User's Manual

DL716 Digital Scope

Please make the following alterations to the User's Manual IM701830-01E.

New functions provided by the newly added High-Resolution Voltage/ RMS Isolation Module (701857)

This section describes the main functions of the new module (701857). For the operation, precautions, and detailed specifications of these functions, see "Alterations by page for User's Manual IM701830-01E" that starts on page 4 of this alteration notice.

> ***Note***
> This module is compatible with products (DL716) with firmware version 2.00 or later.

RMS measurement

If the module of the selected channel is a High-Resolution Voltage/RMS Isolation Module (701857), the rms value of the input signal can be observed.

RMS:AC

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-Vpeak sinusoid input signal is measured, a DC waveform at approximately 1.4 V is displayed (see right figure).
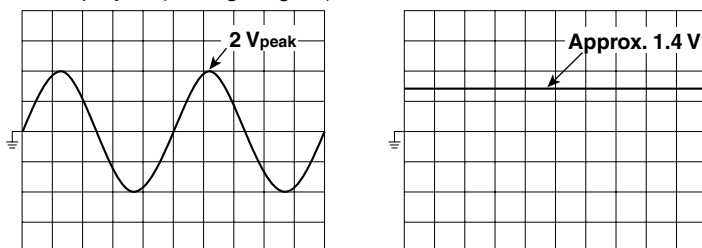
The rms value is derived from the following equation:

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

If u(t) = Vmsinωt (where Vm is the peak value and ω is the angular velocity (= 2πf, where f is the frequency of the sinusoid signal)), the rms value, Vrms, is derived from

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

As in the above example, when Vm is 2 V, the rms value, Vrms, is approximately 1.4 V.

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RMS:DC

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-Vpeak 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).
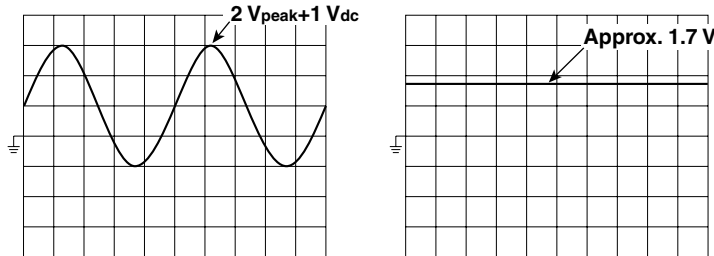

If the DC component is expressed as Vdc and the AC component as u(t) = Vmsinωt, the rms value, Vrms (+DC), of the sinusoid input signal riding on top of the DC component is derived from the following equation:

$$V_{rms(+DC)} = \sqrt{\frac{1}{2\pi}\int_{0}^{2\pi}(V_m\sin\omega t + V_{dc})^2 \, d\omega t} = \sqrt{\left(\frac{V_m}{\sqrt{2}}\right)^2 + (V_{dc})^2}$$

As in the above example, when Vdc is 1 V and Vm is 2 V, the rms value, Vrms (+DC), is approximately 1.7 V.

Vertical zoom by specifying the upper and lower limits of the observed waveform

If the module of the selected channel is a High-Resolution Voltage/RMS Isolation Module (701857), you can zoom in on the desired section of the observed waveform by specifying the upper and lower limits (scale values) of the vertical axis according to the displayed waveform.
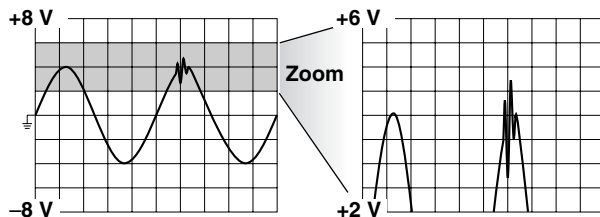
Functions that have been added to products with firmware version 2.00 or later

This section describes the main functions that have been added to products (DL716) with firmware version 2.00 or later. For the operation and precautions of these functions, see "Alterations by page for User's Manual IM701830-01E" that starts on page 4 of this alteration notice.

Additional support for the High-Resolution Voltage/RMS Isolation Module (701857)

In addition to the normal waveform observation of input signals, Module 701857 allows the observation of rms values of the input signal. This module can be used on products (DL716) with firmware version 2.00 or later.

Improvement in the operability of the keyboard that is displayed on the screen and the temporary storage of entered character strings

· **Improvement in the operability of the keyboard**
On products (DL716) with firmware version 2.00 or later, a part of the keyboard can be controlled using the soft keys (when the keyboard is displayed on the screen). The soft key menu that is displayed varies depending on the keyboard that is displayed on the screen.

· **Temporary storage of character strings**
When character strings are entered through the keyboard, up to eight of those character strings are temporarily stored. The stored character strings can be recalled to the entry box as necessary. The character strings for date, time, and equations cannot be temporarily stored.

Additional support for the external clock on the High-Speed Isolation Module (701855) and the High-Speed Module (701856)

Conventionally, when the time base was set to external clock, input modules 701855 and 701856 could not make measurements. This is now possible on products (DL716) with firmware version 2.00 or later. The frequency range of the external clock for various input modules is given in the table below.

Input Module	Frequency Range of the External Clock		
	Up to 1 kHz	1 kHz to 100 kHz	100 kHz to 1 MHz
High-Speed Isolation Module (701855, 12-bit A/D resolution) High-Speed Module (701856, 12-bit A/D resolution)	—[*1]	yes	yes
High-Resolution, High-voltage, Isolation Module (701852) High-Resolution, Isolation Module (701853) High-Resolution Voltage/RMS Isolation Module (701857) Temperature Module (701860) Strain Module (701880)	yes	yes	—[*2]
Logic Input Module (701870) 32-bit extended logic input (option)	yes	yes	yes
High-Speed Isolation Module (701850, 10-bit A/D resolution)[*3] High-Speed Module (701851, 10-bit A/D resolution)[*3]	—	—	—

*1 Operates in the range from 1 kHz to 1 MHz. The DC accuracy is not guaranteed at a frequency less than 1 kHz.
*2 Operates at a frequency less than or equal to 100 kHz. Waveforms will not be displayed correctly, if the frequency exceeds 100 kHz.
*3 Does not operate on external clock. Input modules 701850 and 701851 have been discontinued.

Pulse/Rotate function

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. On products (DL716) with firmware version 2.00 or later, you can specify the number of pulses of the external signal, or, in other words, the number of data samples captured in the acquisition memory that 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 1 rotation. In this case, moving the cursor by 1 division during cursor measurements causes the measured value of the X-axis to increase or decrease by "1."

Maximum record length of realtime recording

The maximum record length of realtime recording has doubled that of products before firmware version 2.00.

Channels Used	Possible Record Length
16 CH (all channels)	1 M to 32 MW (16 MW on products before firmware version 2.00)
8 CH (any 8 channels)	1 M to 64 MW (32 MW on products before firmware version 2.00)
4 CH (any 4 channels)	1 M to 128 MW (64 MW on products before firmware version 2.00)
2 CH (any 2 channels)	1 M to 256 MW (128 MW on products before firmware version 2.00)
1 CH (any 1 channel)	1 M to 512 MW (256 MW on products before firmware version 2.00)

Turning ON/OFF the computed waveform display

On products (DL716) with firmware version 2.00 or later, you have the option to turn OFF the computed waveform display even when computation is performed. You can turn ON/OFF the computed waveform displays for addition/subtraction/multiplication, binary computation (excluding the simultaneous binary computation of all channels), phase-shifted addition/subtraction/multiplication, and user defined computation.
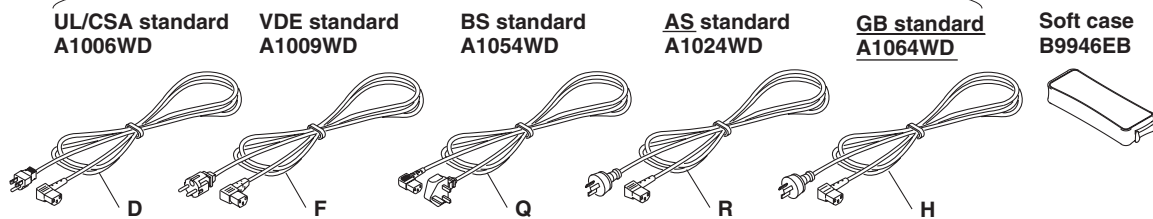
Alterations by page for User's Manual IM701830-01E

Page 2 "DL716 Main Body"

Model	Suffix Code	Specifications
....	....	....
Power cord	....	....
	-R	AS standard power cord (A1024WD)
		Maximum rated voltage : 250 V, maximum rated current : 10 A
	-H	GB standard power cord (complies with the CCC)(A1064WD)
		Maximum rated voltage : 250 V, maximum rated current : 10 A

Page 3 "Standard Accessories"

**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

Soft case B9946EB

Page 3 "Input modules"

Model	Name (Abbreviation)	
701855	....	
701856	....	
701852	....	Voltage modules
701853	....	
701857	High-Resolution Voltage/RMS Isolation Module (HR/RMS)	
701860	....	
	....	

Page 1-10 "Trigger Hysteresis"

....
For voltage modules*

....
*   When the input coupling is set to "RMS:AC" or "RMS:DC" on the High-Resolution Voltage/RMS Isolation Module, the hysteresis width varies. For details, see page 14 in this alteration notice.

Page 1-14 "Realtime Recording"

....
Realtime record to the internal hard disk (optional)
The data can be recorded in realtime to the internal hard disk (optional). The size of the recording area is 512Mword(256Mword on products before firmware version 2.00), and is allocated on the internal hard disk from the beginning. The realtime recording area is overwritten every realtime recording operation. After a realtime recording session, you can also save the data to another area so that they will not be overwritten. The saved data can be recalled (loaded). The record length and time axis setting that can be used for realtime recording are as follows.

Channels Used	Possible Record Length
16 CH (all channels)	1 M to 32 MW (16 MW on products before firmware version 2.00)
8 CH (any 8 channels)	1 M to 64 MW (32 MW on products before firmware version 2.00)
4 CH (any 4 channels)	1 M to 128 MW (64 MW on products before firmware version 2.00)
2 CH (any 2 channels)	1 M to 256 MW (128 MW on products before firmware version 2.00)
1 CH (any 1 channel)	1 M to 512 MW (256 MW on products before firmware version 2.00)

Page 1-15 "Display settings"

Display of the time when the data acquisition ended
The time when the data acquisition ended is displayed in the center section of the screen.

Page 1-22 "User Defined Computation"

You can define a computing equation by combining the following operators:

....
F1($\sqrt{C1^2 + C2^2}$), CF2$\sqrt{C1^2 - C2^2}$), CFV(inverse of the pulse width PHWW)[1], variable T
[1] Functions that are available on firmware versions 1.21 or later.

Page 3-7 "Types of input modules"

The following 8 types are available:

....
- High-Resolution, Isolation Module (Model No. : 701853)
- High-Resolution Voltage/RMS Isolation Module (Model No. : 701857)

Page 3-8 "Input module abbreviations"

Input Module	Abbreviation
....	....
High-Resolution, Isolation Module (701853)	HR
High-Resolution Voltage/RMS Isolation Module (701857)	HR/RMS
....	....

Page 3-11 "3.7 Connecting a Input Cable"

(For High-Resolution, High Voltage, Isolation Module, High-Resolution, Isolation Module, and High-Resolution Voltage/RMS Isolation Module)

Connecting a measurement cable

Connect the measurement cable to any of the input terminals of the High-Resolution, High Voltage, Isolation Module, High-Resolution, Isolation Module, or High-Resolution Voltage/RMS Isolation Module.

WARNING

....
- To prevent electric shock, make sure to use the measurement cable suitable for the voltage range being measured on the input terminals of the High-Resolution, High-Voltage, Isolation Module, High-Resolution, Isolation Module, and High-Resolution Voltage/RMS Isolation Module.

CAUTION

....

For High-Resolution, High-voltage, Isolation Module (701852)

....
Maximum allowable common mode voltage (across the input terminal, H or L, and earth[2])

....

For High-Resolution, Isolation Module (701853)

....
Maximum allowable common mode voltage (across the input terminal, H or L, and earth[4])

....

**For High-Resolution Voltage/RMS Isolation Module (701857)**

Maximum input voltage (across the input terminals, H and L[1], at a frequency of 1 kHz or less)

850 V (DC+ACpeak)

Maximum allowable common mode voltage (across the input terminal, H or L, and earth[2])

500 Vrms (CAT I and II)

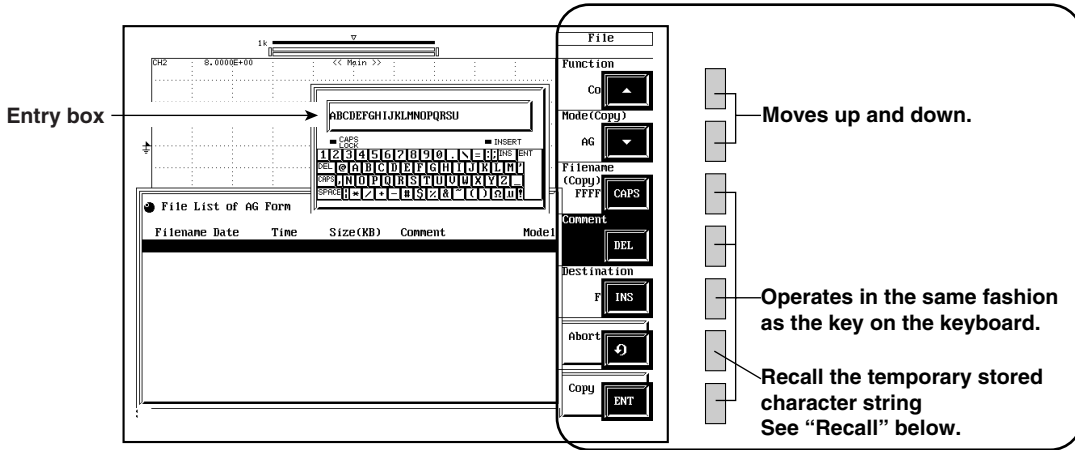(Specification when the EN61010-1 standard does not need to be satisfied: 600 Vrms)

....

....

701852 and 701857 input terminals (H) (L) *1 *2 earth

701853 input terminal (H) (L) *3 *4 earth
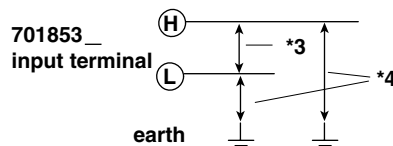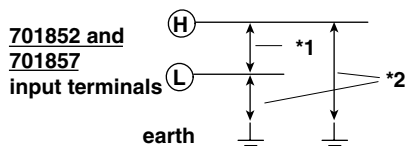
Page 4-2 "Entry using the keyboard"

Entry using the keyboard

- **Entering characters and temporary storing strings**

  1. Turn the jog shuttle to move the cursor to the character to be entered. (On products (DL716) with firmware version 2.00 or later, the "▲" and "▼" soft keys can be used to move the cursor up and down.)
  If a character string such as the date and time has already been entered, move the cursor to the position in the string at which you want to enter a character.

  2. Press the SELECT key to enter the character.

  3. SE¿Uat steps 1 and 2 to enter all the characters in the string.

  4. Selecting "**ENT**" on the keyboard and pressing the SELECT key confirms the string and the keyboard disappears. (On products (DL716) with firmware version 2.00 or later, the "**ENT**" soft key can be used to confirm the string (and hide the keyboard). At this point, the confirmed string is temporarily stored.)

Applicable to products (DL716) with firmware version 2.00 or later

Entry box →

Moves up and down.

Operates in the same fashion as the key on the keyboard.

Recall the temporary stored character string
See "Recall" below.

Operation to temporarily store character strings (Applicable to products (DL716) with firmware version 2.00 or later)

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.

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

- **Recall (Applicable to products (DL716) with firmware version 2.00 or later)**
  (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. Press the "♪" soft key to select a memory from "♪ 0" to "♪ 7." The string that is temporary stored in memories ♪ 0 to ♪ 7 is displayed in the entry box of the keyboard.

  2. Make appropriate corrections to the recalled string and confirm it according to steps 1 to 4 that were described above in "Entering characters and temporarily storing strings." At this point, the confirmed string is temporarily stored.

Page 4-3 "4.2 Initializing Settings"

Settings which cannot be initialized
Date and time
GP-IB/RS-232 interface related settings
SCSI ID number
<u>Settings relating to the ethernet interface</u>

....

Initialization at power ON
Turning the power switch ON while holding down the **RESET** key will start initialization. This also initializes settings relating to the GP-IB/RS-232 interface,<u> ethernet interface</u> and SCSI ID number.

Page 4-5 "Settings made by auto set-up"

....

Vertical-axis settings

....

Vertical position	0 div
<u>Scaling of the observed waveform (variable)*</u>	<u>OFF</u>
Coupling	DC

....

*   <u>Applies to the High-Resolution Voltage/RMS Isolation Module (701857)</u>

Page 4-11 "When selecting "EXT""

....

|	
Connector type	RCA jack (AUDIO jack)
Frequency range	<u>See the table below</u>
....	....
<u>Rise/Fall time of the clock</u>	<u>2 µs or less</u>
Applicable module	<u>See the table below</u>
Inapplicable module	<u>See the table below</u>

Input Module	Frequency Range of the External Clock		
	Up to 1 kHz	**1 kHz to 100 kHz**	**100 kHz to 1 MHz**
High-Speed Isolation Module (701855, 12-bit A/D resolution) High-Speed Module (701856, 12-bit A/D resolution)	—[*1]	yes	yes
High-Resolution, High-voltage, Isolation Module (701852) High-Resolution, Isolation Module (701853) High-Resolution Voltage/RMS Isolation Module (701857) Temperature Module (701860) Strain Module (701880)	yes	yes	—[*2]
Logic Input Module (701870) 32-bit extended logic input (option)	yes	yes	yes
High-Speed Isolation Module (701850, 10-bit A/D resolution)[*3] High-Speed Module (701851, 10-bit A/D resolution)[*3]	—	—	—

*1 Operates in the range from 1 kHz to 1 MHz. The DC accuracy is not guaranteed at a frequency less than 1 kHz. In addition, on products (DL716) with firmware version 2.00 or later, input modules 701855 and 701856 can operate on an external clock signal.

*2 Operates at a frequency less than or equal to 100 kHz. Waveforms will not be displayed correctly, if the frequency exceeds 100 kHz.

*3 Does not operate on external clock. Input modules 701850 and 701851 have been discontinued.

Circuit diagram of the external clock input/timing chart

....
....
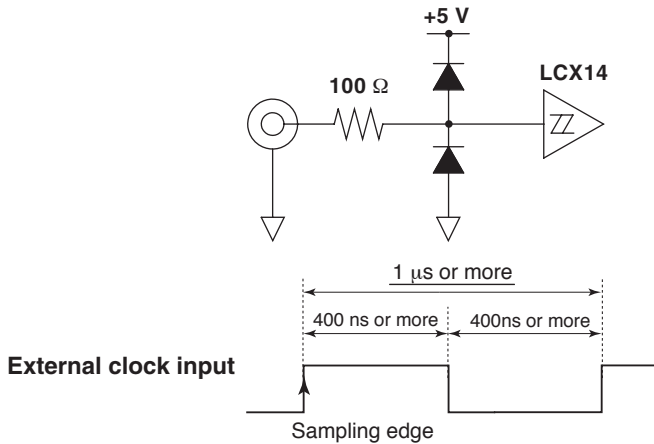
Setting pulse/rotate

On products (DL716) with firmware version 2.00 or later, 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 1800

Page 4-12 "Operating Procedure"

  2. Press the "**Time Base**" soft key and then select "**Int**" or "**Ext**." On products (DL716) with firmware version 2.00 or later, the pulse/rotate menu is displayed when "**Ext**" is selected.

Setting the pulse/rotate
(This is applicable only when "Ext" is selected on products (DL716) with firmware version 2.00 or later.)

  3. Turn the jog shuttle to set the number of pulses (of the external clock signal) for the pulse/rotate function. Pressing the $\boxed{\text{RESET}}$ key will reset the number to "**1**."

Page 5-2 "Maximum sample rate"

....

Input Module	Maximum Sample Rate
....	
High-Resolution, Isolation Module	100 kS/s
High-Resolution Voltage/RMS Isolation Module	100 kS/s
Temperature Module	*1
....	

Page 5-4 "5.3 Setting V/div"

  5.3 Setting V/div (Applicable to Voltage Modules)

....

  V/div setting range

  ....

Input Module	Setting Range
....	
High-Resolution, Isolation Module	5m mV/div to 20 V/div
High-Resolution Voltage/RMS Isolation Module	50 mV/div to 200 V/div

Page 5-5 "5.4 Setting the Vertical Position of a Waveform"

5.4 Setting the Vertical Position of a Waveform (Applicable to Voltage and Logic Input Modules)

Function

On the High-Resolution Voltage/RMS Isolation Module (701857), this function can be used when the [Variable] setting is turned [OFF].
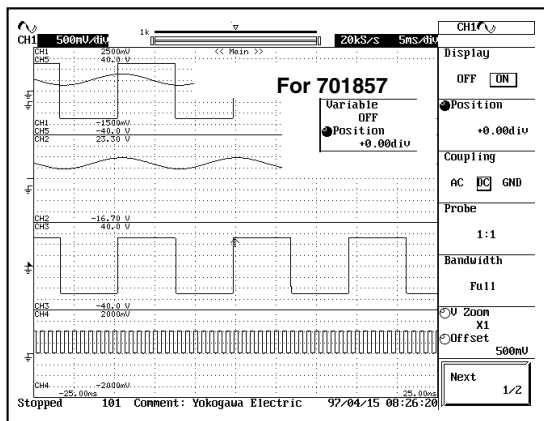
....

....

Operating Procedure

....

2. Press the "**Position**" soft key to set the jog shuttle action to "**Position**". If the input module is a 701857, the jog shuttle action can be set to "**Position**" only when the [**Variable**] setting is turned [**OFF**].

....

Page 5-6 "5.5 Selecting Input Coupling"

5.5 Selecting Input Coupling (Applicable to Voltage Modules)
(For the High-Resolution Voltage/RMS Isolation Module, see section 5.18 (page 11 in this alternation notice).)

Page 5-7 "5.6 Selecting Probe Attenuation"

For the High-Speed Isolation Module and the High-Speed Module, set the attenuation according to the probe being used.

For the High-Resolution, High-Voltage, Isolation Module, the High-Resolution, Isolation Module, and the High-Resolution Voltage/RMS Isolation Module, set the attenuation to 1:1.

Page 5-8 "5.7 Setting the Bandwidth"

5.7 Setting the Bandwidth (Applicable to Voltage, Temperature, and Strain Modules)

....

· **High-Resolution, High-Voltage, Isolation/High-Resolution, Isolation Module (Low pass filter, anti-aliasing filter)**

....

....

· **High-Resolution Voltage/RMS Isolation Module**
Full, 1 kHz, 100 Hz

· **Temperature Module**
Full, 2 Hz/8 Hz

Page 5-10 "5.8 Zooming in Vertical Direction"

5.8 Zooming in Vertical Direction (Applicable to Voltage and Logic Input Modules)
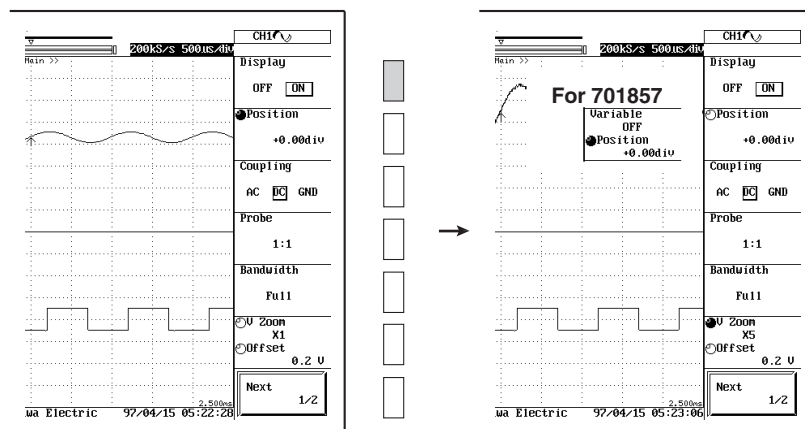
Function

The displayed waveform can be enlarged/reduced in vertical direction. It is useful when you wish to change the vertical axis setting after displaying waveforms using Single Start/Log Start (refer to page 4-6). On the High-Resolution Voltage/RMS Isolation Module (701857), this function can be used when the [Variable] setting is turned [OFF].

....

....

Operating Procedure

....

2. Press the "**V Zoom/Offset**" soft key to set jog shuttle action to "**V Zoom**." If the input module is a 701857, the jog shuttle action can be set to "**V Zoom**" only when the [**Variable**] setting is turned [**OFF**].

....

Page 5-11 "5.9 Setting the Offset Voltage"

5.9 Setting the Offset Voltage (Applicable to Voltage Modules)

Function

The offset voltage can be set regardless of the input coupling setting. On the High-Resolution Voltage/RMS Isolation Module (701857), this function can be used when the [Variable] setting is turned [OFF].

....

Offset voltage setting range

....

....

(For High-Resolution, High Voltage, Isolation Module, High-Resolution, Isolation Module, High-Resolution Voltage/RMS Isolation Modules)

- The waveform can be set in the range between ±4 div.
- The setting resolution is 0.01 div.

....

Operating Procedure

....

2. Press the "**V Zoom/Offset**" soft key to set jog shuttle action to "**Offset**." If the input module is a 701857, the jog shuttle action can be set to "**Offset**" only when the [**Variable**] setting is turned [**OFF**].

Page 5-12 "5.10 Using the Linear Scaling Function"

5.10 sing the Linear Scaling Function (Ax+B) (Applicable to Voltage Modules)
(For the Strain Module and the Voltage Module that is installed in products (DL716) with firmware version 2.00 or later, see section 5.16 (below).)

Function

This function lets you apply linear scaling to the measurement values. If you set this feature ON, the screen displays the scaled results rather than the original measurements. The scaling relationship is

Y = AX + B

Note that you can select the dimensional unit for the scaled display. For products (DL716) with firmware version 2.00 or later, another linear scaling method, "P1-P2" can be specified. For details, see section 5.16 (below).

....

Page 5-14 "5.11 Inverting a Waveform"

5.11 Inverting a Waveform (Applicable to Voltage Modules)

Page 5-22 "5.16 Using the Linear Scaling Function for the Strain"

5.16 Using the Linear Scaling Function (Ax+B and P1-P2) (Applicable to Strain Modules and Voltage Modules that are installed in products (DL716) with firmware version 2.00 or later)

Function

There are two linear scaling methods for Strain Modules and Voltage Modules that are installed in products (DL716) with firmware version 2.00 or later: "Ax+B" and "P1-P2." For the setting ranges and initial settings of "Ax+B," see section 5.10.

....

· **P1–P2**

....

Measurement value (P1:X, P2:X) range: Same as the measurement range

....

Initial setting of scale values: P1:X +0.0000E+00[1],   P1:Y +0.0000E+00

                                              P2:X +1.0000E+00[2],   P2:Y +1.0000E+00

                                              [1] 0.0 uSTR for the Strain Module.

                                              [2] 1.0 uSTR for the Strain Module.

Displaying Upper and Lower Limits
The procedure used to display the upper and lower limits is the same as the description given in section 5.10 "Using the Linear Scaling Function (Ax+B)."
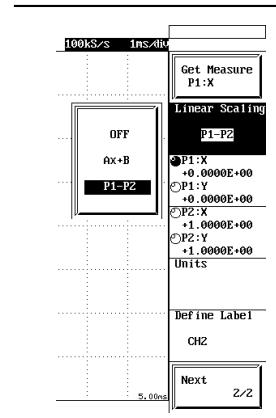
Page 5-23 "Operating Procedure"

1. Press one of the keys from |CH 1| to |CH 16| to select the channel.

Page 5-24 Add a figure of the screen
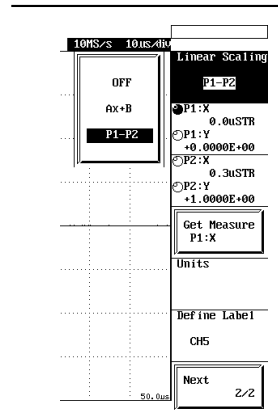
For Strain Modules   For Voltage Modules

Add pages after page 5-26

This section contains additional descriptions related to the functions provided by the newly added High-Resolution Voltage/RMS Isolation Module (701857).

5.18 Observing the RMS Values (Applicable to High-Resolution Voltage/RMS Isolation Modules)

Function

The High-Resolution Voltage/RMS Isolation Module (701857) has a zoom function that is controlled by specifying the upper and lower limits of the observed waveform and an input coupling/observation mode selection function.

Vertical zoom by specifying the upper and lower limits of the observed waveform: Variable

You can select whether or not to enable the vertical zoom display function that is controlled by specifying the upper and lower limits.

- **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. This is a function used to zoom in on the display. The A/D conversion resolution and accuracy remain the same as those for the original waveform, when the waveform is expanded with the "Variable" turned "ON."

- **OFF**

  The observed waveform is not scaled. In this case, the vertical position (section 5.4), vertical zoom (section 5.8), and offset voltage (section 5.9) can be changed.

Range of upper and lower limit values (Upper Scale/Lower Scale)

±(40 times the current V/div setting) or ±2000 V, which ever is smaller. > Make sure the upper limit value (Upper Scale) is greater than the lower limit value (Lower Scale).

Note

- We recommend you adjust the display to obtain the best view of the waveform with the "Variable" turned "OFF", then turn "ON" the "Variable" and scale the observed waveform. This will facilitate the setting of the upper and lower limits used to expand the desired section of the waveform.
- When "Variable" is turned "ON," the V/div setting cannot be changed by turning the V/DIV knob. Turn "OFF" the "Variable" first, then rotate the V/DIV knob to change the V/div setting.
- Pressing $\boxed{RESET}$ when the "Variable" is turned "ON" and the jog shuttle action is set to upper and lower limits (Upper Scale/Lower Scale) causes the upper and lower limits to be reset to "4 div x (V/div set with the V/DIV knob)" and "-4 div x (V/div set with the V/DIV knob)," respectively. Use this function when the waveform goes out of the display area due to the upper and lower limit settings.

Selecting the input coupling and observation mode: Coupling/RMS

In addition to the same input coupling selections that are available on other voltage modules, you can also select the waveform observation mode which directly displays the waveform of the input signal and the RMS observation mode which displays the rms values of the input signal.

- **AC**

  Using the waveform observation mode, only the AC component of the input signal is acquired and displayed. This is the same as the other voltage modules.*

- **DC**

  Using the waveform observation mode, Both the DC and AC components of the input signal are acquired and displayed. This is the same as the other voltage modules.*

- **GND**

  The ground level can be confirmed. This is the same as the other voltage modules.*

- **RMS:AC**

  Using the RMS observation mode, 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 input coupling circuit used when the coupling is set to "AC."
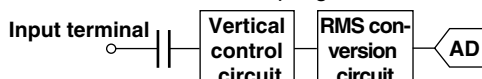
- **RMS:DC**

  Using the RMS observation mode, 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 input coupling circuit used when the coupling is set to "DC."

Input terminal → **Vertical control circuit** → **RMS conversion circuit** → **AD**
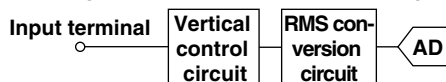
  * For the input coupling circuits of AC, DC, and GND, see page 1-5 in the User's Manual IM701830-01E.

Input coupling settings and frequency characteristics

The frequency characteristics when "AC" and "DC" are specified are shown below. Note that, as shown in the figure below, when "AC" is specified, low frequency signals or signal components are not acquired.

When "AC" is specified
Attenuation

0 dB
−3 dB

Input Frequency   −3 dB attenuation point*
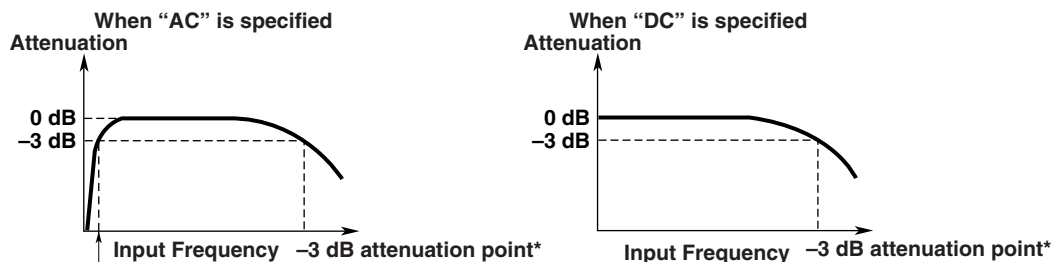
The lower −3 dB attenuation
point during AC coupling*

When "DC" is specified
Attenuation

0 dB
−3 dB

Input Frequency   −3 dB attenuation point*

* For details, see the specifications of the High-Resolution Voltage/RMS Isolation Module (page 21 this alteration notice).

> *Note*
>
> 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 measured correctly.

⚠ **CAUTION**

- When the input coupling is set to "AC" and the frequency of the input signal is less than or equal to 1 Hz, attenuation does not take effect even if the attenuation ratio is set to 10:1 and a probe with an input resistance of 10 MΩ!!! is used. Therefore, pay special attention to signal components that are less than or equal to 1 Hz so that they do not exceed the maximum input voltage of the modules.
- 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.

Operating Procedure

  1. Press one of the keys from $\boxed{CH\,1}$ to $\boxed{CH\,16}$ (key of the channel to which the High-Resolution Voltage/ RMS Isolation Module is installed) to select the channel.

**Vertical zoom by specifying the upper and lower limits of the observed waveform**

  2. Press the "**Variable**" soft key to select "**ON**" or "**OFF**."
  If "**OFF**" is selected, the vertical position (section 5.4), vertical zoom (section 5.8), and offset voltage (section 5.9) can be changed. For the procedures, see the respective sections.
  If you select "**ON**," proceed to step 3.

- **Setting the upper limit**
  3. Press the "**Upper Scale/Lower Scale**" soft key to set jog shuttle action to "**Upper Scale**."
  4. Turn the jog shuttle to set the upper limit.
  You can move between the digits using the arrow keys.

- **Setting the lower limit**
  5. Press the "**Upper Scale/Lower Scale**" soft key to set jog shuttle action to "**Lower Scale**."

6. Turn the jog shuttle to set the lower limit.
You can move between the digits using the arrow keys.

- **Setting the upper and lower limits simultaneously**

7. Press the "**Upper Scale/Lower Scale**" soft key to set jog shuttle action to both "**Upper Scale**" and "**Lower Scale**."

8. Turn the jog shuttle to set the upper and lower limits simultaneously without changing the spacing between the two.
You can move between the digits using the arrow keys.
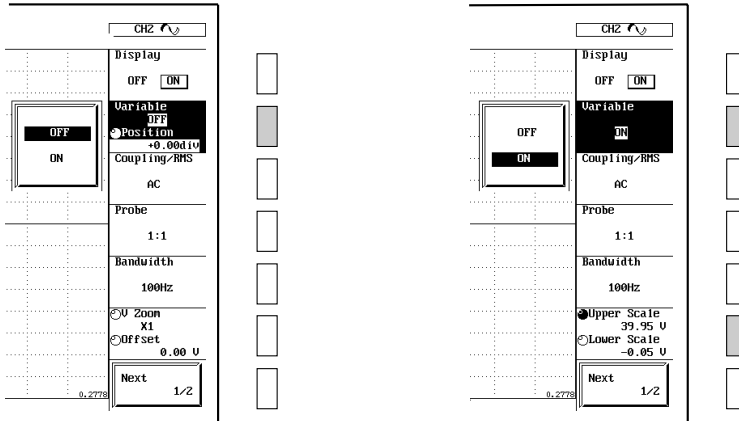
Selecting the input coupling and observation mode

2. Press the "**Coupling/RMS**" soft key to select one from "**AC**" to "**RMS:DC**."
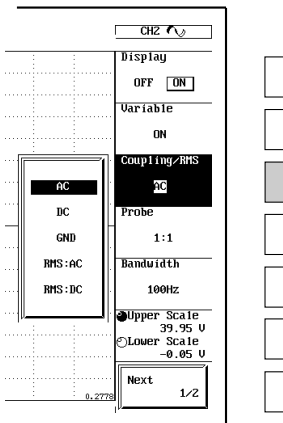
6.3 Setting Trigger Hysteresis for Channels 1 to 16 (Applicable to Voltage, Temperature, and Strain Modules)

....

....

For voltage modules

⌐∿⌐ : Hysteresis of about ±0.1 divisions* centered on the trigger level.

⌐∿⌐ : Hysteresis of about ±0.5 divisions* centered on the trigger level.

⌐∿⌐ : Hysteresis of about ±1 division* centered on the trigger level.

    * When the input coupling is set to "RMS:AC" or "RMS:DC" on the High-Resolution Voltage/RMS Isolation Module, the trigger hysteresis is as follows:
    ⌐∿⌐ : Hysteresis of about ±0.02 divisions centered on the trigger level.
    ⌐∿⌐ : Hysteresis of about ±0.1 divisions centered on the trigger level.
    ⌐∿⌐ : Hysteresis of about ±0.2 divisions centered on the trigger level.

....

....

Pages 6-10 and 6-12 "6.9 Setting the A → B(n) Trigger (ENHANCED)" and "6.10 Setting the A Delay B Trigger (ENHANCED)"

You can also specify the optional extended logic input for condition A.

```
┌─●←Select────────────────────────┐
│                                  │
│ <Parallel A> Condition  Enter    │
│                                  │        Extended logic input
│ CH     1 2 3 4 5 6 7 8 9 1 1 1 1 1 1 1 1 1  ──┐
│                          0 1 2 3 4 5 6 1 2  ──┘
│ Status X X X X X X X X X X X X X X X|X X|
│                                  │
│ <Parallel B> Condition  Enter    │
│                                  │
│ CH     1 2 3 4 5 6 7 8 9 1 1 1 1 1 1 1      │
│                          0 1 2 3 4 5 6      │
│ Status X X X X X X X X X X X X X X          │
│                                  │
│ N Count         1                │
└──────────────────────────────────┘
```
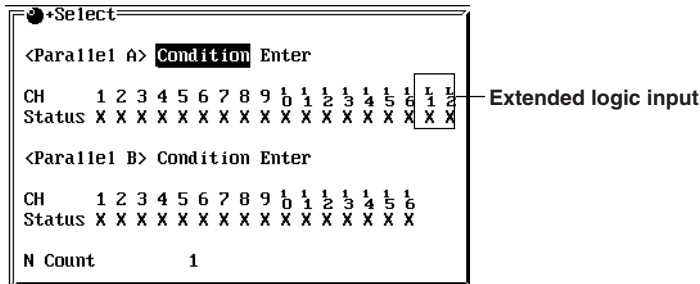
Page 7-6 "7.5 Using the History Memory"

History average function

The waveform data with a record length less than or equal to 100 k that are recorded in the history memory are averaged. The averaging range is the data between "Start Record No." and "End Record No."

1. Press the HISTORY key.
2. Press the "**Display**" soft key to select "**Avg.**"
3. Press the "**Start Record No.**" soft key.
   The "**Start Record No.**" can now be set using the jog shuttle.
4. Turn the jog shuttle to set the desired start record No. for averaging.
5. Set the "**End Record No.**" as well.
6. Press the "**Average**" soft key to display the averaged waveform (average of the data between the Start Record No. and End Record No.).
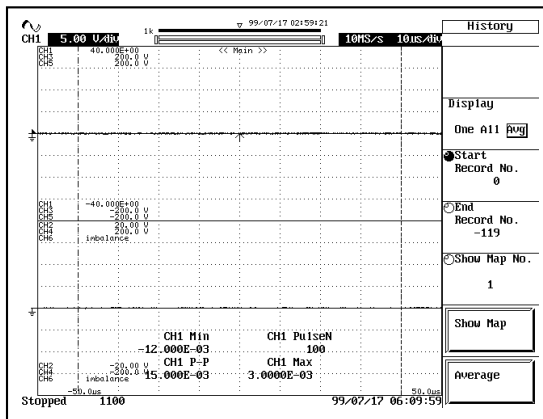
Page 7-11 "Store length"

Select the record length from the following choices. Set this parameter when executing with "Log Start" in the *ACQ* menu.

1 MW, 2 MW, 4 MW, 8 MW, 16 MW, 32 MW[*1], 64 MW[*2], 128 MW[*3], 256 MW[*4], 512MW[*5]

The time corresponding to the set record length is displayed at the lower part of the "Log Start" soft key (for example, 3 12:34:56 is 3 days and 12 hours 34 minutes 56 seconds).

[*1] Any eight channels can be used on products before firmware version 2.00.
[*2] Any eight channels can be used (Any four channels can be used on products before firmware version 2.00.)
[*3] Any four channels can be used (Any two channels can be used on products before firmware version 2.00.)
[*4] Any two channels can be used (Any one channel can be used on products before firmware version 2.00.)
[*5] Any one channel can be used.

Page 7-12 "Points to note when realtime recording"

Points to note when realtime recording

....

· If the power is turned OFF once and turned back ON and the realtime recorded data are restored using [Restore], the date and time of the recording will not be restored. (Show Map of the History menu will display 00:00:00.))
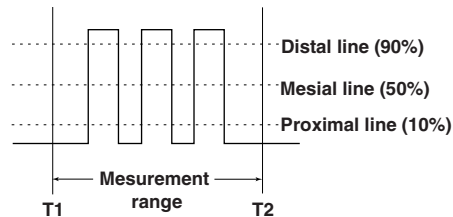
Page 9-2 "Points for attention during cursor measurement"

....

....

- The pulse/rotate function is available on products (DL716) with firmware version 2.00 or later. The pulse/rotate setting affects the X-axis (horizontal) measurement values in cursor measurements. For example, if the pulse/rotate setting is 100 pulses and the record length is 1 kWord, 1 division will be 1 rotation (period). In this case, moving the cursor by 1 division during cursor measurements causes the measured value of the X-axis to increase or decrease by "1."

Page 9-4 "9.2 Automatic Measurement of Waveform Parameters"

Add "Pulse" to the measurement parameters.

Pulse : Pulse Count (PulseN)
When Pulse=3

Set the measurement range (Time Range) to match the pulse width of the signal being measured.

Distal line (90%)

Mesial line (50%)

Proximal line (10%)

Mesurement range

T1   **T2**

Page 9-9 "9.3 Setting Computing Range and Display Units, and Recomputing"
Function

....

....

Turning ON/OFF the computed waveform display

On products (DL716) with firmware version 2.00 or later, you have the option to turn OFF the computed waveform display even when computation is performed. You can turn ON/OFF the computed waveform displays for addition/subtraction/multiplication, binary computation (excluding the simultaneous binary computation of all channels), phase-shifted addition/subtraction/multiplication, and user defined computation (in the displayed unit menu).

Operating Procedure

....

Turning ON/OFF the computed waveform display

**(The setting of this function is possible on products (DL716) with firmware version 2.00 or later.)**

   2. Press the "**Mode**" soft key to select "**Basic**," "**Phase**," or "**UserDefine**."

   *   If "**Basic**" or "**Phase**" is selected, the following menu is displayed. See page 17 in this alteration notice for the menu that is displayed when "**UserDefine**" is selected.

   3. Press the "**Next**" soft key to display the menu with the "**Scale&Unit**" soft key.

   4. Press the "**Scale&Unit**" soft key to display the scaling value setting menu. Move the cursor to "**Display**" using the jog shuttle and press the $\boxed{\textit{SELECT}}$ key to select ON or OFF.

Setting the displayed unit

....

4. Press the "**Scale&Unit**" soft key, ...

.......................enter the character string of the unit.

   *   If "**Basic**" or "**Phase**" is selected, the following menu is displayed. For the keyboard operation, see page 6 this alteration notice. See page 17 in this alteration notice for the menu that is displayed when "**UserDefine**" is selected.

....

Menu that is displayed when the computation mode is set to "Basic" or "Phase" on products (DL716) with firmware version 2.00 or later
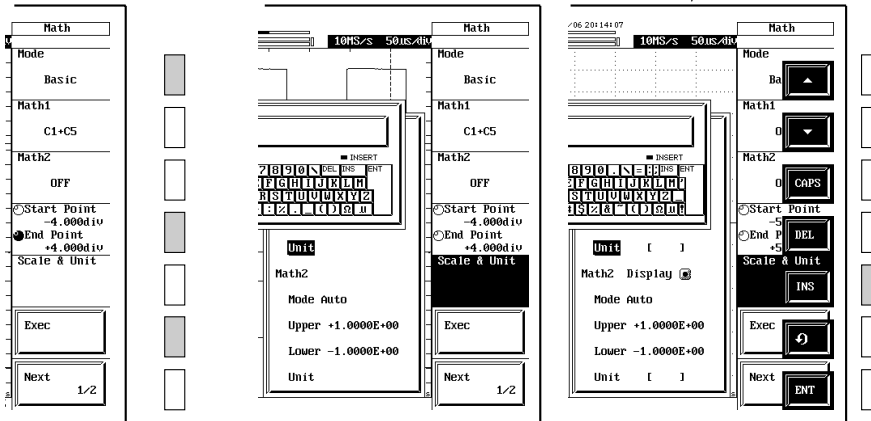
Page 9-19 "Available operators"

Operator	Example	Description
BIN[1]	BIN(C1)	Display the binary computation of the waveform
F2	F2(C1,C2)	Display the result of the expression $\sqrt{C1^2 - C2^2}$ of the 2 specified waveforms.
FV	FV(C1)	Display the inverse of the pulse width PHWW[2]

*1   When operator BIN() is used by itself, the computed result is 0 or 1. However, if the computed result of Bin() is used in a computation, the computed result of Bin() is 0 or 2 to the (16 - computation channel No.) power.
     For example, BIN(C1)*1 will give a result of 0 or 32768 (2 to the (16 - 1) power $\times$ 1).

*2   Functions that are available on firmware versions 1.21 or later.

Page 9-20 "Averaging the computed data/computing the peak*"

....

For cycle averaging, set the number of data points of one cycle (Cycle Count) in the range, 10 to 1800.

....

Turning ON/OFF the computed waveform display

On products (DL716) with firmware version 2.00 or later, you have the option to turn OFF the computed waveform display even when computation is performed.

Page 9-21 "Operating Procedure"

....

User define the computing equation

3. ....

4. Move the cursor to the equation number (M1 to M8) that you wish to compute, and press the $\boxed{\textit{SELECT}}$ key to make the mark a black circle (ON).

....

6. Input the computing equation. For the keyboard operation, see page 6 in this alteration notice.

* The keyboard that is displayed when entering a computing equation is different from the one that is displayed when entering units and file names. The menu that is assigned to the soft keys also varies depending on the keyboard that is displayed. For the keyboard and soft key menu that appears when entering a computing equation, see the figure below.

Menu displayed on products (DL716) with firmware version 2.00 or later.
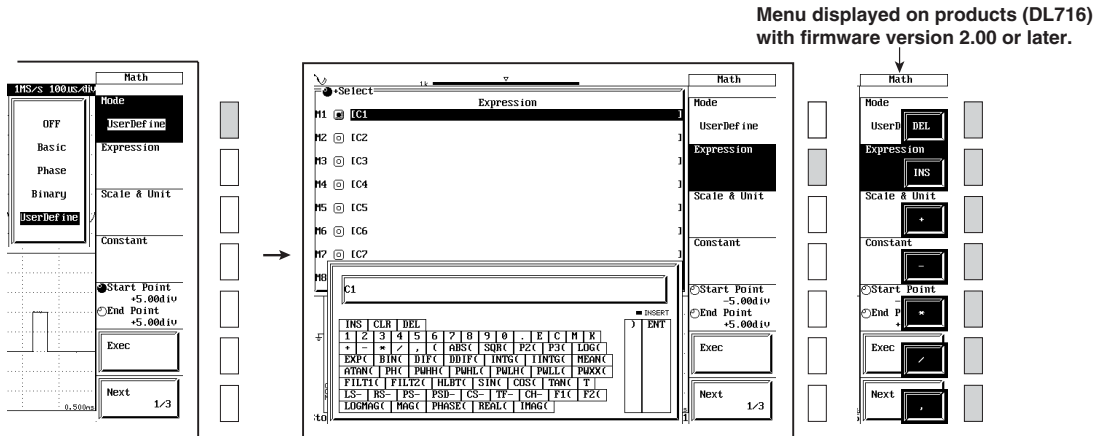
Setting the computing range, displayed units, and manual scaling

· For the procedure related to setting the computing range and displayed units, see section 9.3.

· For the procedure related to setting the manual scaling, see section 9.9.

Turning ON/OFF the computed waveform display

(The setting of this function is possible on products (DL716) with firmware version 2.00 or later.)

3. Press the "**Next**" soft key to display the menu with the "**Scale&Unit**" soft key.

4. Press the "**Scale&Unit**" soft key to display the scaling value setting menu. Move the cursor to "**Disp**" using the jog shuttle and press the $\boxed{\textit{SELECT}}$ key to select ON or OFF.

(The setting of this function is possible on products (DL716) with firmware version 2.00 or later.

Page 11-3 "11.3   Connecting a SCSI Device"
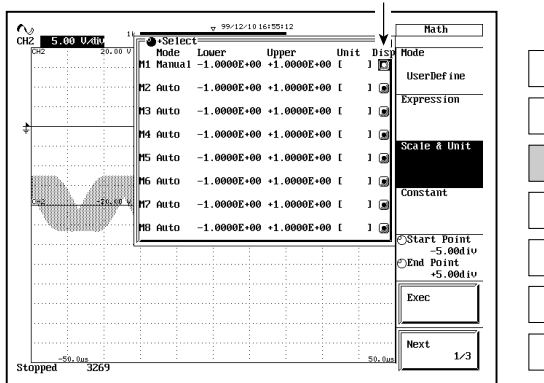
Note

· If you are chaining multiple SCSI devices, - - - - - - - - - -
· Hard disks formatted by the instrument cannot be read by NEC PC series computers.
- -
· When using the instrument to format a hard disk of 2 GB or more, you can create a maximum of five, 2 GB memory partitions.
· The instrument can only recognize five partitions from the top partition on media formatted by an instrument other than the DL. However, it cannot recognize non-FAT16 formatted media at all.

Page 11-4 "11.4   Formatting Disks"

Selecting the formatting mode

It takes approximately 24 minutes to format a 9.2 GB internal hard disk.
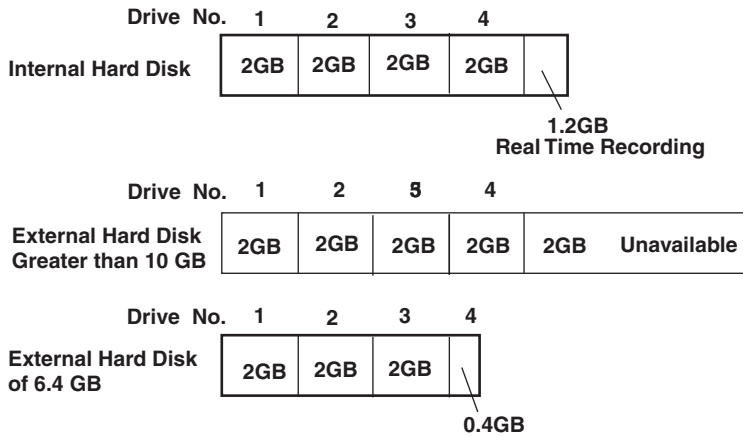
Please add the item below.

Internal Hard Disk

The internal hard disk has 9.2 GB of free space available.

The disk is divided into one 1.2 GB partition, and four 2 GB partitions. The 1.2 GB partition is used as a temporary area for real time recording. The remaining four 2 GB partitions can be used as user partitions.

External Hard Disk

When formatting an external hard disk with this instrument, up to five, 2 GB partitions are automatically created. Even if the disk is larger than 10 GB, the instrument cannot use more than five 2 GB partitions.

Drive No.	1	2	3	4	
Internal Hard Disk	2GB	2GB	2GB	2GB	

1.2GB
Real Time Recording

Drive No.	1	2	3	4		
External Hard Disk Greater than 10 GB	2GB	2GB	2GB	2GB	2GB	Unavailable

Drive No.	1	2	3	4	
External Hard Disk of 6.4 GB	2GB	2GB	2GB		

0.4GB

Page 11-7 "11.5   Selecting the Medium and Directory"

Please add the item below.

Designating Partitions

When using an internal or external hard disk of 2 GB or more, you must designate partitions for loading and saving information such as waveform data and measurement data. Perform the following steps to designate the partitions.

1. Press the FILE key.
2. Press the [Function] soft key repeatedly to select "Media."
3. Press the [Media] soft key repeatedly to select [SCSI] or [HD].
4. Turn the jog shuttle to select the drive number for the memory area.
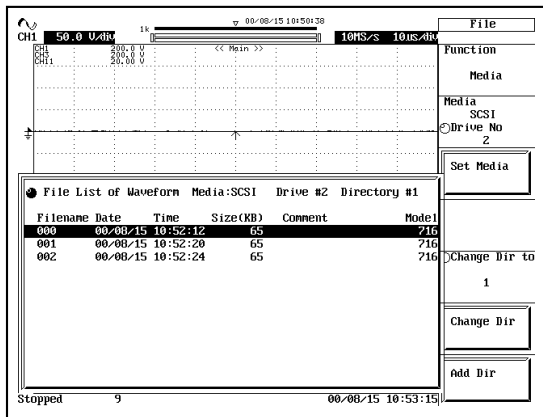
If you selected HD (internal hard disk) under Media, the available drive numbers are 1 to 4. You cannot designate a partition for use during real-time recording.

Page 11-11 "11.7 Saving/Loading Set-up Data"

Loading the set-up data

When set-up data is loaded, the current key settings are replaced by the loaded set-up data, except for the date/time and the GP-IB settings. However, date, time, GP-IB settings, settings dealing with File, and SCSI ID number are not changed.

Page 11-17 "11.10 Copying Files"

Function

....

Selecting the copy source file

The following methods can be used to select the copy source files:

· Select the copy source files by using the jog shuttle.
· Select the copy source file by placing a "C" mark on the file. This is applicable to products (DL716) with firmware version 2.00 or later.
  · Turn the jog shuttle to select the file and press the `SELECT` key to place a "C" mark on the selected file.
  · Press the "Mark/Unmark All Files" soft key to place "C" marks on all the files displayed in the "File List."

Precautions to be taken when copying a file

....

· On products (DL716) with firmware version 2.00 or later, you can place "C" marks on the files you wish to copy and copy those files at once.
· When copying files with "C" marks, the copy destination file name is discarded. The files are copied using the same file names as the copy source.

Operating Procedure

....

Entering the copy source and destination file names and comment
(When copying files that are selected using the jog shuttle)

....

Selecting copy source files by placing "C" marks

  4. Turn the jog shuttle to select a file and press the `SELECT` key. A "C" mark is placed on the selected file. Pressing the key again removes the "C" mark and the file is excluded from the copy source files. Proceed to step 8.

Selecting all files to be copied

  4. Press the "**Mark/Unmark All Files**" soft key to place "C" marks on all the files displayed in the "File List." Pressing the same soft key again removes the "C" marks from all the files. If there are specific files that you wish to exclude from the copy source files, use the jog shuttle and the `SELECT` key to remove the "C" marks from those files. Proceed to step 8.

Selecting the copy destination

....

Page 11-20 "CAUTION"

⚠️

CAUTION

· Make sure to ....
· Do not access the internal hard disk of the DL716 or the storage medium of the external SCSI device from the DL716 and the PC simultaneously. Doing so may cause damage to the files on the storage medium.

Page 11-20 "Precautions when connecting"

Drive

If you format the internal hard disk using the instrument, it is formatted into five partitions. The PC will recognize them as five drives (such as D: to H:). The volume labels are "Realtime" and "User1" to "User4," respectively.

Page 13-5 "Notes about file saving (If Set Action is "Save")"

....

· The number of files that can be saved
  FD: 23 data sets maximum (when the record length per channel is 1 kWord)

Page 14-5 "Error in Setting (800 to 899)"

Code	Message	Corrective Action	Reference Page
....	....		
842	Cannot change when the Variable is turned ON.	Turn OFF the Variable.	Page 13 this alternation notice
843	Cannot change settings of channels which have no input modules installed or those which have logic input modules installed.	—	—
844	Cannot perform zone determination when X-Y display or zoom display is active.	Turn OFF the X-Y display or set the zoom mode to Main.	8-10, 8-12
845	This key is void while editing the zone. Terminate or abort editing using "End" or "Abort."	—	—
846	Cannot take snap shots during zone determination.	—	—

Page 15-2 "15.3 Time Axis"

Item	Specifications	
....		
External clock (EXT CLK IN)	....	
	Frequency range:	1 MHz or less However, the frequency varies depending on the input module. For details, see page 7 this alternation notice.
	....	
	Rise/Fall time of the clock: 2 μs or less	

Page 15-4 "15.8 RS-232 Interface"

Item	Specifications
Connector type	D-sub 9-pin plug

Page 15-6 "15.16 General"

Add the safety standard, emission, and immunity specifications.

Item	Specifications	
Safety standard[2]	Complying standard	EN61010-1 (Applies to 701830, 701852, 701853, 701855, 701856, 701857, 701860, 701870, 701880, 700932, 700933, 700986, and 700987)
	Overvoltage Category (Installation Category) II[3] Measurement Category II[6] Pollution degree 2[4]	
Emission[2]	Complying standard	• EN61326 Class A (applies to 701830, 701852, 701853, 701855, 701856, 701857, 701860, 701870, 701880, 700932, 700933, 700986, and 700987) This product is a Class A (for industrial environment) product. Operation of this product in a residential area may cause radio interference in which case the user is required to correct the interference.
	Cable condition	• External trigger input terminal Use a 3D2W BNC cable[5] and attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA: A1190MN) on each end. • Trigger output terminal Same as the external trigger input terminal above. • External clock input terminal Same as the external trigger input terminal above. • Video output connector Use a D-Sub 15-Pin VGA shielded cable[5] and attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA: A1190MN) on each end. • RS-232 connector Use an RS-232 shielded cable[5] and attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA: A1190MN) on each end. • Printer connector (Centronics) Use a shielded cable[5] to connect to the PRINTER connector. • SCSI connector Use a SCSI shielded cable[5] and attach a ferrite core (TDK: ZCAT2035-0930A, YOKOGAWA: A1190MN) on each end.
	Tests	1: Main terminal disturbance voltage (EN61326) Class A 2: Electromagnetic radiation disturbance (EN61326) Class A 3: Main terminal harmonic current emission (EN61000-3-2: 1995/A14: 2000) 4: Flicker and Voltage Fluctuations (EN61000-3-3)

Item	Specifications	
Immunity[2]	Complying standard	EN50082-2:1995 (applies to 701830, 701852, 701853, 701855, 701856, 701857, 701860, 701870, 701880, 700932, 700933, 700986, and 700987)
	Influence in the immunity environment (performance criterion A)	

Influence in the immunity environment (performance criterion A)
- Noise increase
  - $\leq\pm10$ mV (when using 701852)
  - $\leq\pm1$ mV (when using 701853)
  - $\leq\pm200$ mV (when using 701855)
  - $\leq\pm200$ mV (when using 701856)
  - $\leq\pm10$ mV (when using 701857 in the waveform observation mode)
  - $\leq\pm10$ mVrms (when using 701857 in the RMS observation mode)
  - $\leq\pm10\%$ of FULL SPAN (measurement range) (when using thermocouple K, E, J, L, N, or W on 701860)
  - $\leq\pm20\%$ of FULL SPAN (measurement range) (when using thermocouple T, U, R, or S on 701860)
  - $\leq\pm30\%$ of FULL SPAN (measurement range) (when using thermocouple B or KPvsAu7Fe on 701860)
  - No influence (when using 701870 , 700986)
  - No influence (when using 701870 , 700987)
  - $\leq\pm800 \times 10^{-6}$ strain (when using 701880 and 700932, except for following test)
    $\leq\pm1600 \times 10^{-6}$ strain (when using 701880 and 700932, EM-field immunity: 1.4 GHz to 2GHz, 10 V/A)
  - $\leq\pm800 \times 10^{-6}$ strain (when using 701880 , 700933, except for following test)
    $\leq\pm1600 \times 10^{-6}$ strain (when using 701880 and 700933, EM-field immunity: 1.4 GHz to 2GHz, 10 V/A)
- Test condition
  - 10 MS/s 50 mV/div PeakDetect(Envelope)Mode, input 50 Ω (when using 701852)
  - 10 MS/s 5 mV/div PeakDetect(Envelope)Mode, input 50 Ω (when using 701853)
  - 10 MS/s 50 mV/div PeakDetect(Envelope)Mode 500 Hz BWL, input 50 Ω (when using 701855)
  - 10 MS/s 50 mV/div PeakDetect(Envelope)Mode 500 kHz BWL, input 50 Ω (when using 701856)
  - 10 MS/s, 50 mV/div, PeakDetect (Envelope) Mode, 100 Hz BWL, DC, input 50 Ω (when using 701857)
  - 10 MS/s, 50 mVrms/div, PeakDetect (Envelope) Mode, 100 Hz BWL, RMS:DC, input 50 Ω (when using 701857)
  - 10 MS/s PeakDetect(Envelope)Mode (when using thermocouple J on 701860)
  - 10 MS/s PeakDetect(Envelope)Mode (when using 701870 and 700986)
  - 10 MS/s PeakDetect(Envelope)Mode (when using 701870 and 700987)
  - 10 MS/s 1000×10^{-6} strain bridge voltage 2 V PeakDetect(Envelope)Mode (when using 701880 or 700932, except for following test)
    10 MS/s 20000×10^{-6} strain bridge voltage 2 V PeakDetect(Envelope)Mode (when using 701880 or 700932, EM-field immunity: 1.4 GHz to 2GHz)
  - 10 MS/s 1000×10^{-6} strain bridge voltage 2 V PeakDetect(Envelope)Mode (when using 701880 or 700933, except for following test)
    10 MS/s 20000×10^{-6} strain bridge voltage 2 V PeakDetect(Envelope)Mode (when using 701880 or 700933, EM-field immunity: 1.4 GHz to 2GHz)

	Tests	1. Electrostatic discharge (IEC61000-4-2): 8 kV (air discharge), 4 kV (contact discharge), criterion B

Tests
1. Electrostatic discharge (IEC61000-4-2): 8 kV (air discharge), 4 kV (contact discharge), criterion B
2. EM-field immunity (IEC61000-4-3): 80 MHz to 1 GHz, 10 V/m, criterion A
3. Electrical fast transient/burst (IEC61000-4-4): AC line 2 kV, others 1 kV, criterion B
4. HF conducted immunity (IEC61000-4-6): 0.15 to 80 MHz, 10 Vrms, criterion A
5. Power frequency magnetic field (IEC61000-4-8): 50 Hz, 30 A/m, criterion A
6. Voltage dip/Short interrupt (IEC61000-4-11): 0.5 cycle, each porarity100% criterion B
7. Surge (IEC61000-4-5): 1.0kV (line - line), 2.0 kV (line - ground) criterion B (Compliant products to ship in July, 2001)

Definitions of criteria A and B

	Criterion A	Aforementioned "Influence in the immunity environment" is met during the test.
	Criterion B	Functions and control of this appratus remain operational throughout the test. Changes in the actual operating state or stored data are not allowed.

*1 Because the fuses used by this instrument are all inside the case, they cannot be exchanged by the user. If you believe the fuse inside the case is blown, please contact your nearest YOKOGAWA dealer.
*2 Applies to products manufactured after Feb. 1999 that have CE marks. For all other products, contact your nearest YOKOGAWA dealer.
*3 The Overvoltage Category (Installation Category) is a value used to define the transient overvoltage condition and includes the impulse withstand voltage regulation. II applies to electrical equipment that is powered by a fixed installation such as a distribution board.
*4 Pollution degree is the level of foreign body adhesion such as the solid, liquid, and gas which deteriorates the withstanding voltage or surface resistivity. Pollution degree 2 applies to general indoor atmosphere (non-conductive pollution).
*5 Use a cable of length 3 m or less.
*6 Measurement category II (CAT II) applies to measurement of electrical equipment which is supplied from fixed installations such as a wall outlet wired from a distribution board, or of the wires themselves.

Page 15-8 "15.17 External Dimensions"

Add the external dimensions for the High-Resolution Voltage/RMS Isolation Module (701857).
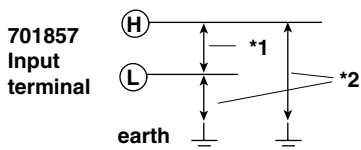
High-Resolution Voltage/RMS Isolation Module (701857)
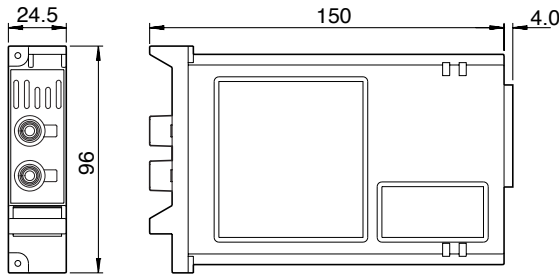
Add pages after page 15-16 "15.25 High-Resolution Voltage/RMS Isolation Module (701857)"

This section contains additional specifications related to the functions provided by the newly added High-Resolution Voltage/RMS Isolation Module (701857).

15.25 High-Resolution Voltage/RMS Isolation Module (701857)

Items that are common to the waveform observation and RMS observation modes

Item	Specifications
Number of input channels	1
Input coupling settings	AC, DC, GND, RMS:AC, RMS:DC • "AC" and "DC" are waveform observation modes. Displays the waveform of the input signal directly. • "RMS:AC" and "RMS:DC" are RMS observation modes. Displays the rms values of the input signal.
Maximum Sample Rate	100 kS/s
Input format	Isolated unbalanced
Voltage-axis sensitivity setting	50 mV/div to 200 V/div (1-2-5 steps)
Maximum input voltage (At 1 kHz or less)	(across input terminals H and L[*1]) 850 V(DC+ACpeak)
Maximum allowable common mode voltage	(across the input terminal, H or L, and earth[*2]) 500 Vrms (Specification when the EN61010-1 standard does not need to be satisfied: 600 Vrms)
Input connector	Safety terminal type (for banana plug)
Input Impedance	1 MΩ±1%
−3dB point for AC coupling used low frequency attenuation point	1 Hz or less
Withstand voltage (across input terminal and earth)	3700 VAC for 1 minute (60 Hz)
Isolation resistance (across input terminal and earth)	10 MΩ or more (500 VDC)
A/D conversion resolution	16 bit (4000 LSB/div)

Temperature coefficient
    Zero point
    Gain
	
	±0.02% of 8 div/°C
	±0.02% of 8 div/°C

Bandwidth limit	Select from OFF/100Hz/1kHz

701857 Input terminal

Items for the waveform observation mode

Item	Specifications
Frequency characteristics[1] (–3 dB point when sine wave of amplitude ±3 div is input)	DC to 40 kHz
Vertical (voltage) axis accuracy DC accuracy[1]	±(0.5% of 8 div)
Common mode rejection ratio	80 dB(50/60 Hz) or more (typical[2])
Residual noise[3]	Larger of ±2.5 mV or ±0.01 div (typical[2])

[1] Measured value under standard operating conditions (refer to page 15-6)

[2] Typical (or average) value; not guaranteed.

[3] Measured under the following conditions: input block shorted

Items for the RMS observation mode

Item	Specifications
Frequency range	DC, 40 Hz to 10 kHz
Vertical (voltage) axis accuracy DC accuracy[1] [2]	±1% of 8 div
AC accuracy[1] [2] (40 Hz to 1 kHz range)	For sinusoid input: ±1.5% of 8 div Crest factor of 2 or less: ±2.0% of 8 div Crest factor of 3 or less: ±3.0% of 8 div

Response time
    Rising edge (0% to 90% of 8 div)
    Falling edge (100% to 10% of 8 div)
	100m ms (typical[3])
	200 ms (typical[3])

Crest factor	3 or less

[1] Measured value under standard operating conditions (refer to page 15-6).

[2] When a signal that is greater than or equal to 10% of 8 div is applied.

[3] Typical (or average) value; not guaranteed.

Adding the GO/NOGO judgement function

GO/NOGO judgement has been added. Before using the GO/NOGO judgement function carefully read the below description.

GO/NO-GO Operation

Function

Applicable waveform parameters

The waveform parameters which are valid for this function are the ones which can be measured automatically using the *MEASURE* key, except for the histogram. (Refer to page 9-4.) Up to sixteen types of parameter can be judged simultaneously.

Parameter upper/lower limit range (Set Limit)

Mode

   OFF : Does not perform GO/NO-GO.

   IN   : Performs GO/NO-GO when the parameter is inside the upper/lower limits.

   OUT : Performs GO/NO-GO when the parameter is outside the upper/lower limits.

Low, Up

   The upper (Up) and lower (Low) limits can be set within the following range.

Waveform parameters	Low/Up setting range	Setting resolution
P-P, Max, Min, High, Low, Ave, Rms	±1.000000E+30	
±Oshot, ±Duty	0 to 100%	1%
Rise, Fall, Period, ±Width	1/SR to the record length/SR[1]	1/SR[1]
R/FDealy(DelayRef=Trig)	–(record length×0.5[2])/SR[1] to (record length×0.5[2])/SR[1]	1/SR[1]
R/FDelay(DelayRef=CH1 to CH8)	–(record length/2)/SR[1] to (record length/2)/SR[1]	1/SR[1]
Freq	Reciprocal of above	Not fixed[3]
Int1TY, Int2TY, Int1XY, Int2XY	±1.000000E+30	
Pulse	1 to 50000	1 step

*1 SR=Sample Rate

*2 When trigger position is at 50%. Value varies according to trigger position.

*3 The frequency is the reciprocal of the period, so the setting resolution is not constant.

AND/OR judgment (AND/OR)

AND : Performs "Action" when all sixteen parameters match the preset conditions.

OR : Performs "Action" when any of the sixteen parameters matches its preset condition.

Status that generates action (Act-Condition)

Always : Always execute selected action.

Failure : Execute action when condition is failed.

Success: Execute action when condition is passed.

If you select Always, the instrument executes the specified action each time a trigger occur. This function is useful when you want to save or print out all triggered waveforms.

Action (Set Action)

Hard copy : Output the screen image to the device selected by the "Copy to" item in the Copy setup menu. (Printer, GP-IB, FD, SCSI, HD, Net-Drive[1], or Net-Printer[1]).

Save   : Save the waveform data to the device selected in the File menu (FD, SCSI, HD, or Net-Drive[1]).

Buzzer   : Sound the buzzer.

[1]: Only for /C10 model

Number of actions (Sequence)
Single: Perform action once only.
Cont : Execute the action repeatedly. (The number of actions cannot exceed the acquisition count set under acquisition mode. If the count is set to Infinite, actions can repeat until acquisition is stopped.)

File names used for data saves to FD, MO, and SCSI
All filenames consist of a five-letter common part followed by a three-digit value (starting from 001) indicating the file generation sequence. The common part of the filename is selected as follows.
Hard Copy: Filename setting in the Copy setup menu. (See Section 10.6)
Save   : Filename setting in the File setup menu. (See Section 11.6.)

Notes about file saving (If Set Action is "Save")
· Data is saved to the device selected by the Misc item in the FILE menu. (Note that you must press the "**Change Media Exec**" soft key to change the selection.)
· File-save capacity is as follows.
  FD   : 23 files (Record length: 1k/CH)
  SCSI, HD: 1000 file sets per high-level directory. (Please create the required number
  Net-Drive[1] of high-level directories ahead of time using the Add Dir function; see
  (Dri1)   Section 11.5.) When the instrument fills one directory, it moves to the
              next.
    [1]: Only for /C10 model

Performing GO/NOGO operation on signals / outputting the judgement results to an external source.
It is possible to perform synchronous GO/NOGO operation on external signals which are input on the GO/NOGO input/output terminal of this instrument, and to output the judgement results to an external source. To perform GO/NOGO operation on external signals it is required to set "Remote Start" to ON.
For details see page 5 of this Note of Alterations.

Note ————————————————————————————————
If you use external signals without performing GO/NOGO operation, make sure to set "Remote Start" to OFF. If you set it to ON errors may occur when using the START/STOP key for data acquisition.
————————————————————————————————————

Notes about GO/NO-GO operation
· Judgment is performed on the parameter which has been turned ON using the *MEASURE* key. No judgment will be performed if measure mode or the parameter has not been turned ON.
· The upper left of the screen shows the success and failure count.
· You use the *START/STOP* key to start the GO/NO-GO operation. Operation stops automatically when completed.
· During GO/NO-GO operation, all keys other than *START/STOP* are disabled.
· The judgment cycle is synchronous with the trigger. (Triggers are not recognized during post-judgment processing.)
· The judgment operation varies according to the acquisition mode, as follows.
  If Average (exponential)   : No judgment.
  If Average (simple)   : All acquisitions within one average cycle (as set by average count) are handled as one acquisition for purpose of judgment.
  If Sequence   : No judgment.
  If BoxAverage or Envelope: Judgment applies to waveform as acquired in the selected mode.

Operating Procedure

Performing automatic measurement of the parameters to be judged

1. Perform automatic measurement of the parameters to be judged as described on page 9-6.

Turning the mode ON and selecting the Act-Condition and Sequence setting

2. Press the $\underline{^{MISC}}$ key.
3. Press the "**GO/NO-GO**" soft key to display the GO/NO-GO menu.
4. Press the "**Mode**" soft key to select "**Param**".

Setting the limit setting mode

5. Press the "**Set Limit**" soft key to display the limit setting menu.
    The parameters which were turned ON in step 1 will be displayed.
6. Turn the jog shuttle to move the cursor to each parameter.
7. Press the $\underline{^{SELECT}}$ key to display the limit setting mode menu.
8. Press the $\underline{^{SELECT}}$ key again to select "**OFF**", "**IN**" or "**OUT**".
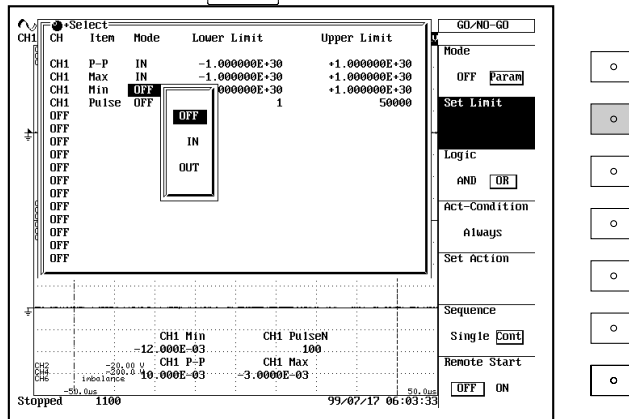
Setting the upper/lower limits

9. Turn the jog shuttle to move the cursor to "**Low**".
10. Press the $\underline{^{SELECT}}$ key to display the lower limit menu.
11. Turn the jog shuttle to set the desired lower limit.
12. Press the $\underline{^{SELECT}}$ or $\underline{^{ESC}}$ key to confirm the limit set.
13. Repeat the above steps to set the desired upper limit (Up).
14. Repeat steps 6 to 13 until the upper/lower limits are set for all the selected parameters.
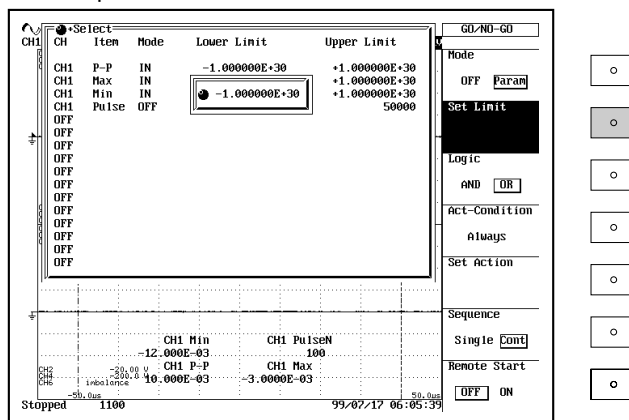
Selecting AND or OR judgment and setting the response (Set Action) to be made when Act-Condition is met (or not met)

15. Press the "**Logic**" soft key to select "**AND**" or "**OR**".

16. Press the "**Act-Condition**" soft key to display the Act-Condition menu.

17. Press the "**Act-Condition**" soft key again to select "**Always**", "**Failure**" or "**Success**".

18. Press the "**Set Action**" soft key to display the response menu.

19. Turn the jog shuttle to move the cursor to the parameter to be turned ON.

20. Press the $\overline{\text{SELECT}}$ key to turn it ON.

21. Repeat steps 19 to 20 until Set Action is set for all the selected parameters.

22. Press the "**Sequence**" soft key to select "**Single**" or "**Cont**".
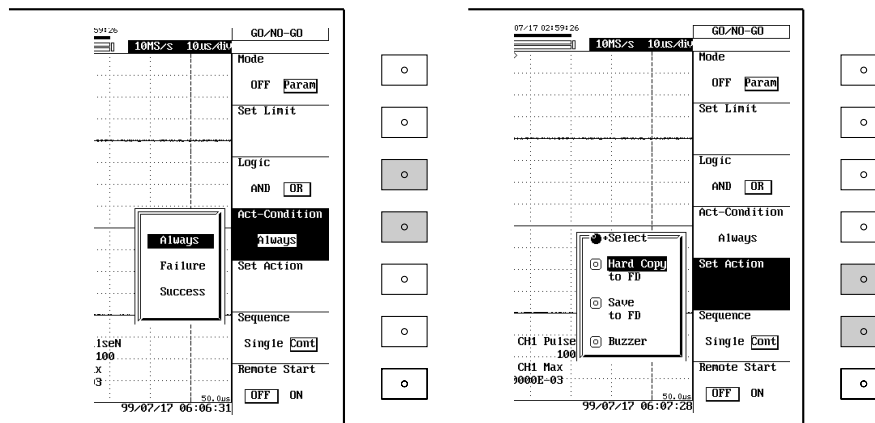
De-/activating external input signals

23. Press the "**Remote Start**" softkey and select ON to activate or OFF to deactivate external input signals.

Executing GO/NO-GO judgment

24. Press the $\overline{\text{START/STOP}}$ key to start acquisition. GO/NO-GO judgment will be executed. To force GO-NO-GO judgment to stop, press the $\overline{\text{START/STOP}}$ key to stop acquisition.

Performing GO/NO-GO Determination Using Zones

Function

GO/NO-GO is determined by creating a zone based on a reference waveform and checking whether or not the waveform has left or entered the zone.
Waveform on which to perform GO/NO-GO determination/determination mode (Setup)
You can select any waveform from input signal waveforms (CH1 to CH8) and computation waveforms (Math1 to Math8). You can also perform GO/NO-GO determination on multiple waveforms.
The following determination mode can be specified on each target waveform:
- IN: Performs GO/NO-GO when the waveform enters the determination zone.
- OUT: Performs GO/NO-GO when the waveform exits the determination zone.
- OFF: Do not perform GO/NO-GO determination on this waveform.

Selecting the reference waveform: Base Trace
Select the reference waveform used to create the determination zone. You can select any of the following waveforms, that can be displayed as a trace, as the reference waveform.
- Input signal waveform
- Computation waveform
- Determination zone

Creating the determination zone: Redraw/New
You can specify up to 4 determination zones. The range is as follows:
- Vertical range: ±8 div from the reference waveform
- Horizontal range: ±5 div from the center of the screen

Setting the Logic
AND: Performs the "Action" when the conditions of all channels that are specified to perform GO/NO-GO determination are met.
OR: Performs the "Action" when any of the conditions of channels that are specified to perform GO/NO-GO determination is met.

Action condition: Act-Condition
Always : Always execute the operation specified in "Set Action."
Failure : Execute the operation specified in "Set Action" when the condition is not met.
Success : Execute the operation specified in "Set Action" when the condition is met.
When "Always" is selected, the operation specified in "Set Action" is executed each time the trigger occurs. This function is useful such as when you wish to output the waveform to the printer each time the trigger occurs.

Action to be executed when the condition is met (or not met): Set Action
Hard copy : Output the screen image to the device selected by the "Copy to" item in the Copy setup menu. (Printer, GP-IB, FD, SCSI, HD, Net-Drive[1], or Net-Printer[1]).
Save   : Save the waveform data to the device selected in the File menu (FD, SCSI, HD, or Net-Drive[1]).
Buzzer   : Sound the buzzer.
[1]: Only for /C10 model

Number of actions: Sequence
Single: Perform the "Action" once.
Cont : Repeat the "Action" up to acquisition count specified in the acquisition mode. (If the count is set to Infinite, the "Action" is repeated until the waveform acquisition is stopped.)

Setting the file name when the data save destination is set to a floppy disk, a HD, or an external SCSI device in "Set Action"

The file name consists of a common part (up to 5 characters) followed by a three-digit value (automatically assigned starting from 001). The common part of the file name is specified in the Filename parameter in the following menus:

Hard copy: Filename in the Copy setup menu (see section 10.6).
Save　　 : Filename in the File setup menu (see section 11.6).

Notes about file saving (If Set Action is "Save")
- The save destination is set to the storage medium selected by the "Misc" item in the FILE menu. (Note that you must press the "Change Media" soft key to change the selection.)
- The number of files that can be saved
  FD　　　 : 23 data sets (when the data length of 1 CH is 1 kWord).
  SCSI, HD : 1000 file sets per high-level directory. (Please create the required number
  Net-Drive*1 of high-level directories ahead of time using the Add Dir function; see
  (Dri1)　　 Section 11.5.) When the instrument fills one directory, it moves to the next.
  *1: Only for /C10 model

Performing GO/NO-GO using external signals/Outputting the determination result

GO/NO-GO determination can be performed by synchronizing to an external signal applied to the GO/NO-GO I/O terminal. The determination result can also be output externally. "Remote Start" must be turned ON in order to perform GO/NO-GO determination using an external signal.
For details, see page ? in this alternation notice.

Note
If you are not going to perform GO/NO-GO determination using an external signal, make sure to turn "Remote Start" OFF. Leaving it ON can cause instability in the start/stop operation of data acquisition using the "START/STOP" key.

Notes when performing zone determination
- Zone determination cannot be performed when zoom waveform or X-Y waveform is being displayed.
- The determination result (success and failure counts) is displayed at the lower section of the screen.
- The GO/NO-GO determination is started using the "*START*" key or the "START IN" signal.
- All keys except the *START/STOP* key are disabled while determination is in progress.
- The determination period is synchronized to the trigger. (However, triggers are not detected while processing the determination result.)
  The determination method varies depending on the acquisition mode.
  If Average (exponential)　: No judgment.
  If Average (simple)　　　 : All acquisitions within one average cycle (as set by average count) are handled as one acquisition for purpose of judgment.
  If Sequence　　　　　　 : No judgment.
  If BoxAverage or Envelope: Judgment applies to waveform as acquired in the selected mode.
- Using auto scaling when performing GO/NO-GO determination on the computed waveform can cause the scaling values to vary when zones are created and when the GO/NO-GO determination is executed. As a result, in some cases, the GO/NO-GO determination is not performed properly. To avoid this problem, use manual scaling when performing GO/NO-GO determination on the computed waveform.
- Waveform is not acquired during the period in which the action is being performed after the determination.

Note

The zone waveform that is created can be saved to the floppy disk as set-up data.

Operation Procedure

Setting the mode

1. Press the $\boxed{^{MISC}}$ key.
2. Press the "**GO/NO-GO**" soft key to display the GO/NO-GO menu.
3. Press the "**Mode**" soft key to select "**Zone**."

Setting the determination conditions

4. Press the "**Zone Menu**" soft key to display the zone determination menu.
5. Press the "**Setup**" soft key to display the determination condition setup menu.
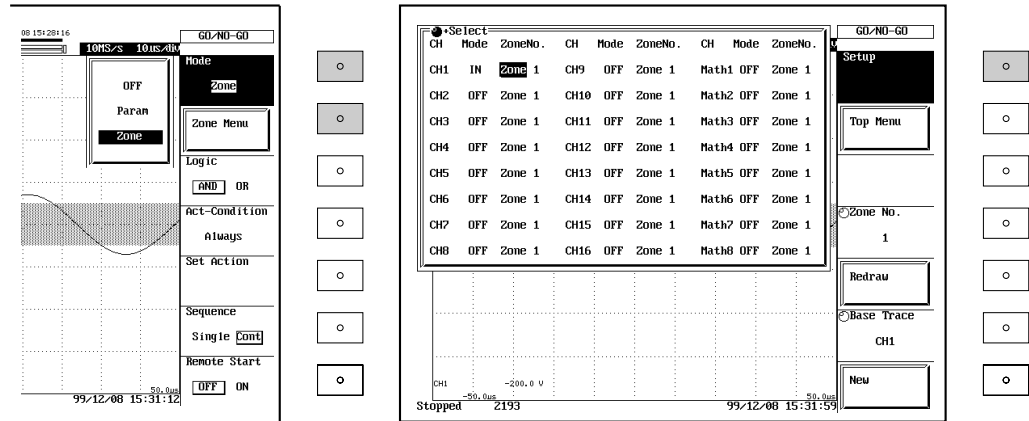
6. Turn the jog shuttle to move the cursor to the desired waveform.

7. Press the $\boxed{^{SELECT}}$ key to display the determination mode menu.

8. Press the same $\boxed{^{SELECT}}$ key several times to select "**OFF**," "**IN**," or "**OUT**."
   If "**OFF**" selected, GO/NO-GO determination will not be performed on the waveform.

9. Turn the jog shuttle to move the cursor to the determination zone number.

10. Press the $\boxed{^{SELECT}}$ key to display the determination zone setup menu.

11. Turn the jog shuttle to select the zone from "**Zone1**" to "**Zone4**" and press the $\boxed{^{SELECT}}$ key.

Creating the determination zone

Creates a new determination zone.

12. Press the "**Zone No.**" soft key.

13. Turn the jog shuttle to select the number of the determination zone to be created.

14. Press the "**Base Trace**" soft key.

15. Turn the jog shuttle to select the reference waveform used to set the determination zone.

16. Press the "**New**" soft key to display the zone edit menu.

Editing the entire zone

17. Press the "**Edit Mode**" soft key to select "**Whole**."
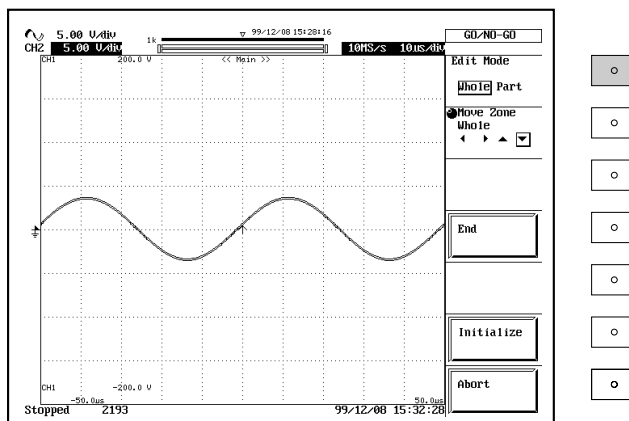
18. Press the "**Move Zone**" soft key to select the direction in which to set the zone.

19. Turn the jog shuttle to create the zone.

The following figure shows an example when you create the zone horizontally.

20. Repeat step 19 to create the desired zone. Proceed to step 21 to edit a section of the zone. Proceed to step 27 to finish the creation the zone.
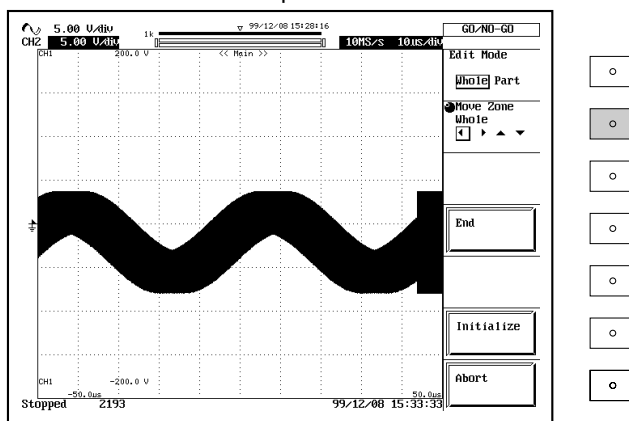
Editing a section of the zone

21. Press the "**Edit Mode**" soft key to select "**Part**."

22. Press the "**Move Zone Part**" soft key to select the right cursor or the left cursor.

23. Turn the jog shuttle to set the right or left edge of the partial zone.

24. Press the "**Move Zone Part**" soft key to select the direction in which to set the zone. Then, turn the jog shuttle to create the zone.

25. Repeat steps 22 to 24 to create the desired zone.
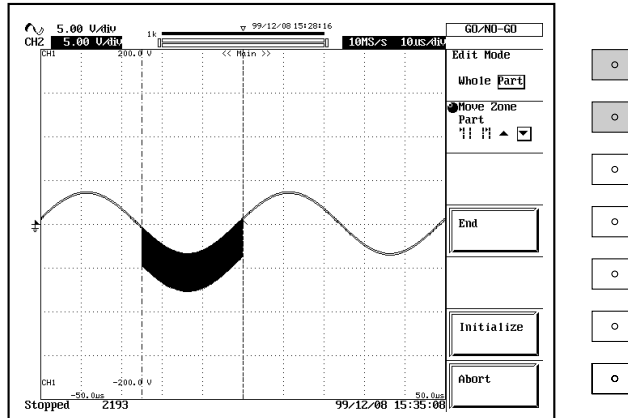
Initializing

26. Press the "**Initialize**" soft key to create a zone of width 1 division at the center of the vertical axis. The horizontal width is the entire screen width if you are editing the entire zone and the selected section if you are editing a section of the zone.

Ending the zone editing

27. Press the "**End**" soft key to end the zone editing and return to the zone determination menu.
Press the "**Abort**" soft key to cancel the edited zone.

Correcting a preexisting determination zone

Corrects a determination zone that was created in the past.

28. In the zone determination menu, press the "**Zone No.**" soft key.

29. Turn the jog shuttle to select the number of the determination zone to be corrected.

30. Press the "**Redraw**" soft key to display the zone edit menu.
Then, repeat steps 17 to 27 to correct the desired zone.

Setting AND/OR and the action to be performed when the condition is met (not met)

31. Press the "**Logic**" soft key to select "**AND**" or "**OR**."

32. Press the "**Act-Condition**" soft key to display the "**Action**" condition menu.

33. Press the same "**Act-Condition**" soft key several times to select "**Always**," "**Failure**," or "**Success**."

34. Press the "**Set Action**" soft key to display the menu used to set the action to be performed when the condition is met (not met).

35. Turn the jog shuttle to move the cursor to the item that you wish to turn ON.

36. Press the $\boxed{SELECT}$ key to turn it ON.

37. Repeat steps 35 and 36 as necessary.

38. Press the "**Sequence**" soft key to select "**Single**" or "**Cont**."
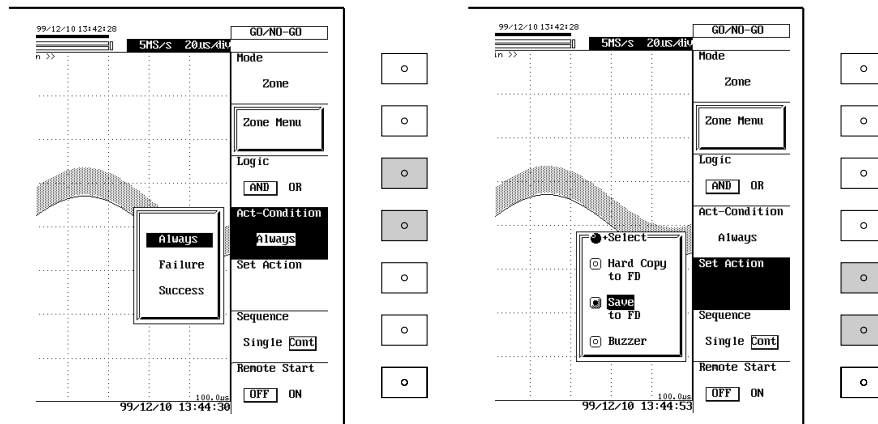
Enabling or disabling the external input signal

39. Press the "**Remote Start**" soft key to select "**OFF**" or "**ON**."

Executing the determination

40. The determination is executed when the waveform acquisition is started by pressing the $\boxed{START/STOP}$ key.

Waveform acquisition stops automatically, when determination is finished.

To abort the determination, stop the waveform acquisition by pressing the $\boxed{START/STOP}$ key.

Using the GO/NOGO Judgement In/Output Function

Functions

It is possible to perform GO/NOGO judgement on external signals which are input on the GO/NOGO input/output terminal of the DL716, and to output the judgement results to an external source from the GO/NOGO input/output terminal.
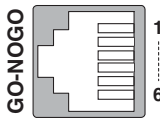
GO/NOGO input/output terminal connector

Format

A modular jack (RJ12) is applied. Please use the separately sold cable no. 366973. If you use a different cable (modular 4 cable for telephone circuits) read below instructions before connecting the cable.

In/Output level

Within 0 to 5 Volt, Treshold value: TTL.

Pin arrangement

| Pin number	signal	Logic
1	NC (unconnected)	
2	START IN	Negative
3	GO OUT	Negative
4	NOGO OUT	Negative
5	GND	
6	NC (unconnected)	

GO-NOGO
1 ⋮ 6

DL side connector.

Input Signal

START IN signal (negative)

Used when performing synchronous GO/NOGO judgement. Only active when "Remote Start" is set to ON. When "Remote Start" is set to OFF, GO/NOGO judgement will be performed unrelated to external signal input (and judgement results will be output).

Signal input circuit chart
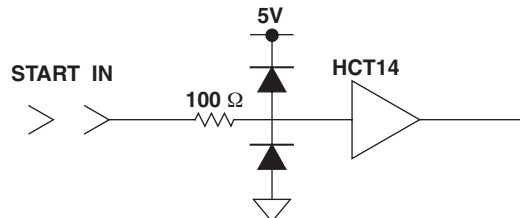
Note

The START IN signal does not get "pulled-up". If you don't use the START IN signal, or if the connector is disconnected, make sure to set "Remote Start" to OFF. If you set it to ON errors may occur when using the START/STOP key for acquisition.
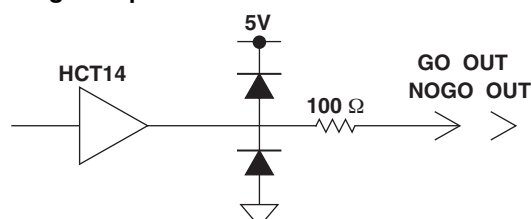
Output Signal

NOGO OUT (negative)

If the judgement result is "NO-GO", the output single level will temporarily change from high level (H) to low level (L).
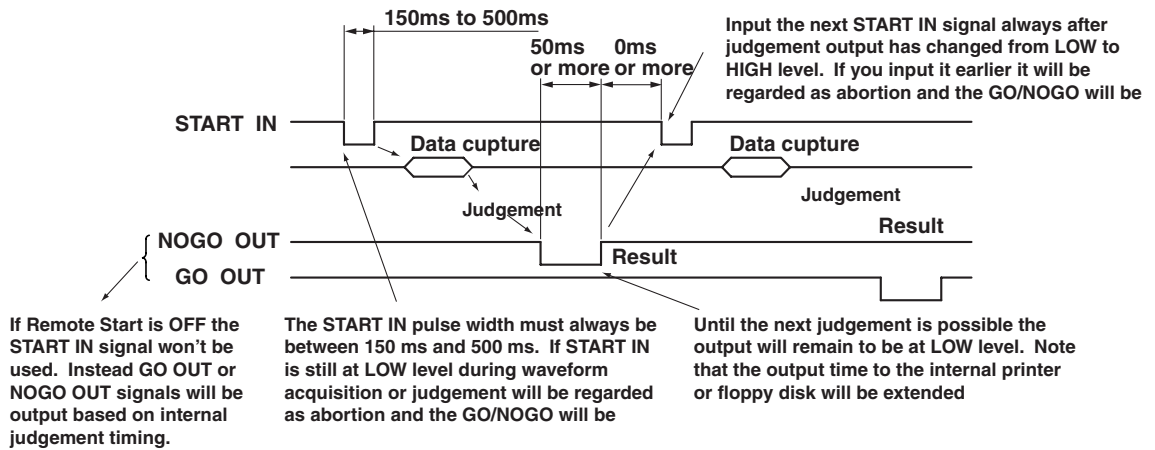
GO OUT (negative)

If the judgement result is "GO", the output single level will temporarily change from high level (H) to low level (L).

Single output circuit chart

GO/NOGO In/Output Timing

150ms to 500ms

50ms **0ms**
or more **or more**

Input the next START IN signal always after judgement output has changed from LOW to HIGH level. If you input it earlier it will be regarded as abortion and the GO/NOGO will be

START IN

Data cupture **Data cupture**

Judgement **Judgement**

Result

NOGO OUT

Result

GO OUT

If Remote Start is OFF the START IN signal won't be used. Instead GO OUT or NOGO OUT signals will be output based on internal judgement timing.

The START IN pulse width must always be between 150 ms and 500 ms. If START IN is still at LOW level during waveform acquisition or judgement will be regarded as abortion and the GO/NOGO will be

Until the next judgement is possible the output will remain to be at LOW level. Note that the output time to the internal printer or floppy disk will be extended

GO/NOGO cable no. 366973 (separately sold)

Do not use the cable for other purposes than for DL716 GO/NOGO judgement.
To connect an external device, read the following:

Approx. 1.5 m

6

Connect to the DL716

1

Use the cable's loose wires as required.

RJ12 connector
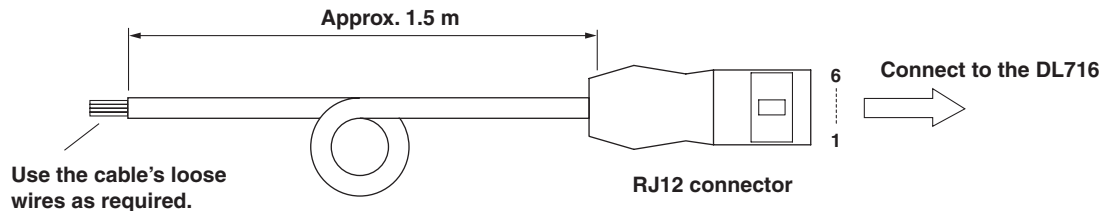
Color	Pin number	Signal	logic
Yellow	2	START IN	Negative
White	3	GO OUT	Negative
Green	4	NOGO OUT	Negative
Blue	5	GND	