuring the Frequency

Setting the Measurement Item

4. Press the **FV Setup** soft key. A setup dialog box opens.
5. Use the **jog shuttle** and **SELECT** to set Function to Frequency.

Setting Value/Div

6. Turn the V/DIV knob to set the Value/Div value. You can also set Value/Div by pressing the **Value/Div** soft key and turning the **jog shuttle**.

Note

The unit for Value/Div and offset are synchronized to the unit of the measurement mode selected in steps 4 and 5. For the procedure of setting the offset value, see section 5.10.

Carry out steps 7 to 12 below as necessary.

Setting the Smoothing Filter

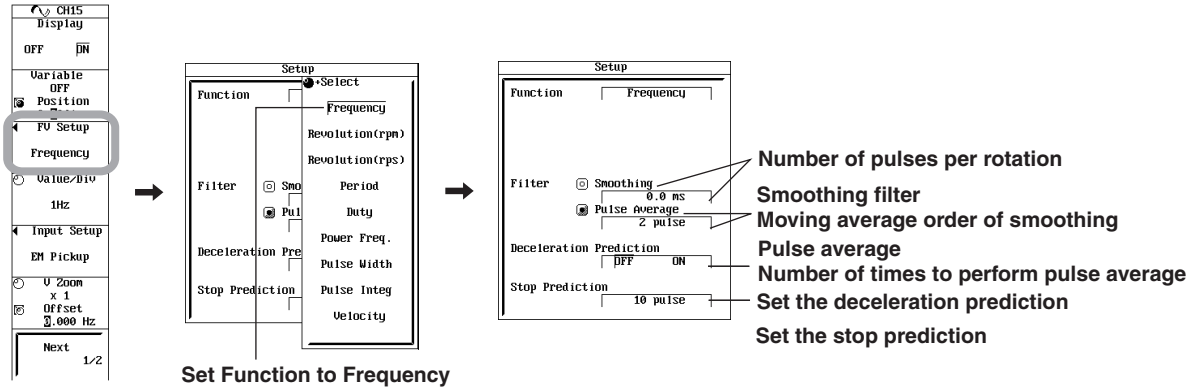
7. To enable the smoothing filter, use the **jog shuttle** and **SELECT** to set Filter to Smoothing.
8. Use the **jog shuttle** and **SELECT** to set the moving average order of smoothing in the range of 0.0 to 1000.0 ms.

Setting the Pulse Average

9. To enable pulse average, use the **jog shuttle** and **SELECT** to select Pulse Average.
10. Use the **jog shuttle** and **SELECT** to set the number of times to perform pulse average in the range of 1 to 4096.

Setting Deceleration Prediction and Stop Prediction

11. To enable deceleration prediction, use the **jog shuttle** and **SELECT** to turn Deceleration Prediction ON.
12. To enable stop prediction, use the **jog shuttle** and **SELECT** to set Stop Prediction in the range of 1.5 to 10 pulses.



When Measuring RPMs or RPSs

Setting the Measurement Item

4. Press the **FV Setup** soft key. A setup dialog box opens.
5. Use the **jog shuttle** and **SELECT** to set Function to Revolution (rpm) or Revolution (rps).

Setting the Number of Pulses per Rotation

6. Use the **jog shuttle** and **SELECT** to set Pulse/Rotate in the range of 1 to 99999 pulses.

Setting Value/Div

7. Turn the V/DIV knob to set the Value/Div value. You can also set Value/Div by pressing the **Value/Div** soft key and turning the **jog shuttle**.

Note

The unit for Value/Div and offset are synchronized to the unit of the measurement mode selected in steps 4 and 5. For the procedure of setting the offset value, see section 5.10.

Carry out steps 8 to 13 below as necessary.

Setting the Smoothing Filter

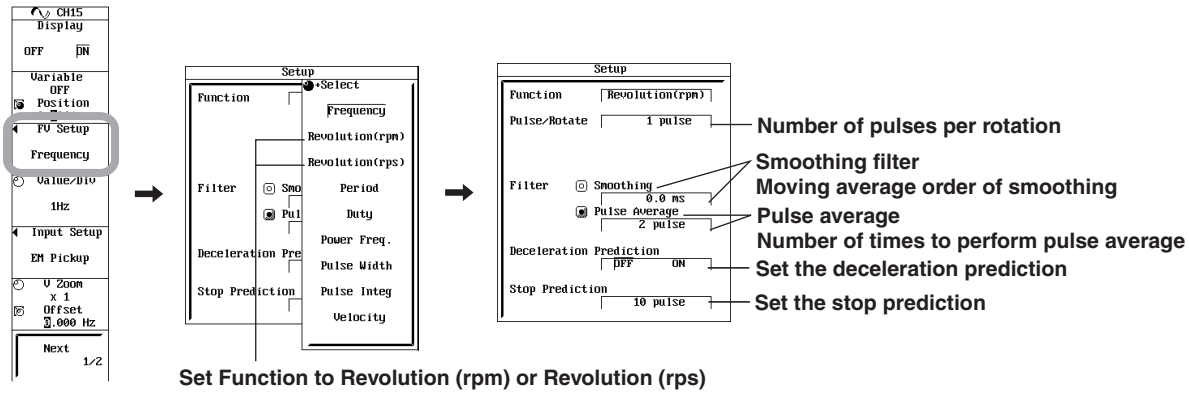
8. To enable the smoothing filter, use the **jog shuttle** and **SELECT** to set Filter to Smoothing.
9. Use the **jog shuttle** and **SELECT** to set the moving average order of smoothing in the range of 0.0 to 1000.0 ms.

Setting the Pulse Average

10. To enable the pulse average, use the **jog shuttle** and **SELECT** to select Pulse Average.
11. Use the **jog shuttle** and **SELECT** to set the number of times to perform pulse average in the range of 1 to 4096.

Setting Deceleration Prediction and Stop Prediction

12. To enable deceleration prediction, use the **jog shuttle** and **SELECT** to turn Deceleration Prediction ON.
13. To enable stop prediction, use the **jog shuttle** and **SELECT** to set Stop Prediction in the range of 1.5 to 10 pulses.



Set Function to Revolution (rpm) or Revolution (rps)

When Measuring the Period

Setting the Measurement Item

4. Press the **FV Setup** soft key. A setup dialog box opens.
5. Use the **jog shuttle** and **SELECT** to set Function to Period.

Setting Value/Div

6. Turn the V/DIV knob to set the Value/Div value. You can also set Value/Div by pressing the **Value/Div** soft key and turning the **jog shuttle**.

Note

The unit for Value/Div and offset are synchronized to the unit of the measurement mode selected in steps 4 and 5. For the procedure of setting the offset value, see section 5.10.

Carry out steps 7 to 12 below as necessary.

Setting the Smoothing Filter

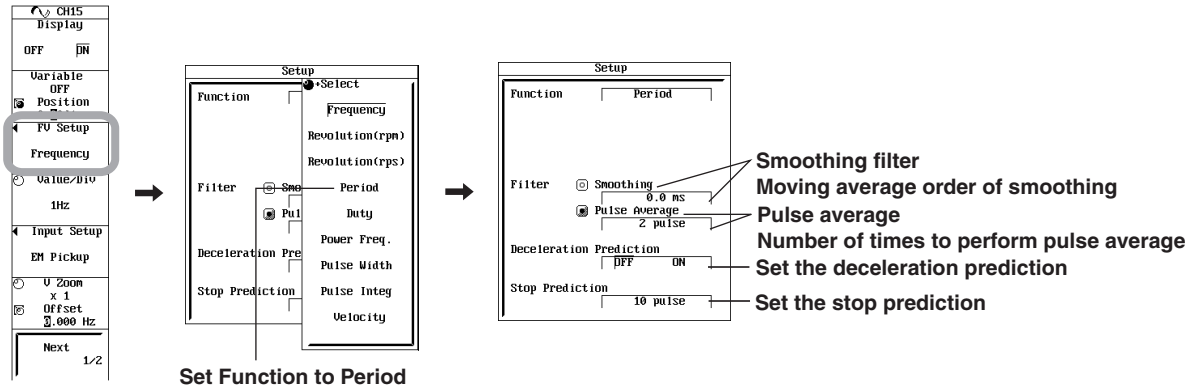
7. To enable the smoothing filter, use the **jog shuttle** and **SELECT** to set Filter to Smoothing.
8. Use the **jog shuttle** and **SELECT** to set the moving average order of smoothing in the range of 0.0 to 1000.0 ms.

Setting the Pulse Average

9. To enable the pulse average, use the **jog shuttle** and **SELECT** to select Pulse Average.
10. Use the **jog shuttle** and **SELECT** to set the number of times to perform pulse average in the range of 1 to 4096.

Setting Deceleration Prediction and Stop Prediction

11. To enable deceleration prediction, use the **jog shuttle** and **SELECT** to turn Deceleration Prediction ON.
12. To enable stop prediction, use the **jog shuttle** and **SELECT** to set Stop Prediction in the range of 1.5 to 10 pulses.



When Measuring the Duty Cycle

Setting the Measurement Item

4. Press the **FV Setup** soft key. A setup dialog box opens.
5. Use the **jog shuttle** and **SELECT** to set Function to Duty.

Setting the Measurement Pulse

6. Use the **jog shuttle** and **SELECT** to set Measure Pulse to Positive or Negative.

Setting Value/Div

7. Turn the V/DIV knob to set the Value/Div value. You can also set Value/Div by pressing the **Value/Div** soft key and turning the **jog shuttle**.

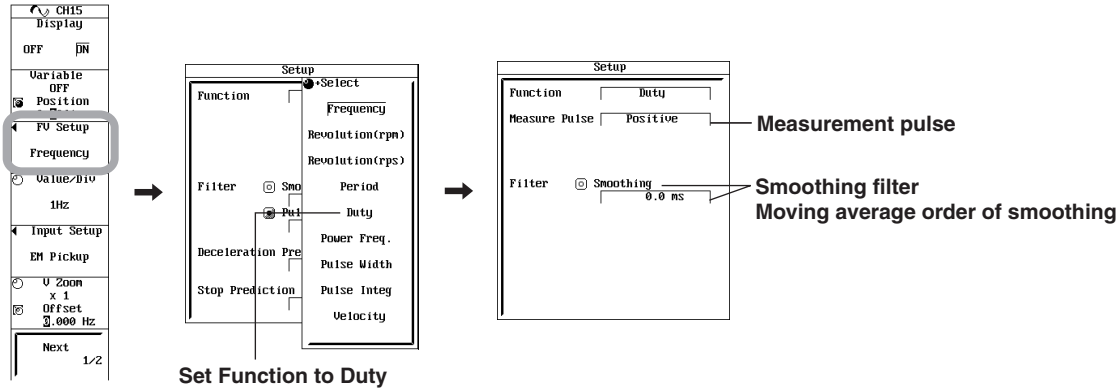
Note

The unit for Value/Div and offset are synchronized to the unit of the measurement mode selected in steps 4 and 5. For the procedure of setting the offset value, see section 5.10.

Carry out steps 8 and 9 below as necessary.

Setting the Smoothing Filter

8. To enable the smoothing filter, use the **jog shuttle** and **SELECT** to set Filter to Smoothing.
9. Use the **jog shuttle** and **SELECT** to set the moving average order of smoothing in the range of 0.0 to 1000.0 ms.



When Measuring the Power Supply Frequency

Setting the Measurement Item

4. Press the **FV Setup** soft key. A setup dialog box opens.
5. Use the **jog shuttle** and **SELECT** to set Function to Power Freq.

Setting the Center Frequency

6. Use the **jog shuttle** and **SELECT** to set Center Frequency to 50 Hz, 60 Hz, or 400 Hz.

Setting Value/Div

7. Turn the V/DIV knob to set the Value/Div value. You can also set Value/Div by pressing the **Value/Div** soft key and turning the **jog shuttle**.

Note

The unit for Value/Div and offset are synchronized to the unit of the measurement mode selected in steps 4 and 5. For the procedure of setting the offset value, see section 5.10.

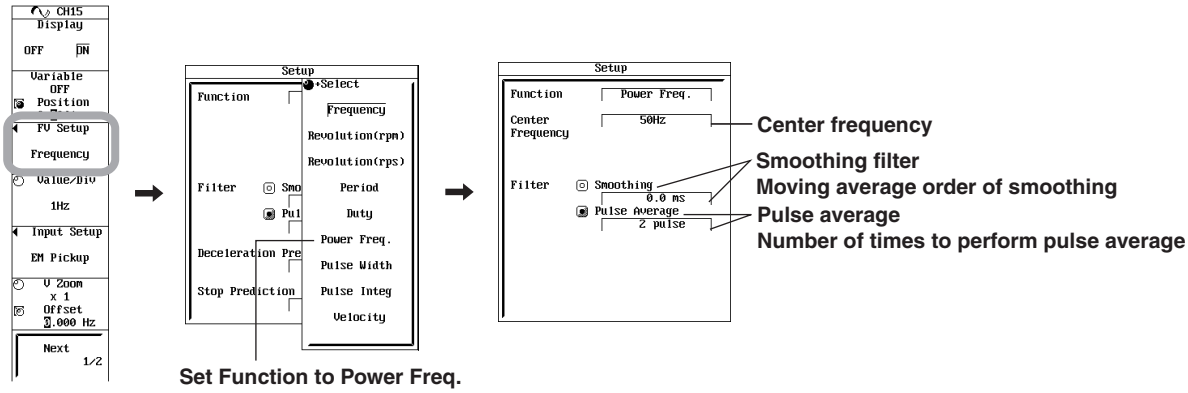
Carry out steps 8 to 11 below as necessary.

Setting the Smoothing Filter

8. To enable the smoothing filter, use the **jog shuttle** and **SELECT** to set Filter to Smoothing.
9. Use the **jog shuttle** and **SELECT** to set the moving average order of smoothing in the range of 0.0 to 1000.0 ms.

Setting the Pulse Average

10. To enable the pulse average, use the **jog shuttle** and **SELECT** to select Pulse Average.
11. Use the **jog shuttle** and **SELECT** to set the number of times to perform pulse average in the range of 1 to 4096.



When Measuring the Pulse Width

Setting the Measurement Item

4. Press the **FV Setup** soft key. A setup dialog box opens.
5. Use the **jog shuttle** and **SELECT** to set Function to Pulse Width.

Setting the Measurement Pulse

6. Use the **jog shuttle** and **SELECT** to set Measure Pulse to Positive or Negative.

Setting Value/Div

7. Turn the V/DIV knob to set the Value/Div value. You can also set Value/Div by pressing the **Value/Div** soft key and turning the **jog shuttle**.

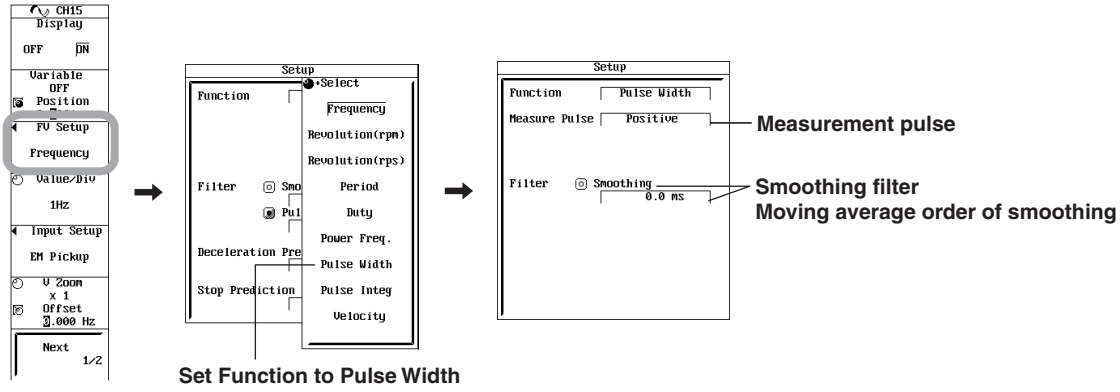
Note

The unit for Value/Div and offset are synchronized to the unit of the measurement mode selected in steps 4 and 5. For the procedure of setting the offset value, see section 5.10.

Carry out steps 8 and 9 below as necessary.

Setting the Smoothing Filter

8. To enable the smoothing filter, use the **jog shuttle** and **SELECT** to set Filter to Smoothing.
9. Use the **jog shuttle** and **SELECT** to set the moving average order of smoothing in the range of 0.0 to 1000.0 ms.



When Measuring the Pulse Integration

Setting the Measurement Item

4. Press the **FV Setup** soft key. A setup dialog box opens.
5. Use the **jog shuttle** and **SELECT** to set Function to Pulse Integ.

Setting the Unit/Pulse and Unit

6. Use the **jog shuttle** and **SELECT** to set Unit/Pulse in the range of –9.9999E–30 to 9.9999E+30.
7. As necessary, use the **jog shuttle** and **SELECT** to select Unit and enter the unit according to the procedure given in section 4.2.

Setting Value/Div

8. Turn the V/DIV knob to set the Value/Div value. You can also set Value/Div by pressing the **Value/Div** soft key and turning the **jog shuttle**.

Note

The unit for Value/Div and offset are synchronized to the unit of the measurement mode selected in steps 4 and 5. For the procedure of setting the offset value, see section 5.10.

Resetting the Pulse Count

9. To manually reset the pulse count, use the **jog shuttle** and **SELECT** to select Exec to the right of Reset. The pulse count is reset.
10. To reset the pulse count automatically when the range is exceeded, use the **jog shuttle** and **SELECT** to set Over Limit Reset to ON.

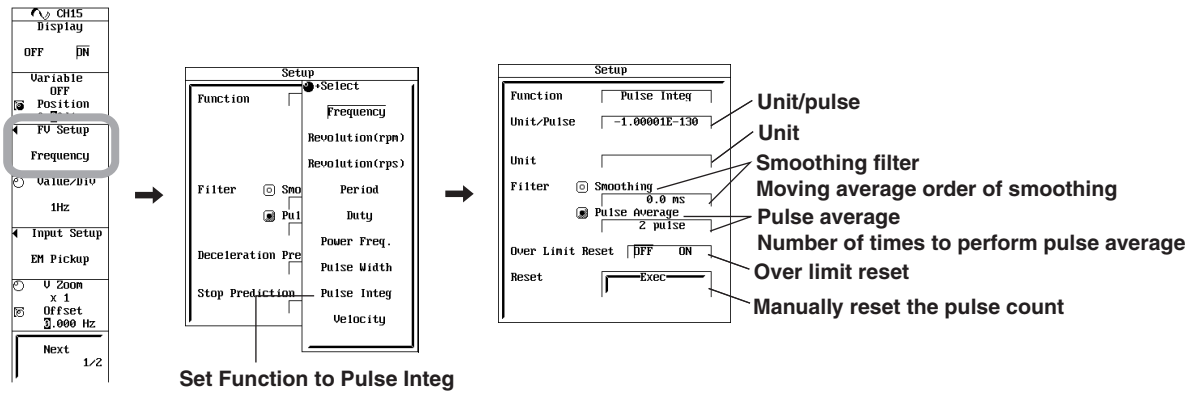
Carry out steps 11 to 14 below as necessary.

Setting the Smoothing Filter

11. To enable the smoothing filter, use the **jog shuttle** and **SELECT** to set Filter to Smoothing.
12. Use the **jog shuttle** and **SELECT** to set the moving average order of smoothing in the range of 0.0 to 1000.0 ms.

Setting the Pulse Average

13. To enable the pulse average, use the **jog shuttle** and **SELECT** to select Pulse Average.
14. Use the **jog shuttle** and **SELECT** to set the number of times to perform pulse average in the range of 1 to 4096.



When Measuring the Velocity

Setting the Measurement Item

4. Press the **FV Setup** soft key. A setup dialog box opens.
5. Use the **jog shuttle** and **SELECT** to set Function to Velocity.

Setting the Distance/Pulse

6. Use the **jog shuttle** and **SELECT** to set Distance/Pulse in the range of –9.9999E–30 to 9.9999E+30.

Setting the Time Unit and Unit

7. Use the **jog shuttle** and **SELECT** to set **Time Unit** to hour, min, or sec.
8. Use the **jog shuttle** and **SELECT** to select **Unit** and enter the unit to be displayed on the screen according to the procedure given in section 4.2.

Setting Value/Div

9. Turn the V/DIV knob to set the Value/Div value. You can also set Value/Div by pressing the **Value/Div** soft key and turning the **jog shuttle**.

Note

The unit for Value/Div and offset are synchronized to the unit of the measurement mode selected in steps 4 and 5. For the procedure of setting the offset value, see section 5.10.

Carry out steps 10 to 15 below as necessary.

Setting the Smoothing Filter

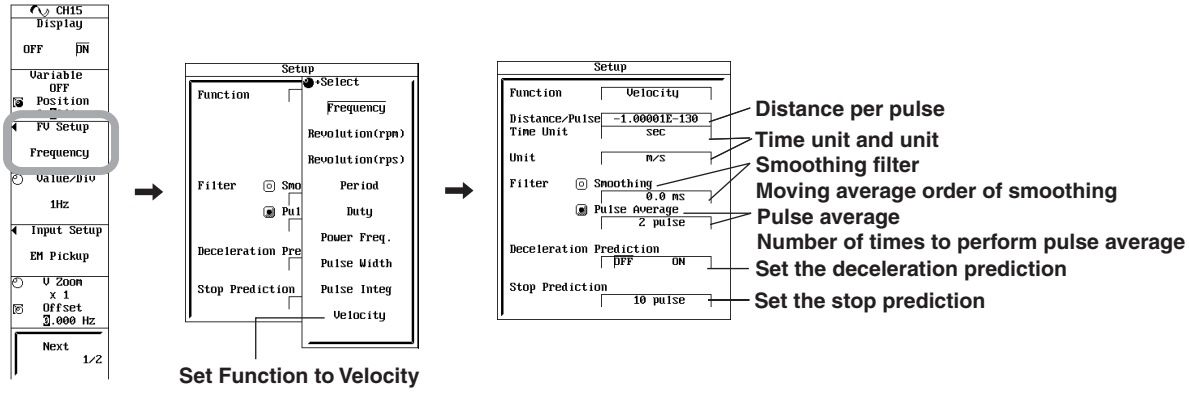
10. To enable the smoothing filter, use the **jog shuttle** and **SELECT** to set Filter to Smoothing.
11. Use the **jog shuttle** and **SELECT** to set the moving average order of smoothing in the range of 0.0 to 1000.0 ms.

Setting the Pulse Average

12. To enable the pulse average, use the **jog shuttle** and **SELECT** to select Pulse Average.
13. Use the **jog shuttle** and **SELECT** to set the number of times to perform pulse average in the range of 1 to 4096.

Setting Deceleration Prediction and Stop Prediction

14. To enable deceleration prediction, use the **jog shuttle** and **SELECT** to turn Deceleration Prediction ON.
15. To enable stop prediction, use the **jog shuttle** and **SELECT** to set Stop Prediction in the range of 1.5 to 10 pulses.



Explanation

Setting the Input: Input Setup

Preset

Select a preset to automatically enter settings appropriate for the signal (Some items need to be manually entered). If you select User (user-defined), all the setup items can be set arbitrarily. The following 10 presets are available. For details on the settings of each preset, see appendix 13.

- **Logic 5V, Logic 3V, Logic 12V, and Logic 24V**
  Use this preset when the output from the sensor or other equivalent item changes in the range of 0 V to 5 V (or 3 V, 12 V, or 24 V: supply voltage applied to the sensor). The voltage range is automatically set to the optimum voltage range, and the threshold level is automatically set to one-half the voltage.
- **Pull-up 5V**
  Use this preset when the sensor output is open collector or contact output. The pull-up function is enabled only when this preset is selected. The pull-up voltage is approximately 5 V, and the pull-up resistor is 4.7 kΩ. If you turn pull-up ON, set the input voltage in the range of 0 V to 5 V. If the input voltage exceeds this range, the protection circuit is tripped and the pull-up resistor is automatically cut off.
- **ZeroCross**
  Use this preset when the input voltage changes around 0 V. The input coupling is automatically set to AC, and the threshold level is automatically set to 0 V. When setting the voltage range, be sure that the maximum amplitude does not exceed the voltage range.
- **AC100V or AC200V**
  Use this preset when measuring the supply voltage of 100-V or 200-V power supply systems. The probe type is automatically set to 10:1; the voltage range is automatically set to a value suitable for the input voltage and probe factor; and the coupling is automatically set to AC. Be sure to use the isolated probe (700929) when measuring the power supply voltage.
- **EM Pickup: Electromagnetic Pickup**
  Use this preset when connecting the electromagnetic pickup directly. The voltage range is automatically set to ±1 V, and the threshold level is automatically set to 0 V.
- **User: User-defined**
  Use this preset when entering the input conditions arbitrarily. Pull-up cannot be specified.

Note

- When measuring high voltage exceeding 42 V (AC+DCpeak) on the 701280 (FREQ), be sure to use the isolated probe (700929).
- Use EM Pickup only when connecting the electromagnetic pickup.
- When set to EM Pickup, the LEDs of the frequency module do not illuminate in red even when the range is exceeded.
- The DL750/DL750P does not support electromagnetic pickups that require power supply or those that require terminators at the output. For these types of electromagnetic pickup, furnish appropriate measures on the sensor end.
- The output from the electromagnetic pickup must be within 42 V_{P-P}. The minimum sensitivity is 0.2 V_{P-P}. If the output is less than the minimum sensitivity, the measured values may be unstable.
- When using the pull-up function, do not let the voltage exceed the 0 to 5 V range. If the voltage exceeds the range, the protection circuit will be tripped, and the pull-up circuit will be cut off.

The following 10 input setup items are available.

- **Voltage Range: V Range**
  Select the input voltage range (±FS) from the following:
  - **When the probe attenuation is set to 1:1**
    ±1 V, ±2 V, ±5 V, ±10 V, ±20 V, or ±50 V (±FS)
  - **When the probe attenuation is set to 10:1**
    ±10 V, ±20 V, ±50 V, ±100 V, ±200 V, or ±500 V (±FS)

- **Coupling**
  Set the input coupling to DC or AC.
  The description is the same as with the input coupling of other modules. See the functional explanation given in “Input Coupling” on page 2-8 and the explanation given in section 5.5.

- **Probe Type**
  Select 1:1 or 10:1.
  The description is the same as with the probe type of other modules. See the functional explanation given in “Probe Type” on page 2-9 and the explanation given in section 5.6.

- **Bandwidth Limit**
  Set the bandwidth limit to 100 Hz, 1 kHz, 10 kHz, 100 kHz, or Full. You cannot select Full when the preset is set to AC100V or AC200V.

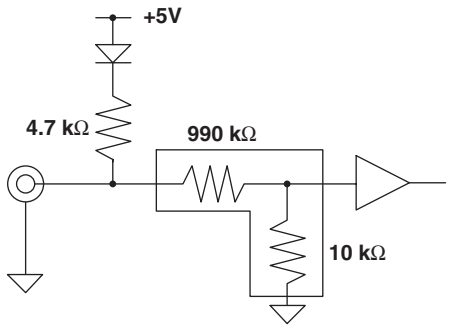
- **Threshold Level**
  Set the level within FS of the input voltage range. The resolution is a value corresponding to 1% of FS.

- **Hys (Hysteresis)**
  Set the hysteresis to ±1%, ±2.5%, or ±5% of the FS of the input voltage range.

- **Slope**
  Select ⎍ (rising) or ⎎ (falling).

- **Chatter Elimination**
  Eliminates the chatter that occurs such when the contact input is turned ON/OFF. The changes in the signal over the specified time can be discarded. Set the interval in the range of 0 to 1000 ms (1-ms resolution). When 0 ms is selected, the chatter elimination function is turned OFF.
  Chattering elimination is effective against both the rising and falling edges.

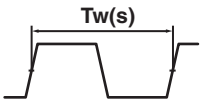
- **Pull Up**
  You can turn ON/OFF pull-up only when the preset is set to Pull-up 5V. Pull-up is not possible in other presets.
  When using pull-up, set the input voltage in the range of 0 V to 5 V. If a voltage exceeding this range is applied, the internal protection circuit will cut off the pull-up circuit.
  Internal equivalent circuit when using pull-up



Setting the Measurement Item: Function

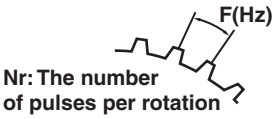
The following nine items are available.

- **Frequency**
  Frequency (Hz) = 1/Tw (s)
  Measurable range: 0.01 Hz to 200 kHz

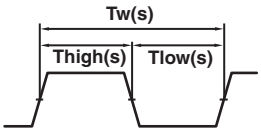


- **Period**
  Period (s) = Tw (s)
  Measurable range: 5 μs to 50 s

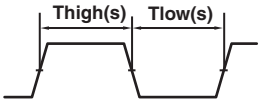
- **RPMs/RPSs**
  RPMs = Frequency (Hz)/the number of pulses per rotation (Nr) × 60
  Measurable range: 0.01 rpm to 100000 rpm
  RPSs = Frequency (Hz)/the number of pulses per rotation (Nr)
  Measurable range: 0.001 rps to 2000 rps



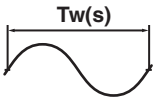
- **Duty Cycle**
  Duty cycle (%) = Thigh (s)/Tw (s)
  Or, duty cycle (%) = Tlow (s)/Tw (s)
  Measurable range: 0% to 100%



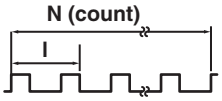
- **Pulse Width**
  Pulse width (s) = Thigh (s)
  or pulse width (s) = Tlow (s)
  Measurable range: 2 μs to 50 s



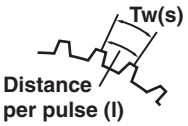
- **Power Supply Frequency**
  Power supply frequency (Hz) = 1/Tw (s)
  Resolution: 0.01 Hz
  Measurable range: (50 Hz, 60 Hz, or 400 Hz) ± 20 Hz



- **P& se Integration (Distance/Flow Rate)**
  Pulse integrated value = N (count) × physical amount per pulse (I)
  Set the physical amount per pulse (I) to distance or flow rate. A suitable user-defined unit can be assigned to the specified physical amount.
  Measurable range: Up to 2×10^9 counts



- **Velocity**
  Velocity (km/h) = Distance per pulse I (km)/Tw (s) × 3600
  Velocity (m/s) = Distance per pulse I (m)/Tw (s)
  The distance and unit can be user defined (angular velocity, etc.).
  Measurable range: F (=1/Tw) = 0.01 Hz to 200 kHz



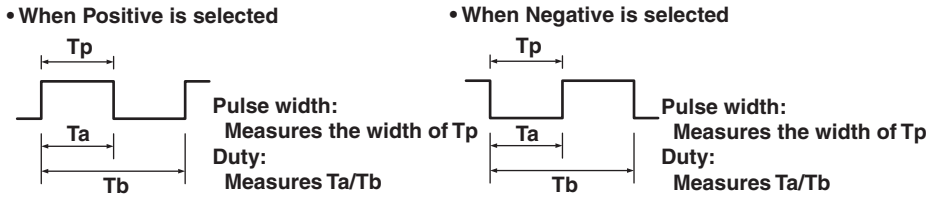
Setup Items for Each Measurement Item

When the Measuring Rotation

- **Pulse/Rotate**
  Set the number of pulses per rotation in the range of 1 to 99999 pulses.

When Measuring the Duty Cycle or Pulse Width

- **Measure Pulse**
  Set the measurement pulse to Positive or Negative.
  - **When Measuring the Duty Cycle**
    Positive: Measures the ratio of the positive pulses.
    Negative: Measures the ratio of the negative pulses.
  - **When Measuring the Pulse Width**
    Positive: Measures the width of the positive pulse.
    Negative: Measures the width of the negative pulse.

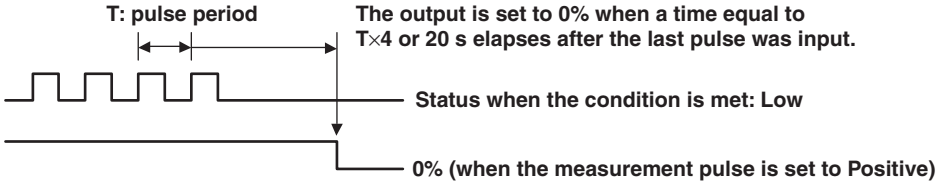


Precautions to Be Taken When Measuring the Duty Cycle

The output is set to 0% or 100% when either of the conditions below is met when measuring the duty cycle.

- When there is no pulse input after a time equal to 4 times the period of the pulse that was input immediately before.
- When there is no pulse input for 20 s.

When the measurement pulse is set to Positive, the output is set to 0% when the pulse input is low when the condition is met and 100% when the pulse input is high. When the measurement pulse is set to Negative, the output is set to 0% when the pulse input is high when the condition is met and 100% when the pulse input is low.



When Measuring the Power Supply Frequency

- **Center Frequency**
  Set the center frequency to 50 Hz, 60 Hz, or 400 Hz.

When Measuring the Pulse Integration

- **Unit/Pulse**
  Set the physical amount per pulse in the range of –9.9999E+30 to 9.9999E+30.

- **Unit**
  As necessary, enter the unit of pulse integration to be displayed on the screen using up to 4 characters.

- **Over Limit Reset**
  Select ON to reset the pulse count automatically when the range is exceeded. Select OFF to not reset the pulse count. The default setting is OFF.

- **Reset**
  To reset the pulse count manually, select Exec.

When Measuring the Velocity

- **Distance/Pulse**
  Set the distance per pulse in the range of –9.9999E+30 to 9.9999E+30.
- **Time Unit**
  Set the time unit to hour, min, or sec.
  The output is automatically converted to a velocity with respect to the specified time.
- **Unit**
  Set the unit of the velocity to be displayed on the screen using up to 4 characters.
  The default setting is m/s.

Filter

Computation such as smoothing filter and pulse average can be performed depending on the selected measurement mode.

- Smoothing
  Set the moving average order of smoothing in the range of 0.0 to 1000.0 ms.
- Pulse Average
  Set the number of times to perform pulse average in the range of 1 to 4096.

Deceleration Prediction

Select ON to automatically compute and predict the deceleration curve from the elapsed time after the pulse stops. Select OFF to not perform deceleration prediction.

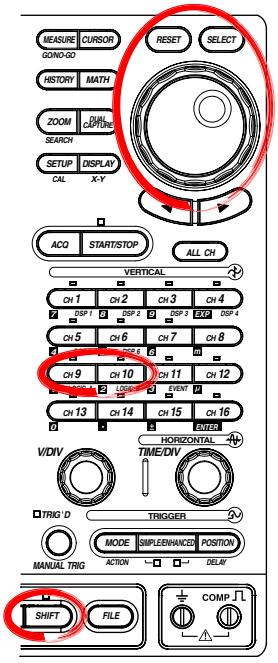
Stop Prediction

Set the time from the point when the pulse input stops to the point when the function determines that the object has stopped The time can be set to ×1.5, ×2, ×3, ... , ×9, and ×10 (10 settings) of the pulse period (T) of the pulse one period before the pulse input stopped. Select OFF to not perform stop prediction.

5.20 Setting Logic Waveforms

<For a description of this function, refer to page 2-19.>

Procedure



1. Press **SHIFT+CH9(LOGIC A)** or **SHIFT+CH10(LOGIC B)**.

Note

For a description of setting the vertical position, see section 5.4. For a description of zooming vertically by setting the zoom rate, see section 5.8. For a description of setting waveform labels, see section 8.10.

Turning ON/OFF Logic Waveforms

2. Press the **Display** soft key to select ON or OFF.

Turning ON/OFF the Bit Display

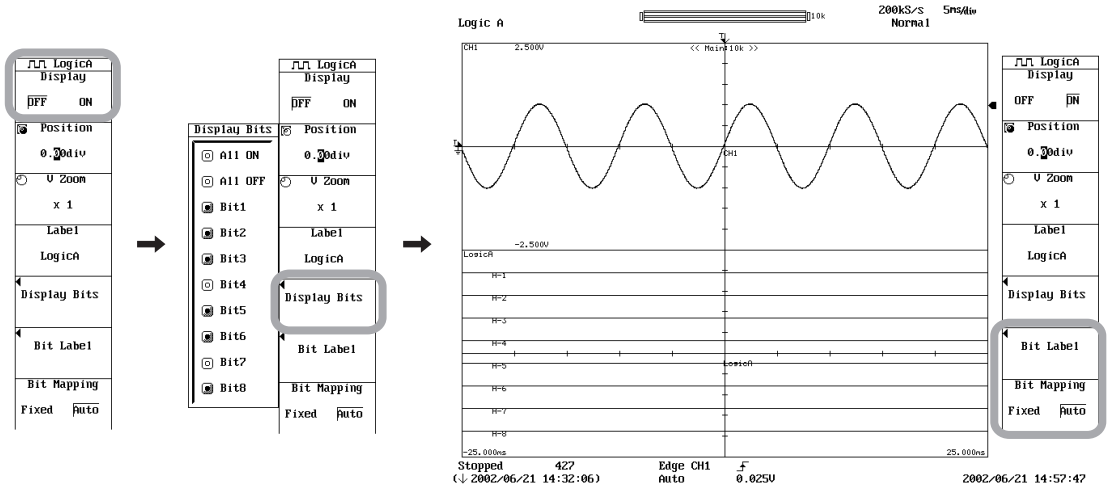
3. Press the **Display Bits** soft key to display the display ON/OFF setup screen.
4. Turn the **jog shuttle** to move the cursor to the bit you wish to turn ON.
5. Press **SELECT** to turn it ON.
   You can turn ON all items at once by selecting All ON.
   You can turn OFF all items at once by selecting All OFF.
6. As necessary, repeat steps 4 and 5.

Selecting the Bit Display Position

7. Press the **Bit Mapping** soft key to select Fixed or Auto.

Setting Labels for Each Bit

8. Press the **Bit Label** soft key. A setup dialog box opens.
9. Turn the **jog shuttle** to move the cursor to the bit on which to set the label and enter the label according to the procedures given in section 4.2.



Explanation

Turning ON/OFF the Bit Display

You can specify whether to display the waveform for each bit.

Bit Display Position: Bit Mapping

- Fixed: A space is allocated for bits that are turned OFF.
- Auto: A space is not allocated for bits that are turned OFF.
  Only the bits that are turned ON are displayed in order from the top.

Fixed (when bit 7 of LOGIC A is OFF)

A1
A2
A3
A4
A5
A6
A8

Auto (when bit 7 of LOGIC A is OFF)

A1
A2
A3
A4
A5
A6
A8

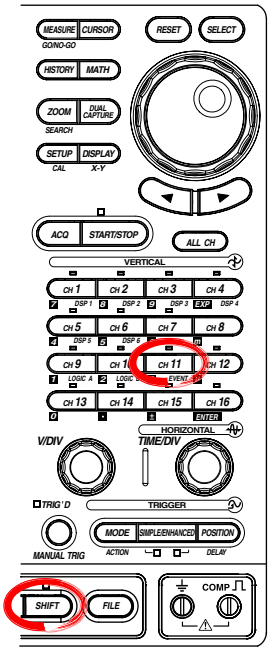
Setting Labels for Each Bit

Alphanumeric characters that can be entered: Up to 8 characters

5.21 Setting Event Waveforms

<For a description of this function, refer to page 2-19.>

Procedure



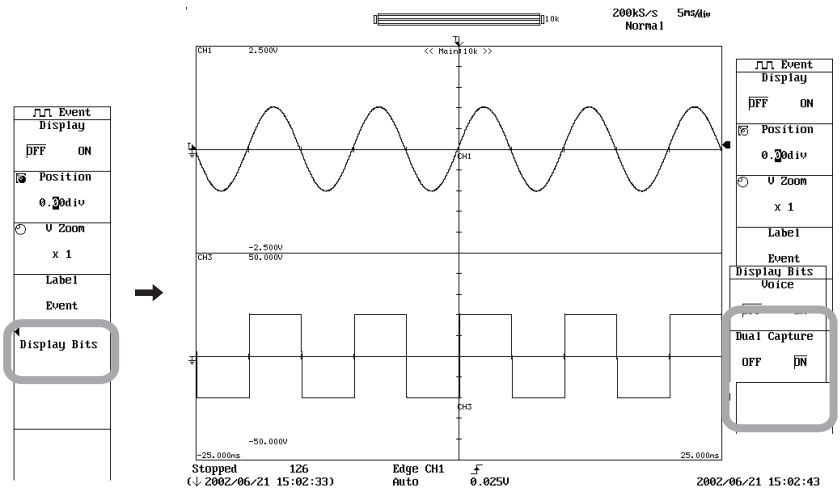
1. Press **SHIFT+CH11(EVENT)**.

Note

For a description of turning ON/OFF the event waveform, see section 5.1. For a description of setting the vertical position, see section 5.4. For a description of zooming vertically by setting the zoom rate, see section 5.8. For a description of setting waveform labels, see section 8.10.

Selecting the Event Waveform to Be Displayed

2. Press the **Display Bits** soft key.
3. Press the **Dual Capture** or **Voice** soft key to select ON or OFF.



Explanation

Selecting the Event Waveform to Be Displayed: Display Bits

You can select the event waveform you wish to display and turn it ON/OFF.

Dual Capture: Displays the times when triggers are activated when using the dual capture function (see section 7.6) as event waveforms.

Voice: Indicates the interval of the voice memo that has been recorded using the voice memo function (see section 7.9). The interval during which a voice memo is recorded is from the rising edge to the falling edge of the event waveform.

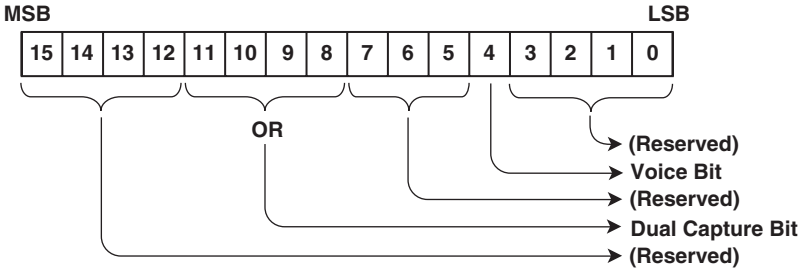
Notes Regarding the Event Waveform (Voice Memo Function)

- If the record length setting is set long in the ACQ menu causing the number of channels that can be used to 3 channels or less, event waveforms are not displayed. In this case, the voice memo function cannot be used.
- If the voice memo function is OFF (Voice Memo menu > Mode: OFF) even when the event waveform display is ON (Display Bits > Voice: ON), event waveforms are not saved when waveform data is saved. In addition, even if a voice memo is recorded during waveform acquisition, if the voice memo function is turned OFF at the time waveform data is saved, event waveform data/voice data will not be saved.
- In realtime recording, if the valid number of channels[1] is 3 channels or less, event waveforms cannot be used. In this case, the voice memo function cannot be used.

1. Valid number of channels signify the number of channels that are turned ON excluding MATH1 to MATH8 channels. However, for LOGIC A and LOGIC B, the number of channels is counted as 1 regardless of whether one of the channels is ON or both channels are ON.

Format of Event Waveform

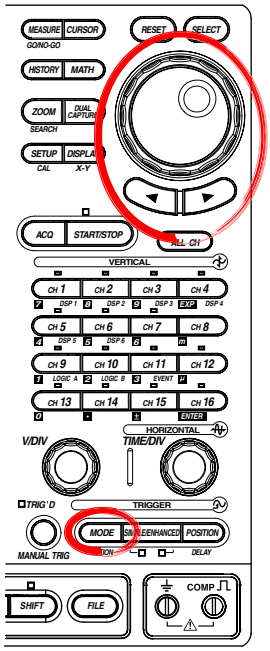
For event waveforms, the following format is used.



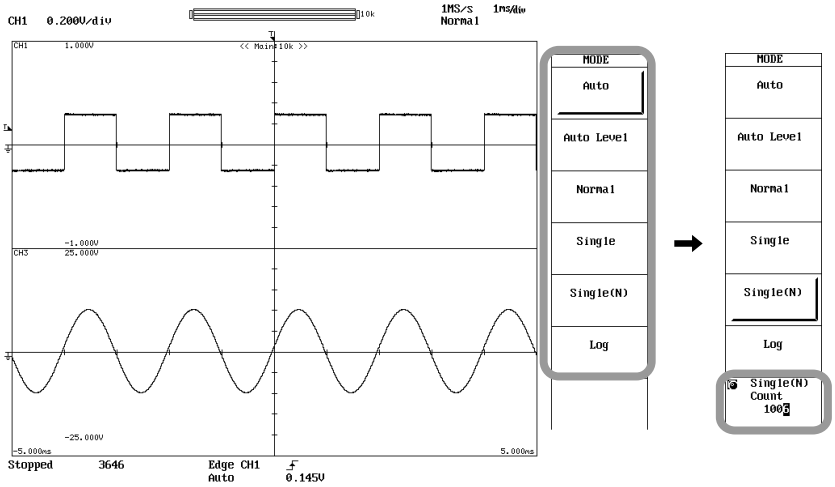
6.1 Setting the Trigger Mode

<For a description of this function, refer to page 2-27.>

Procedure



1. Press **MODE**.
2. Press the soft key corresponding to the desired mode to set the trigger mode.
3. If you select Single(N), turn the **jog shuttle** to set Single(N) Count (the number of times to acquire the waveform).



Explanation

Auto Mode

If the trigger condition is met within the 50-ms timeout period, the waveform is updated on each trigger occurrence. If the trigger condition is not met after the timeout period elapses, the waveform is automatically updated. If the time axis setting is in the range in which the display mode is set to roll mode, the display is set to roll mode.
However, triggering operates in normal mode when using simple trigger with the trigger source set to Time, even if auto mode is specified.

Auto Level Mode

Within the timeout period (approximately 1 s), the waveforms are displayed in the same fashion as in the auto mode. If a trigger does not occur within the timeout period (approximately 1 s), the center value of the amplitude of the trigger source is detected, the trigger level is automatically changed to the center value, and the trigger is generated to update the displayed waveform. The auto-level mode is valid only if the trigger is a simple trigger and the trigger source is between CH1 and CH16. For all other cases, the operation is the same as the auto mode.
If the time axis setting is in the range in which the display mode is set to roll mode, the display is set to roll mode.

Normal Mode

The display is updated only when the trigger conditions are met. The display is not updated if the trigger does not occur. Therefore, to check the waveform or ground level when no trigger is detected, use auto mode.

Single Mode

The display is updated once when the trigger conditions are met and the waveform acquisition stops. In the time axis setting range in which the display mode is set to roll mode, the display is set to roll mode. When a trigger occurs, the specified record length of data is acquired and the displayed waveform stops.

Single (N) Mode

When the trigger condition is met, the waveform is acquired the specified number of times and stops. This mode is used when acquiring a waveform using the sequential store function.

Log Mode

In this mode, the trigger settings are disabled. The specified record length of data is acquired once when acquisition is started, and the displayed waveforms are updated. If the time axis setting is in the range in which the display mode is set to roll mode, the display is set to roll mode.

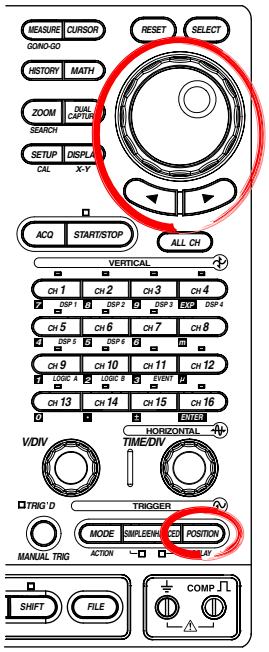
Note

- The trigger mode setting applies to both simple and enhanced triggers.
- In the recorder mode of the DL750P (see chapter 9), select the trigger mode from Auto, Repeat, Single, and Log. For details on the Repeat mode, see section 9.3.

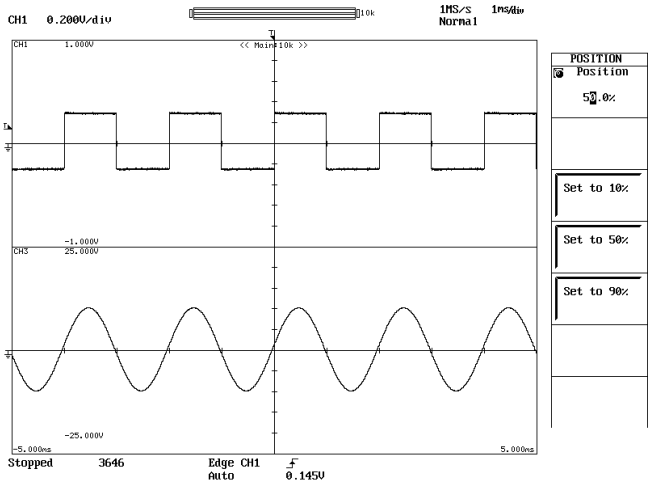
6.2 Setting the Trigger Position

<For a description of this function, refer to page 2-28.>

Procedure



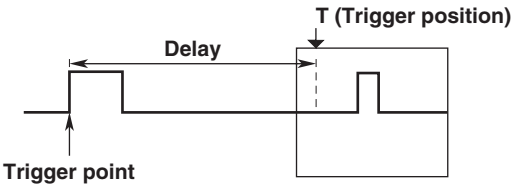
1. Press **POSITION**.
2. Turn the **jog shuttle** to set the **trigger position**.
   If you wish to select 10%, 50%, or 90%, you can press the corresponding soft key.
   Pressing **RESET** resets the position to 50%.



Explanation

Trigger Position

Trigger position = Trigger point + trigger delay
You can select the location of the trigger position on the screen.
If the trigger delay is 0 s, the trigger position and the trigger point match.



Selectable Range of Trigger Position

With the display record length taken to be 100%, set in the range of 0 to 100% (in 0.1% steps).

Trigger Position Marker

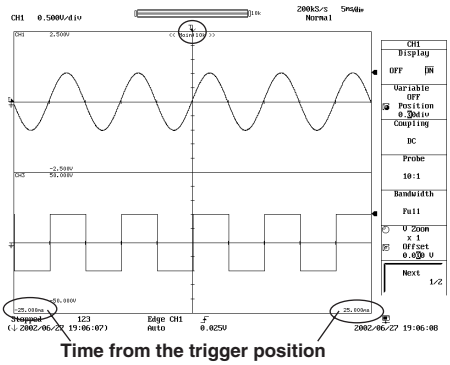
A position marker (▼) appears at the top of the screen. The marker indicates the trigger position with respect to the display record length.

Time Reference Mark

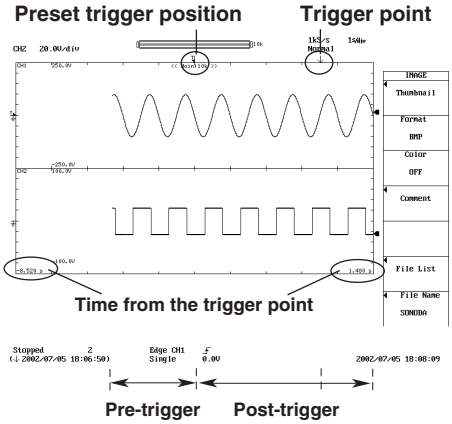
A ↓ mark is displayed at the time reference position of the acquisition data separately from the trigger position.

- **When Set to a Mode Other Than Roll Mode**
  Normally, the time reference point and the trigger position are displayed at the same position, because they match.
  If the waveform acquisition is stopped in the middle of the operation, the preset trigger position and the actual trigger position (trigger point) are offset, because not all the data of the pre-trigger section and post-trigger section have not been acquired. In this case, the time reference mark is offset from the trigger position mark, because it indicates the actual trigger point.

When the time reference mark is displayed overlapped with the trigger position mark (↓)

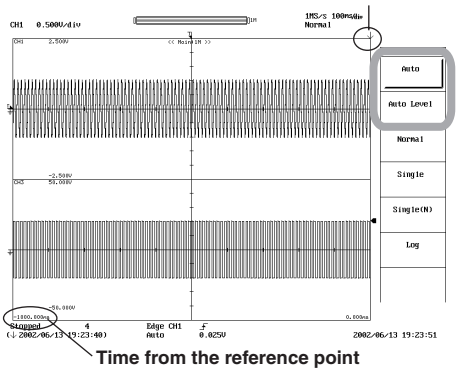


When the time reference mark is displayed offset from the trigger position mark

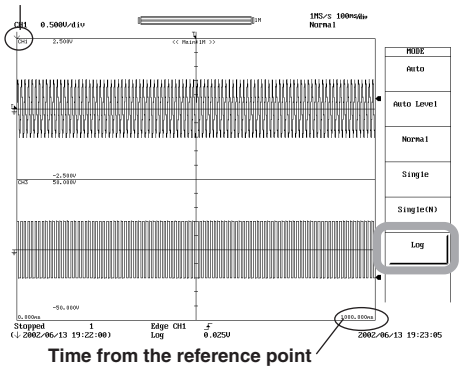


- **For Roll Mode Display**
  When the trigger mode is set to Auto or Auto Level, the reference point is the point when the waveform acquisition was stopped.
  When the trigger mode is set to Log, the reference point is the point when the waveform acquisition was started.

When trigger mode is set to Auto/Auto Level



When trigger mode is set to Log



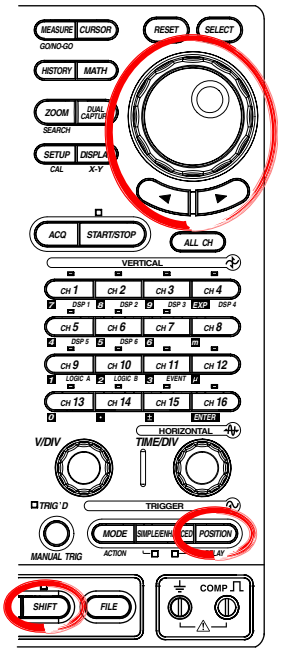
Notes for Setting the Trigger Position

- If you change the trigger position while waveform acquisition is stopped, the new setting will not become effective until acquisition is started and the waveform is updated.
- Note that cursor time measurements are with respect to the trigger position. Changing the trigger position therefore changes the measurement values (except when in roll mode display).
- If you change the T/div setting, the time axis setting is rescaled with respect to the trigger position.

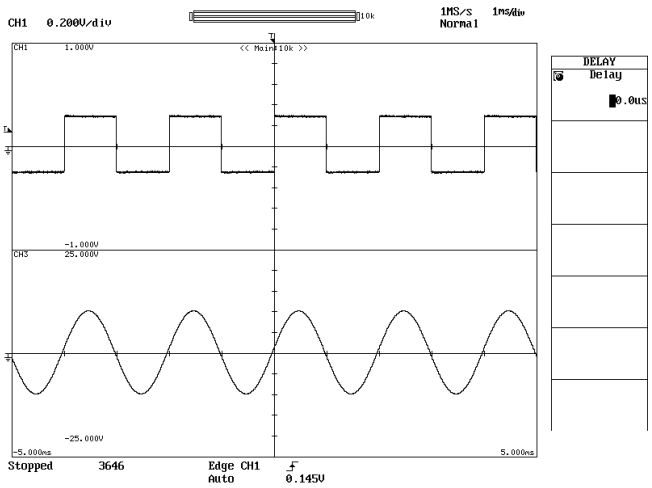
6.3 Setting the Trigger Delay

<For a description of this function, refer to page 2-28.>

Procedure



1. Press **SHIFT+POSITION**.
2. Turn the **jog shuttle** to set the trigger delay.
   Press **RESET** to reset the value corresponding to the selected unit to 0.0 µs.

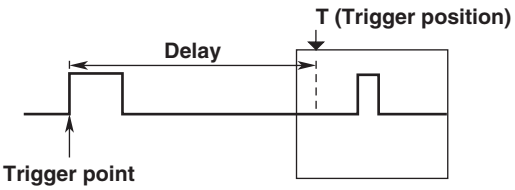


Explanation

Although the display usually shows the waveform before and after the trigger point, it is possible to display the acquired waveform after a fixed time period elapses using the delay function.

Selectable Range of Trigger Delay

0 to 10 s
(Minimum resolution is 100 ns.)



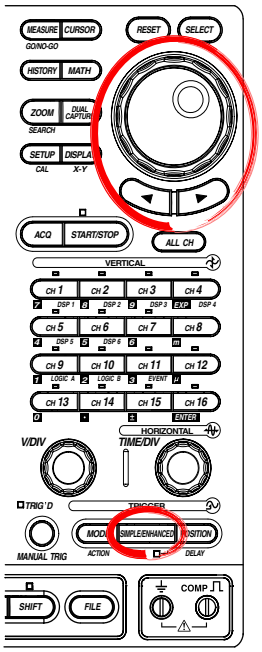
Notes for Setting the Trigger Delay

- When T/div is changed, the trigger delay remains unchanged.

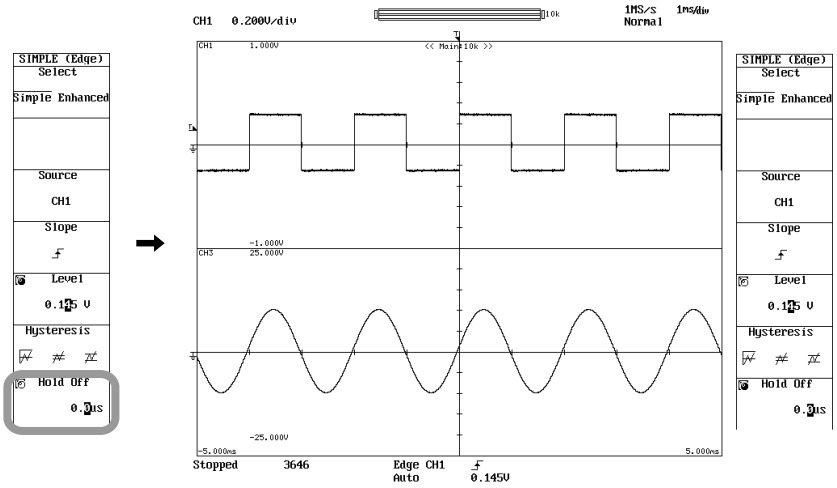
6.4 Setting the Hold Off Time

<For a description of this function, refer to page 2-29.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Hold Off** soft key.
3. Turn the **jog shuttle** to set the hold off time.
   Pressing **RESET** resets the value to 0.0 µs.

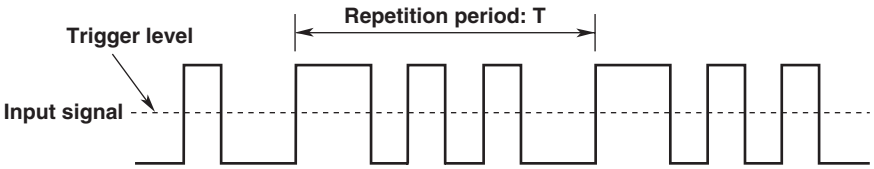


Note

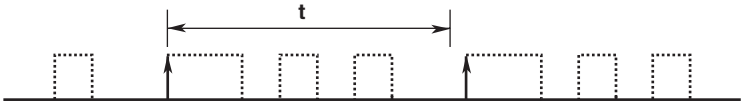
The hold off time setting applies to simple trigger and enhanced triggers.

Explanation

This function prevents a trigger from being activated for a specified time, even if the trigger conditions are met during this time. This is useful when you wish to activate the trigger in sync with a periodic signal as shown in the figure below.



Trigger signal limited by hold off time t (when the trigger slope is set to rising edge)



Selectable Range of Hold Off Time

0 ns to 10 s (the initial value is 0 ns). The resolution is 100 ns.

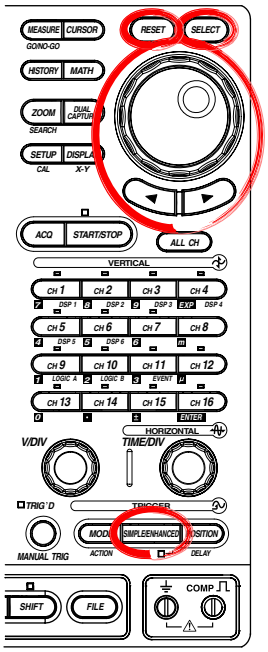
Notes for Setting the Hold Off Time

- If you are setting the hold off time to 50 ms or greater, set the trigger mode to normal.
- When used with A->B(N) or A Delay B trigger, the hold off time applies only to condition B.
- The hold off time is set to 0 ns for Period trigger, and this function is invalid.

6.5 Setting the Edge Trigger (SIMPLE)

<For a description of this function, refer to page 2-20.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Simple.

Setting the Trigger Source

3. Press the **Source** soft key. The trigger source selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select the trigger source from CH1 to CH16, DSP1 to DSP6 (optional).

Note

The menu does not appear for channels without modules.

Setting the Trigger Level

5. Press the **Level** soft key.
6. Turn the **jog shuttle** to set the trigger level. Press RESET to set the trigger level to 0.

Note

The trigger level setting applies to both simple and enhanced triggers.

Setting the Trigger Slope

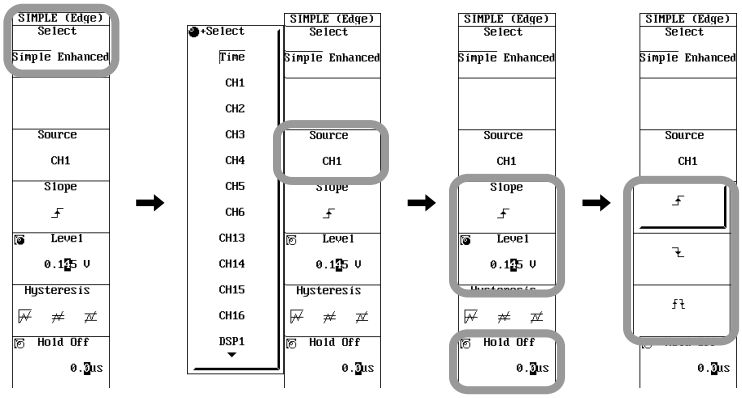
7. Press the **Slope** soft key to select ⨍, ⨏, or ⨍⨏.

Setting the Hysteresis

8. Press the **Hysteresis** soft key to select ⩚, ⩚, or ⩚.

Setting the Hold Off

9. Set the hold off time according to the procedures given in section 6.4.



DSP1 to DSP6 are optional.

Explanation

An edge trigger is generated when the trigger source signal crosses a specified level.

Setting the Trigger Source

Select the trigger source from CH1 to CH16, DSP1 to DSP6 (optional).

Note

If you set the trigger source to a value other than CH1 to CH16, DSP1 to DSP6 (optional), see the sections below.

- Time: Section 6.8, “Setting the Timer Trigger (SIMPLE)”
- LogicA, Logic B: Section 6.9, “Setting the Logic Trigger (SIMPLE)”
- Ext (TRIG IN terminal of the side panel): Section 6.6, “Setting the External Trigger.”
- Line (commercial power supply signal): Section 6.7, “Generating Triggers on the Power Signal (SIMPLE)”

Setting the Trigger Level

- **When Measuring Voltage**
  Selectable range: ±(V/div)×10
  Resolution: Varies depending on the input module.
- **When Measuring Temperature**
  Selectable range: Measurement range of each thermocouple
  Resolution: 0.1°C, 0.1 K, or 0.1°F (set within the measurement range (varies depending on the thermocouple type)
  For a description of the measurement range of thermocouples, see section 5.16.
- **When observing strain**
  Selectable range: ±(Measurement range)
  Resolution: 1 μSTR or 0.0005 mV/V

Trigger Level and Resolution

The resolution varies depending on the input module as follows:

When Measuring Voltage (When the Probe Attenuation Is 1:1)

	Input Module				
V/div	701250/701255/ 701261/701262	701251	701265	701260	701275
0.1 mV/div	-	-	0.001 mV	-	-
0.2 mV/div	-	-	0.002 mV	-	-
0.5 mV/div	-	-	0.005 mV	-	-
1 mV/div	-	0.01 mV	0.01 mV	-	-
2 mV/div	-	0.02 mV	0.02 mV	-	-
5 mV/div	0.05 mV	0.05 mV	0.05 mV	-	0.05 mV
10 mV/div	0.1 mV	0.1 mV	0.1 mV	-	0.1 mV
20 mV/div	0.2 mV	0.2 mV	0.2 mV	0.2 mV	0.2 mV
50 mV/div	0.5 mV	0.5 mV	0.5 mV	0.5 mV	0.5 mV
100 mV/div	0.001 V	0.001 V	0.001 V	0.001 V	0.001 V
200 mV/div	0.002 V	0.002 V	0.002 V	0.002 V	0.002 V
500 mV/div	0.005 V	0.005 V	0.005 V	0.005 V	0.005 V
1 V/div	0.01 V	0.01 V	0.01 V	0.01 V	0.01 V
2 V/div	0.02 V	0.02 V	0.02 V	0.02 V	0.02 V
5 V/div	0.05 V	0.05 V	0.05 V	0.05 V	0.05 V
10 V/div	0.1 V	0.1 V	0.1 V	0.1 V	0.1 V
20 V/div	0.2 V	0.2 V	-	0.2 V	-
50 V/div	-	-	-	0.5 V	-
100 V/div	-	-	-	0.001 kV	-
200 V/div	-	-	-	0.002 kV	-

The resolution is 0.01 div on all modules.

When Measuring Temperature

Range	Resolution
K, E, J, T, L, U, N, R, S, B, W	0.1°C
Au7Fe	0.1 K

Setting the Trigger Slope

Select how the trigger source is to cross the specified level for activating the trigger from the following three choices.

: Activated when the trigger source changes from below the trigger level to above the trigger level (rising).

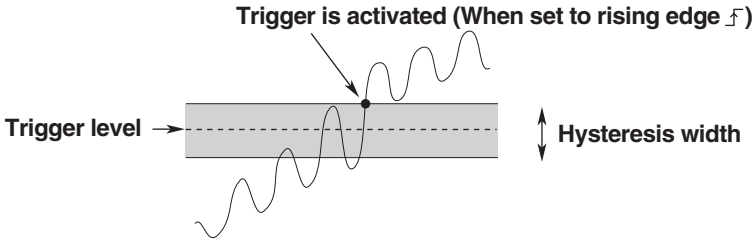
: Activated when the trigger source changes from above the trigger level to below the trigger level (falling).

: Activated on either a rising edge or falling edge.

Setting the Trigger Hysteresis

Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. Select the trigger hysteresis from the following three types.

- **When Measuring Voltage**
  : Approx. ±0.1 division of hysteresis around the trigger level.
  : Approx. ±0.5 division of hysteresis around the trigger level.
  : Approx. ±1 division of hysteresis around the trigger level.
- **When Measuring Temperature**
  : Approx. ±0.5°C (K, °F)
  : Approx. ±1°C (K, °F)
  : Approx. ±2°C (K, °F)
- **When Measuring Strain**
  Hysteresis of approximately ±2.5% of the range around the trigger level.
  Hysteresis of approximately ±12.5% of the range around the trigger level.
  Hysteresis of approximately ±25% of the range around the trigger level.
- **When Measuring Acceleration**
  : Hysteresis of approximately ±0.1 divisions of the range around the trigger level.
  : Hysteresis of approximately ±0.5 divisions of the range around the trigger level.
  : Hysteresis of approximately ±1 division of the range around the trigger level.
- **When Measuring Frequency and Other Parameters on the Frequency Module**
  : Hysteresis of approximately ±0.01 divisions of the range around the trigger level.
  : Hysteresis of approximately ±0.5 divisions of the range around the trigger level.
  : Hysteresis of approximately ±1 division of the range around the trigger level.



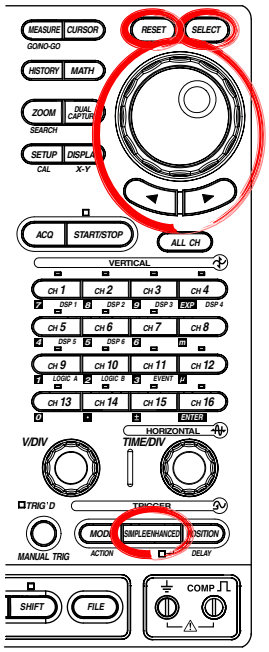
Setting the Hold Off

For details, see section 6.4, “Setting the Hold Off Time.”

6.6 Setting the External Trigger (SIMPLE)

<For a description of this function, refer to page 2-20.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Simple.

Setting the Trigger Source

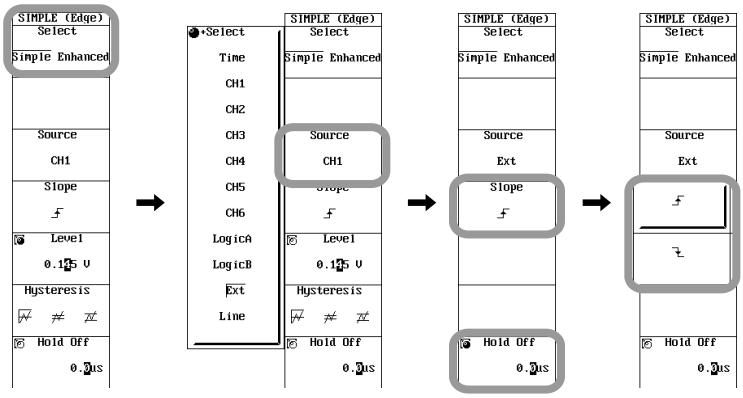
3. Press the **Source** soft key. The trigger source selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select Ext.

Setting the Trigger Slope

5. Press the **Slope** soft key to select ⨍ or ⨍̲.

Setting the Hold Off

6. Set the hold off time according to the procedures given in section 6.4.



DSP1 to DSP6 are optional.

Explanation

The external signal that is input through the TRIG IN terminal on the left side panel of the DL750/DL750P can be used to generate triggers.

Note

For details on the TRIG IN terminal, see section 14.1.

Setting the Trigger Source

Select Ext.

Setting the Trigger Slope

Select how the trigger source is to cross the specified level for activating the trigger from the following two choices.

⨍: Activated when the trigger source changes from below the trigger level to above the trigger level (rising).

⨍̲: Activated when the trigger source changes from above the trigger level to below the trigger level (falling).

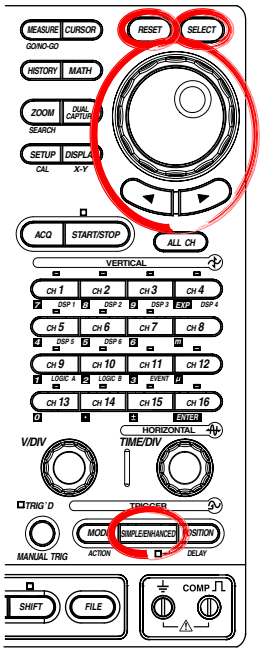
Setting the Hold Off

For details, see section 6.4, “Setting the Hold Off Time.”

6.7 Generating Triggers on the Power Signal (SIMPLE)

<For a description of this function, refer to page 2-20.>

Procedure



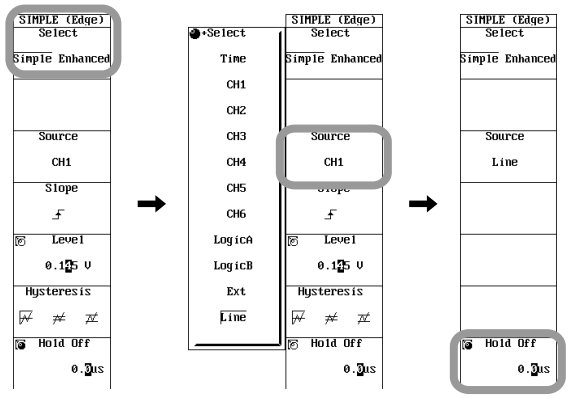
1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Simple.

Setting the Trigger Source

3. Press the **Source** soft key. The trigger source selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select Line.

Setting the Hold Off

5. Set the hold off time according to the procedures given in section 6.4.



DSP1 to DSP6 are optional.

Explanation

Triggers can be generated on the rising edge of the power signal that is being supplied to the DL750/DL750P. Waveforms can be observed by synchronizing to the commercial power supply frequency (50 Hz or 60 Hz).

Setting the Trigger Source

Select Line. The power signal that is being supplied to the DL750/DL750P becomes the trigger source.

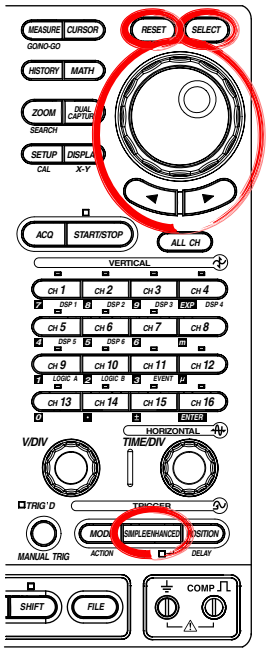
Setting the Hold Off

For details, see section 6.4, “Setting the Hold Off Time.”

6.8 Setting the Timer Trigger (SIMPLE)

<For a description of this function, refer to page 2-20.>

Procedure



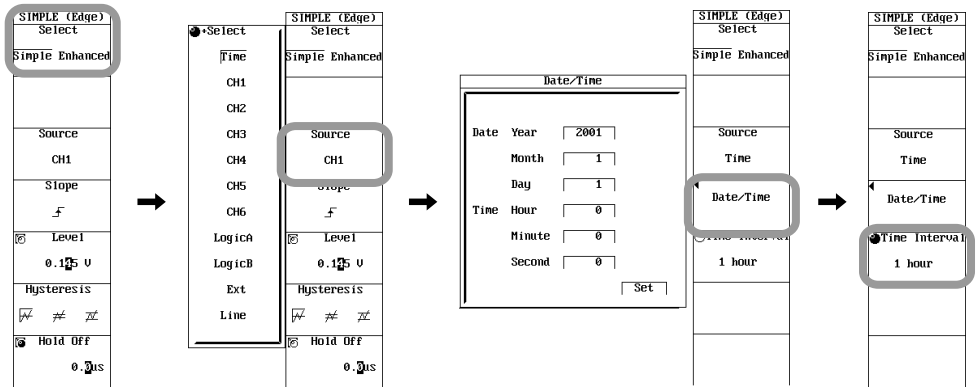
1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Simple.

Setting the Trigger Source

3. Press the **Source** soft key. The trigger source selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select Time.

Setting the Date/Time and the Interval for Activating Triggers

5. Press the **Date/Time** soft key. A setup dialog box opens.
6. Use the **jog shuttle** and **SELECT** to set the Date and Time.
7. When you are done, use the **jog shuttle** and **SELECT** to select Set.
8. Press the **Time Interval** soft key.
9. Turn the **jog shuttle** to set the time interval for activating triggers in the range of 1 min to 24 hours.



DSP1 to DSP6 are optional.

Explanation

The trigger is activated at specified time intervals from the specified time.

Setting the Trigger Source

Select Time.

Setting the Reference Date and Time for Activating Triggers

Select the date and time for activating the trigger.

Setting the Time Interval for Activating Triggers

The following intervals can be specified.
1 min, 2 min, 3 min, 4 min, 5 min, 6 min, 7 min, 8 min, 9 min, 10 min, 15 min, 20 min, 25 min, 30 min, 40 min, 45 min, 50 min, 1 hour, 2 hour, 3 hour, 4 hour, 5hour, 6 hour, 7 hour, 8 hour, 9 hour, 10 hour, 11 hour, 12 hour, 18 hour, and 24 hour

Trigger Position

Like the normal trigger, you can set the trigger position to observe the phenomenon occurring around the specified time. Initially, the trigger position is set to 50% and positioned at the center of the screen. To observe only the waveform after the trigger set the trigger position to 0%. To observe only the waveform before the trigger set it to 100%.

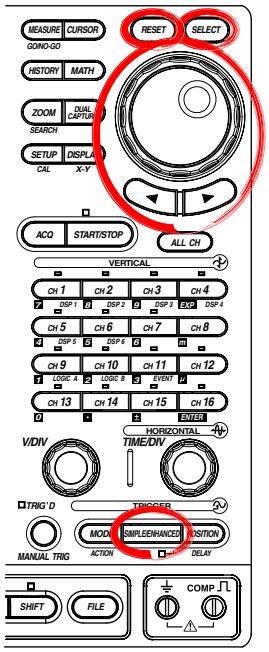
Notes on the Timer Trigger

- Depending on the time interval setting, a trigger may occur while the waveform is being acquired or during the pre-trigger period (a preparation period for observing the waveform before the trigger time). In such cases, the trigger is ignored.
- If the trigger time is set to a time in the past, the trigger is activated when the current time becomes
  Specified time + time interval × N (where N is an integer).
- If you specify the acquisition count, the waveforms are acquired the specified number of times. If it is set to infinite, the waveforms are acquired until the STOP key is pressed. For the procedure in setting the acquisition count, see section 7.3.
- You can save the waveform to a floppy disk, Zip disk, PC card, or internal hard disk (optional), output the waveform on the built-in printer, and do other operations by using the action-on-trigger function.

6.9 Setting the Logic Trigger (SIMPLE)

<For a description of this function, refer to page 2-20.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Simple.

Setting the Trigger Source

3. Press the **Source** soft key. The trigger source selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select Logic A or Logic B.

Specifying the Bit for Assigning the Trigger Slope

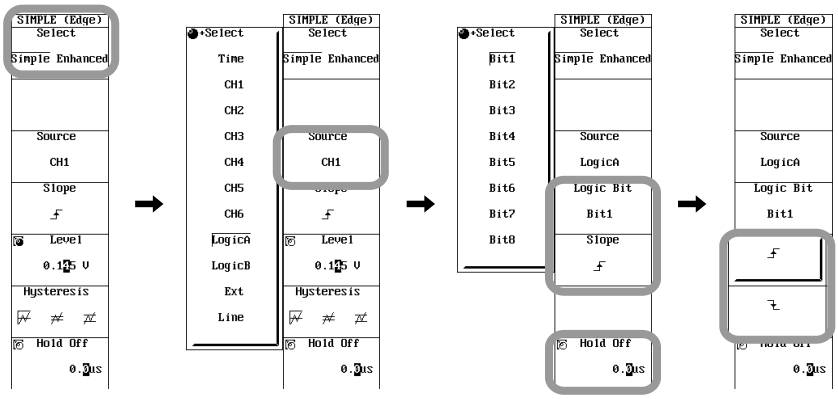
5. Press the **Logic Bit** soft key. The bit source selection menu appears.
6. Use the **jog shuttle** and **SELECT** to set the bit to assign the trigger slope.

Setting the Trigger Slope

7. Press the **Slope** soft key to select ⎍ or ⎎.

Setting the Hold Off

8. Set the hold off time according to the procedures given in section 6.4.



DSP1 to DSP6 are optional.

Explanation

This is the edge trigger when the trigger source is set to a logic waveform.

Setting the Trigger Source

Select Logic A or Logic B.

Specifying the Bit to Assign the Trigger Slope

Select from Bit 1 to Bit 8.

Setting the Trigger Slope

Select how the trigger source is to cross the specified level for activating the trigger from the following two choices.

- ⌐: Activated when the trigger source changes from below the trigger level to above the trigger level (rising).
- ¬: Activated when the trigger source changes from above the trigger level to below the trigger level (falling).

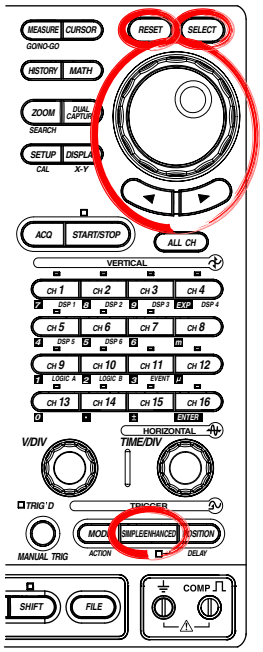
Setting the Hold Off

For details, see section 6.4, “Setting the Hold Off Time.”

6.10 Setting the A -> B(N) Trigger (ENHANCED)

<For a description of this function, refer to page 2-21.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Enhanced.

Setting the Trigger Type

3. Press the **Type** soft key. The trigger type selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select A -> B(N).

Setting Condition A

5. Press the **Set Pattern** soft key. The A -> B(N) trigger setup menu appears.

- **Setting the Condition A Pattern**

6. Use the **jog shuttle** and **SELECT** to select the pattern of each channel (CH1 to CH16) from H, L, and X. For logic input channels, select Disable or Enable.

- **Setting the Condition A Condition**

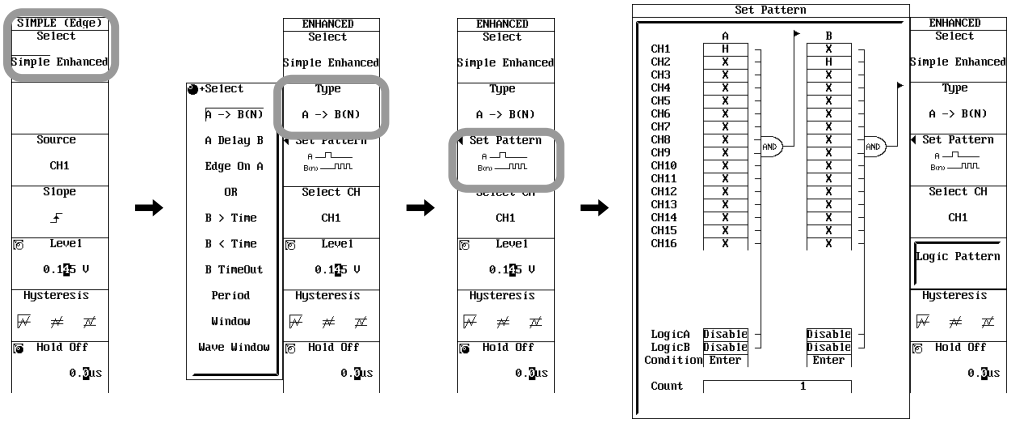
7. Use the **jog shuttle** and **SELECT** to set Condition to Enter or Exit.

Setting Condition B

8. Set the pattern and condition of condition B in a similar fashion as in steps 6 and 7.

- **Setting the Number of Times Condition B Is to Be Met**

9. Use the **jog shuttle** and **SELECT** to set Count (the number of times condition B is to be met). Pressing **RESET** resets the number to 1.



Setting the Bit Patterns of Logic A and Logic B

(Only when using logic input channels)

10. Press the **Logic Pattern** soft key. The Logic Pattern setup dialog box appears.
11. Use the **jog shuttle** and **SELECT** to select the pattern of each bit (Bit A1 to Bit A8 and Bit B1 to Bit B8) from H, L, and X.

Setting the Trigger Level

12. Press the **Select CH** soft key. The channel selection menu appears.
13. Use the **jog shuttle** and **SELECT** to set the channel to assign the trigger level.
14. Press the **Level** soft key.
15. Use the **jog shuttle** and **SELECT** to set the trigger level.
16. Likewise, set the trigger level for all channels for which patterns were assigned in steps 6 to 8.

Note

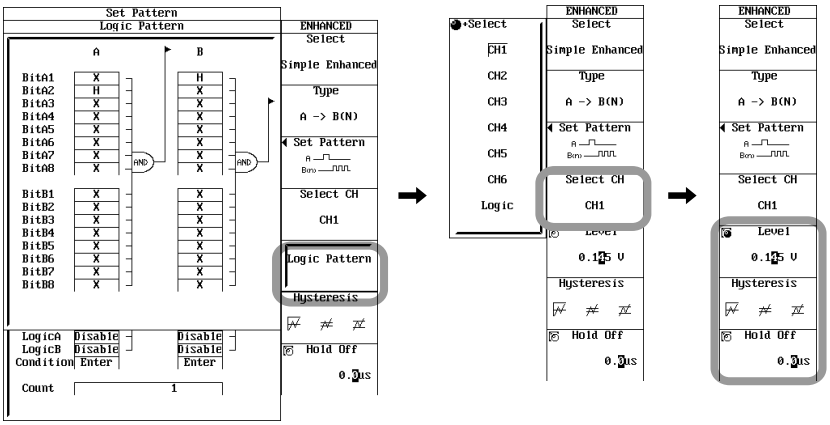
The trigger level setting applies to both simple and enhanced triggers.

Setting the Hysteresis

17. Press the **Hysteresis** soft key to select  ,  , or  .

Setting the Hold Off

18. Set the hold off time according to the procedures given in section 6.4.



Note

The pattern settings of conditions A and B apply to all trigger types.

Explanation

This function activates a trigger on the n^{th} time condition B becomes true after condition A becomes true.

Setting Conditions A and B

- **Pattern of Each Channel: CH1 to CH16, Logic A, and Logic B**
  Select from the following:
- **For CH1 to CH16 (Other Than Logic Inputs)**
  H: Above the preset trigger level
  L: Below the preset trigger level
  X: Don't Care
- **For Logic Input**
  Enable: Make the combination of the pattern[1] of each bit the trigger condition
  Disable: Don't Care
  1. Select the pattern of each bit from the following:
     H: Above a certain level[2]
     L: Below a certain level[2]
     X: Don't Care
  2. Varies depending on the logic probe being used as follows:
     700986: Approx. 1.4 V
     700987: 6 V± 50% (for DC input)
     700987: 50 V± 50% (for AC input)
- **Condition**
  Select from the following:
  Enter: A trigger is activated when all channels match the specified pattern.
  Exit: A trigger is activated when any of the channels no longer match the specified pattern.
- **Number of Times Condition B Is to Be Met**
  1 to 255 times

Setting the Trigger Level

The trigger level setting applies to both simple and enhanced triggers.
For details, see "Setting the Trigger Level" in section 6.5.

Setting the Trigger Hysteresis

Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. Select the trigger hysteresis from  ,  , and  .
For details, see "Setting the Trigger Hysteresis" in section 6.5.

Setting the Hold Off

For details, see section 6.4, "Setting the Hold Off Time."

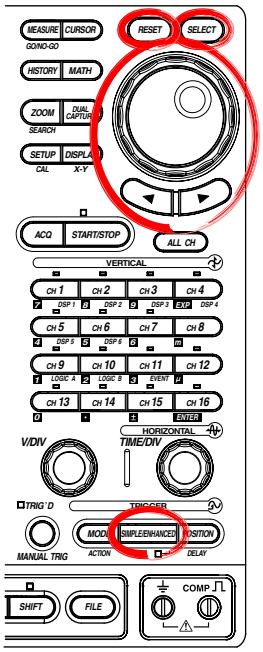
Note

- If you wish to use a simple pattern trigger (only one pattern condition for activating the trigger), set all of the status of condition B to Xs (Don't care) and set a pattern for condition A.
- If you wish to set the trigger only on the condition of the pattern of each bit of the logic input (trigger on the AND of each bit), then make the following settings.
  Condition A pattern: Set the logic input channels to be used to Enable, All other channels to X (Don't care)
  Condition B pattern: All Xs (Don't Care)
  Bit pattern of logic input: Set arbitrarily.

6.11 Setting the A Delay B Trigger (ENHANCED)

<For a description of this function, refer to page 2-21.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Enhanced.

Setting the Trigger Type

3. Press the **Type** soft key. The trigger type selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select A Delay B.

Setting Condition A

5. Press the **Set Pattern** soft key. The A Delay B trigger setup menu appears.

- **Setting the Condition A Pattern**

6. Use the **jog shuttle** and **SELECT** to select the pattern of each channel (CH1 to CH16) from H, L, and X. For logic input channels, select Disable or Enable.

- **Setting the Condition A Condition**

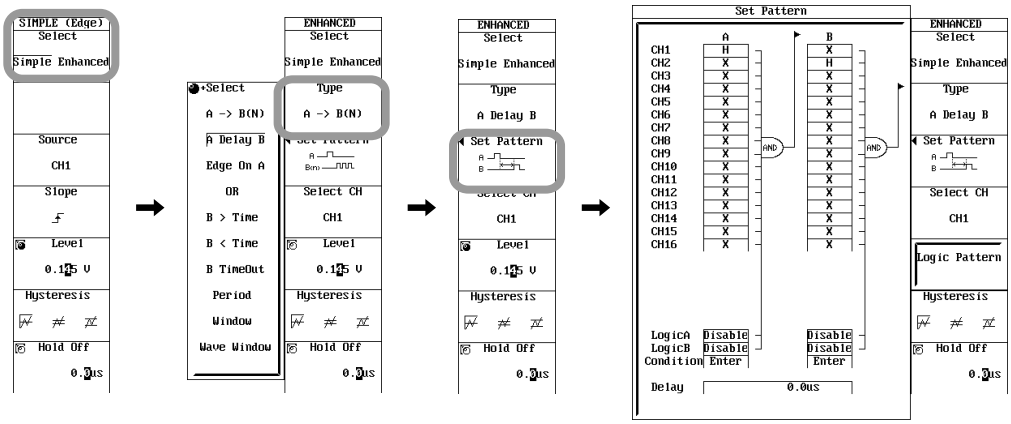
7. Use the **jog shuttle** and **SELECT** to set Condition to Enter or Exit.

Setting Condition B

8. Set the pattern and condition of condition B in a similar fashion as in steps 6 and 7.

Setting the Delay Time

9. Use the **jog shuttle** and **SELECT** to set Delay. Pressing **RESET** resets the value to 0.0 µs.



Setting the Bit Patterns of LOGIC A and LOGIC B

(Only when using logic input channels)

10. Press the **Logic Pattern** soft key. The Logic Pattern setup dialog box appears.
11. Use the **jog shuttle** and **SELECT** to select the pattern of each bit (Bit A1 to Bit A8 and Bit B1 to Bit B8) from H, L, and X.

Setting the Trigger Level

12. Press the **Select CH** soft key. The channel selection menu appears.
13. Use the **jog shuttle** and **SELECT** to set the channel to assign the trigger level.
14. Press the **Level** soft key.
15. Use the **jog shuttle** and **SELECT** to set the trigger level.
16. Likewise, set the trigger level for all channels for which patterns were assigned in steps 6 to 8.

Note

The trigger level setting applies to both simple and enhanced triggers.

Setting the Hysteresis

17. Press the **Hysteresis** soft key to select , , or .

Setting the Hold Off

18. Set the hold off time according to the procedures given in section 6.4.

Note

The pattern settings of conditions A and B apply to all trigger types.

Explanation

This function activates a trigger the first time condition B becomes true after condition A has become true and the preset time has elapsed.

Setting Conditions A and B

- **Pattern of Each Channel: CH1 to CH16, Logic A, and Logic B**
  Select from the following:
- **CH1 to CH16 (Other Than Logic Inputs)**
  H: Above the preset trigger level
  L: Below the preset trigger level
  X: Don't Care
- **Logic Input**
  Enable: Make the combination of the pattern[1] of each bit the trigger condition
  Disable: Don't Care
  1. Select the pattern of each bit from the following:
     H: Above a certain level[2]
     L: Below a certain level[2]
     X: Don't Care
  2. Varies depending on the logic probe being used as follows:
     700986: Approx. 1.4 V
     700987: 6 V±50% (for DC input)
     700987: 50 V± 50% (for AC input)
- **Condition**
  Select from the following:
  Enter: A trigger is activated when all channels match the specified pattern.
  Exit: A trigger is activated when any of the channels no longer match the specified pattern.
- **Delay**
  0 to 10 s (resolution is 100 ns)

Setting the Trigger Level

The trigger level setting applies to both simple and enhanced triggers.
For details, see "Setting the Trigger Level" in section 6.5.

Setting the Trigger Hysteresis

Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. Select the trigger hysteresis from  , , and  .
For details, see "Setting the Trigger Hysteresis" in section 6.5.

Setting the Hold Off

For details, see section 6.4, "Setting the Hold Off Time."

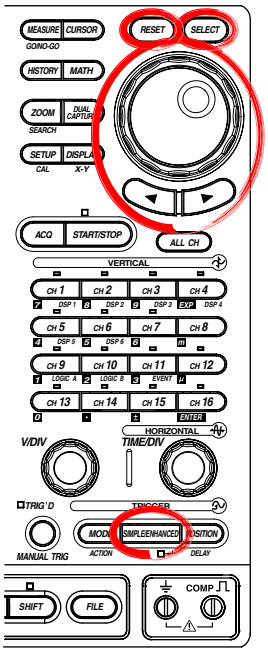
Note

If you want to activate only one pattern trigger, use the A -> B(n) trigger function (see section 6.10).

6.12 Setting the Edge on A Trigger (ENHANCED)

<For a description of this function, refer to page 2-22.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Enhanced.

Setting the Trigger Type

3. Press the **Type** soft key. The trigger type selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select Edge on A.

Setting Condition A

5. Press the **Set Pattern** soft key. The Edge on A trigger setup menu appears.

- **Setting the Condition A Pattern**

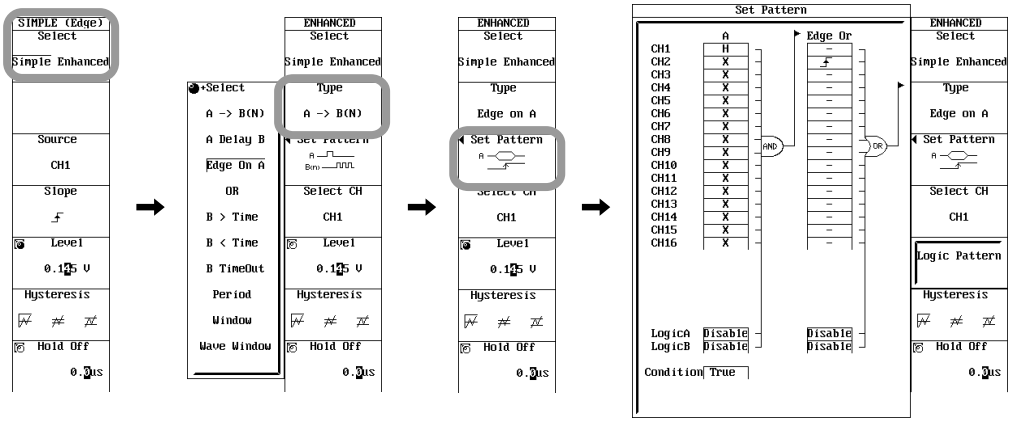
6. Use the **jog shuttle** and **SELECT** to select the pattern of each channel (CH1 to CH16) from H, L, and X. For logic input channels, select Disable or Enable.

- **Setting the Condition A Condition**

7. Use the **jog shuttle** and **SELECT** to set Condition to True or False.

Setting the Edge Trigger OR

8. Use the **jog shuttle** and **SELECT** to select the edge trigger OR status of each channel (CH1 to CH16) from ⨍, ⨏, and –. For logic input channels, select Disable or Enable.



Setting the Bit Patterns/Status of LOGIC A and LOGIC B

(Only When Using Logic Input Channels)

9. Press the **Logic Pattern** soft key. The Logic Pattern setup dialog box appears.
10. Use the **jog shuttle** and **SELECT** to select the pattern of each bit (Bit A1 to Bit A8 and Bit B1 to Bit B8) of condition A from H, L, and X.
11. Likewise, use the **jog shuttle** and **SELECT** to select the edge trigger OR status from ↓, ↑, and –.

Setting the Trigger Level

12. Press the **Select CH** soft key. The channel selection menu appears.
13. Use the **jog shuttle** and **SELECT** to set the channel to assign the trigger level.
14. Press the **Level** soft key.
15. Use the **jog shuttle** and **SELECT** to set the trigger level.
16. Likewise, set the trigger level for all channels for which patterns were assigned in steps 5 to 6.

Note

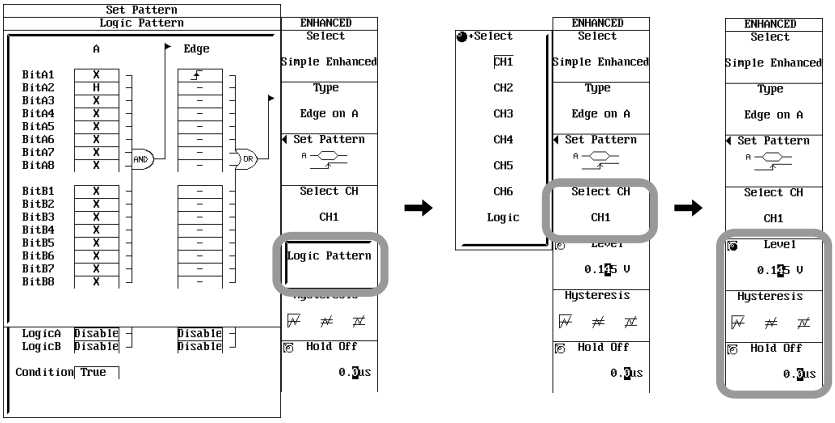
The trigger level setting applies to both simple and enhanced triggers.

Setting the Hysteresis

17. Press the **Hysteresis** soft key to select ⩘, ⩘, or ⩘.

Setting the Hold Off

18. Set the hold off time according to the procedures given in section 6.4.



Note

The pattern settings of condition A apply to all trigger types.

Explanation

This function activates a trigger on the OR logic of the edge trigger of each channel while condition A is true.

Setting Conditions A/Edge Or

- **Pattern of Each Channel of Condition A: CH1 to CH16, Logic A, and Logic B**
  Select from the following:
- **CH1 to CH16 (Other Than Logic Inputs)**
  H: Above the preset trigger level
  L: Below the preset trigger level
  X: Don't Care
- **Logic Input**
  Enable: Make the combination of the pattern[1] of each bit the trigger condition
  Disable: Don't Care
  1. Select the pattern of each bit from the following:
     H: Above a certain level[2]
     L: Below a certain level[2]
     X: Don't Care
  2. Varies depending on the logic probe being used as follows:
     700986: Approx. 1.4 V
     700987: 6 V± 50% (for DC input)
     700987: 50 V± 50% (for AC input)
- **Condition**
  Select from the following:
  True: A trigger is activated while all channels match the specified pattern.
  False: A trigger is activated while any of the channels do not match the specified pattern.
- **Edge Trigger of Each Channel**
  This setting is possible only if the channel's condition A pattern is set to X (Don't Care). If you set all condition A patterns to X (Don't Care), the trigger will operate as an OR trigger.
- **CH1 to CH16 (Other Than Logic Inputs)**
  ⎍: Rising edge
  ⎎: Falling edge
  –: Don't Care
- **Logic Input**
  Enable: Make the combination of the pattern[1] of each bit the trigger condition
  Disable: Don't Care
  1. Select the pattern of each bit from the following:
     ⎍: When the signal goes above a certain level[2]
     ⎎: When the signal goes below a certain level[2]
     –: Don't Care
  2. Varies depending on the logic probe being used as follows:
     700986: Approx. 1.4 V
     700987: 6 V± 50% (for DC input)
     700987: 50 V± 50% (for AC input)

Setting the Trigger Level

The trigger level setting applies to both simple and enhanced triggers.
For details, see “Setting the Trigger Level” in section 6.5.

Setting the Trigger Hysteresis

Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. Select the trigger hysteresis from  , , and  .
For details, see “Setting the Trigger Hysteresis” in section 6.5.

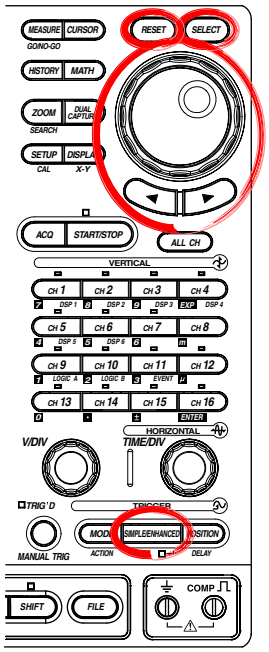
Setting the Hold Off

For details, see section 6.4, “Setting the Hold Off Time.”

6.13 Setting the OR Trigger (ENHANCED)

<For a description of this function, refer to page 2-22.>

Procedure



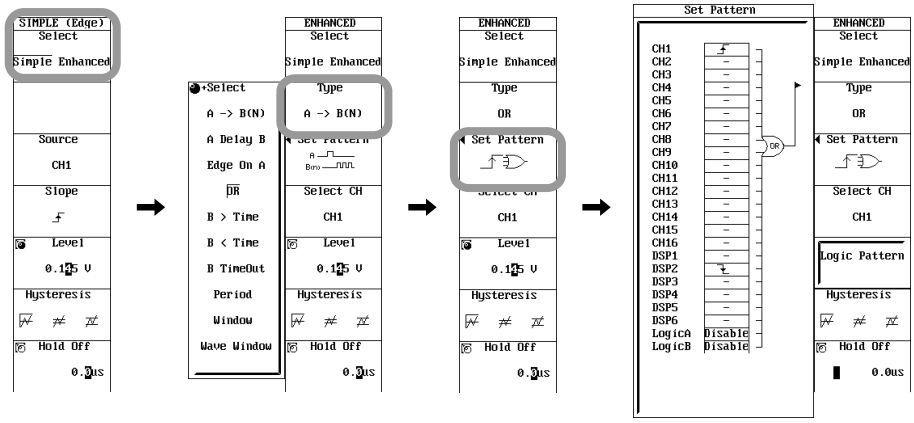
1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Enhanced.

Setting the Trigger Type

3. Press the **Type** soft key. The trigger type selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select OR.

Setting the Edge Trigger OR

5. Press the **Set Pattern** soft key. The OR trigger setup menu appears.
6. Use the **jog shuttle** and **SELECT** to select the edge trigger OR status of each channel (CH1 to CH16, DSP1 to DSP6 (optional)) from ⎍, ⎎, and –. For logic input channels, select Disable or Enable.



Setting the Status of Each Bit of Logic A and Logic B (Only When Using Logic Input Channels)

7. Press the **Logic Pattern** soft key. The Logic Pattern setup dialog box appears.
8. Use the **jog shuttle** and **SELECT** to select the edge trigger OR status of each bit (Bit A1 to Bit A8 and Bit B1 to Bit B8) from , , and –.

Setting the Trigger Level

9. Press the **Select CH** soft key. The channel selection menu appears.
10. Use the **jog shuttle** and **SELECT** to set the channel to assign the trigger level.
11. Press the **Level** soft key.
12. Use the **jog shuttle** and **SELECT** to set the trigger level.
13. Likewise, set the trigger level for all channels for which patterns were assigned in step 6.

Note

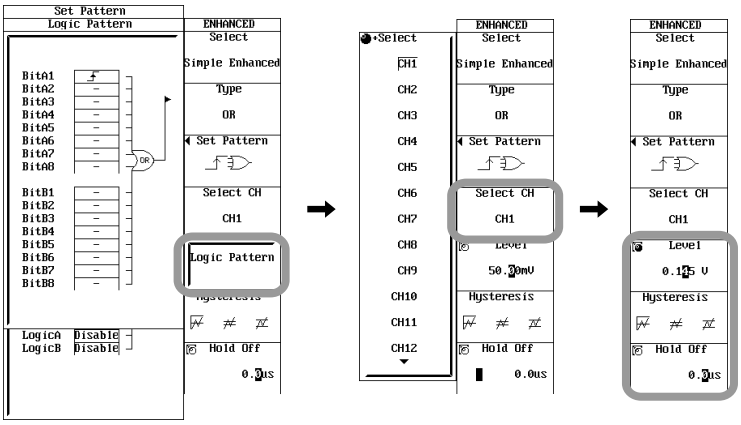
The trigger level setting applies to both simple and enhanced triggers.

Setting the Hysteresis

14. Press the **Hysteresis** soft key to select , , or .

Setting the Hold Off

15. Set the hold off time according to the procedures given in section 6.4.



Explanation

This function activates a trigger on the OR logic of edge triggers. You can set trigger conditions on all channels (CH1 to CH16) and DSP channels (DSP1 to DSP6 (option)). For example, a trigger can be activated on the rising edge of CH1 or CH2.

Setting the Edge Trigger of Each Channel

Select from the following:

- **CH1 to CH16 (Other Than Logic Inputs) or DSP1 to DSP6 (optional)**
  ⎍ : Rising edge
  ⎎: Falling edge
  –: Don't Care
- **Logic Input**
  Enable: Make the combination of the status[1] of each bit the trigger condition
  Disable: Don't Care
  1. Select the status of each bit from the following:
     ⎍ : When the signal goes above a certain level[2]
     ⎎: When the signal goes below a certain level[2]
     –: Don't Care
  2. Varies depending on the logic probe being used as follows:
     700986: Approx. 1.4 V
     700987: 6 V±50% (for DC input)
     700987: 50 V± 50% (for AC input)

Setting the Trigger Level

The trigger level setting applies to both simple and enhanced triggers.
For details, see "Setting the Trigger Level" in section 6.5.

Setting the Trigger Hysteresis

Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. Select the trigger hysteresis from  ,  , and  .
For details, see "Setting the Trigger Hysteresis" in section 6.5.

Setting the Hold Off

For details, see section 6.4, "Setting the Hold Off Time."

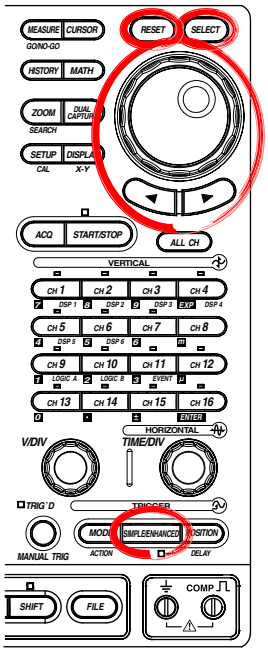
Note

The OR trigger is equivalent to setting the pattern of condition A of Edge on A trigger to all Xs (Don't Care).

6.14 Setting the B > Time, B < Time, or B TimeOut (Pulse Width) Trigger (ENHANCED)

<For a description of this function, refer to page 2-23.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Enhanced.

Setting the Trigger Type

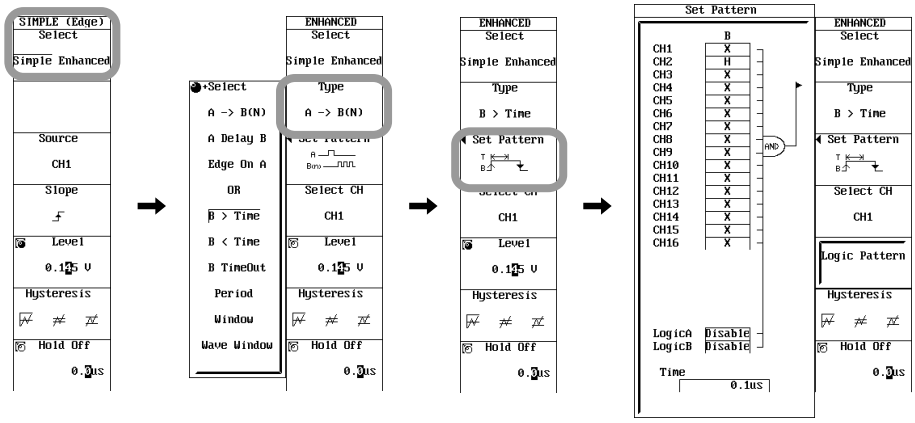
3. Press the **Type** soft key. The trigger type selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select B > Time, B < Time, or B TimeOut.

Setting the Condition B Pattern

5. Press the **Set Pattern** soft key. The B > Time trigger, B < Time trigger, and B TimeOut trigger setup menu appears.
6. Use the **jog shuttle** and **SELECT** to select the pattern of each channel (CH1 to CH16) from H, L, and X. For logic input channels, select Disable or Enable.

Setting the Pulse Width

7. Use the **jog shuttle** and **SELECT** to set Time. Pressing **RESET** resets the value to 0.1 µs.



Setting the Bit Patterns of LOGIC A and LOGIC B (Only When Using Logic Input Channels)

8. Press the **Logic Pattern** soft key. The Logic Pattern setup dialog box appears.
9. Use the **jog shuttle** and **SELECT** to select the pattern of each bit (Bit A1 to Bit A8 and Bit B1 to Bit B8) from H, L, and X.

Setting the Trigger Level

10. Press the **Select CH** soft key. The channel selection menu appears.
11. Use the **jog shuttle** and **SELECT** to set the channel to assign the trigger level.
12. Press the **Level** soft key.
13. Use the **jog shuttle** and **SELECT** to set the trigger level.
14. Likewise, set the trigger level for all channels for which patterns were assigned in step 6.

Note

The trigger level setting applies to both simple and enhanced triggers.

Setting the Hysteresis

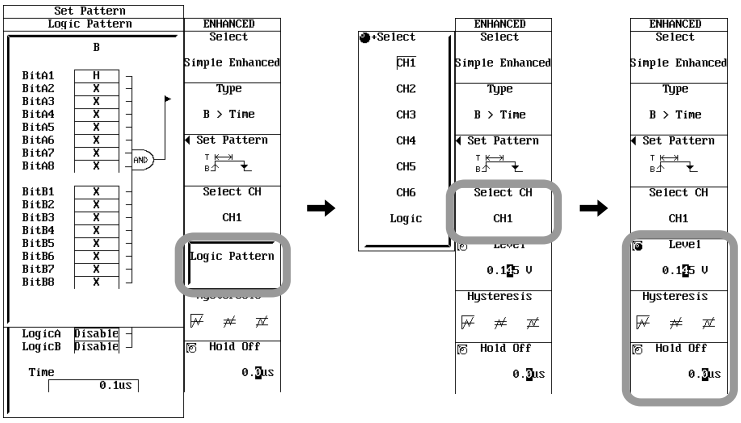
15. Press the **Hysteresis** soft key to select  ,  , or  .

Setting the Hold Off

16. Set the hold off time according to the procedures given in section 6.4.

Note

The pattern settings of condition B apply to all trigger types.



Explanation

The following three pulse width triggers are available.

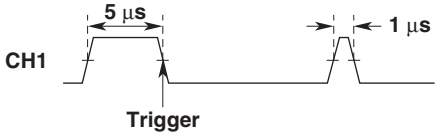
B > Time: A trigger is activated when condition B goes false after holding true for the preset pulse width.

B < Time: A trigger is activated when condition B goes false after holding true for less than the preset pulse width.

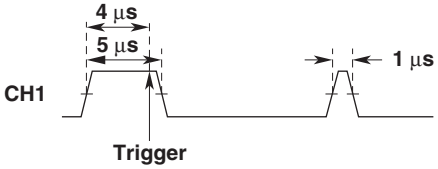
B Time Out: A trigger is activated when condition B has held true for the preset pulse width.

The point where the trigger occurs differs between B > Time and B Time Out as shown in the figure below.

When B > Time, CH1 = H, and Time = 4 μs

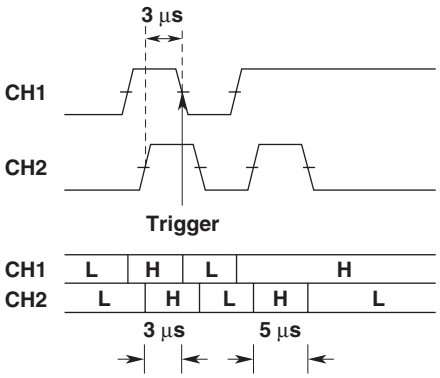


When B Time Out, CH1 = H, and Time = 4 μs



B < Time Setup Example

When B < Time, condition B: CH1 = H, CH2 = H, and Time = 4 μs



Setting Condition B

- **Pattern of Each Channel: CH1 to CH16, Logic A, and Logic B**

Select from the following:

- **CH1 to CH16 (Other Than Logic Inputs)**
  H: Above the preset trigger level
  L: Below the preset trigger level
  X: Don't Care
- **Logic Input**
  Enable: Make the combination of the pattern[1] of each bit the trigger condition
  Disable: Don't Care

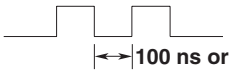
1. Select the pattern of each pattern from the following:
   H: Above a certain level[2]
   L: Below a certain level[2]
   X: Don't Care
2. Varies depending on the logic probe being used as follows:
   700986: Approx. 1.4 V
   700987: 6 V± 50% (for DC input)
   700987: 50 V± 50% (for AC input)

Setting the Pulse Width

100 ns to 10 s (resolution is 100 ns)

Notes When Setting the B>Time, B<Time, or B Time Out Trigger

- Correct operation is not guaranteed if adjacent pulses are less than 100 ns apart or if the pulse width is less than 100 ns (typical).



Setting the Trigger Level

The trigger level setting applies to both simple and enhanced triggers.
For details, see "Setting the Trigger Level" in section 6.5.

Setting the Trigger Hysteresis

Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. Select the trigger hysteresis from  ,  , and  .
For details, see "Setting the Trigger Hysteresis" in section 6.5.

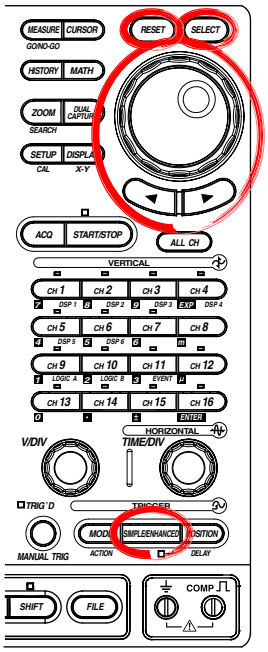
Setting the Hold Off

For details, see section 6.4, "Setting the Hold Off Time."

6.15 Setting the Period Trigger (ENHANCED)

<For a description of this function, refer to page 2-24.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Enhanced.

Setting the Trigger Type

3. Press the **Type** soft key. The trigger type selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select Period.

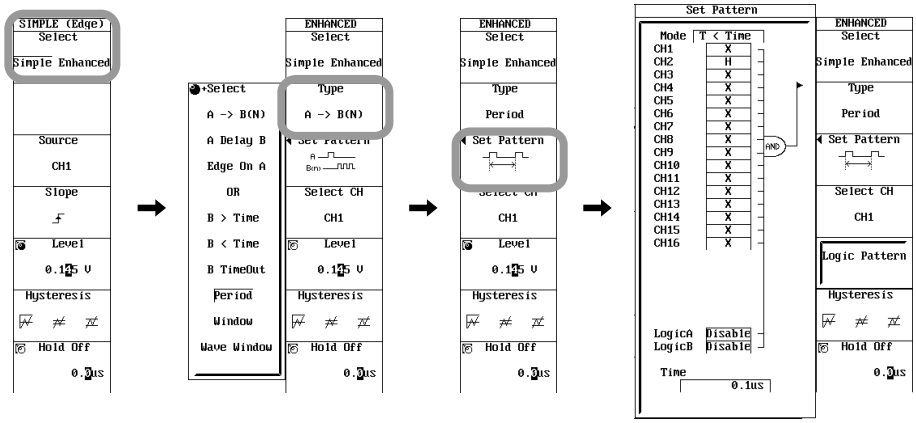
Setting the Condition B Status

5. Press the **Set Pattern** soft key. The Period trigger setup menu appears.
6. Press the **Mode** soft key and use the **jog shuttle** and **SELECT** to select T > Time, T < Time, T1 < T < T2, or T < T1,T2 < T.
7. Use the **jog shuttle** and **SELECT** to select the pattern of each channel (CH1 to CH16) from H, L, and X. For logic input channels, select Disable or Enable.

Setting the Time of Satisfaction

- **For T > Time or T < Time**
  8. Use the **jog shuttle** and **SELECT** to set Time. Pressing **RESET** resets the value to 0.1 µs.

- **For T1 < T < T2 or T < T1,T2 < T**
  8. Use the **jog shuttle** and **SELECT** to set Time1 and Time2. Pressing **RESET** resets Time1 to 0.1 µs and Time2 to 0.2 µs.



Setting the Bit Patterns of LOGIC A and LOGIC B (Only When Using Logic Input Channels)

9. Press the **Logic Pattern** soft key. The Logic Pattern setup dialog box appears.
10. Use the **jog shuttle** and **SELECT** to select the pattern of each bit (Bit A1 to Bit A8 and Bit B1 to Bit B8) from H, L, and X.

Setting the Trigger Level

11. Press the **Select CH** soft key. The channel selection menu appears.
12. Use the **jog shuttle** and **SELECT** to set the channel to assign the trigger level.
13. Press the **Level** soft key.
14. Use the **jog shuttle** and **SELECT** to set the trigger level.
15. Likewise, set the trigger level for all channels for which patterns were assigned in step 7.

Note

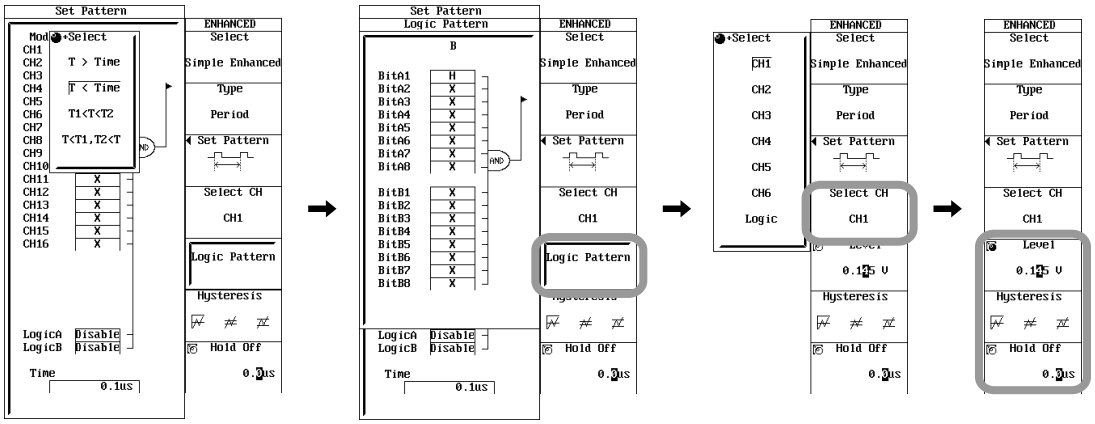
The trigger level setting applies to both simple and enhanced triggers.

Setting the Hysteresis

16. Press the **Hysteresis** soft key to select  ,  , or  .

Note

The pattern settings of condition B apply to all trigger types.



Explanation

The following four period triggers are available.

T > Time: A trigger is activated when condition B is met the second time, if the time when condition B is met the second time is longer than a specified time.

T < Time: A trigger is activated when condition B is met the second time, if the time when condition B is met the second time is shorter than a specified time.

T1 < T < T2: A trigger is activated when condition B is met the second time, if the time when condition B is met the second time is within a specified time range.

T < T1, T2 < T: A trigger is activated when condition B is met the second time, if the time when condition B is met the second time is outside a specified time range.

Setting Condition B

- **Pattern of Each Channel: CH1 to CH16, Logic A, and Logic B**
  Select from the following:
- **CH1 to CH16 (Other Than Logic Inputs)**
  H: Above the preset trigger level
  L: Below the preset trigger level
  X: Don't Care
- **Logic Input**
  Enable: Make the combination of the pattern[1] of each bit the trigger condition
  Disable: Don't Care
  1. Select the pattern of each pattern from the following:
     H: Above a certain level[2]
     L: Below a certain level[2]
     X: Don't Care
  2. Varies depending on the logic probe being used as follows:
     700986: Approx. 1.4 V
     700987: 6 V± 50% (for DC input)
     700987: 50 V± 50% (for AC input)

- **Setting the Time of Satisfaction**
- **For T > Time or T < Time**
  Time: 0.1 µs to 9999999.9 µs
- **For T1 < T < T2 or T < T1, T2 < T**
  Time1: 0.1 µs to 9999999.9 µs
  Time2: 0.2 µs to 10000000.0 µs

Setting the Trigger Level

The trigger level setting applies to both simple and enhanced triggers.
For details, see "Setting the Trigger Level" in section 6.5.

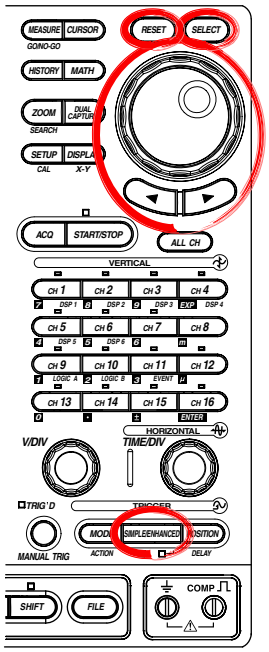
Setting the Trigger Hysteresis

Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. Select the trigger hysteresis from  ,  , and  .
For details, see "Setting the Trigger Hysteresis" in section 6.5.

6.16 Setting the Window Trigger (ENHANCED)

<For a description of this function, refer to page 2-25.>

Procedure



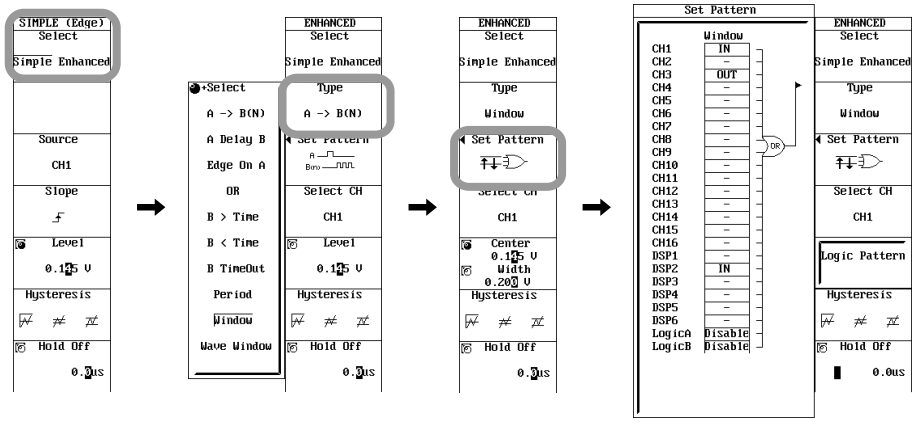
1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Enhanced.

Setting the Trigger Type

3. Press the **Type** soft key. The trigger type selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select Window.

Set the Trigger Condition

5. Press the **Set Pattern** soft key. The Window trigger setup menu appears.
6. Use the **jog shuttle** and **SELECT** to select the pattern of each channel (CH1 to CH16, DSP1 to DSP6 (optional)) from IN, OUT, and –. For logic input channels, select Disable or Enable.



Setting the Status of Each Bit of LOGIC A and LOGIC B (Only When Using Logic Input Channels)

7. Press the **Logic Pattern** soft key. The Logic Pattern setup dialog box appears.
8. Use the **jog shuttle** and **SELECT** to select the status of each bit (Bit A1 to Bit A8 and Bit B1 to Bit B8) from ⌐, ¬, and –.

Selecting the Target Waveform

9. Press the **Select CH** soft key. The channel selection menu appears.
10. Use the **jog shuttle** and **SELECT** to select the target channel.

Setting the Window (When the Target Waveform Is Not LOGIC)

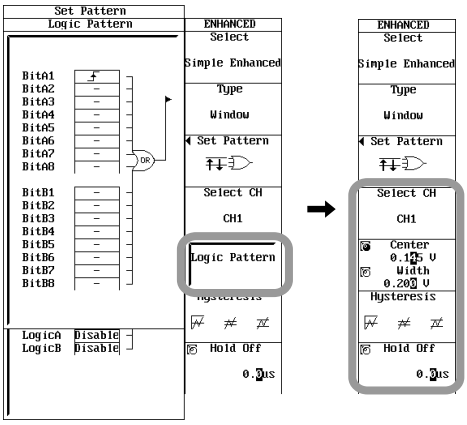
- **Setting the Center Level**
  11. Press the **Center/Width** soft key to set the jog shuttle control to Center.
  12. Turn the **jog shuttle** to set the center level.
- **Setting the Window Width**
  13. Press the **Center/Width** soft key to set the jog shuttle control to Width.
  14. Turn the **jog shuttle** to set the window width.

Setting the Hysteresis

15. Press the **Hysteresis** soft key to select ⩘, ⩙, or ⩗s.

Setting the Hold Off

16. Set the hold off time according to the procedures given in section 6.4.



Explanation

Window Trigger Target

You can set trigger conditions on all channels (CH1 to CH16) other than logic waveforms and DSP channels (DSP1 to DSP6 (option)). A trigger occurs if any of the specified trigger conditions (OR condition) is met.

Selecting the Trigger Condition

- **CH1 to CH16 (Other Than Logic Inputs) or DSP1 to DSP6 (oprional)**
  - IN: A trigger is activated when the trigger source enters the window (the area between two preset levels).
  - OUT: A trigger is activated when the trigger source exits the window.
- **Logic Input**
  - Enable: Make the combination of the status[1] of each bit the trigger condition
  - Disable: Don't Care

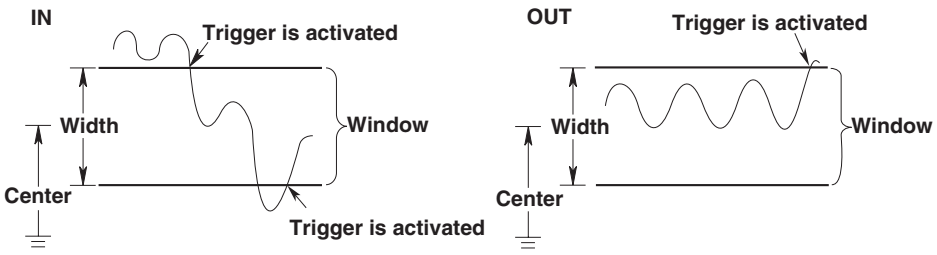
1. Select the status of each bit from the following:
   - ⊓: When the signal goes above a certain level[2]
   - ⊔: When the signal goes below a certain level[2]
   - –: Don't Care
2. Varies depending on the logic probe being used as follows:
   - 700986: Approx. 1.4 V
   - 700987: 6 V± 50% (for DC input)
   - 700987: 50 V± 50% (for AC input)

Setting the Window

A window is defined by its center level and width.

Selectable range of Center: ±(V/div)×10 when measuring voltage, measurement range of the thermocouple when measuring temperature (Resolution: Same as the resolution of the trigger level. See section 6.5.)

Selectable range of Width: ±(V/div)×10 when measuring voltage, measurement range of the thermocouple when measuring temperature around the center level (Resolution: Same as the resolution of the trigger level. See section 6.5.)



Setting the Trigger Hysteresis

Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. Select the trigger hysteresis from , , and .
For details, see "Setting the Trigger Hysteresis" in section 6.5.

Setting the Hold Off

For details, see section 6.4, "Setting the Hold Off Time."

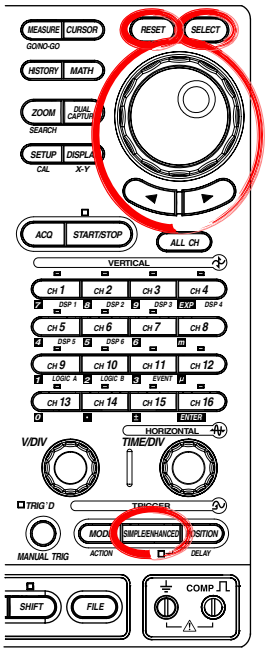
Notes When Activating Window Triggers

The operation is the same as the OR trigger for logic input.

6.17 Setting the Wave Window Trigger (ENHANCED)

<For a description of this function, refer to page 2-26.>

Procedure



1. Press **SIMPLE/ENHANCED**.
2. Press the **Select** soft key to select Enhanced.

Setting the Trigger Type

3. Press the **Type** soft key. The trigger type selection menu appears.
4. Use the **jog shuttle** and **SELECT** to select Wave Window.

Setting the Trigger Condition

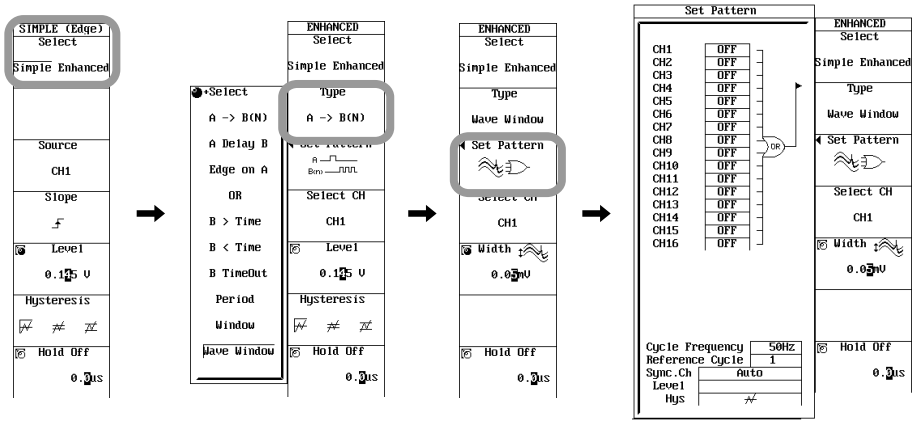
5. Press the **Set Pattern** soft key. The Wave Window trigger setup menu appears.
6. Use the **jog shuttle** and **SELECT** to select the pattern of each channel (CH1 to CH16) from ON and OFF.

Note

- The wave window trigger does not apply to the 701265 (TEMP/HPV) and the 701280 (FREQ).
- Wave window trigger is not applicable when measuring temperature on the 701261 (UNIVERSAL) or 701262 (UNIVERSAL (AAF)).
- Wave window trigger cannot be used in the recorder mode.

Setting the Cycle Frequency, Reference Cycle, Synchronization Channel, Level, and Hysteresis

7. Use the **jog shuttle**, **SELECT**, and **jog shuttle** to set the Cycle Frequency. Pressing **RESET** resets the frequency to 50 Hz.
8. Likewise, set the Reference Cycle to 1, 2, or 4.
9. Likewise, set Sync. Ch to Auto or CH1 to CH16.
10. If a setting other than Auto was selected in step 9, set the Level of the synchronization channel.
11. Likewise, set Hys to  ,  , or  .



Selecting the Target Waveform

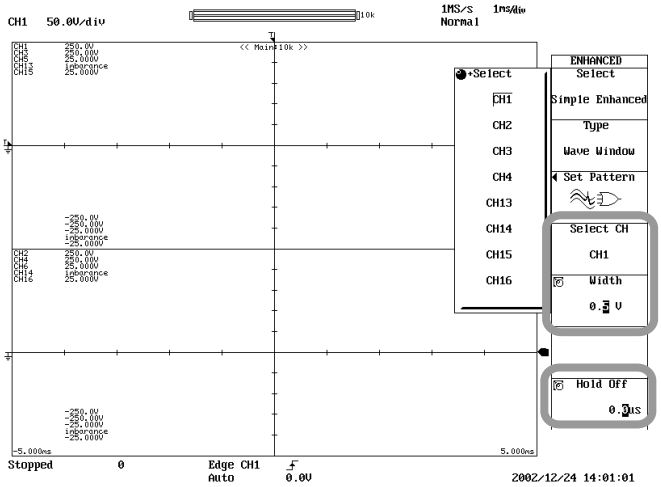
12. Press the **Select CH** soft key. The channel selection menu appears.
13. Use the **jog shuttle** and **SELECT** to select the target channel.

Setting the Window Width

14. Press the **Width** soft key.
15. Turn the **jog shuttle** to set the window width.

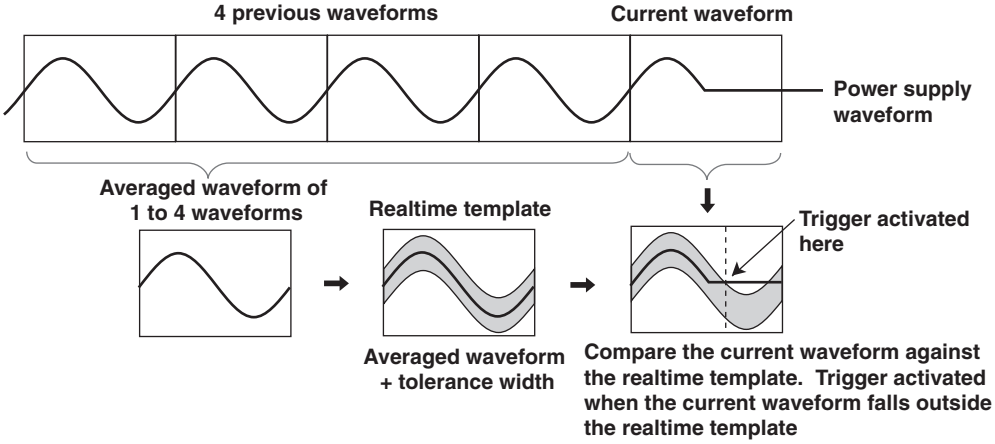
Setting the Hold Off

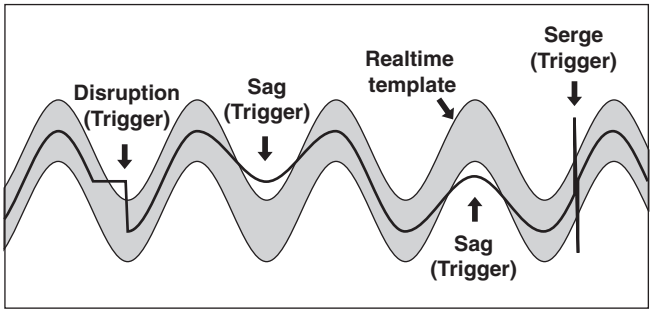
16. Set the hold off time according to the procedures given in section 6.4.



Explanation

This trigger is used to detect abnormalities in the power waveform (disruption, sag, serge, frequency fluctuation, voltage drop, etc.). A realtime template is continuously created automatically using 1 to 4 waveforms before the current waveform, and comparison is made between the current waveform and the realtime template. A trigger occurs if the current waveform falls outside the realtime template.





Operating Conditions of the Wave Window Trigger

Target waveform:	AC waveform or triangular waveform between 40 and 1 kHz. (Rectangular waveforms such as inverter waveforms and waveforms with a fast rising edge are excluded)
Sample rate:	10 kS/s to 500 kS/s
Acquisition mode:	Normal
Trigger mode:	Normal, Single, or Single(N)

Applicable Modules

- 701250 (HS10M12)
- 701251 (HS1M16)
- 701255 (NONISO_10M12)
- 701260 (HV(with RMS))
- 701261 (UNIVERSAL) (only when measuring voltage)
- 701262 (UNIVERSAL (AAF)) (only when measuring voltage)
- 701270 (STRAIN_NDIS)
- 701271 (STRAIN_DSUB)
- 701275 (ACCL/VOLT)

A trigger occurs if any of the specified trigger conditions (OR condition) is met.

Notes When Using the Wave Window Trigger

The wave window trigger cannot be used in the following cases:

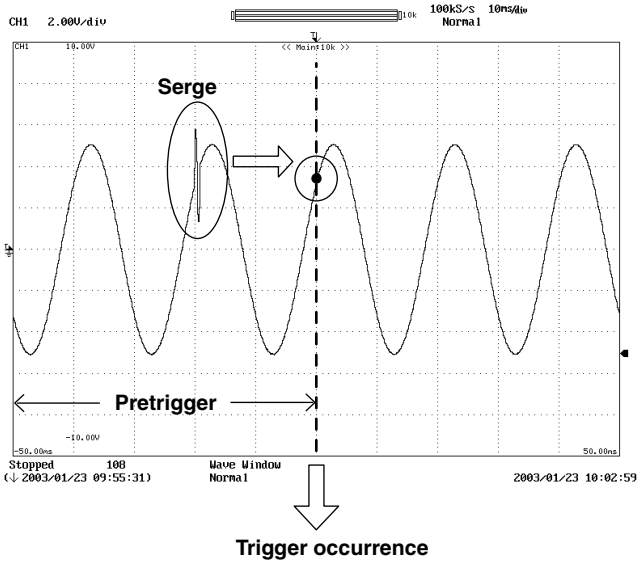
- When the dual capture function is ON.
- When the acquisition mode is set to Average or Envelope
- When the record length is less than or equal to 25 kW and T/div is less than 10 mS/div.

Wave window triggers are not easily triggered when the trigger mode is set to Auto or Auto Level.

Normally, set the trigger mode to Normal, Single, or Single(N).

The wave window trigger is used to detect rapid changes in the waveform. If a difference is observed after comparing 1 to 4 cycles (reference cycles) of the previous waveform and the current waveform, a trigger is activated. Therefore, if an abnormal waveform such as serge is contained in the 1 to 4 cycles of the previous waveform, a trigger is activated on the normal waveform. In such case, the trigger point may appear as though it is delayed by several cycles as shown in the figure below. This phenomenon is unavoidable due to the principles of the wave window trigger.

Trigger appears as though it is delayed by 1 cycle.



Trigger occurrence

The time difference from the abnormal waveform to the trigger point varies depending on the reference cycle as follows. When the frequency of the trigger is low, the time difference from the abnormal waveform to the trigger point is 0 cycles in most cases.

Reference Cycle	Time Difference
1 cycle	0 or 1 cycle
2 cycles	0, 1 or 2 cycles
4 cycles	0, 1, 2, 3, or 4 cycles

When using the wave window trigger, it is recommended that a pretrigger equal to the reference cycle be specified. This allows abnormal waveforms to be observed even when the above phenomenon occurs.

Selecting the Trigger Condition

ON: Use the channel as a target channel for the wave window trigger.
OFF: Do not use the channel as a target channel for the wave window trigger.

- **Cycle Frequency**
  Set the frequency of the measured power supply in the range of 40 to 1000 Hz. The resolution is 0.1 Hz. The default value is 50 Hz.
  If the actually frequency is within ±10% of the specified value, it is automatically tracked.

- **Reference Cycle**
  Select how many waveforms before the current waveform are used to create the realtime template (wave window).
  1 (1 waveform), 2 (2 waveforms), or 4 (4 waveforms)
  The waveforms of the specified number of reference cycles are used to create the realtime template.

- **Sync. Ch, Level, and Hys**
  Select the channel used to detect the waveform determination start point of the wave window trigger. Select the synchronization channel from Auto or CH1 to CH16.
  If a setting other than Auto was selected, set the level and hysteresis of the synchronization channel.
  If set to Auto, the synchronization channel is automatically set using the following conditions.
  Target channel: Channel with the smallest channel number among the target channels of the wave window trigger.
  Level: 1/2 the peak-to-peak value over 0.5 s after starting the waveform acquisition.
  Hysteresis: Same as the hysteresis of an edge trigger (see section 6.5)
  If a setting other than Auto was selected, set the level and hysteresis of the synchronization channel.

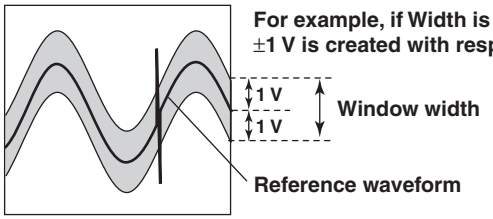
- **Setting the Level**
  The selectable range of the level is the same as that of the simple trigger.

- **Setting the Hysteresis**
  Sets a width to the trigger level so that triggers are not activated by small changes in the trigger signal. Select the trigger hysteresis from  ,  , and  .
  For details, see “Setting the Trigger Hysteresis” in section 6.5.

Window Width

The realtime template is created by applying a tolerance width (window width) to the averaged waveform. The selectable range of the window width varies depending on the observed item as follows.

When observing voltage: (V/div)×1/100 to (V/div)×10
When observing strain: 1 μSTR to (measurement range)×2
Or, 0.0005 mV/V to (measurement range)×2
When measuring acceleration: 0.01 Unit to (Unit/div)×10
(The resolution is the same as the resolution of the trigger level. See section 6.5.)



For example, if Width is set to 2 V, a window width of ±1 V is created with respect to the reference waveform.

Hold Off

For details, see section 6.4, “Setting the Hold Off Time.”

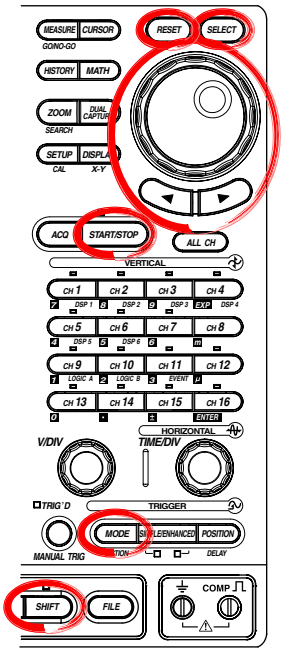
Note

If a trigger waveform such as a serge is input immediately before the completion of the pre-trigger, the trigger point may be delayed by up to 4 cycles.

6.18 Setting the Action-on-Trigger

<For a description of this function, refer to page 2-29.>

Procedure



1. Press **SHIFT+MODE**. The ACTION menu appears.

Setting the Action

2. Press the **Mode** soft key. The Mode select menu appears.
3. Press the soft key corresponding to the desired mode: OFF, On Trigger, or On Stop.
4. Press the **Action** soft key. The Action setup menu appears.
5. Use the **jog shuttle** and **SELECT** to select action to be enabled. (You can select multiple actions.)
6. If you selected Save to File in step 3, use the **jog shuttle** and **SELECT** to set the file save format to Binary, ASCII, or Float. If you selected Send Mail, use the **jog shuttle** and **SELECT** to set Mail Count.

Setting the Number of Actions

7. Press the **Sequence** soft key to select Single or Continuous.
8. Press the **ACQ Count** sof key.
9. Turn the **jog shuttel** to set the numeber of actions. Pressing **RESET** resets the count Infinite.

Setting the Execution Mode of the Action-on-Trigger/Action-on-Stop at Power ON

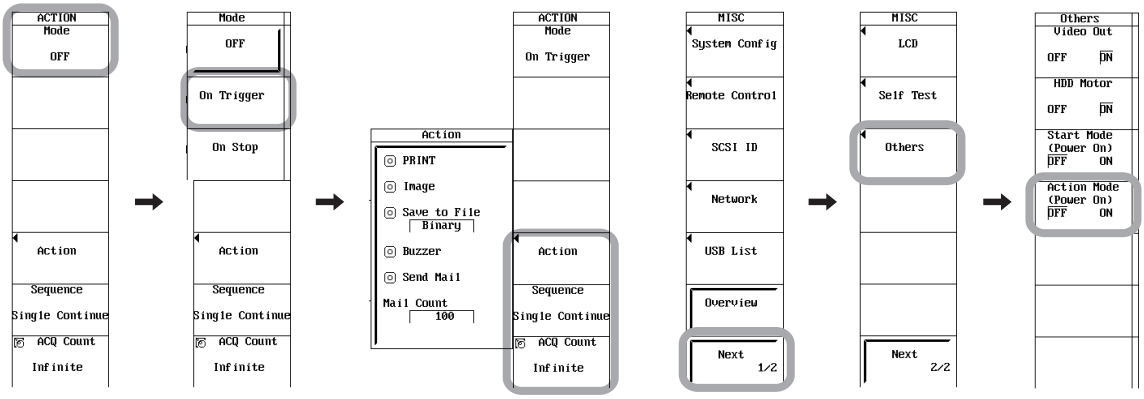
10. Press **MISC**.
11. Press the **Next 1/2** soft key.
12. Press the **Others** soft key.
13. Press the **Action Mode(Power ON)** soft key to select ON or OFF.

Executing the Action-on-Trigger/Action-on-Stop

14. Press **START/STOP** to start the waveform acquisition and execution the action-on-trigger. While action-on-trigger or action-on-stop is in execution,  is displayed at the upper left corner of the screen.
    In addition, if the following action is specified, the following icon is displayed in the upper left corner of the screen while the action is being executed.
    Image/Save to File: Save destination medium ( FD,  Zip disk,  PC card,  SCSI device,  internal HD,  network drive, or  USB storage device.)
    Send Mail: 

Aborting the Action-on-Trigger/Action-on-Stop

15. Press **START/STOP** to stop the waveform acquisition and abort the action-on-trigger or action on stop.



Explanation

Setting the Mode

- **On Trigger (Action-on-Trigger)**
  A specified action is executed each time a trigger is activated. When action-on-trigger is enabled, the trigger mode is set to Single.
- **On Stop (Action-on-Stop)**
  The specified record length of data is acquired when measurement is started, and the waveform is displayed. Then, the specified action is executed. When action-on-stop is enabled, the trigger mode is set to Log.

Setting the Action

The following five types of actions are available.

- **Print the Screen Image Data: PRINT**
  Prints the screen image data on the printer (Printer (built-in printer), USB (USB printer), or Net Print (network printer)) specified by Print to in the PRINT menu.
- **Save the Screen Image Data: Image**
  Saves the screen image data to the destination (FD, Zip disk, PC card, internal HD (optional), SCSI device, or USB storage device) specified in the IMAGE SAVE menu.
- **Save the Waveform Data: Save to File**
  Saves the waveform data in binary, ASCII, or floating format to the destination (FD, Zip disk, PC card, internal HD (optional), SCSI device, or USB storage device) specified in the FILE menu. The save format is synchronized to data type (see section 13.7) on the FILE menu.
- **Buzzer**
  Sounds a buzzer.
- **Send Mail**
  Sends an e-mail message to a specified address (when Ethernet interface option is installed). Set the number of e-mail transmission in the range of 1 to 1000.
  For the procedure in setting the address, see section 16.5, “Sending Periodic Mail or Action Mail.”

Note

If action-on—trigger is used, the data is acquired in Single mode regardless of the trigger mode setting, and the specified action is carried out.

Setting the Number of Actions

Sequence

Single: Performs the action once.
Continue: Performs the action the number of times specified by ACQ Count.

ACQ Count

2 to 65536: Repeats the action the specified number of counts.
Infinite: Repeats the action until waveform acquisition is stopped.

Save to File/Hard Copy/Image Operation

Operates according to the settings in the FILE, PRINT, or Image Save menu.

File Name When Action Is Set to Save to File or Image

If the Auto Naming of the File menu or the Image Save menu is OFF, numbers are automatically assigned to the file names. Otherwise, the file is saved using the specified method.
For details, see section 13.11, “Saving the Screen Image Data” or section 13.7, “Saving/Loading Waveform Data.”

Send Mail Operation

Sends e-mail messages to the address specified using Network > Mail Setup > Mail Address in the MISC menu.

Note

- If action-on-trigger is started, the data is acquired in single mode trigger regardless of the trigger mode setting, and the specified action is carried out.
- If action-on-stop is started, the data is acquired in Log mode regardless of the trigger mode setting, and the specified action is carried out. The specified action is also carried out when the measurement is stopped in the middle of the measurement.

Setting the Execution Mode of the Action-on Trigger/Action-on Stop at Power ON

You can select whether to enable the action-on-trigger or action-on-stop mode at power ON. For example, turn this ON if you wish to continue the action-on-trigger or action-on-stop operation after a power failure.

ON: At power ON, the action-on-trigger/action-on-stop is set to the mode that was used when the power was turned OFF.

OFF: Action Mode is turned OFF at power ON.

The initial setting is OFF.

Notes When Using the Action-on-Trigger/Action-on-Stop

- Action-on-trigger and action-on-stop cannot be used if the acquisition mode is Average.
- You cannot change the settings while the action-on-trigger or action-on-stopis in progress.
- The action-on-trigger or action-on-stop operation may slow down if there is access from the network while the following action is in progress.
  Printing/saving of the screen image data or saving of the waveform data
- You cannot use action-on-trigger or action-on-stop when the dual capture function is ON or when the realtime recording to the internal hard disk is ON.

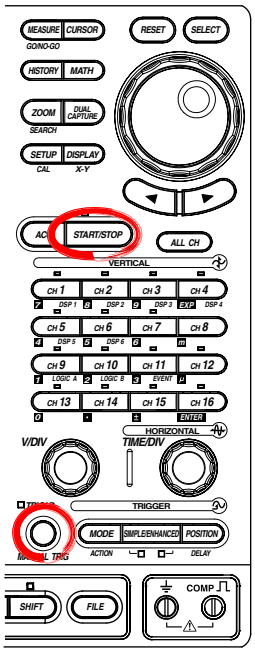
Notes When Action Is Set to Save to File or Image Save

- Do not specify the root directory of the medium as the save destination directory. (Only up to 512 files can be saved to the root directory of a medium that has been formatted using the DL750/DL750P.)
- The maximum number of files that can be created in a single directory is 5000. Do not place files in the save destination folder before starting the action-on-trigger or action-on-stop operation.
- If you select Save to File and Image Save simultaneously, separate the folders specified by the FILE menu and the IMAGE SAVE menu.
- If you selected Numbering for the file name assignment method (Auto Naming) in the FILE menu and the IMAGE SAVE menu, the creation of files takes an extended period when the number of saved files becomes large. When creating more than 2000 files, select Date for Auto Naming.
- When 5000 files are saved, the action-on-trigger or action-on-stop operation ends.

6.19 Setting Manual Triggers

<For a description of this function, refer to page 2-30.>

Procedure



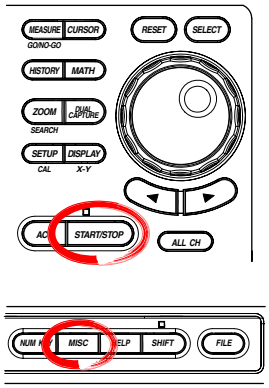
1. Press **START/STOP** to start the waveform acquisition.
2. Press **MANUAL TRIG** to manually activate the trigger.

Explanation

You can manually activate a trigger by pressing the MANUAL TRIG key on the front panel.

7.1 Starting/Stopping Waveform Acquisition

Procedure



Setting the Waveform Acquisition Mode at Power ON

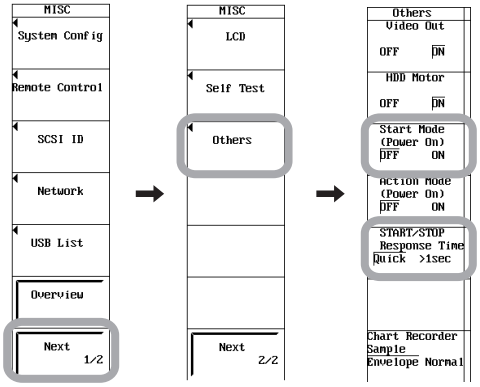
1. Press **MISC**.
2. Press the **Next 1/2** soft key
3. Press the **Others** soft key.
4. Press the **Start Mode(Power On)** soft key to select ON or OFF.

START/STOP Key Response Time Setting

5. Press the **START/STOP Response Time** soft key, then select Quick or >1sec.

Starting/Stopping Waveform Acquisition

6. Press **START/STOP**. Waveform acquisition is started/stopped.
   Waveform acquisition is in progress when the indicator above and to the right of the key is illuminated.



Explanation

Waveform Acquisition and Indicator Display

- If the indicator above START/STOP is illuminated, the waveform acquisition is in progress. “Running” is displayed at the lower left corner of the screen.
- If the indicator above START/STOP is not illuminated, the waveform acquisition is stopped. “Stopped” is displayed at the lower left corner of the screen.

Operation When the Acquisition Mode Is Set to Averaging Mode

- Averaging is stopped when waveform acquisition is stopped.
- Averaging starts again when waveform acquisition is restarted.

START/STOP Operation during Accumulation

Accumulation is suspended when acquisition is stopped.
It is resumed when acquisition is restarted.

Conditions When Waveform Acquisition Cannot Be Started or Stopped

- Remote mode using the communication interface
- When printing or during auto setup

Setting the Waveform Acquisition Mode at Power ON

You can select whether to start waveform acquisition at power on. For example, select ON if you wish to start waveform acquisition when power supply recovers after a power failure. The initial setting is OFF.

ON: Starts waveform acquisition at power on.

OFF: Does not start waveform acquisition at power on.

START/STOP Key Response Time Setting

You can enter a setting to specify whether the instrument responds immediately when the START/STOP key is pressed, or whether the instrument only responds if the key is pressed for one second or longer.

Quick: Immediate response

>1sec: Responds when the key is pressed for one second or longer

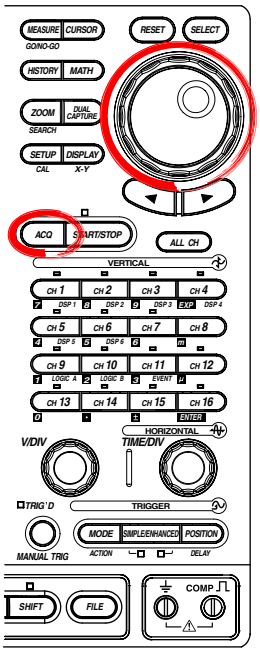
Note

- If you start waveform acquisition after changing the waveform acquisition conditions indicated below, the data that had been stored in the acquisition memory up to that point is cleared.
  - Setup conditions on the ACQ menu
  - Setup conditions of the module
    - Input coupling of the 701265 (TEMP/HPV) (when a change is made between TC and some other setting) and the thermocouple type setting (when measuring temperature)
    - Input coupling of the 701275 (ACCL/VOLT) (when a change is made between ACCL and some other setting) and the sensitivity setting (when measuring acceleration)
    - FV setting of the 701280 (FREQ) and offset setting
  - Trigger setup conditions
  - Setup conditions of the DUAL CAPTURE menu
  - T/div
- A snapshot function that keeps the current displayed waveform on the screen is also available. You can update the display without stopping the waveform acquisition (see the next section).
- For a description of the behavior when the Start Mode (Power On) is ON or OFF, see appendix 9.
- When waveforms are being acquired using roll mode display (see page 2-4), voice memo can be recorded. For details, see section 7.9, “Using the Voice Memo Function.”

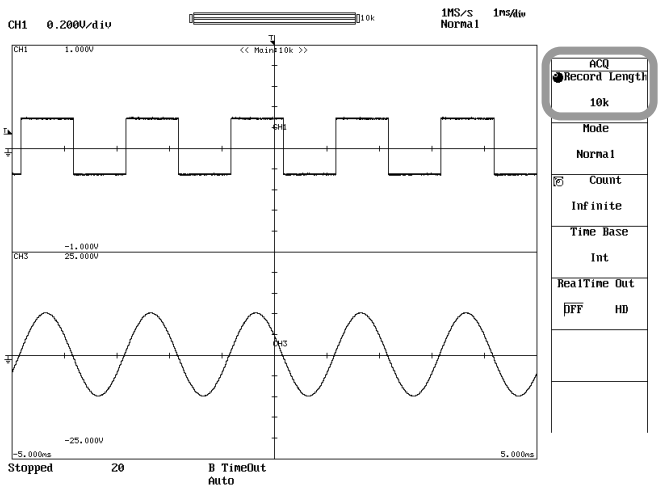
7.2 Setting the Record Length

<For a description of this function, refer to page 2-31.>

Procedure



1. Press **ACQ**.
2. Press the **Record Length** soft key.
3. Turn the **jog shuttle** to set the record length.



Explanation

The record length sets the amount of data to be written into the acquisition memory. The selectable maximum record length varies depending on the model.

- **2.5 MW/CH Model (Standard)**
  1 kW, 2.5 kW, 5 kW, 10 kW, 25 kW, 50 kW, 100 kW, 250 kW, 500 kW, 1 MW, 2.5 MW, 5 MW, 10 MW, 25 MW, and 50 MW
- **10 MW/CH Model (/M1 Option)**
  1 kW, 2.5 kW, 5 kW, 10 kW, 25 kW, 50 kW, 100 kW, 250 kW, 500 kW, 1 MW, 2.5 MW, 5 MW, 10 MW, 25 MW, 50 MW, 100 MW, and 250 MW
- **25 MW/CH Model (/M2 Option)**
  1 kW, 2.5 kW, 5 kW, 10 kW, 25 kW, 50 kW, 100 kW, 250 kW, 500 kW, 1 MW, 2.5 MW, 5 MW, 10 MW, 25 MW, 50 MW, 100 MW, 250 MW, and 500 MW
- **50 MW/CH Model (/M3 Option)**
  1 kW, 2.5 kW, 5 kW, 10 kW, 25 kW, 50 kW, 100 kW, 250 kW, 500 kW, 1 MW, 2.5 MW, 5 MW, 10 MW, 25 MW, 50 MW, 100 MW, 250 MW, 500 MW, and 1 GW

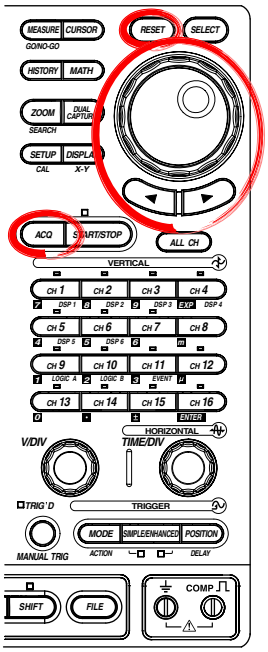
Notes When Setting the Record Length

- Increasing the record length automatically limits the number of channels that can be used. The display of the channels which can no longer be used because the record length is increased can not be turned ON/OFF. The number of channels that can be used is displayed on the soft key menu of Record Length of the ACQ menu (right of the record length display).
- The maximum record length when acquisition mode is average is 1 MW on the standard model, 2.5 MW on the M1 option model, 5 MW on the M2 option model, and 10 MW on the M3 option model. (For details, see appendix 1.)
- The maximum record length when using the dual capture function is 5 MW on the standard model, 10 MW on the M1 option model, 50 MW on the M2 option model, and 100 MW on the M3 option model. (For details, see appendix 1.)
- The maximum record length when performing realtime recording is 1 GW (1 CH).
- When the trigger mode is Auto, Auto Level, Normal, or Single (N) and the display is not in roll mode, you cannot select a record length that is greater than or equal to 2.5 MW on the standard model, 10 MW on the M1 option model, 25 MW on the M2 option model, and 50 MW on the M3 option model.

7.3 Setting the Acquisition Mode

<For a description of this function, refer to page 2-31.>

Procedure



Setting the Action Mode

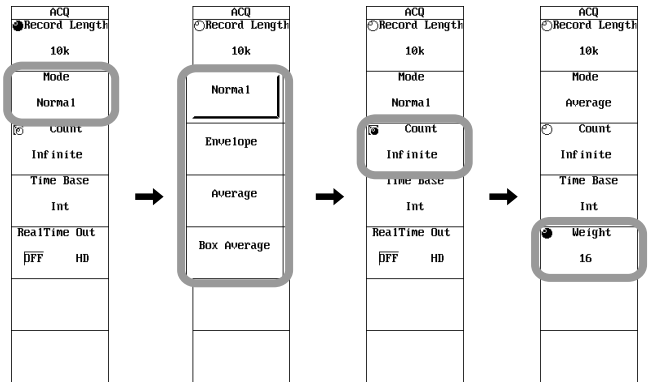
1. Press **ACQ**.
2. Press the **Mode** soft key. The mode selection menu appears.
3. Press the soft key corresponding to the desired mode from Normal, Envelope, Average, and Box Average.
   You may not be able to select some modes depending on the trigger mode setting.

Setting the Acquisition Count

4. Press the **Count** soft key.
   You cannot set the acquisition count when the trigger mode is Single, Single (N), or Log.
5. Turn the **jog shuttle** to set the acquisition count.
   Pressing **RESET** resets the count to Infinite.
   If the acquisition mode is Average and you set Count to Infinite, proceed to step 6.

Setting the Attenuation (When the Acquisition Mode Is Average and Count Is Infinite)

6. Press the **Weight** soft key.
7. Turn the **jog shuttle** to set the attenuation.



Explanation

Selecting the Acquisition Mode

You can select any of the acquisition modes below. The default setting is Normal.

- **Normal Mode**
  Sampled data are stored in the acquisition memory without special processing.

- **Envelope Mode**
  The maximum and minimum values are determined every acquisition interval from the data sampled at 10 MS/s. The maximum and minimum values are stored to the acquisition memory and an envelope waveform is displayed.

- **Average Mode**
  Sampled data is averaged and stored to the acquisition memory. The averaging method varies depending on the acquisition count setting.
  If the acquisition count is set to Infinite, exponential averaging is performed. You are required to set the attenuation (Weight).
  If the acquisition count is set to a value in the range of 2 to 65536, simple averaging is performed. The specified value is the average count.

  • Exponential average (when set to Infinite)

  $$An = \frac{1}{N}\{(N-1)A_{n-1}+X_n\}$$

  An: nth averaged value
  Xn: nth measured value
  N: Attenuation (2 to 256, 2^n steps)

  • Simple average (when set to 1 to 65536)

  $$A_N = \frac{\sum_{n=1}^{N} X_n}{N}$$

  Xn: nth measured value
  N: Average count
  (acquisition count, 2^n steps)

  You cannot use averaging mode when the trigger mode is Single, Single (N), or Log. In addition, you cannot use averaging mode when the dual capture function is used or when realtime recording is in progress.
  For details on the roll mode, see appendix 1, “Relationship between the Time Axis Setting, Sample Rate and Record Length.”

- **Box Average Mode**
  For details, see section 7.4, “Acquiring Data Using Box Average.”

Note

For the procedure of switching the acquisition mode in Chart Recorder mode on the DL750P, see section 9.3.

Acquisition Count

Set the acquisition count in the following range. If you set the value to Infinite, acquisition will continue until you press the START/STOP key. The default setting is Infinite. You cannot change the acquisition count during measurement. The new value is activated when the measurement is stopped.
Normal, Envelope, and Box Average: 2 to 65536 (in 1 step) and Infinite
Average: 2 to 65536 (in 2^n steps) and Infinite

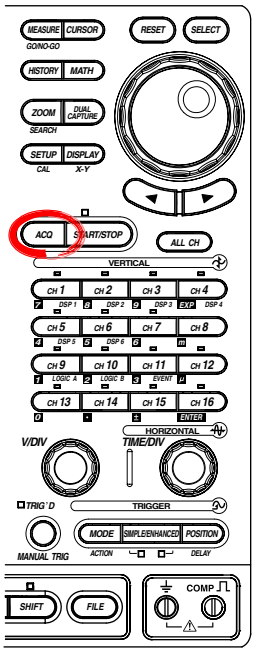
Notes on Averaging

- Averaging is effective only against repetitive waveforms.
- Correct averaging is not possible if the waveform has imperfect triggering (incomplete synchronization), and the displayed waveform will be distorted. When working with this type of signal, set the trigger mode to Normal, so that the waveform display is updated only when the trigger is activated (see section 6.1).
- Roll mode display is disabled during averaging.
- Averaging is not possible when the trigger mode is Single, Single (N), or Log.
- If you stop waveform acquisition by pressing the START/STOP key, the averaging process also stops. Averaging restarts from the beginning when acquisition resumes.
- If you are using simple averaging, the DL750/DL750P terminates acquisition automatically when it completes the specified number of acquisitions (acquisition count).
- Averaging is not possible when the dual capture function is used or when realtime recording is in progress.
- When acquiring waveforms in averaging mode, the data that is retained in the history memory is 1 record.

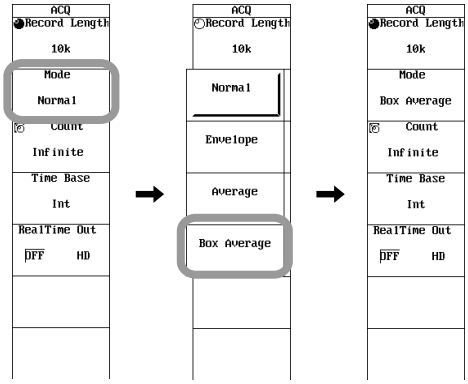
7.4 Acquiring Data Using Box Average

<For a description of this function, refer to page 2-32.>

Procedure

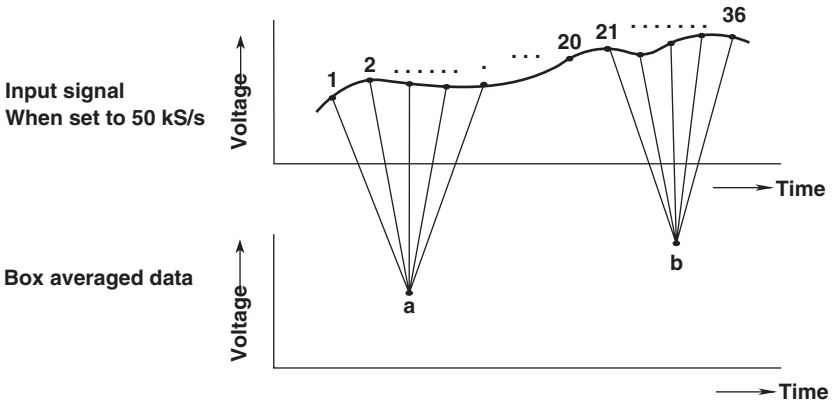


1. Press **ACQ**.
2. Press the **Mode** soft key. The mode selection menu appears.
3. Press the **Box Average** soft key.



Explanation

This function is valid only on the 701250 (HS10M12) and the 701255 (NONISO_10M12). At sample rates that allow box averaging, data is normally sampled at 10 MS/s and the sampled data is decimated according to the T/div setting and stored to the acquisition memory. The internal sample rate is the same as the envelope mode.
For details, see appendix 1, “Relationship between the Time Axis Setting, Sample Rate and Record Length.”
When you use the box averaging function, the operation is different. Moving average is computed on a given number of data points and the result is sampled and stored to the acquisition memory.



Number of Data Points on Which Moving Average Is Computed

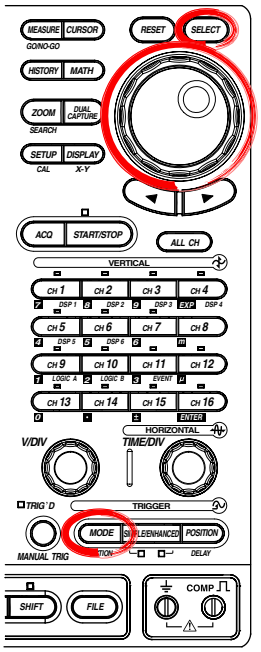
Sample Rate (S/s)	Number of Data Points
10 M[1]	1 point
5 M	2 points
2 M	4 points out of 5 points
1 M	8 points out of 10 points
500 k	16 points out of 20 points
200 k	32 points out of 50 points
100 k	64 points out of 100 points
50 k	128 points out of 200 points
20 k	256 points out of 500 points
10 k or less	256 points out of (10 M ÷ sample rate)

1. Same operation as the normal mode.

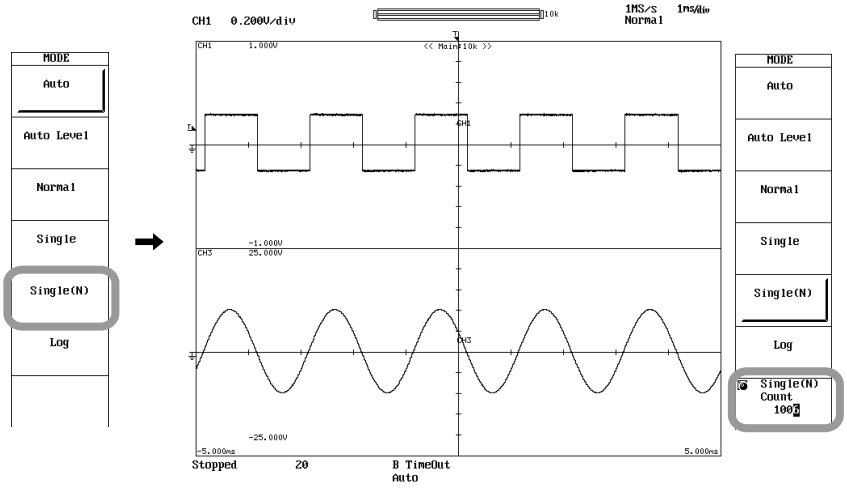
7.5 Acquiring Data Using the Sequential Store Function (Single (N) Mode)

<For a description of this function, refer to page 2-33.>

Procedure



1. Press **MODE**.
2. Press the **Single(N)** soft key.
3. Use the **jog shuttle** and **SELECT** to set Single(N) Count.



Explanation

By setting the trigger mode to Single(N), the sequential store function can be used.

Acquisition Count

Set the acquisition count in the range from 1 to 2000.
However, the selectable acquisition count varies depending on the selected record length and acquisition mode.
For details, see appendix 1, “Relationship between the Time Axis Setting, Sample Rate and Record Length.”

Displaying Waveforms

You can recall waveforms from memory in the same fashion as for the history memory function.
For details, see section 11.1, “Displaying History Waveforms.”

Notes When Using Sequential Store

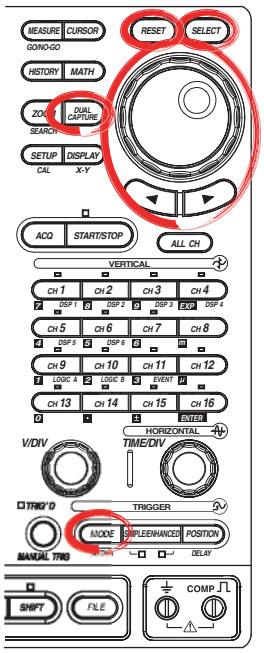
- If you stop waveform acquisition by pressing the START/STOP key, the sequential store operation also stops. Sequential store restarts from the beginning when acquisition resumes.

7.6 Using the Dual Capture Function

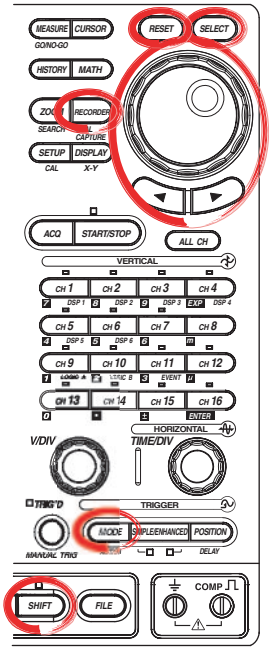
<For a description of this function, refer to page 2-34.>

Procedure

DL750



DL750P



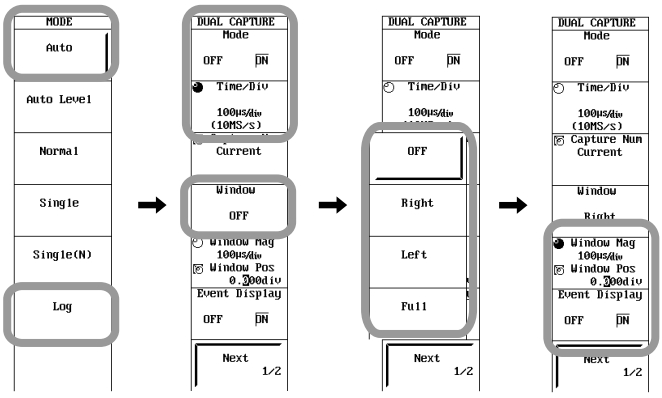
Setting the Main Waveform (Low-Speed)

- **Set the Trigger Mode**
  1. Press the **MODE** soft key.
  2. Press the soft key corresponding to **Auto** or **Log**.
- **Setting the Roll Mode Display**
  3. Turn TIME/DIV to set T/div to 100 ms/div to 3 day/div.

Setting the Sub Waveform (High-Speed)

4. Press **DUAL CAPTURE**. (On the DL750P, press **SHIFT+RECORDER (DUAL CAPTURE)**.)
5. Press the **Mode** soft key to select ON.

- **Setting the Time Axis**
  6. Press the **Time/Div** soft key.
  7. Turn the **jog shuttle** to set the time axis of the sub waveform. The top row displays Time/Div; the bottom row displays the sample rate.
- **Setting the Sub Waveform Window**
  8. Press the **Window** soft key.
  9. Press any of the soft keys from **OFF**, **Right**, **Left**, or **Full**.
- **Setting the Zoom Ratio/Display Position**
  10. Press the **Window Mag/Window Pos** soft key to set the jog shuttle control to Window Mag.
  11. Turn the **jog shuttle** to set the zoom ratio of the sub waveform. Pressing **RESET** resets the value to default.
  12. Press the **Window Mag/Window Pos** soft key to set the jog shuttle control to Window Pos.
  13. Turn the **jog shuttle** to set the display position of the sub waveform . Pressing **RESET** resets the value to default.
- **Turning ON/OFF the Event Waveform Display**
  14. Press the **Event Display** soft key to select OFF or ON. For a description of event waveforms, see section 5.21.



Selecting the Display Format of Sub Waveforms

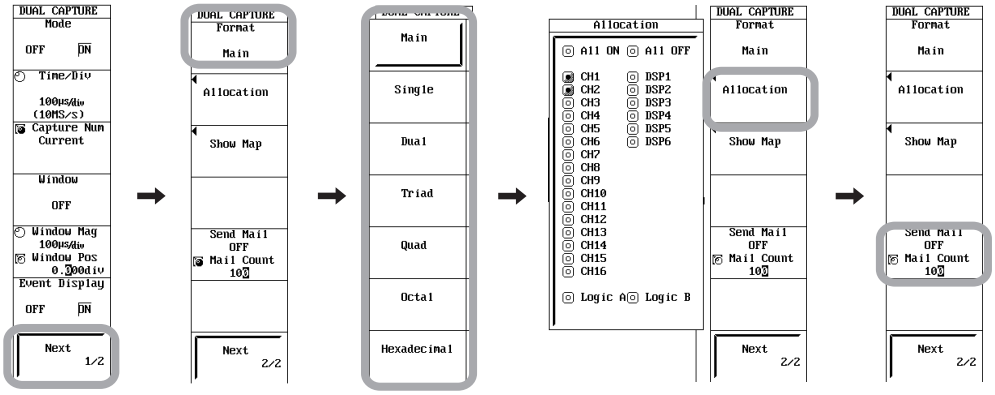
15. Press the **Next 1/2** soft key.
16. Press the **Format** soft key. The display format selection menu appears.
17. Use the **job shuttle** and **SELECT** to select the display format of the sub waveforms.

Selecting the Channels to Be Displayed in the Sub Waveform Window

18. Press the **Allocation** soft key. A menu used to select the channels to be displayed appears.
19. Use the **job shuttle** and **SELECT** to select the channels whose waveforms are to be displayed.

Turning ON/OFF Mail Transmission

20. Press the **Send Mail** soft key. The mail transmission setup menu appears.
21. Press the ON or OFF soft key.
22. Use the**job shuttle** to set the number of times to send the mail.



Executing the Waveform Acquisition

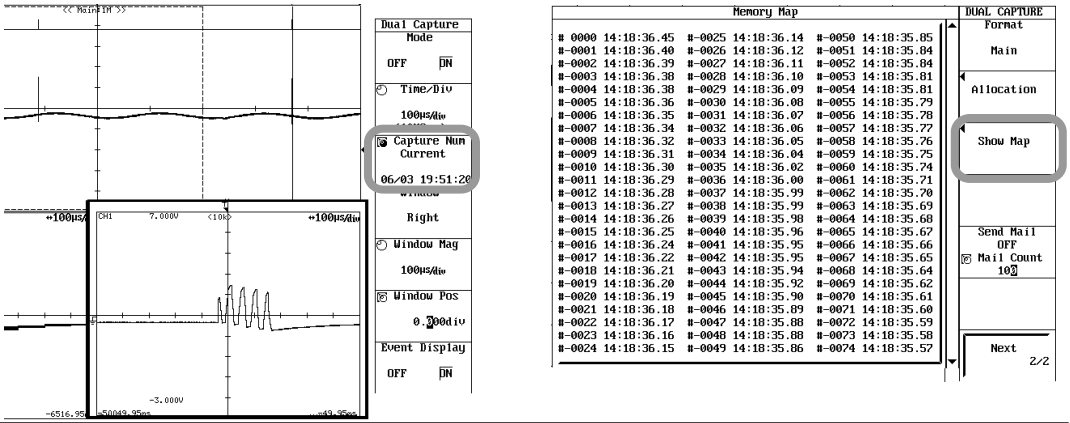
23. Press **START/STOP** to start the waveform acquisition.
    When a trigger is activated on the specified trigger conditions, the waveform is displayed in the sub waveform window.

Specifying and Displaying the Captured Waveform

24. Press the **Capture Num** soft key.
25. Turn the **jog shuttle** to specify the number of the waveform you wish to display.

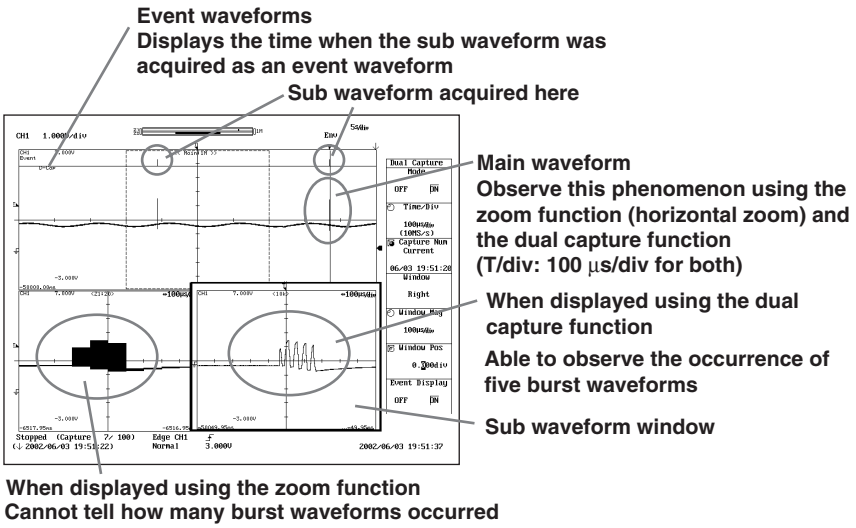
Displaying a Waveform from the List of Captured Waveforms

26. In the 2/2 menu, press the Show Map soft key. A list of acquired waveforms is displayed.
27. Turn the**job shuttle** to select the waveform to be displayed and press **SELECT**.



Explanation

This function enables waveform acquisition in low-speed roll mode (main waveform) along with high-speed waveforms (sub waveform) at a different sampling interval. It is useful when capturing at high speeds abnormal phenomenon that occurs suddenly during long-term observation (low-speed sampling). The sub waveform is saved simultaneously when the main waveform is saved. Likewise, when the main waveform is loaded, the sub waveform is also loaded. This function is valid when the acquisition mode is set to normal, envelope, or box average.



The dual capture function has the following two trigger modes.

- **Auto Mode**
  For the main waveform, measurement is performed from the time sampling is started until there is a request to end the sampling. The number of sub waveforms that can be saved varies between the standard model and memory expansion models (/M1, /M2, and /M3).

Standard model:	Up to 100
/M1 model:	Up to 250
/M2 and /M3 models:	Up to 500

  If the maximum number of sub waveforms is exceeded, the oldest sub waveform is deleted, and the newest waveforms are saved.

- **Log Mode**
  For the main waveform, the waveform is acquired from the time sampling is started up to the specified record length. For the sub waveform, up to 100 sets can be stored. When this number is reached, the acquisition of sub waveforms stops.

Waveform Acquisition Condition of the Dual Capture Function

Waveforms can be acquired when all of the following conditions are met.

- When the T/div setting of the main waveform is from 100 ms/div to 3 days/div
- When the sample rate of the main waveform is less than or equal to 100 kS/s
- When the sample rate of the main waveform is less than the sample rate of the sub waveform

Applicable Channels

The applicable channels are all channels that are identified for both main waveform and sub waveform (However, when the record length is greater than or equal to 2.5 MW on the standard model, 10 MW on the M1 option model, 25 MW on the M2 option model, and 50 MW on the M3 option model, the applicable channels are those that are turned ON). DSP channels are also applicable.

Setting the Sub Waveform

- **Record Length of the Sub Waveform**
  Fixed to 10 kW.
- **Time/div Setting of the Sub Waveform**
  The maximum sample rate is 10 MS/s.
- **Acquisition Mode of the Sub Waveform**
  Fixed to Normal.
- **Trigger Setting of the Sub Waveform**
  When the dual capture mode is turned ON, the trigger setting is no longer applied to the main waveform, but applied to the sub waveform.
  In addition, the trigger output during acquisition in dual capture mode becomes the trigger output of the sub waveform.
- **Sub Waveform Display: Window**
  Select the from the following four types.
  OFF: Does not display the sub waveform.
  Right : Displays the sub waveform at the lower right section of the screen at 1/4 size.
  Left: Displays the sub waveform at the lower left section of the screen at 1/4 size.
  Full: Displays the sub waveform on a full screen.
- **Waveform Display Position: Window Pos**
  Set the display position of the sub waveform.
- **Sub Waveform Zoom Ratio: Window Mag**
  The sub waveform is displayed at the zoom rate specified by Window Mag around the waveform display position specified by Window Pos.
- **Display Format of Sub Waveforms**
  Set the display format of sub waveforms.

Main:	Same format as the main window	Single:	1 window
Dual:	2 windows	Triad:	3 windows
Quad:	4 window	Octal:	8 windows
Hexadecimal:	16 windows		

Selecting the Displayed Trace: Allocation
The traces that are turned ON under Allocation are displayed.

- **Displaying the Acquired Waveform: Capture Num**
  You can specify the number of the acquired waveform to be displayed in the sub waveform window.
  The time that is shown below the number is the trigger time of the waveform.
  When in Auto Mode
  Current, –1, –2, ...
  where current is the newest waveform, –1 is the waveform previous to the newest waveform, and –2 is the waveform that is 2 triggers before the newest waveform.
  The acquired waveform can be displayed only when the waveform acquisition is stopped.
  When in Log Mode
  Current, 1, 2, ...
  where current is the newest waveform, 1 is the oldest waveform, and 2 is the second oldest waveform.
  The acquired waveform can be displayed even when the waveform acquisition is in progress.

- **Displaying the List of Captured Waveforms: Show Map**
  The number of the acquired waveform and the trigger time are listed. You can also select the desired waveform number to display the list.
- **Send Mail**
  When turned ON, a mail is sent to the mail address specified in NetWork settings each time a waveform is acquired. For details, see section 16.5, "Sending Periodic Mail or Action Mail."

▼ Mark

The ▼ mark indicates the position of the sub waveform specified by Capture Num at the top section of on the main waveform window. However, when waveforms are being acquired in the Auto mode, the ▼ mark is not displayed for sub waveform positions that exceed the end of the main waveform.

Note

Key response is slowed down when waveform acquisition is in progress using the dual capture function.

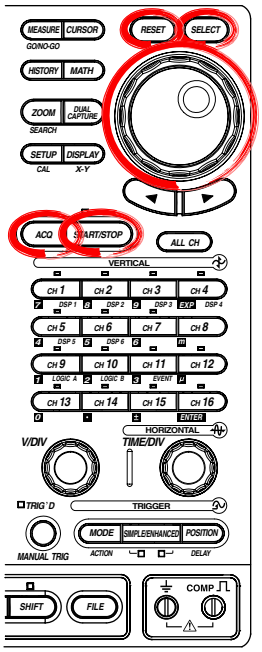
Notes When Using the Dual Capture Function

- The dual capture function can be used only when the trigger mode is set to Auto or Log.
- The maximum record length of the main waveform varies depending on the model as follows: The dual capture function cannot be used at record lengths that exceed the maximum record length.
  Standard model: 5 M /M1 model: 10 M
  /M2 model: 50 M /M3 model: 100 M
- The dual capture function cannot be used if the acquisition mode of the main waveform is Average.
- The dual capture function and the realtime recording function cannot be used simultaneously.
- The dual capture mode cannot be changed while waveform acquisition is in progress.
- If you restart measurements after acquiring waveforms, all the waveforms that were acquired before changing the mode are cleared.
- The dual capture function cannot be applied to X-Y waveforms.
- Saving/loading of the waveforms acquired using the dual capture function is performed simultaneously for the main waveform and the sub waveform. For details on the saving/loading of the waveform, see section 13.7, “Saving/Loading Waveform Data.”
- The dual capture function cannot be used if the time base is set to external clock.
- Accumulate function cannot be used.
- Cursor measurements and automated measurement of waveform parameters are suspended while waveforms are acquired using the dual capture function.
- Automated measurement of waveform parameters and computations cannot be performed on the sub waveform.
- When the sub waveform is displayed, cursor measurements are made on the sub waveform.

7.7 Realtime Recording to the Internal Hard Disk (Optional)

<For a description of this function, refer to page 2-35.>

Procedure



1. Press **ACQ**.
2. Press the **RealTime Out** soft key to select HD.

Note

The RealTime Out menu does not appear if Time Base is set to Ext.

Setting the Realtime Recording

3. Press the **RealTime Out Setup** soft key. A setup dialog box opens.
4. Use the **jog shuttle** and **SELECT** to set Sequence to Single or Continue.
5. If you selected Continue in step 4, use the **jog shuttle** and **SELECT** to set Count to a value in the range of 2 to 128.
6. Use the **jog shuttle** and **SELECT** to select the Auto Naming method from OFF, Numbering, and Date.
7. As necessary, enter the File Name and Comment according to the procedures given in section 4.2.

Executing the Realtime Recording

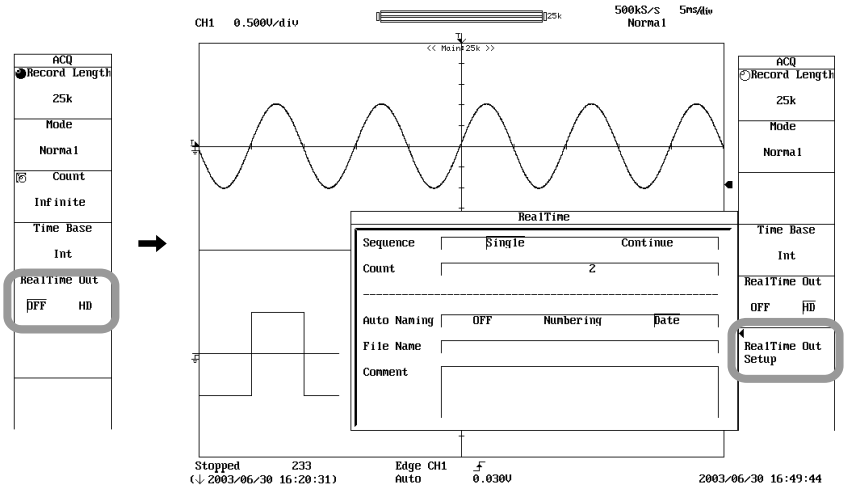
8. Press the **START/STOP** key to start the waveform acquisition. Realtime recording is executed.
   While realtime recording is executing,  is displayed at the upper left corner of the screen.

Aborting the Realtime Recording

9. Press the **START/STOP** key to stop the waveform acquisition. Realtime recording is aborted.

Note

If you stop the waveform acquisition by pressing the START/STOP key, realtime recording is aborted even if it is within the specified recording time.



Explanation

The data can be recorded in realtime to the internal hard disk (optional).
The internal hard disk consists of the following drives.

Realtime: For realtime recording. You can set the realtime recording area in the range of 30% to 70% of the entire capacity of the internal hard disk when you format the internal hard disk (see section 13.5).

HD-0, HD-1*: For saving various data.

* HD-0 only if the internal hard disk is partitioned to 2; HD-0 and HD-1 if the internal hard disk is partitioned to 3.

Waveforms That Are Realtime Recorded

All normal waveforms displayed on the screen are realtime recorded.

Possible Time Axis Range, Maximum Record Length, and Maximum Sample Rate for Realtime Recording

Varies depending on the number of channels that are to be realtime recorded as follows:

Number or Channels	Time Axis Range	Maximum Record Length	Maximum Samlpe Rate
18 channels or more	20 s/div to 3 day/div	25 MW	5 kS/s
12 to 17 channels	20 s/div to 3 day/div	50 MW	5 kS/s
6 to 11 channels	6 s/div to 3 day/div	50 MW	10 kS/s
4 to 5 channels	3 s/div to 3 day/div	100 MW	20 kS/s
3 channels	2 s/div to 3 day/div	250 MW	50 kS/s
2 channels	1 s/div to 3 day/div	500 MW	100 kS/s
1 channel	1 s/div to 3 day/div	1 GW	100 kS/s

Realtime recording is possible within the maximum record length and maxim sample rate ranges of the number of channels to be realtime recorded.
The setting shown above is common to all models (memory options standard, M1, M2, and M3).

Realtime Recording Mode

If you select Single, the following two trigger modes are available. If you select Continue, only Log is valid.

Auto: Acquisition is started by pressing START. If the specified record length is exceeded, old data is overwritten. Acquisition continues until you press STOP.

Log: Acquisition is started by pressing START. When the specified record length is reached, acquisition stops.

Sequence/Count

Single: Acquisition is started by pressing START. When the specified record length is reached, acquisition stops.

Continue: Acquisition is started by pressing START. When the specified record length is reached, acquisition stops. This sequence is repeated the specified number of times (count).

Auto Naming

File names are automatically created during realtime recording. You can also enter comments. The following three auto naming types are available.

- **OFF**
  File name specified by File Name (up to 16 characters).
- **Numbering**
  Automatically creates files by attaching a four-digit number, 0000 to 4999, to the file name. You can assign a common name before the number (Specified with File Name. Up to 4 characters).

- **Date**
  Automatically creates files using the date and time for the file names. (The file name specified by File Name is void.)
  Selecting Date is convenient for file management, because the file names do not overlap.

Executing the Realtime Recording

When you press START/STOP, realtime recording is started. After recording for the specified time, the operation stops.

Aborting the Realtime Recording

Press START/STOP to abort the waveform acquisition. Realtime recording is aborted even if it is within the specified recording time.

Saving and Loading the Waveform Data That Has Been Realtime Recorded

For details, see section 13.14, “Loading/Converting Realtime Recorded Waveform Data.”

Notes When Realtime Recording

- Realtime recording is not possible when the acquisition mode is set to Average.
- During realtime recording, only the executing/aborting of the realtime recording, zoom display setting, and protection function are valid.
- Realtime recording is possible only when the trigger mode is set to Auto or Log.
- Cursor measurements and automated measurement of waveform parameters are suspended when realtime recording is in progress.
- History memory waveforms, recalled waveforms, and computed waveforms cannot be displayed when realtime recording is in progress.
- The following operations are possible on the data that is realtime recorded to the hard disk (history memory function cannot be used).
  - Cursor measurement and automated measurement of waveform parameters (up to 10 MW)
  - Zooming on the Waveform
  - Various computations
  - X-Y display (uses compressed data)
  - Saving/Loading of waveform data
  - Printer output
- When realtime recording to the internal hard disk, do not connect a PC to the SCSI connector.
- Realtime recording is not possible when action-on-trigger is ON or when the dual capture function is in use.
- Realtime recording is not possible if the record length is less than 1 MW.
- Key response slows down when realtime recording is in progress.
- The maximum number of files that can be created in the realtime recording area of the internal hard disk is 128. If the number of files reach 128, delete unneeded files by operating the DL750/DL750P. You can also copy the files to an area outside the realtime recording area of the internal hard disk or to other storage media.
- Zoom waveforms can be displayed using the ZOOM menu when realtime recording is in progress. However, there is a limitation on the magnification (Zoom Mag) depending on the record length.

Record Length	Possible Zoom Mag
1 MW to 10 MW	T/div in which the number of displayed points is 250 k or more
25 MW	T/div in which the number of displayed points is 500 k or more
50 MW	T/div in which the number of displayed points is 1 M or more
100 MW to 1 GW	T/div in which the number of displayed points is 2.5 M or more

CAUTION

- If the power is cut off when realtime recording is in progress, a disk area that cannot be freed may result in the realtime recording area or the internal hard disk may be damaged.
  If a disk area that cannot be freed results, the disk performance in the realtime area may deteriorate. Consequently, realtime recording may not operate properly. In this case, back up the required data on the internal hard disk and format the internal hard disk.
- Do not expose the DL750/DL750P to shock when realtime recording is in progress. The internal hard disk may get damaged or the realtime recording may not operate properly.
- The Real Time drive is a working area on the DL750/DL750P internal hard disk for realtime recording.
  Never delete files from the drive or add files to the drive from an external PC such as by using the FTP server function.
  If you do, the realtime recording may not operate properly.

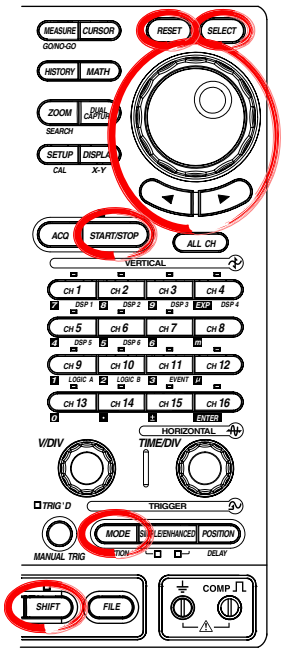
Note

For the procedure in saving the data, see section 13.14.

7.8 Setting the Action When Waveform Display Is Updated (Action-on-Stop)

<For a description of this function, refer to page 2-36.>

Procedure



1. Press **SHIFT+MODE** to display the ACTION menu.

Setting the Action

2. Press the **Mode** soft key to display the Mode setup menu.
3. Press the **On Stop** soft key.
4. Press the **Action** soft key to display the Action setup menu.
5. Use the **jog shuttle** and **SELECT** to select action to be enabled. (You can select multiple actions.)
6. If you selected Save to File in step 3, use the **jog shuttle** and **SELECT** to set the file save format to Binary, ASCII, or Float. If you selected Send Mail, use the **jog shuttle** and **SELECT** to set Mail Count.

Setting the Number of Actions

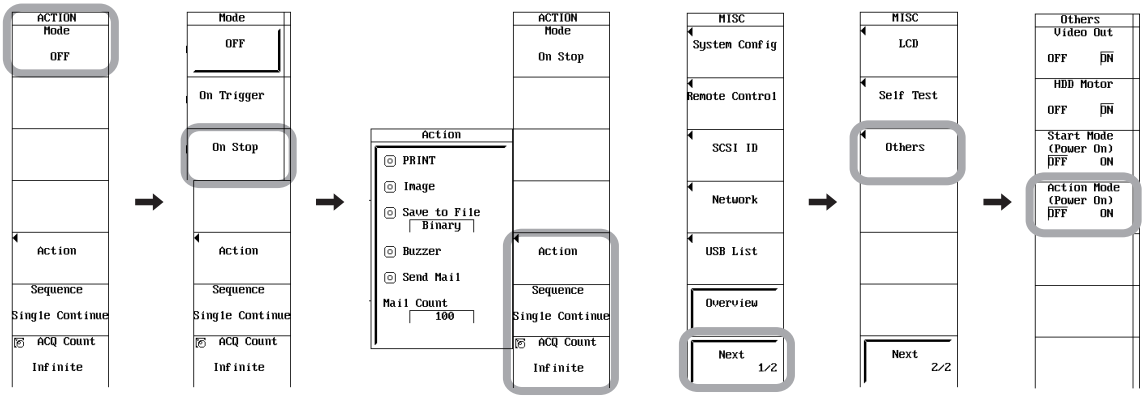
7. Press the **Sequence** soft key to select Single or Continue.
8. Press the **ACQ Count** sof key.
9. Turn the **jog shuttel** to set the numeber of actions. Pressing **RESET** resets the count Infinite.

Setting the Execution Mode of the Action-on-Stop at Power ON

10. Press **MISC**.
11. Press the **Next 1/2**soft key
12. Press the **Others** soft key.
13. Press the **Action Mode (Power ON)** soft key to select ON or OFF.

Executing the Action-on-Stop

14. Press **START/STOP**. Waveform acquisition is started, and action-on-stop is executed. While action-on-stop is in execution, is displayed in the upper left corner of the screen.
    In addition, if the following action is specified, the following icon is displayed in the upper left corner of the screen while the action is being executed.
    Image/Save to File: Save destination medium (FD, Zip disk, PC card, SCSI device, internal HD, network drive, or USB storage device)
    Send Mail:



Aborting the Action-on-Stop

15. Press **START/STOP**. Waveform acquisition is stopped, and action-on-stop is aborted.

Explanation

Setting the Mode

The specified record length of data is acquired when measurement is started, and the waveform is displayed. Then, the specified action is executed. In addition, the specified action is also executed when measurement is stopped. When action-on-stop is enabled, the trigger mode is set to Log.

Setting the Action

The following five types of actions are available.

Print the Screen Image Data: PRINT
Prints the screen image data on the printer (Printer (built-in printer), USB (USB printer), Net Print (network printer)) specified by Print to in the PRINT menu.

Save the Screen Image Data: Image
Saves the screen image data to the destination (FD, Zip disk, PC card, internal HD (optional), SCSI device, or USB storage device) specified in the IMAGE SAVE menu.

Save the Waveform Data: Save to File
Saves the waveform data in binary, ASCII, or floating format to the destination (FD, Zip disk, PC card, internal HD (optional), SCSI device, or USB storage device) specified in the FILE menu. The save format is synchronized to data type (see section 13.7) on the FILE menu.

Buzzer
Sounds a buzzer.

Send Mail
Sends an e-mail message to a specified address (when Ethernet interface option is installed). Set the number of mail transmissions in the range of 1 to 1000.
For the procedure of setting the address, see section 16.5, “Sending Periodic Mail or Action Mail.”

Note

If action-on-stop is executed, the data is acquired in Log mode regardless of the trigger mode setting, and the specified action is carried out. The specified action is also carried out when the measurement is stopped in the middle of the measurement.

Setting the Number of Actions: Sequence

Sequence
Single: Performs the action once.
Continue: Performs the action the number of times specified by ACQ Count.

ACQ Count
2 to 65536: Repeats the action the specified number of counts.
Infinite: Repeats the action until waveform acquisition is stopped.

Save to File/Hard Copy/Image Operation

Operates according to the settings in the FILE, PRINT, or IMAGE SAVE menu.

File Name When Action Is Set to Save to File or Image

If the Auto Naming of the File menu or the Image Save menu is OFF, numbers are automatically assigned to the file names. Otherwise, the file is saved using the specified method.
For details, see section 13.11, “Saving the Screen Image Data” or section 13.7, “Saving/Loading Waveform Data.”

Send Mail Operation

Sends e-mail messages to the address specified using Network > Mail Setup > Mail Address in the MISC menu.

Setting the Execution Mode of the Action-on-Stop at Power ON: Action Mode (Power ON)

You can select whether to enable action-on-stop at power-on For example, turn this ON if you wish to continue the action-on-stop operation after a power failure.
ON: At power ON, the action-on-stop is set to the mode that was used when the power was turned OFF.
OFF: Action Mode is turned OFF at power ON.
The initial setting is OFF.

Notes When Using the Action-on-Stop

- Action-on-stop cannot be used if the acquisition mode is Average.
- You cannot change the settings while the action-on-stop is in progress.
- The action-on-stop operation may slow down if there is access from the network while the following action is in progress.
  Printing/saving of the screen image data and saving of the waveform data
- You cannot use action-on-stop when the dual capture function is ON or when the realtime recording to the internal hard disk is ON.

Notes When Action Is Set to Save to File or Image Save

- Do not specify the root directory of the medium as the save destination directory. (Only up to 512 files can be saved to the root directory of a medium that has been formatted using the DL750/DL750P.)
- The maximum number of files that can be created in a single directory is 5000. Do not place files in the save destination folder before starting the action-on-stop operation.
- If you select Save to File and Image Save simultaneously, separate the folders specified by the FILE menu and the IMAGE SAVE menu.
- If you selected Numbering for the file name assignment method (Auto Naming) in the FILE menu and the IMAGE SAVE menu, the creation of files takes an extended period when the number of saved files becomes large. When creating more than 2000 files, select Date for Auto Naming.
- When 5000 files are saved, the action-on-stop operation ends.

7.9 Using the Voice Memo Function

<For a description of this function, refer to page 2-36.>

This section describes only the voice memo function. For a description of the voice comment function, see section 13.19.
Before using the voice memo function, connect the earphone microphone with a PUSH switch to the DL750/DL750P by referring to section 3.14, “Connecting the Earphone Microphone with a PUSH Switch and Connecting the Speaker.”

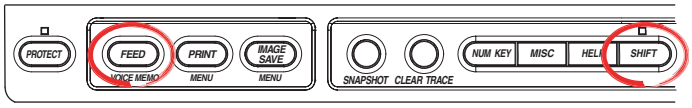
Note

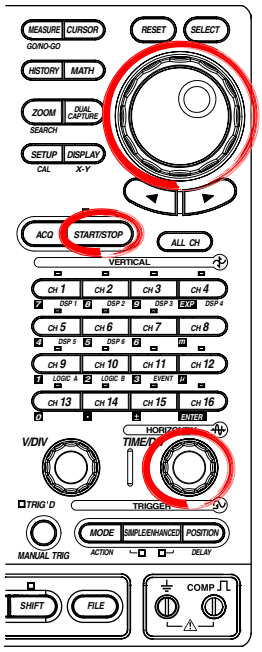
- The REC LEVEL and VOLUME knobs on the left side panel click in place at the center position. When using the earphone microphone with a PUSH switch, set the REC LEVEL and VOLUME knobs to the center position to obtain adequate recording level and play volume.
- If you are outputting the voice to an external speaker for the first time by using the optional speaker cable (sold separately), set the play volume to the minimum setting using the VOLUME knob.

Procedure

DL750

DL750P





Setting the Voice Memo Function

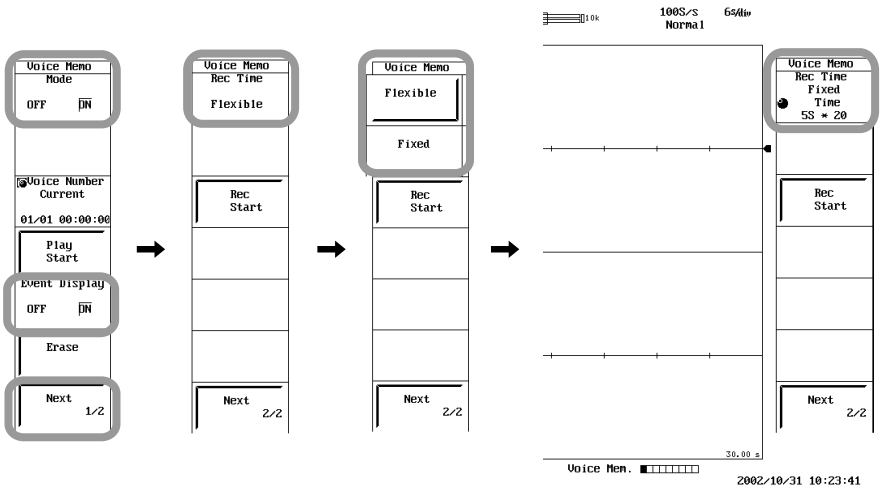
1. Press **VOICE MEMO**. (On the DL750P, press **SHIFT+FEED (VOICE MEMO)**.)
2. Press the **Mode** soft key to select ON.

- **Turning ON/OFF the Event Waveform Display**

3. Press the **Event Display** soft key to select OFF or ON. For a description of event waveforms, see section 5.21.
4. Press the **Next 1/2** soft key.

- **Setting the Record Time**

5. Press the **Rec Time** soft key.
6. Press the **Flexible** or **Fixed** soft key. If you wish to record for an arbitrary length of time without specifying the record time, select Flexible; if you wish specify the record time and count before recording, select Fixed. If you select Flexible proceed to step 8; if you select Fixed proceed to step 7.
7. Use the **jog shuttle** to set the Time in the range of 5 s * 20 (5 s × 20 times) to 100 s * 1 (100 s × 1 time).



Executing the Waveform Acquisition

8. Turn TIME/DIV to set T/div in the range of 100 ms/div to 3 day/div.
9. Press **START/STOP**.

Note

If the ACQ MEMORY BACKUP switch (located on the DL750/DL750P right side panel) is turned ON, the voice memo data is backed up as with the waveform data. The backup procedure is the same as the backup function of the acquisition memory. See section 7.10.

Recording a Voice Memo

- **When Flexible Is Selected**

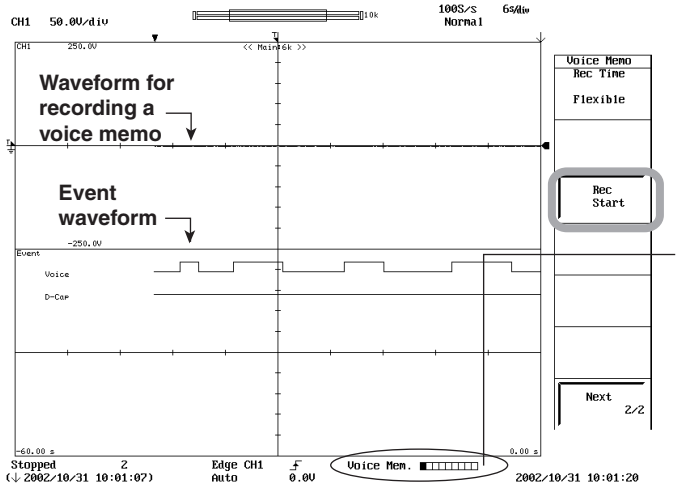
  There are two record methods.

  Recording by Using the PUSH Switch on the Earphone Microphone

  10. Record the voice memo while holding down the PUSH switch on the earphone microphone.
  11. To stop recording, release the PUSH switch. When the recording is finished, proceed to step 12.

  Recording Using the Voice Memo Menu

  10. Record the voice memo by pressing the **Rec Start** soft key. The soft key changes to Rec Stop.
  11. To stop the recording, press the **Rec Stop** soft key. When the recording is finished, proceed to step 12.



Voice memory indicator

0 s **100 s**

Indicates the record time of voice memos. As time elapses, the indicator turns red[1].

1. When the screen color setting (see section 17.4) is set to default.

Note

- Voice memos can be recorded repeatedly until the total record time reaches 100 s.
- If the total record time reaches 100 s, succeeding recordings will be invalid. Refer to the voice memory indicator that is displayed at the lower right corner of the screen for the record time and record count.
- An icon appears at the upper left corner of the screen while voice memo recording is in progress.

- **When Fixed Is Selected**

  There are two record methods.

  Recording by Using the PUSH Switch on the Earphone Microphone

  10. Record the voice memo by pressing the PUSH switch on the earphone microphone. When the recording is finished, proceed to step 12.

Note

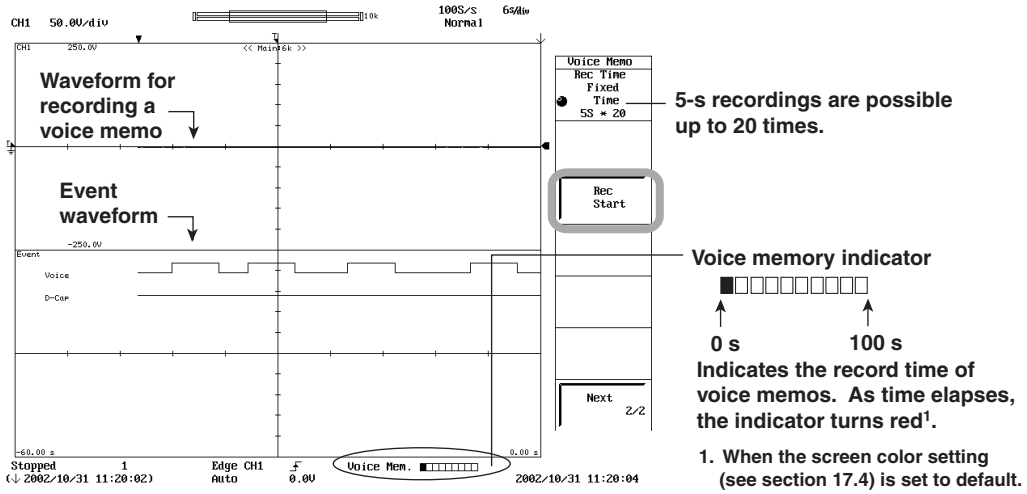
When Fixed is selected, the voice memo is recorded for the time specified by Rec Time by pressing the PUSH switch once. The PUSH switch does not have to be held down.

Recording Using the Voice Memo Menu

10. Record the voice memo by pressing the **Rec Start** soft key. The voice memo is recorded for the time specified by Rec Time. When the recording is finished, proceed to step 12.

Note

When Fixed is selected, the Rec Start soft key display does not change even while recording is in progress.



Note

- An icon appears at the upper left corner of the screen while voice memo recording is in progress.
- Of the waveform data stored to the acquisition memory using the history memory function (see section 11.1), the voice memo data is stored only for the newest waveform data. Only event waveforms are stored for waveforms other than the newest waveform. Thus, voice memo cannot be played even if the waveform data is loaded using the history memory function.

Stopping the Waveform Acquisition

12. Press **START/STOP**. Waveform acquisition stops.

Playing of the Voice Memo

13. Press the **Next 2/2** soft key.
14. Press the **Voice Number** soft key.
15. Use the **jog shuttle** to select the number of the voice data you wish to play.
16. Press the **Play Start** soft key. The voice memo of the specified number is played.

Note

- Current indicates the newest voice memo (voice recorded on the rising edge of the event bit of the event waveform that is displayed at the right-most position on the screen). The oldest memo is indicated as #1. The voice memo is newer as the number gets larger.
- While the voice memo is being played, the soft key indication changes to Play Stop. To stop the voice memo while it is playing, press the Play Stop soft key.
- An icon appears at the upper left corner of the screen while voice memo is being played.
- The voice memo can be played through a speaker by connecting an external speaker. For the procedure of connecting a speaker, see section 3.14.
- The voice memo can also be played using voice search of the SEARCH menu. For details, see section 11.4.

Executing the Waveform Data Save Operation

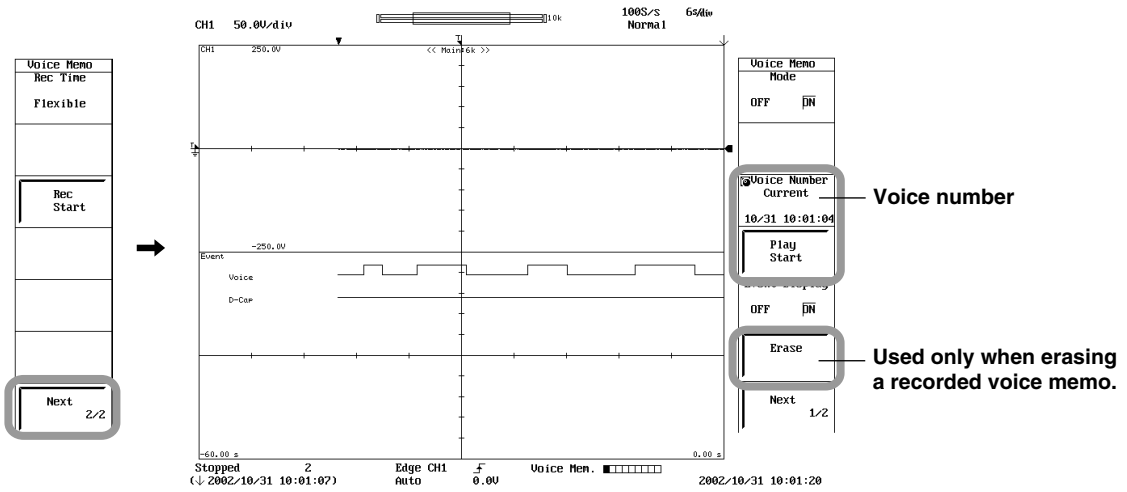
17. Save the waveform data according to steps 1 to 25 in “Saving the Waveform Data” in section 13.7. The recorded voice memo is also saved.

Executing the Waveform Data Load Operation

18. Load the waveform data according to steps 1 to 10 in “Loading the Waveform Data” in section 13.7. When waveform data with a voice memo is loaded, the voice memo can be played. The procedure of playing the voice memo is the same as steps 13 to 16 in this section.

Note

To determine whether a voice memo is attached to the waveform data, open the properties of the waveform data (see section 13.7) using FILE key > Load > Property. If the VOICE MEMO item in the properties is ON, a voice memo is attached to the waveform data, otherwise a voice memo is not attached.



Erasing Voice Memos

The recorded voice memo can be erased. This operation is performed when a voice memo was recorded while waveform acquisition was in progress, but you wish to save the waveform data without the voice memo.

After step 16 of this section, press the **Erase** soft key. The voice memo is erased, and the voice memory indicator value on the screen is cleared.

Note

Once a voice memo is erased, it cannot be recovered. Use caution when erasing a voice memo.

Explanation

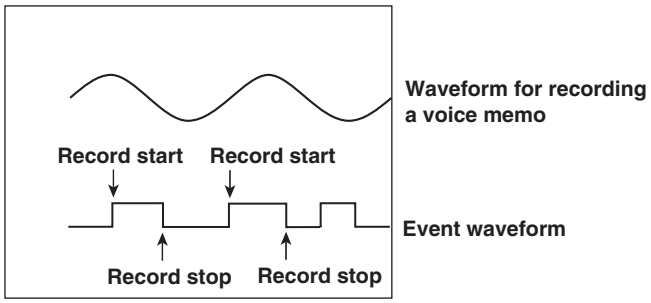
A voice memo can be recorded while waveform acquisition is in progress (when in roll mode display) by connecting an earphone microphone with a PUSH switch to the DL750/DL750P.

Setting the Mode

To enable the voice memo function, set Mode to ON.
When turned ON, a voice memory indicator is displayed at the lower right corner of the screen.

Displaying Event Waveforms

The event waveform (Voice bit of the event waveform) indicates the record interval of the voice memo. The interval during which a voice memo is recorded is from the rising edge to the falling edge of the event waveform. For the procedure of setting event waveforms, see section 5.21.



Precautions Regarding the Voice Memo Function

- If the record length setting is set long in the ACQ menu causing the number of channels that can be used to 3 channels or less, event waveforms are not displayed. In this case, the voice memo function cannot be used.
- If the voice memo function is OFF (Mode: OFF) even when the event waveform display is ON (Event Display: ON), event waveforms are not saved when waveform data is saved. In addition, even if a voice memo is recorded during waveform acquisition, if the voice memo function is turned OFF at the time waveform data is saved, event waveform data/voice data will not be saved.
- In realtime recording, if the valid number of channels[1] is 3 channels or less, event waveforms cannot be used. In this case, the voice memo function cannot be used.

1. Valid number of channels signify the number of channels that are turned ON excluding MATH1 to MATH8 channels. However, for LOGIC A and LOGIC B, the number of channels is counted as 1 regardless of whether one of the channels is ON or both channels are ON.

Rec Time

Recording is possible up to a total of 100 s.
The following two methods are available in setting the record time.

Flexible

Recording continues while the PUSH switch on the earphone microphone is held down or from the time when the Rec Start soft key of the Voice Memo menu is pressed until the Rec Stop soft key is pressed. To stop the recording, release the PUSH switch or press the Rec Stop soft key. The shortest record time of one session is 3 s. (Even if the record stop operation is performed within 3 s of starting the recording, recording continues for 3 s.)

Fixed

Recording is performed for the specified time and count (the combination of time and count is bound to 100 s total). Once the PUSH switch or the Rec Start soft key of the Voice Memo is pressed, recording is performed for the specified length of time. When using the PUSH switch, the PUSH switch does not have to be held down.
The combination of record time and record count can be selected from the following:
5 s * 20, 10 s * 10, 20 s * 5, 25 s * 4, 50 s * 2, and 100 s * 1
For example, if you select 5 s * 20 and press the PUSH switch once, recording is performed for 5 s. Press the PUSH switch again to record another 5 s. The record operation can be repeated up to 20 times.

Playing the Voice Memo: Voice Number and Play Start

Use the Play Start soft key to play the voice memo specified by Voice Number.
Use Voice Number to specify the number of the voice memo you wish to play. Current indicates the newest voice memo. The oldest memo is indicated as #1. The voice memo is newer as the number gets larger. The date/time displayed below Voice Number is the date/time when the voice memo recording was started.

Erasing Voice Memos

The recorded voice memo is erased. Use caution because voice memos that are erased cannot be recovered.

Note

- The search and zoom function (see section 11.4) can be used to search the section of the waveform data where a voice memo is recorded (voice search). Playing the voice memo that has been found is also possible. For a description of the voice search function, see section 11.4.
- The data size of waveform data with a voice memo increases as compared to waveform data without a voice memo. For example, if a voice memo is recorded for 100 s and saved, the data size increases by approximately 440 KB.

7.10 Using the Acquisition Memory Backup Function

<For a description of this function, refer to page 2-36.>

The data held in the acquisition memory can be backed up immediately before the power is shut down even if the power supply is cut off due to reasons such as a sudden power failure.

Data That Is Backed Up

- Waveform data
- History memory data
- sub window data of the dual capture function
- Voice memo data

Backup Batteries

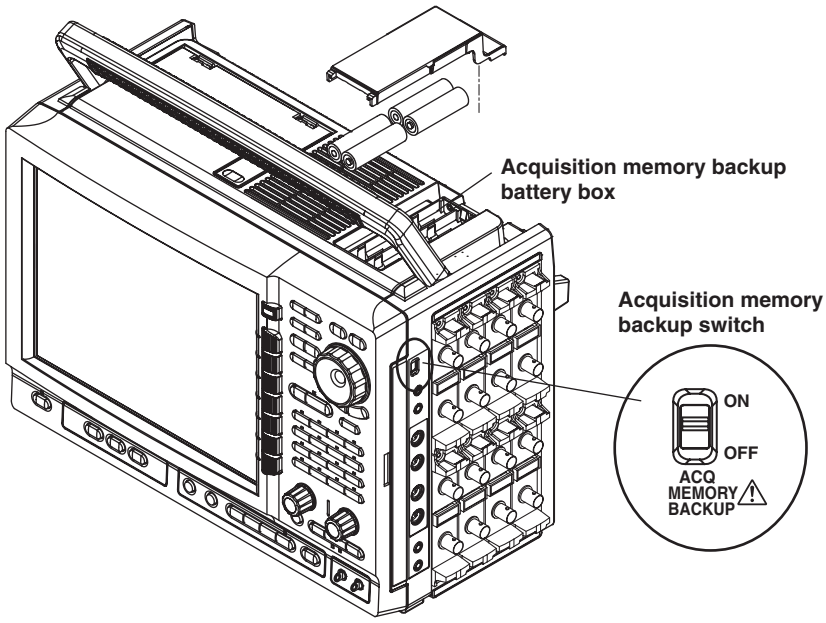
Type of Batteries That Can Be Used

- AAA alkaline dry cells (AA/R6) (JIS, IEC model: LR6): 4 cells
- Nickel hydride rechargeable batteries: 4 cells

Battery Storage

The battery storage box is located on the right side of the top panel.

1. Lift the handle and remove the screws from the battery storage box using a screwdriver.
2. Remove the storage box cover, and insert four batteries paying attention to their direction.
3. Set the storage box cover back to the original place and fasten the screws.



Backup Procedure

1. Turn ON the acquisition memory backup switch on the right side panel of the DL750/DL750P. The acquisition memory backup starts.
2. To stop the acquisition memory backup, turn OFF the acquisition memory backup switch.

The backup time varies depending on the operating environment. See section 19.5.

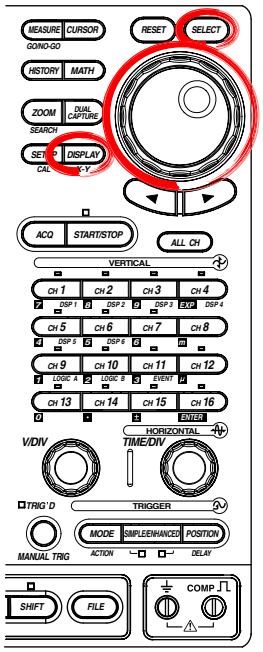
Note

- When using the nickel hydride rechargeable batteries, be sure to charge them before use. (The DL750/DL750P does not have a charge function.)
- You cannot check the battery level on the DL750/DL750P. Use a commercially sold battery level checker or other similar devices.
- For a description of the backup operation, see appendix 9.

8.1 Changing the Display Format

<For a description of this function, refer to page 2-37.>

Procedure



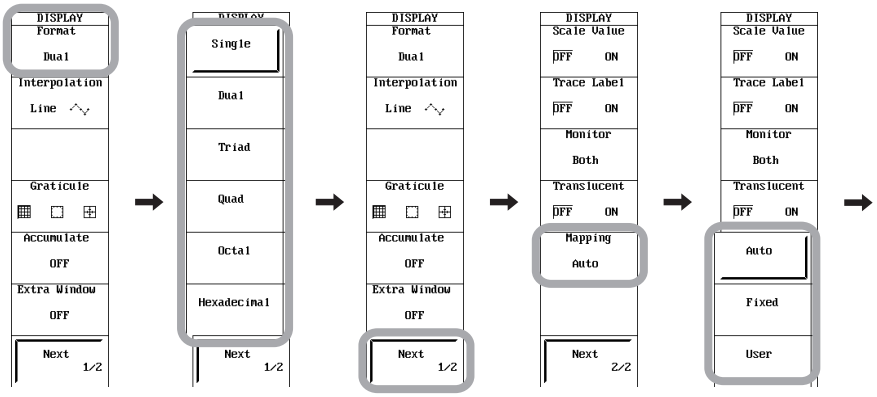
1. Press **DISPLAY**.

Setting the Display Format

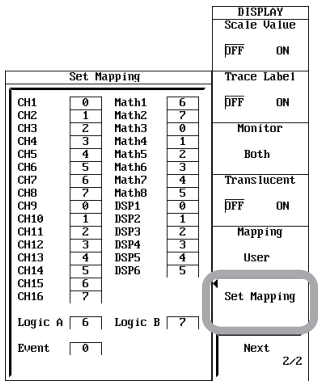
2. Press the **Format** soft key. The format selection menu appears.
3. Press the soft key corresponding to the desired format from Single (one division) to Hexadecimal (16 divisions).

Setting the Waveform Mapping

4. Press the **Next 1/2** soft key.
5. Press the **Mapping** soft key to select Auto, Fixed, or User. If you select User, proceed to step 6.
6. Press the **Set Mapping** soft key. The waveform mapping setup menu appears.
7. Use the **jog shuttle** and **SELECT** to set the mapping number of each channel.



Mapping: User



DSP1 to DSP6 are optional.

Explanation

You can select the number of windows into which the analog waveform display window is divided. The position of the waveform of each channel varies depending on the display format.

Display Format

Single:	1 window	Quad:	4 windows
Dual:	2 windows	Octal:	8 windows
Triad:	3 windows	Hexadecimal:	16 windows

Waveform Mapping

- **Auto**
  Windows are arranged from top to bottom in order: CH1, CH2, ... , CH16, DSP1 to DSP6 (optional), Math1 to Math8. But no windows are shown for channels whose display is set to OFF.
- **Fixed**
  Channels are that are set to OFF are also mapped.
- **User**
  Assign numbers from 0 to 7 to CH1, CH2, ... , CH16, DSP1 to DSP6 (optional), Math1 to Math8. The display position varies depending on the assigned numbers.

Mapping Example When Display Format Is DUAL

CH1,
CH2, CH4

Fixed
(When CH3, CH5 to CH16 = OFF)

CH1, CH4
CH2,

Auto
(When CH3, CH5 to CH16 = OFF)

0, 2, 4
1, 3, 5

User
(When CH6 to CH16 = OFF)

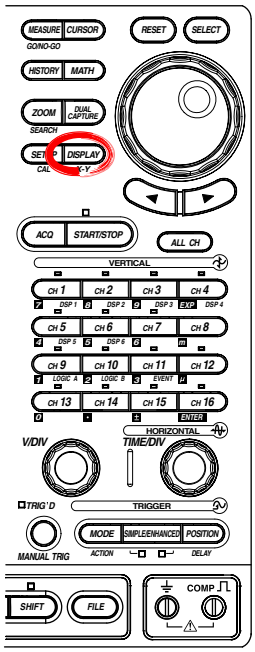
The number of points that can be displayed vertically (10 divisions) for each channel varies as follows according to the display format. However, the vertical resolution remains unchanged.

Single(□):	512 points	Quad(▤):	128 points
Dual(⊟):	256 points	Octal(▤):	64 points
Triad(⊟):	170 points	Hexadecimal(▤):	32 points

8.2 Setting the Display Interpolation Method

<For a description of this function, refer to page 2-37.>

Procedure



1. Press **DISPLAY**.

Setting the Interpolation Method

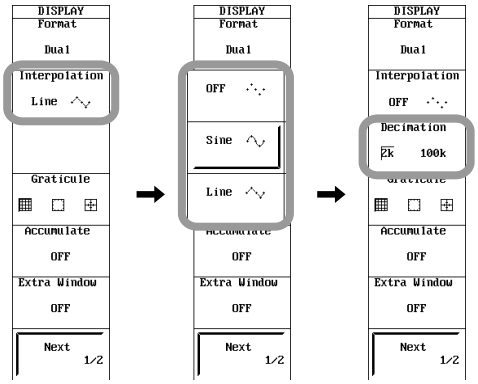
2. Press the **Interpolation** soft key. The interpolation selection menu appears.
3. Press the soft key corresponding to the desired interpolation method from **OFF**, **Sine**, and **Line**.
   If you select OFF, proceed to step 4.

Setting the Number of Data Points to Be Used for Waveform Display

4. Press the **Decimation** soft key to select the number of points to be used for the display from 2k and 100k.

Note

Decimation specifies the number of dots when interpolation is turned OFF. For example, if the record length is 100 kW and Decimation is set to 2k, data is extracted at constant intervals. Waveform is displayed using 2 kW of data. If Decimation is set to 100 k, the waveform is displayed using all 100 kW of data.

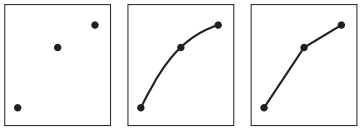


Explanation

Setting the Interpolation Method

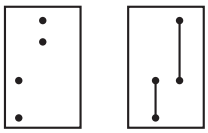
Any area along the time axis having less than 1000 points in 10 divisions (less than 500 points in the Z1 and Z2 window when displaying Main & Z1 & Z2) is recognized as an interpolation area. If you leave interpolation off, these points will appear as discrete dots (so that the display will show gaps between dots or vertical lines).
If you set interpolation on, however, the DL750/DL750P will connect the points. Three following interpolation methods are available.
Sine(∿): Interpolates between two points using the sin(x)/x function.
Line(⋰): Linearly interpolates between two points.
OFF(⋱): No interpolation.

- **When the Area Is Not an Interpolation Area**
  If interpolation is set to Sine or Line, the instrument draws lines between points that are aligned vertically.



Interpolate: OFF Sine Line

- **When the Area Is Not an Interpolation Area**
  If interpolation is set to Sine or Line, the instrument draws lines between points that are aligned vertically. If the number of data points is greater than or equal to 2002, P-P compression is performed (maximum and minimum values are determined at certain intervals), and two points are displayed on a single vertical line (1 raster).



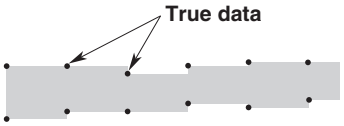
Interpolate: OFF Sine/Line

Setting the Number of Data Points to Be Used for Waveform Display: Decimation

When the area is not an interpolation area on the T-Y waveform display and Interpolation is set to Sine or Line, the aforementioned P-P compressed values are displayed. However, if Interpolation is set to OFF or if X-Y waveforms are being displayed, the acquisition data is decimated and data that has been picked up at certain intervals are displayed.
Set the number of data points for displaying the waveform to 2k or 100k.
If 2k is selected and the record length is greater than or equal to 2 kW, the data is decimated to 2 kW, and two points are displayed on one vertical line. If 100k is selected and the record length is greater than or equal to 100 kW, the data is decimated to 100 kW, and 100 points are displayed on one vertical line. Otherwise, all points are displayed.
If the number of data points per division is greater than or equal to 100 for a realtime recorded waveform or when in roll mode, the maximum and minimum values at certain number of data points of acquisition data are displayed using linear interpolation.

Data Interpolation and Envelope Mode

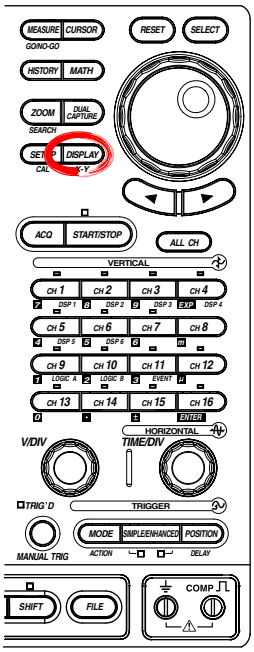
When the acquisition mode is envelope, the data is interpolated using an area regardless of the specified interpolation method (see the following figure). This is because in envelope mode the maximum and minimum values are determined over a certain interval, and the data time position cannot be pinpointed.



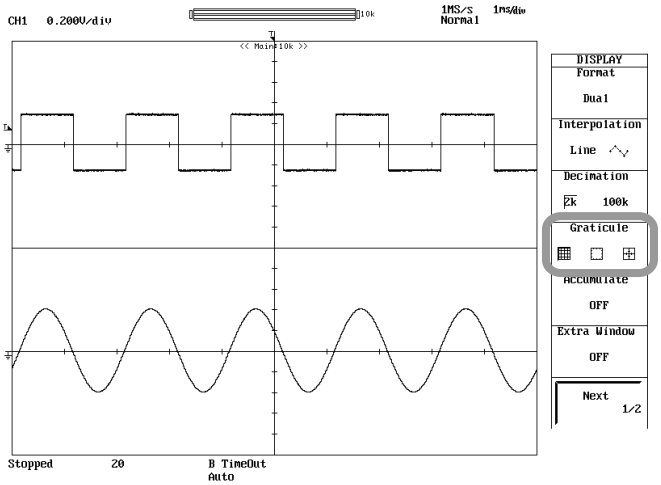
8.3 Changing the Graticule

<For a description of this function, refer to page 2-38.>

Procedure



1. Press **DISPLAY**.
2. Press the **Graticule** soft key to select the graticule.

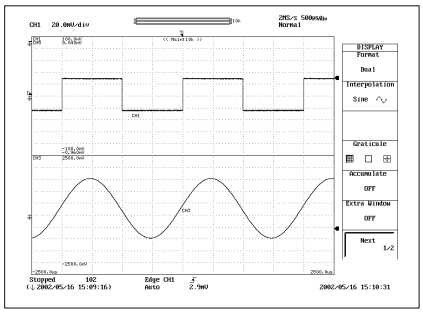


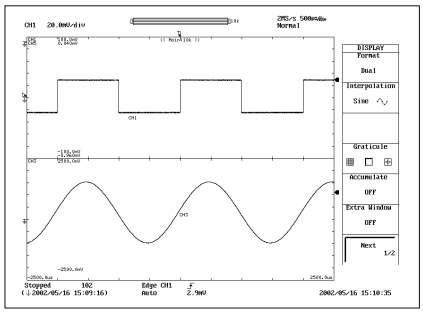
Note

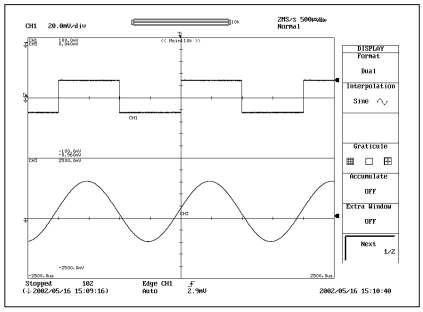
On the DL750P, the graticule setting is linked to the RECORDER menu > Print Setup > Graticule setting. However, if is selected, it is set to OFF in the RECORDER menu.

Explanation

Select the graticule from the following three types.



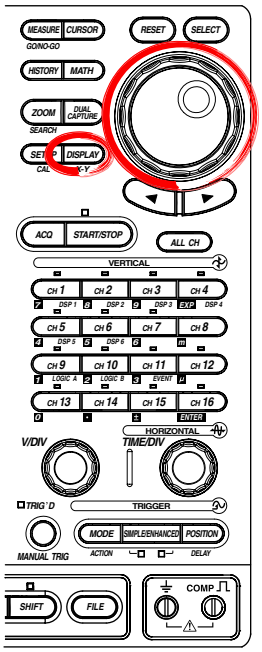




8.4 Accumulated Waveform Display

<For a description of this function, refer to page 2-38.>

Procedure

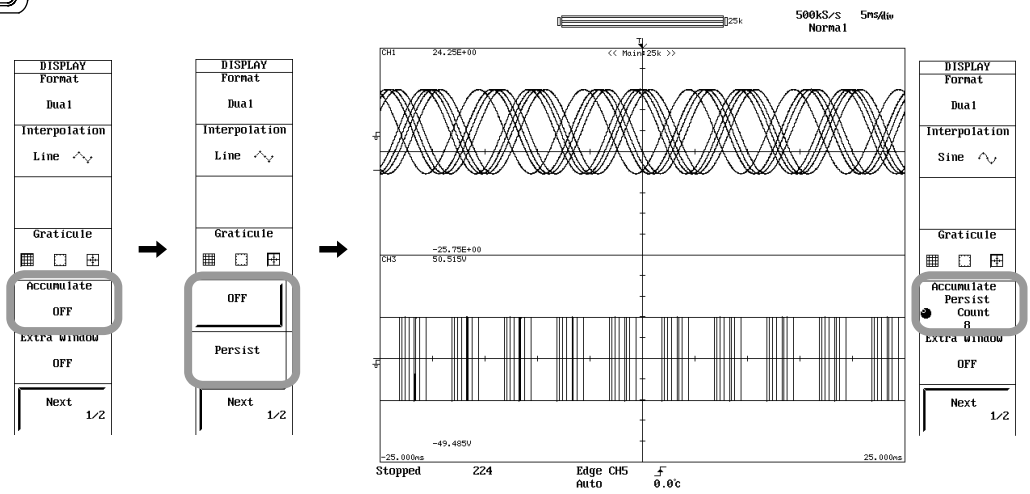


Setting the Accumulate Mode

1. Press **DISPLAY**.
2. Press the **Accumulate** soft key. The accumulate mode selection menu appears.
3. Press the **OFF** or **Persist** soft key to select the accumulate mode.
   If you select Persist, proceed to step 4.

Setting the Accumulate Time

4. Turn **the jog shuttle** to set the Count in the range of 2 to 128 (2^n step).



Explanation

Normally, the display is updated every time the trigger is activated making it difficult to capture transient conditions such as sudden distortion of waveforms. By using the accumulate function, the waveform display of the acquired data remains on the screen for the specified time.

Accumulate Mode

Persist: Persistence mode. Accumulates in red. Displayed for the specified time period by gradually lowering the brightness.

Accumulate Period: Count

When using persistence mode, set the number of times to accumulate the waveform in the range of 2 to 128 (in 2^n steps). If you select Infinite, the accumulation is carried out infinitely. The default value is 16.

Notes When Using Accumulation

- Automated measurement of waveform parameters and GO/NO-GO determination are performed on the newest waveform.
- When printing accumulated waveforms using the built-in printer, they are printed using two tones.
- If the waveform acquisition is forcibly stopped by pressing START/STOP, the accumulation is temporarily suspended. When the acquisition is restarted, the display is cleared and accumulation continues.
- You cannot change the parameters on the HISTORY menu when accumulating waveforms on the display.
- Accumulated display is not possible in roll mode display.
- When you turn OFF the accumulate mode, accumulated waveforms are cleared. To display the acquired waveforms again, specify the record number on the HISTORY menu.
- If you display the waveforms again by setting the accumulate mode to Persist, the accumulated waveforms are not cleared. To clear them, execute CLEAR TRACE.
- Even if you change the display format during accumulated display, the waveforms that are already displayed accumulated are not cleared. To clear them, execute CLEAR TRACE.

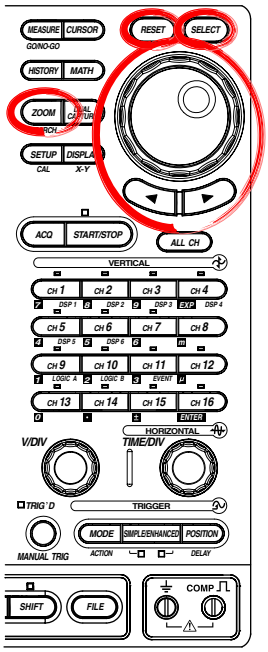
Clearing Accumulated Waveforms

You can clear accumulated waveforms by pressing the CLEAR TRACE key.

8.5 Zooming the Waveform

<For a description of this function, refer to page 2-41.>

Procedure



Selecting the Display Mode

1. Press **ZOOM**.
2. Press the **Mode** soft key. The display mode selection menu appears.
3. Press the soft key corresponding to the desired mode.
   If you select Main, you cannot carry out the following operations.

Selecting the Display Format of Zoomed Waveforms

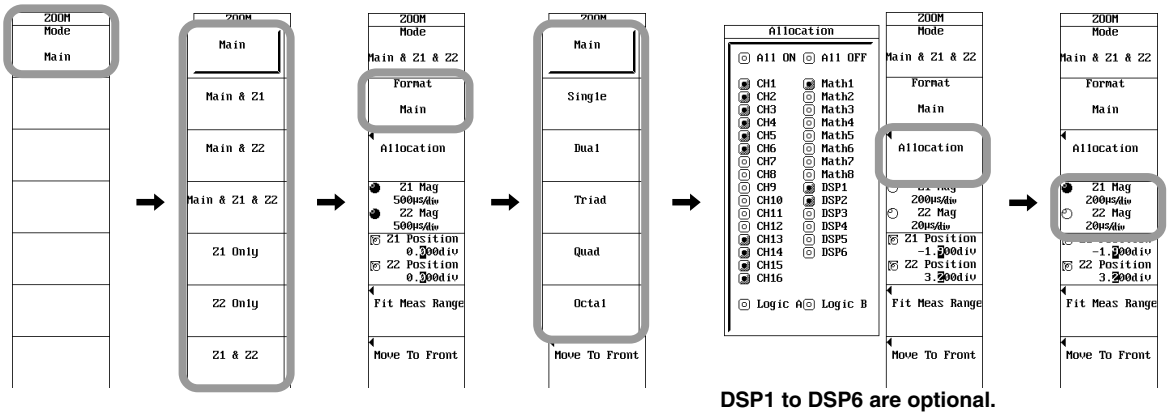
4. Press the **Format** soft key. The format selection menu appears. (If you set Mode to Main, the Format selection menu is not displayed.)
5. Press the soft key corresponding to the desired format.

Setting the Waveform to Be Zoomed

6. Press the **Allocation** soft key. The menu for setting the waveform to be zoomed appears.
7. Use the **jog shuttle** and **SELECT** to select the waveform to be zoomed.
   Select All ON to select all waveforms that are currently displayed.

Setting the Zoom Rate

8. Press the **Z1 Mag/Z2 Mag** soft key to set the **jog shuttle** control to Z1 Mag. (If you set Mode to Z1, Z1 Mag is displayed. If you select Z2, Z2 Mag is displayed. If you select Z1 and Z2, Z1 Mag/Z2 Mag is displayed.)
   Turn the **jog shuttle** to set the zoom rate of the Z1 zoom box.
9. Likewise set the zoom rate of the Z2 zoom box with Z2 Mag.



DSP1 to DSP6 are optional.

Setting the Zoom Position

10. Press the **Z1 Position/Z2 Position** soft key to set the **jog shuttle** control to Z1 Position. (If you set Mode to Z1, Z1 Position is displayed. If you select Z2, Z2 Position is displayed. If you select Z1 and Z2, Z1 Position/Z2 Position is displayed.) Turn the **jog shuttle** to set the zoom position of the Z1 zoom box.
11. Likewise set the zoom position of the Z2 zoom box with Z2 Position.
    By setting the jog shuttle control to both Z1 Position and Z2 Position, the zoom positions of both Z1 and Z2 can be moved simultaneously.

Changing the Range of the Automated Measurement of Waveform Parameters

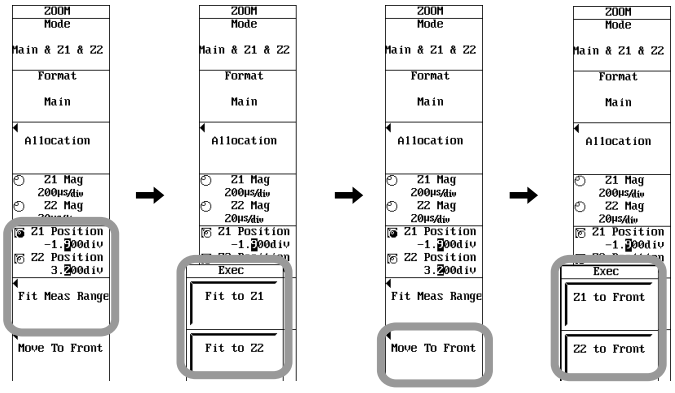
- **When Mode is set to a setting other than Main&Z1&Z2**
  12. Press the **Fit Meas Range to Z1** or **Fit Meas Range to Z2** soft key. The range of the automated measurement of waveform parameters is set to the zoom range of Z1 or Z2.
      Proceed to step 15.

- **When Mode is set to Main&Z1&Z2**
  12. Press the **Fit Meas Range** soft key.
  13. Press the **Fit to Z1** or **Fit to Z2** soft key.

Moving the Zoom Box to the Head Position of the Waveform

- **When Mode is set to a setting other than Main&Z1&Z2**
  14. Press the **Move Z1 to Front** or **Move Z2 to Front** soft key. The zoom box moves to the head position of the waveform.

- **When Mode is set to Main&Z1&Z2**
  14. Press the **Move to Front** soft key.
  15. Press the **Z1 to Front** or **Z2 to Front** soft key.



Explanation

Zoomed waveforms of two locations can be displayed simultaneously (dual zoom). You can also specify which channels to zoom. Zooming is not possible if the number of points displayed on the screen is less than or equal to 10 points (less than or equal to 50 for FFT waveforms).

Selecting the Display Mode of Zoomed Waveforms

Main:	Displays only the main (unzoomed) waveform.
Z1 Only:	Displays only the zoomed waveform of zoom box Z1.
Z2 Only:	Displays only the zoomed waveform of zoom box Z2.
Main&Z1:	Displays the main waveform in the top window and zoomed waveform of zoom box Z1 in the bottom window.
Main&Z2:	Displays the main waveform in the top window and zoomed waveform of zoom box Z2 in the bottom window.
Z1&Z2:	Displays the zoomed waveform of zoom box Z1 in the top window and the zoomed waveform of zoom box Z2 in the bottom window.
Main&Z1&Z2:	Displays the main waveform in the top window, the zoomed waveform of zoom box Z1 in the lower left window and the zoomed waveform of zoom box Z2 in the lower right window.

Note

On the DL750P, the range of zoom box Z2 can be printed expanded on the built-in printer (zoom print). For details, see section 12.2.

Selecting the Zoomed Trace: Allocation

The traces whose Allocation is turned ON are zoomed. If the allocation is OFF, the trace is not zoomed. You cannot allocate channels whose display is turned OFF.

Display Format of Zoomed Waveforms

Similar to the main waveform, 6 types (Main[1], Single, Dual, Triad, Quad, Octal, Hexadecimal) of display formats are available. You cannot set different formats for Z1 and Z2.

1. Selecting Main results in the same format as Main Format in the DISPLAY menu .

Zoom Rate: Z1 Mag/Z2 Mag

- Sets the T/div of the zoom waveform display area.
- If the time base is set to an external clock signal, select the magnification from the following:
  ×2, ×2.5, ×5, ×10, ×25, ×50, ×100, ×250, ×500, ×1000, ×2500, ... , ten-fold multiples of 1, 2.5, 5, up to ×1000000
- The maximum zoom rate varies depending on the display record length.
  Maximum zoom rate: Display record length ÷ 10
- The maximum magnification during realtime recording with respect to the display record length of the main waveform is as follows:

Main Waveform Record Length	Record Length of the Zoom Window
1 MW to 10 MW	250 kW
25 MW	500 kW
50 MW	1 MW
1000 MW or more	2.5 MW

- The display record length does not necessarily match the record length.
  For details on the display record length, see appendix 1, “Relationship between the Time Axis Setting, Sample Rate and Record Length.”
- You can set different zoom rates for Z1 and Z2 (zoomed waveform of two locations).

Zoom Position: Z1Position and Z2Position

- The zoom position can be set by specifying the zoom center position (center of the zoom box) in the range –5 to +5 divisions with the center of the waveform display frame set to 0 divisions. The resolution is as follows:
  Selectable steps of zoom position: T/div × 10 ÷ display record length
- The zoom box enclosed by solid lines is Z1 and the one enclosed by dashed lines is Z2. Since each box is independent, you can set the position separately.

Changing the Range of the Automated Measurement of Waveform Parameters: Fit Meas Range to Z1/Fit Meas Range to Z2

Sets the range of the automated measurement of waveform parameters to the zoom range of Z1 or Z2. This is valid even if the automated measurement of waveform parameters is turned OFF.

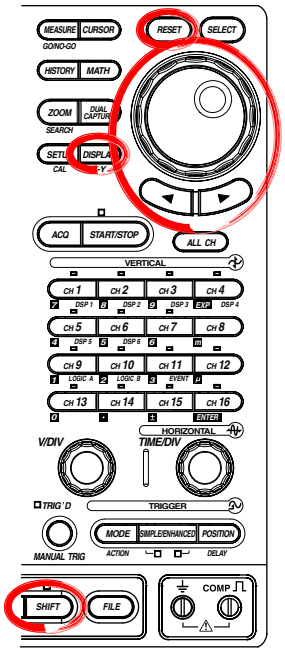
Moving the Zoom Box to the Head Position of Waveform: Z1 to Front/Z2 to Front

Moves the zoom box of Z1 or Z2 to the head position of the main waveform.

8.6 Displaying X-Y Waveforms

<For a description of this function, refer to page 2-40.>

Procedure



1. Press **SHIFT+DISPLAY**. The X-Y menu appears.

Selecting the Display Mode

2. Press the **Mode** soft key. The mode selection menu appears.
3. Press the **T-Y**, **X-Y**, or **T-Y&X-Y** soft key to set the mode.

Setting the Number of Data Points to Be Used for Waveform Display

4. Press the **Decimation** soft key to select the number of points to be used for the display from 2k and 100k.

Selecting the X Axis Mode (When Mode Is Set to X-Y or T-Y&X-Y)

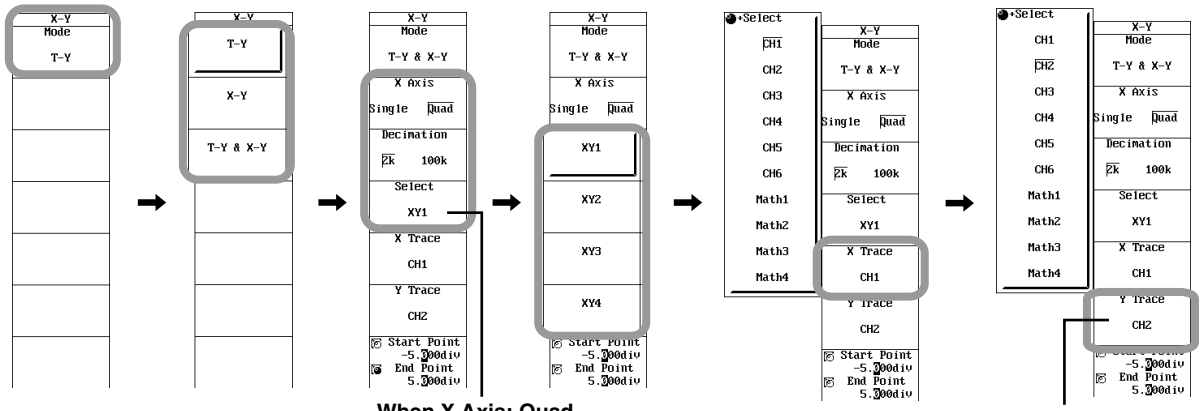
5. Press the **X Axis** soft key to select Single or Quad.
   If you select Single proceed to step 8; if you select Quad proceed to step 6.
6. Press the **Select** soft key. The X-Y waveform selection menu appears.
7. Press the soft key corresponding to the desired X-Y waveform from **XY1** to **XY4**.

Setting the X Axis

8. Press the **X Trace** soft key. The channel selection menu appears.
9. Use the **jog shuttle** and **SELECT** to select the channel to be assigned to the X axis. If you set X Axis to Quad, proceed to step 10.

Setting the Y Axis (When X Axis Is Set to Quad)

10. As with the X axis, press the **Y Trace** soft key to set the Y axis.



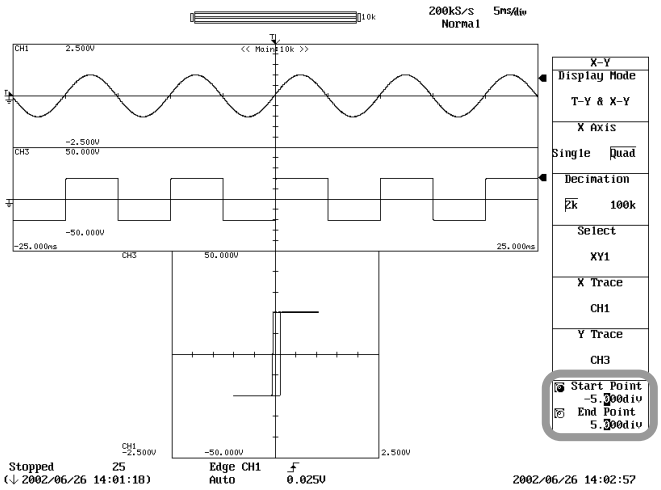
When X Axis: Quad

DSP1 to DSP6 are optional.

When X Axis: Quad

Setting the Display Range

11. Press the **Start Point/End Point** soft key to set the jog shuttle control to Start Point.
12. Turn the **jog shuttle** to set the start point of the X-Y waveform display.
13. Likewise, press the **Start Point/End Point** soft key to set the jog shuttle control to End Point and set the end point of the X-Y waveform display.



Explanation

Selecting the X Axis Mode

Single: The X axis is set to a common trace, and the Y axis displays all the waveforms whose display are turned ON.

Quad: The X axis trace and Y axis trace are set individually for XY1 to XY4.

Assigning X (Horizontal) and Y (Vertical) Axes (When X Axis Is Set to Quad)

The channels that are assigned to the X and Y axes depending on the X-axis mode are as follows:

X Axis Mode	X-Y Waveform	X Axis	Y Axis
Single		CH1 to CH16, DSP1 to DSP6 Math1 to Math8	All channels that are turned ON
Quad	XY1	CH1 to CH8, DSP1 to DSP3 Math1 to Math4	CH1 to CH8, DSP1 to DSP3 Math1 to Math4
	XY2	CH1 to CH8, DSP1to DSP3 Math1 to Math4	CH9 to CH16, DSP4 to DSP6 Math5 to Math8
	XY3	CH9 to CH16, DSP4 to DSP6 Math5 to Math8	CH1 to CH8, DSP1 to DSP3 Math1 to Math4
	XY4	CH9 to CH16, DSP4 to DSP6 Math1 to Math4	CH9 to CH16, DSP4 to DSP6 Math5 to Math8

Number of X-Y Waveforms That Can Be Displayed

The number of X-Y waveforms that can be displayed is 16 for Single and 4 for Quad. The display of each X-Y waveform is turned ON/OFF by turning the Y axis trace display ON/OFF.

Selecting the Display Mode

You can select from the following three display modes.

T-Y&X-Y: The top window displays T-Y (normal) waveforms. The bottom window displays X-Y waveforms.

X-Y: Displays only X-Y waveforms.

T-Y: Displays only T-Y waveforms.

Setting the Number of Data Points to Be Used for Waveform Display: Decimation

Same as “Setting the Number of Data Points to Be Used for Waveform Display” described in section 11.6.
For details, see section 11.6.

Selecting the Display Range of X-Y Waveforms: Start Point/End Point

The X-Y display shows the range selected on the T-Y waveform.
You can set the start (fine dashed line) and end (coarse dashed line) positions in the range –5 to +5 divisions from the center of the waveform display frame. The start and end positions are not displayed if only X-Y waveforms are displayed.
The resolution is as follows:
Resolution: T/div ×10 ÷ display record length

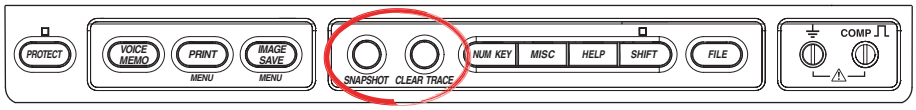
Notes When Displaying X-Y Waveforms

- The divided windows of the T-Y waveform display when using the T-Y & X-Y mode are displayed according to Format in the DISPLAY menu.
- The zoom function applies only to T-Y waveforms. In addition, Main, Z1, or Z2 can be selected for the T-Y waveform display.
- To expand the X-Y waveform, change Upper and Lower settings or V Zoom setting of each channel. The displayed waveform can be enlarged/reduced in a similar fashion.
- To change the display position of the X-Y waveform, change the position of each channel (for voltage input).
- X-Y waveform is not displayed when the horizontal axis of a waveform trace is in units of time and the horizontal axis of another waveform trace is in units of frequency.
- Logic waveforms and event waveforms are not applicable to X-Y waveform display.
- When using the dual capture function, X-Y display and T-Y&X-Y display are not possible.

8.7 Using the Snapshot Function and Clear Trace Function

<For a description of this function, refer to page 2-41.>

Procedure



Snapshot

Press **SNAPSHOT** to take a snapshot of the screen.

Clear Trace

Press **CLEAR TRACE** to clear the waveform.

Explanation

Snapshot

The snapshot function leaves the current displayed waveform on the screen. This function allows the current displayed waveform to remain temporarily on the screen (snapshot waveform) without requiring waveform acquisition to stop. It is useful when you wish to compare waveforms.

You cannot perform the following operations on snapshot waveforms.

- Cursor measurements and automated measurement of waveform parameters
- Zoom and computation
- Position movement
- X-Y waveform display

You can save and load snapshot waveforms.
For details, see section 13.9, “Saving and Loading Waveforms Captured Using Snapshot.”

Clear Trace

Clears all the waveforms that are currently displayed on the screen.
Loaded waveforms are also cleared.
When you restart waveform acquisition, the waveforms in the acquisition memory are cleared.

Note

The data corresponding to the waveforms that have been cleared by executing clear trace remains in the history memory. You can display the waveform again by selecting the desired waveform record using Select Record on the History menu.

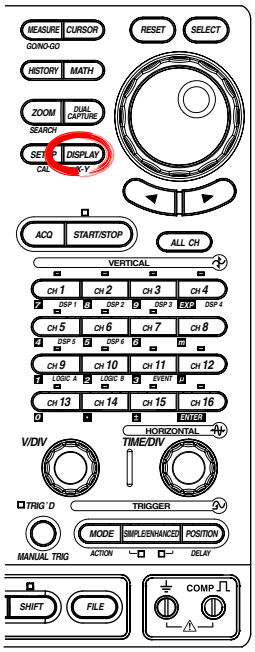
Conditions When SNAP SHOT and CLEAR TRACE Cannot Be Used

- Remote mode using the communication interface
- When printing
- During auto setup
- When Mode is set to Zone in the GO/NO-GO menu

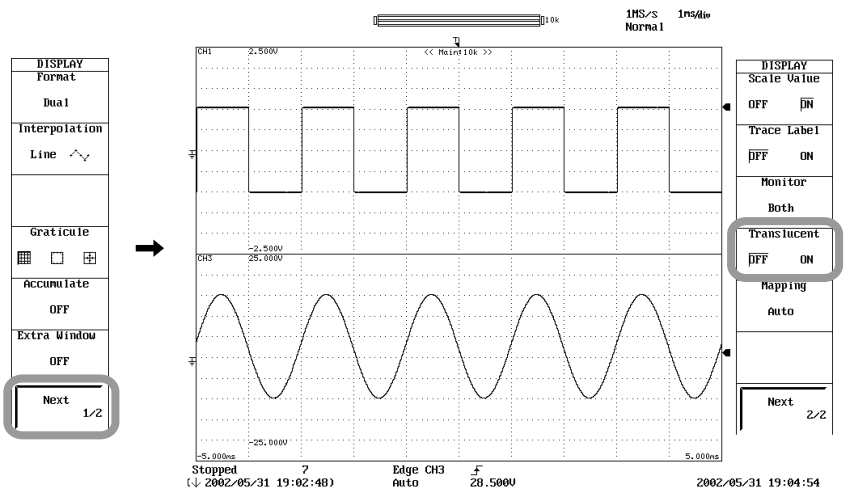
8.8 Turning Translucent Mode ON/OFF

<For a description of this function, refer to page 2-38.>

Procedure



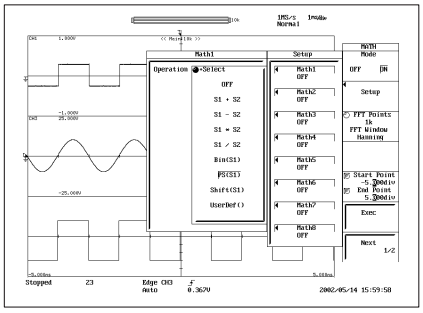
1. Press **DISPLAY**.
2. Press the **Next 1/2** soft key.
3. Press the **Translucent** soft key to select ON or OFF.



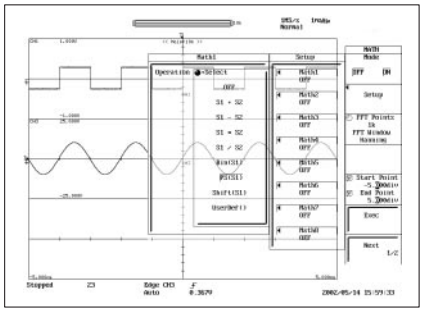
Explanation

When this is turned to ON, the popup menu becomes translucent. The contents underneath the popup menu can be seen.

Translucent: OFF



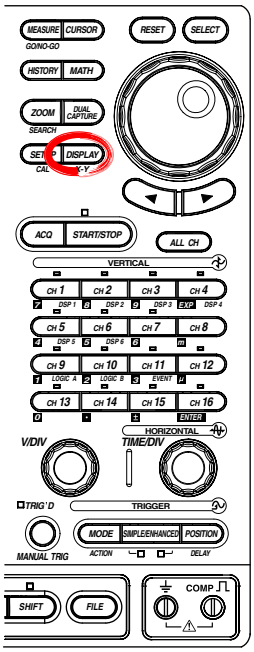
Translucent: ON



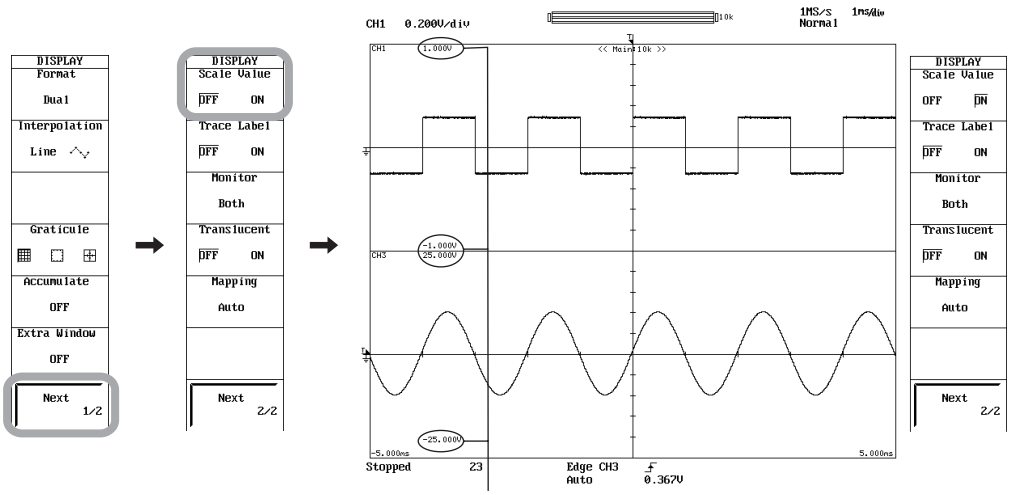
8.9 Turning the Scale Value Display ON/OFF

<For a description of this function, refer to page 2-38.>

Procedure



1. Press **DISPLAY**.
2. Press the **Next 1/2** soft key.
3. Press the **Scale Value** soft key to select ON or OFF.



Scale value

Explanation

You can turn ON/OFF the upper and lower limits of the vertical and horizontal axes of each channel and the scale value display corresponding to the upper and lower limits.

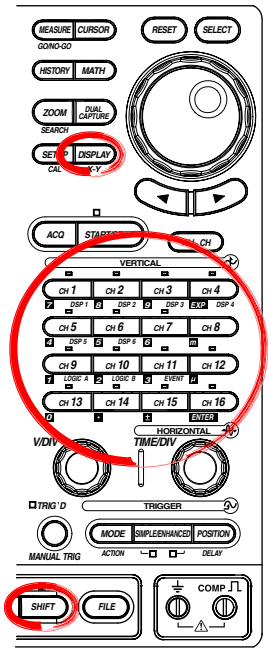
Note

The scale values are displayed to the left of the waveform display area. If the scale values do not fit in the section left of the waveform display area, they are displayed on the right side of the waveform display area.

8.10 Setting Waveform Labels

<For a description of this function, refer to page 2-38.>

Procedure

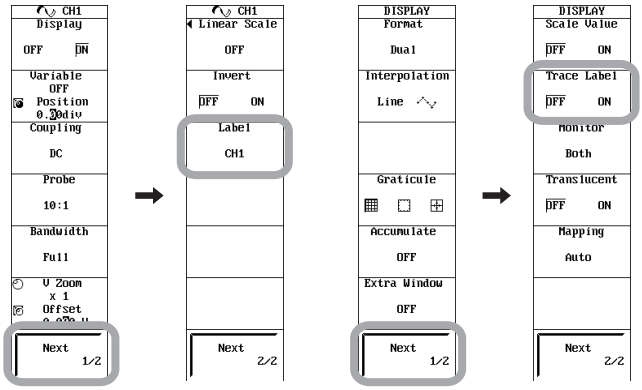


Setting the Waveform Label

1. Press **CH1** to **CH16**, **SHIFT+CH9 (LOGIC A)**, **SHIFT+CH10 (LOGIC B)**, or **SHIFT+CH11 (EVENT)** to select the desired channel. If you select a channel between CH1 and CH16, proceed to step 2; If you select LOGIC A, LOGIC B, or EVENT, proceed to step 3.
2. Press the **Next 1/2** soft key.
3. Press the **Label** soft key to display a keyboard, and enter the waveform label according to the procedure given in section 4.2.

Turning ON/OFF the Waveform Labels

4. Press **DISPLAY**.
5. Press the **Next 1/2** soft key.
6. Press the **Trace Label** soft key to select ON or OFF.



Explanation

Setting the Waveform Label

You can arbitrary set the waveform label of each channel using up to eight characters. The labels are applied to waveform labels, scale values, numeric display, and cursor measurement values. (However, for cursor measurement, only the first 5 characters are displayed.)

Turning ON/OFF the Waveform Labels

You can select whether to display labels corresponding to the displayed waveforms.

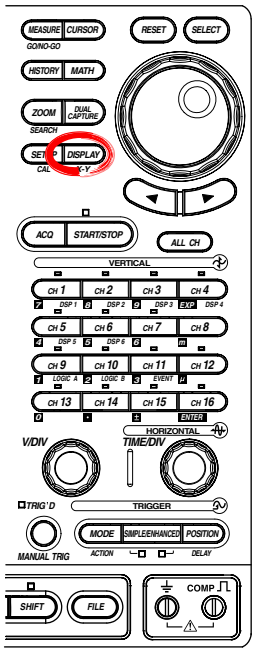
Note

If the waveform display area is small due to the display format setting or zoom format, waveform labels may not be displayed.

8.11 Turning the Extra Window ON/OFF

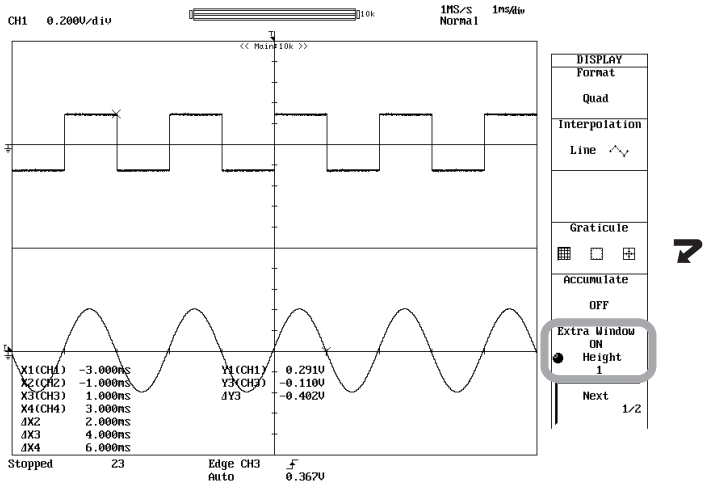
<For a description of this function, refer to page 2-38.>

Procedure

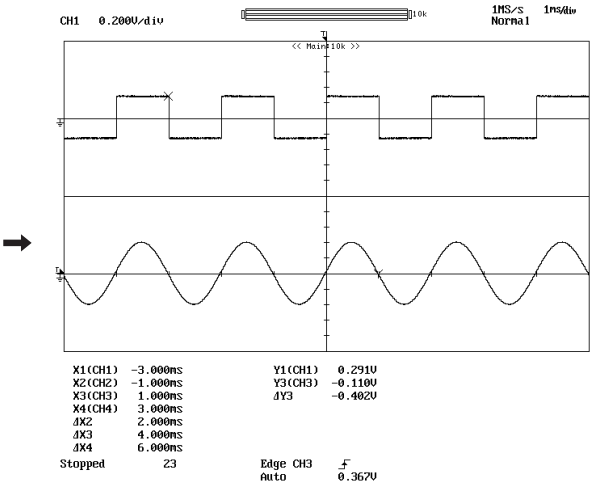


1. Press **DISPLAY**.
2. Press the **Extra Window** soft key. The extra window selection menu appears.
3. Press the ON or OFF soft key.
4. If you select ON, use the **jog shuttle** to set the height of the extra window in the range of 0 to 8.

Extra Window: OFF



Extra Window: ON

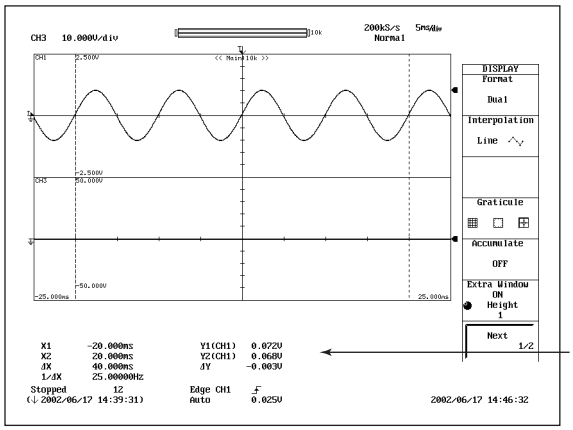


Explanation

An extra window is provided to display information other than waveforms when waveforms obscure the information in the display area. The following three types of information can be displayed in the extra window.

- Cursor measurement values
- Automated measured value of waveform parameters
- Numeric display of each channel (only during roll mode display)

- **Example of Cursor Measurement Values**



Extra window
(Displays cursor measurement values)

Number of Points Displayed Vertically When Extra Window Is ON

When the extra window is turned ON, the vertical axis size of the waveform display window is reduced according to the Height setting. The vertical resolution does not change, but the number of displayed points varies as follows:

Height setting = 8:	384	Height setting = 7:	400
Height setting = 6:	416	Height setting = 5:	432
Height setting = 4:	448	Height setting = 3:	464
Height setting = 2:	480	Height setting = 1:	496
Height setting = 0:	518		

(When the display format is set to Single)

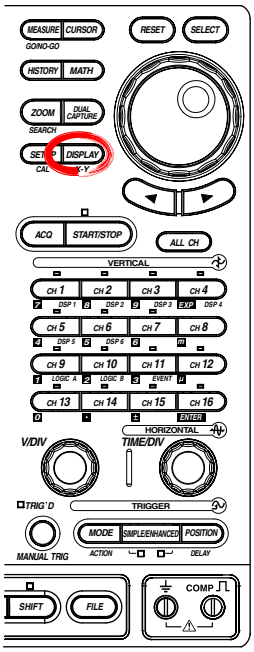
Note

Use of the extra window together with certain zoom formats may cause scale values to overlap making them difficult to be read.

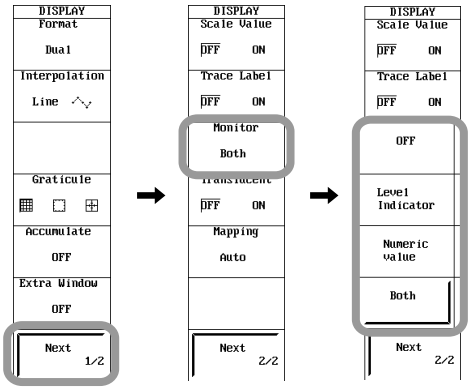
8.12 Turning the Level Indicator and Numeric Value Display ON/OFF

<For a description of this function, refer to page 2-38.>

Procedure



1. Press **DISPLAY**.
2. Press the **Next 1/2** soft key.
3. Press the **Monitor** soft key. The monitor selection menu appears.
4. Press the **Level Indicator** soft key to display the level indicator, the **Numeric Value** soft key to display numeric values, the **Both** soft key to display both, or the **OFF** soft key to display neither.

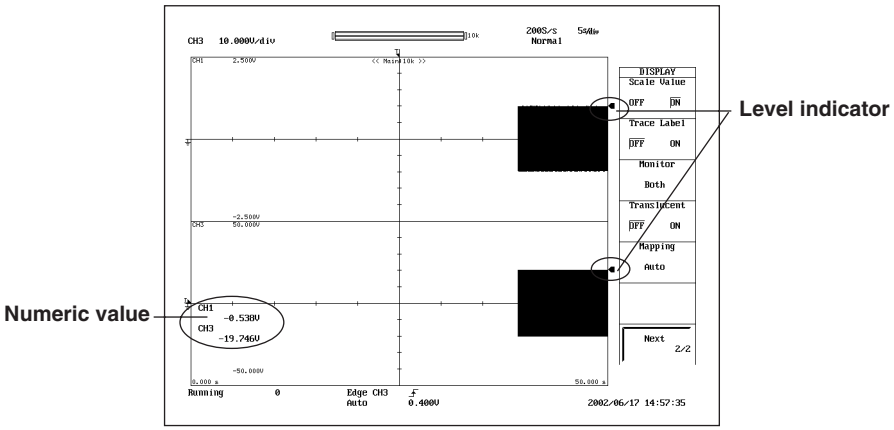


Explanation

Level Indicator and Numeric Values: Monitor

Level indicator: The level of each waveform is displayed using an indicator to the right of the waveform display window.

Numeric value: Displays the measured value of each channel when in roll mode.



Note

- The numerical values are displayed when the time base is set to internal clock and the T/div setting is set slower than 100 ms/div.
- The numerical values are not displayed during the GO/NO-GO determination.

8.13 Displaying Channel Information/Displaying Waveforms on a Full Screen (Expanding the Waveform Area)

<For a description of this function, refer to page 2-39.>

Procedure

Displaying the Channel Information

1. Press **ESC** while the setup menu is displayed. The setup menu displayed on the right side of the screen disappears, and the key information about the channels (CH1 to CH16, DSP1 to DSP6 (option)) whose display is turned ON is displayed.

Displaying the Numeric Monitor

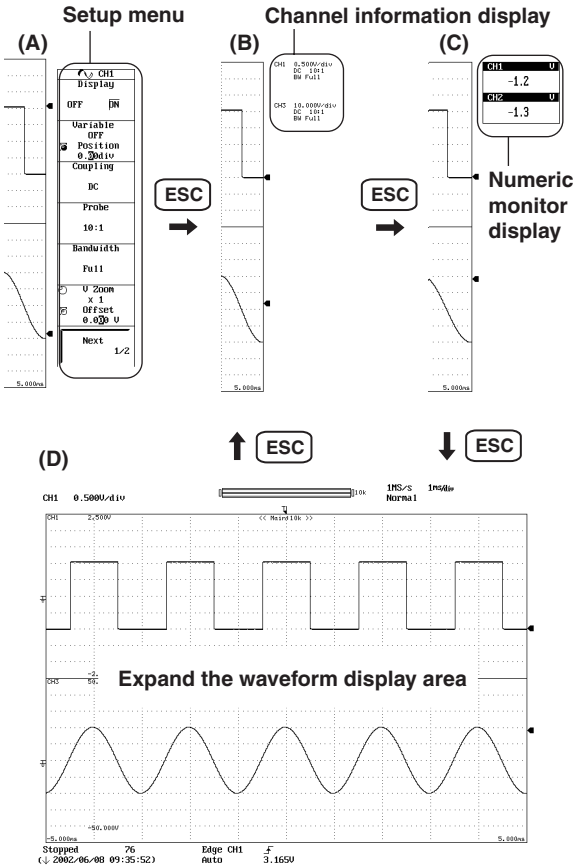
2. Press **ESC** on the screen showing the channel information. The channel information disappears, and the numeric monitor of the channels (CH1 to CH16, LogicA, LogicB, DSP1 to DSP6 (option)) whose display is turned ON is displayed.

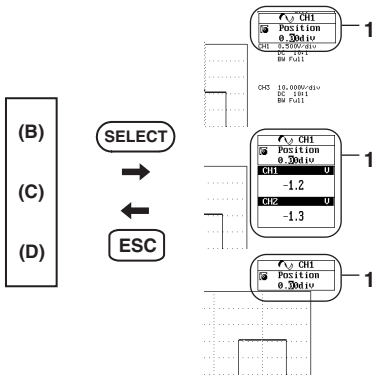
Expanding the Waveform Display Area

3. Press **ESC** on the screen showing the numeric monitor. The numeric monitor disappears and the waveform display area is expanded horizontally.
   If you press **ESC** again, the channel information is displayed.

Displaying the Parameter That Was Controlled by the Jog Shuttle Immediately Before Pressing the ESC Key

4. Press **SELECT** in step 1, 2, or 3. The parameter that was controlled by the jog shuttle immediately before pressing ESC is displayed. To change the setting, operate the jog shuttle in the usual manner.
5. Press **ESC**. The parameter display disappears.





1. If there are two parameters in a single setup menu such as the Z1 Position and Z2 Position settings of the zoom rate (see section 8.5), the parameter controlled by the jog shuttle switches each time you press the SELECT key. The jog shuttle icon (or) is usually white, but it sometimes turns yellow. Yellow indicates that two parameters are selected simultaneously (controlled by the jog shuttle). Taking Z1 Position and Z2 Position as an example, pressing the SELECT key once selects Z1 Position. Pressing the SELECT key again selects Z2 Position. Pressing the SELECT key once more turns the icon yellow and the jog shuttle controls Z1 Position and Z2 Position. If you press the SELECT key yet again, the icon returns to a white color, and the jog shuttle controls only Z1 Position.

Note

- Each time you press the ESC key, the display switches cyclically as follows: channel information display → numeric monitor display → full screen display of waveforms full → channel information display.
- When the DL750/DL750P receives communication commands, the screen switches to channel information display.

Explanation

Displaying the Channel Information

Pressing the ESC key once when the setup menu is displayed shows the channel information. The parameters displayed in the channel information are as follows. However, not all parameters may be displayed when the number of display channels increases.

- When measuring voltage: V/div setting, input coupling, probe attenuation (type), and bandwidth limit.
- When measuring temperature: Temperature/div setting, thermocouple type, and bandwidth limit.
- When measuring strain: μSTR/div (or [mV/V]/div) setting, measurement range, and bandwidth limit.
- When measuring acceleration*: Acceleration/div setting, gain, input coupling, and bias setting.
- When measuring the frequency*: Value/div setting, measurement mode setting, and preset setting.
- For DSP channels: Value/div setting and computing equation.

* Some items may not be displayed depending on the amount of information present.

Displaying the Numeric Monitor

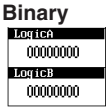
Pressing ESC key once when the channel information is displayed clears the channel information and shows the numeric monitor of the channels (CH1 to CH16, LogicA, LogicB, DSP1 to DSP6 (option)) whose display is turned ON is displayed.
The display update interval of numeric monitor is 1 s.

Note

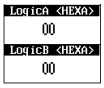
Notation of the Numeric Monitor of Logic Waveforms
The numeric monitor of logic waveforms (Logic A or Logic B) is displayed in binary or hexadecimal notation.
Select the notation by carrying out the following procedure.

Press the CURSOR key > Type soft key > Vertical soft key, press the Logic Setup soft key that appears when Trace is set to All, LogicA, LogicB, or LogicA & LogicB, and set Format to Binary or Hexa. For details, see step 1 to 7 on page 11-18 and “Display Format of Logic Waveforms” on page 11-28.

• Binary



• Hexadecimal



Expanding the Waveform Display Area

Pressing the ESC key once when the channel information is displayed clears the channel information and expands the waveform display area horizontally to cover the entire screen. The waveform display area is expanded at power up.

Displaying the Parameter That Was Controlled by the Jog Shuttle Immediately Before Pressing the ESC Key

The parameter that was controlled by the jog shuttle immediately before can be displayed by pressing the SELECT key when the channel information is displayed or when the waveform display area is expanded. The setting of this parameter can be changed by operating the jog shuttle in the usual manner. To clear the display of the parameter, press the ESC key.

9.1 Loading the Roll Paper into the DL750P Built-in Printer

This section describes how to load the DL750P roll paper. For the procedure to load the DL750 roll paper, see section 12.1.

Printer Roll Paper

Use a dedicated roll paper (for the DL750P) that is provided by YOKOGAWA. Do not use other types of roll paper. When you are using the printer for the first time, use the roll paper that comes with the package. Order extra rolls from your nearest YOKOGAWA dealer.

Part No.: 701966
Specifications: Thermal paper, 20 m
Minimum Q'ty: 6 rolls

Roll Paper Handling

The paper is a Thermal paper that changes color with the application of heat. Note the following:

Storage Precautions

The paper starts changing color at around 70° C. It is affected by heat, humidity, light, and chemicals regardless of whether the paper has been used.

- Store the paper rolls in a cool, dry, and dark place.
- After opening the package, use it quickly.
- If the paper is left in contact with plastic film containing plasticizers (such as a vinyl chloride film or Scotch tape) for an extended time, the paper will lose some of its ability to reproduce color. If you are going to store the paper in a folder, for example, use a folder made of paper stock or polypropylene.
- When using glue on the paper, do not use glue containing organic solvents such as alcohol or ether, as they will change the color of the paper.
- For prolonged storage, we suggest you make copies of results printed on the roll paper. Due to the characteristics of the Thermal paper, the recording section may lose color over time.

Handling Precautions

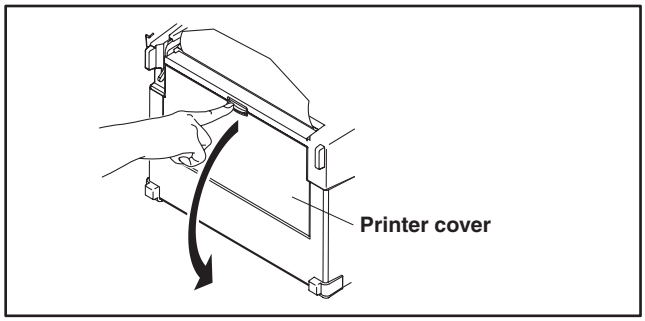
- Be sure to use only genuine paper rolls provided by YOKOGAWA.
- Touching the paper with sweaty hands can leave finger prints or blur the printing.
- Rubbing the surface with a hard object can cause the paper to change color due to the heat caused by friction.
- If chemicals, oil, or other liquids come in contact with the paper, the paper may change color or the printing may fade.

Precautions to Be Taken When Using the Built-in Printer

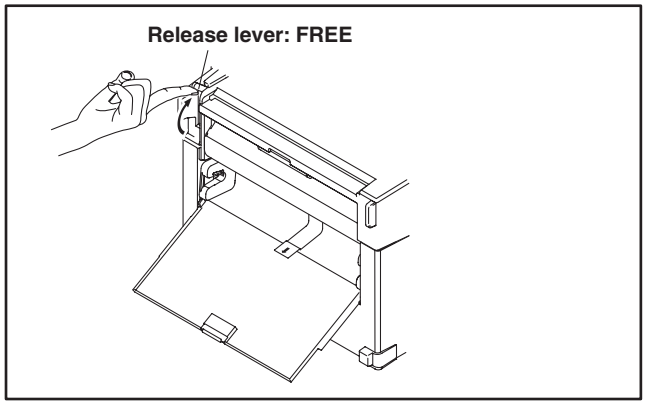
Allow enough space around the output area of the printer. If the roll paper is continuously fed out when the output area is close to a wall, for example, the roll paper that has been delivered may reenter the output area and get entangled.

Procedure

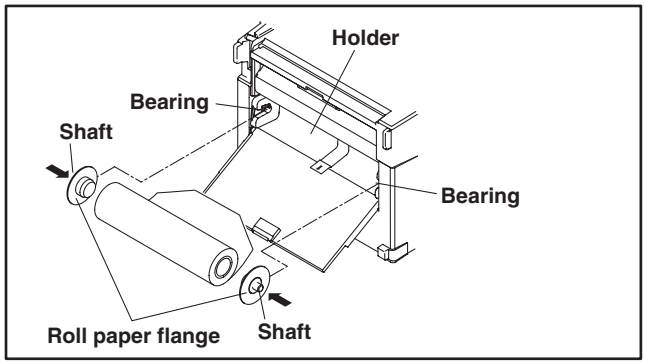
Loading the Roll Paper



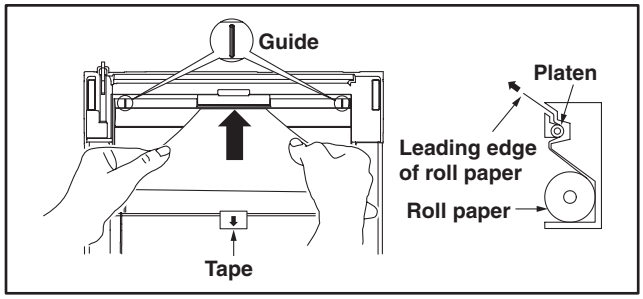
1. While pressing the knob down on the top side of the printer cover, open the printer cover.



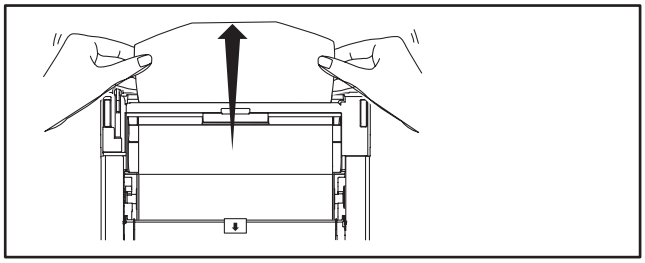
2. Move the release lever at the top left side to the FREE position (up direction).



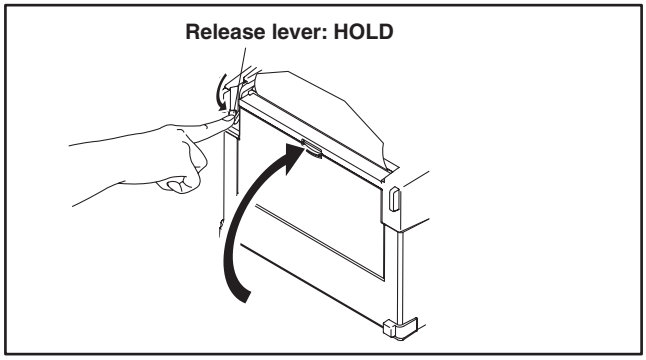
3. Fit the roll paper flange to the left and right edges of the roll paper core.
4. With the leading edge of the roll paper in the back, load the roll paper in the holder by pressing the shaft of the roll paper flange in the holder bearing. Set the direction of the roll paper as shown in the left figure. If the direction is reversed, the printer head does not make contact with the thermal-sensitive surface. If this happens, nothing may be printed, or the paper may not feed properly.



5. Insert the leading edge of the roll paper evenly from the bottom side of the platen, and pass it through so that approximately 2 cm is showing from the top side. Align the roll paper with the left and right guides.
   To remove a roll paper that is already loaded, pull the tape in the direction of the arrow.



6. Pull the roll paper out further to straighten out the paper.



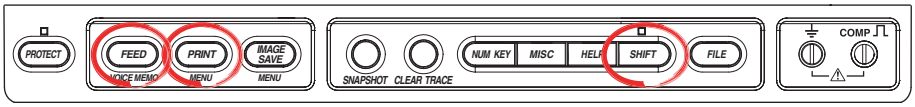
7. Move the release lever to the HOLD position (down direction). The printing will fail with an error message, if the release arm is in the FREE position during operation.
8. Close the printer cover. Push the printer cover down firmly until it clicks into place.

Note

- If you are reusing an old roll paper that had been taken out, the roll paper can be inserted easily by cutting the leading edge at an angle.
- Before closing the printer cover, be sure to set the release arm position to HOLD.
- After loading the roll paper, make sure that the paper is feeding properly according to the steps given below. If the paper is not being fed evenly, continue to feed the paper for approximately 30 cm. The paper will straighten out.

Feeding the Paper

You can feed the paper to check whether the roll paper has been loaded properly or to skip dirty sections.

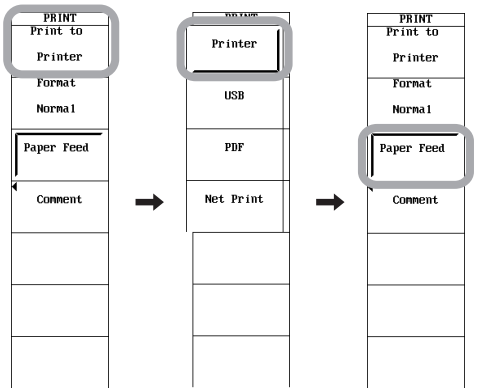


Feeding Paper with the FEED Key

1. Press the **FEED** key. Each time the key is pressed, the paper is fed out by 15 mm.

Feeding Paper from the PRINT Menu

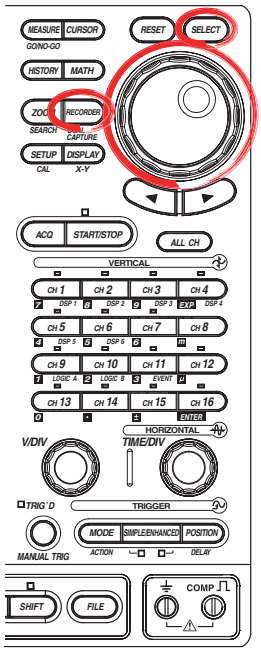
1. Press **SHIFT+PRINT**.
2. Press the **Print to** soft key. The printer selection menu appears. (Net Print appears only when the Ethernet interface option is installed.)
3. Press the **Printer** soft key.
4. Press the **Paper Feed** soft key. Each time the key is pressed, the paper is fed out by 15 mm.



9.2 Selecting the Recorder Mode

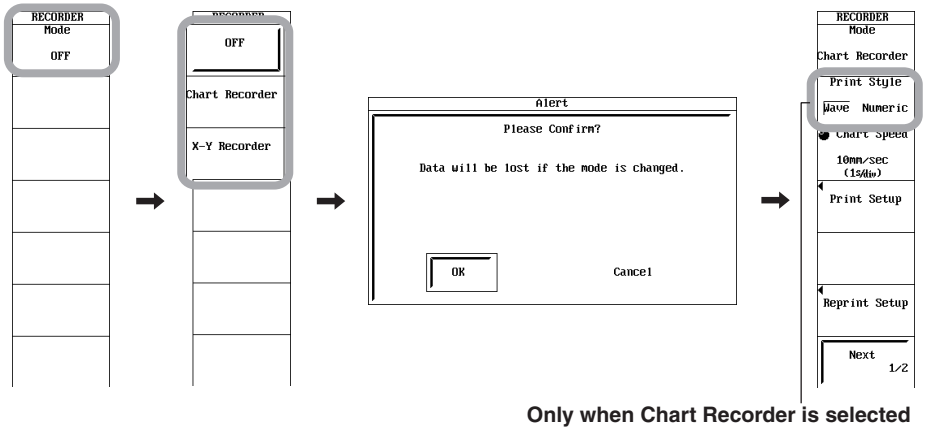
<For a description of this function, refer to page 2-43.>

Procedure



When the recorder mode is changed by following the procedure in this section, the measured data is cleared. Be sure to save data that you need before changing the recorder mode. For the procedure of saving the data, see chapter 13 in the User's Manual Part 2.

1. Press **RECORDER**.
2. Press the **Mode** soft key to display the recorder mode selection menu.
3. Press the **Chart Recorder** or **X-Y Recorder** soft key.
   If the recorder mode is changed to a mode different from the mode up to then or if a recorder mode is selected from the OFF setting, an alert dialog box appears.
4. If an alert dialog box appears, use the **jog shuttle** and **SELECT** to select OK.
   If Chart Recorder is selected, proceed to step 5.
5. Press the **Print Style** soft key to select Wave (recorder T-Y waveforms) or Numeric (record numeric values).



Only when Chart Recorder is selected

Then, configure the respective recorder mode.

When Chart Recorder Is Selected

When Wave (Record T-Y Waveforms) Is Selected

Continue with the procedures described in sections 9.3 to 9.5.

When Numeric (Record Numeric Values) Is Selected

Continue with the procedures described in section 9.6.

When X-Y Recorder Is Selected

Continue with the procedures described in section 9.7.

Explanation

Selecting the Recorder Mode

When recording in recorder mode, first select the recorder mode. There are two recorder modes, Chart Recorder and X-Y Recorder. If Chart Recorder mode is selected, select the print style, Wave (record T-Y waveforms) or Numeric (record numeric values).

Functions That Cannot Be Used during Chart Recorder Mode or X-Y Recorder Mode

The following functions (keys) cannot be used during recorder mode.

- History memory (HISTORY)
- GO/NO-GO determination (GO/NO-GO)
- Dual capture
- Waveform computation (MATH)

Also, items that are set with the ACQ or X-Y key cannot be changed.
Search & zoom (SHIFT+ZOOM (SEARCH)) cannot be used in X-Y Recorder mode.

DL750P Settings in Chart Recorder Mode

If Chart Recorder mode is selected, the DL750P settings change as follows:

Menu	Soft Key	Setting
ACQ	Record Length	Fixed to 2.5 MW
	Mode	Envelope*1
	Time Base	Int
	RealTime Out	OFF
TIME/DIV		Linked to the chart speed*2
X-Y	Mode	T-Y Only
GO/NO-GO	Mode	OFF
MATH	Mode	OFF
DUAL CAPTURE	Mode	OFF
MEASURE	Mode	Statistics and History Statistics set to OFF
DISPLAY	Accumulate	OFF

*1 The acquisition mode can be changed from Envelope to Normal using MISC menu > Others soft key. For details, see section 9.3.
*2 For the procedure of setting the chart speed, see section 9.3.

If the recorder mode is switched from OFF to Chart Recorder mode back to OFF, the ACQ menu items and TIME/DIV setting return to the settings that existed before switching to Chart Recorder mode.

DL750P Settings during X-Y Recorder Mode

If X-Y Recorder mode is selected, the DL750P settings change as follows:

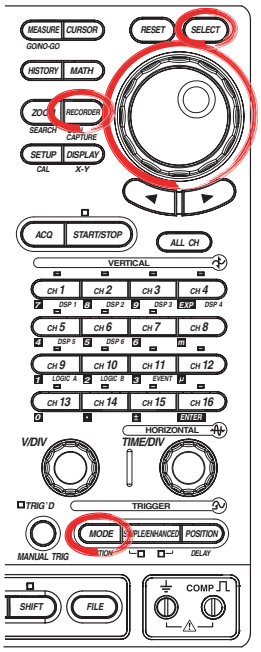
Menu	Soft Key	Setting
ACQ	Record Length	Fixed to 1 MW
(TRIGGER)MODE		Auto

If the recorder mode is switched from OFF to X-Y Recorder mode back to OFF, the ACQ menu items and (TRIGGER) MODE setting return to the settings that existed before switching to X-Y Recorder mode.

9.3 Setting the Record Conditions of T-Y Waveform Recording

<For a description of this function, refer to page 2-43.>

Procedure



Before carrying out the procedure below, set the recorder mode and print style as follows according to the procedures in section 9.2.

- Recorder mode: Chart Recorder
- Print style: Wave (T-Y waveform recording)

Setting the Chart Speed

1. Press the **Chart Speed** soft key.
2. Use the **jog shuttle** to set the chart speed in the range of 10 mm/h to 20 mm/s.

Note

The chart speed can also be set using the TIME/DIV knob.

Setting the Shot Recording

3. Press the **Next 1/2** soft key
4. Press the **Shot Recording** soft key to display a menu used to select the length of the short recording.
5. Press the soft key corresponding to the desired length of the short recording. Select OFF (no shot recording), 20 cm, 50 cm, 1 m, or 2m.

Enabling/Disabling T-Y Recording to the Built-in Printer

6. Press the **Printer Output** soft key to select ON or OFF.

Setting the Trigger Mode

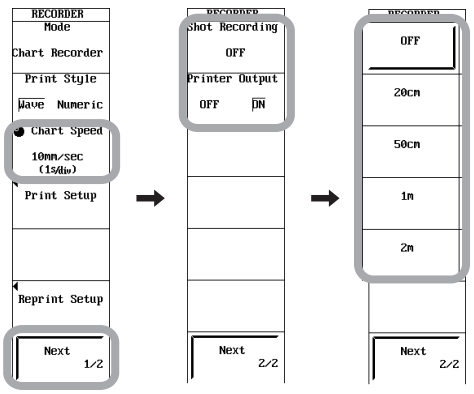
7. Press **MODE**.
8. Press the soft key corresponding to the desired mode to set the trigger mode to Auto, Repeat, Single, or Log.

Setting the Acquisition Mode

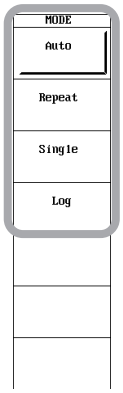
Normally, the acquisition mode in Chart Recorder mode is envelope. If you wish to switch to normal mode, carry out steps 9 to 12 below.

9. Press **MISC**.
10. Press the **Next 1/2** soft key.
11. Press the **Others** soft key.
12. Press the **Chart Recorder Sample** soft key to select Envelope or Normal.

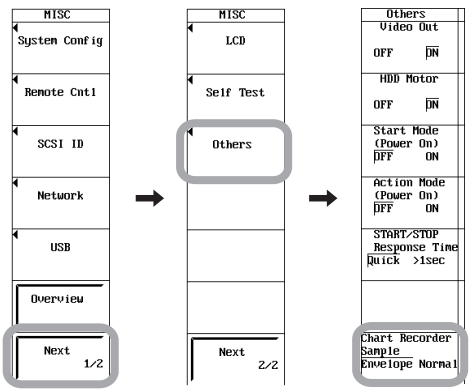
Set the chart speed and enable/disable shot recording and T-Y recording



Set the trigger mode



Set the acquisition mode



Explanation

Chart Speed

For T-Y Recording, the chart speed can be selected from below.
10 mm/h, 20 mm/h, 25 mm/h, 50 mm/h, 100 mm/h, 1 mm/min, 2 mm/min, 5 mm/min, 10 mm/min, 20 mm/min, 25 mm/min, 50 mm/min, 100 mm/min, 1 mm/s, 2 mm/s, 5 mm/s, 10 mm/s, and 20 mm/s

You can set the chart speed using the following two methods.

- Menu that appears by selecting RECORDER menu > Chart Speed soft key
- TIME/DIV knob

The top section of the Chart Speed soft key shows the chart speed. The bottom section shows the horizontal scale (time per division) for T-Y waveform recording.
The chart speed can be changed even while recording is in progress. However, the data saved in the internal memory is cleared.

Shot Recording

When the specified length of data is recorded, the measurement and recording stop.
The length of the shot recording can be selected from OFF (no shot recording), 20 cm, 50 cm, 1 m, or 2 m.

T-Y Recording to the Built-in Printer: Printer Output

Set whether to carry out T-Y recording to the built-in printer. If set to ON, data is recorded on the built-in printer and saved to the internal memory. If set to OFF, data is saved only to the internal memory. The data is not recorded on the built-in printer.

Trigger Mode

In Chart Recorder mode, you can select the trigger mode from Auto, Log, Single, or Repeat.

Auto
Starts recording to the built-in printer simultaneously with the start of the measurement. Recording continues until the measurement is stopped.

Log
Starts recording to the built-in printer simultaneously with the start of the measurement. Measurement and recording stops when the maximum number of divisions (see page 2-45) of measured values that can be saved is recorded.

Single
Starts recording when the trigger conditions are met after the start of the measurement. Measurement and recording stops when the maximum number of divisions (see page 2-45) of measured values that can be saved is recorded.

Repeat
Starts recording when the trigger conditions are met after the start of the measurement. Recording stops when the shot record length of measured values is recorded. Then, the DL750P enters the trigger-wait state. The starting/stopping of the recording is repeated until the measurement is stopped.

For details on the trigger mode in Chart Recorder mode, see page 2-43.

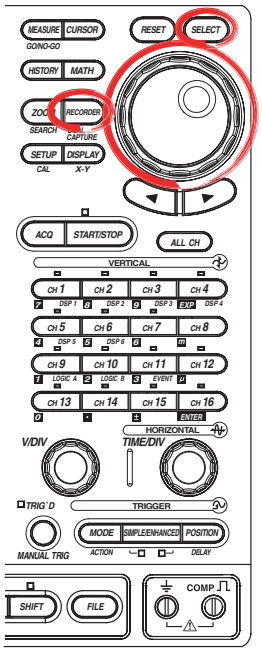
Acquisition Mode

The acquisition mode in Chart Recorder mode is envelope. However, the mode can be changed to normal mode by using the MISC menu > Others menu.
Envelope and normal modes in Chart Recorder mode are the same as those when recorder mode is disabled. For details, see page 2-31.

9.4 Setting the Recording Format of T-Y Waveform Recording

<For a description of this function, refer to page 2-43.>

Procedure



Before carrying out the procedure below, set the recording conditions of T-Y waveform recording according to the procedures in sections 9.2 and 9.3.

1. Press the **Print Setup** soft key to display the print setup dialog box.

Setting the Display (Recording) Format

2. Use the **jog shuttle** and **SELECT** to select Format from Single (1 division) to Hexadecimal (16 divisions).

Note

The display (recording) format setting is linked with the DISPLAY menu > Format setting.

Setting the Extra Area

3. Use the **jog shuttle** and **SELECT** to set **Extra Area** to ON or OFF.

Setting the Flexible Zone

4. Use the **jog shuttle** and **SELECT** to select **Setup** in **Flexible Zone**.
5. Use the **jog shuttle** and **SELECT** to set Mode to OFF or ON.
6. Use the **jog shuttle** and **SELECT** to set Upper/Lower of the waveform to be recorded.

Setting the Graticule

Setting the Graticule

7. Use the **jog shuttle** and **SELECT** to set Type to  , OFF, or  .

Setting Dark/Light

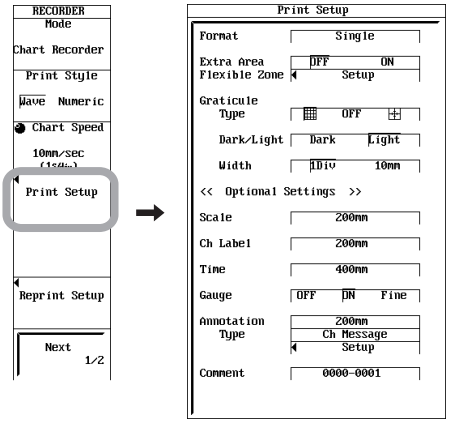
8. Use the **jog shuttle** and **SELECT** to set Dark/Light to Light or Dark.

Setting the Width of the Vertical Scale

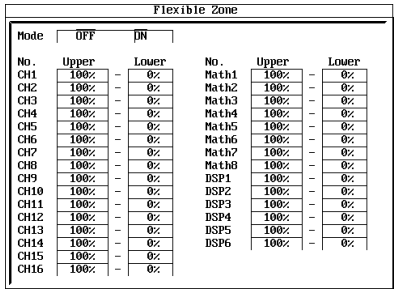
9. Use the **jog shuttle** and **SELECT** to set Width to 1div or 10mm.

Note

The graticule setting is linked with the DISPLAY menu > Graticule setting. However, if OFF is selected, the DISPLAY menu is set to  .



When Setup of Flexible Zone is selected



Setting Details

Setting the Print Interval of Scale Values

10. Use the **jog shuttle** and **SELECT** to set Scale to OFF, 200mm, 400mm, or 800mm.

Setting the Print Interval of Channel Labels

11. Use the **jog shuttle** and **SELECT** to set CH Label to OFF, 200mm, 400mm, or 800mm.

Setting the Print Interval of Time

12. Use the **jog shuttle** and **SELECT** to set Time to OFF, 200mm, 400mm, or 800mm.

Setting the Gauge Print

13. Use the **jog shuttle** and **SELECT** to set Gauge to OFF, ON, or Fine.

Setting the Annotation

14. Use the **jog shuttle** and **SELECT** to set the print interval of annotations in the right column of Annotation to OFF, 200mm, 400mm, or 800mm.
15. Use the **jog shuttle** and **SELECT** to set the type of annotation to be printed in the right column of Type to CH Information, CH Message, or CH Data.
    If CH Message is selected, proceed to step 16.
    If CH Information or CH Data is selected, proceed to step 17.
16. Use the **jog shuttle** and **SELECT** to select Setup. Then, enter the message you wish to print for the channel using up to 80 characters according to the procedure in section 4.2.

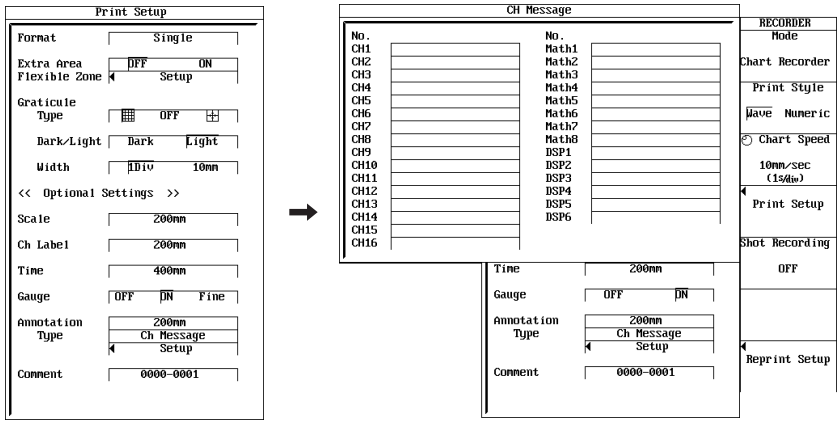
Setting a Comment

17. Use the **jog shuttle** and **SELECT** to select Comment. Then, enter the comment text you wish to print using up to 20 characters according to the procedure in section 4.2.

Note

The comment setting is linked with the PRINT menu > Comment setting.

When Annotation Type is set to CH Message



Explanation

Display Format

Select the number of divisions of the recording area when recording to the built-in printer.

Single:	1 division	Triad:	3 divisions	Octal:	8 divisions
Dual:	2 divisions	Quad:	4 divisions	Hexadecimal:	16 divisions

The display (recording) format setting is linked with the DISPLAY menu > Format setting.

Extra Area

The extra area can be set only when the display (recording) format is set to Single, Dual, Triad, or Quad.

When the Format Is Single

If extra area is turned ON, the top 16 cm of the recording area (20 cm) is used to record waveforms, and the remaining 4 cm is used to record waveform information (extra area). Annotations (see the next page) and logic waveforms are recorded in the extra area. The default setting is OFF.

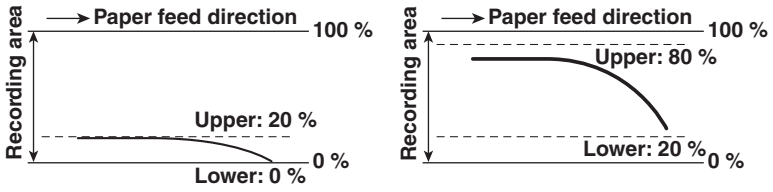
When the Format is Dual, Triad, or Quad

If extra area is turned ON, the area below each of the divided waveform recording area is used to record the waveform information (extra area). If extra area is turned OFF, the extra area between each waveform recording area disappears. The vertical axis of each waveform recording area is adjusted automatically according to the paper size and recorded. The default setting is ON.

Flexible Zone

The flexible zone can be set only when the display (recording) format is Single and the extra area is OFF. The position in the recording area (20 cm) where each waveform is to be recorded is set with Upper and Lower (%). The Upper value can be set in the range of 2% to 100%. The Lower value can be set in the range of 0% to 98%. Each value can be set in 1% steps. The minimum width is 2%.

[Example]
- When Flexible Zone on CH1 is set to Upper = 20% and Lower = 0%
  The CH1 waveform is recorded in the area from the bottom to 4 cm of the recording area.
- When Flexible Zone on CH2 is set to Upper = 80% and Lower = 20%
  The CH2 waveform is recorded in the area from 4 cm to 16 cm from the bottom of the recording area.



Graticule

Type

Select the graticule type from ▦, OFF, or ⊞. The graticule setting is linked with the DISPLAY menu > Graticule setting. However, if OFF is selected, the DISPLAY menu is set to ⬚.

Dark/Light

Set the graticule Dark/Light setting to Light or Dark.

Width of the Vertical Scale: Width

Select how to set the vertical scale width.

1div: Graticule obtained by dividing the recording area into 10 areas

10mm: mm graticule type

Graticule lines that are printed

The format of the scale lines that are printed depending on the selected graticule type and width is given in the table below.

Graticule Width	Graticule Type		
	▦	OFF	⊞
1 div	1 div	No graticule lines	1 div
10 mm	10 mm	No graticule lines	10 mm

Details

Print Interval of Scale Values

Select the interval for the scale values printed at the top and bottom edges of the recording area from OFF, 200 mm, 400 mm, or 800 mm. If OFF is selected, the scale values are not printed.

Print Interval of Channel Labels

Select the interval for printing waveform channel labels from OFF, 200 mm, 400 mm, or 800 mm. The channel label is printed near each waveform. If OFF is selected, the channel labels are not printed.

Time Print

Select the interval for printing the time from OFF, 200 mm, 400 mm, or 800 mm. The time is printed at the top section of the recording area. If OFF is selected, the times are not printed.

Gauge Print

Select whether to not print (OFF), print (ON), or print in detail (Fine) on the right (or left) side of the recording area. If ON is selected a gauge that equally divides the waveform display area into two is displayed. If Fine is selected, a gauge that equally divides the waveform display area into 10 is displayed. In realtime recording, the gauge is printed on the right side of the recording area when the recording is completed. When reprinting waveforms saved to the internal memory (see section 9.8), the gauge is printed on the left side of the recording area when the recording is started. The gauge, scale values, an arrow indicating the ground position, and V/div (Value/div)* are printed.

* Depending on the setting of T-Y Recording, V/div (Value/div) may not be printed.

Annotation

Channel information, channel messages, or measured values are printed. Use Annotation to select the print interval from OFF, 200 mm, 400 mm, and 800 mm. Use Type to select the type of annotation to be printed from CH Information, CH Message, and CH Data.

- **CH Information**
  Prints settings such as V/div, filter, and module.
- **CH Message**
  Prints the character string (up to 80 characters) that is assigned to each channel.
- **CH Data**
  Records the measured values at a given interval using numeric values.

The position where annotations are printed varies depending on the display (recording) format and extra area settings as follows:

- When Format is Single, Dual, Triad, or Quad, and Extra Area is ON
  The annotations are printed in the extra area. Annotations are not printed in the waveform recording area.
- When Format is Single, Dual, Triad, or Quad, and Extra Area is OFF
  The annotations are printed at the bottom section of the waveform recording area.
- When Format is Octal or Hexadecimal
  The annotations are printed between the divided waveform recording areas (between the graticules).

Note

If all of the conditions below are met, only up to 67 characters of CH Message are printed.
Format: Single/Dual/Triad/Quad, Extra Area: OFF, Scale: Other than OFF

Comment

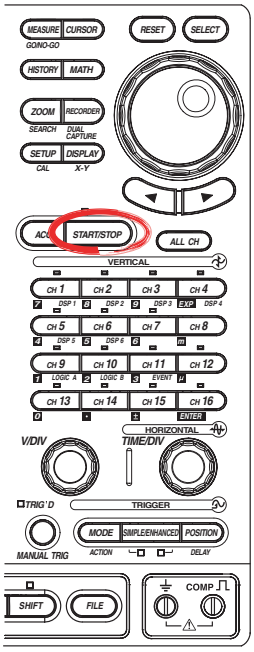
A comment string of up to 20 characters can be printed at the bottom right section.

For a print example on the built-in printer of T-Y recording, see the next section.

9.5 Recording T-Y Waveforms (T-Y Waveform Recording)

<For a description of this function, refer to page 2-43.>

Procedure



Before carrying out the procedure below, set the recording conditions and recording format of T-Y waveform recording according to the procedures in sections 9.2 to 9.4.

Starting/Stopping T-Y Waveform Recording

1. Press **START/STOP** to start the waveform acquisition and T-Y waveform recording.
2. To stop T-Y waveform recording, press **START/STOP** again. Waveform acquisition and T-Y waveform recording stop.

Explanation

Starting/Stopping T-Y Waveform Recording

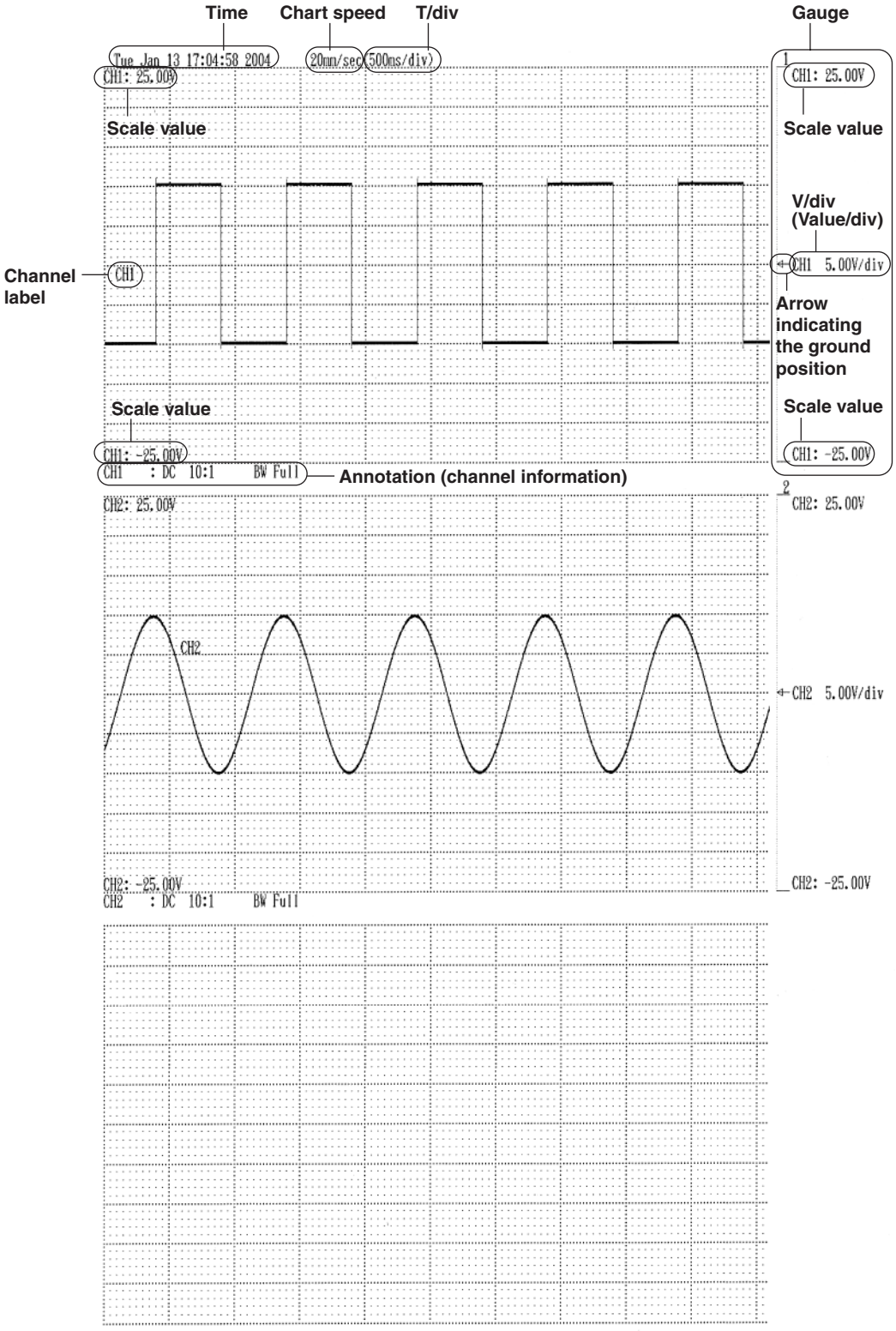
When waveform acquisition is started by pressing the START/STOP key, T-Y waveform recording to the built-in printer also starts. To abort the T-Y waveform recording, press the START/STOP key to stop the waveform acquisition. However, if the T-Y waveform recording to the built-in printer was set to OFF in section 9.4, the data is saved only to the internal memory. T-Y waveform recording to the built-in printer is not performed.

Changing the Settings during T-Y Waveform Recording

- The input conditions can be changed even during T-Y waveform recording. (The recording does not stop.)
- Calibration is not executed during T-Y waveform recording.
- The recording format cannot be changed during T-Y waveform recording.
- The chart speed can be changed even during T-Y waveform recording. (The data after the chart speed is changed is saved to the internal memory.)

Print Example of T-Y Waveform Recording

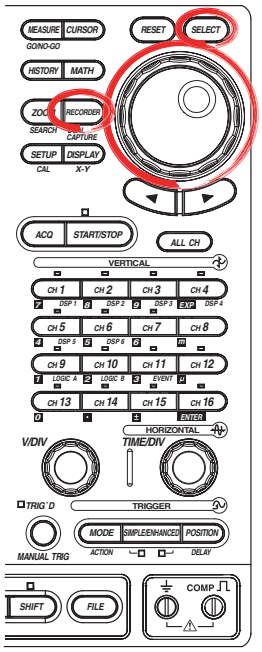
Format: Triad
Graticule Type:
Width: 10 mm



9.6 Recording Numeric Values

<For a description of this function, refer to page 2-43.>

Procedure



Before carrying out the procedure below, set the recorder mode and print style as follows according to the procedures in section 9.2.

- Recorder mode: Chart Recorder
- Print style: Numeric (numeric value recording)

1. Press the **Print Setup** soft key to display the print setup dialog box.

Setting the Output Destination

2. Use the **jog shuttle** and **SELECT** to set Output Device to Chart or File.

Setting the Output Interval

3. Use the **jog shuttle** and **SELECT** to set Interval to 1s or 60min.

If Chart is selected step 2, proceed to step 4.

If File is selected step 2, proceed to step 5.

Setting the Print Direction (If Chart Is Selected in Step 2)

4. Use the **jog shuttle** and **SELECT** to set Direction to Normal (the newest data is at the top of the paper) or Rotation (the oldest data is at the top of the paper). Proceed to step 8.

Setting the Output File (If File Is Selected in Step 2)

Setting Auto Naming

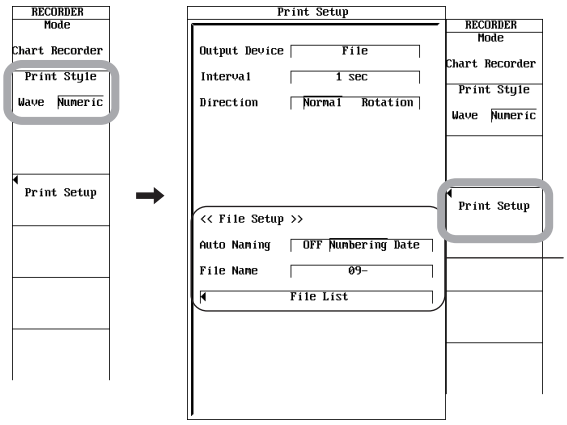
5. Use the **jog shuttle** and **SELECT** to select Auto Naming from OFF, Numbering, and Date.

Setting the File Name

6. Use the **jog shuttle** and **SELECT** to select File Name. Then, enter the file name using up to 16 characters according to the procedure in section 4.2.

Selecting the File Output Destination

7. Use the **jog shuttle** and **SELECT** to select File List. Then, select the file output destination according to steps 14 to 17 in section 13.7. Proceed to step 8.



Note

Up to 10000 lines are output to the file. When 10000 lines are exceeded, writing stops. However, the measurement continues.

Setting the Trigger Mode

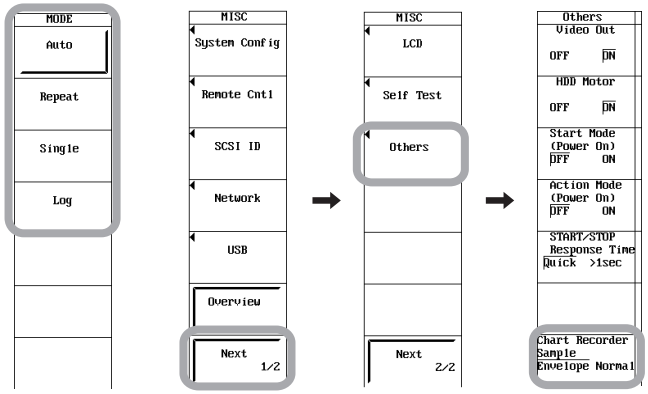
8. Press **MODE**.
9. Press the soft key corresponding to the desired mode to set the trigger mode to Auto or Log.

Setting the Acquisition Mode

Normally, the acquisition mode in Chart Recorder mode is envelope. If you wish to switch to normal mode, carry out steps 10 to 13 below.

10. Press **MISC**.
11. Press the **Next 1/2** soft key
12. Press the **Others** soft key.
13. Press the **Chart Recorder Sample** soft key to set the acquisition mode in Chart Recorder mode to Envelope or Normal.

Set the trigger mode **Set the acquisition mode**



Starting/Stopping the Numeric Value Recording

14. Press **START/STOP**. The waveform acquisition starts, and chart recording with numeric values also starts.
15. To stop chart recording with numeric values, press **START/STOP** again. The waveform acquisition stops, and chart recording with numeric values also stops.

Explanation

Output Device

To record numeric values on the built-in printer, select Chart. To save numeric values to a file on a specified storage medium, select File.

Output Interval: Interval

Select 1 s, 2 s, 5 s, 10 s, 15 s, 20 s, 30 s, 1 min, 2 min, 5 min, 10 min, 15 min, 20 min, 30 min, or 60 min.

Print Direction: Direction

If the output destination is set to Chart, set the print direction to Normal (the newest data is at the top of the paper) or Rotation (the oldest data is at the top of the paper).

Output File: File Setup

If the output destination is set to File, set the output file (auto naming, file name, and file output destination). These settings are the same as those of normal files. For details, see section 13.7.

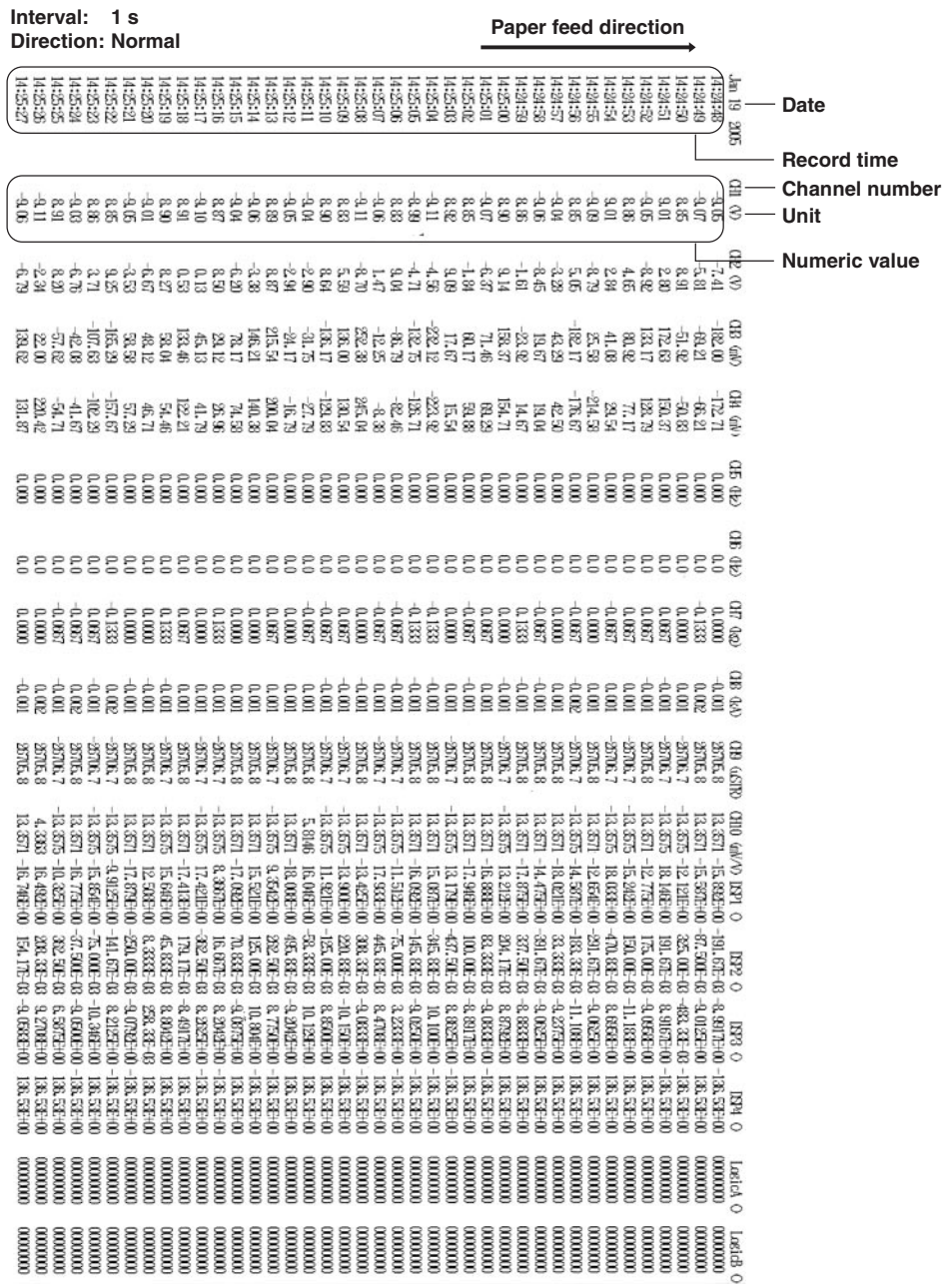
Trigger Mode

In Chart Recorder mode, you can select the trigger mode from Auto or Log. This is the same as the trigger mode of T-Y recording. For details, see page 2-43 and section 9.3.

Acquisition Mode

The acquisition mode in Chart Recorder mode is envelope. However, the mode can be changed to normal mode by using the MISC menu > Others menu.
Envelope and normal modes in Chart Recorder mode are the same as those when recorder mode is disabled. For details, see page 2-31.

Print Example of Numeric Value Recording



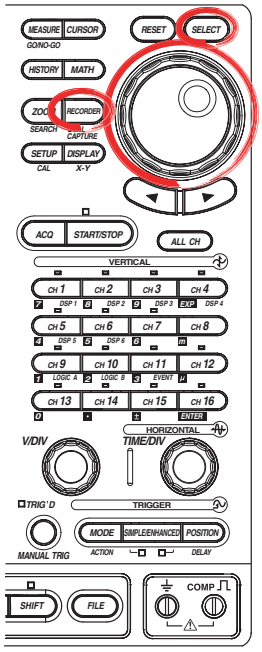
Note

- If the output destination is set to File, measurement does not start when the power is turned ON even if the waveform acquisition mode at power ON (see section 7.1) is turned ON.
- The print timing may deviate from the specified output interval.

9.7 Recording X-Y Waveforms (X-Y Waveform Recording)

<For a description of this function, refer to page 2-46.>

Procedure



Before carrying out the procedure below, set the recorder mode as follows according to the procedures in section 9.2.
Recorder mode: X-Y Recorder

Setting the Sample Rate

1. Press the **Sample Rate** soft key.
2. Use the **jog shuttle** to set the sample rate in the range of 5 S/s to 5 kS/s.

Setting the Interpolation Method

3. Press the **Interpolation** soft key to display the interpolation selection menu.
4. Press the soft key corresponding to the desired interpolation method, **OFF** or **Line**.

Setting Auto Print

5. Use the **jog shuttle** and **SELECT** to set **Auto Print** to ON or OFF. If ON is selected, X-Y waveform recording on the built-in printer starts automatically when waveform acquisition stops.

Selecting the X-Y Waveform to Be Recorded (Displayed)

6. Press the **Print Setup** soft key to display the print setup dialog box.
7. Use the **jog shuttle** and **SELECT** to select the X-Y waveform to be recorded (displayed) in the range of XY1 to XY4.

Setting the Graticule

Setting the Graticule

8. Use the **jog shuttle** and **SELECT** to set Type to ▦, OFF, or ⊞.

Setting Dark/Light

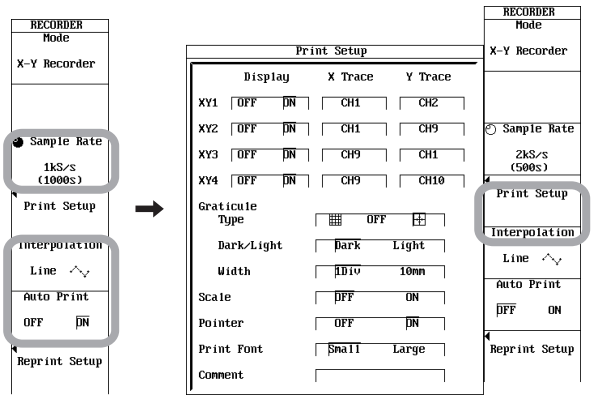
9. Use the **jog shuttle** and **SELECT** to set Dark/Light to Light or Dark.

Setting the Width of the Vertical Scale

10. Use the **jog shuttle** and **SELECT** to set Width to 1div or 10mm.

Note

The graticule setting is linked with the DISPLAY menu > Graticule setting. However, if OFF is selected, the DISPLAY menu is set to ⬚.



Setting Whether to Print the Scale

11. Use the **jog shuttle** and **SELECT** to set Scale to OFF or ON.

Setting the Pointer

12. Use the **jog shuttle** and **SELECT** to set Pointer to ON or OFF. If ON is selected, a pointer indicating the most recent recording position appears on the screen.

Setting the Font Size

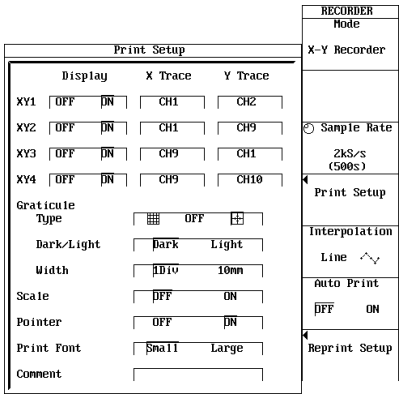
13. Use the **jog shuttle** and **SELECT** to set Print Font to Small or Large.

Setting Comments

14. Use the **jog shuttle** and **SELECT** to select Comment. Then, enter the comment text you wish to print using up to 20 characters according to the procedure in section 4.2.

Note

- The comment setting is linked with the PRINT menu > Comment setting.
- The pointer is not printed during X-Y waveform recording.



Starting/Stopping X-Y Waveform Recording

15. Press **START/STOP**. The waveform acquisitions starts, and the screen shows the X-Y waveform.
16. Press **START/STOP**. The waveform acquisition stops.
    If auto print is turned ON in step 4, the X-Y waveform recording starts when the data acquisition stops.

Note

Use the Reprint Setup menu (see section 9.8) to execute X-Y waveform recording when auto print is turned OFF.

Explanation

Sample Rate

Select the sample rate from the following.
5 S/s, 10 S/s, 20 S/s, 50 S/s, 100 S/s, 200 S/s, 500 S/s, 1 kS/s, 2 kS/s, and 5 kS/s

Interpolation

Set the interpolation format to OFF or Line. For details on the interpolation method, see section 8.2.

Auto Print

Select whether to automatically perform X-Y waveform recording (printing) on the built-in printer when waveform acquisition is stopped.

Selecting the X-Y Waveform to Be Recorded (Displayed)

Select the X-Y waveform to be recorded (displayed) in the range of XY1 to XY4.

Graticule

Type

Select the graticule type from  , OFF, or  .
The graticule setting is linked with the DISPLAY menu > Graticule setting. However, if OFF is selected, the DISPLAY menu is set to  .

Dark/Light

Set the graticule Dark/Light setting to Light or Dark.

Scale Width of the X- and Y-Axes: Width

Select how to set the scale width of the X- and Y-axes. For details on the format of the scale lines that are printed, see page 9-10.
1div: Graticule obtained by dividing the recording area into 10 areas
10mm: mm graticule type

Scale Printing

Select whether to print the scale.

Pointer

Select whether to display the pointer that indicates the most recent recording position on the screen.
The pointer is only displayed on the screen; it is not printed during X-Y waveform recording.

Font Size: Print Font

Select the size of the printed characters to small or large. The setting applies to all printed characters.

Comment

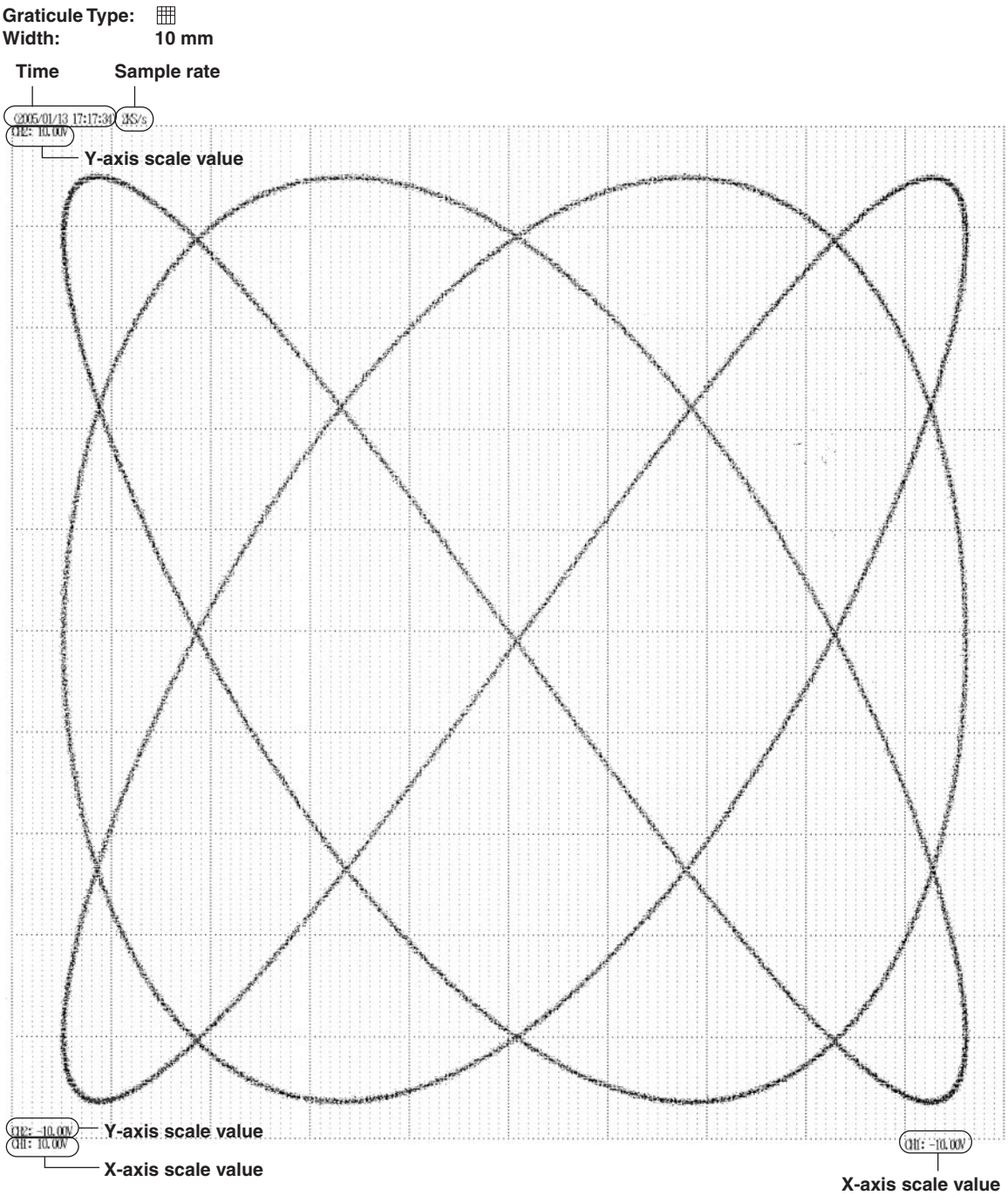
A comment string of up to 20 characters can be printed at the bottom right section.

Starting/Stopping X-Y Waveform Recording

When the START/STOP key is pressed, the waveform acquisitions starts, and the screen shows the X-Y waveform. Pressing the START/STOP key again stops the waveform acquisition.
If auto print is turned ON, the X-Y waveform recording on the built-in printer starts when the data acquisition stops. The waveform that is acquired between start and stop is recorded.
The Reprint Setup menu (see section 9.8) can be used to execute X-Y waveform recording on the built-in printer when auto print is turned OFF.
The most recent 1 MW of data that are acquired during X-Y waveform recording are saved to the internal memory of the DL750P. The data can be analyzed using automated measurement of waveform parameters* (see section 11.6), cursor measurements (excluding the marker cursor. See section 11.5), etc. The data can also be saved to a storage medium.

* Area computation on the X-Y waveform is performed only on XY1.

Print Example of X-Y Waveform Recording

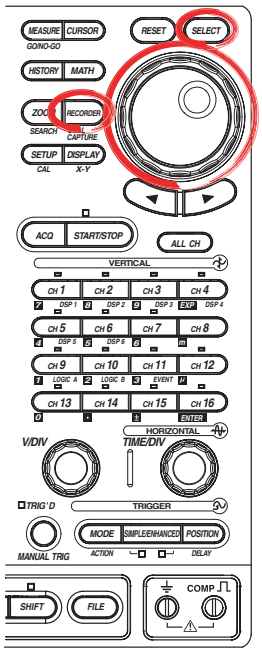


9.8 Reprinting on the Built-in Printer

<For a description of this function, refer to page 2-46.>

Procedure

Reprinting the Waveform Recorded in Chart Recorder Mode (T-Y Recording)



Before carrying out the procedure below, record the T-Y waveform in Chart Recorder mode according to the procedures in sections 9.2 and 9.5.

1. Press the **Reprint Setup** soft key.

Setting the Print Destination

2. Press the **Print to** soft key to display the menu used to select the print destination.
3. Press the **Printer** soft key.

Selecting the Print Length

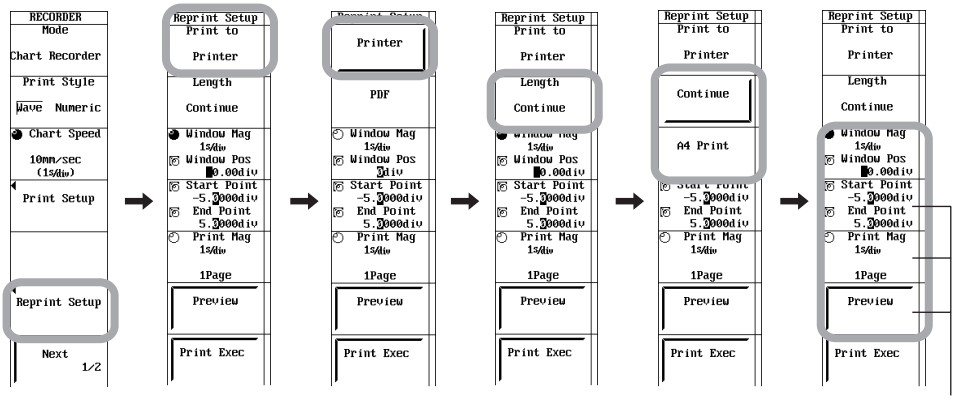
4. Press the **Length** soft key to display the menu used to select the print length.
5. Press the **Continue** or **A4 Print** soft key.

Selecting the Section to Be Reprinted

6. Press the **Window Mag/Window Pos** soft key to select Window Mag.
7. Use the **jog shuttle** and **SELECT** to set the zoom rate. You can reduce the zoom rate to redisplay the waveform that had been cleared from the screen.
8. Press the **Window Mag/Window Pos** soft key to select Window Pos.
9. Use the **jog shuttle** and **SELECT** to set the zoom position. You can move the zoom position to redisplay the waveform that had been cleared from the screen.
10. If Continue was selected in step 5, press the **Start Point/End Point** soft key.
11. Use the **jog shuttle** and **SELECT** to set the start and end points of the section to be reprinted.

Setting the Print Magnification (Only If Continue Is Selected in Step 5)

12. Press the **Print Mag** soft key.
13. Use the **jog shuttle** to set the magnification of the section to be reprinted that was selected in steps 6 to 11. The top section of the menu shows the magnification; the bottom section shows the number of pages when the waveform is recorded using the magnification indicated in the top section.



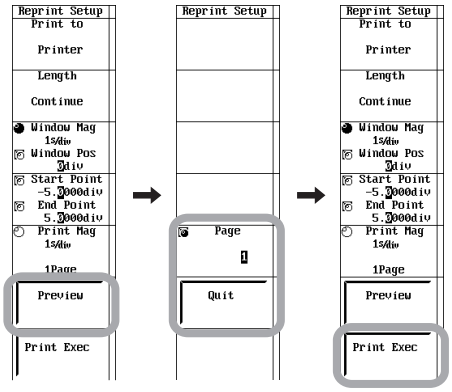
Start Point/End Point, Print Mag, and Preview are displayed only when Length is set to Continue.

Displaying the Preview (Only If Continue Is Selected in Step 5)

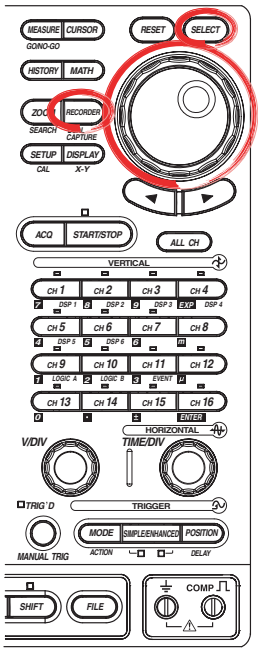
14. Press the **Preview** soft key.
15. Use the **jog shuttle** to select the page you wish to preview.
16. Press the **Quit** soft key. The preview display closes.

Executing the Reprint Operation

17. Press the **Print Exec** soft key. Reprint is executed using the conditions set in steps 6 to 13.



Reprinting the Waveform Recorded in X-Y Recorder Mode

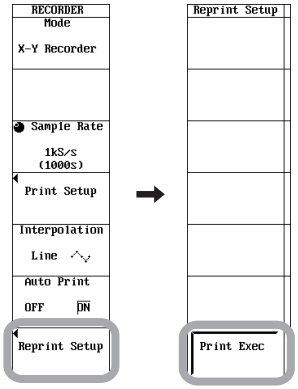


Before carrying out the procedure below, record the X-Y waveform in X-Y Recorder mode according to the procedures in sections 9.2 and 9.7.

1. Press the **Reprint Setup** soft key.

Executing the Reprint Operation

2. Press the **Print Exec** soft key.



Explanation

The measured data of the T-Y waveform recorded in Chart Recorder mode or the measured data of the X-Y waveform recorded in X-Y Recorder mode is stored in the internal memory.

Reprinting the Waveform Recorded in Chart Recorder Mode (T-Y Waveform Recording)

Print to

To reprint the waveform recorded in Chart Recorder mode (T-Y waveform recording), set the print destination to Printer (built-in printer).

Length

Continue: Prints the range specified by Window Mag/Window Pos and Start Point/End Point using the magnification specified by Print Mag.

A4 Print: Prints the range specified by Window Mag/Window Pos and Start Point/End Point to A4 size. The magnification changes automatically so that the specified print range fits on an A4 size paper.

Selecting the Section to Be Reprinted

Zoom Rate/Zoom Position: Window Mag/Window Pos

When selecting the section to be reprinted, Window Mag is used to reduce the zoom rate in order to redisplay the waveform that has been cleared from the screen. You can also move Window Pos to redisplay the waveform that had been cleared from the screen.

Start Point/End Point

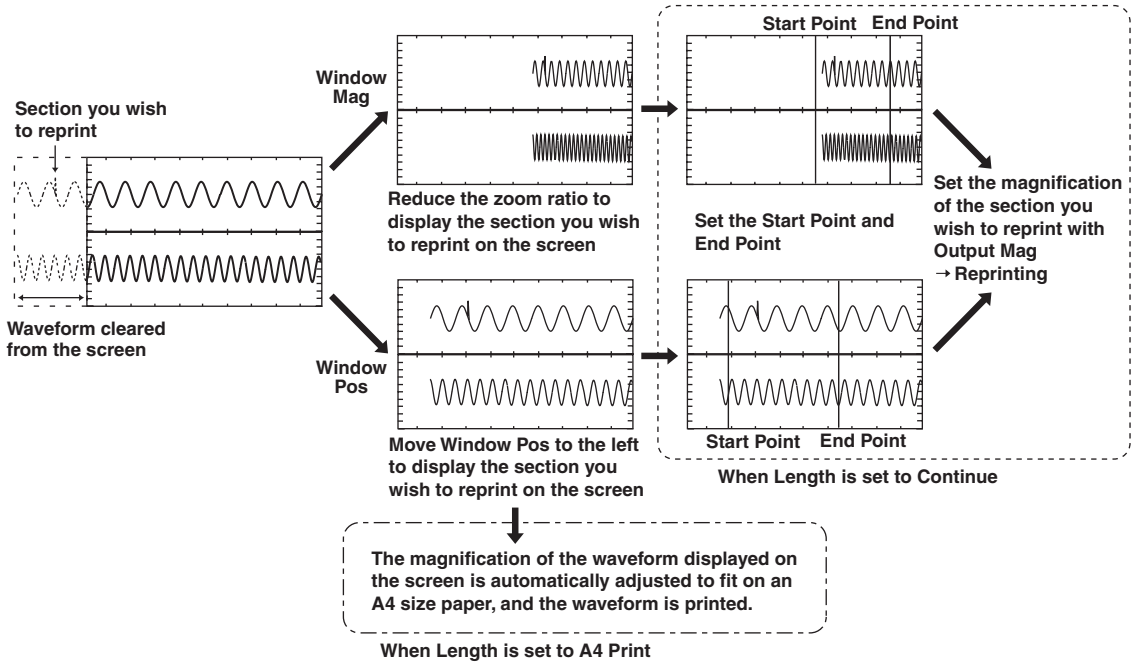
If Length is set to Continue, display the section to be reprinted on screen, and then use Start Point and End Point to set the start and end points.

After displaying the section to be reprinted on screen, use Start Point and End Point to set the start and end points.

Print Magnification: Print Mag

Set Print Mag on when Length is set to Continue.

Set the waveform magnification for reprinting. The top section of the menu shows the magnification; the bottom section shows the number of pages when the waveform is recorded using the magnification indicated in the top section.



Preview

Displays a preview of the section that you wish to reprint. Press the Quit soft key to close the preview display.

Executing the Reprint Operation: Print Exec

Reprint is executed using the specified conditions.

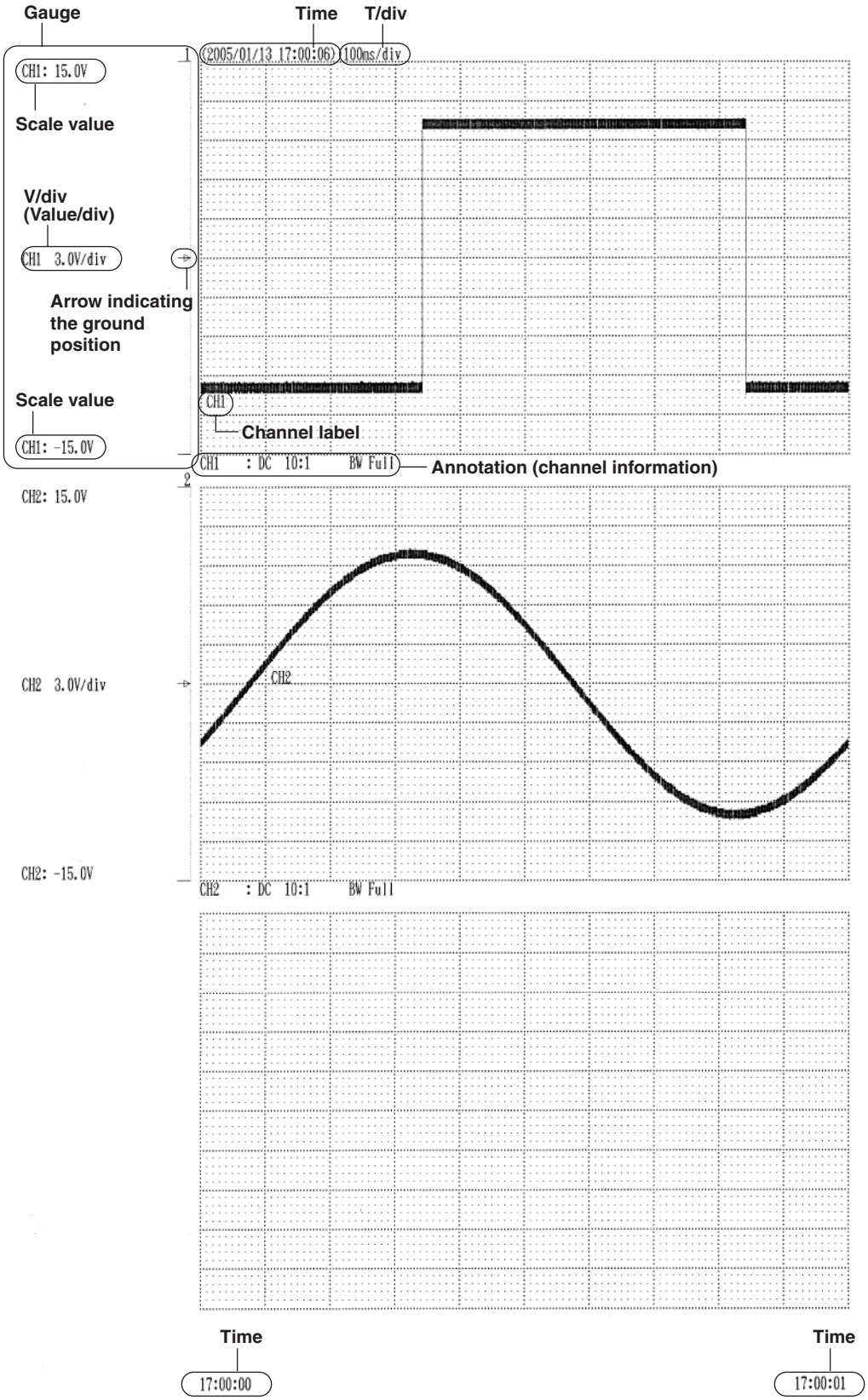
Reprinting the Waveform Recorded in X-Y Recorder Mode (X-Y Waveform Recording)

Executing the Reprint Operation: Print Exec

The measured data recorded to the internal memory immediately before in X-Y Recorder mode is reprinted as a waveform.

Reprint Example of T-Y Waveform Recording

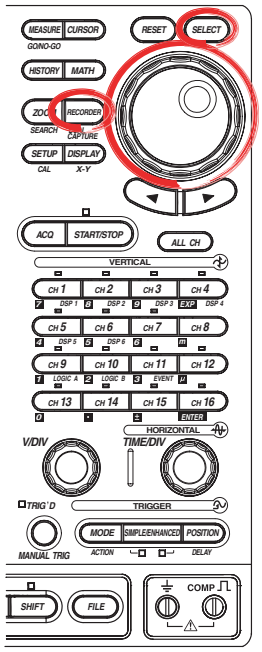
Format: Triad
Graticule Type:
Width: 10 mm



9.9 Creating a PDF File of the Reprint Image

<For a description of this function, refer to page 2-46.>

Procedure



Before carrying out the procedure below, record the T-Y waveform in Chart Recorder mode according to the procedures in sections 9.2 and 9.5, or record the X-Y waveform in X-Y Recorder mode according to the procedures in section 9.7.

1. Press the **Reprint Setup** soft key.

Setting the Print Destination

2. Press the **Print to** soft key to display the menu used to select the print destination.
3. Press the **PDF** soft key.
   In Chart Recorder mode, proceed to step 4.
   In X-Y Recorder mode, proceed to step 12.

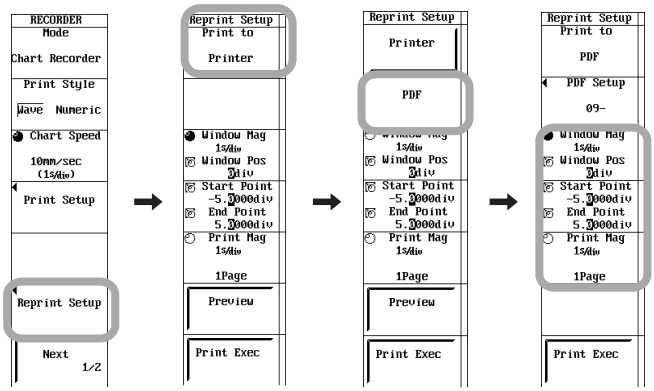
Selecting the Section to Be Output to the PDF File (Only When the Chart Recorder Mode

4. Press the **Window Mag/Window Pos** soft key to select Window Mag.
5. Use the **jog shuttle** and **SELECT** to set the zoom rate. You can reduce the zoom rate to redisplay the waveform that had been cleared from the screen.
6. Press the **Window Mag/Window Pos** soft key to select Window Pos.
7. Use the **jog shuttle** and **SELECT** to set the zoom position. You can move the zoom position to redisplay the waveform that had been cleared from the screen.
8. Press the **Start Point/End Point** soft key.
9. Use the **jog shuttle** and **SELECT** to set the start and end points of the section to be output to the PDF file.

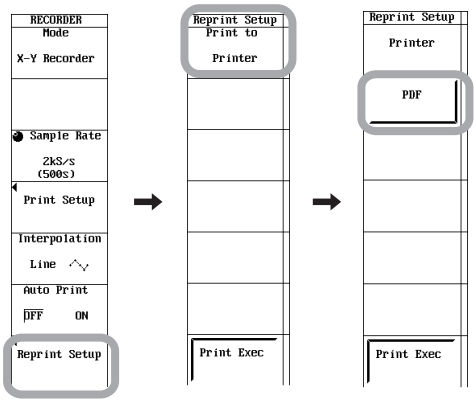
Setting the Print Magnification (Only When the Chart Recorder Mode)

10. Press the **Print Mag** soft key.
11. Use the **jog shuttle** to set the magnification of the section to be output to the PDF file that was selected in steps 4 to 9. The top section of the menu shows the magnification; the bottom section shows the number of pages when the waveform is recorded using the magnification indicated in the top section.

When the Chart Recorder Mode



When the X-Y Recorder Mode



Setting the PDF File

12. Press the **PDF Setup** soft key to display the PDF setup dialog box.

Setting the Paper Size

13. Use the **jog shuttle** and **SELECT** to set Paper Size to Built-in Printer, A3, A4, or A5.

Setting the Orientation (If A3, A4, or A5 was selected in step 13)

14. Use the **jog shuttle** and **SELECT** to set Orientation to Landscape or Portrait.

Setting the Number of Divisions per Page (If A3, A4, or A5 was selected in step 13 (Only When the Chart Recorder Mode))

15. Use the **jog shuttle** and **SELECT** to set Div/Page.

Setting Document Information

16. Use the **jog shuttle** and **SELECT** to select Title, Author, Sub Title, or KeyWord. Enter the title, author, sub title of the PDF file using up to 30 characters and the keyword using up to 90 characters according to the procedure given in section 4.2.

Setting the Color

17. Use the **jog shuttle** and **SELECT** to set Color to OFF or ON.

Enabling/Disabling Compression

18. Use the **jog shuttle** and **SELECT** to set Compression to ON or OFF.

Setting Auto Naming

19. Use the **jog shuttle** and **SELECT** to select Auto Naming from OFF, Numbering, and Date.

Setting the PDF File Name

20. Use the **jog shuttle** and **SELECT** to select File Name. Then, enter the file name using up to 16 characters according to the procedure in section 4.2.

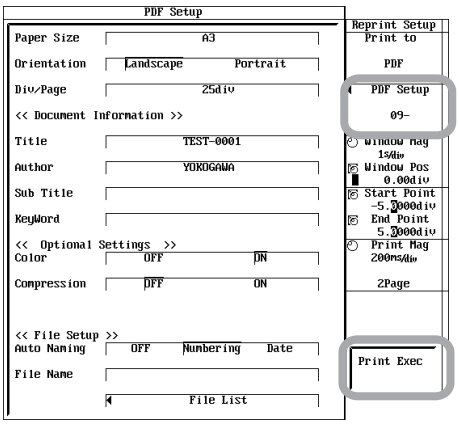
Selecting the Output Destination of the PDF File

21. Use the **jog shuttle** and **SELECT** to select File List. Then, select the file output destination according to steps 14 to 17 in section 13.7.

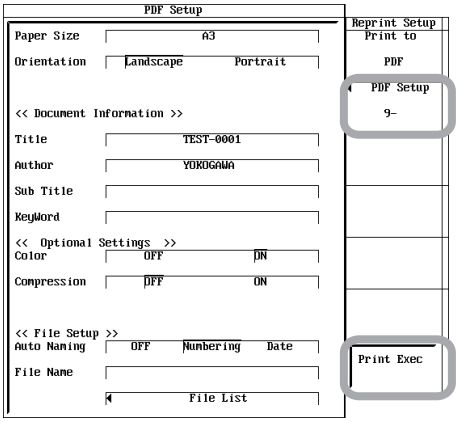
Executing the PDF File Generation

22. Press the **Print Exec** soft key. A PDF file is created using the conditions set in steps 4 to 21.

When the Chart Recorder Mode



When the X-Y Recorder Mode



Explanation

Print to

When creating a PDF file of the waveform recorded in Chart Recorder mode (T-Y recording) or X-Y Recorder mode, set the print destination to PDF.

Selecting the Section to Be Output to the PDF File: Window Mag/Window Pos and Start Point/End Point

Can be specified only in Chart Recorder mode. These are the same as Window Mag/Window Pos and Start Point/End Point when reprinting on the built-in printer. See page 9-23.

Print Magnification: Print Mag

Can be specified only in Chart Recorder mode. This is the same as Print Mag when reprinting on the built-in printer. See page 9-23.

Setting the PDF File

Paper Size

Select the paper size from built-in printer size, A3, A4, and A5. If the built-in printer size is selected, a PDF file is created of an image similar to the printed output on the built-in printer (A4 size).

Orientation

If the paper size is set to A3, A4, or A5, set the orientation of the PDF file to Landscape or Portrait.

Number of Divisions per Page: Div/Page

Can be specified only in Chart Recorder mode. If the paper size is set to A3, A4, or A5, set the number of divisions to be printed per page in the PDF file. The specified number of divisions is printed per page. The selectable range varies depending on the paper size, orientation, and gauge (see section 9-11) as follows:

Paper Size	Orientation	Selectable Range of Div/Page	
		Gauge: OFF	Gauge: ON
Built-In Printer	-	20 (fixed)	20 (fixed)
A3	Portrait	1 to 25	1 to 20
A3	Landscape	1 to 40	1 to 35
A4	Portrait	1 to 20	1 to 15
A4	Landscape	1 to 25	1 to 20
A5	Portrait	1 to 10	1 to 10
A5	Landscape	1 to 20	1 to 15

Document Information: Title, Author, Sub Title, and KeyWord

As necessary, enter the title, author, sub title, and keyword of the PDF file to be created.

Color

The PDF file is created in color if ON is selected and monochrome if OFF is selected.

Compression

Select whether to compress the file. If ON is selected, the file is compressed. However, the generation of the PDF file takes longer than when OFF is selected.

File Setup

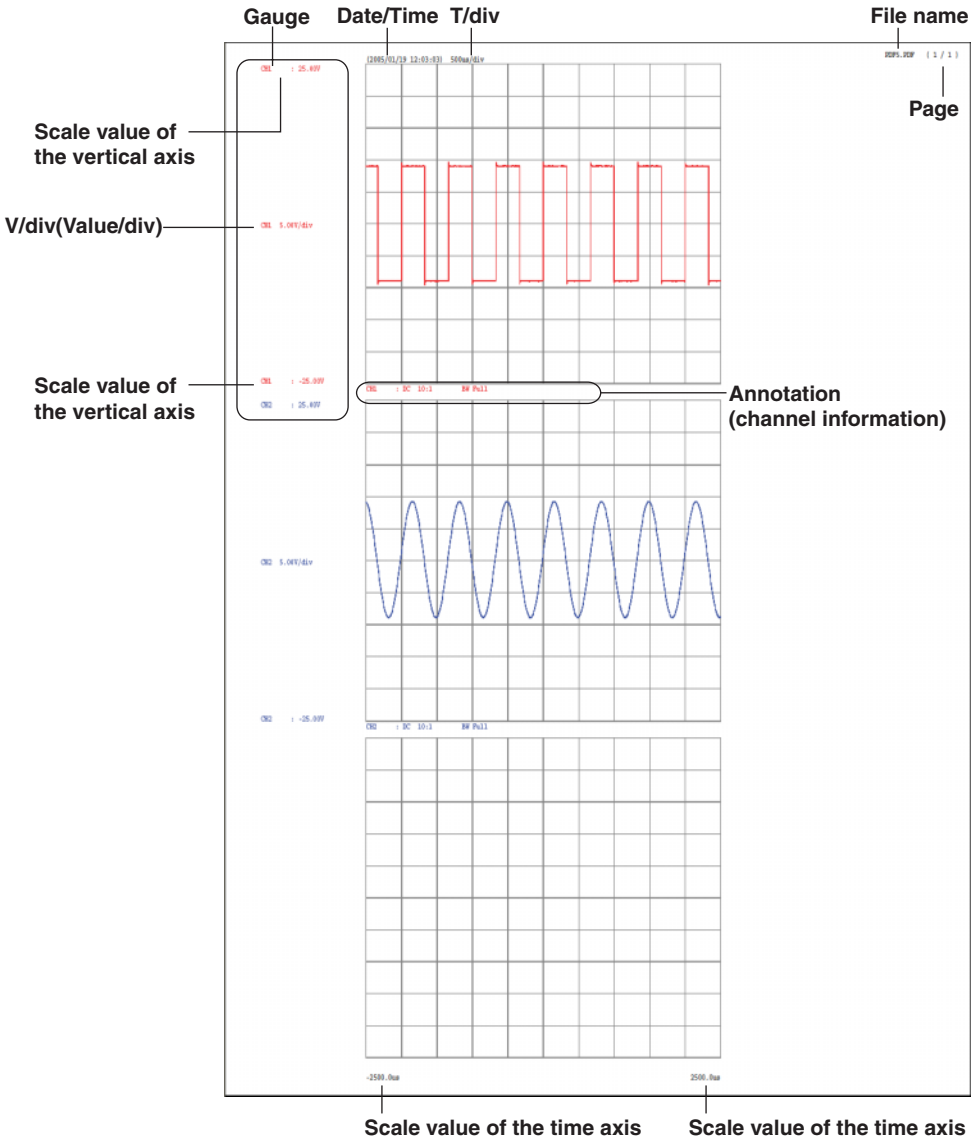
Set the auto naming, file name, and file output destination of the PDF file. These settings are the same as those of normal files. For details, see section 13.7.

Executing the PDF File Generation

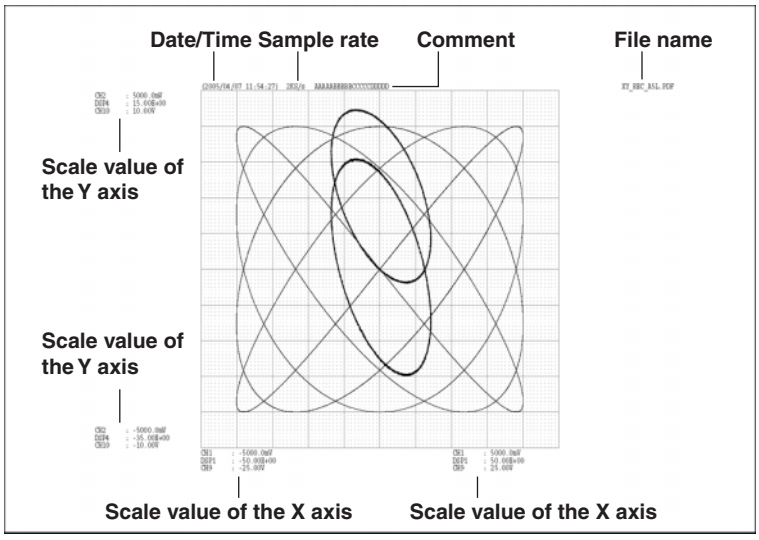
The PDF file is created using the specified conditions. The extension to the PDF file is .pdf.

PDF File Example

When the Chart Recorder Mode (Paper Size: A4)



When the X-Y Recorder Mode (Paper Size: A5)



Index

Symbols

A

B

C

D

E

F

G

H

I

J

K

L

M

Page

N

Page

O

Page

P

Page

R

S

T

U

V

W

X

Z