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MU163020B
200M 16CH Pulse Pattern Generator Unit
and
MU163040B
200M 16CH Error Detector Unit
Operation Manual

First Edition

Read this manual before using the equipment.
Keep this manual with the equipment.

ANRITSU CORPORATION

Document No. : M-W1444AE-1.0

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Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment.
Some or all of the symbols may not be used on this equipment. In addition, when drawings are included in this manual, labels on the equipment may not be shown on them.

Safety Symbols Used in Manual

DANGER This indicates a very dangerous procedure that could result in death or serious injury if not performed properly

WARNING This indicates a hazardous procedure that could result in death or serious injury if not performed properly

CAUTION This indicates a hazardous procedure or danger that could result in light-to-serve injury, or loss related to malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

The following safety symbols are used inside or on the equipment near operation location, and/or in manual to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE


This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.


This indicates an obligatory safety precaution. The obligatory operation is indicated in or near the circle.


This indicates warning or caution. The contents are indicated symbolically in or near the triangle.


This indicates a note. The contents are described in box.


This indicates that the marked part should be recycled.

MU163020B 200M 16CH Pulse Pattern Generator
and MU163040B 200M 16CH Error Detector
Operation Manual

31 August 1998 (First Edition)

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For Safety

WARNING ⚠



1. ALWAYS refer to the operation manual when working near location at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.
   Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangerous.

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WARNING ⚠

2. This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. These are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.

CAUTION ⚠

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Don't input a signal which is excessive electric circuit exceed a definite rule between the terminal and earth. There is a possibility to be damaged the inside equipment.

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Anritsu Corporation certifies that this equipment was tested before shipment using caribrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the Electrotechnical Laboratory, National Research Laboratory and the Communication Research Laboratory, and was found to meet the published specification.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of- charge if malfunction occurs within 1 year after shipment due to manufacturing fault, provided that this warranty is rendered void under any or all of following condition.

- The fault is outside the scope of the warranty conditions described in operation manual.
- The fault is due to mishandling, misuse, or unauthorized modification or repair of the equipment by customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by customer.
- The fault is due to natural disaster including fire, flooding, earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

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A gallium arsenic is contained in electronic circuit of the equipment. When you dispose the equipment, you must dispose of it, baled on a each local regulations and each national lows.

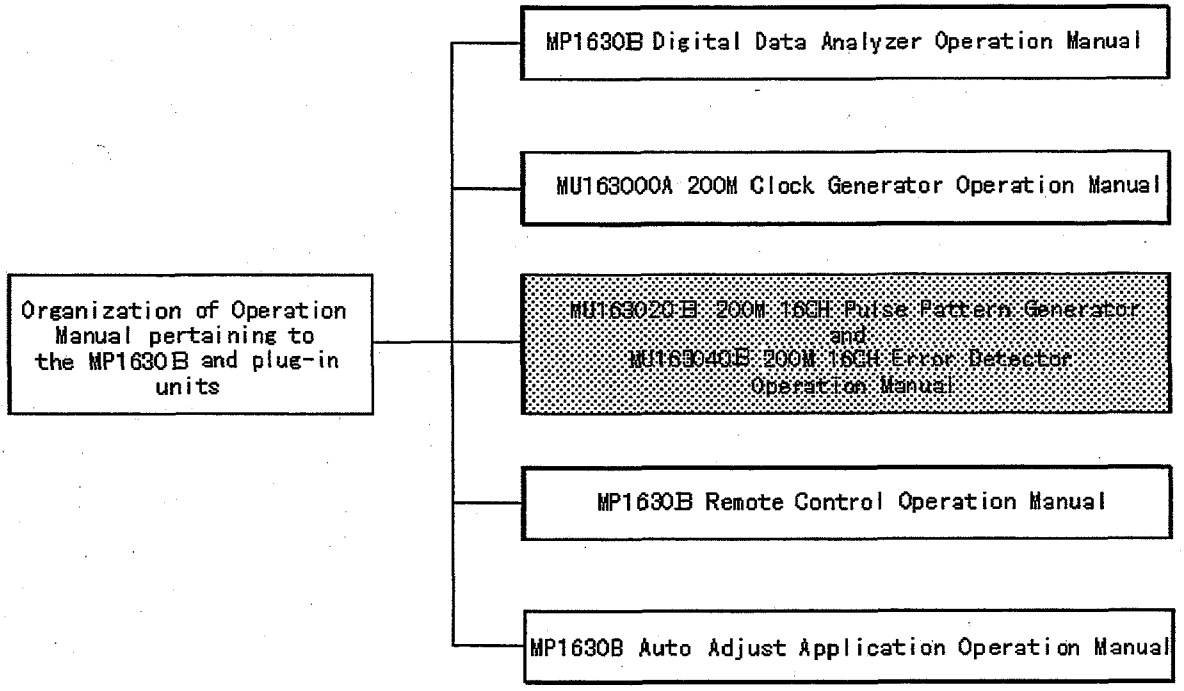
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INTRODUCTION

Organization of Operation Manual

Operation Manual are divided into five volumes pertaining to the MP1630B digital data analyzer itself and the individual plug-in units. Use these user's guides to suit intended applications.



- MP1630B Digital Data Analyzer Operation Manual
  Gives an overview of the MP1630B and describes its setup steps, its panels, the relevant standards, performance details, and how to operate the unit.
- MU163000A 200M Clock Generator Operation Manual
  Gives an overview of the MU163000A 200M clock generator unit and describes the relevant standards, performance details, and how to operate the unit.
- MU163020B 200M 16CH PPG and MU163040B 200M 16CH ED Operation Manual
  Gives an overview of the 200M 16CH PPG and ED units and describes the relevant standards, performance details, and how to operate the units.
- MP1630B Remote Control Operation Manual
  Explains the concepts of external interface (RS-232C, GPIB option, and Ethernet option) control, and also contains sample programs.
- MP1630B Autoadjust Application Operation Manual(only MP1630B)

  Explains how to operate the relevant to the MP1630B Autoadjust Application Operation Manual.

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1.CHAPTER1 INTRODUCTION

CHAPTER 1 INTRODUCTION

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1.1 Product Overview

The MU163020B 200M 16CH Pulse Pattern Generator generates pulse patterns for 16 channels ranging from 10 kb/s to 200 Mb/s. The MU163040B 200M 16CH Error Detector detects pulse patterns in 16 channels ranging from 10 kb/s to 200 Mb/s. The MU163020B and MU163040B are used with the MP1630B Digital Data Analyzer to evaluate various digital communication equipment, digital communication modules, and devices. This unit is suitable for research and development and production.

Features

- Independent pulse pattern generation for 16 channels and simultaneous error detection
  - Data, clock and trigger input/output: 16 channels
  - AUX(envelope or resetting) output: 8 channels + 1 channel(OR output)
- Bit error detection by either continuous or burst signal
  - A burst enable length and guard times can be set in bits
  - A preamble, overhead, and information bit length can be set for each channel.
- Various patterns
  - PRBS(2^n-1 : n=7 to 31, variable mark rate), PRGM(64Kbits/channel), zero substitution pattern, and MIX pattern split into maximum 32 blocks, and PRGM or PRBS can be allocated to each column. (PRGM and PRBS can be freely set for 32 clocks)
- Measurement items

  Bit error rate, bit error count, error interval count, error free interval rate, error performance(G821-compliant), clock frequency, and delay measurement
- Error analysis function
- Eye margin measurement
- Auto search function (identification of PRBS and automatic setting of best phases of pattern and clock)
- Burst signal generation/analysis ready for passive optical network

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Subjects of Measurement

- Optical access network (PDS/PON) unit and module
- SDH/ATM unit and module
- Digital CATV cable modem
- TDMA/CDMA satellite/mobile communication
- wireless LAN
- Multichannel optical module for optical interconnection
- Next-generation PC interface

  Fibre channel,IEEE1394,SSA、ATM-25
- O/E and E/O converters and QPSK/QAM modulation/demodulation modules
- Communication devices such as LSI, ASIC/FPGA, and CCD

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1.2 Structure of This Manual

Information in this Operation Manual is organized into ten chapters, two appendixes, and one index.

Chapter	Description
CHAPTER 1 INTRODUCTION	Product overview, organization of the operation manual, hardware configurations, specifications.
CHAPTER 2 PRECAUTION	Ambient conditions, safety precautions, preparations for turning power on.
CHAPTER 3 EXPLANATION OF PANELS	Location and functions of instrument panel keys, LED's, connectors, and so on.
CHAPTER 4 SCREEN CONFIGURATION	Screen configuration.
CHAPTER 5 BASIC OPE	Explains basic operation, setting interface, Measuring Errors/Alarms, and so on.
CHAPTER 6 APPLICABLE OPERATION	Explains function in grouping and eye margin measurement.
CHAPTER 7 ACTUAL MEASUREMENT	Connection for measurement and actual example of set up method.
CHAPTER 8 PERFORMANCE TEST	Explains how to examine performance of unit itself.
CHAPTER 9 SELF-DIAGNOSIS	Explains self-diagnosis software.
CHAPTER 10 MAINTENANCE	Preventive maintenance to ensure safety, daily care calibration, storage and shipping tips.
APPENDIX	Factory default setting.

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1.3 Unit Configuration

1.3.1 Standard configuration

The standard configuration of the MU163020B 200M 16CH Pulse Pattern Generator is as follows:

Table 1.-1 Standard configuration of MU163020B

Item	Type and Symbol	Description	Quantity	Remarks
Unit configuration	MU163020B	200M 16CH Pulse Pattern Generator Unit	1	
Accessories	J0693D	SMA cable	2	0.27m (double shield)
	W1444AE	Operation Manual	1	

The standard configuration of the MU163040B 200M 16CH Error Detector is as follows:

Table 1.-2 Standard configuration of MU163040B

Item	Type and Symbol	Description	Quantity	Remarks
Unit configuration	MU163040B	200M 16CH Error Detector Unit	1	
Accessories	J0693D	SMA cable	1	0.27m (double shield)
	J0828	Multi-core cable	2	16pins、0.5m
	J0829	Multi-core cable	1	17pins、0.5m
	W1444AE	Operation manual	1	Not supplied when Pulse Pattern Generator Unit purchased as same time.

1.3.2 Applied components

Applied components of MU163020B 200M 16CH Pulse Pattern Generator and MU163040B 200M 16CH Error Detector are as follows:

Table 1.-3 Applied components

Type and symbol	Description	Remarks
J0776D	BNC cable	2m (double shield)
J0824	BNC multi-core cable	16pins,1.0m
J0825	BNC multi-core cable	9pins,1.0m
J0826	SMA multi-core cable	16pins,1.0m
J0827	SMA multi-core cable	9pins,1.0m
J0858	SMA multi-core cable	16pins,2.0m
J0859	SMA multi-core cable	9pins,2.0m
J0860	BNC multi-core cable	16pins,2.0m
J0861	BNC multi-core cable	9pins,2.0m

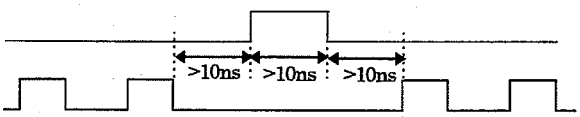
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1.4 Specifications

1.4.1 MU163020B 200M 16CH Pulse Pattern Generator

This section describes a specifications of MU163020B 200M 16CH pulse pattern generator in table1-4

Table 1-4 Specifications of MU163020B (1/9)

	Items	Specifications
Input interface	Clock input	
	Operation frequency range	10k to 200MHz
	Level	V_{IH} : -1.1±0.1V V_{IL} : -1. 5±0.1V
	Termination condition	50 Ω to -1.3 V
	Connector	SMA
	Input duty	50±2.5%
	PATT reset signal input	
	Level	ECL (V_{IH} : -0.9±0.2V V_{IL} : -1.7±0.2V)
	Connector	SMA
	Input timing	PATT RESET CLOCK INPUT  Clock inhibit
	EXT. BURST trigger input	
	Level	TTL (V_{IH} : +2.4V_{min} V_{IL} : +0.4V_{max}) 、High impedance
	Connector	BNC
	Logic	A burst cycle at a edge of raise begins Asynchronization
	EXT. ERROR input	
	Level	TTL (V_{IH} : +2.4V_{min} V_{IL} : +0.4V_{max}) 、High impedance
	Connector	BNC
	Logic	A error insert in edge of raise. Asynchronization

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Table 1-4 Specifications of MU163020B (2/9)

	Items	Specifications
Output interface	16CH Data output	
	The number of output	16
	Operation bit rate	10k to 200Mbps
	Wave form	NRZ
	Level	ECL (V_{OH} : -0.9V V_{OL} : -1.7V) PECL (V_{OH} : +4.1V V_{OL} : +3.3V) TTL (V_{OH} : +5.0V V_{OL} : +0.0V) LVTTL (V_{OH} : +3.3V V_{OL} : +0.0V) VAR High impedance V_{OH} : -4.500 to +5.000 V／5 mV steps V_{OL} : -5.000 to +4.500 V／5 mV steps +0.500V≦$V_{OH}-V_{OL}$≦+5.000 V／10 mV steps 50 Ω to GND V_{OH} : -2.250 to +2.500 V／2.5 mV steps V_{OL} : -2.500 to +2.250 V／2.5 mV steps +0.250V≦$V_{OH}-V_{OL}$≦+2.500 V／5 mV steps Setting error : Larger of ±0.1V and ±10% for V_{OH}／V_{OL} setting value
	Skew variable range	-5.0ns to +5.0ns ／ 0.1ns steps Accuracy ±150ps (for setting value)
	Jitter	450ps or less
	Raise／Fall time	The time is regulated in10 to 90% of an amplitude (50 Ω terminal) 0.8+0.5×(V_{p-p})ns or less
	Termination condition	VAR : 50 Ω to GND／-2 V／+3 V or High impedance ECL : 50 Ω to -2 V PECL : 50 Ω to +3 V TTL、LVTTL : High impedance
	Connector	(34 pins) multipolar connector
	Output	ON/OFF (Set at each CH) High impedance while output is OFF
	Wave form distortion	Larger of ±0.15V and under 10% for amplitude
	Skew among a CH	2.5ns or less (Measurement at 0ns)

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Table 1-4 Specifications of MU163020B (3/9)

	Items	Specifications
Output interface (continued)	16CH Clock output	
	The number of output	16
	Operation frequency	10k to 200MHz
	Inverse of a property of a pole	POS／NEG (Set at each CH)
	Level	ECL (V_{OH} : -0.9V V_{OL} : -1.7V) PECL (V_{OH} : +4.1V V_{OL} : +3.3V) TTL (V_{OH} : +5.0 V V_{OL} : +0.0 V) LVTTL (V_{OH} : +3.3V V_{OL} : +0.0V) VAR High impedance V_{OH} : -4.500 to +5.000 V／5 mV steps V_{OL} : -5.000 to +4.500 V／5 mV steps +0.500V≦$V_{OH}-V_{OL}$≦+5.000 V／10 mV steps 50 Ω to GND V_{OH} : -2.250 to +2.500 V／2.5 mV steps V_{OL} : -2.500 to +2.250 V／2.5 mV steps +0.250V≦$V_{OH}-V_{OL}$≦+2.500 V／5 mV steps Setting error : Larger of ±0.1V and ±10% for V_{OH}／V_{OL} setting value
	Delay(Change amount)	-5.0ns to +5.0ns／0.1ns steps Accuracy : Larger of ±150ps and ±10% for the setting value
	Jitter	450ps or less
	Raise／Fall time	The time is regulated in 10 to 90% of amplitude (50 Ω Terminal) 0.8 ns+0.5× (V_{p-p}) ns
	Termination condition;	VAR : 50 Ω to GND／-2 V／+3 V or High impedance ECL : 50 Ω to -2 V PECL : 50 Ω to +3 V TTL、LVTTL : High impedance
	Connector	Multipolar connector (34 pins)
	Output ON／OFF	It is possible to set ON/OFF in each CH High impedance while output is OFF
	Output method	It is possible to change between Repeat and Burst
	Burst shift	While output is burst, it is possible to shift at the range of 0 to 9999bits on burst interval. The settings is virtually a Burst Trigger output
	Skew among a CH	2.5ns or less (Measurement at 0ns)

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Table 1-4 Specifications of MU163020B (4/9)

Items		Specifications
Output interface (continued)	Burst trigger output	
	The number of output	16
	Operation frequency range	10k to 200Mbps
	Output level	ECL (V_{OH} : -0.9±0.1V V_{OL} : -1.7±0.1V)
	Output logic	Low : enable (valid area of data) High : disable
	Termination condition	50 Ω to -2 V
	Connector	Multipolar connector (34 pins)

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Table 1-4 Specifications of MU163020B(5/9)

	Items	Specifications
Output interface (continued)	Trigger output Trigger Source	Select between Error (Error addition) and Block (A pattern is composed at a block)
	The number of output	1
	Level	V_{OH} : 0±0.2V V_{OL} : -1±0.2V
	Termination condition	50 Ω to GND
	Connector	Multipolar connector (Common with Burst Trigger output connector)
	SYNC output Source	One is selected among below 1/1 Clock、1/8 Clock、PRBS Sync.、PRGM Sync ※PRBS Sync and PRGM Sync generate a time in a cycle
	The number of output	1
	Level	V_{OH} : 0 ±0.2 V V_{OL} : -1±0.2 V
	Termination condition	50 Ω to GND
	Connector	BNC
	AUX. output	It shows a edge or an area of data signal in Burst/PON
	The number of output	8
	Level	10k～100Mbps TTL (V_{OH} : +4.0V_{min} V_{OL} : +0.5V_{max}) 10k～200Mbps ECL (V_{OH} : -0.9±0.2V V_{OL} : -1.7±0.2V)
	Termination condition	50 Ω to -2 V (ECL) High impedance (TTL)
	Connector	Multipolar connector (34 pins)
	AUX. OR output (Port9) The number of output	AUX.OR output is outputted after all of AUX.output performed OR operation 1
	Level	10k to 100Mbps TTL (V_{OH} : +4.0V_{min} V_{OL} : +0.5V_{max}) 10k to 200Mbps ECL (V_{OH} : -0.9±0.2V V_{OL} : -1.7±0.2V)
	Termination condition	50 Ω to -2 V (ECL) High impedance (TTL)
	Connector	Multipolar connector (Common with AUX output connector)

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Table 1-4 Specifications of MU163020B (6/9)

	Items	Specifications
Generation pattern	PRBS pattern	
	Cycle	2^N-1 (N=7、9、11、15、20、23、31)
	Mark rate	1/2、1/4、1/8、ALL0
	Bits sift	(By means of logic inverse 1/2INVT、3/4、7/8、ALL1) The number of a bits sift in variable mark rate.
	Phase Difference	1 bit／3 bits selectable None : Generate PRBS pattern in each CH independently MUX : When CH1 to CH16 are the same cycle Generate a PRBS pattern which shifted a phase 1/16 cycle by 1/16 cycle When CH1 to CH8 are the same cycle Generate a PRBS pattern which shifted a phase 1/8 cycle by 1/8 cycle When CH9 to CH16 are the same cycle Generate a PRBS pattern which shifted a phase 1/8 cycle by 1/8 cycle ※ Because a channel accepted as group in CH1 to CH8 and CH9 to CH16, it is impossible to select the MUX when a cycle of a PRBS is different from a channel among each group.
	PRGM pattern	
	Pattern length	2 to 65,536bits／CH Relation between a pattern length and a step : 2 to 8,192bits ／ 1bit step 8,192 to 65,536bits ／ 8bits steps
	Logic inverse	POS／NEG
	Zero substitution pattern	
	Configuration	Zero continuation is substituted into PRBS pattern
	Pattern length	2^N (N=7、9、11、15)
	Zero substitution length	N to (2^N-1) bits
	Logic inverse	POS／NEG

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Table 1-4 Specifications of MU163020B (7/9)

Items		Specifications
Generation pattern (continued)	MIX pattern	You can select a PRGM/PRBS pattern in each column after you divide a pattern between Row/Column.
	Configuration	Row : 1 to 32 Column : 1 to 8 (but, Row×Column ≦32)
	Block length	PRGM part : per 1 block 8 to 8,192 bits/CH 8bits steps PRBS part : A block length is different depend on a combination of blocks.

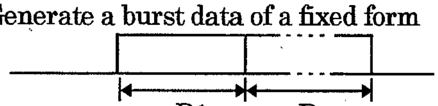
M I X pattern PRBS block length

Row \ Column	1	2	3	4	5	6	7	8
1		131,072	65,536	65,536	32,768	32,768	32,768	32,768
2	131,072	65,536	32,768	32,768	16,384	16,384	16,384	16,384
3,4	65,536	32,768	16,384	16,384	8,192	8,192	8,192	8,192
5	32,768	16,384	8,192	8,192	8,192	8,192		
6	32,768	16,384	8,192	8,192	8,192			
7,8	32,768	16,384	8,192	8,192				
9,10	16,384	8,192	8,192					
11 - 16	16,384	8,192						
17 - 32	8,192							

unit : bits

8bits steps

Items		Specifications
Generation pattern (continued)	Logic inverse	POS/NEG (only PRGM part)
	PON pattern Configuration	Generate a burst data of a fixed form



Bn : n=1 to 7

It is a possible to select PRGM/PRBS in each block.

Block length

PRGM 8 to 8,192 bits 8bits steps

PRBS 8 to 131,072 bits 8bits steps

The largest length of blocks is restricted as below by the number of blocks in PRBS

The reration between the number of blocks and the largest length of block.

The number of blocks	1	2	3	4	5	6	7
The largest length value of Block	131,072	98,304	65,536	32,768	32,768	32,768	32,768

Logic inverse: POS/NEG (PRGM part)

Downside: A independent parallel data in each CH generation

Upside: A serial data which a signal performed OR operation from CH1 to CH(n) (n:1 to 16) output from CH1

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Table 1-4 Specifications of MU163020B (8/9)

	Items	Specifications
Generation pattern	Repeat generation	Output a voluntary pattern (PRGM,PRBS,MIX) continually.
	Internal burst generation Burst cycle Enable length Data mode	A voluntary pattern output in a certain period of time uncontinually. 0.1 to 10ms/0.1ms steps 8 to 1,999,968bits/8bits steps Consecutive/restart You can choice (PRBS pattern is valid in only Consecutive, and all of CH is common) Consecutive : A pattern continue among the burst Restart : A pattern restart in each burst
	External burst generation Enable length	Output burst data specified an enable length as an beginning position which is raising edge of external burst signal input 8 to 2,097,144 bits 8bit steps
Error insert	Internal error insert Insert mode Normal Insert rate (error rate) Insert CH Insert position Burst Insert rate (error rate) Burst length Enable length Insert CH Insert position	 Normal : An error insertion in certain cycle Burst : An error insertion in particular area Single, 10^{-N} (N=3 to 9) ON/OFF (Set at each CH) You can select a block, while the mode is MIX/PON (It is impossible to select while the mode is PRBS and PRGM) 10^{-N} (N= 2 to 9) 1 to 10s / 1s steps 20 to 140ms / 20ms steps ON/OFF (Set at each CH) You can select a block, while the mode is MIX/PON (It is impossible to select while the mode is PRBS and PRGM) Attention) Settings of a error are common in all CHs except insert CH and insert position
	External error insert Insert mode Normal Insert CH Insert position Burst Insert rate (Error rate) Insert CH Insert position	 Normal : An error insertion at raising edge of the external error signal input Burst : An error insertion specified by high interval of the external error signal input ON/OFF (Set at each CH) You can select a block, while the mode is MIX/PON (It is impossible to select while the mode is PRBS and PRGM) 10^{-N} (N= 2 to 9) ON/OFF(Set at each CH) You can select a block, while the mode is MIX/PON (It is impossible to select while the mode is PRBS and PRGM) Attention) Settings of a error are common in all CH except insert CH and insert position

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Table 1-4 Specifications of MU163020B (9/9)

	Items	Specifications
measurement	Delay measurement	
	Measurement method	Special pattern is inserted in output data
	Insert cycle	1 to 10s／1s steps
	Operation temperature range	5 to 40℃
	External dimensions	448.9±5(D)×232±4(W)×49±2.8(H) mm
	Weight	3.5kg or less
	Power consumption	380VA or less

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1.4.2 MU163040B 200M 16CH Error Detector unit

This section describes specifications of MU163040B 200M 16CH Error Detector in Table1-5

Table1-5 Specifications of MU163040B (1/8)

	Items	Specifications
Input interface	16CH Clock input	
	The number of input	16
	Operation frequency	10k to 200MHz
	Inverse of a property of a pole	POS/NEG (Set eachCH individually)
	Level	V_{IH} : -4.500 to +5.000 V V_{IL} : -5.000 to +4.500 V V_{P-P} : 0.500 to +5.000 V P－P
	Delay(Change amount)	-5.0ns to +5.0ns ／ 0.1ns steps Accuracy : Larger of ±150ps and ±10% for setting value
	Termination condition	50 Ω to GND ／ -2 V ／ +3 V
	Change of clock route	Each CH independence／All CH commons (CH1/Reference)
	Change of Repeat/Burst Clock	When burst data is recived, Repeat/Burst is specified based on state of the then clock signal When a mode is Burst Clock, a clock reference voltage in each clock is identical to a data threshold voltage in each clock. When a mode is PON(Upside), reference clock is selected amoung CG clock or CH1
	Connector	Multipolar (34pins)
	Duty	50%±5%
	16CH Data input	
	The number of input	16
	Wave form	NRZ
	Operation bit rate	10k to 200Mbps
	Input level	V_{IH} : -4.500 to +5.000 V V_{IL} : -5.000 to +4.500 V V_{P-P} : 0.500 to +5.000 V P－P
	Threshold level	V_{th} : -5.000 to +5.000 V ／ 5mV steps (VAR GND terminal) : -2.000 to -0.600V ／ 5mV steps (VAR -2V terminal) : +3.000 to +4.400V ／ 5mV steps (VAR +3V terminal)
	Termination condition	ECL : 50 Ω to -2 V (V th : -1.3 V) PECL : 50 Ω to +3 V (V th : +3.7 V) TTL : 50 Ω to GND (V th : +1.4 V) CMOS : 50 Ω to GND (V th : +2.5 V) LVTTL : 50 Ω to GND (V th : +1.4 V) VAR : 50 Ω to GND ／ -2 V ／ +3 V
	Connector	Multipolar connector (34 pins)

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Table1-5 Specifications of MU163040B (2/8)

	Items	Specificatons
Input interface (continued)	CLK input	(This input is connected to MU163000A Clock Generator unit)
	The number of input	1
	Operation frequency	10k to 200MHz
	Level	V_{IH} : -1.1±0.1V V_{IL} : -1. 5±0.1V
	Termination condition	50 Ω to -1.3V
	Connector	SMA
	Duty	50%±2.5%
	Burst trigger input	
	The number of input	16
	Operation bit rate	10k to 200Mbps
	Level	ECL (V_{IH} : -0.9±0.1 V V_{IL} : -1.7±0.1 V) Low : enable (valid area of data) High : disable
	Terminal condition	50 Ω to -2 V
	Connector	Multipolar connector (34 pins)
	Trigger input	
	The number of input	1
	Level	V_{IH} : 0.0±0.2 V V_{IL} : -1.0±0.2 V
	Termination condition	50 Ω to GND
	Connector	Multipolar connector (This is common with Burst Trigger input connector)
Output interface	SYNC output	
	Source	One is selected among below 1/1 Clock、1/8 Clock、PRBS Sync.、PRGM Sync ※PRBS Sync. and PRGM Sync. generate a time in a cycle
		1
	Output level	V_{OH} : 0±0.2 V V_{OL} : -1±0.2 V
	Termination condition	50 Ω to GND
	Connector	BNC

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Table1-5 Specifications of MU163040B (3/8)

Items		Specifications
Detect pattern	PRBS pattern	
	Cycle	2^N-1 (N=7、9、11、15、20、23、31)
	Mark rate	1/2、1/4、1/8、ALL0 (by mean of logic invese 1/2INVT、3/4、7/8、ALL1)
	Bit sift	The number of a bits sift in variable mark rate 1bit/3bits selectable
	PRGM pattern	
	Pattern length	2 to 65,536bits/CH Relation a pattern length and a steps : 2 to 8,192bits / 1bit step 8,192 to 65,536bits / 8bits steps
	Logic inverse	POS/NEG
	MIX pattern	You can select a PRGM/PRBS pattern in each Column after you divide a pattern between Row/Column.
	Configuration	Row : 1 to 32 Column : 1 to 8 (but, Row×Column ≦32)
	Block length	PRGM part : per 1Block 8 to 8,192 bits/CH 8bits steps PRBS part : A block length is different depend on a combination of blocks.
	Logic inverse	POS/NEG (PRGM parts only) 8bits steps
	Zero substitution pattern	
	Configuration	Zero continuation is substituted into PRBS pattern
	Pattern length	2^N (N=7、9、11、15)
	Zero substitution length	N to (2^N-1) bits
	Logic inverse	POS/NEG

MIX pattern PRBS block length

Row \ Column	1	2	3	4	5	6	7	8
1		131,072	65,536	65,536	32,768	32,768	32,768	32,768
2	131,072	65,536	32,768	32,768	16,384	16,384	16,384	16,384
3,4	65,536	32,768	16,384	16,384	8,192	8,192	8,192	8,192
5	32,768	16,384	8,192	8,192	8,192	8,192		
6	32,768	16,384	8,192	8,192	8,192			
7,8	32,768	16,384	8,192	8,192				
9,10	16,384	8,192	8,192					
11 - 16	16,384	8,192						
17 - 32	8,192							

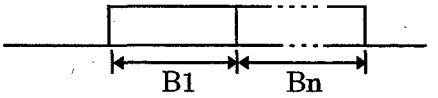
unit : bits

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Table1-5 Specifications of MU163040B (4/8)

<table>
<tr><th colspan="2">Items</th><th>Specifications</th></tr>
<tr><td rowspan="2">Detect pattern (continued)</td><td>PON pattern
Configuration

Bit length

Logic inverse
Downside
Upside</td><td>Generate a fixed form of a burst data
 

Bn : n =1 to 7 (PR parts is out of measurement object)
It is a possible to select PRGM/PRBS in each block
PRGM 8 to 8,192 bits 8bits steps
PRBS 8 to 131,072 bits 8bits steps
When a mode is PRBS, the largest length of blocks is restricted as follows by a number of block
Relation between a number of block and largest block length in PRGM
<table><tr><td>The number of block</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>The largest value of block length</td><td>131,072</td><td>98,304</td><td>65,536</td><td>32,768</td><td>32,768</td><td>32,768</td><td>32,768</td></tr></table>POS／NEG (PRGM part)
A independent parallel data in each CH generation.
※ Because a channel accepted as group in CH1 to CH8 and CH9 to CH16, it is impossible to select the MUX when a cycle of a PRBS is different from a channel among each group.</td></tr>
<tr><td>Reception mode</td><td>Repeat
Synchronization</td><td>PRBS Reading method
PRGM Normal／Frame
Frame length : 8/16/24/32bits
MIX PRBS part : reading mothod
PRGMpart : Normal/Frame
Frame length : 8/16/24/32bits
Zero-subst Normal</td></tr>
<tr><td></td><td>External burst
Enable length

Data mode

Synchronization</td><td>Burst of a pattern perform by burst trigger input signal
While burst trigger input signal is in enable interval, error detect is performed
Consecutive／Restart it is possible to select (PRBS pattern is only Consecutive)
Consecutive : A pattern is successive between a burst
Restart : A pattern restarts at each burst
PRBS (Reading method) Consecutive only
PRGM (Normal) Consecutive
(Frame) Restart
MIX (PRBS part) (Reading method)
(PRGM part) (Normal) Consecutive
(Frame) Restart
PON (Frame) Restart only</td></tr>
</table>

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Table1-5 Specifications of MU163040B (5/8)

Items		Specifications
Reception mode	Internal burst	Frame pattern in signal is detected, and measurement signal is made in ternal burst circuit
	Enable length	8 to 2,097,144bits／8bits steps
	Data mode	Restart : A pattern restarts at each burst cycle
	Synchronization	PRGM (Frame) Frame length : 8/16/24/32bits MIX (PRBS part) (Reading method) (PRGM part) (Frame) Frame length : 8/16/24/32bits PON (Frame) Frame length : 8/16/24/32bits

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Table1-5 Specifications of MU163040B (6/8)

	Items	Specifications
Measurement	Error measurement	
	Detection mode	All : Calculate all of a bit error Insertion : Calculate 0→1 error Omittion : Calculate 1→0 error Insertion&Omittion : Calculate Insertion&Omittion by turns
	Measurement range	ALL : Calculate error in all blocks Selected : Calculate a voluntary block error
	Error rate	0.0000×10^{-16} to 1.00000×10^{0}
	Error count	0 to 9999999 and 1.0000×10^{7} to 9.99999×10^{16}
	Error interval	0 to 9999999 and 1.0000×10^{7} to 9.99999×10^{16} Interval : 10ms、500ms、1s
	Error free interval	0.0000% to 100.0000% Interval : 10ms、500ms、1s
	Frequency counter	10k to 200MHz (Dismantle ability 100Hz Valid display place 6 place) (Accuracy ±(1 countor±10ppm))
	Bit error LED	Turn on a light by OR error in each CH (You can select ON/OFF in each CH)
	Measurement mode	Single : Perform measurement only once for setting time Repeat : Measure repeaty for setting time Untimed : Perform a successive mesurement
	Measurement time	1 second to 99 days 23 hours 59 minutes 59 seconds
	AUTO SYNC.	ON/OFF setting is enable Threshold PRBS : 1×10^{-n} (n=2 to 7) PRGM : 1×10^{-n} (n=2 to 8) and Auto
	Current data Error performance (G.821)	Cycle time : 0.5sec EC ES (%ES) EFS (%EFS) SES (%SES) DM (%DM) US (%US)

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Table1-5 Specifications of MU163040B (7/8)

	Items	Specifications
Measurement (continued)	Alarm detect	
	Power failure	Power failure detection
	Clock failure	Clock failure detection
	Pattern synchronous less	PRBS／PRGM synchronous less detection
	Auto search function	It is possible to select Threshold／Phase Threshold&Phase : Detect the most suitable value of both voltage and phase direction, and set Threshold : Detect the most suitable value of only a voltage direction, and set Phase : Detect the most suitable value of only a phase direction, and set Pattern : Only PRBS pattern
	Eye Margin measurement Function	Perform measurement of Eye Diagram and Eye Margin in one CH specified
	Measurement items	It is possibe to select a Eye Margin and Eye Diagram marin measurement Eye Margin measurement Measure Threshold margin／Phase Bit error rate range : 1×10^{-n} (n=3 to 9) Accuracy : Fine/Coarse it is possible to chnge Eye Diagram measurement By means of a bit error measurement, Eye opening range is measured in two dimensions Bit error rate range : 1×10^{-n} (n=3 to 9) Measurement point : 8/16/32/64 Points

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Table1-5 Specifications of MU163040B (8/8)

Items		Specifications
Measurement (continued)	Delay measurement	
	Function	Delay time measurement of a data.
	Delay measurement mode	Mode1 : Detect a 32 bit special pattern inserted into a recive pattern Mode2 : Detect a special pattern of PRBS PRBS 7 8bits detect PRBS 15 16bits detect PRBS 23 24bits detect PRBS 31 32bits detect
	Measurement range(Time)	0 to 999 μs／1 μs step 1 to 999ms／1ms step 1 to 10s ／1s step
	(Bit)	2^{31} bits(Max.)
	Timeout	0.5s、1s、2s、5s、10s
	Measurement dismantle ability	0.1 μs
	Measurement mode	Single／Repeat
	Operation temperature range	5 to 40℃
	External dimensions	448.9±5(D)×232±4(W)×49±2.8(H) mm
	Weight	2.5kg or less
	Power consumption	260VA or less

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CHAPTER 2 PRECAUTIONS

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2.1 Environmental Conditions of Installation Site

MU163020B 200M 16CH Pulse Pattern Generator and MU163040B 200M 16CH Error Detector(here after called "this unit")operates normally at an ambient temperature of 5℃ to 40℃ and ambient humidity of 85% or less. This unit must be stored in an environment where the temperature is -20℃ to 60℃ and the humidity does not exceed 85%.Do not use or store this unit in a location exposed to:

1. A place exposed to direct sunlight or heavy dust.
2. A place exposed to water splashes or active gases.
3. A place where oxidization could occur or a place exposed to strong vibrations.

⚠ CAUTION

Using this unit at room temperatures after leaving it in at low temperatures for a long period could cause the internal circuits to short because of condensation. To avoid this, use the unit after condensation has been allowed to dry.

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2.2Safety Precautions

⚠ WARNING

- Don't replace the plug-in units by themselves. Replacement is performed by Anritsu service department. Contact your dealer or Anritsu sales office. There is a possibility to make a electric shock accident reaching a death or injury.

⚠ CAUTION

- This unit has been developed only for use with the MP1630B Digital Data Analyzer. Using this unit with it inserted in any equipment other than the MP1630B could result in damage or malfunction. Never use it with equipment other than the MP1630B.
- When inputting signals, do not apply voltages exceeding the rated values. This could damage the internal circuit.
- The output must be terminated with a 50-ohm resistor. Never pass current through the output.
- Before connecting other equipment (including experimental circuits) to the input/output connectors, be sure to establish a ground to prevent static damage.
- The outer conductor and core wires of a coaxial cable may be charged like a capacitor. Use them after discharging electrons using a metallic object.
- Do not remove the internal radial cooling panel. If unit performance degradation or trouble occur by using the unit with the internal radial cooling panel removed, it may not be eligible for maintenance.

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CHAPTER 3 PANELS

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3.1Panel Layout and Explanation of Panel

3.1.1 MU163020B panel layout

Figures 3.1 and 3.2 show the front and back panels of the MU163020B 200M 16CH Pulse Pattern Generator respectively.

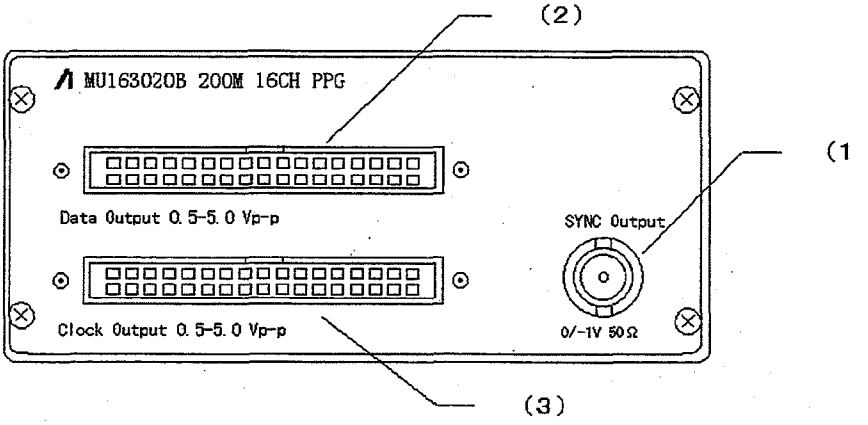


Fig. 3.-1 Front panel of MU163020B

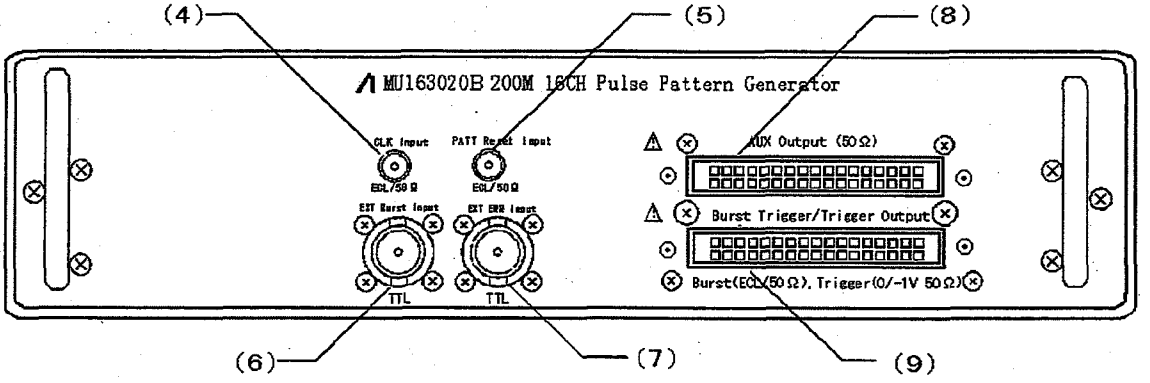
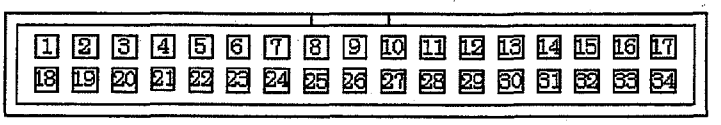


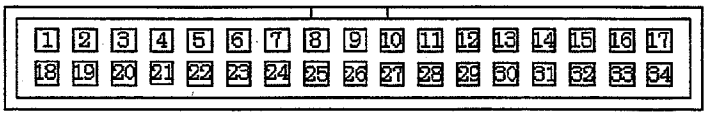
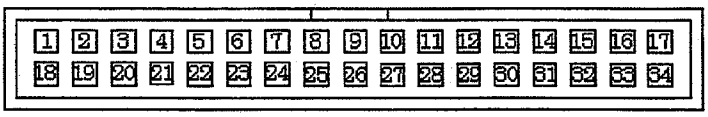
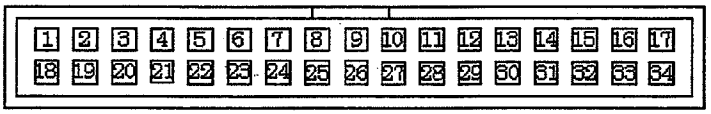
Fig 3.-2. Back panel of MU163020B

Table 3-1 Explanation of MU163020B panels

No	Label	Description
(1)	SYNC Output	Synchronous output connector (BNC)
(2)	Data Output	Coaxial multipin connector for data output  1-16 : CH1 to CH16 data output (pin 1 → CH1) 18-33 : GND for CH1 to CH16 data output (pin 18 → CH1) 17 , 34 : Not used

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Table 3.-1 Explanation of MU163020B panels (continued)

(3)	Clock Output	Coaxial multipin connector for clock output  1-16 : CH1 to CH16 clock output (pin 1 → CH1) 18-33 : GND for CH1 to CH16 clock output (pin 18 → CH1) 17 , 34 : Not used
(4)	CLK Input	Clock generator pulse input connector (SMA)
(5)	PATT Reset Input	Pattern reset signal input connector (SMA)
(6)	EXT Burst Input	External burst signal input connector (BNC)
(7)	EXT ERR Input	External error signal input connector (BNC)
(8)	AUX Output	Coaxial multipin connector for AUX output  1-8 : Port 1 to port 9 AUX output (pin 1 → port 1) 9 : Port 8 AUX output (OR output from port1 to port 8) 18-26 : GND for port 1 to port 9 AUX output(pin 18 → port 1) 10-17 , 27-34 : Not used
(9)	Burst Trigger/Trigger Output	Coaxial multipin connector for burst trigger and trigger output  1-16 : CH1 to CH16 burst trigger output (pin 1 → CH1) 18-33 : GND for CH1 to CH16 burst trigger output (pin 18 → CH1) 17 : Trigger output 34 : GND for trigger output

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3.1.2 MU163040B panel layout

Figures 3.3 and 3.4 show the front and back panels of the MU163040B 200M 16CH Error Detector.

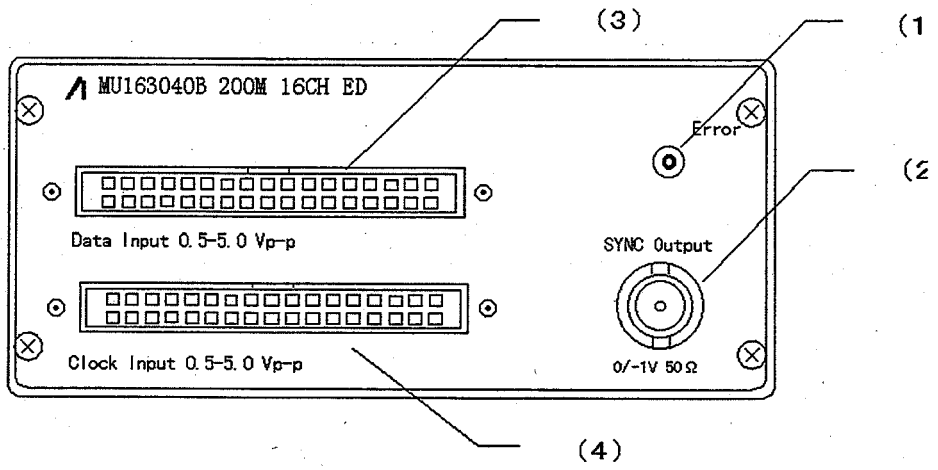


Fig 3.-3 Front panel of MU163040B

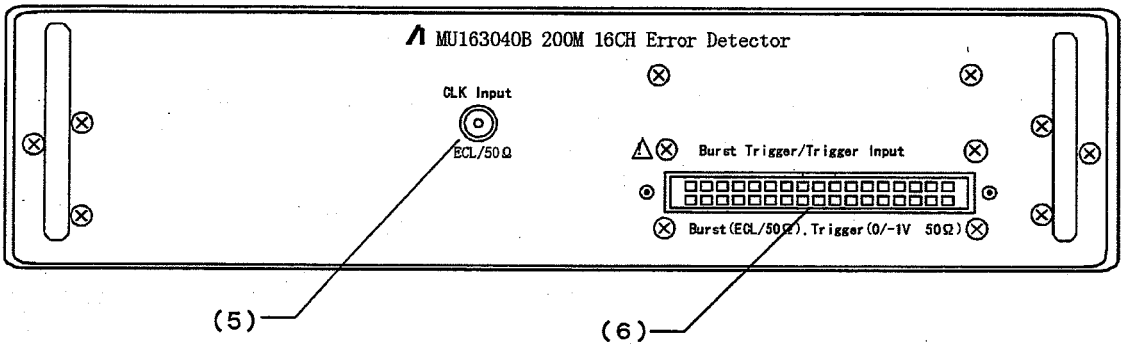
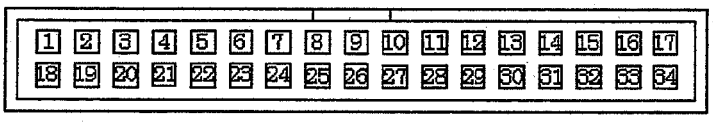


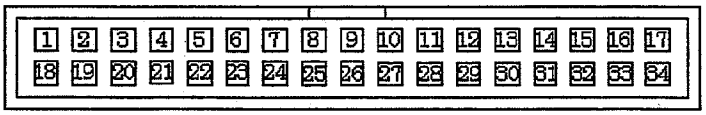
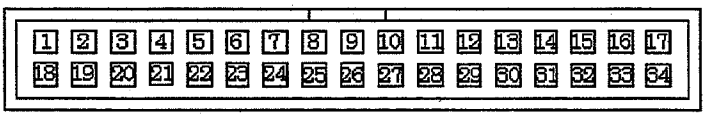
Fig 3.-4 Back panel of MU163040B

Table 3-2 Explanation of MU163040B panels

No	Label	Description
(1)	Error	Error monitor LED
(2)	SYNC Output	Synchronous output connector (BNC)
(3)	Data Input	Coaxial multipin connector for data input  1-16 : CH1 to CH16 data input (pin 1 → CH1) 18-33 : GND for CH1 to CH16 data input (pin 18 → CH1) 17 , 34 : Not used

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Table 3.-2 Explanation of MU163040B panels (continued)

(4)	Clock Input	Coaxial multipin connector for clock input  1-16 : CH1 to CH16 clock input (pin 1 → CH1) 18-33 : GND for CH1 to CH16 clock input (pin 18 → CH1) 17 , 34 : Not used
(5)	CLK Input	Reference clock input connector (SMA) Used for measurement of PON in upstream line(ONU →OSU)
(6)	Burst Trigger/Trigger Input	Coaxial multipin connector for burst trigger and trigger input  1-16 : CH1 to CH16 burst trigger input (pin 1 → CH1) 18-33 : GND for CH1 to CH16 burst trigger input (pin 18 → CH1) 17 : Trigger input 34 : GND for trigger input

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3.2Connections between Units

This section explains how to connect between units inserted MP1630B main frame.

- **Connection(1): connection with the CG unit**

  Slot1 : MU163000A 200M Clock Generator
  Slot3 : MU163020B 200M 16CH Pulse Pattern Generator
  Slot4 : MU163040B 200M 16CH Error Detector
  Cable: SMA cables

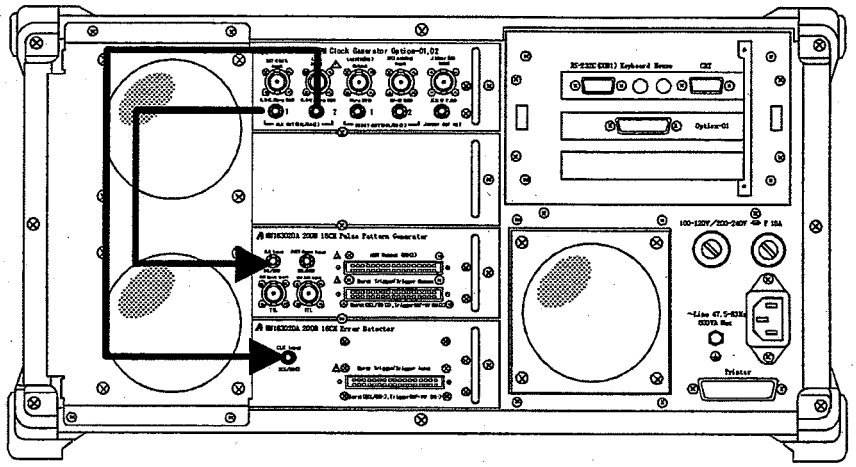


Fig 3.-5 Connections between Units (1)

- **Connection (2) : connection with the CG unit (For clock reset function)**

  Slot1 : MU163000A 200M clock generator
  Slot3 : MU163020B 200M 16CH pulse pattern generator

  Cable: SMA cable

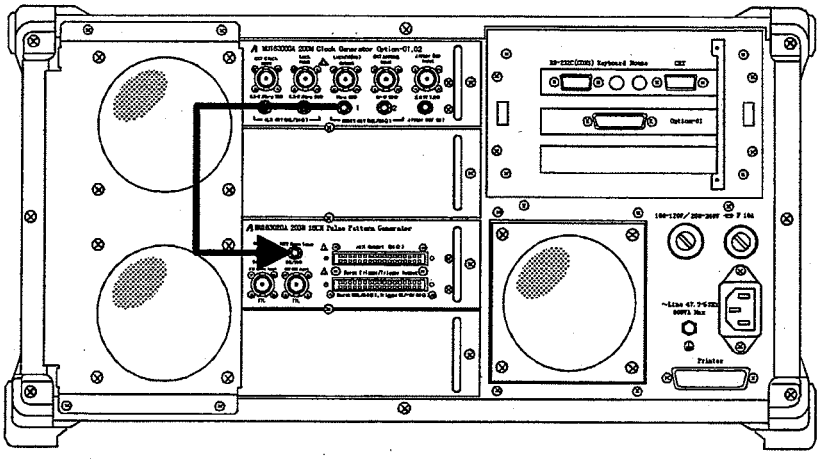


Fig 3.-6 Connections between Units (2)

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3.3Connecting External Equipment

This section explains how to connect this unit to external equipment.

- **Connection (1) (Signal input from external equipment)**

  Cable: BNC cable

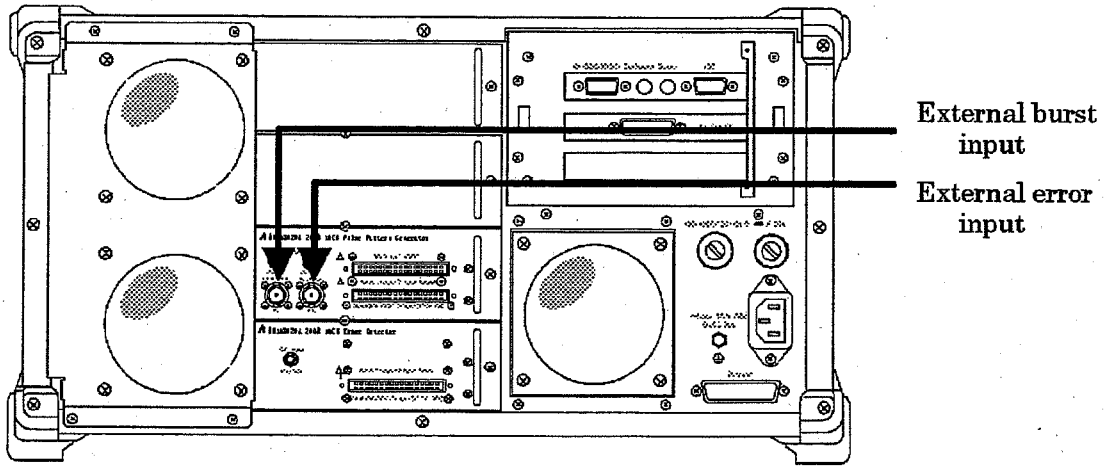


Fig 3.-7 Connection with External Equipment (1)

- **Connection (2) (Signal output to external equipment : front)**

  Cable: BNC cable

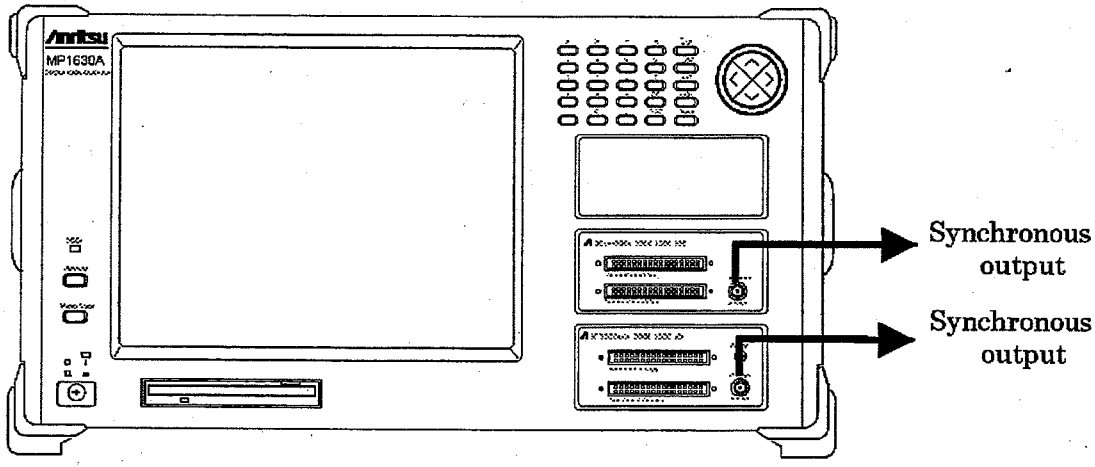


Fig 3.-8 Connection with External Equipment (2)

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- Connection (3) (Signal output to external equipment : rear)

  Cable : Coaxial multipin cable

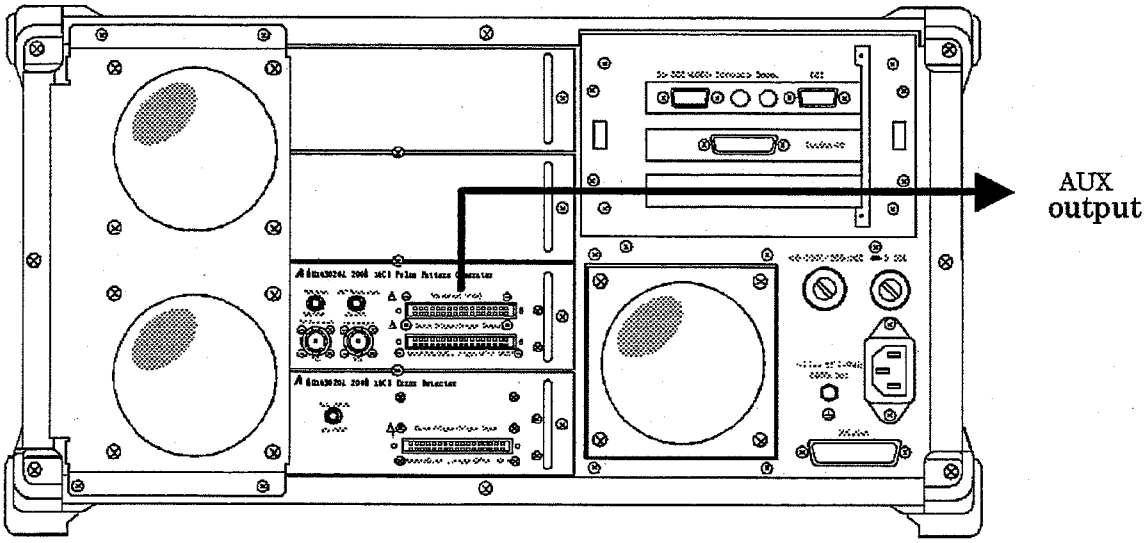


Fig 3-9 Connection with External Equipment (3)

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CHAPTER 4 SCREEN CONFIGURATION

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When this unit, PPG (Pulse Pattern Generator), and ED (Error Detector) are inserted in the slots in the MP1630B, subwindows and panels are hierarchically structured as shown below. For details on the shaded portions, refer to the Operation Manuals that come with the MP1630B and MU163000A 200M Clock Generator

Table 4.-1 Hierarchical structure of screens

Subwindow	Panel	Setting item
System	System	Allows you to set date, time, remote function, and system operation mode.
	Option	Displays the configuration of the units inserted in the MP1630B.
Setup	Setup	Allows you to make basic settings.
	Frequency	Allows you to set a frequency, and jitter (option).
	Clock I/F	Allows you to set the clock input/output interface.
	Data I/F	Allows you to set the data input/output interface.
	Pattern	Allows you to set a send/receive pattern, burst, and synchronization.
	AUX I/F	Allows you to set the AUX output (envelope resetting).
	Trigger I/F	Allows you to set trigger and synchronous input/output signals.
Test Menu	Measurement	Allows you to set measurement conditions.
	Error Addition	Allows you to set the conditions for error addition and delay measurement pattern insertion.
	Analyze	Allows you to set the conditions for setting the analyze function.
Result	Error/Alarm	Displays the error/alarm measurement result and allows you to start/stop measurement.
	Eye Margin	Displays the eye margin measurement result and allows you to start/stop measurement.
	Delay(Mode 1)	Displays the delay (Mode 1) measurement result and allows you to start/stop measurement.
	Delay(Mode 2)	Displays the delay (Mode 2) measurement result and allows you to start/stop measurement.
Analyze	Trace Text	Displays an error/alarm measurement data analyze text.
	Recall Text	Opens and displays an analyze text.
Customize		Displays the setting & error measurement result (allows you to select items and set values directly).

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5.

CHAPTER 5 BASIC OPERATION

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5.1Viewing the Current Settings

This section explains the basic procedure for viewing the current settings on the screen for confirmation. This procedure is required for the panels listed below. For other panels, this procedure is not required because all settings appear the instant a panel has been opened.

Setup:Clock I/F panel, Setup:Data I/F panel, Setup:Pattern panel,
Setup-AUX I/F panel, Test Menu:Error Addition panel,
Test Menu:Measurement panel (when error/alarm measurement is set)

The operation procedure is explained below taking the Setup:Pattern panel as an example.

- **Viewing the setting of one channel**

1. Select the View menu from the main window. Make sure the menu option "Display ALL CH" is not ticked. Selecting the menu option "Display ALL CH" will toggle the tick on and off.

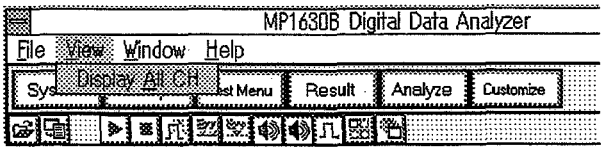


Fig. 5.-1 View menu

2. Select a channel number from the CH spin box in the group box of the target unit.

3. To change the setting, press the Setup button. A dialog box will open, allowing you to make a setting for the selected channel immediately.

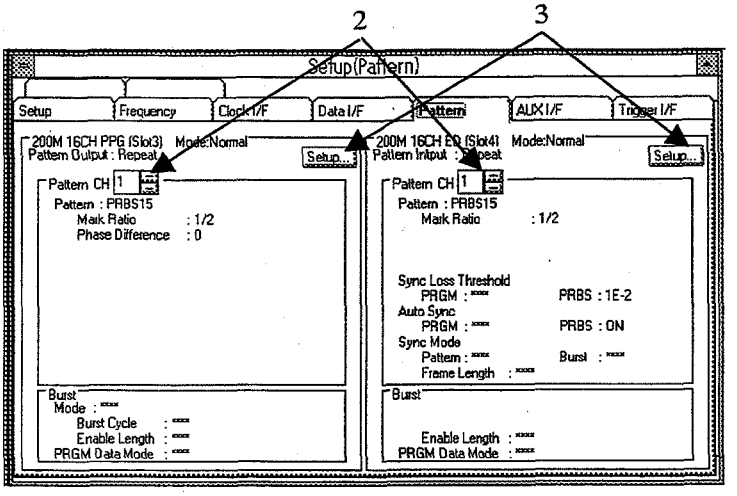


Fig. 5.-2 Setup: Pattern panel (display of setting of one channel)

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- **Viewing settings of all channels**

1. Select the View menu from the main window. Make sure the menu option "Display ALL CH" is ticked. Selecting the menu option "Display ALL CH" will toggle the tick on and off.

2. If settings of all channels cannot be displayed within the screen, page change buttons will appear.

3. Move the mouse pointer to the target channel, then the shape of the mouse pointer will change. Double-clicking the mouse button will open the dialog box that allows you to set the target channel.

4. The dialog box can also be opened by pressing the Setup button.

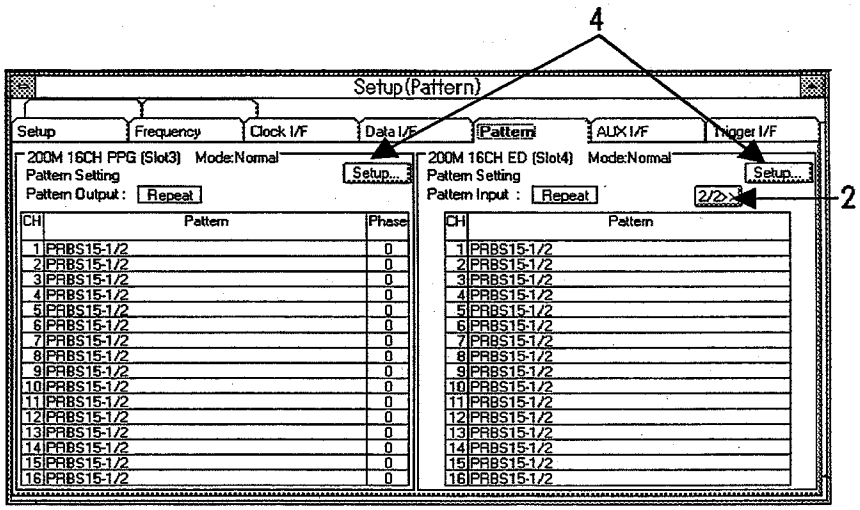


Fig. 5.-3 Setup: Pattern panel (display of settings of all channels)

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5.2Setting a Send/Receive Pattern

5.2.1 Selecting a send/receive pattern

The MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit) and the MU163040B 200M 16CH Error Detector (hereafter called the ED unit) allows you to set a programmable (PRGM) pattern, pseudo random (PRBS) pattern, zero substitution (Zero-Subst) pattern, or mixed (MIX) pattern as a send/receive pattern. The following describes how to set a send/receive pattern. For more details on patterns, see Section 1, "About the Send/Receive Patterns," in Appendix.

The above patterns can be set when "Normal" is selected as a pattern mode. When "PON" is selected as a pattern mode, the send/receive pattern setting method is different from that discussed here. For further details, see Section 5.3, "Performing Settings for PON Measurement."

1. Open the Setup: Setup panel.

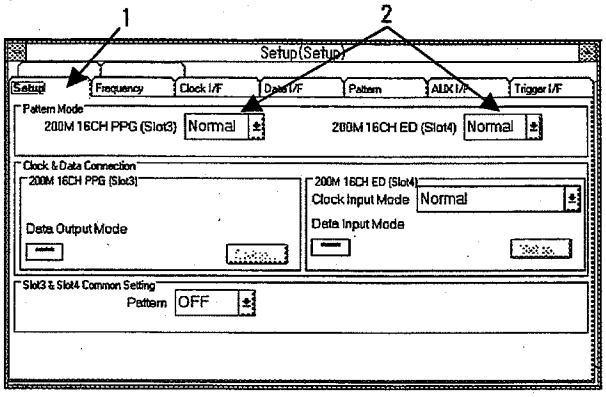


Fig. 5.-4 Setup: Setup panel

2. Set a pattern mode. Select Normal from the PPG or ED drop-down list box in the Pattern Mode group box.

3. Open the Setup: Pattern panel.

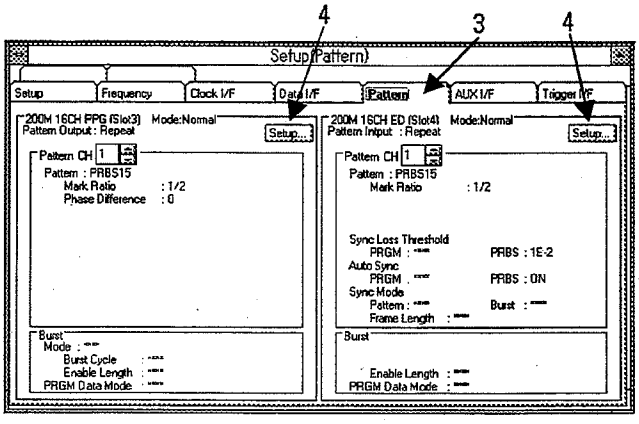


Fig. 5.-5 Setup: Pattern panel

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4. To set a send pattern, press the Setup button in the PPG group box. To set a receive pattern, press the Setup button in the ED group box. The Pattern dialog box will open. Figure 5.6 shows the Pattern dialog box for the PPG unit. The send pattern setting method for the PPG unit also applies to the ED unit. The following describes how to set a send pattern for the PPG unit.

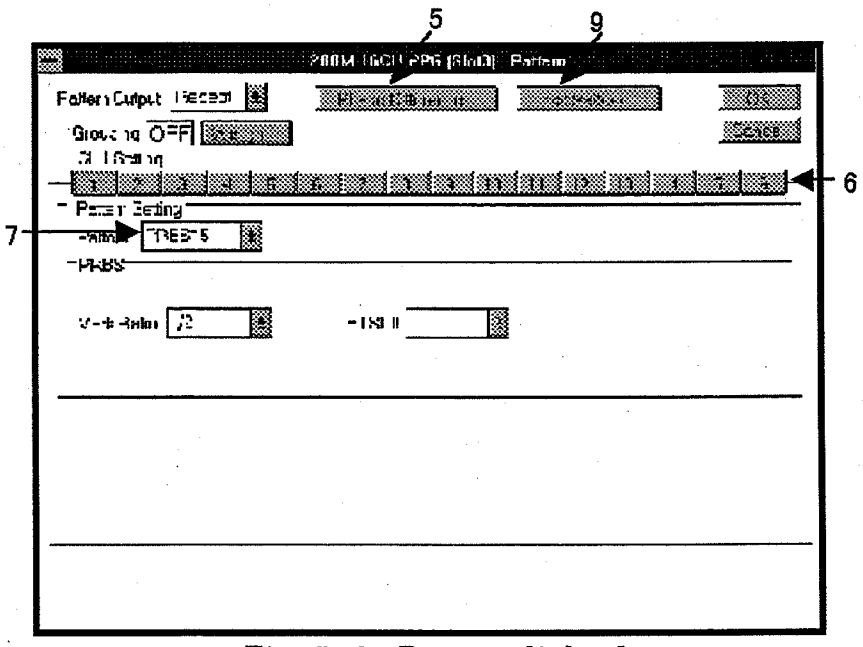


Fig. 5.-6 Pattern dialog box

5. Set a phase difference as necessary. For details, see Section 6.6, "Performing MUX Externally for a PRBS Pattern."

6. Press the button of the target channel. To set patterns for multiple channels, see Section 6.1, "Setting Multiple Channels at the Same Time."

7. See the section corresponding to the pattern you want to set.

PRGM pattern:	See Section 5.2.2 "Setting a PRGM pattern."
PRBS pattern:	See Section 5.2.3 "Setting a PRBS pattern."
Zero-Subst pattern:	See Section 5.2.4 "Setting a Zero-Subst pattern."
MIX pattern:	See Section 5.2.5 "Setting a MIX pattern."

8. Perform steps 6 and 7 repeatedly as many times as the number of target channels.

9. To edit the PRGM pattern or MIX pattern, press the Edit Pattern button. The Pattern Editor dialog box will open. For how to use the Pattern Editor dialog box, see 5.4, "Creating or Editing a Pattern."

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5.2.2 Setting the PRGM pattern

This section explains how to set a PRGM pattern as a send/receive pattern.

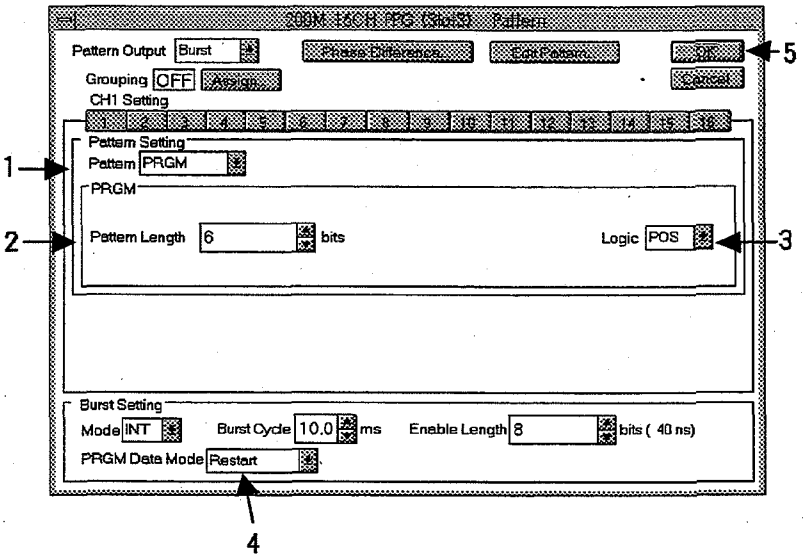


Fig. 5.-7 Pattern dialog box (when PRGM is selected)

1. Select PRGM from the Pattern drop-down list box in the Pattern Setting group box.

2. Enter a pattern length in the Pattern Length text box in the PRGM group box. The maximum pattern length is 65,536 bits.

3. Set a pattern logic by selecting it from the Logic drop-down list box in the PRGM group box.

4. When you have selected Burst as a pattern input/output mode, select a PRGM Data mode from the Data Mode drop-down list box in the PRGM group box.

Restart	Sends a PRGM pattern for each burst cycle, starting at the beginning.
Consecutive	Sends a PRGM pattern for each burst cycle, continuing from the end of the previous PRGM pattern.

   For how to select Burst as a pattern input/output mode, see 5.5, "Sending/Receiving a Burst Pattern." For details on the PRGM Data mode, see Section 3, "About the PRGM Data Mode," in Appendix.

5. This completes the setting. Press the OK button to make the new setting to take effect.

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5.2.3 Setting a PRBS pattern

This section explains how to set a PRBS pattern as a send/receive pattern.

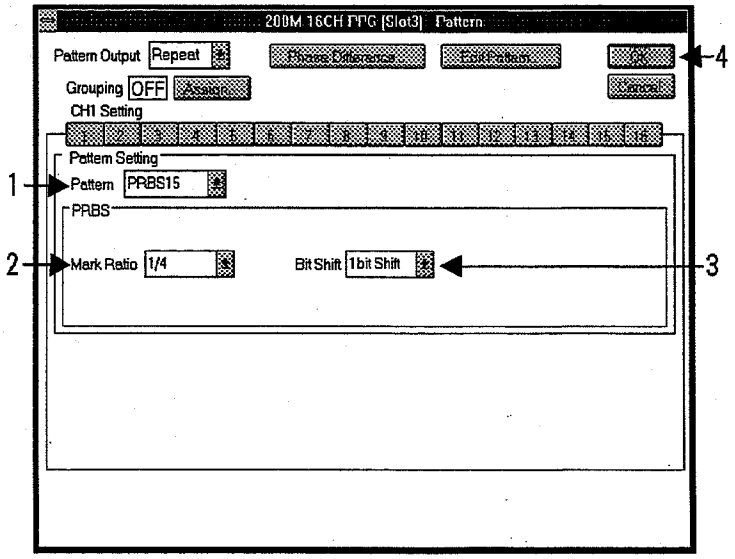


Fig. 5.-8 Pattern dialog box (when PRBS is selected)

1. Select a pattern from the Pattern drop-down list box in the Pattern Setting group box.

PRBS7	Selects a 2^7-1 PRBS pattern.
PRBS9	Selects a 2^9-1 PRBS pattern.
PRBS11	Selects a 2^{11}-1 PRBS pattern.
PRBS15	Selects a 2^{15}-1 PRBS pattern.
PRBS20	Selects a 2^{20}-1 PRBS pattern.
PRBS23	Selects a 2^{23}-1 PRBS pattern.
PRBS31	Selects a 2^{31}-1 PRBS pattern.

2. Select a mark ratio from the Mark Ratio drop-down list box in the PRBS group box.

1/2	Sets the mark ratio to 1/2.
1/4	Sets the mark ratio to 1/4.
1/8	Sets the mark ratio to 1/8.
ALL0	Selects an all-zero pattern.
1/2INVT	Sets the mark ratio to $\overline{1/2}$.
3/4	Sets the mark ratio to 3/4.
7/8	Sets the mark ratio to 7/8.
ALL1	Selects all-one pattern.

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3. Select a bit shift mode from the Bit Shift drop-down list box in the PRBS group box.

1bit Shift	Select a 1-bit shift mode.
3bit Shift	Select a 3-bit shift mode.

Note

When you have selected 1/2, 1/2INVT, ALL0, or ALL1 as a mark ratio in step 2, you cannot set a bit shift mode.

4. This completes the setting. Press the OK button to make the new setting effective.

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5.2.4 Setting a Zero-Subst pattern

This section explains how to set a Zero-Subst pattern as a send/receive pattern.

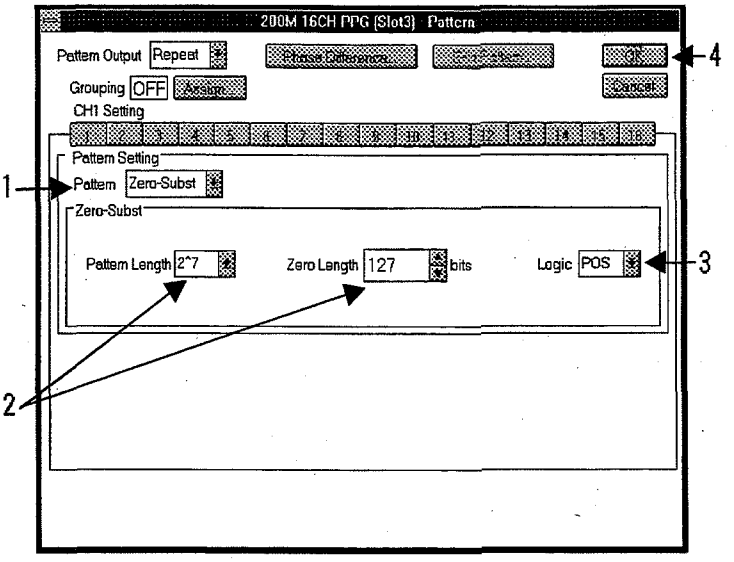


Fig. 5.-9 Pattern dialog box (When Zero-Subst is selected)

1. Select Zero-Subst from the Pattern drop-down list box in the Pattern Setting group box.

   Note

   When you have selected Burst as a pattern input output mode, you cannot select Zero-Subst.

2. Select a pattern length from the Pattern Length drop-down list box in the Zero-Subst group box, and enter a zero bit length in the Zero Length text box.

3. Relationships between the pattern lengths and the minimum and maximum zero bit lengths are as follows:

Pattern Length	Minimum zero bit length	Maximum zero bit length
2^7	7	127
2^9	9	511
2^11	11	2,047
2^15	15	32,767

4. Select a pattern logic from the Logic drop-down list box in the Zero-Subst group box.

5. This completes the setting. Press the OK button to make the new setting effective.

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5.2.5 Setting a MIX pattern

This section explains how to set a MIX pattern as a send/receive pattern.

A MIX pattern consists of a maximum of 32 blocks. Specify the number of blocks in a matrix form. A bit length and a pattern type (PRGM or PRBS) can be set for each column.

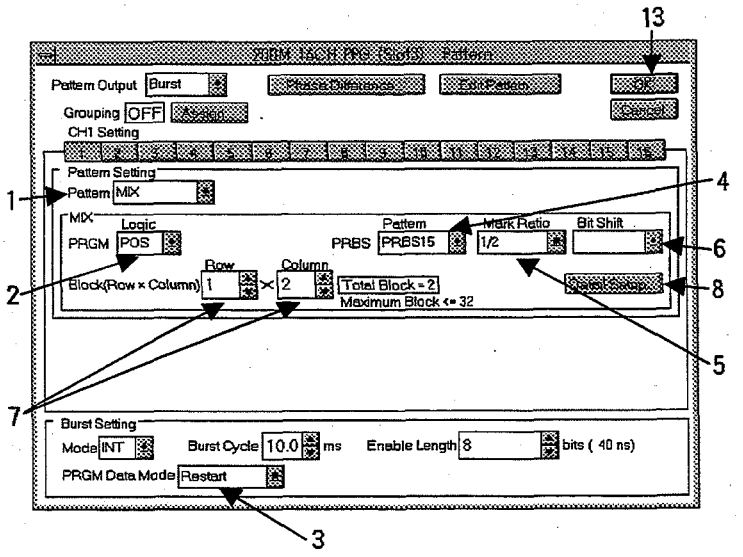


Fig. 5.-10 Pattern dialog box (When MIX is selected)

1. Select MIX from the Pattern drop-down list box in the Pattern Setting group box.
2. Select a PRGM pattern logic from the Logic drop-down list box in the MIX group box.
3. When you have selected Burst as a pattern input/output mode, select a PRGM Data mode from the Data Mode drop-down list box in the PRGM group box.

Restart	Sends a PRGM pattern for each burst cycle, starting at the beginning.
Consecutive	Sends a PRGM pattern for each burst cycle, continuing from the end of the previous PRGM pattern.

For how to select Burst as a pattern input/output mode, see 5.5, "Sending/Receiving a Burst Pattern." For details on the PRGM Data mode, see Section 3, "About the PRGM Data Mode," in Appendix.

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4. Select a number of PRBS rows from the Pattern drop-down list box in the MIX group box.

PRBS7	Selects a 2^7-1 PRBS pattern.
PRBS9	Selects a 2^9-1 PRBS pattern.
PRBS11	Selects a 2^{11}-1 PRBS pattern.
PRBS15	Selects a 2^{15}-1 PRBS pattern.
PRBS20	Selects a 2^{20}-1 PRBS pattern.
PRBS23	Selects a 2^{23}-1 PRBS pattern.
PRBS31	Selects a 2^{31}-1 PRBS pattern.

5. Select a PRBS block mark ratio from the Mark Ratio drop-down list box in the MIX group box.

1/2	Sets the mark ratio to 1/2.
1/4	Sets the mark ratio to 1/4.
1/8	Sets the mark ratio to 1/8.
ALL0	Selects an all-zero pattern.
1/2INVT	Sets the mark ratio to $\overline{1/2}$.
3/4	Sets the mark ratio to 3/4.
7/8	Sets the mark ratio to 7/8.
ALL1	Selects all-one pattern.

6. Select a PRBS block bit shift mode from the Bit Shift drop-down list box in the MIX group box.

1bit Shift	Selects a 1-bit shift mode.
3bit Shift	Selects a 3-bit shift mode.

Note

When you have selected 1/2, 1/2INVT, ALL0, or ALL1 as a mark ratio in step 5, you cannot set a bit shift mode.

7. Specify the number of blocks constituting a MIX pattern by entering a number of rows and a number of columns from the Row and Column text boxes in the MIX group box. The maximum number of blocks is 32.

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8. Set a block bit length and pattern type. Press the Detail Setup button in the MIX group box. The MIX Pattern Detail Setup dialog box will open.

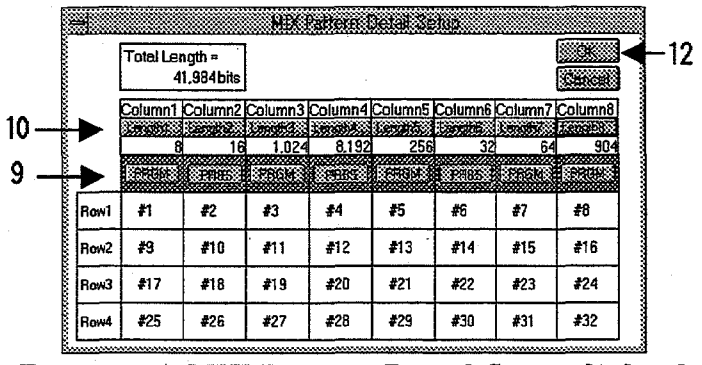


Fig. 5.-11 MIX Pattern Detail Setup dialog box

Note

Set a block length and pattern type on a column basis.

9. Set a pattern type. Pressing a PRGM button in the MIX Pattern Detail Setup dialog box will change the pattern of that column to a PRBS pattern. Pressing the PRBS button will change the pattern of that column to a PRGM pattern.

10. Set a block length. Press the Length button in the MIX Pattern Detail Setup dialog box. The Column Length dialog box will open.

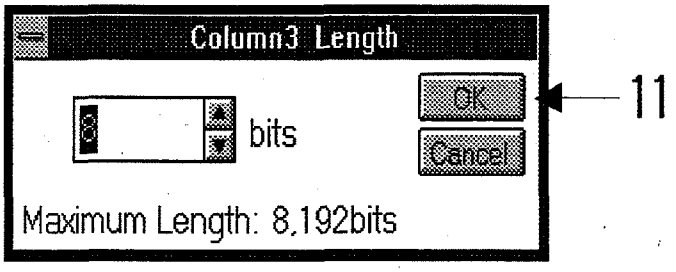


Fig. 5.-12 Column Length dialog box

11. Enter a block length in the text box, then press the OK button. The Column Length dialog box will close. The maximum block length depends on the number of blocks specified in step7.

- When a block selected in step 10 is PRGM pattern.
  Block length:8 to 8192 bits/8 bits step
- When a block selected in step 10 is PRBS pattern.
  Block length:8 to 131072 bits/8 bits step
  (Refer to table 5-1 for the relation between a block length and the number of blocks.)

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Table 5.-1 Maximum block lengths

Row \ Column	1	2	3	4	5	6	7	8
1		131,072	65,536	65,536	32,768	32,768	32,768	32,768
2	131,072	65,536	32,768	32,768	16,384	16,384	16,384	16,384
3,4	65,536	32,768	16,384	16,384	8,192	8,192	8,192	8,192
5	32,768	16,384	8,192	8,192	8,192	8,192		
6	32,768	16,384	8,192	8,192	8,192			
7,8	32,768	16,384	8,192	8,192				
9,10	16,384	8,192	8,192					
11 - 16	16,384	8,192						
17 - 32	8,192							

12. Perform steps 9 through 11 repeatedly if required, then press the OK button. The MIX Pattern Detail Setup dialog box will close.

13. This completes the setting. Press the OK button to make the new setting effective.

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5.3Performing Settings for PON Measurement

5.3.1 Setting the transmission direction

The MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit) supports a dedicated mode for facilitating the measurements made using the Passive Optical Network (hereafter called a PON). In this mode, downstream transmission to the OSU and upstream transmission to the ONU can be simulated.
To select the above mode, select PON as the pattern mode. The following describes how to set the pattern mode PON and the basic procedure for setting the transmission direction for PON measurement. See also Section 7.1, "PDS Upstream Line (ONU→OSU)Test."

1. Open the Setup: Setup panel.

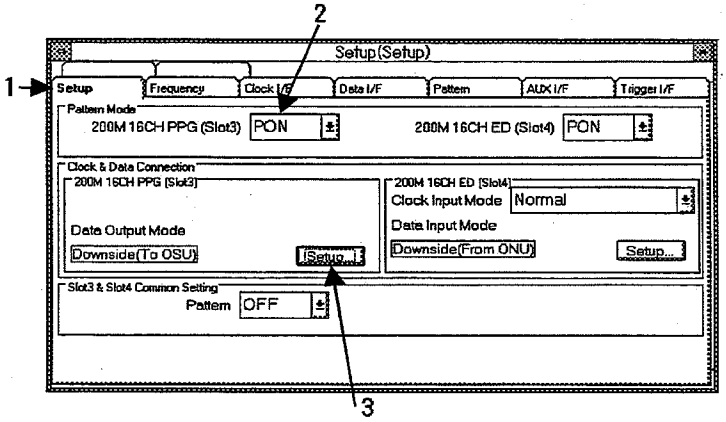


Fig. 5.-13 Setup: Setup panel

2. Select PON as a pattern mode by selecting PON from the PPG unit drop-down list box in the Pattern Mode group box.

3. Press the Setup button in the PPG unit group box in the Clock & Data Connection group box. The Data Output Mode dialog box will open.

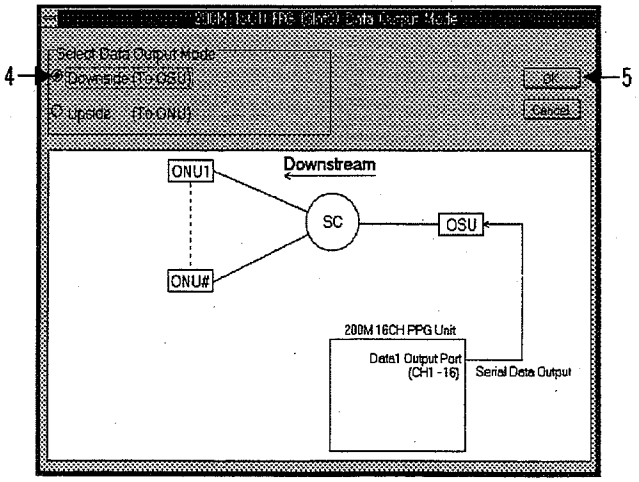


Fig. 5.-14 Data Output dialog box

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4. Select a pattern transmission direction by clicking on the check button in the Select Data Output Mode group box.

Downside (To OSU)	Measure the downstream line (OSU→ONU) by sending a pattern signal to the OSU.
Upside (To ONU)	Measure the upstream line (ONU→OSU) by sending a pattern signal to the ONU.

5. This completes the setting. Press the OK button to make the new setting effective.

6. For how to set a send pattern, see Section 5.3.3, "Setting guard times."

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5.3.2 Setting the reception direction

The MU163040B 200M 16CH Error Detector (hereafter called the ED unit) supports a dedicated mode for facilitating the measurements made using the Passive Optical Network (hereafter called a PON). In this mode, downstream reception from the OSU and upstream reception from the ONU can be simulated.

To select the above mode, select PON as a pattern mode. The following describes how to set the pattern mode PON and the basic procedure for setting the reception direction for PON measurement. See also Section 7.1, "PDS Upstream Line (ONU→OSU)Test."

1. Open the Setup: Setup panel.

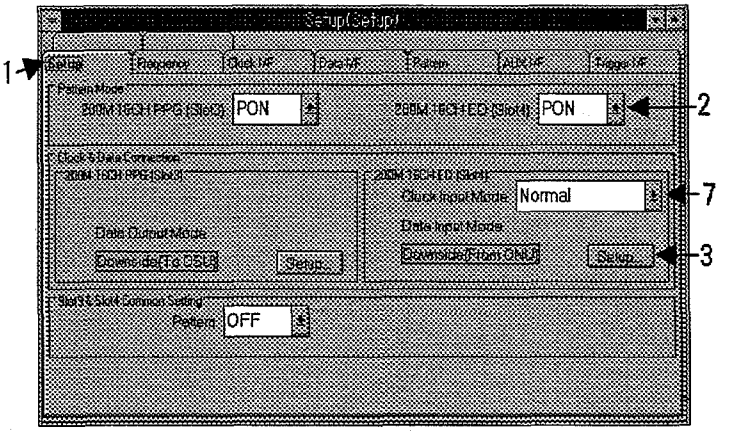


Fig. 5.-15 Setup: Setup panel

2. Select PON as a pattern mode by selecting PON from the ED unit drop-down list box in the Pattern Mode group box.

3. Press the Setup button in the ED unit group box in the Clock & Data Connection group box. The Data Input Mode dialog box will open.

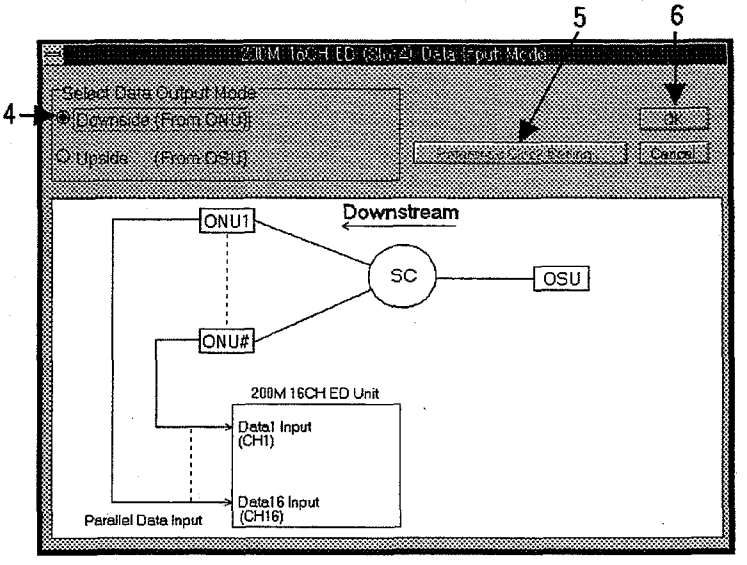


Fig. 5.-16 Data Input dialog box

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4. Select a data reception direction by clicking on the check button in the Select Data Input Mode group box.

Downside (From ONU)	Measure the downstream line (OSU→ONU) by receiving a pattern signal from the ONU.
Upside (From OSU)	Measure the upstream line (ONU→OSU) by sending a pattern signal from the OSU.

Note

If you have selected Upside(From OSU)from a data reception direction. Polarity and Delay among Clock input interface set up from CH2 to CH16 is prohibited. For how to clock input interface set up. see Section5.6.4,"Setting clock input interface."

5. Note If you have selected Upside(From OSU) from the Data Input Mode dialog box, press the Reference Clock Setting button to open the Reference Clock Setting dialog box.

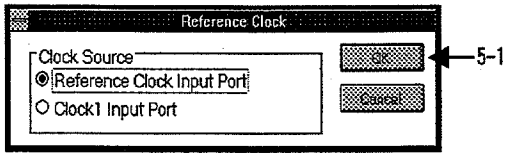


Fig. 5.-17 Reference Clock dialog box

5.1 After clicking on the Reference Clock Input Port check button, press the OK button to close the Reference Clock dialog box. The functions of the check buttons are as follows:

Reference Clock Input Port	Use the clock input from the CLK Input connector on the back panel as a reference clock signal.
Clock Input Port	Use the channel 1 clock signal as the reference clock signal.

6. Press the OK button to make the new setting effective. The Data Input Mode dialog box will close.

7. For how to set a Clock Input Mode in ED unit, Decide as follow by a data reception direction.

   Downside:Normal or Common(Clock1),Common(Reference)
   Upside:Common(Clock1)

   For detail on the Clock Input mode, see Section 5.7,"Sharing a Clock Input among All Channels."

8. For how to set a receive pattern, see Section 5.3.5, "Setting a PON receive pattern."

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5.3.3 Setting a PON send pattern

This section explains how to set a pattern for PON measurement. Before setting a pattern, select PON as a pattern mode and set a transmission direction following the procedure described in Section 5.3.1, "Setting a transmission direction."

1. Open the Setup: Pattern panel.

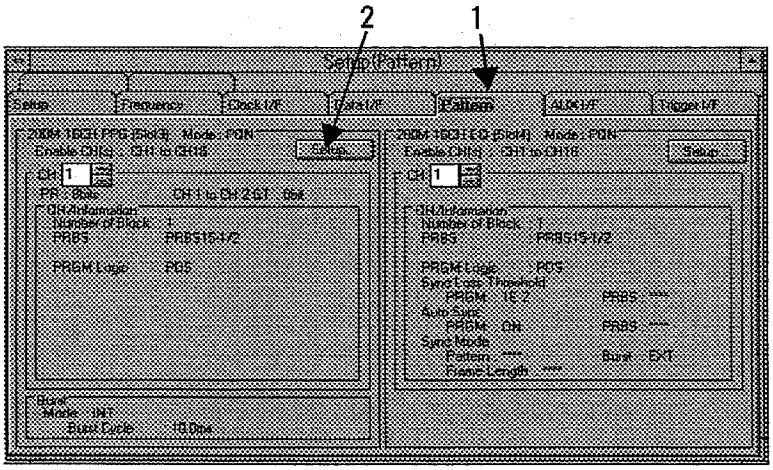


Fig. 5.-18 Setup: Pattern panel (PON mode)

2. Press the Setup button in the PPG unit. The Pattern dialog box will open.

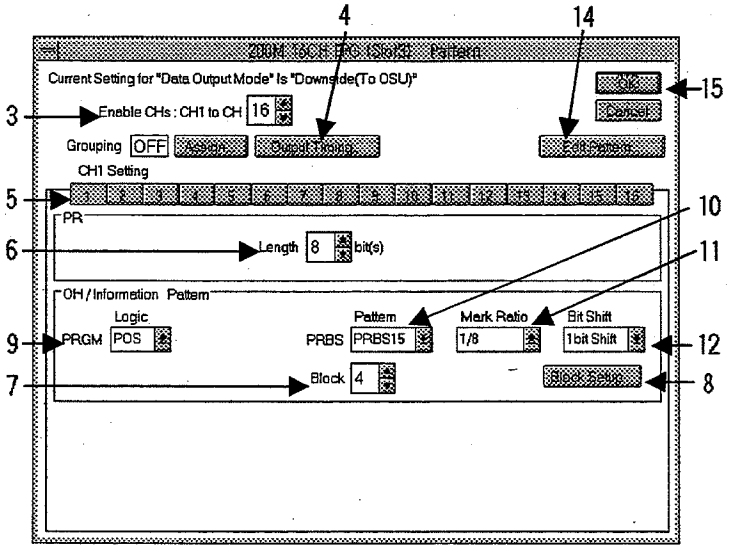


Fig. 5.-19 Pattern dialog box (PON mode)

3. Select a number of effective channels subject to pattern generation by entering the maximum effective channel number in the Enable CHs text box. Contiguous effective channels must be specified, beginning with CH1.

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4. Set Guard Time. Press the Output Timing button to open the Output Timing dialog box. For how to use the Output Timing dialog box, see Section 5.3.4, "Setting guard times."

5. Press the target channel button. For how to set two or more channels at a time, see Section 6.1, "Setting Multiple Channels at a Time."

6. Enter a preamble length in the Length text box in the PR group box. The maximum preamble length is 64 bits.

7. Set the number of blocks constituting OH/Information using the Block spin box in the OH/Information Pattern group box. The maximum number of blocks is 7.

8. Set the pattern type and length of the blocks constituting OH/Information. For how to use this dialog box, see Section 5.3.6, "Setting the structure of ON/information."

9. Select a PRGM block logic by selecting it from the Logic drop-down list box in the OH/Information Pattern group box.

10. Select a number of PRBS block rows from the Pattern drop-down list box in the OH/Information group box.

PRBS7	Selects a 2^7-1 PRBS pattern.
PRBS9	Selects a 2^9-1 PRBS pattern.
PRBS11	Selects a 2^{11}-1 PRBS pattern.
PRBS15	Selects a 2^{15}-1 PRBS pattern.
PRBS20	Selects a 2^{20}-1 PRBS pattern.
PRBS23	Selects a 2^{23}-1 PRBS pattern.
PRBS31	Selects a 2^{31}-1 PRBS pattern.

11. Select a PRBS block mark ratio from the Mark Ratio drop-down list box in the OH/Information group box.

1/2	Sets the mark ratio to 1/2.
1/4	Sets the mark ratio to 1/4.
1/8	Sets the mark ratio to 1/8.
ALL0	Selects an all-zero pattern.
1/2INVT	Sets the mark ratio to $\overline{1/2}$.
3/4	Sets the mark ratio to 3/4.
7/8	Set the mark ratio to 7/8.
ALL1	Selects all-one pattern.

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12. Select a PRBS block bit shift mode from the Bit Shift drop-down list box in the OH/Information group box.

1bit Shift	Selects a 1-bit shift mode.
3bit Shift	Selects a 3-bit shift mode.

Note

If you have selected 1/2, 1/2INV, ALL0, or ALL1 as a mark ratio in step 12, you cannot set a bit shift mode.

13. Perform steps 5 through 12 repeatedly as many times as the number of target channels.

14. To edit the PRGM block pattern, press the Edit Pattern button. The Pattern Editor dialog box will open. For how to use the Pattern Editor dialog box, see 5.4, "Creating or Editing a Pattern."

15. This completes the setting. Press the OK button to make the new setting effective. The PPG Pattern dialog box will close.

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5.3.4 Setting guard times

When setting a PON send pattern, press the Output Timing button in the Pattern dialog box. Then, the Output Timing dialog box will open, allowing you to set PON pattern guard times and a burst cycle.

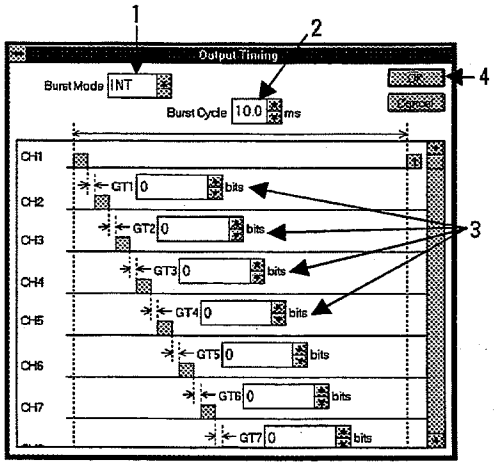


Fig. 5.-20 Output Timing dialog box

1. Select a Burst signal source from the Burst Mode drop-down list box.

INT	Sends a pattern using an internal Burst signal.
EXT	Sends a pattern using an external Burst signal source.

2. Enter a burst cycle in the Burst Cycle text box within the range from 0.1 ms to 10.0 ms. When you have selected EXT in step 1, you cannot set a burst cycle.

3. Enter interchannel guard times using spin boxes.

Note

The following relationships must be established between the burst cycle and the enable length.

$$\text{Enable length} \leq \text{Burst cycle}$$

The unit of measure of the burst cycle is ms and that of the enable length is bit.

The result of converting the enable length into time depends on the frequency set on the Setup:Frequency panel. Values not meeting the above condition cannot be entered.

When an external clock source is specified, this conversion is not made. It should be noted that you can make a setting that does not satisfy the above condition. For how to set a clock generation source, refer to Section 5.1, "Setting Frequencies," in the Clock Generator Instruction Manual.

4. This completes the setting. Press the OK button to make the new setting effective. The Output Timing dialog box will close.

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5.3.5 Setting a PON receive pattern

This section explains how to set a pattern for PON measurement. Before setting a pattern, select PON as a pattern mode and set a reception direction following the procedure discussed in Section 5.3.2, "Setting a reception direction."

1. Open the Setup: Pattern panel.

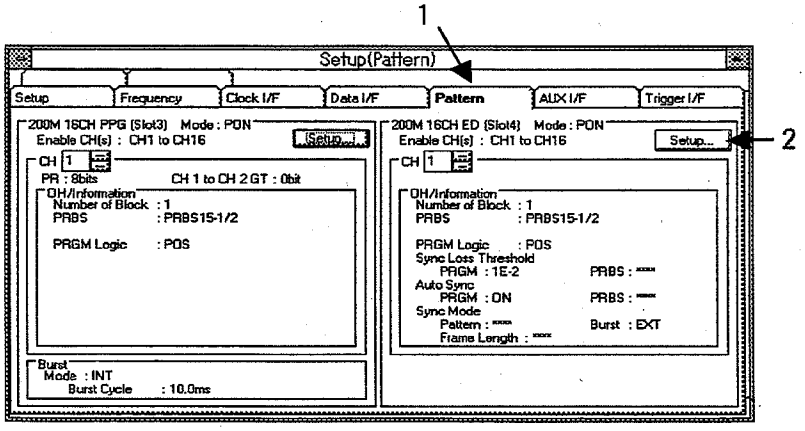


Fig. 5.-18 Setup: Pattern panel (PON mode)

2. Press the Setup button in the ED unit. The Pattern dialog box will open.

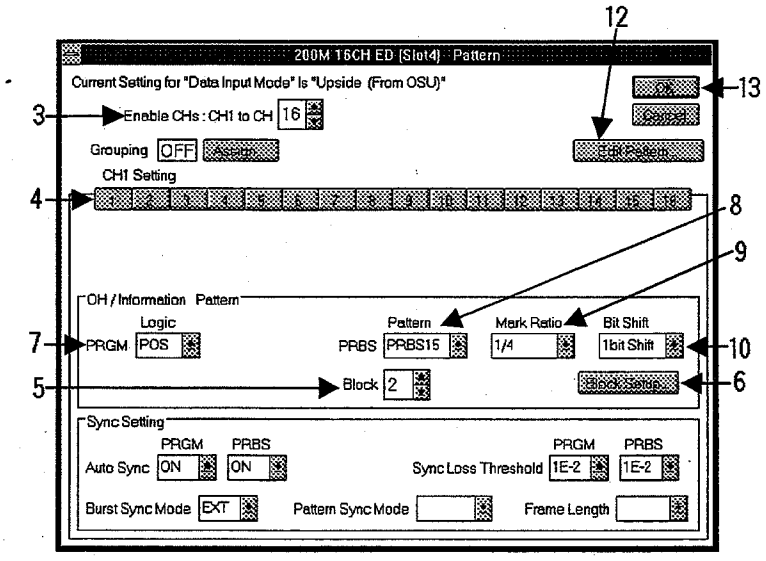


Fig. 5.-19 Pattern dialog box (PON mode)

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3. Select a number of effective channels subject to pattern generation by entering the maximum effective channel number in the Enable CHs text box. Contiguous effective channels must be specified, beginning with CH1.

4. Press the target channel button. For how to set two or more channels at a time, see Section 6.1, "Setting Multiple Channels at a Time."

5. Set the number of blocks constituting OH/Information using the Block spin box in the OH/Information Pattern group box. The maximum number of blocks is 7.

6. Set the pattern type and length of the blocks constituting OH/Information. Press the Block Setup button to open the PON Pattern Detail Setup dialog box. For how to use this dialog box, see Section 5.3.6, "Setting the structure of OH/information."

7. Select a PRGM block logic by selecting it from the Logic drop-down list box in the OH/Information Pattern group box.

8. Select a number of PRBS block rows from the Pattern drop-down list box in the OH/Information group box.

PRBS7	Selects a 2^7-1 PRBS pattern.
PRBS9	Selects a 2^9-1 PRBS pattern.
PRBS11	Selects a 2^{11}-1 PRBS pattern.
PRBS15	Selects a 2^{15}-1 PRBS pattern.
PRBS20	Selects a 2^{20}-1 PRBS pattern.
PRBS23	Selects a 2^{23}-1 PRBS pattern.
PRBS31	Selects a 2^{31}-1 PRBS pattern.

9. Select a PRBS block mark ratio from the Mark Ratio drop-down list box in the OH/Information group box.

1/2	Sets the mark ratio to 1/2.
1/4	Sets the mark ratio to 1/4.
1/8	Sets the mark ratio to 1/8.
ALL0	Selects an all-zero pattern.
1/2INVT	Sets the mark ratio to $\overline{1/2}$.
3/4	Sets the mark ratio to 3/4.
7/8	Sets the mark ratio to 7/8.
ALL1	Selects all-one pattern.

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10. Select a PRBS block bit shift mode from the Bit Shift drop-down list box in the OH/Information group box.

1bit Shift	Selects a 1-bit shift mode.
3bit Shift	Selects a 3-bit shift mode.

Note

If you have selected 1/2, 1/2INV, ALL0, or ALL1 as a mark ratio in step 9, you cannot set a bit shift mode.

11. Perform steps 4 through 10 repeatedly as many times as the number of target channels.

12. To edit the PRGM block pattern, press the Edit Pattern button. The Pattern Editor dialog box will open. For how to use the Pattern Editor dialog box, see 5.4, "Creating or Editing a Pattern."

13. This completes the setting. Press the OK button to make the new setting effective. The ED Pattern dialog box will close.

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5.3.6 Setting the Structure of OH/information

When setting a PON send pattern or PON receive pattern, pressing the Block Setting button in the Pattern dialog box will open the PON Pattern Detail Setup dialog box. With this box, you can set pattern types and bit lengths of the blocks constituting the OH/Information.

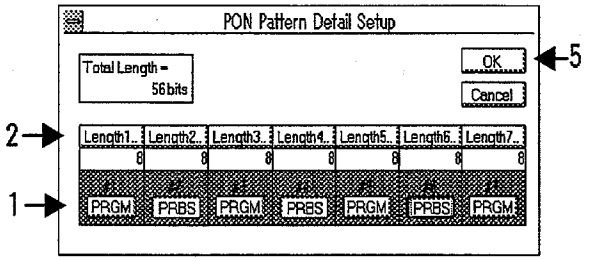


Fig. 5.-20 PON Pattern Detail Setup dialog box

1. Set pattern types of Blocks. When PRGM button is pressed, the Block pattern changes PRBS pattern, and when PRBS button is pressed the Block pattern changes PRGM pattern.

2. Press the Length button of the target block. The Block Length dialog box will open.

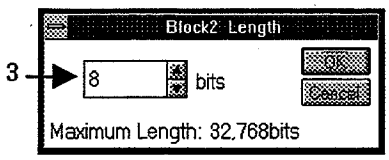


Fig. 5.-21 Column Length dialog box

3. Enter the bit length of the block in the text box in the Column Length dialog box, then press the OK button. Setting ranges are as follows:

- When a block selected in step1 is PRGM pattern.
  Block length:8～8,192bits/8bits step
- When a block selected in step1 is PRBS pattern.

Number of blocks	Setting range
1	8 bits to 131,072 bits
2	8 bits to 98,304 bits
3	8 bits to 65,536 bits
4 or more	8 bits to 32,768 bits
Step	8bits step

4. Perform steps 1 through 3 repeatedly as many times as the number of target blocks.

5. This completes the setting. Press the OK button to make the new setting effective. The PON Pattern Detail Setup dialog box will close.

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5.4Creating or Editing a Pattern

5.4.1 Selecting a display mode

To create or edit a PRGM pattern on the MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit) and MU163040B 200M 16CH Error Detector (hereafter called the ED unit), use a Pattern Editor dialog box. The Pattern Editor dialog box allows you to create or edit a PRGM pattern or a pattern in the MIX/PON pattern of the PRGM block.
This section describes how to create or edit a PRGM pattern using a Pattern Editor dialog box. Pressing the Edit Pattern button on the Pattern dialog box in the Setup:Setup panel will open the Pattern Editor dialog box.

Note

1. When the System Mode is "Measurement Power Fail Mode", you cannot open the Pattern Editor dialog box. Edit a pattern in the Customize subwindow or switch between System Modes.
2. For how to switch between System Modes, refer to Section 6.4, "Setting a System Operations," in the MP1630B Digital Analyzer Operation Manual.
3. For how to use the Customize subwindow, see Section 5.14, "For the Users of the BERTS in the past."
4. There is a case it is difficult for you to see a cursor on editor depend on a color setting of Windows. A color settings of Windows set on Control Panel in Main group of Program Manager. For how to use a Control Panel, see online help in Control Panel. A color settings in shipping is "MP1630B."

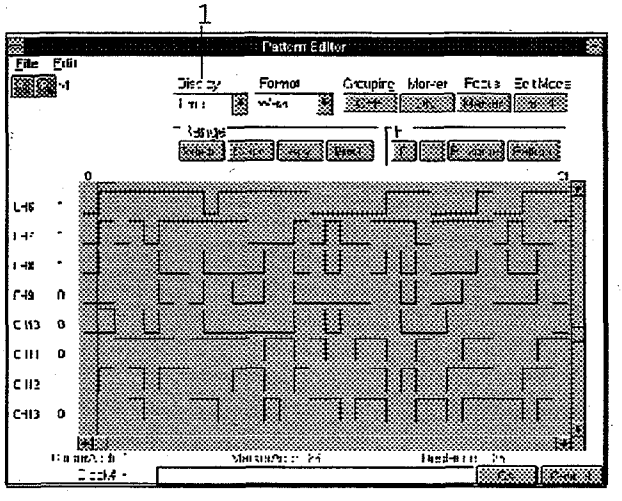


Fig. 5.-25 Pattern Editor dialog box

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1. Select a display mode from the Display drop-down list box.

Time	Display and edit the pattern of each channel horizontally on a line with reference to the time axis shown horizontally. You can display and edit the pattern with a wave image or binary characters.
State	Display and edit one piece of 16-bit data whose most significant bit is for CH1. You can display and edit the pattern with binary, hexadecimal, or ASCII characters.
Dump	Display and edit the pattern of one channel with a memory dump image. You can display and edit the pattern with binary or hexadecimal characters.

Note

In the State mode, a pattern cannot be displayed or edited in the following cases:

1. When the Grouping button is turned ON, furthermore ,PRGM pattern and pattern length are not equal for all channel.
2. When the Grouping button is turned ON, furthermore the number of effective channels isn't sixteen. PON pattern and Block configuration are not equal, Block configuration said here contains the number of block and each block length ,a setting of PRGM or PRBS.

2. See the explanation of the editing method suited to the display mode selected from the Display drop-down list box.

For how to edit a pattern in the Time mode, see Section 5.4.2, "Editing in the Time mode."
For how to edit a pattern in the State mode, see Section 5.4.3, "Editing in the State mode."
For how to edit a pattern in the Dump mode, see Section 5.4.4, "Editing in the Dump mode."

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5.4.2 Editing in the Time mode

This section explains how to create or edit a pattern in the Time display mode.

1. Select a display format from the Format drop-down list box in the Pattern Editor dialog box.

Wave	Display a wave for editing. You can enlarge or reduce the wave with Zoom Up and Zoom Down buttons.
BIN	Display binary characters for editing.

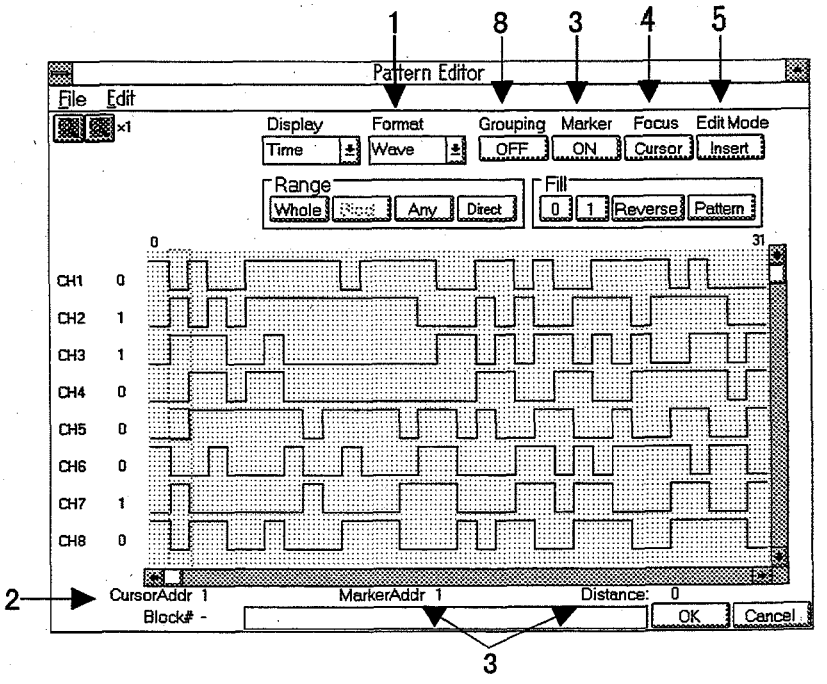


Fig. 5.-26 Pattern Editor dialog box (Time display mode)

2. The cursor address is shown beside the Cursor Addr label. The bit states of 8 channels at the cursor position appear in the display area. When the cursor is at the channel with a block, the number of the block at the cursor is displayed beside the Block# label.

3. Set marker display. Pressing the Marker button will toggle the marker on and off. The marker address beside the Marker Addr label, and the cursor-to-marker distance beside the Distance label.

4. Select a cursor or marker by pressing the Focus button. You can move the selected cursor or marker using the arrow keys or rotary encoder.

5. Set an edit mode. Pressing the Edit Mode button will toggle between Insert and Overwrite modes.

6. Input a pattern with the 0 and 1 keys. Note that PRBS portions of the pattern cannot be edited.

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7. By double click, a cursor is moved and the bit invert.

8. When you press the Grouping button, you can be effective in the grouping settings. The grouping is set in the Pattern dialog box. For grouping settings, see Section 6.1,"Setting Multiple Channels at a Time."

9. For other functions, see Section 5.4.5, "Setting a selection area."

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5.4.3 Editing in the State mode

This section explains how to create or edit a pattern in the State display mode.

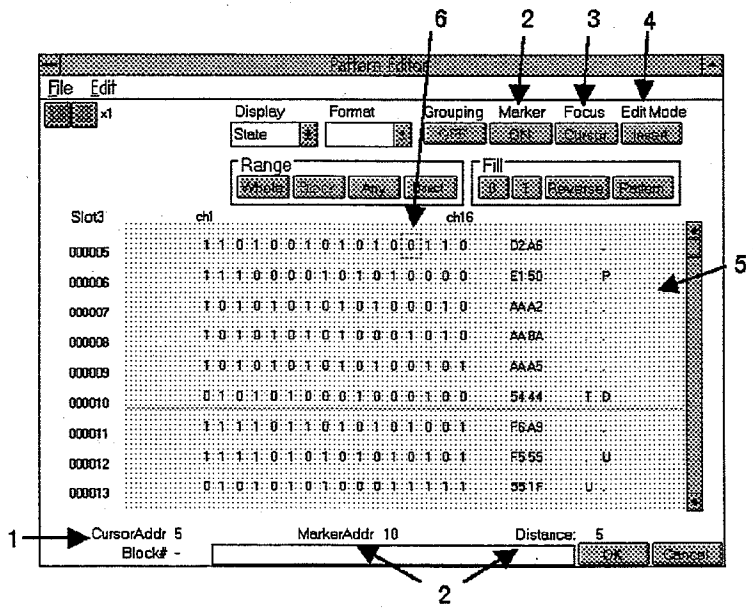


Fig. 5.-27 Pattern Editor dialog box (State display mode)

1. The cursor address is shown beside the Cursor Addr label. When editing pattern is MIX or PON, the number of the block at the cursor is displayed beside the Block# label.

2. Set marker display. Pressing the Marker button in the Pattern Editor dialog box will toggle the marker on and off. The marker address beside the Marker Addr label, and the cursor-to-marker distance beside the Distance label.

3. Select a cursor or marker by pressing the Focus button. You can move the selected cursor or marker using the arrow keys or rotary encoder.

4. Set an edit mode. Pressing the Edit Mode button will toggle between Insert and Overwrite modes.

5. To input a pattern in a binary form, use the 0 and 1 keys. To input a pattern in a hexadecimal form, use 0 to 9 and A to F keys. To input a pattern in a ASCII form, you need a keyboard Note that the PRBS portion of a pattern is represented by and it cannot be edited. Cursor moving between each display binary form, hexadecimal form, ASCII form, use click.

6. By double click in binary display part, a cursor moves to a position you clicked and the bit invert.

7. For other functions, see Section 5.4.5, "Setting a selection area."

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5.4.4 Editing in the dump mode

This section explains how to create or edit a pattern in the Dump mode.

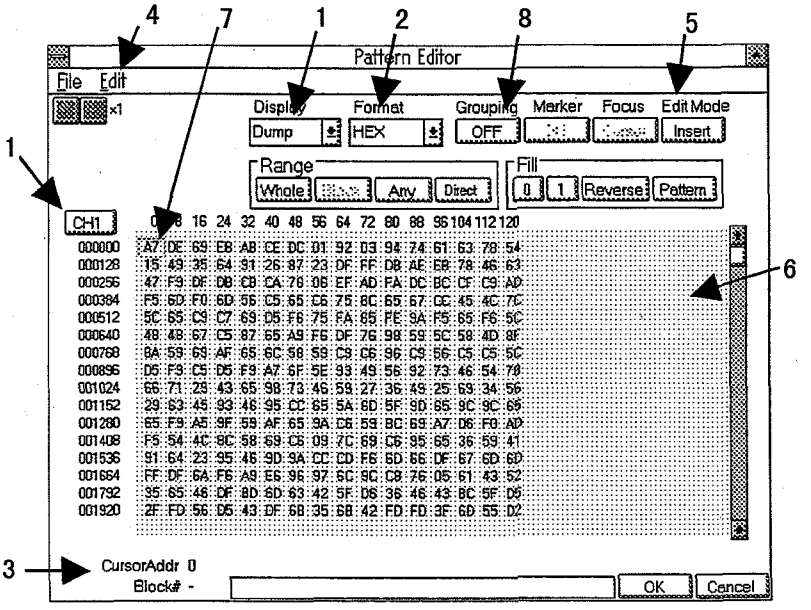


Fig. 5.-28 Pattern Editor dialog box (Dump display mode)

1. Selecting Dump from the Display drop-down list box will open the CH Select dialog box. Select the channel subject to editing by pressing the corresponding option button, then press the OK button.

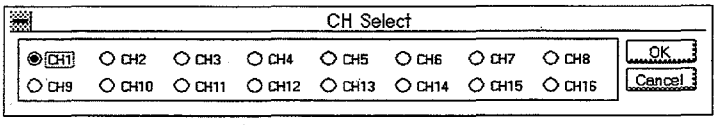


Fig. 5.-29 CH Select dialog box

Pressing the CH button also can open the CH Select dialog box.

2. Select a display format from the Format drop-down list box in the Pattern Editor dialog box.

BIN	Displays binary characters for editing.
HEX	Displays hexadecimal characters for editing.

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3. The cursor address is shown beside the Cursor Addr label. When the cursor is at the channel with a block, the number of the block at the cursor is displayed beside the Block# label. On hexadecimal display, a block number belong to the head bit in eight bit of cursor position is displayed.

4. Set the quantity of the data to be displayed on a line. Select Line from the Edit pull-down list box to open the Line dialog box. Enter the number of bytes per line in the spin box, then press the OK button.

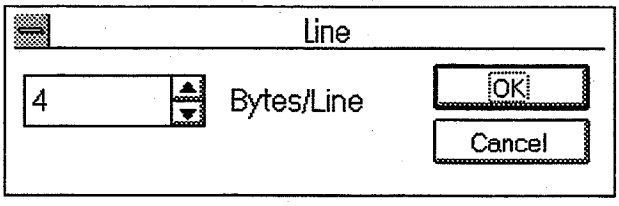


Fig. 5.-30 Line dialog box

5. Set an edit mode. Pressing the Edit Mode button will toggle between Insert and Overwrite modes.

6. Input a pattern. To input a pattern in a binary form, use the 0 and 1 keys To input a pattern in a hexadecimal form, use 0 to 9 and A to F keys. Note that the PRBS portion of a pattern is represented by * and it cannot be edited.

7. By double click on binary display, a cursor moves to a position you clicked and the bit invert.

8. When you press the Grouping button, you can be effective in grouping setting. Grouping is set in Pattern dialog box. For grouping setting ,see Section 6.1,"Setting Multiple Channels at a Time."

9. For other functions, see Section 5.4.5, "Setting a selection area" and later.

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5.4.5 Selecting a selection area

This section explains how to set a selection area using a Range group box. The selection area will be used when the Fill group box is used for substitution, when an edit command (Cut, Copy, or Paste) is used, or when a PRGM pattern is saved.

1. It is an impossible to contain PRBS bit.
2. On Time display, it is an impossible to select an area extents over multichannel.
3. On State display, an area specification is limited to a line unit.

To set a selection area, use the buttons in the Range group box. Functions of these buttons are as follows:

Button	Function
Whole	Set the area that contains the whole pattern of the channel at the cursor position.
Block	Set the area that contains the whole block at the cursor position.
Any	Set an area by specifying addresses in the Input Range dialog box.
Direct	Set an area by specifying addresses with the cursor.

■ The following describes how to specify a selection area using the Any button.

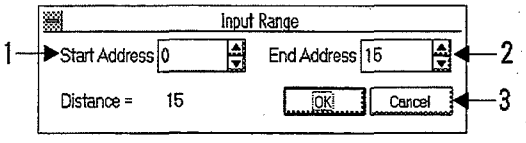


Fig. 5.-31 Input Range dialog box

1. Enter the start address of the selection area in the Start Address spin box.
2. Enter the end address of the selection area in the End Address spin box.
3. Press the OK button. Then, the specified area will be displayed in reverse video.

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■ The following describes how to specify a selection area using the Direct button.

1. Press the Direct button. The button will be kept pressed down and the Direct mode will be selected. In the Direct mode, you cannot input or edit a pattern.

2. Specify the start point of the selection area. Double-click on the start point, or position the cursor at the starting point and press the Enter key.

3. Specify the end point. Using the edit command "Jump" or any other appropriate command, display the selection area end point on the current screen. Double-click on the end point, or position the cursor at the end point and press the Enter key.

4. Thus, the selection area has been set.

■ Other methods for specifying a selection area are as follow:

1. Drag the mouse.

2. Click on the start point of the selection area, then click on the end point with the Shift key held pressed down.

3. Locate the cursor at the start point, then specify the end point with the cursor key while pressing down the Shift key.

4. On deciding the area, if you click a position while pressing down the Shift key, you can specify the end point again.

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5.4.6 Inputting a pattern

This section explains how to input a pattern using the buttons in the Fill group box. Functions of the buttons in the Fill group box are as follows:

Button	Function
0	Replace the bit(s) with 0.
1	Replace the bit(s) with 1
Reverse	Invert the bit(s).
Pattern	Repeat the specified pattern.

■ The following describes how to input a pattern using the Pattern button.

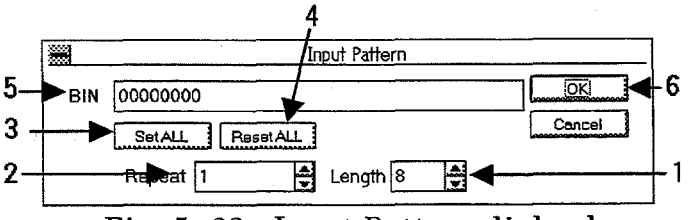


Fig. 5.-32 Input Pattern dialog box

1. Enter a pattern length (number of bits) in the Length spin box.
2. Enter the number of times the specified pattern is to be input, in the Repeat spin box. If you have specified a selection area, this spin box cannot be used.
   The specified pattern will be input repeatedly up to the selection area length.
3. Pressing the SetALL button will set all bits to 1s.
4. Pressing the ResetALL button will set all bits to 0s.
5. Enter a pattern in the text box.
6. Pressing the OK button will add the pattern at the cursor position.

Note

- If you open Input Pattern dialog on a state specified the selection area, the selection area is replaced in repetition of specification pattern without being related to the repetition number specified in the Repeat spin box.

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5.4.7 Edit commands

This section explains the commands that can be selected from the Edit pull-down menu in the Pattern Editor dialog box.

Table 5.-2 Edit commands of Pattern Editor

Command	Function
Undo	Cancel the preceding operation.
Cut	Remove the data in the selection area or at the cursor and stores it in the buffer.
Copy	Copies the data in the selection area or at the cursor to the buffer.
Paste	If a selection area has been set, substitute it with the data stored in the buffer. If not set, the data stored in the buffer is added at the cursor position.
Jump-Head	Jump to the beginning of the pattern.
Jump-Tail	Jump to the end of the pattern of the channel at the cursor position.
Jump-Marker	If the marker is ON, jump the marker to the center of the screen.
Jump-Address	Jump to the specified address of the channel at the cursor position.
Jump-Block	Jump to the specified block of the channel at the cursor position.
Jump-Pattern	Search for the specified block of the channel at the cursor position, and jump to the head of the first searched pattern.
Jump-Next	Search for the next pattern under the same condition as that of the Jump-Pattern command executed directly before.

■ Specifying the address at the jump destination

1. Selecting Jump-Address will open the Input Address dialog box.

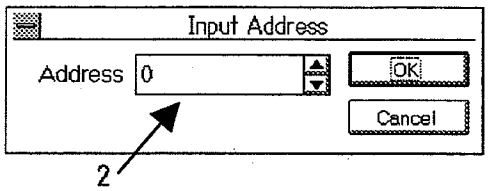


Fig. 5.-33 Input Address dialog box

2. Enter the jump destination address in the spin box in the Input Address dialog box, then press the OK button.

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■ Specifying the block at the jump destination

1. Selecting Jump-Block will open the Block Select dialog box.

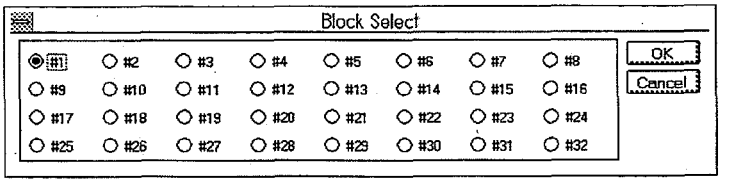


Fig. 5.-34 Block Select dialog box

2. Specify the destination block number by pressing the corresponding option button, then press the OK button.

■ Specifying the pattern to search

1. Selecting Jump-Pattern will open the Input Pattern dialog box.

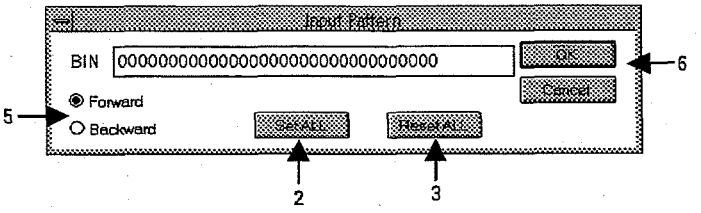


Fig. 5.-35 Input Pattern dialog box

2. Pressing the SetALL button will set all bits to 1s.

3. Pressing the ResetALL button will set all bits to 0s.

4. Enter a pattern in the BIN or HEX text box. To enter a Don't Care bit, press the 0 key with the Shift key pressed down. Pattern length you can reference is variable from 1 bit to 32 bits.

5. Select the search direction by pressing the Forward or Backward option button.

6. Press the OK button.

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5.4.8 Panel key and keyboard operations

This section lists the operations that can be performed using the keys on the Pattern Editor panel and optional keyboard.

Table 5.-3 Panel key operations

Arrow keys	Move the cursor.
Shift + Left/Right	Perform the same operation as area specification per formed by dragging the mouse.
Enter	Performs the same operation as double clicking
Numeric characters and A to F	Input a pattern
Shift+0	Specifies Don't Care.
Back Space	Deletes the data to the left of the cursor.

Table 5.-4 Keyboard key operations

Arrow keys	Move the cursor.
Shift + Left/Right	Performs the same operation as area specification performed by dragging the mouse.
Home	Moves the cursor to the left end of the screen.
Ctrl + Home	Jumps the cursor to the head of the pattern.
End	Moves the cursor to the right end of the screen.
Ctrl + End	Jumps to the end of the pattern of the channel at cursor.
Page Up	Scrolls the screen one page rightward or downward.
Page Down	Scrolls the screen one page leftward or upward.
Enter	Performs the same operation as double clicking
Numeric characters and A to F	Input a pattern.
Shift + 0 or X	Specifies Don't Care.
Delete	Removes the data in the selection area or at the cursor and stores it in the buffer.
Back Space	Deletes the data to the left of the cursor.
Insert	Switches between Insert and Overwrite modes.

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5.4.9 Saving a PRGM pattern

There are two methods for saving the pattern edited using the Pattern Editor dialog box: a method by which the edited pattern is saved as a pattern setting data file and a method by which the edited pattern is saved as a pattern clip file. The pattern setting data file includes the setting states of the patterns of all channels in addition to pattern bit strings. On the other hand, the pattern clip file includes only pattern bit strings.
This section describes how to save a created PRGM pattern as a pattern clip file. For details on the pattern setting data file, see Section 5.15, "Saving Setting States in the Data File: Opening the Data File."

1. Select Save from the File pull-down menu in the Pattern Editor dialog box. The Save dialog box will open.

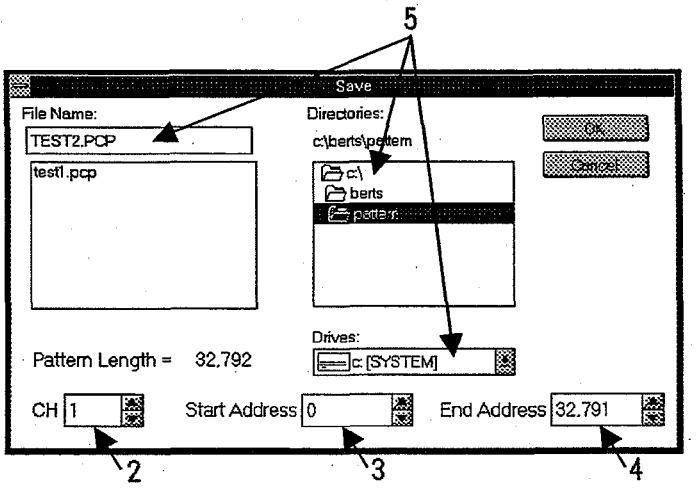


Fig. 5.-36 Save dialog box

2. Enter the channel whose pattern is to be saved, in the CH spin box.
3. Enter the start address in the Start Address spin box.
4. Enter the end address in the End address spin box.
5. Enter drive, directory, and file names, then press the OK button. Do not change the file name extension when entering the file name.

Note

- If the area specified in Save dialog box includes PRBS bits, you can't save the pattern.
- If the Save dialog box is opened after selecting an area, the selected area will be set in the CH spin box, Start Address spin box, and End Address spin box.

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5.4.10 Opening a PRGM pattern

The pattern saved as a pattern clip file can be read and inserted in or written over the pattern currently being edited. This section explains how to read a pattern clip file.

1. The read pattern will be added at the cursor position. Move the cursor to the position where the read patter is to be added.

2. Select Open from the File pull-down menu in the Pattern Editor dialog box. The Open dialog box will open.

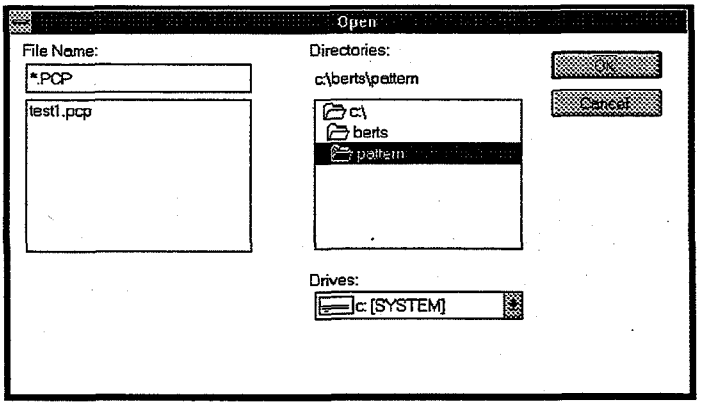


Fig. 5.-37 Open dialog box

3. Enter drive, directory, and file names, then press the OK button. The read pattern will be added at the cursor position.

Note

In State display mode, you cannot open the pattern clip files saved in Time or Dump display mode. In Time or Dump display mode, you cannot open the pattern clip file saved in State display mode.

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5.4.11 Printing a pattern

This section explains how to print a created generation/measurement pattern. There are two printing method. One is printing from the Pattern Editor dialog box, the other is from the main window. A print example is given in Section 7, "Printer Output Example," in Appendix.

Printing from the Pattern Editor dialog box

1. Select Print from the File pull-down menu in the Pattern Editor dialog box. The Print dialog box will open.

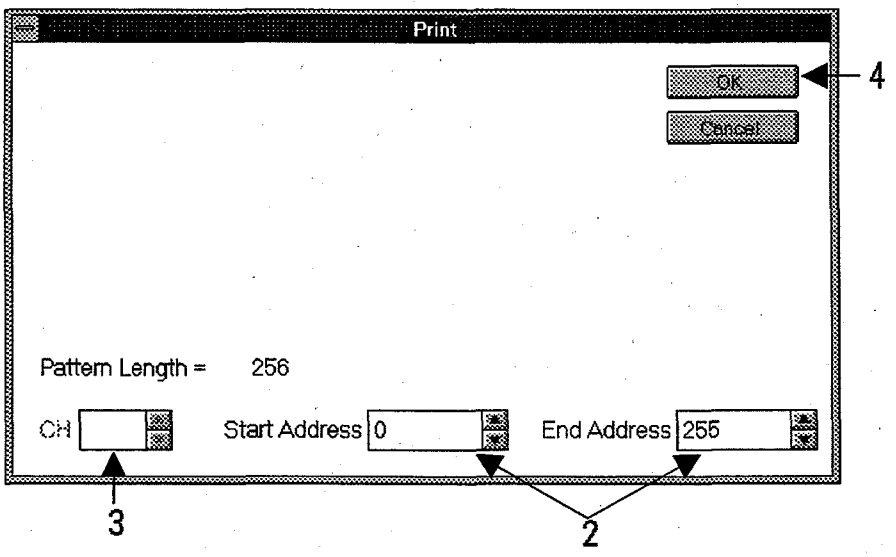


Fig. 5.-38 Print dialog box

2. Specify a pattern range you want to print to Start Address and End Address spin box.
3. When you open the print dialog box while displaying Dump. you can specify which channel pattern you print. Specify in CH spin box.
4. Press the OK button, then printing start.

Note

Output form output such as a pattern display form in the Pattern Editor dialog box. But, while displaying the Wave form in the Time display mode, output form is BIN form.

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Printing from the main window

1. Select Print from the File pull-down menu in the main window. The Print dialog will open.

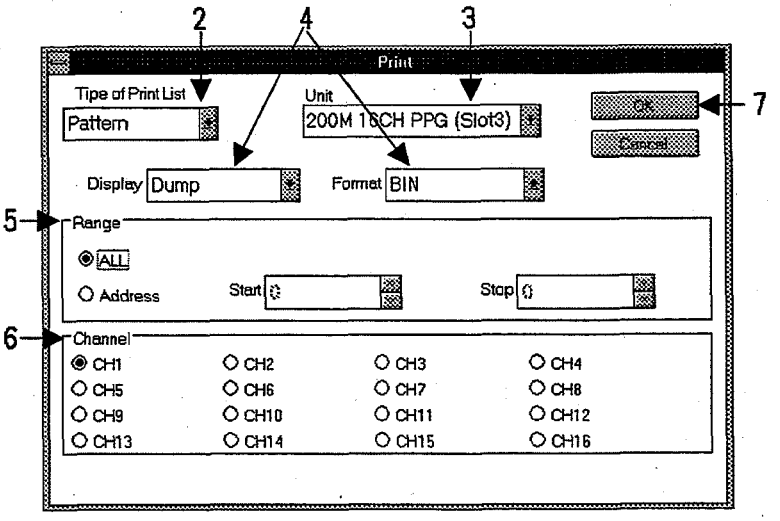


Fig. 5.-39 Print dialog box

2. Select Pattern in the Type of Print List drop down list box.

3. Select the unit saving a pattern you want to print in the Unit drop down list box.

4. Specify a pattern form you want to print in the Display drop down list box or the Format drop down list box.

5. Check ALL when you want to print in the whole range of a pattern. When you want to print only in a voluntary range, check Address, and specify a range in Start Address and End Address spin box.

6. When you print at Dump form, you can specify which channel pattern to print. Check your request channel in the channel group box.

7. Press OK button, then printing start.

Note

1. When the System Mode is "Measurement Power Fail Mode". It is impossible to print a Pattern.
2. For changing System Mode, see section 6.4, "Setting System Operations." in the MP 1630B Digital Data Analyzer Operation Manual.

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5.5Sending/Receiving a Burst Pattern

5.5.1 Sending a burst pattern

The MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit) allows you to send a burst pattern and clock signal.
You can select either internal or external burst trigger signal for burst control. If you have selected an internal signal, you must set a burst cycle and an enable length. A burst trigger signal output from the Burst Trigger Output connector on the back panel of the PPG unit. For how to set the Burst trigger signal, see Section 5.5.3,"Setting Burst Trigger Output." For more details, see Section 2, "Burst Pattern Generation Principle," in Appendix.
This section describes how to send a burst pattern and clock signal.

Note

When a burst pattern is sent, a Zero-Subst pattern cannot be generated.

1. Open the Setup: Setup panel.

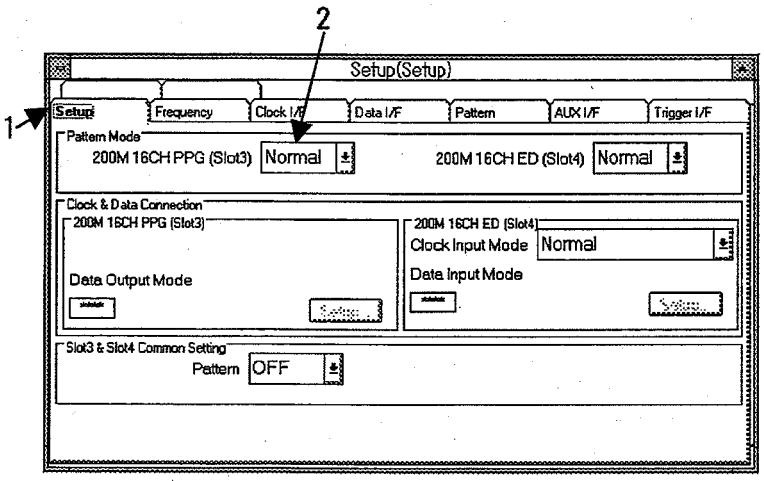


Fig. 5.-40 Setup: Setup panel

2. Select Normal from the PPG unit drop-down list box in the Pattern Mode group box.

3. Open the Setup: Pattern panel.

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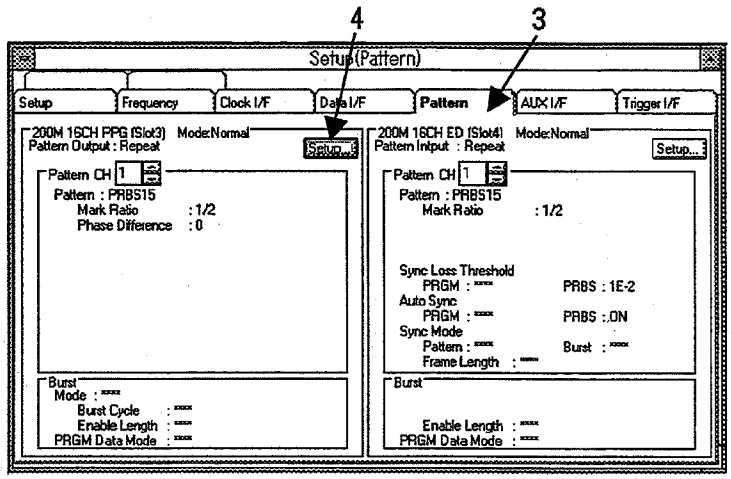


Fig. 5.-41 Setup: Pattern panel

4. Press the Setup button in the PPG group box. The Pattern dialog box will open.

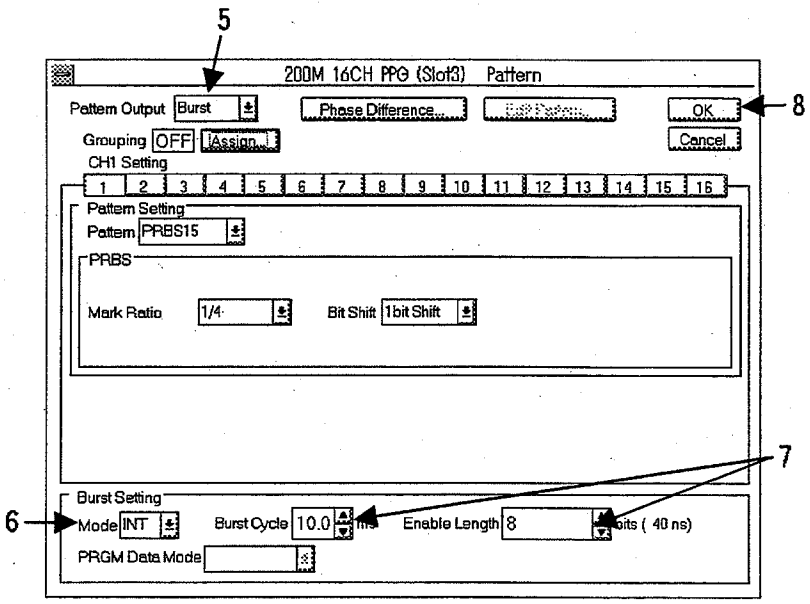


Fig. 5.-42 Pattern dialog box

5. Select Burst from the Pattern Output drop-down list box. The setting items in the Burst Setting group box will become effective.

6. Select a burst trigger signal source from the Mode drop-down list box in the Burst Setting group box.

INT	Generates an internal burst trigger signal for burst control to send a burst pattern.
EXT	Inputs an burst trigger signal for burst control to the EXT Burst Input connector on the back panel of the PPG unit.

7. If you have selected INT in step 6, enter a burst cycle and enable length in the Burst Cycle and Enable Length spin boxes. Setting ranges are as follows:

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Item	Setting range
Burst cycle	0.1 ms to 10 ms
Enable length	8 bits to 2,097,144 bits (INT)
	8bits to 1,999,968bits (ENT)

Note

The following relationships must be established between the burst cycle and the enable length.

$$\text{Enable length} + 32\text{bits} \leqq \text{Burst cycle}$$

The unit of measure of the burst cycle is ms and that of the enable length is bit. The result of converting the enable length into time depends on the frequency set on the Setup: Frequency panel. The conversion result is shown at the right. Values not meeting the above condition cannot be entered.

When an external clock source is specified, this conversion is not made. It should be noted that you can make a setting that does not satisfy the above condition. For how to set a clock generation source, refer to Section 5.1, "Setting Frequencies," in the Clock Generator Instruction Manual.

8. This completes the setting. Press the OK button to make the new setting effective.

9. If required, carry out steps 10 and later to make the clock output a burst output. If not required, the setting procedure is complete.

10. Open the Setup: Clock I/F panel.

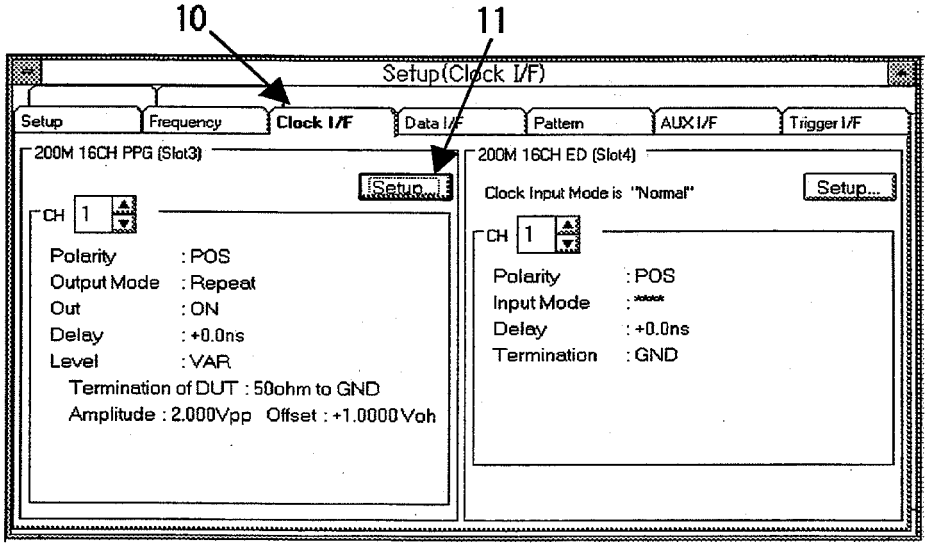


Fig. 5.-43 Setup: Clock I/F panel

11. Press the Setup button in the PPG group box. The Clock Interface dialog box will open.

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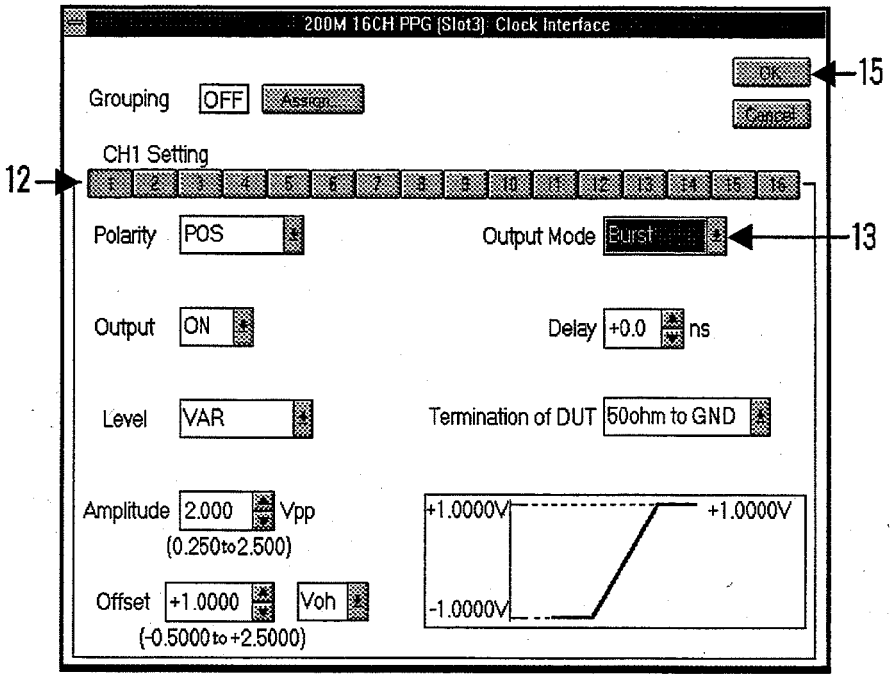


Fig. 5.-44 Clock Interface dialog box

12. Press the target channel button. To set multiple channels at a time, follow the procedure stated in Section 6.1, "Setting Multiple Channels at a Time."

13. Select Burst from the Output Mode drop-down list box. The Burst signal source, enable length, and burst cycle set in steps 5 through 7 will be set automatically.

14. Perform steps 12 and 13 repeatedly as many times as the number of channels to be set.

15. This completes the setting. Press the OK button to make the new setting effective.

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5.5.2 Receiving a burst pattern

The MU163040B 200M 16CH Error Detector (hereafter called the ED unit) can measure a burst pattern and clock signal.
You can select either internal or external burst trigger signal for burst control. If you have selected an internal signal, you must set a burst cycle and an enable length.
This section describes how to receive a burst pattern and clock signal.

Note

When a burst pattern is received, a Zero-Subst pattern cannot be measured.

1. Open the Setup: Setup panel.

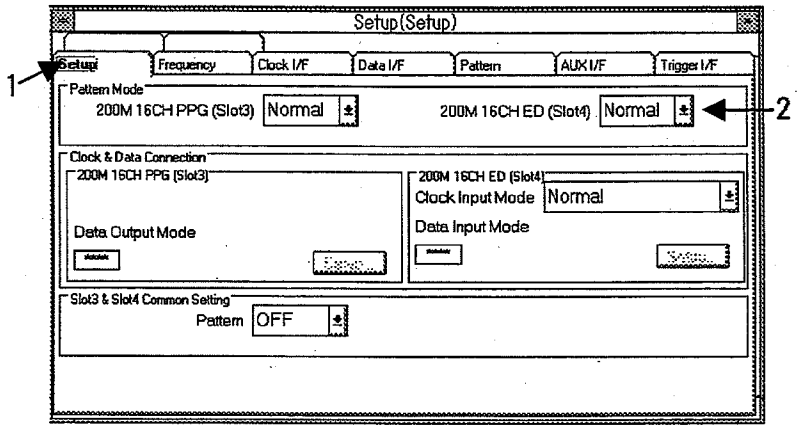


Fig. 5.-45 Setup: Setup panel

2. Select Normal from the ED unit drop-down list box in the Pattern Mode group box.

3. Open the Setup: Pattern panel.

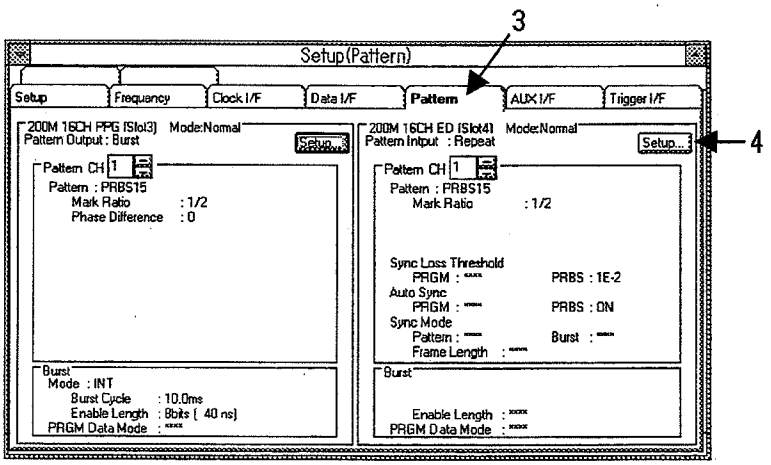


Fig. 5.-46 Setup: Pattern panel

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4. Press the Setup button in the ED group box. The Pattern dialog box will open.

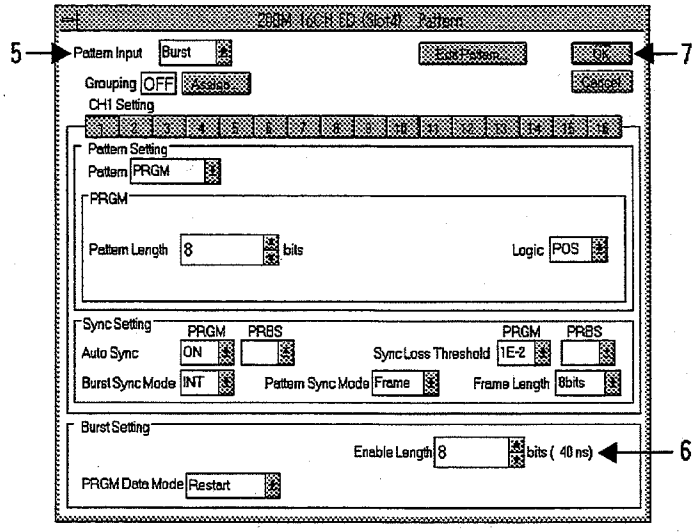


Fig. 5.-47 Pattern dialog box

5. Select Burst from the Pattern Output drop-down list box. The setting items in the Burst Setting group box will become effective.

6. Enter an enable length in the Enable Length text box in the Burst Setting group box. The setting range is from 8 bits to 2,097,144 bits.

Note

1. If you have selected EXT as the Burst Sync mode for all channels (EXT is selected from the Burst Sync Mode drop-down list box in the Pattern dialog box shown in Fig. 5.47), you cannot set an enable length. For details on the Burst Sync mode, see Appendix 4, "About Auto Sync."
2. The result of converting an enable length into time is shown at the right. When an external clock is specified as an input clock source, this conversion is not made. For how to set a clock, refer to Section 5.1, "Setting Frequencies," in the Clock Generator Instruction Manual.

7. This completes the setting. Press the OK button to make the new setting effective.

8. If required. carry out steps 9 and later to make the clock input a burst input. If not required. the setting procedure is complete.

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9. As for a channel received a burst clock, it is necessary to set a Burst on Input Mode setting in clock interface. Open the Setup : Clock I/F panel..

Note

There are Burst and Repeat in Input Mode setting of clock interface. When the Input Mode is Repeat, threshold value of input clock is automatically calculated. Receiving Burst clock, if you select Repeat in the Input Mode, it is impossible to find an appropriate threshold value, because out of enable interval is made the calculated target of threshold value.
Owing to select Burst in Input Mode, a clock threshold value is equal to a threshold value of data interface. For setting a data interface, see section 5.6.3, "Setting the data input interface".

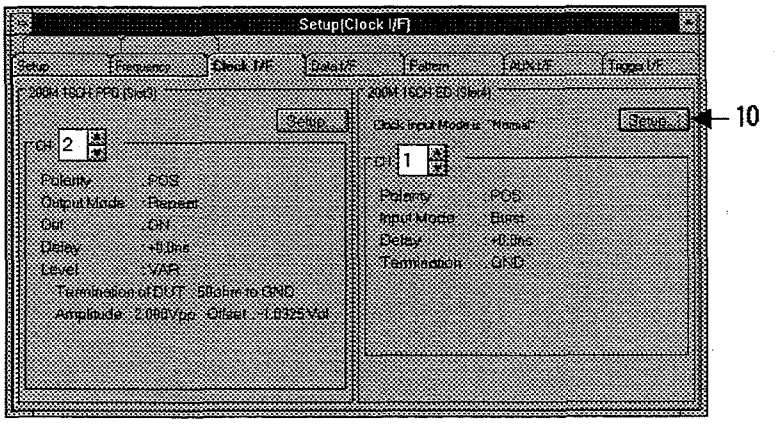


Fig. 5.-48 Setup:Clock I/F panel

10. Press Setup button in group box on the ED side. Clock interface dialog box will open.

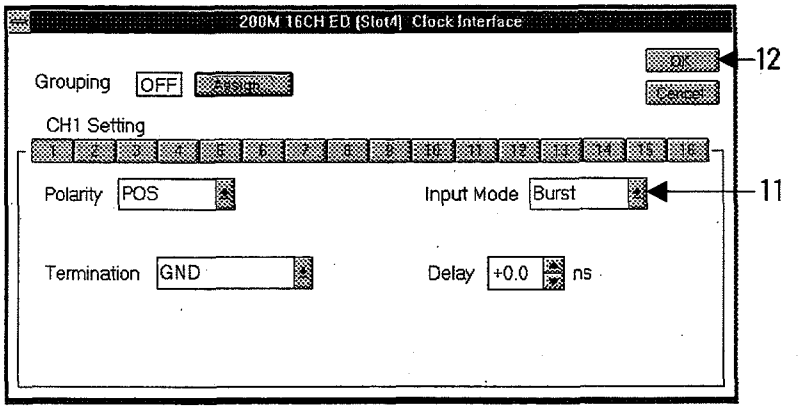


Fig. 5.-49 Clock Interface dialog box

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11. After press the button of channel receiving a burst clock, select Burst in the Input Mode drop down box.

Note

In order to make the ED unit operate in Burst clock, it is necessary to be DUT which can output when a clock and data are the same terminal prerequisite. Set both terminal settings which a channel inputting a burst clock and the channel on data interface identically. For setting a data interface, see section 5.6.3 ,"Setting the data input interface".

12. This completes the setting. Press the OK button to make the new setting effective.

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5.5.3 Setting Burst Trigger Outputs

The MU163020B 200M Pulse Pattern Generator (hereafter called the PPG unit) has one Trigger Output and 16 Burst Trigger Outputs. This section explains the procedure for setting Burst Trigger Outputs.
Signals output from the Burst Trigger Outputs are synchronized with the Burst Trigger signal for burst pattern control. Their lengths are the same as the enable length. You can set delays relative to the rising edge of the Burst Trigger signal.

Note

Burst Trigger Output signals can only be output in the following cases:

(1) When the pattern mode is PON.

(2) When the pattern output mode is Burst and an internal burst signal source is used

For the procedure for setting the pattern mode to PON, see Section 5.3.3, "Setting guard times." For the procedure for setting the pattern output mode to Burst, see Section 5.5.1, "Sending a burst pattern."

1. Open the Setup: Trigger I/F panel. The setting state is shown in the Trigger Output group.

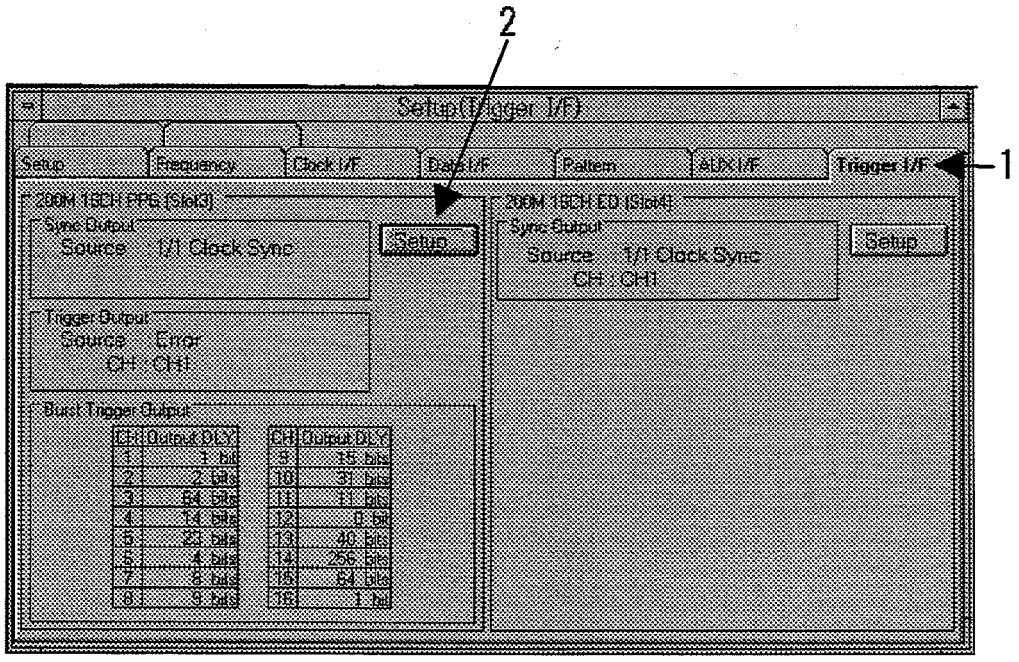


Fig. 5.-50 Setup: Trigger I/F panel

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2. Press the Setup button in the PPG unit group box. The Trigger Interface dialog box will open.

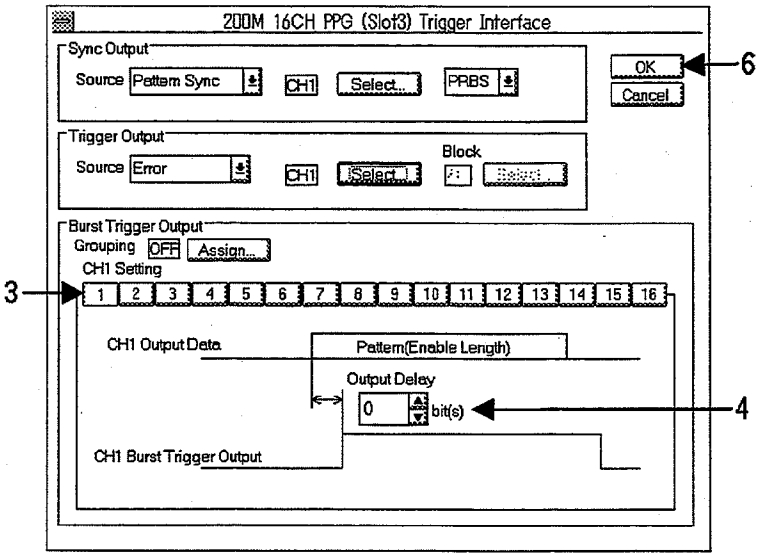


Fig. 5.-51 Trigger Interface dialog box

3. Select the target channel by pressing the corresponding channel button in the Burst Trigger Output group box. When the patter mode is PON, the buttons of the channels not selected as effective channels (Enable CHs) cannot be pressed.

4. Select a Trigger signal output timing. Enter the delay from the pattern enabling start location in the Output Delay spin box. The setting range is from 0 bits to 9999 bits.

5. Perform steps 3 and 4 repeatedly as many times as the number of channels to be set.

6. This completes the setting. Press the OK button to make the new setting effective.

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5.6Setting an Amplitude, Offset Level, Termination, and Phase

5.6.1 Setting the data output interface

This section explains how to set the data output interface of the MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit).

1. Open the Setup: Data I/F panel.

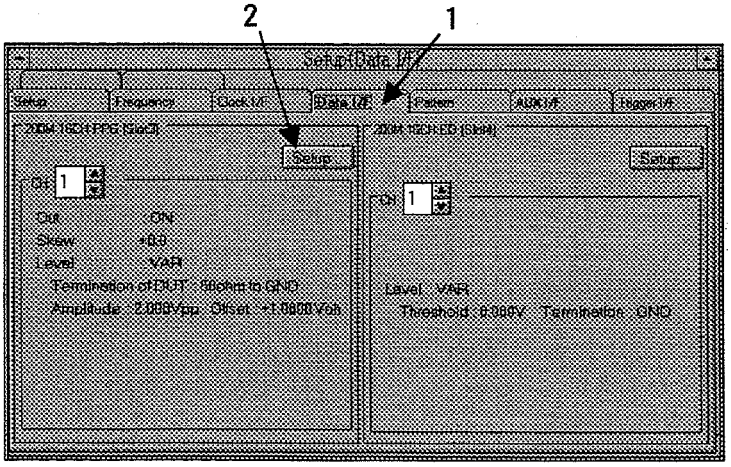


Fig. 5.-52 Setup: Data I/F panel

2. Press the Setup button in the PPG group box. The Data Interface dialog box will open.

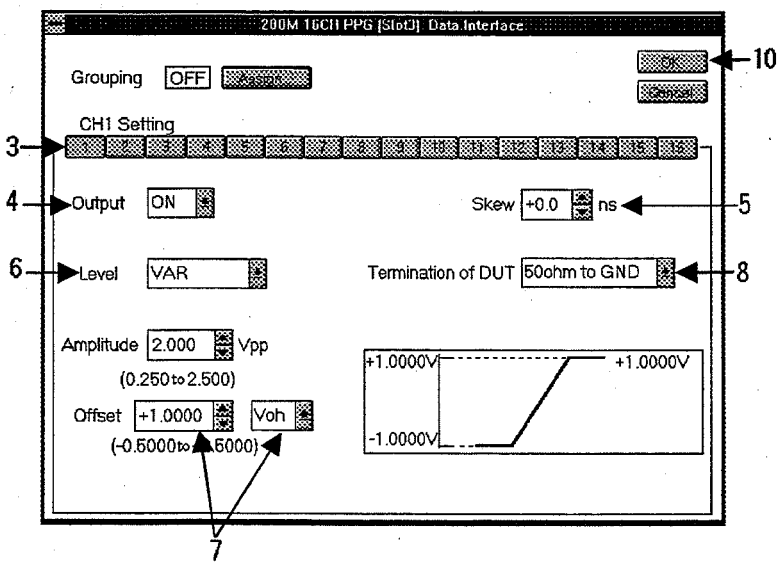


Fig. 5.-53 Data Interface dialog box

3. Press the target channel button. In the PON measurement mode, you cannot press ineffective channel buttons. To set multiple channels at a time, follow the procedure stated in Section 6.1, "Setting Multiple Channels at a Time.

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4. Turn on or off the data output by selecting ON or OFF from the Output drop-down list box.

5. Enter a skew value in the Skew spin box. The setting range is from -5.0 ns to 5.0 ns.

6. Select a level from the Level drop-down list box. When you have selected ECL, PECL, or TTL, LVTTL you cannot execute steps 7 and 8.

VAR	Sets an arbitrary level.
ECL	Sets the ECL level [1].
PECL	Sets the PECL level [2].
TTL	Sets the TTL level [3].
LV TTL	Sets the LV TTL level[4].

7. Set an amplitude and offset. Select the potential that provides a standard for offsets, from the drop-down list box shown at the right of the Offset text box. The setting ranges of amplitude and offset depend on the termination setting. The setting range of offset also depends on the amplitude setting. For more details, see Appendix 5, "Relationships among Amplitude, Offset, and Termination."

Voh	Sets an offset value at the high level.
Vth	Sets an offset value at the center of high and low levels.
Vol	Sets an offset value at the low level.

8. Set termination of the DUT subject to data output measurement. Select a termination type from the Termination of DUT drop-down list box.

50ohm to GND	Selects this when the DUT terminates with 50 ohms/ground.
50ohm to -2V	Selects this when the DUT terminates at the ECL level.
50ohm to +3V	Selects this when the DUT terminates at the PECL level.
Open	Selects this when the DUT terminates at high impedance (CMOS, TTL, LVTTL).

9. Perform steps 3 to 8 repeatedly as many times as the number of channels to be set.

10. This completes the setting. Press the OK button to make the new setting effective.

Note ⚠ CAUTION

The DUT may break down depending on the setting you have made. In such a case, a confirmation message will appear. Check the setting you have made and the DUT carefully before starting measurements.

[1] ECL level High:-0.9V, Low:-1.7V
[2] PECL level High: 4.1V, Low: 3.3V
[3] TTL level High: 5.0V, Low: 0.0V
[4] LV TTL level High:3.3V,Low:0.0V

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5.6.2 Setting the clock output interface

This section explains how to set the clock output interface of the MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit).

1. Open the Setup: Clock I/F panel.

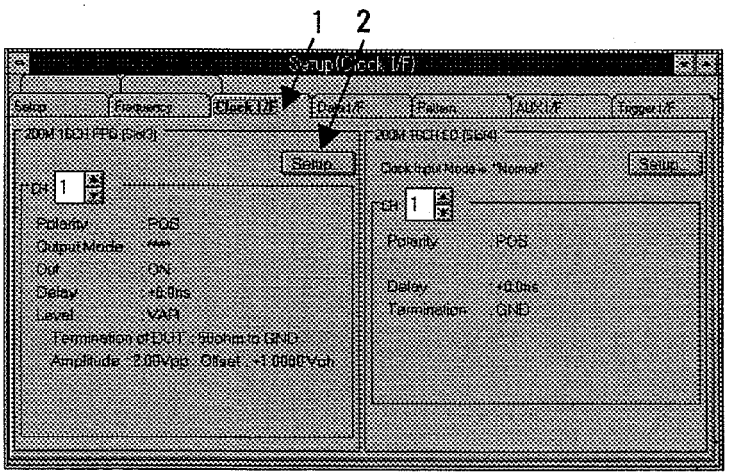


Fig. 5.-54 Setup: Clock I/F panel

2. Press the Setup button in the PPG group box. The Clock Interface dialog box will open.

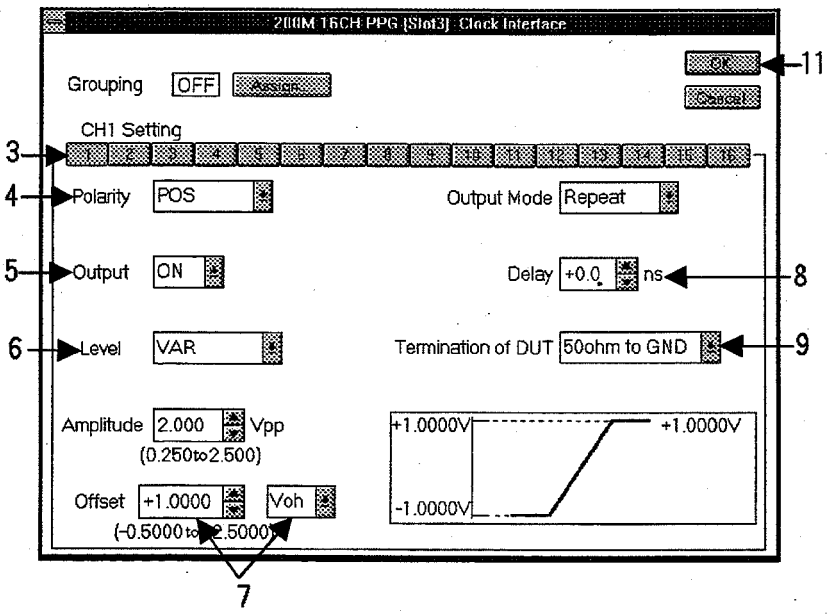


Fig. 5.-55 Clock Interface dialog box

3. Press the target channel button. To set multiple channels at a time, follow the procedure stated in Section 6.1, "Setting Multiple Channels at a Time."

4. Select a clock polarity from the Polarity drop-down list box.

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5. Turn on or off the clock output by selecting ON or OFF from the Output drop-down list box.

6. Select a level from the Level drop-down list box. When you have selected ECL, PECL, or TTL, LVTTL you cannot execute steps 7 and 9.

VAR	Sets an arbitrary level.
ECL	Sets the ECL level [1].
PECL	Sets the PECL level [2].
TTL	Sets the TTL level [3].
LVTTL	Sets the LVTTL level[4].

7. Set an amplitude and offset. Select the potential that provides a standard for offsets, from the drop-down list box shown at the right of the Offset text box. The setting ranges of amplitude and offset depend on the termination setting. The setting range of offset also depends on the amplitude setting. For more details, see Appendix 6, "Relationships among Amplitude, Offset, and Termination."

Voh	Sets an offset value at the high level.
Vth	Sets an offset value at the center of high and low levels.
Vol	Sets an offset value at the low level.

8. Enter a delay value in the Delay spin box. The setting range is from -5.0 ns to 5.0 ns.

9. Set termination of the DUT subject to clock output measurement. Select a termination type from the Termination of DUT drop-down list box.

50ohm to GND	Selects this when the DUT terminates with 50 ohms/ground.
50ohm to -2V	Selects this when the DUT terminates at the ECL level.
50ohm to +3V	Selects this when the DUT terminates at the PECL level.
Open	Selects this when the DUT terminates at high impedance (CMOS, TTL, LVTTL).

10. Perform steps 3 to 9 repeatedly as many times as the number of channels to be set.

11. This completes the setting. Press the OK button to make the new setting effective.

⚠ CAUTION

Note

The DUT may break down depending on the setting you have made. In such a case, a confirmation message will appear. Check the setting you have made and the DUT carefully before starting measurements.

[1] ECL level High:-0.9V, Low:-1.7V
[2] PECL level High: 4.1V, Low: 3.3V
[3] TTL level High: 5.0V, Low: 0.0V
[4] LV TTL level High:3.3V, Low: 0.0V

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5.6.3 Setting the data input interface

This section explains how to set the data input interface of the MU163040B 200M 16CH Pulse Pattern Generator (hereafter called the ED unit).

1. Open the Setup: Data I/F panel.

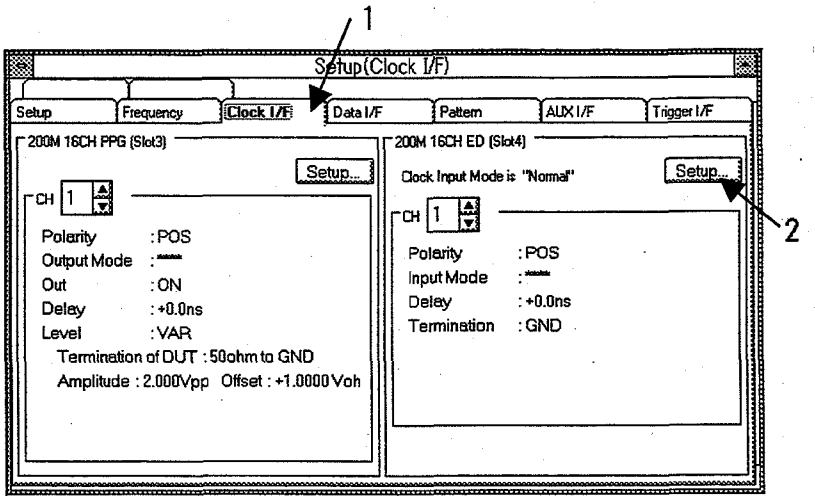


Fig. 5.-56 Setup: Data I/F panel

2. Press the Setup button in the ED unit group box. The Data Interface dialog box will open.

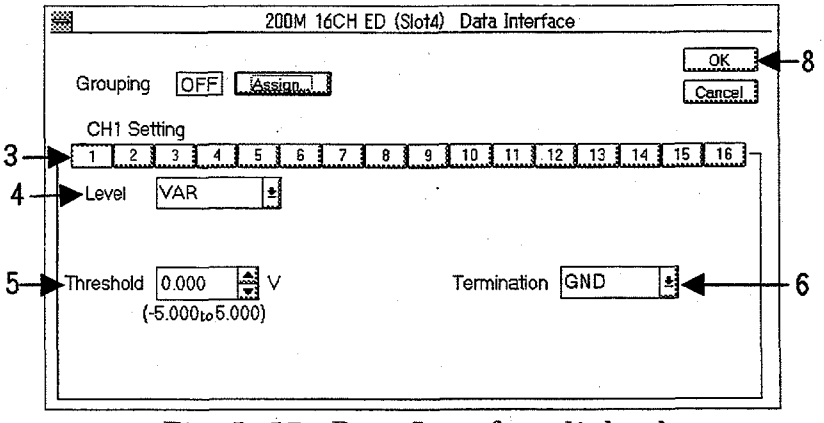


Fig. 5.-57 Data Interface dialog box

3. Press the target channel button. In the PON measurement mode, you cannot press ineffective channel buttons. To set multiple channels at a time, follow the procedure stated in Section 6.1, "Setting Multiple Channels at a Time."

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4. Select a threshold level from the Level drop-down list box. When you have selected ECL, PECL, TTL, or CMOS, LVTTL you cannot execute steps 5 and 6.

VAR	Sets an arbitrary level.
ECL	Sets the ECL level [1].
PECL	Sets the PECL level [2].
TTL	Sets the TTL level [3].
CMOS	Sets the CMOS level [4].
LVTTL	Sets the LVTTL level[5].

5. Enter a threshold value in the Threshold spin box. The setting range is depend on a data input termination condition as bellow:

Termination condition	Range
GND	-5.000V to +5.000V
-2V	-2.000V to -0.600V
+3V	+3.000V to +4.400V

6. Select a data input termination condition from the Termination drop-down list box.

GND	Selects ground termination.
-2V	Selects termination for ECL-level[1] signal.
+3V	Selects termination for PECL-level[2] signal.

7. Perform steps 3 to 6 repeatedly as many times as the number of channels to be set.

8. This completes the setting. Press the OK button to make the new setting effective.

[1] ECL level Threshold:-1.3V
[2] PECL level Threshold: 3.7V
[3] TTL level Threshold: 1.4V
[4] CMOS level Threshold: 2.5V
[5] LVTTL level Threshold: 1.4V

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5.6.4 Setting the clock input interface

This section explains how to set the clock input interface of the MU163040B 200Mb/s 16CH ED (hereafter called the ED unit).

1. Open the Setup : Clock I/F panel.

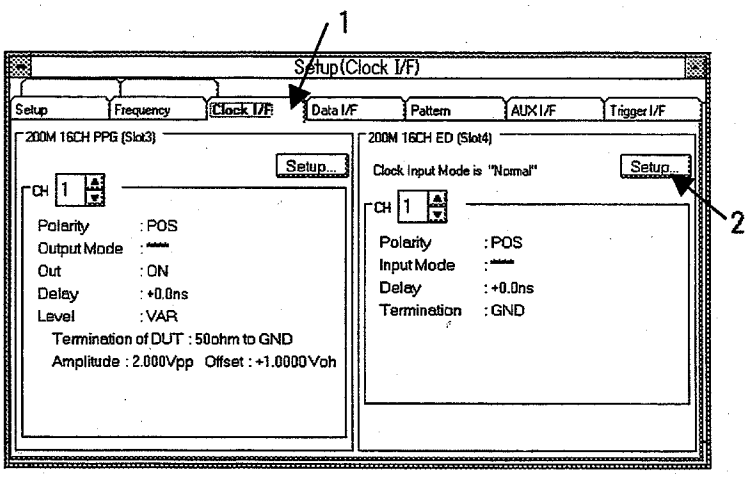


Fig. 5.-58 Setup : Clock I/F panel

2. Press the Setup button in the ED unit group box. The Clock Interface dialog box will open.

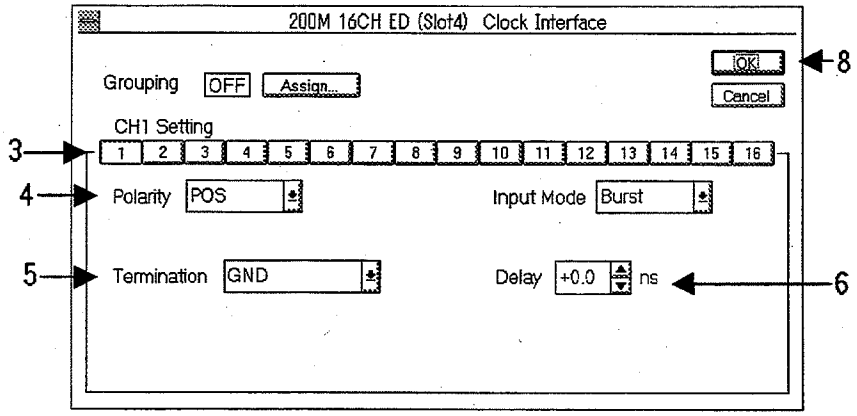


Fig. 5.-59 Clock Interface dialog box

3. Press the target channel button. To set multiple channels at a time, follow the procedure stated in Section 6.1, "Setting Multiple Channels at a Time."

4. Select a clock polarity from the Polarity drop-down list box.

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5. Select a clock input termination condition from the Termination drop-down list box.

GND	Select ground termination.
-2V	Select termination for ECL-level [1] signal.
+3V	Select termination for PECL-level [2] signal.

6. Perform steps 3 to 6 repeatedly as many times as the number of channels to be set.

7. This completes the setting. Press the OK button to make the new setting effective.

[1] ECL level Threshold -1.3V
[2] PECL level Threshold 3.7V

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5.7Sharing a Clock Input among All Channels

The MU163040B 200M 16CH Error Detector (hereafter called the ED unit) allows you to share the clock input from channel 1 among all channels by selecting Common as a clock input mode. If there is only one clock input when data is received from two or more channels for DUT measurement, select the Common mode.
Clock input modes are as follows:

Normal	Use clock inputs from individual channels.
Common(Clock1)	Share the clock input from channel 1 among all channels.
Common(Reference)	Share the clock input from a reference clock input on the back panel of the ED unit among all channels.

1. Open the Setup: Setup panel.

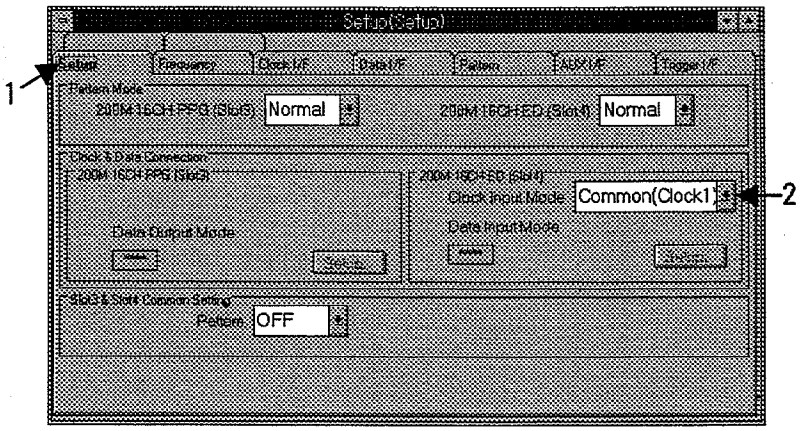


Fig. 5.-60 Setup: Setup panel

2. Select a clock input mode from the Clock Input Mode drop-down list box in the ED unit group box.

3. This completes the setting.

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5.8Synchronizing with a Received Pattern

5.8.1 Selecting synchronization modes

The MU163040B 200Mb/s 16CH ED unit (hereafter called the ED unit) supports an Auto Sync function for synchronizing the internal reference pattern with the input pattern, preventing many errors from occurring. When measuring a burst pattern, a setting for burst cycle synchronization is required.

There are two pattern synchronization modes, Normal and Frame. There are also two burst synchronization modes, INT and EXT.

Restrictions listed in Table 5.5 are placed on the above modes depending on the settings of the pattern type, pattern input mode, and PRGM data mode.

For more details, see Appendix 4, "About Auto Sync."

Table 5.-5 Restrictions on selection of Pattern Sync and Burst Sync modes

Setting conditions			Synchronous mode	
Pattern	Pattern Input Mode	PRGM ※4 Data Mode	Burst Sync Mode	Pattern Sync Mode
PRGM	Repeat			Normal
				Frame※1
	Burst	Restart	INT※1	Frame
			EXT	
		Consecutive	EXT	Normal
PRBS	Repeat			
	Burst		EXT	
Zero-Subst	Repeat			
MIX	Repeat			Normal
				Frame※2
	Burst	Restart ※3	INT※2	Frame
			EXT	
		Consecutive※3	EXT	Normal
PON			INT※2	Frame
			EXT	

※1 The PRGM pattern length must be 8 bits or longer.
※2 The pattern of the first block must be PRGM and the block length must be 8 bits or longer.
※3 When all block in MIX pattern is selected at PRBS, this mode is prohibit.
※4 Setting of PRGM Data Mode is common in all CH.

Note

For details in each setting condition and the PRGM Data Mode, see Appendix3, "PRGM Data Mode."

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5.8.2 Synchronizing with the received pattern

1. Open the Setup: Pattern panel.

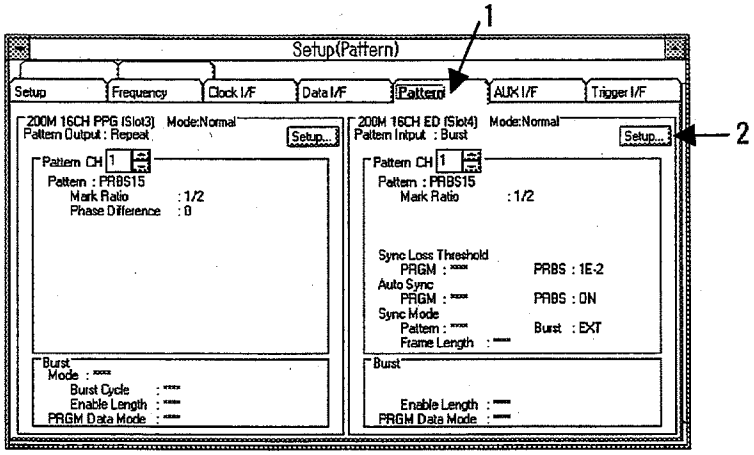


Fig. 5.-61 Setup: Pattern panel

2. Press the Setup button in the ED unit group box. The Pattern dialog box will open. Fig. 5.62 shows the screen that appears when the pattern mode is Normal. The configuration of the Sync Setting group box is the same if the pattern mode is PON. Use the Sync Setting group box to make the settings mentioned below.

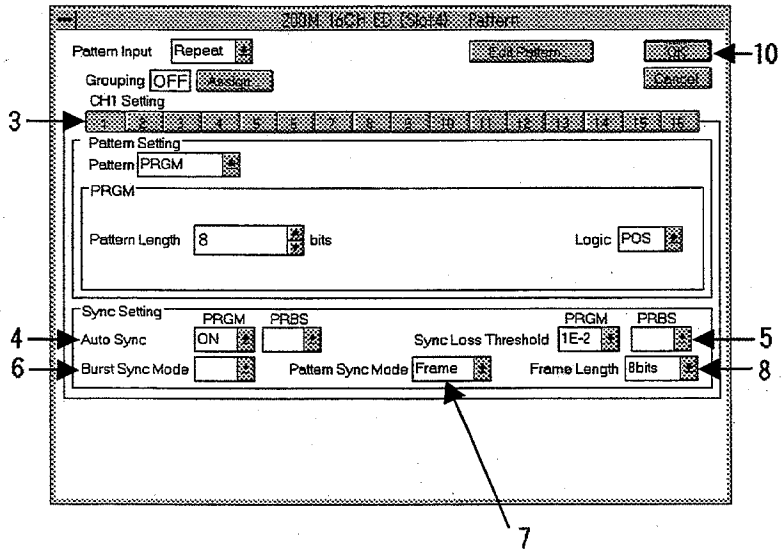


Fig. 5.-62 Pattern dialog box

3. Press the target channel button. To set multiple channels at a time, follow the procedure stated in Section 6.1, "Setting Multiple Channels at a Time."

4. Turn on or off the Auto Sync function by selecting ON or OFF from the Auto Sync drop-down list box. This setting must be made for PRGM and PRBS patterns respectively.

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Note

If the pattern of the channel currently being set is PRGM or MIX and Restart is selected as a PRGM data mode, the Auto Sync function is automatically turned on for the PRGM pattern.

5. Select a sync loss threshold value from the Sync Loss Threshold drop-down list box. This setting must be made for PRGM and PRBS patterns respectively. For more details, see Appendix 9 "Sync Loss Threshold."

Sync Loss Threshold (PRGM) setting range:	1E-2, 1E-3, 1E-4, 1E-5, 1E-6, 1E-7, 1E-8,Auto
Sync Loss Threshold (PRBS) setting range:	1E-2, 1E-3, 1E-4, 1E-5, 1E-6, 1E-7

6. Select a burst synchronization mode from the Burst Setting Mode drop-down list box. You cannot make this setting when the pattern input mode is Repeat.

INT	Synchronizes with received pattern using the specified number of bits at the head of the received pattern as a frame.
EXT	Synchronizes with the received pattern using the signal input to the Burst Trigger Input connector.

7. Select a pattern synchronization mode from the Pattern Sync Mode drop-down list box. If you have selected INT in step 6, Frame is selected automatically. For the relations between other setup condition, see section5.8.1 "selecting synchronization mode."

Normal	Synchronizes with the received pattern by a normal method.
Frame	Synchronizes with the received pattern using a specified frame.

8. If you have selected Frame as a pattern synchronization mode in step 7, select a frame length from the Frame Length drop-down list box.

8bit	Sets the frame length to 8 bits.
16bit	Sets the frame length to 16 bits.
24bit	Sets the frame length to 24 bits.
32bit	Sets the frame length to 32 bits.

Note

You cannot set a frame length longer than the pattern or first block length.

9. Perform steps 3 to 8 repeatedly as many times as the number of channels to be set.

10. This completes the setting. Press the OK button to make the new setting effective.

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5.9Performing Auto Searches

The MU163040B 200M 16CH Error Detector (hereafter called an ED unit) supports two types of search functions.

Phase/threshold level auto search function

This function is used to detect optimum values of the phase relationship (between data and clock) and input data threshold level automatically according to the error rate. Optimum values of both the phase relationship and threshold level can be searched at the same time.

Pattern search function

This function is used to search for the number of rows and mark ratio assuming that the input data signal has a PRBS pattern.

You can perform searches for the channels selected as DUTs. For how to select the channels subject to measurement, see steps 7 and later in Section 5.10.2, "Setting measurement conditions." When two or more channels are specified, they are searched one after another. Two types of searches can be conducted in parallel. However, since only one channel can be subjected to eye margin measurement, auto search can be performed only for this channel. For how to set the channel subject to eye margin measurement, see the explanation of step 6 in Section 6.7.2, "Making setting for eye margin measurement."

The optimum value of the threshold level can be searched only when the mark ratio of the pattern received by the channel subject to search is 1/8 to 7/8.

The search functions cannot be used when the pattern mode is PON or the pattern input mode is Burst.

1. Select Repeat as a pattern input mode.

   1-1. select Normal from the Pattern Mode group box on the Setup : Setup panel.

   1-2. On the Setup : Pattern panel, press the Setup button The Pattern dialog box will open.

   1-3. Select Repeat from the Pattern Input drop-down list box, then press the OK button.

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2. Open the Result subwindow.

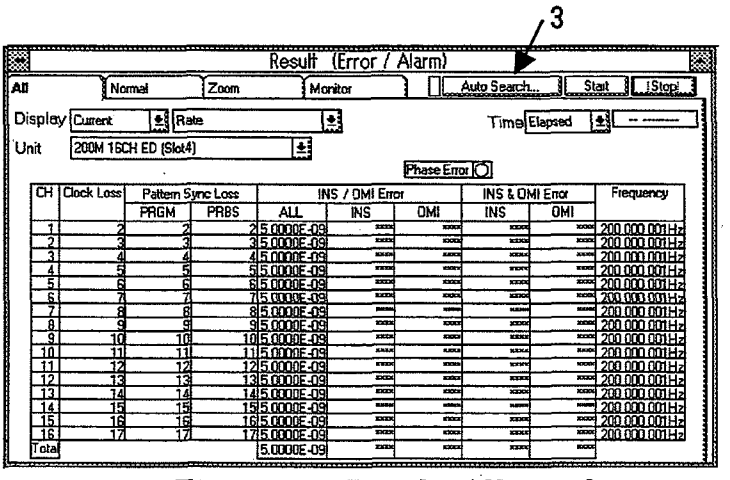


Fig. 5.-63 Result: All panel

3. Press the Auto Search button. The Auto Search dialog box will open. Figure 5.63shows an example of the Result subwindow which appears when error/alarm measurement is specified in the Test Menu subwindow. However, this operation can be performed for other measurements.

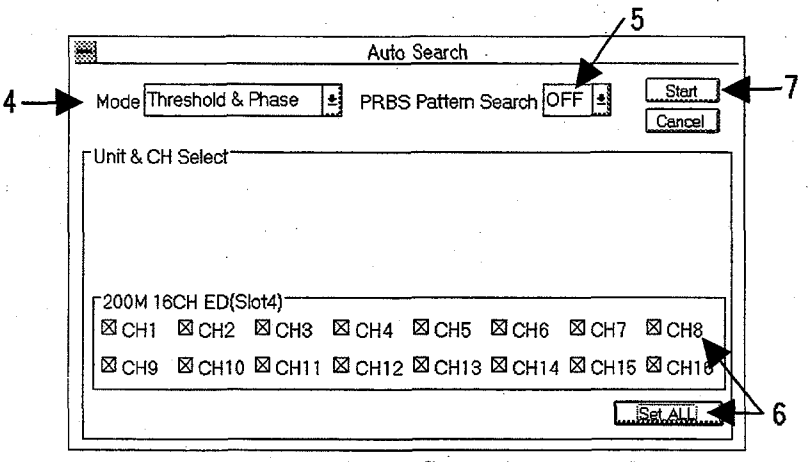


Fig. 5.-64 Auto Search dialog box

4. Select an auto search mode from the Mode drop-down list box.

Threshold & Phase	Searches for the optimum values of both the threshold level and phase.
Threshold	Searches for the optimum value of the threshold level.
Phase	Searches for the optimum value of the phase.
OFF	Does not search for the optimum values of the threshold level and phase.

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5. Turn on or off the pattern search function by selecting ON or OFF from the PRBS Pattern Search drop-down list box.

6. Select the channels subject to auto search by ticking the corresponding check boxes. To tick all check boxes, press the Set ALL button.

Note

1. You cannot select channels for which Auto Sync is set to OFF(either PRBS or PEGM) on the Setup: Pattern panel (see Section 5.8.2, "Synchronizing with the received pattern").
2. If the mark ratio of the entire received pattern is extremely low or high, auto search cannot be performed properly in the threshold direction. Therefore, you cannot select channels whose mark ratio is not between 1/8 and 7/8.
3. You cannot select channels not subjected to error/alarm, delay, or eye margin measurement.

7. Pressing the Start button will start auto search. Pressing the Cancel button will close the Auto Search dialog box and cancel the setting made here. If there is any channel failed to be searched automatically, then the dialog box shown below will appear. Pressing the Result button allows you to check the previous auto search end state.

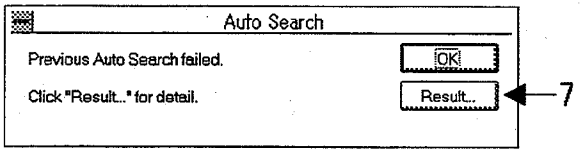


Fig. 5.-65 Auto Search dialog box (when search failed)

Note

When auto search starts, the groups assigned using the Setup: Clock I/F panel and Setup: Data I/F panel are turned off forcibly. For details on grouping, see Section 6.1, "Setting Multiple Channels at a Time."

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8. When auto search starts, the dialog box for monitoring opens. The lamp of the channel being searched blinks in green. The lamp lit in green indicates that auto search of the indicated channel has been completed. The lamp lit in red indicates that auto search of the indicated channel has failed. Channels not subjected to auto search are overridden. This dialog box will close automatically after all the selected channels have been searched. To interrupt auto search, press the Cancel button.

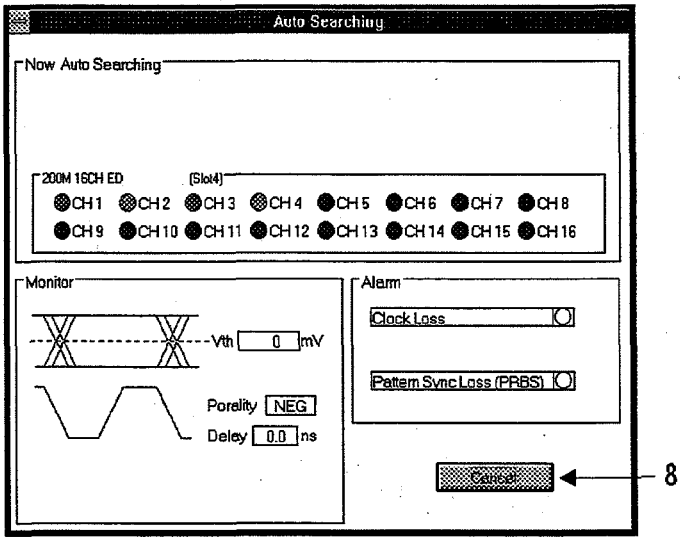


Fig. 5.-66 Auto Searching dialog box

Note

You cannot press the Start button when both the auto search operation mode and pattern search function are off.

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5.10Measuring Errors/Alarms

5.10.1 Functions

The MU163040B 200M 16CH Error Detector (hereafter called the ED unit) allows you to set the following error/alarm measurement items:

Error measurement items

ER EC EI %EFI Threshold EI Threshold %EFI

Error performance (conforming to ITU-T G.821)

ES EFS SES US DM EC
%ES %EFS %SES %US %DM

Alarm measurement items

- Power failure occurrence/recovery time
- Clock loss occurrence/recovery time
- Sync loss occurrence/recovery time
- Power failure interval
- Clock loss interval
- Sync loss interval

Insertion error (INS error) and omission error (OMI error) modes can be specified as error detection modes. An INS error occurs when a 0 bit of the input pattern is inverted to 1 although the corresponding bit of the reference pattern must be 0. On the contrary, an OMI error occurs when a 1 bit of the input pattern is inverted to 0 although the corresponding bit of the reference pattern must be 1. In the ALL error mode, both of these errors are detected.

Note

If INS&OMI is selected as the error detection mode, both INS and OMI errors can be detected. In the INS&OMI mode, INS and OMI modes are switched at fixed intervals (500 ms) to detect INS and OMI errors at the same time. (See Fig. 5.67.)

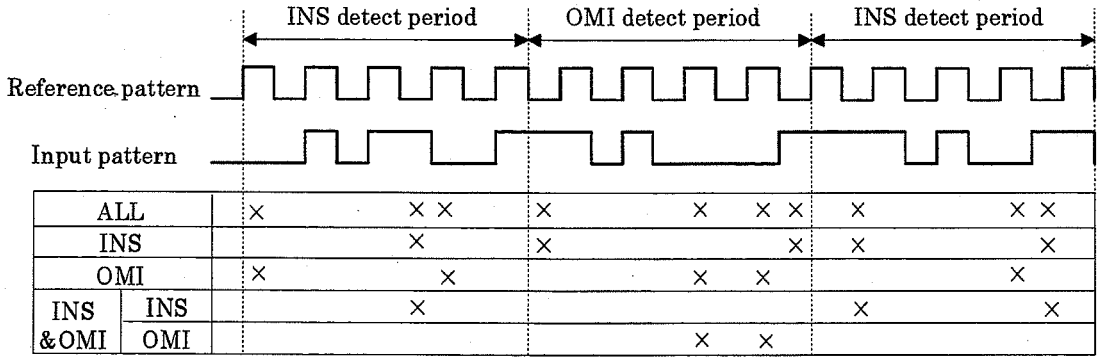


Fig. 5.-67 Relations between error detection modes and detected errors

In the INS&OMI detection mode, no OMI error is detected in the INS detection period and no INS error is detected in the OMI detection period, failing to detect all errors.

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5.10.2 Setting measurement conditions

1. Open the Test Menu: Measurement panel and select Error/Alarm from the Test Item drop-down list box.

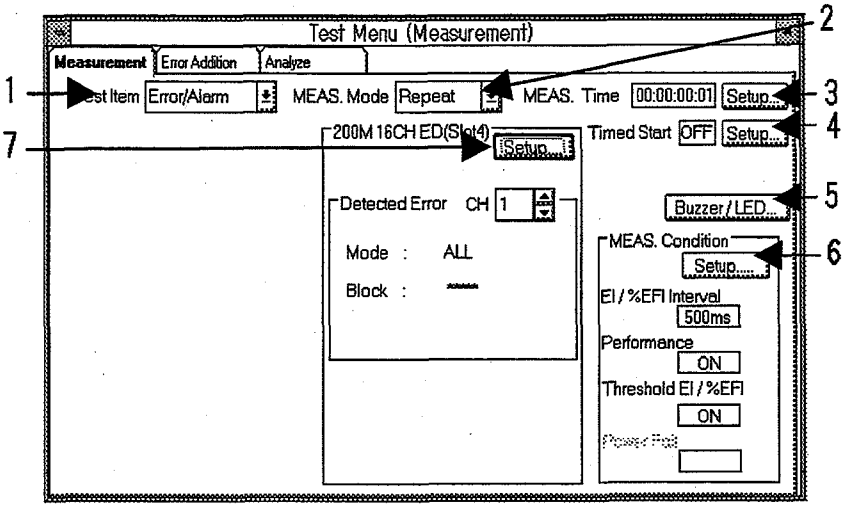


Fig. 5.-68 Test Menu: Measurement panel (Error/Alarm)

2. Select a measurement mode from the MEAS. Mode drop-down list box. When you have selected Untimed, you need not execute step 3.

Repeat	Repeats measurement in the measurement section.
Single	Performs measurement once in the measurement section.
Untimed	Continues measurement from the time start of measurement is instructed to the time end of measurement is instructed.

3. Set the one measurement cycle time. Press the Setup button. Then the Measurement Time dialog box will open. Enter the time of one measurement section, then press the OK button.

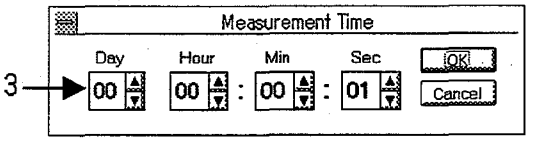


Fig. 5.-69 Measurement Time dialog box

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4. To set the measurement start time, press the Setup button). The timed Start dialog box will open.

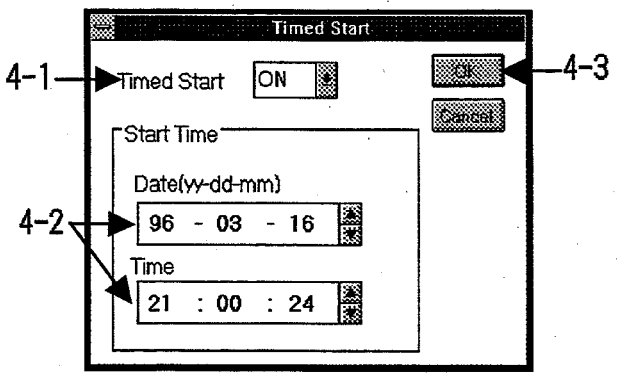


Fig. 5.-70 Timed Start dialog box

4-1. Select ON from the Timed Start drop-down list box.

4-2. Enter the date and time in the spin boxes.

4-3. Press the OK button to make the new setting effective.

5. Set the conditions for turning on the buzzer and the LED on the front panel. Press the Buzzer/LED button. The Error/Alarm Buzzer dialog box will open.

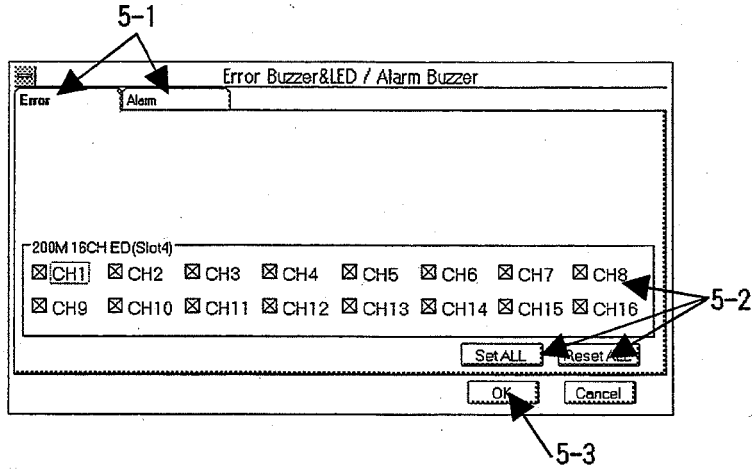


Fig. 5.-71 Error/Alarm Buzzer dialog box

5-1. To turn on the buzzer or LED when an error occurs, open the error panel. To turn on the alarm when an alarm occurs, open the Alarm panel.

5-2. Tick the channels for which the buzzer or LED is to be turned on at occurrence of an error or alarm. To tick all channels, press the Set ALL button. To clear ticks of all channels, press the Reset ALL button.

5-3. Press the OK button to make the new setting effective.

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6. Set various measurement conditions. Press the Setup button in the MEAS Condition group box. Then the Measurement Condition dialog box will open.

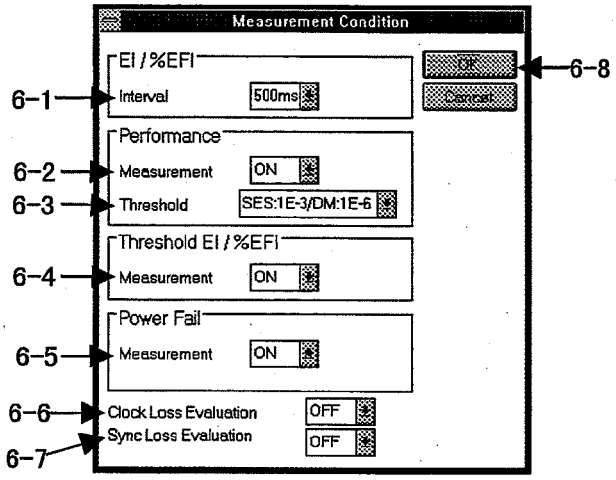


Fig. 5.-72 Measurement Condition dialog box

6-1. Set an EI/%EFI interval. Set 10ms, 500ms, or 10s from the Interval drop-down list box.

6-2. Determine whether performance is to be measured by selecting ON or OFF from the Measurement drop-down list box.

6-3. Select the threshold values used for calculating SES and DM from the Threshold drop-down list box. This setting is disabled when you have selected OFF from the Measurement drop-down list box.

SES:1E-3/DM:1E-6	Use 10^{-3} as the threshold value for SES calculation and 10^{-6} as the threshold value for DM calculation.
SES:1E-4/DM:1E-8	Use 10^{-4} as the threshold value for SES calculation and 10^{-8} as the threshold value for DM calculation.

6-4. Determine whether threshold EI and threshold %EFI measurements are to be performed by selecting ON or OFF from the Measurement drop-down list box in the Threshold EI/%EFI group box.

6-5. Determine whether the power failure measurement is to be performed by selecting ON or OFF from the Measurement drop-down list box in the Power Fail group box.

Note

You cannot make this setting if detection of power failure is not enabled (setting of a System Mode) on the System: System panel. For details on system operation modes, refer to Section 6.4, "Setting System Operations," in the MP1630B Digital Data Analyzer Operation Manual.

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6-6. Select the processing to be performed during the clock loss period, from the Clock Loss Evaluation drop-down list box.

ON	The intervals at which clock loss occurred are included in the clock loss interval count and the total interval count; however, it is not included in the error interval count. The intervals at which clock loss occurred become nonoperating intervals. If they are included in the operating time, then they are included in the error second count and the SES count.
OFF	The intervals at which clock loss occurred are counted only in the clock loss interval count; not included in other counts. The intervals at which clock loss occurred are not included in the non-operating time or the operating time. The intervals under judgment are not included in the non-operating time or the operating time.

The errors and clocks counted during the clock loss period are excluded from the calculation irrespective of whether ON or OFF is selected.

6-7. Select the processing to be performed during the sync loss period, from the Sync Loss Evaluation drop-down list box.

ON	The intervals at which sync loss occurred are included in the sync loss interval count and the total interval count; however, it is not included in the error interval count. The intervals at which sync loss occurred become non-operating intervals. If they are included in the operating time, then they are included in the error second count and the SES count.
OFF	The intervals at which sync loss occurred are counted only in the sync loss interval count; not included in other counts. The intervals at which sync loss occurred are not included in the non-operating time nor the operating time. The intervals under judgment are not included in the non-operating time or the operating time.

The errors and clocks counted during the clock sync period are excluded from the calculation irrespective of whether ON or OFF is selected.

6-8. This completes the setting. Press the OK button to make the new setting effective. The Measurement Condition dialog box will close.

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7. Specify the channels subject to measurement and error detection blocks. Press the Setup button in the ED unit group box. The Error Detect dialog box will open.

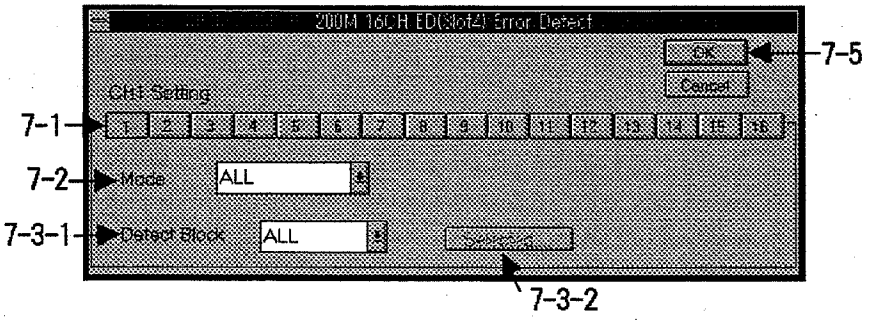


Fig. 5.-73 Error Detect dialog box

7-1. Press the buttons of the channels subject to measurement. In the PON measurement mode, the buttons of the channels not selected as effective channels (Enable CHs) cannot be pressed.

7-2. Select an error detection mode from the Mode drop-down list box.

OFF	Does not detect errors.
ALL	Detects errors irrespective of error types (INS and OMI).
INS	Detects only INS errors.
OMI	Detects only OMI errors.
INS & OMI	Detects and counts INS and OMI errors separately.

7-3. During PON measurement or when the pattern of the channel being set is a MIX pattern, an error detection block can be specified.

7-3-1. Select either of the following from the Detect Block drop-down list box.

ALL	All blocks
Selected	Selected blocks

7-3-2. Press the Select Block button to open the Detected Block dialog box. Select ON or OFF from the drop-down list box of the target channel.

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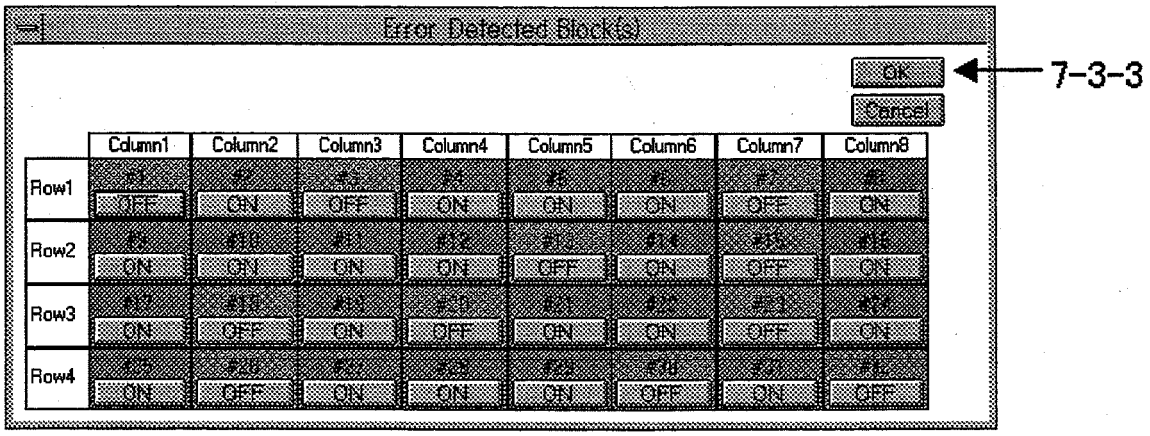


Fig. 5.-74 Detected Block dialog box

7-3-3. When you are finished with the setting, press the OK button to close the Detected Block dialog box.

7-4. Perform steps 7-1 to 7-3 repeatedly as many times as the number of channels to be set.

7-5. Press the OK button to make the new setting effective.

8. This completes the setting. Press the OK button to make the new setting effective. For the measurement start procedure, see the next section.

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5.10.3 Starting the error/alarm measurement

To start or interrupt measurement, use the Result subwindow or tool bar. Make sure Error/Alarm has been selected from the Test Item drop-down list box on the Test Menu: Measurement panel, then open the Result subwindow. Pressing the Start button will start measurement.

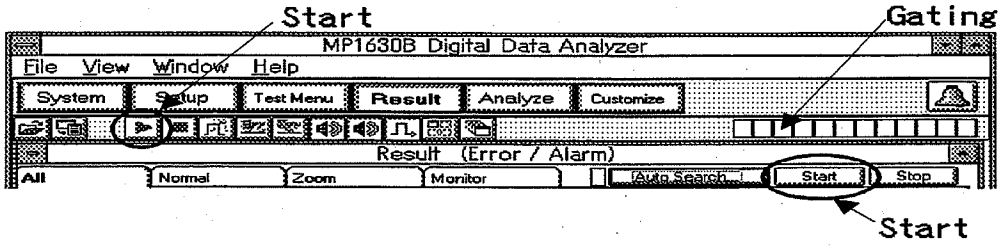


Fig. 5.-75 Measurement start button

During the measurement, the gauge in the parent window indicates that measurement is being performed. The progress of measurement is shown in the subwindow. There are four measurement progress display modes. Switch between these modes using the tabs in the Result subwindow.

• ALL	Displays errors and alarms of all channels at the same time. However, only one error item is displayed.
• Normal	Selects one channel and display all error items and alarms.
• Zoom	Selects a maximum of four measurement items for a certain channel and zoom in them.
• Monitor	Indicates whether any error or alarm occurred in any channel using LEDs.

Often displayed 「*****」 and 「-----」 in measurement result display. Each mark indicate as follow, this is common in all display mode.

*****	This mark indicate the measurement item is out of an object.
-----	This mark indicate you cannot have an effective measurement result for some reason.

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(1) ALL display mode

1. Open the Result: All panel.

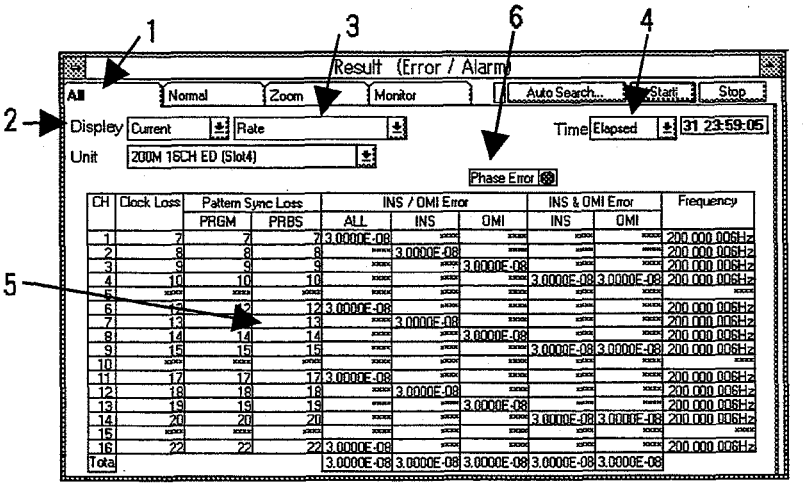


Fig. 5.-76 Result: All panel (error/alarm measurement)

2. Select a measurement progress display mode from the Display drop-down list box.

Current	Displays the current measurement data real time.
Last	Displays the result of the measurement made in the last measurement cycle. The displayed data is retained until the measurement in the next measurement cycle is completed.

3. Select error items from the drop-down list box.

Error Rate	Displays error rates.
Error Count	Displays error counts.
EI	Displays error intervals.
%EFI	Displays error-free interval rates.
Threshold EI	Displays threshold error intervals.
Threshold %EFI	Displays threshold error-free interval rates.
Performance	Displays performances.

3-1. When you have selected Threshold EI or Threshold %EFI, select a threshold value. Press the Select button. The Threshold EI/%EFI Select dialog box will open. Select a threshold value by pressing the corresponding option button, then press the OK button.

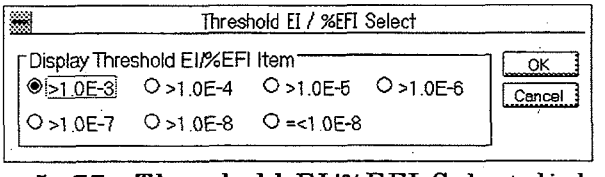


Fig. 5.-77 Threshold EI/%EFI Select dialog box

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3-2. When you have selected Performance, press the Select button. The Performance Item Select dialog box will open. Select an item by pressing the corresponding option button, then press the OK button.

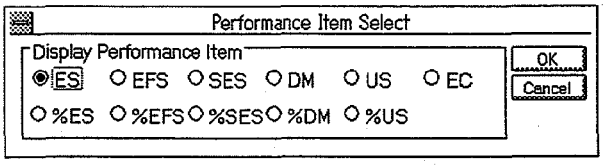


Fig. 5.-78 Performance Item Select dialog box

4. Select a time display mode from the Time drop-down list box.

Elapsed	Displays the elapsed time. When Repeat is selected as a MEAS. mode, the elapsed time of the current measurement section is displayed.
Timed	Displays the remaining time of the measurement section. When Repeat is selected as a MEAS. mode, the remaining time of the current measurement section is displayed. This mode cannot be selected when Untimed is selected as a MEAS. mode.
Start	Displays the measurement start time. When Repeat is selected as a MEAS. mode, the start time of the current measurement section is displayed.
Date & Time	Displays the current date and time.

5. You click double inside of a result display table, then, the display is replaced by Normal display mode correspondence to channel, replied to the click position.

6. When an ED unit setting are Pattern mode "PON" and Data Input mode "Upside", Phase Error monitor lamp is displayed. Phase Error occur when a clock phase isn't suitable to a data. Regulate the clock phase of the ED unit for restored to the error.

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(2) Normal display mode

1. Open the Result: Normal panel.

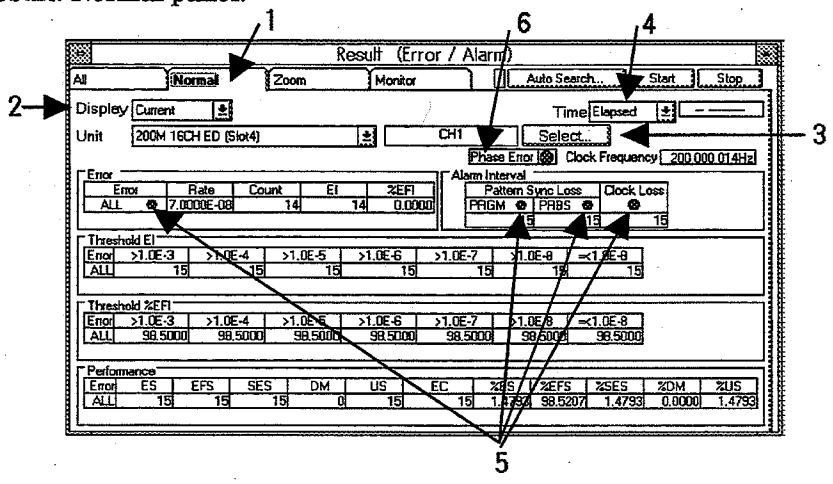


Fig. 5.-79 Result: Normal panel

2. Select a measurement progress display mode from the Display drop-down list box.

Current	Displays the current measurement data real time.
Last	Displays the result of the measurement made in the last measurement cycle. The displayed data is retained until the measurement in the next measurement cycle is completed.

3. Set the target channels. Press the Select button. The CH Select dialog box will open. Select the target channels by pressing the corresponding option buttons, then press the OK button. Meanings of "Total *** Error" are given below. For how to set an error detection mode, see Section 5.10.2, "Setting measurement conditions."

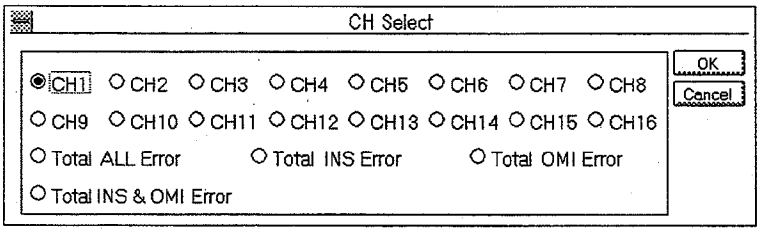


Fig. 5.-80 CH Select dialog box

Total ALL Error	Group representing all channels in the error detection mode "ALL"
Total INS Error	Group representing all channels in the error detection mode "INS"
Total OMI Error	Group representing all channels in the error detection mode "OMI"
Total INS&OMI Error	Group representing all channels in the error detection mode "INS&OMI"

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4. Select a time display mode from the Time drop-down list box.

Elapsed	Displays the elapsed time. When Repeat is selected as a MEAS. mode, the elapsed time of the current measurement section is displayed.
Timed	Displays the remaining time of the measurement section. When Repeat is selected as a MEAS. mode, the remaining time of the current measurement section is displayed. This mode cannot be selected when Untimed is selected as a MEAS. mode.
Start	Displays the measurement start time. When Repeat is selected as a MEAS. mode, the start time of the current measurement section is displayed.
Date & Time	Displays the current date and time.

5. The lamps in error and Alarm Interval group box lit in red when error and alarm occurs.

6. When an ED unit setting are Pattern mode "PON" and Data Input mode "Upside", Phase Error monitor lamp is displayed. Phase Error occur when a clock phase isn't suitable to a data. Regulate the clock phase of the ED unit for restored to the error.

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(3) Zoom display mode

1. Open the Result: Zoom panel.

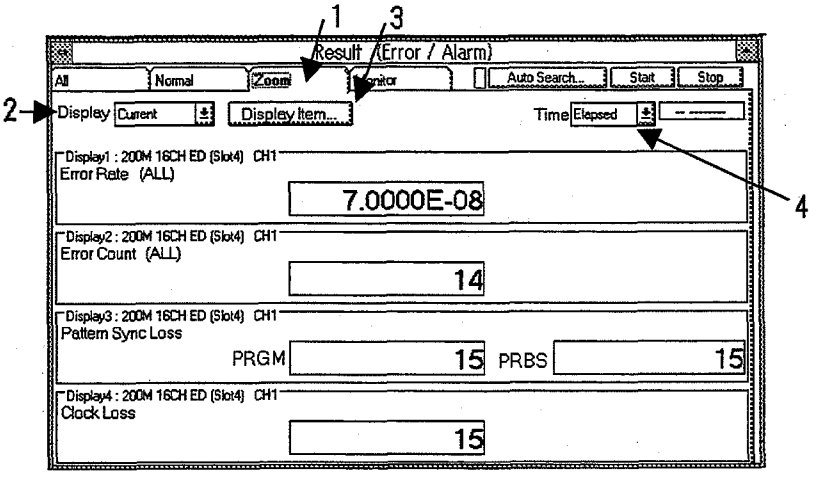


Fig. 5.-81 Result: Zoom panel

2. Select a measurement progress display mode from the Display drop-down list box.

Current	Displays the current measurement data real time.
Last	Displays the result of the measurement made in the last measurement cycle. The displayed data is retained until the measurement in the next measurement cycle is completed.

3. Select the items to be displayed in four zoom display areas. Press the Display Item button to open the Display Item Select dialog box.

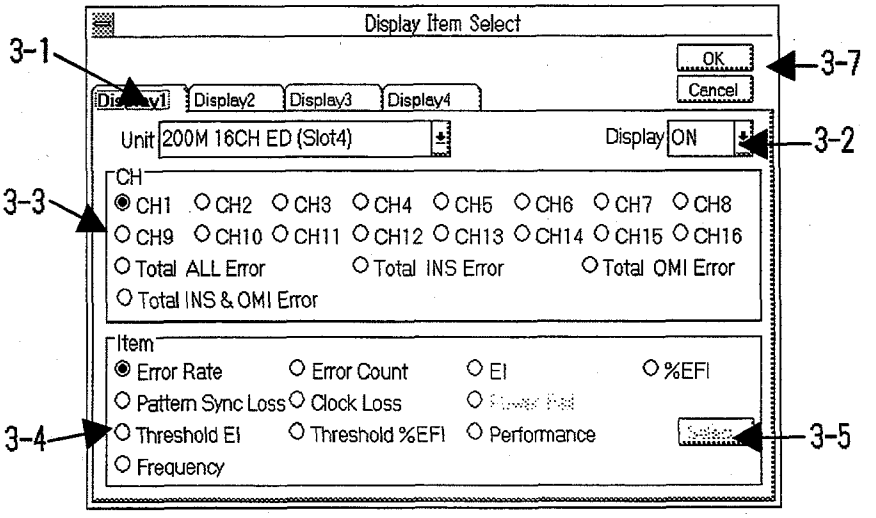


Fig. 5.-82 Display Item Select dialog box

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3-1. Open the panel corresponding to the display area to be set.

3-2. Select ON or OFF from the Display drop-down list box.

3-3. Select the channels to be displayed by pressing the option buttons in the CH group box. Meanings of "Total *** Error" are given below.

Total ALL Error	Group representing all channels in the error detection mode "ALL"
Total INS Error	Group representing all channels in the error detection mode "INS"
Total OMI Error	Group representing all channels in the error detection mode "OMI"
Total INS&OMI Error	Group representing all channels in the error detection mode "INS&OMI"

3-4. Select the items to be displayed by pressing the corresponding option buttons in the Item group box.

Note

1. You cannot set Power Fail as this setting if detection of power failure is not enabled (setting of a System Mode) on the System: System panel. For details on system operation modes, refer to Section 6.4, "Setting System Operations," in the MP1630B Digital Data Analyzer Operation Manual.
2. If you have selected "Total *** Error" in the CH group box, you can select either Error Rate or Error Count.

3-5. If you have selected Threshold EI or Threshold %EFI as an item to be displayed, the Select button will appear. Press the Select button to open the Threshold EI%EFI dialog box. Select a threshold value by pressing the corresponding option button, then press the OK button.

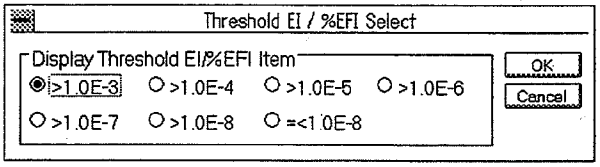


Fig. 5.-83 Threshold EI/%EFI Select dialog box

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3-6. If you have selected Performance as an item to be displayed, the Select button will appear. Press the Select button to open the Performance Item Select dialog box. Select performance items by pressing the corresponding option buttons, then press the OK button.

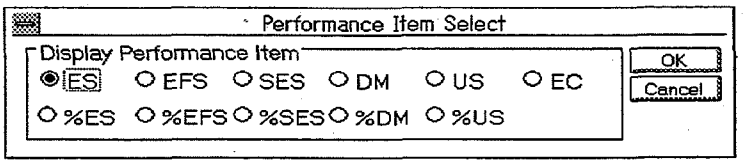


Fig. 5.-84 Performance Item Select dialog box

Perform the above steps for all other display areas.

3-7. Press the OK button to make the new setting effective.

4. Select a time display mode from the Time drop-down list box.

Elapsed	Displays the elapsed time. When Repeat is selected as a MEAS. mode, the elapsed time of the current measurement section is displayed.
Timed	Displays the remaining time of the measurement section. When Repeat is selected as a MEAS. mode, the remaining time of the current measurement section is displayed. This mode cannot be selected when Untimed is selected as a MEAS. mode.
Start	Displays the measurement start time. When Repeat is selected as a MEAS. mode, the start time of the current measurement section is displayed.
Date & Time	Displays the current date and time.

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(4) Monitor display mode

1. Open the Result: Monitor panel.

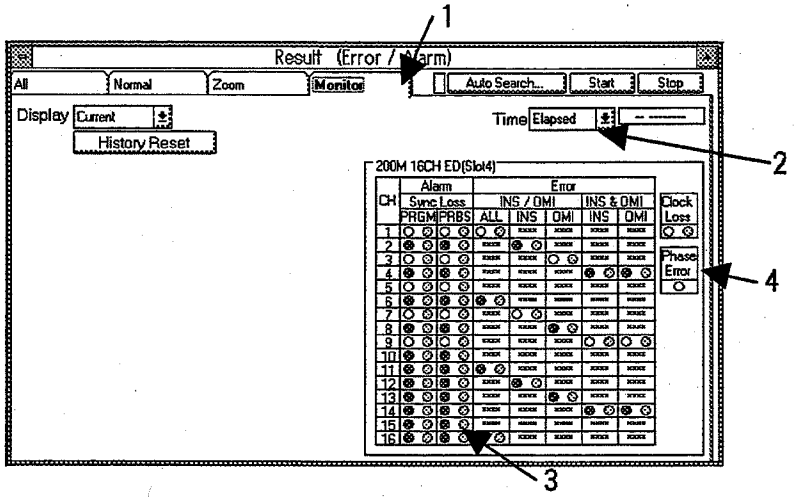


Fig. 5.-85 Result: Monitor panel

2. Select a time display mode from the Time drop-down list box.

Elapsed	Displays the elapsed time. When Repeat is selected as a MEAS. mode, the elapsed time of the current measurement section is displayed.
Timed	Displays the remaining time of the measurement section.
Start	Displays the measurement start time. When Repeat is selected as a MEAS. mode, the start time of the current measurement section is displayed.
Date & Time	Displays the current date and time.

3. The two lumps in Error column indicate as follow:

the left lamp (red)	It is a real time monitor.
the right lamp (yellow)	It is a history monitor. When an error or alarm occur, it lights in Yellow and keeps lit until current measurement section finishes.

4. When an ED unit setting are Pattern mode "PON" and Data Input mode "Upside", Phase Error monitor lamp is displayed. Phase Error occur when a clock phase isn't suitable to a data. Regulate the clock phase of the ED unit for restored to the error.

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5.10.4 Printing measurement results during measurement

1. Select Print from File menu in the main window.

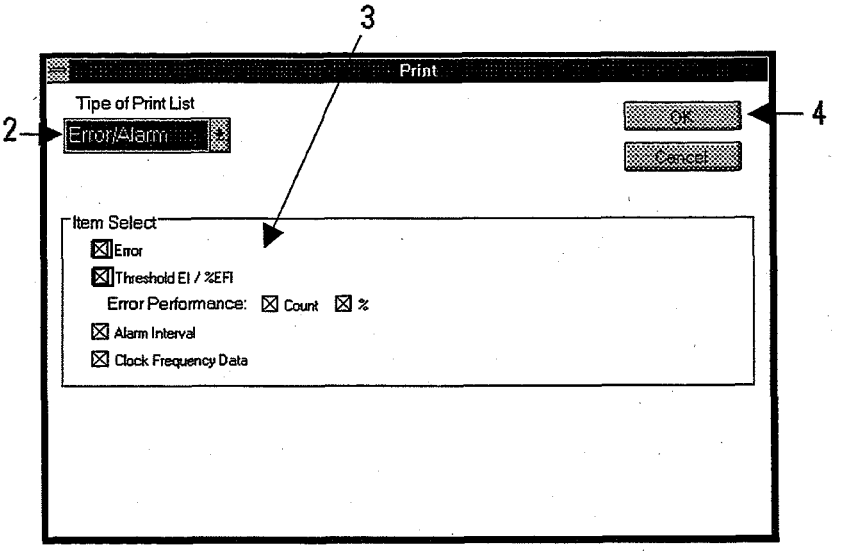


Fig. 5.-86 Print dialog box

2. Select Error/Alarm from the Type of Print List drop-down list box.

3. Check the item you want to print in the Item Select group box.

Error	Outputs EC, ER, EI, and %EFI as end data.
Threshold EI/%EFI	Outputs threshold EI and threshold %EFI as end data.
Performance Count	Outputs EC, ES, EFS, SES, US, and DM as end data.
Performance %	Outputs %ES, %EFS, %SES, %US, and %DM as end data.
Alarm Interval	Outputs an alarm interval as end data.
Clock Frequency Data	Outputs a frequency measurement result as end data.

Note

1. If you have set Threshold EI/%EFI to OFF when setting measurement conditions, you cannot tick the Threshold EI/%EFI check button.
2. If you have set Performance to OFF when setting measurement conditions, you cannot tick the Performance Count and Performance % check buttons.

4. Press the OK button, then printing start.

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5.11Analyzing Error/Alarm Measurement Results

5.11.1 Setting the conditions for analyzing measurement results

The MU163040B 200M16CH Error Detector (hereafter called the ED unit) has a function of storing and analyzing the data generated during measurement in the memory.

1. Open the Test Menu: Analyze panel.

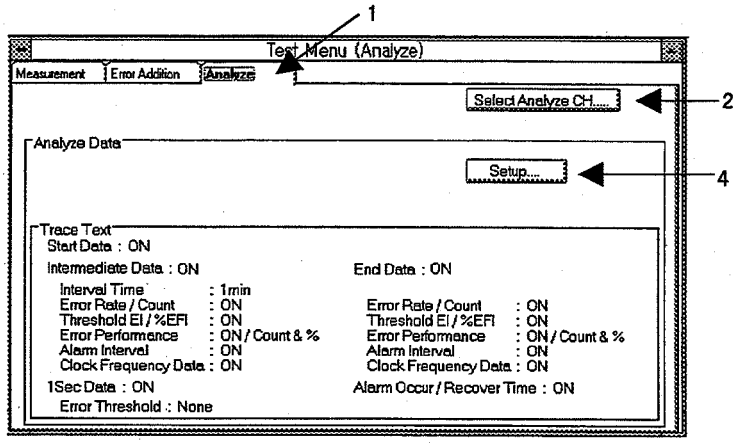


Fig. 5.-87 Test Menu: Analyze panel

2. Select the channels subject to analysis. Press the Select Analyze CH button to open the Analyze CH Select dialog box.

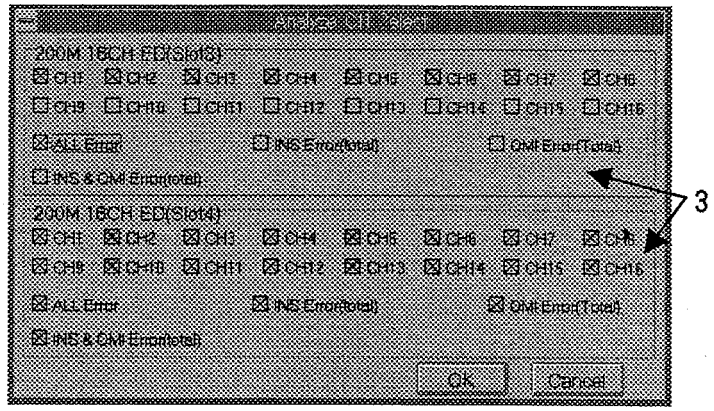


Fig. 5.-88 Analyze CH Select dialog box

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3. Tick the buttons of the channels whose analysis data is to be stored in the memory, then press the OK button to close the dialog box. Meanings of "Total *** Error" are given below.

Total ALL Error	Group representing all channels in the error detection mode "ALL"
Total INS Error	Group representing all channels in the error detection mode "INS"
Total OMI Error	Group representing all channels in the error detection mode "OMI"
Total INS&OMI Error	Group representing all channels in the error detection mode "INS&OMI"

Note

1. You cannot tick the check buttons of the channels for which OFF is selected as an error detection mode. For how to set an error detection mode, see Section 5.10.2, "Setting measurement conditions."
2. When PON is selected as a pattern mode, you cannot tick the check buttons of the channels which have not been made effective.
3. When ALL,INS,OMI,INS&OMI aren't selected in Error Detect mode respectively, you cannot select Total ***Error.

4. Select analysis items. Press the Setup button in the Analyze Data group box. The Analyze Data dialog box will open.

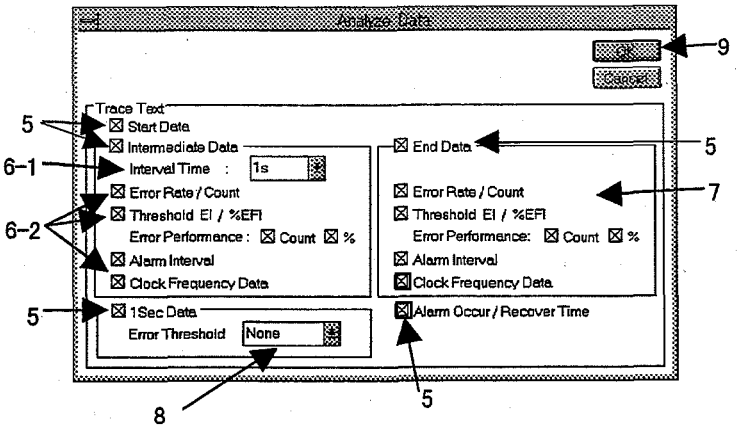


Fig. 5.-89 Analyze Data dialog box

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5. Set items of the data collected as text data. Tick the Start Data, Intermediate Data, End Data, 1sec Data, and/or Alarm Gen/Rec Time check buttons. If the measurement time is 1 second, you cannot tick Intermediate Data and 1sec Data check buttons.

6. When you have ticked the Intermediate Data check button in step 5, make the following setting in the Intermediate Data group box.

   6-1. Set an intermediate data output cycle by selecting 1s, 10s, 1min, 15min, or 60min from the Interval Time drop-down list box. You cannot select an intermediate data output cycle longer than the measurement time.

   6-2. Tick output items.

Error Rate/Count	Outputs EC, ER, EI, and %EFI as intermediate data.
Threshold EI/%EFI	Outputs threshold EI and threshold %EFI as intermediate data.
Performance Count	Outputs EC, ES, EFS, SES, US, and DM as intermediate data.
Performance %	Outputs %ES, %EFS, %SES, %US, and %DM as intermediate data.
Alarm Interval	Outputs an alarm interval as intermediate data.
Clock Frequency Data	Outputs a frequency measurement result as intermediate data.

Note

1. If you have set Threshold EI/%EFI to OFF when setting measurement conditions, you cannot tick the Threshold EI/%EFI check button.
2. If you have set Performance to OFF when setting measurement conditions, you cannot tick the Performance Count and Performance % check buttons.
3. If you have selected INS&OMI(Total) only in step 2, you can tick the Error check button only.

7. If you have ticked the End Data check box in step 8, tick the output items in the End Data group box.

Error Rate/Count	Outputs EC, ER, EI, and %EFI as end data.
Threshold EI/%EFI	Outputs threshold EI and threshold %EFI as end data.
Performance Count	Outputs EC, ES, EFS, SES, US, and DM as end data.
Performance %	Outputs %ES, %EFS, %SES, %US, and %DM as end data.
Alarm Interval	Outputs an alarm interval as end data.
Clock Frequency Data	Outputs a frequency measurement result as end data.

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Note

1. If you have set Threshold EI/%EFI to OFF when setting measurement conditions, you cannot tick the Threshold EI/%EFI check button.
2. If you have set Performance to OFF when setting measurement conditions, you cannot tick the Performance Count and Performance % check buttons.
3. If you have selected INS&OMI(Total) only in step 2, you can tick the Error check button only.

8. If you have ticked 1sec Data check box in step 5, set a threshold value of error data. Select it from the Threshold drop-down list box in the 1sec Data group box.

None	Sets the error threshold value of 1-second data to >0.
>1E-8	Sets the error threshold value of 1-second data to $>10^{-8}$.
>1E-7	Sets the error threshold value of 1-second data to $>10^{-7}$.
>1E-6	Sets the error threshold value of 1-second data to $>10^{-6}$.
>1E-5	Sets the error threshold value of 1-second data to $>10^{-5}$.
>1E-4	Sets the error threshold value of 1-second data to $>10^{-4}$.
>1E-3	Sets the error threshold value of 1-second data to $>10^{-3}$.
>1E-2	Sets the error threshold value of 1-second data to $>10^{-2}$.

Note

One second data don't output during error-free and generating an alarm.

9. This completes the setting. Press the OK button to make the new setting effective.

Note

The size of the memory for storing measurement data is 1.2 MB. When you have ticked check buttons of all channels, setting the intermediate data interval to 1s will cause the memory to become full 40 to 50 seconds later.

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5.11.2 Looking at analysis data in the test display mode

The measurement data stored in the analysis memory can be displayed in the Analyze subwindow. This section describes how to display measurement data in the text display mode.

1. Open the Analyze subwindow.

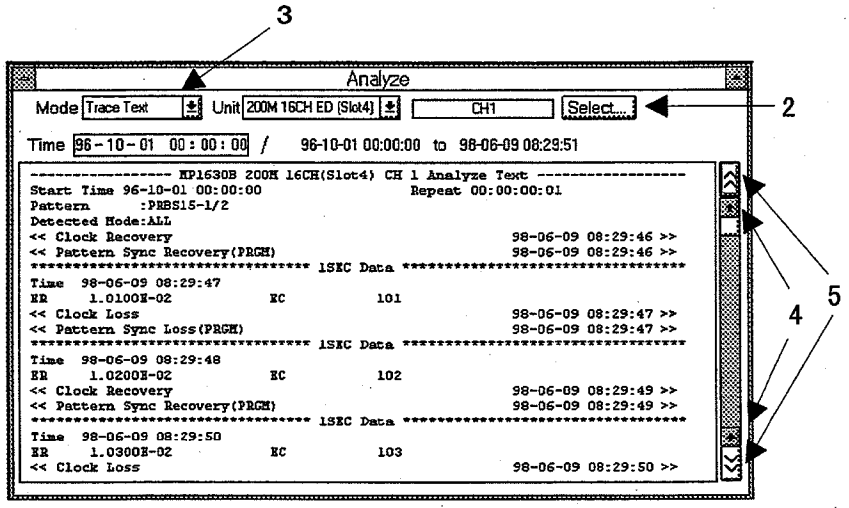


Fig. 5.-90 Analyze subwindow

Note

You can open an Analyze subwindow, when you select just "Error/Alarm" on Test Item drop down list box in Test Menu: Measurement panel.

2. Select the channels for which measurement data is to be displayed. Press the Select button to open the CH Select dialog box. After selecting the channels, press the OK button.

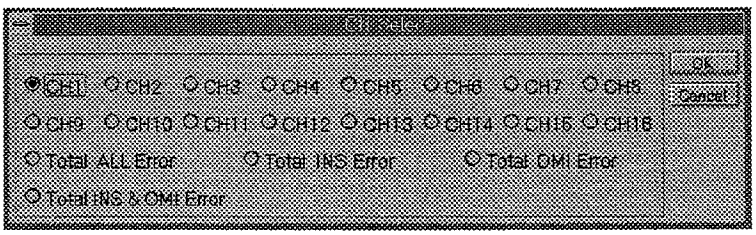


Fig. 5.-91 CH Select dialog box

Note

You cannot select the channels not subject to analysis. For how to set the channels subject to analysis, see the explanation of step 2 in Section 5.11.1, "Looking at analysis data in the test display mode."

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3. To display the data at a specific time, enter the time in the Time text box.

   The meaning of the data in the Time text box is as follows:

   Current display data time/Start data time to Latest data time

   The time input format is as follows:

   <Year>-<Month>-<Day> <Time>:<Minute>:<Second>
   ※ <Year> must be specified with the last two digits of Gregorian year.

4. Pressing the arrow button scrolls the screen one line up or down respectively.

5. Pressing the express  button or  button moves the cursor to the first or latest data respectively.

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5.11.3 Saving analysis data in a file

You can save the measurement data-which is stored in the memory-so that you can open it later for analysis. This section describes how to save measurement data in a file.

1. Select Save from the File menu in the main window. Then the Save dialog box will open. You can open any subwindow.

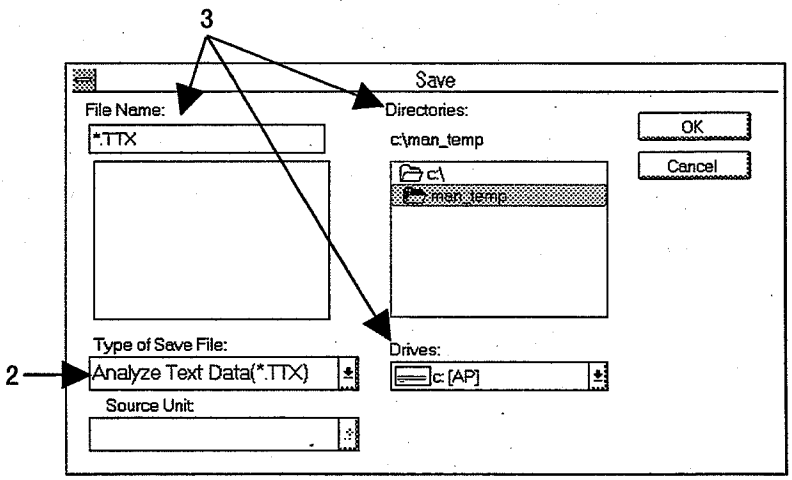


Fig. 5.-92 Save dialog box

2. Select a save file from the Type of Save File drop-down list box. If measurement data has been saved in a text format, it can be displayed using an editor such as a memo pad. However, it cannot be displayed by opening it in the Analyze subwindow. If you want to display in the Analyze subwindow later, select saving of data in the binary format.

Analyze Text(*.TBN)	Saves text display data in the binary format.
Analyze Text(*.TTX)	Saves text display data in the text format.

3. Specify the drive, directory, and file for saving the analysis data, then press the OK button. Do not change the file name extension (three characters following the period (.)). If drive D is specified, the data will not be saved.

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5.11.4 Opening an analysis data file

You can open the measurement data stored in a file and display it on the display. Since the memory area used to open the measurement data file is different from that used to store the current measurement data, preventing the current measurement data from being erased.

1. Select Open from the File menu in the main window. The Open dialog box will open. You can open any subwindow. When Measurement Power Fail Mode has been selected, you cannot select Open.
   Make sure that the Normal system mode has been selected on the System: System panel. (For how to set a system mode on the System: System panel, see Section 6.4, "Setting System Operations," in the MP1630B Digital Analyzer Operation Manual.)

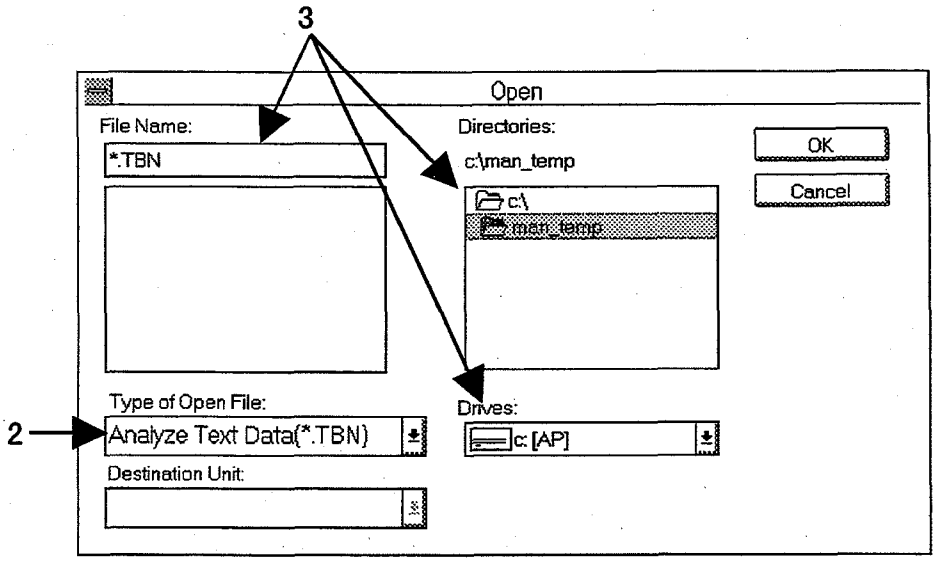


Fig. 5.-93 Open dialog box

2. Select an open file type from the Type of Open File drop-down list box.

Analyze Text(*.TBN)	Opens the data file saved in the text format.

3. Specify the names of the drive, directory, and file storing analysis data, then press the OK button.

4. The read data can be displayed in the Analyze subwindow.

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5.11.5 Printing analysis data

1. Select Print from file menu in the main window. Print dialog box will open. Any subwindow opening will do.

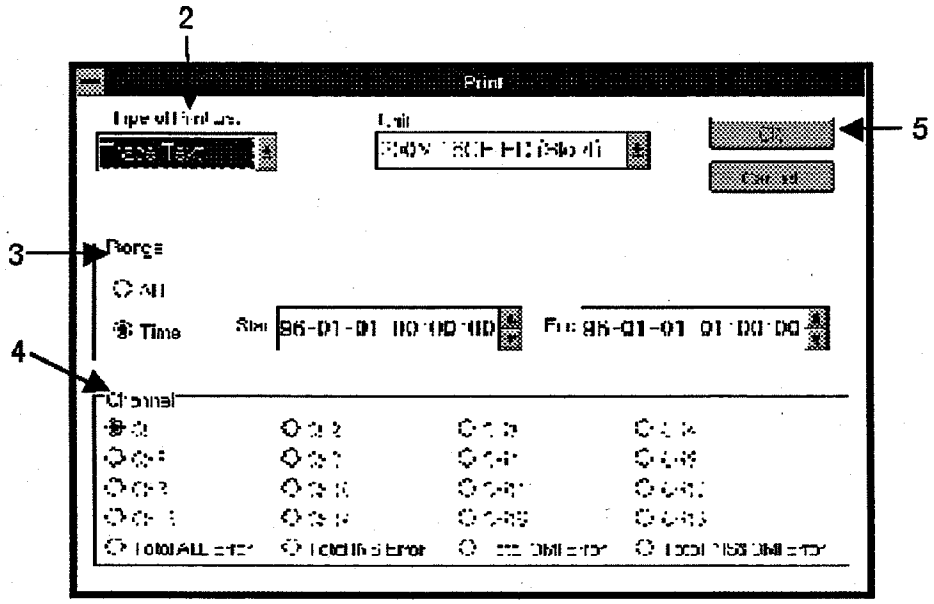


Fig. 5.-94 Print dialog box

2. Select in the Type of Print list box.

Trace Text	Printing Text display data of measurement which performed just before.
Recall Text	Printing Text display data which read from a file just before.

3. Specify a data range you want to print. Set as follow in Range group box.

   3-1 select ALL option button, when you want to print in the whole range.

   3-2 Press the Time option button, when you want to print in particular range.

   3-3 Input a generation time of the first data and the last data to each text box.

4. Specify a channel of printing data. Select a channel to press a option switch in CH group box . But it is an impossible to select when the setting is out of analyze target. For setting of analyze target, see section 5.11.1 ,"Setting the conditions for analyzing measurement results".

5. Press the OK button, then printing start.

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5.12 Measuring Delay

5.12.1 Measurement mode

The MU163040B 200M 16CH Error Detector (hereafter called the ED unit) allows you to measure a time lag between a signal which passed DUT or not, when a unique pattern is transmitted between the MU163020B Pulse Pattern Generator (hereafter called the PPG unit) and the ED unit There are two ways how to detect a time lag.

Error detect mode (Mode1) — A 32 bit unique pattern is transmitted from the PPG unit. The ED unit allows you to measure a time lag between a trigger and a 32 bit unique pattern. It is a possible to measure in the plural channels at a stretch.

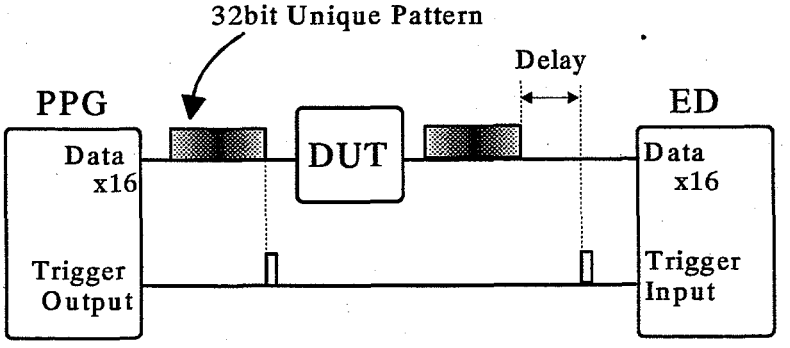


Fig. 5.-95 Overview of delay measurement (Mode1)

Pattern agreement detect mode (Mode2) — The ED unit allows you to detect a unique pattern depends on the number of steps of a PRBS pattern which is set in the ED unit side, and it can also measure a time lag between a trigger and a pattern of agreement detect. Measure after you select one channel among the 16 channels.

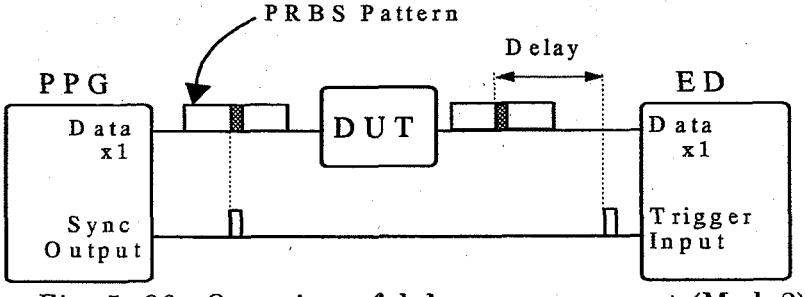


Fig. 5.-96 Overview of delay measurement (Mode2)

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5.12.2 Setting conditions for measurement in the error detection mode (Mode1)

This section explains how to set the conditions for making measurements in the error detection mode (Mode1). When using the error detection mode, you must make settings on the ED and PPG. This section assumes that the MU163020B is inserted in slot3 and MU163040B is inserted in slot4. When the PPG and ED are in separate cabinets, the associated control boxes screen will appear to allow you to make settings for the PPG and ED separately.

Note

The delay measurement in the error detection mode can be performed only when Repeat is selected as a pattern input/output mode. Make PPG and ED such a setting.
If you don't have synchronization between PPG and ED unit, you will be failure in delay measurement. For measurement object channel prepare for measurement, it is necessary to synchronize with an auto search after pattern setting gathered. For the auto search, see Section 5.9, "Performing Auto Searches."

1. Open the Test Menu: Measurement panel and select Delay(Mode1) from the Test Item drop-down list box.

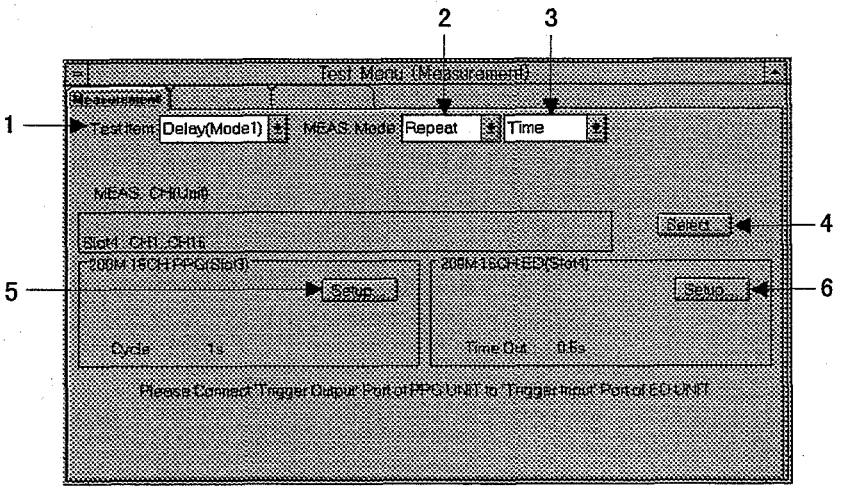


Fig. 5.-97 Text Menu: Measurement panel (Delay Mode1)

2. Select a measurement mode from the MEAS. Mode drop-down list box.

Single	Performs measurement up to the last target channel.
Repeat	Performs measurement up to the last target channel, then repeats measurement starting with the first channel.

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3. Set a unit of measurement result. Select in drop down list box of an arrow.

Time	Measurement a delay by time (us).
Bit	Measurement a delay by a bit unit.

4. Select the ED-side channels subject to measurement. Press the Select button to open the Measurement CH Select dialog box. Tick the check buttons of the channels you want to select, then press the OK button.

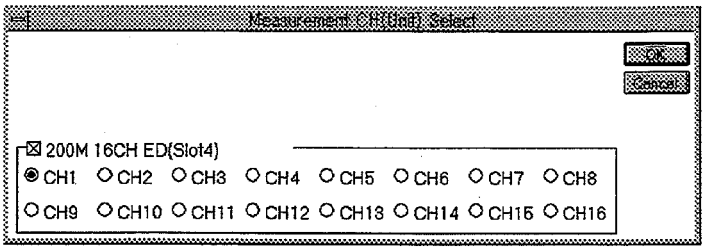


Fig. 5.-98 Measurement CH Select dialog box

5. Specify the cycle of 32-bit continuous error pattern insertion by the PPG. Press the Setup button in the PPG unit group box to open the Delay(Mode1) dialog box. Enter a cycle in the Pattern Insertion Cycle spin box. The setting range is from 1 s to 10 s. Next, press the OK button.

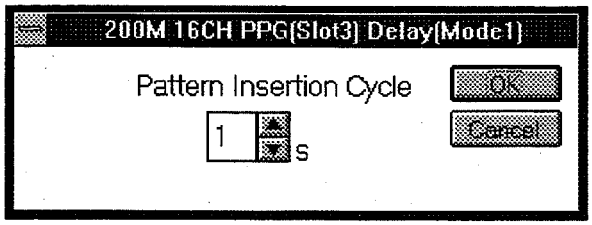


Fig. 5.-99 200M 16CH PPG Delay(Mode1) dialog box

6. Set the time-out time of ED-side delay measurement. Press the Setup button in the ED unit group box to open the Delay(Mode1) dialog box. Select 0.5s, 1s, 2s, 5s, or 10s from the Time Out drop-down list box, then press the OK button.

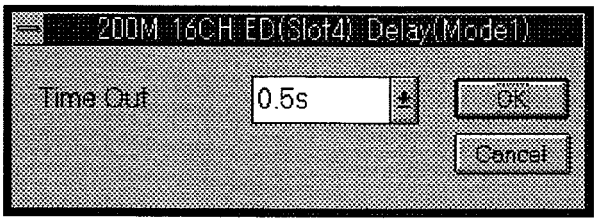


Fig. 5.-100 200M 16CH ED Delay(Mode1) dialog box

7. This completes the setting. For the measurement start procedure, see Section 5.12.4, "Starting Delay Measurement."

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5.12.3 Setting conditions for measurement in the pattern match mode (mode2)

This section explains how to set the conditions for making measurements in the pattern match mode (Mode2).

Note

The delay measurement in the pattern match detection mode can be performed only when PON is selected as the pattern mode of PG and ED units or Burst is selected as a pattern input/output mode. Set these modes on your PPG and ED. Use an internal burst signal source. For how to set the pattern mode "PON," see Section 5.3, "Making Setting for PON Measurement." For how to set the pattern input/output mode "Burst," see Section 5.5, "Sending/Receiving a Burst Pattern."

Connect Sync Output connector of front panel PPG unit and Trigger Input connector of rear panel of ED unit. For position of each connector, see Section 3.1,"Panel Layout and Explanation of Panel."

1. Open the Test Menu: Measurement panel. Select Delay(Mode2) from the Test Item drop-down list box.

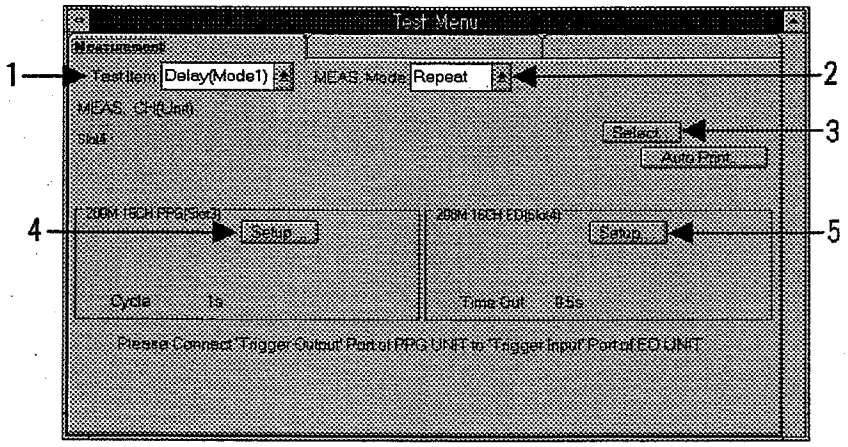


Fig. 5.-101 Test Menu: Measurement panel (Delay Mode2)

2. Select a MEAS. mode from the MEAS. Mode drop-down list box.

Single	Performs measurement for the selected channels only once.
Repeat	Repeats measurement for the selected channels until the Stop button is pressed.

3. Set a unit of measurement result. Select in drop down list box of an arrow.

Time	Measurement a delay by time(us).
Bit	Measurement a delay by a bit unit.

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4. Select the ED-side channels subject to measurement. Press the Select button. The Measurement CH Select dialog box will open. Tick the option buttons of the channels subject to measurement, then press the OK button.

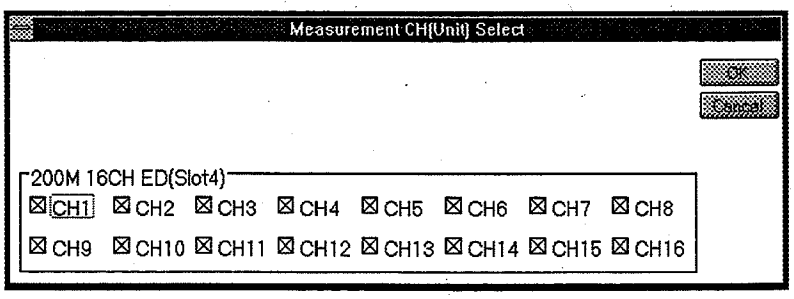


Fig. 5.-102 Measurement CH Select dialog box

5. Set the ED-side time-out time and the number of PRBS patterns. Press the Setup button. The Delay (mode2) dialog box will open.

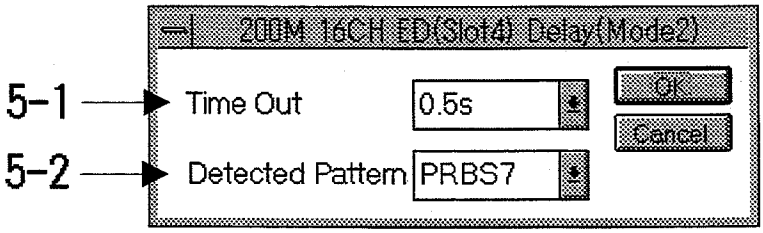


Fig. 5.-103 Delay (mode2) dialog box

5-1. Set the time-out time. Select 0.5s, 1s, 2s, 5s, or 10s from the Time Out drop-down list box.

5-2. Select the PRBS pattern to detect from the Detected Pattern drop-down list box, then press the OK button.

PRBS7	Selects a 2^7-1 PRBS pattern.
PRBS15	Selects a 2^{15}-1 PRBS pattern.
PRBS23	Selects a 2^{23}-1 PRBS pattern.
PRBS31	Selects a 2^{31}-1 PRBS pattern.

6. For the channels connected to the ED, make the following settings on the PPG:

6-1. When PON is selected as a pattern mode, set the number of blocks to 1 and set the pattern type to PRBS. The number of rows of the PRBS pattern must be the same as in step 5. The block length is free. For the setting procedure, see 5.3.3, "Setting a PON receive pattern."

6-2. When Burst is selected as a pattern output mode, use the PRBS pattern whose number of rows was selected in step 5. For the setting procedure, see Section 5.2.3, "Setting a PRBS pattern."

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6-3. Select Burst as the output mode of the clock I/F. For the setting procedure, see Section 5.6.2, "Setting the clock output interface."

6-4. Select Pattern Sync as the Source of sync output, For the setting procedure, see section 6.4,"Setting the Trigger Output.

7. This completes the setting. For the measurement start procedure, see Section 5.12.4, "Starting Delay Measurement."

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5.12.4 Starting Delay Measurement

1. Start delay measurement with the Result subwindow. Make sure that Delay(Mode1) or Delay(Mode2) has been selected from the Test Item drop-down list box on the Test Menu: Measurement panel, then open the Result subwindow.

2. Pressing the Start button will start measurement. During measurement, the gauge in the main window is kept lit. To interrupt measurement, press the Stop button. The elapsed time is displayed in the Result subwindow.

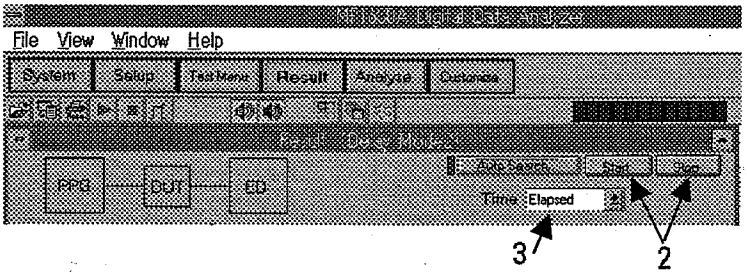


Fig.5-104 Start button

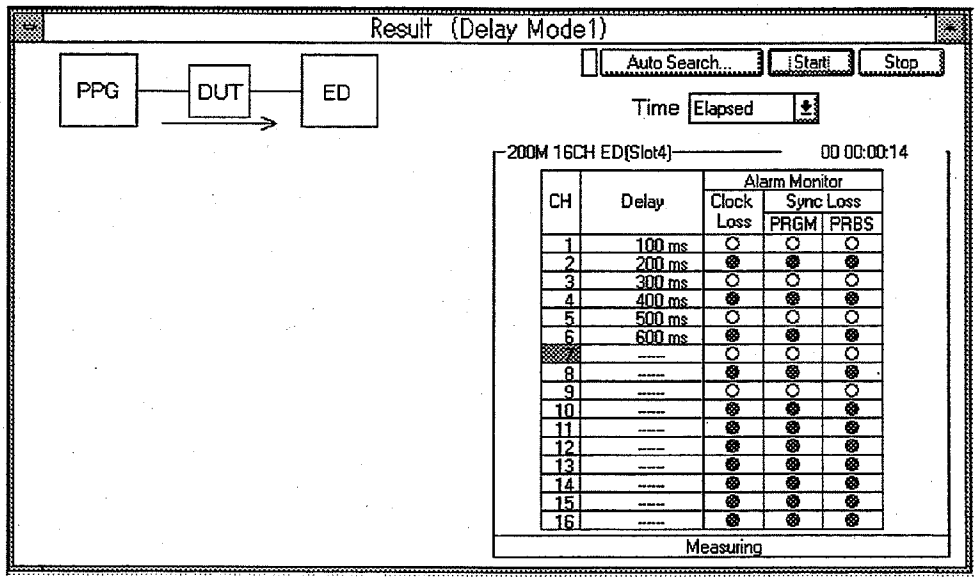


Fig. 5.-105 Delay measurement monitoring screens. (Mode1)

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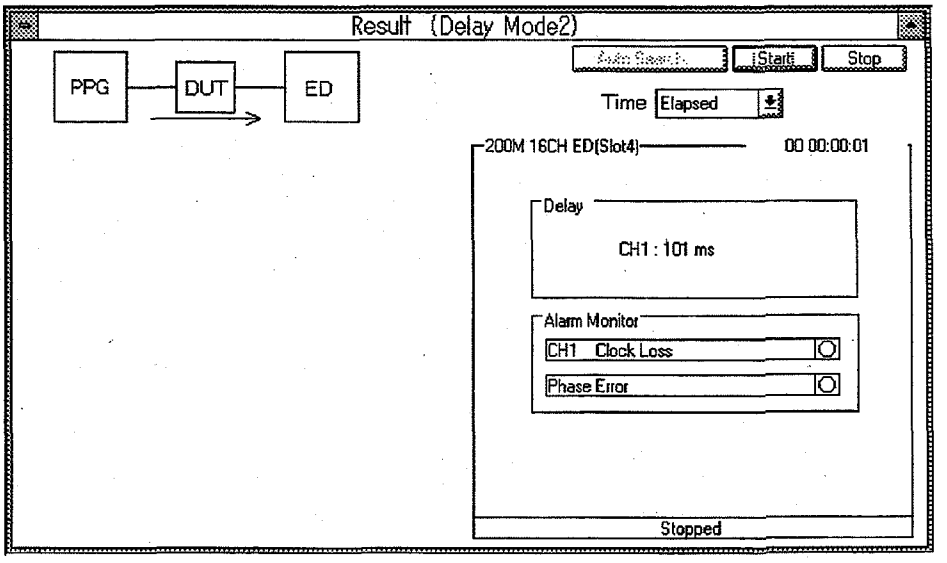


Fig. 5.-106 Delay measurement monitoring screens (Mode2)

Note

Phase Error monitor lamp in fig 5-106 is displayed, when the ED unit setting set as just follows. For these setting, see Section 5.3,"Performing Settings for PON Measurement."

- Pattern mode is "PON", And,
- Data Input mode is "Upside".

Phase Error occur when a clock phase isn't suitable to a data. Regulate the clock phase of the ED unit for restored to the error.

3. Select a time display mode from the Time drop-down list box.

Elapsed	Displays the elapsed time. When Repeat is selected, the elapsed time of the current measurement section is displayed.
Start	Displays the remaining time of the measurement section. When Repeat is selected, the remaining time of the current measurement section is displayed.
Date & Time	Displays the current date and time.

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5.12.5 Printing the measurement result

This section explains how to print the delay measurement result, Examples of the data output to the printer are given in Appendix 7, "Printer Output Examples."

1. Select the print on File menu in mainwindow, print dialog will open.

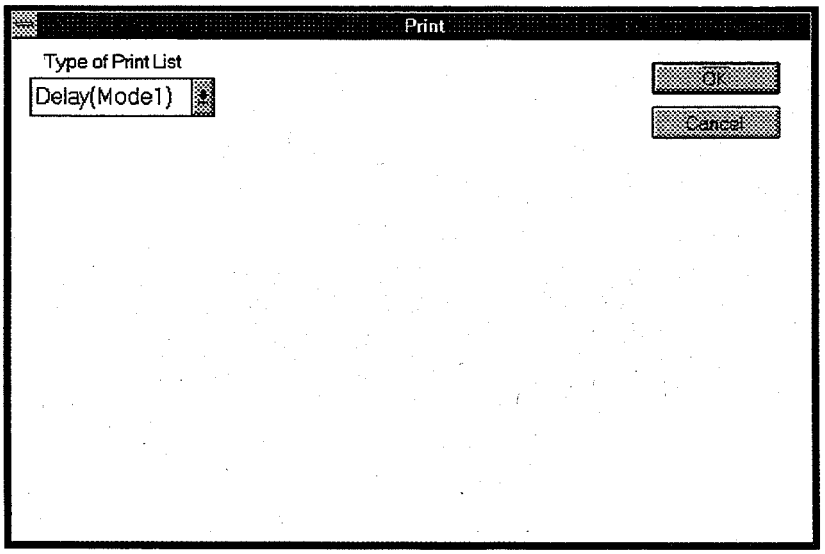


Fig. 5.-107 Print dialog box

2. Select the Delay (Mode1) or Delay (Mode2) in Type of Print List drop down list.

3. Press the OK button, then printing start.

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5.13Sending a Pattern with Errors Added

5.13.1 Setting conditions for adding continuous errors

The MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit) can send patterns with errors added. There are two error addition methods: a continuous error addition method and a burst-like addition method. The following describes the continuous error addition method.
For details on error addition, see Appendix 6, "About Error Addition."

1. Open the Test Menu: Error Addition panel to check the error addition method and the error addition positions of individual channels.

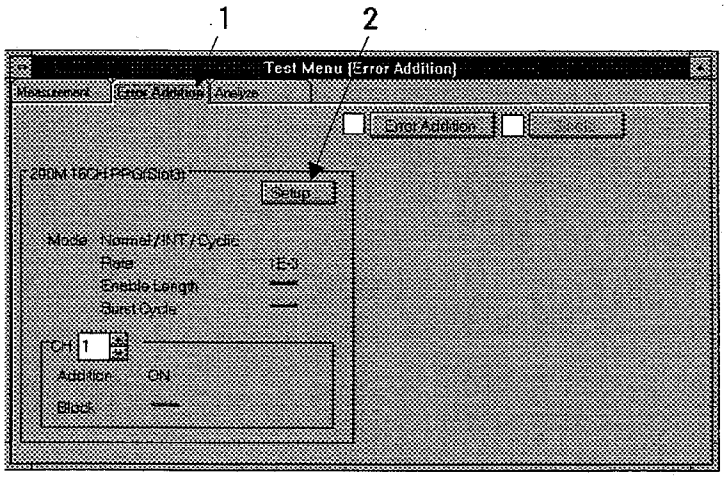


Fig. 5.-108 Test Menu: Error Addition panel

Note

If you have selected Delay(Mode1) from the Test Menu drop-down list box on the Test Menu: Measurement panel, you cannot open this panel.

2. Make various settings related to the error addition method. Press the Setup button in the group box of the target unit. Then the Error Addition dialog box will open.

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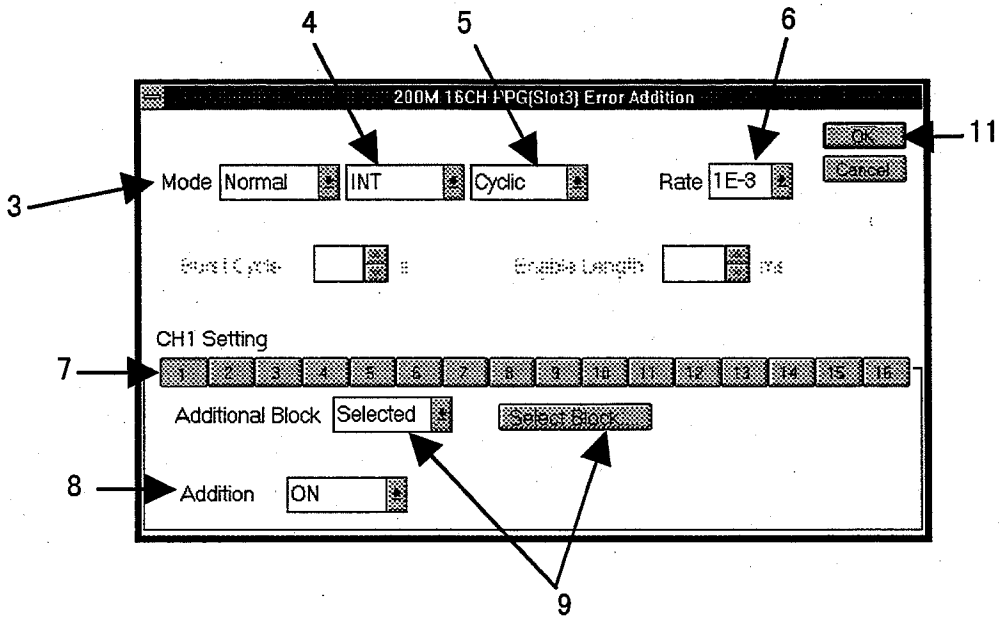


Fig 5-109 Error Addition dialog box

3. Select Normal from Mode drop-down list box (1).

4. Select an error generation signal source from Mode drop-down list box (2). If you have selected EXT, you can skip steps 5 and 6. Proceed to step 7.

INT	Adds errors at the internally set rate.
EXT	Adds errors according to the signal input from EXT Error Input.

5. Select Cyclic or Single from Mode drop-down list box (3). If you have selected Single, you can skip step 6. Proceed to step 7.

Cyclic	Continues to add errors at the specified rate.
Single	Adds only one error at the timing the Single button is pressed.

6. Select an error rate from the Rate drop-down list box.

1E-3	Adds errors at the rate of 10^{-3}.
1E-4	Adds errors at the rate of 10^{-4}.
1E-5	Adds errors at the rate of 10^{-5}.
1E-6	Adds errors at the rate of 10^{-6}.
1E-7	Adds errors at the rate of 10^{-7}.
1E-8	Adds errors at the rate of 10^{-8}.
1E-9	Adds errors at the rate of 10^{-9}.

7. Make the succeeding settings for each channel. Press the channel button of the target channel. In the PON measurement mode, you cannot press ineffective channel buttons.

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8. Turn on or off the error addition function. Select ON or OFF from the Addition drop-down list box.

9. When the pattern mode is PON or the pattern of the target channel is an MIX pattern, the error addition function can be turned on or off on a block basis. Select Selected from the Additional Block drop-down list box and press the Select Block button. The Error Additional Block(s) dialog box will open.

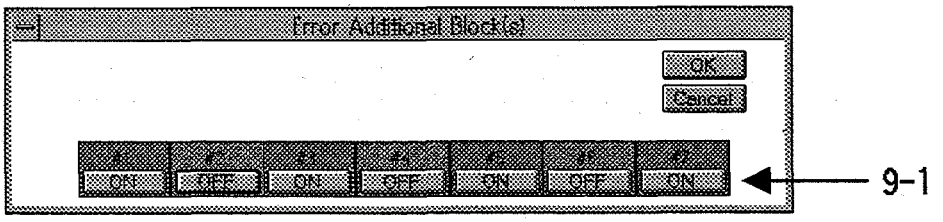


Fig. 5.-110 Error Additional Block(s) dialog box

9-1. Press the buttons under block numbers to turn on or off the function. After turning on or off the error addition function for all blocks, press the OK button.

10. Perform steps 7 through 9 repeatedly as many times as the number of channels to be set.

11. This completes the setting. Press the OK button to make the new setting effective.

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5.13.2 Setting conditions for adding burst-like errors

The MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit) can send patterns with errors added. There are two error addition methods: a continuous error addition method and a burst-like addition method. This section describes the burst-like error addition method.
For details on error addition, see Appendix 6, "About Error Addition."

1. Open the Test Menu: Error Addition panel to check the error addition method and the error addition positions of individual channels.

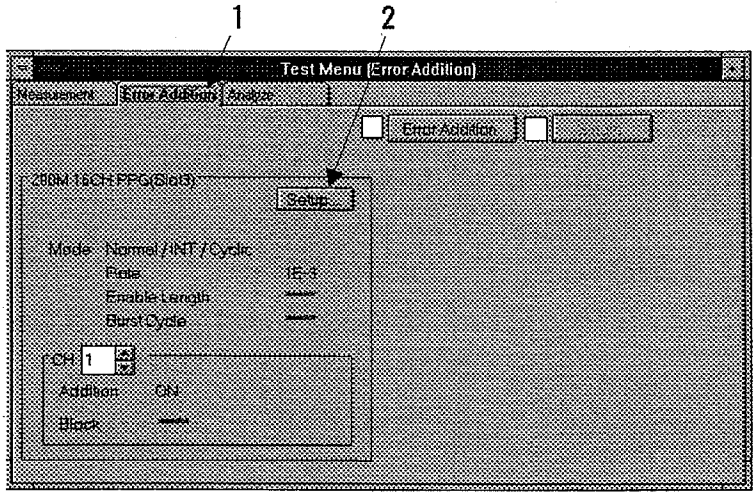


Fig. 5.-111 Test Menu: Error Addition panel

2. Make various settings related to the error addition method. Press the Setup button in the group box of the target unit. Then the Error Addition dialog box will open.

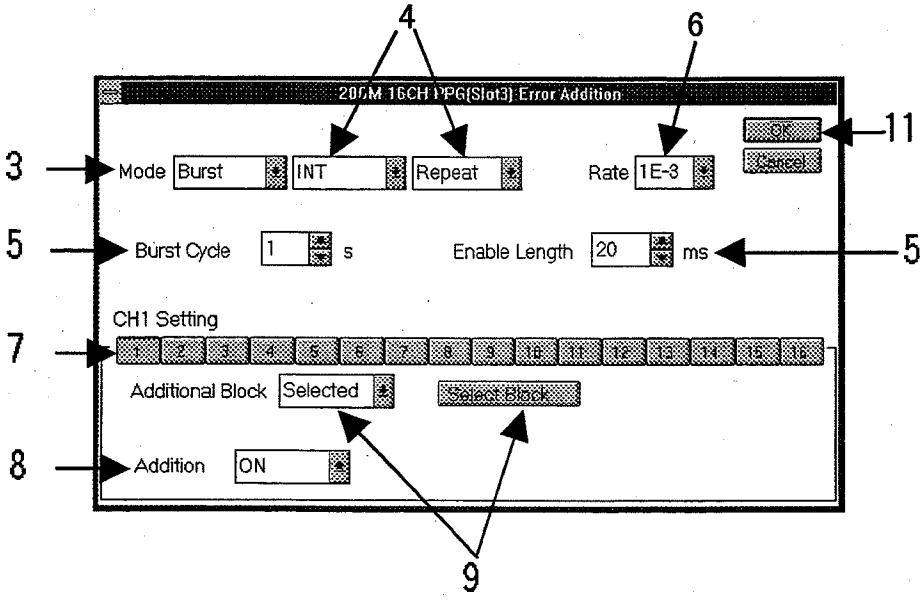


Fig. 5.-112 Error Addition dialog box

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3. Select Burst from Mode drop-down list box (1).

4. Select a burst signal source from Mode drop-down list box (2). If you have selected EXT, you can skip steps 5 and 6. Proceed to step 7.

INT	Adds errors according to the internally generated burst signal. Repeat is selected in Mode drop-down list box(3)
EXT	Adds errors according to the burst signal input from EXT Error Input. Level is selected in Mode drop-down list box(3)

5. Enter a burst cycle and enable length in the Burst Cycle spin box and Enable Length spin box respectively. The burst cycle setting range is from 1 s to 10 s. The enable length setting range is from 20 ms to 140 ms.

6. Select an error rate from the Rate drop-down list box.

1E-2	Adds errors at the rate of 10^{-2}.
1E-3	Adds errors at the rate of 10^{-3}.
1E-4	Adds errors at the rate of 10^{-4}.
1E-5	Adds errors at the rate of 10^{-5}.
1E-6	Adds errors at the rate of 10^{-6}.
1E-7	Adds errors at the rate of 10^{-7}.
1E-8	Adds errors at the rate of 10^{-8}.
1E-9	Adds errors at the rate of 10^{-9}.

Note

"Error rate" refers to the number of errors inserted in the enable section. "Enable section" refers to the following:

- Enable length set in step 5 if INT was selected in step 4
- Section in which the external burst signal level is high if EXT was selected in step 4.

7. Make the succeeding settings for each channel. Press the channel button of the target channel. In the PON measurement mode, you cannot press ineffective channel buttons.

8. Turn on or off the error addition function. Select ON or OFF from the Addition drop-down list box.

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9. When the pattern mode is PON or the pattern of the target channel is an MIX pattern, the error addition function can be turned on or off on a block basis. Select "Select" from the Additional Block drop-down list box and press the Select Block button. The Error Additional Block dialog box will open.

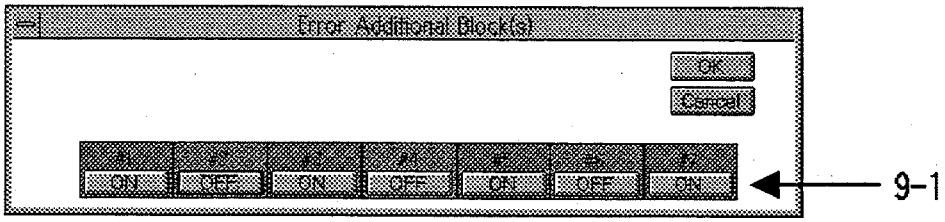


Fig. 5.-113 Error Additional Block dialog box

9-1. Press the buttons under block numbers. After turning on or off the error addition function for all blocks, press the OK button.

10. Perform steps 7 through 9 repeatedly as many times as the number of channels to be set.

11. This completes the setting. Press the OK button to make the new setting effective.

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5.13.3 Adding errors actually

To add errors actually under the conditions set as mentioned in Section 5.13.1, "Setting conditions for adding continuous errors," and Section 5.13.2, "Setting conditions for adding burst-like errors," you must operate the buttons on the Test Menu: Error Addition panel.

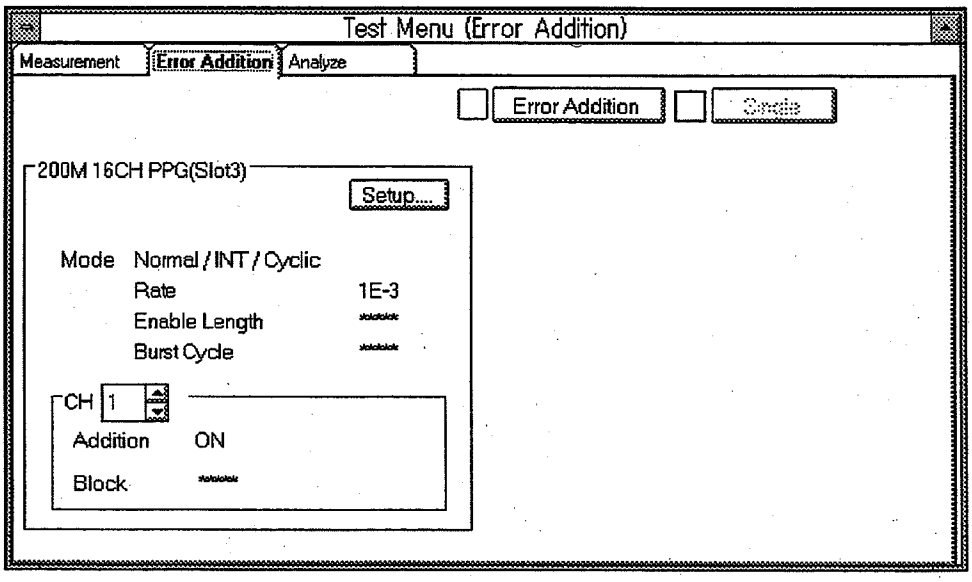


Fig. 5.-114 Test Menu: Error Addition panel

(Normal/INT/Single mode)

Press the Error Addition button. The lamp on the left will go on. With the lamp on, pressing the Single button will add a 1-bit error simultaneously. If a block for which the error addition function is turned off is being sent at the moment when the Single button is pressed, an error will be added when a block for which the error addition function is turned ON is sent next time.

(Other modes)

Press the Error Addition button. The lamp on the left will go on. Pressing the Error Addition button again will turn off the lamp and stop adding errors.

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5.14For the Users of the Existing BERTS

5.14.1 Customize subwindow

The Customize subwindow is intended for the users of BERTS. It allows you to make various settings and monitoring on one screen. The Customize subwindow consists of a total of eight frames: six Setup group boxes, a Result group box, and a Pattern Edit group box.
The user can freely assign setting items to these group boxes, so only one screen is required to perform operations necessary to carry out measurements. For example, using the Customize subwindow allows you to measure an error rate with the clock delay changed continuously.

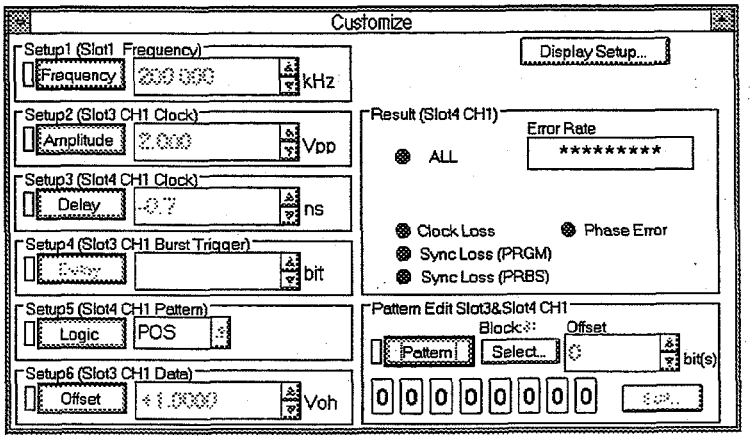


Fig. 5.-115 Customize subwindow

To change a setting, press the button in the associated group box. The LED on the left of the button will light to indicate that setting is enabled. You can change the setting using a spin box or drop-down list box. When the button is pressed again, the LED goes off to indicate that setting is disabled. Of all group boxes assigned to the Customize subwindow, only one group box can be used at a time to make settings.

Note

If settings are changed with this panel and another panel opened at the same time, setting of some items or pattern editing could be disabled.

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Table 5.6 lists the setting items that can be assigned to the six Setup group boxes.

Table 5.-6 Setting items that can be assigned to Setup group boxes

Setting items related to MU163020B	
Clock output interface	Amplitude※1、Offset※1、Delay、Polarity
Data output interface	Amplitude※2、Offset※2、Skew
Trigger output interface	Output Delay of Burst Trigger
Send pattern	Mark Ratio、Logic

Setting items related to MU163040B	
Clock input interface	Delay、Polarity
Data input interface	Threshold※2
Send pattern	Mark Ratio、Logic

In addition, setting items related to the clock generator can be assigned. For details, refer to Section 5.5, "For Users of the Existing BERTS," in the MU16300A Clock Generator Operation Manual.

※1 This item cannot be assigned if VAR is not selected from the Level drop-down list box on the Setup:Clock I/F panel.

※2 This item cannot be assigned if VAR is not selected from the Level drop-down list box on the Setup:Data I/F panel.

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5.14.2 Assigning setting items to the Setup group boxes

This section explains the procedure for assigning setting items to Setup group boxes. A maximum of six items can be assigned.

1. Press the Display Setup button in the Customize subwindow. The Customize Window Display Setup dialog box will open.

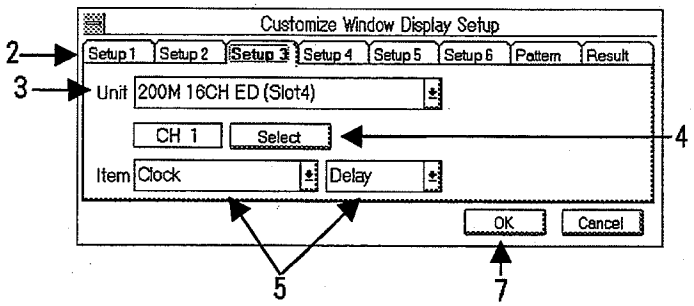


Fig. 5.-116 Customize Window Display Setup dialog box

2. Select a group box to which a setting item is to be assigned. Press a tab (Setup1 to Setup6) to open the desired panel.

3. When multiple units are used in combination, select the target unit from the Unit drop-down list box. When it is not necessary to assign any setting item, select OFF. For the setting item assignment procedure to be followed when a unit other than the 200M 16CH PPG and 200M 16CH ED is selected, refer to the Instruction Manual that comes with the selected unit.

4. Select channels. Press the Select button to open the CH Select dialog box. Next, press the OK button.

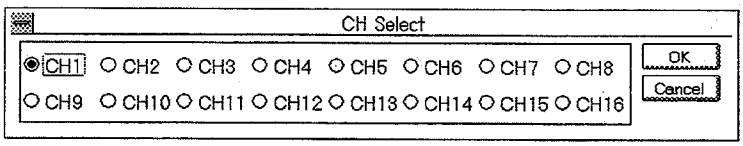


Fig. 5.-117 CH Select dialog box

5. Select setting items from the Item drop-down list boxes (1) and (2). For the selectable setting items, see Table 5.6.

6. Perform steps 2 through 5 as many times as the number of items to be assigned.

7. This completes the setting. Press the OK button to make the new setting effective.

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5.14.3 Assigning measurement items to the Result group box

This section explains the procedure for assigning measurement items to the Result group box. Without the ED unit, you cannot assign measurement items.

1. Press the Display Setup button in the Customize subwindow. The Customize Window Display Setup dialog box will open.

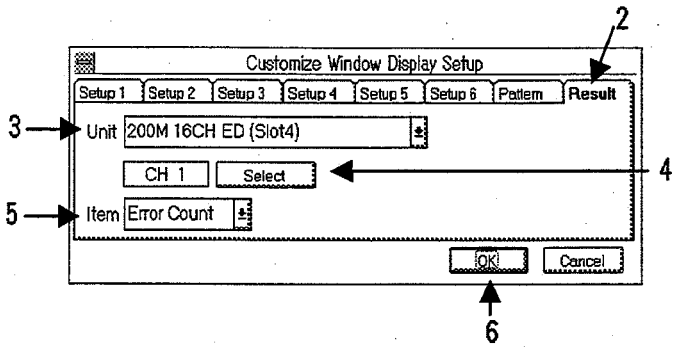


Fig. 5.-118 Customize Window Display Setup dialog box

2. Press the Result tab.

Note

It is an impossible to assign the measurement item except on Error/Alarm measurement. When the selection in Test Item drop down list box on Test Menu subwindow Measurement panel isn't Error/Alarm, Result tab is invalid state.

3. When it is not necessary to assign any measurement item, select OFF.

4. Select channels. Press the Select button to open the CH Select dialog box. Next, press the OK button.

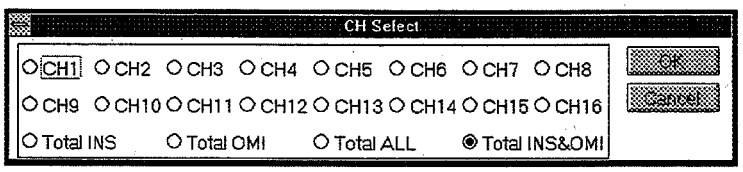


Fig. 5.-119 CH Select dialog box

5. Select the measurement items to be displayed in the Result group box, from the Item drop-down list.

Error Rate	Displays an error rate item in the Result group box.
Error Count	Displays an error count item in the Result group box.

6. This completes the setting. Press the OK button to make the new setting effective.

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5.14.4 Editing a pattern in the Customize subwindow

This section explains how to edit a pattern in the Customize subwindow. When editing a pattern, assign target channels to the Panel Editor group box following the procedure discussed below.

- **Assigning to the Pattern Edit group box**

1. Press the Display Setup button in the Customize subwindow. The Customize Window Display Setup dialog box will open.

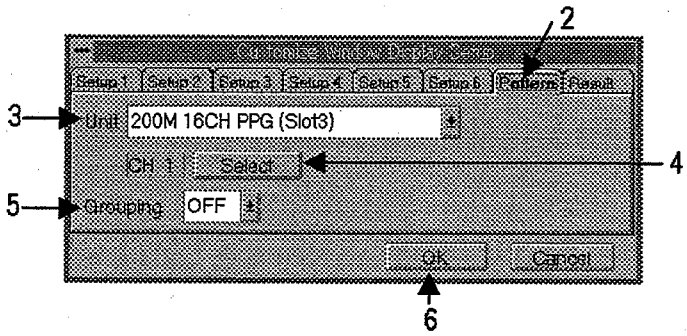


Fig. 5.-120 Customize Window Display Setup dialog box

2. Press the Edit Pattern tab.

3. When multiple units are used in combination, select the target unit from the Unit drop-down list box. When it is not necessary to assign any setting item, select OFF.

4. Select channels. Press the Select button to open the CH Select dialog box. Select the channel on option button. Next, press the OK button.

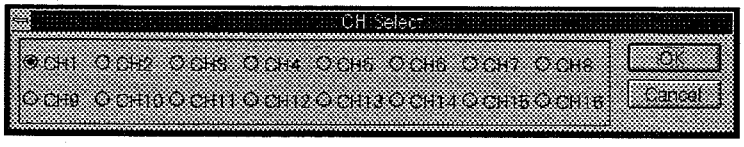


Fig. 5.-121 CH Select dialog box

5. Select ON or OFF from the Grouping drop-down list box. When ON is selected, the succeeding editing procedure will be performed according to the grouping on the Pattern dialog box. For details on grouping, see Section 6.1, "Setting Multiple Channels at a Time."

Note

Grouping ON/OFF setting is valid only when System Mode is Measurement Power Fail Mode. For System Mode setting, see section 6.4,"Setting System Operations" in the MP1630B Digital Data Analyzer Operation Manual.

6. Press the OK button to make the new setting effective. The Customize Display Window Setup dialog box will close.

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- **Editing a pattern**

After assigning the channels subject to editing, edit a pattern. It should be noted that PRBS and Zero-Subst patterns cannot be edited.

1. When the pattern mode is PON or the pattern of the target channel is an MIX pattern, specify block numbers. Press the Select button to open the Block Select dialog box. Select blocks by pressing the corresponding buttons, then press the OK button. If the pattern of a specified block is a PRBS pattern, steps 2 and later cannot be executed.

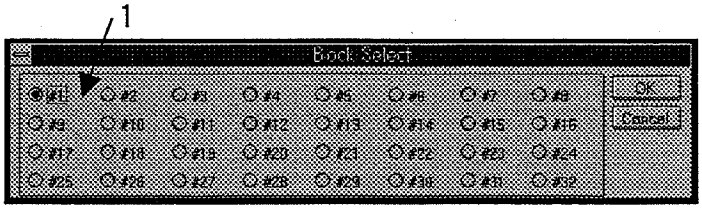


Fig. 5.-122 Block Select dialog box

2. Specify the bit positions of the target pattern. Use the Offset spin box for this specification.

3. Input the pattern byte by byte. Press the Edit button to open the Pattern Edit dialog box.

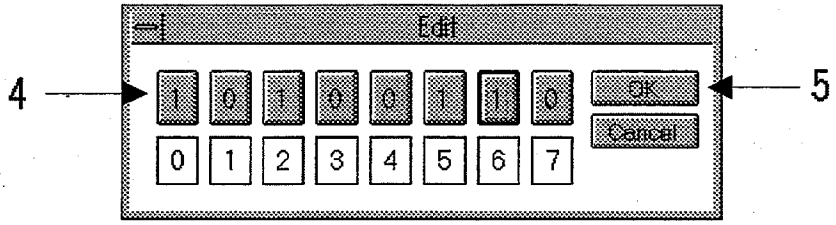


Fig. 5.-123 Pattern Edit dialog box

4. Press bit number buttons. The selected bits will be inverted.

5. Press the OK button to allow the new pattern take effect.

6. Repeat steps 2-4 as required.

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5.15Saving Setting Data in Data Files and Opening Data Files

5.15.1 Saving Setting Data in Data Files

The MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit) and the MU163040B 200M 16CH Error Detector (hereafter called the ED unit) allow you to save the setting data in data files.
Data files are classified by unit type. The PPG unit setting data file can be distinguished from the ED unit setting data file according to their file name extensions. The file name extension of the PPG unit setting data file is ".PPG". The file name extension of the ED unit setting data file is ".ED".
The above setting data files do not contain pattern-related setting data (setting items that can be checked on the Setup:Pattern panel). Pattern-related setting data of the PPG and ED units are saved as pattern data files with a file name extension ".PTN".
For example, when the PPG unit and the ED unit are installed separately, a total of four files-a .PPG file, an .ED file, and two .PTN files-are generated.

Data file	Description
.PPG	A PPG unit setting data file (not including pattern-related setting data).
.ED	An ED unit setting data file (not including pattern-related setting data).
.PTN	A pattern data file including pattern-related setting data of ED and PPG units.

1. Select Save from the File menu in the main window to select the Save dialog box. You can open any subwindow.

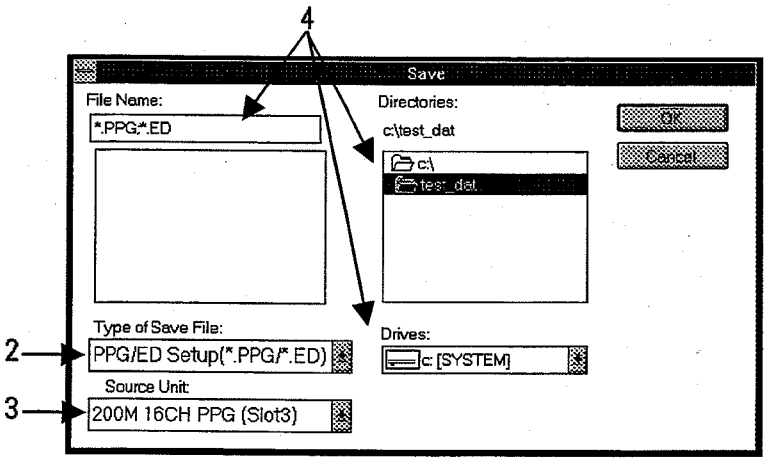


Fig. 5.-124 Save dialog box

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2. Select a save file type from the Type of Save File drop-down list box.

PPG/ED Setup(*.PPG/*.ED)	Save setting data of the PPG or ED unit.
Pattern Data(*.PTN)	Save pattern-related setting data and the generated pattern data.

3. When multiple units are used in combination, select the target unit from the Unit drop-down list box.

4. Specify the names of the drive, directory, and file, then press the OK button. Do not change the file name extension. If drive D is specified, setting data will not be saved.

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5.15.2 Opening Data Files

The MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit) and the MU163040B 200M 16CH Error Detector (hereafter called the ED unit) allow you to open the data files storing setting data.
Data files are opened on a unit basis. The PPG unit setting data file can be distinguished from the ED unit setting data file according to their file name extensions. The file name extension of the PPG unit setting data file is ".PPG". The file name extension of the ED unit setting data file is ".ED".
The above setting data files do not contain pattern-related setting data (setting items that can be checked on the Setup:Pattern panel). Pattern-related setting data of the PPG and ED units are saved as pattern data files with a file name extension ".PTN".

Data file	Description
.PPG	A PPG unit setting data file (not including pattern-related setting data).
.ED	An ED unit setting data file (not including pattern-related setting data).
.PTN	A pattern data file including pattern-related setting data of ED and PPG units. (It includes the created PRGM pattern.)

1. Select Open from the File menu in the main window to select the Open dialog box. You can open any subwindow.

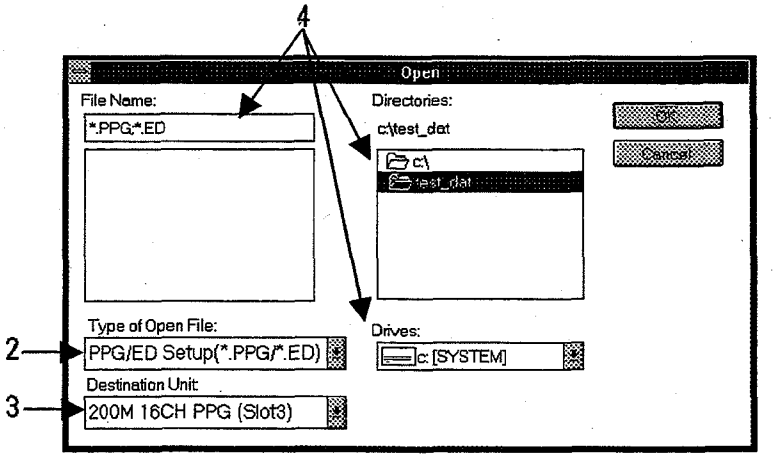


Fig. 5.-125 Open dialog box

2. Select an open file type from the Type of Open File drop-down list box.

PPG/ED Setup(*.PPG/*.ED)	Save setting data of the PPG or ED unit.
Pattern Data(*.PTN)	Save pattern-related setting data and the generated pattern data.

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3. When two units are used in combination, select the target unit from the Unit drop-down list box.

4. Specify the names of the drive, directory, and file, then press the OK button.

Note

1. *PPG file and *ED file have interchangeability. You can open the PPG unit on ED unit. The reverse is also feasible. In this case, only setting items that common the PPG unit and the ED unit are renew. For setting items common the PPG unit and ED unit, see table 5-7.
2. It is possible to open PTN file regardless of a sort of saved unit. For example you can open PTN file saved by PPG unit in the ED unit. In this case, a characteristic setting items is skipped over to the PPG unit. For a characteristic setting items to the PPG unit, see table 5-8, and for to the ED unit, see table 5-9.

Table 5.-7 Setting items common the PPG and ED unit saved in unit setting file

Screen name	Setting items
Setup:Setup	Pattern Mode
Setup:Clock I/F	Polarity
	Delay
	Output / Input Mode
Setup:Data I/F	Level
Setup:Trigger I/F	Setting contain the Sync Output group box.

Table 5.-8 A characteristic setting items of the PPG unit saved in a pattern file

Measurement mode	Setting items
Normal	Phase Difference
	Burst Cycle
PON	Phase Difference
	All setting contain the Output Timing dialog box
	PR Length

Table 5.-9 A characteristic setting items of the ED unit saved in a pattern file

Measurement mode	Setting items
Normal	All setting contain the Output Timing dialog box
PON	All setting contain the Output Timing dialog box

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CHAPTER 6 APPLICABLE OPERATION

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6.1Setting Multiple Channels at a Time

6.1.1 Grouping function

The MU163020B and MU163040B has many setting items (e.g., setting items concerning data and clock interfaces) that can be set for individual channels. It is not efficient to perform the same setting item assignment procedure for multiple channels.
Some panels are provided with a grouping function which allows setting items to be assigned to groups of channels at a time. Table 6.1 lists the panels supporting a grouping function and the setting items subject to grouping.

Table 6.-1 Panels allowing grouping and setting items subject to grouping

Panel	Setting items subject to grouping	
	MU163020B	MU163040B
Setup:Clock I/F	Polarity Output Mode Output Delay Level※	Polarity Input Mode Delay Termination
Setup:Data I/F	Output Skew Level※	Level
Setup:Pattern (Normal pattern mode)	Pattern setting	Pattern setting Sync Setting
Setup:Pattern (PON pattern mode)	PR OH/Information	OH/information Sync Setting
Setup:Trigger I/F	Burst Trigger Output Delay	—

※ "Level" includes Amplitude, Offset, and Termination of DUT.(PPG)
"Level" includes Threshold,Termination.(ED)

A maximum of 16 channels can belong to a group. The maximum number of groups is 8. First, specify the channels to be included in the group. Next, define a channel as a master channel. When the grouping function is turned on, the other channels belonging to the same group are assigned the same setting items as those of the master channel.
Each panels has its own groups to which channels belong. For example, the groups of the Clock I/F panel are independent of those of the Data I/F panel.
You can determine whether each setting item is to be subjected to grouping. For example, you can exclude only "Delay" from grouping a group of the Clock I/F panel.

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6.1.2 Making settings for grouping

This section explains how to enable the grouping function taking as an example the MU163020B clock interface.

1. Press the Setup button on the Setup: Clock I/F panel to open the Clock Interface dialog box.

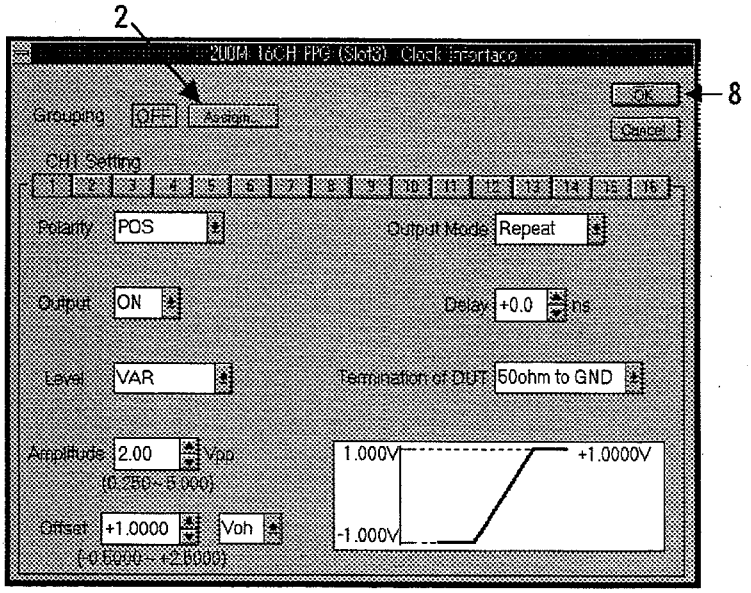


Fig. 6.-1 Clock Interface dialog box

2. Press the Assign button. The Grouping Assign dialog box will open. Select ON from the Grouping drop-down list box in the upper-left corner of the dialog box.

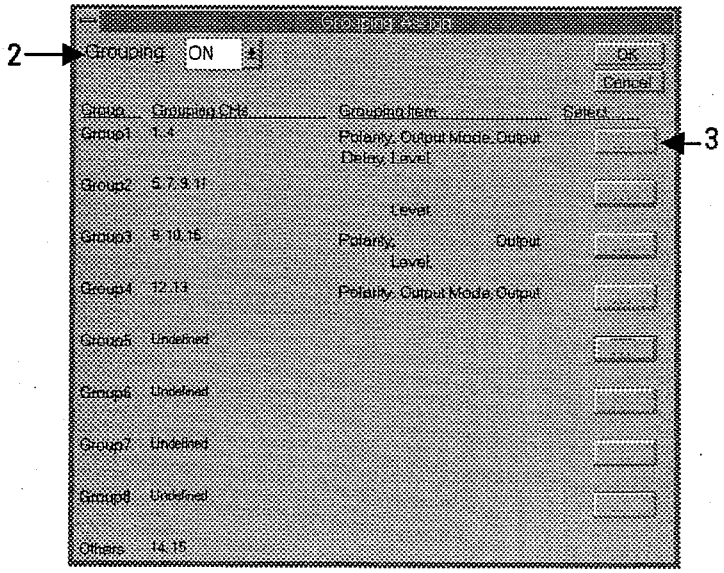


Fig. 6.-2 Grouping Assign dialog box

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3. Press the [···] button beside the group to be set. The Grouping # Setting dialog box will open. (# stands for a group number.)

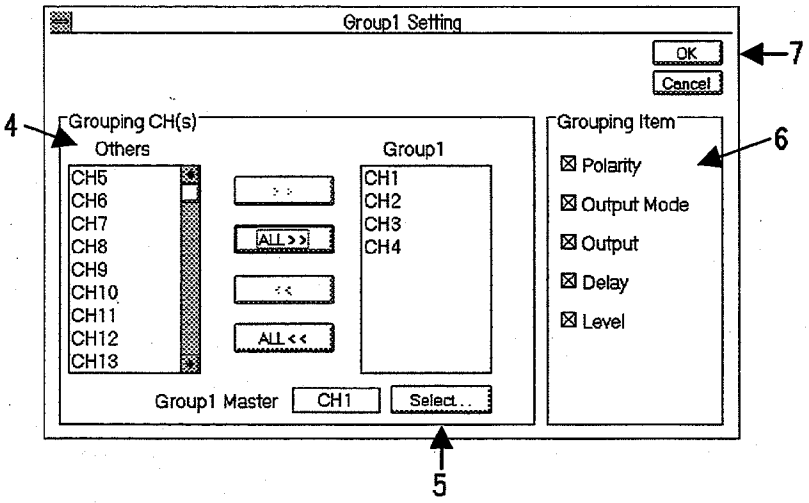


Fig. 6.-3 Group # Setting dialog box

4. Select the channels that belong to the group. In the Grouping CH(s) group box, make the following settings:

   4-1. In the Others or Group # list box, press the channel items you want to move. The selected items will be displayed in reverse video. You can select multiple items.

   4-2. Pressing the [>>] or [<<] button will move the selected items.

   4-3. Pressing the [ALL>>] or [ALL<<] button will move all items irrespective of the selected items.

5. Select a master channel. Press the Select button to open the Master CH dialog box. Select a master channel by pressing the corresponding option button, then press the OK button.

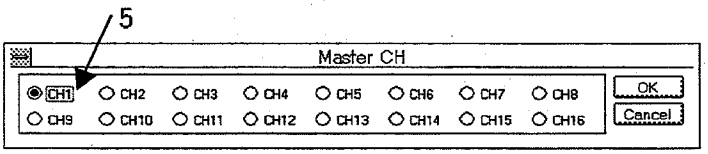


Fig. 6.-4 Master CH dialog box

6. Select the items subject to grouping. In the Grouping Item group box, tick the setting items subject to grouping.

7. Press the OK button to make the new setting effective.

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8. Perform steps 3 through 7 repeatedly as many times as the number of groups subject to setting. After making settings for all groups, press the OK button.

Note

1. When the OK button is pressed in step 9, the grouping setting is defined. At this time, the grouping setting items of the channels belonging to the set groups become the same as those of the master channel. If Grouping is set to OFF just after this, the grouping setting will not be restored to the previous setting.
2. The grouping setting made on the Setup: Pattern panel affects the pattern editing setting made in the Pattern Editor dialog box. However, you can turn on or off the grouping function using the Pattern Editor dialog box.

9. Part of the setting items of the Clock Interface dialog box changes owing to the grouping setting. Setting items subject to grouping are highlighted. In the example below, setting items other than Delay are subject to grouping.

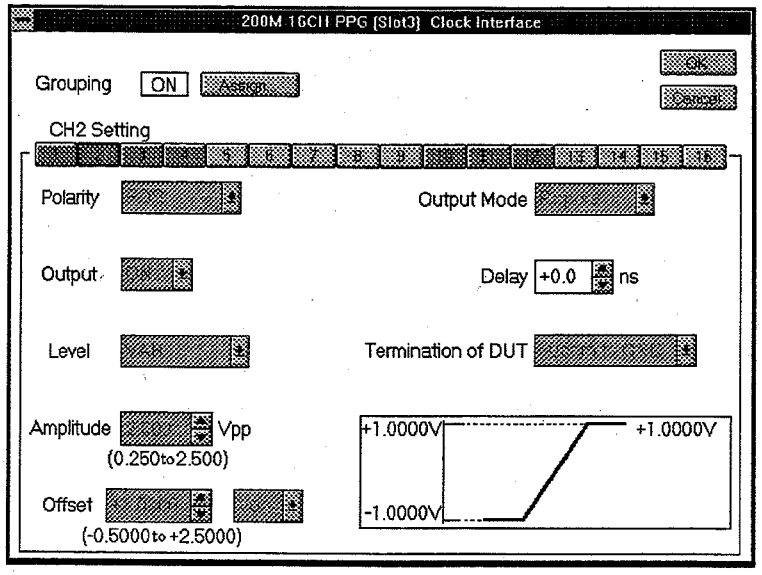


Fig. 6.-5 Clock Interface dialog box after grouping

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6.2Making Pattern Settings Common to Units

When the MU163020B 200M 16CH Pulse Pattern Generator unit (hereafter called the PPG unit) and the MU163040B 200M 16CH Error Detector unit (hereafter called the ED unit) is being mounted in the MP1630B, the settings are fundamentally set at each unit.

For this reason, when you set the type of each channel pattern in the PPG unit and ED unit identically, you need repeat the same operation twice. In order to avoid such a trouble, you can set a pattern setting in common between two unit.

Setting items which only one unit is effective between the PPG and ED unit is also displayed, for example items in a Sync Setting group box is only effective to ED unit, but a change of setting is only reflected to effective unit.

As follows, explain operation procedure in order to common a setting on a pattern.

1. Open the Setup:Setup panel

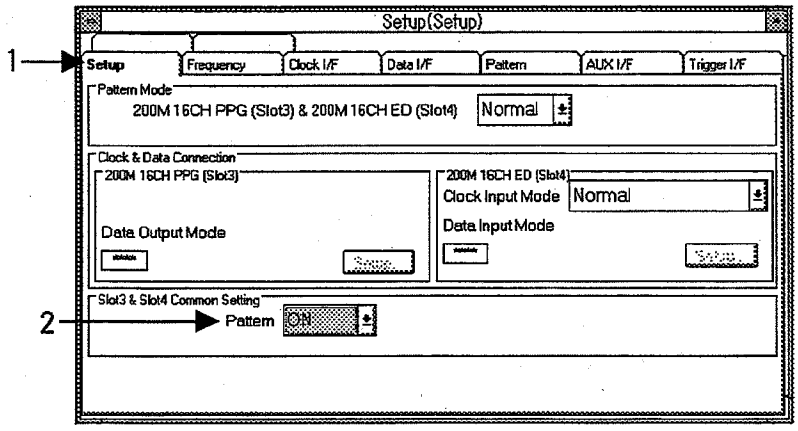


Fig. 6.-6 Setup:Setup panel

2. Select ON on the Pattern drop down list box in the Slot3&Slot4 common setting group box.

Note

1. Change ON and OFF in the Pattern drop down list box, then grouping settings in the Pattern dialog box are canceled at the both unit.
2. When the PPG and ED unit combine if you turned the Pattern drop down list box ON, both units settings is suited to the ED unit side.

3. Mentioned above, you can set a settings on a pattern in common between two unit. Fundamental operation method is similar to the case of common setting, see section 5.2,"Setting a Send/Receive Pattern", or section 5.3,"Performing Settings for PON Measurement".

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6.3Setting AUX Outputs

6.3.1 Setting AUX outputs when the pattern output mode is Burst

When the pattern mode is Burst, the PPG unit is possible to transmission an AUX output signal synchronized a burst trigger signal. There are nine AUX outputs, Port1 to Port9. The Port9 is the result of ORing Port1 to Port8. You can select a channel which provides the standards for port signal output timings, among CH1 to CH16. This section explains the procedure for setting AUX outputs when the pattern output mode is Burst. For details on how to set the pattern output mode, see Section 5.5.1, "Sending a burst pattern."

1. Open the Setup: AUX I/F panel.

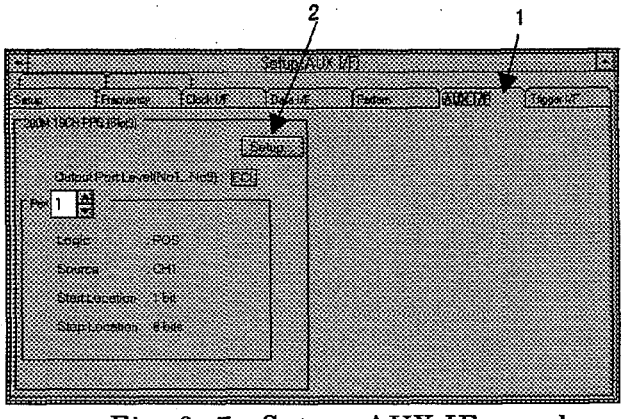


Fig. 6.-7 Setup: AUX IF panel

2. Press the Setup button. The AUX Interface dialog box will open.

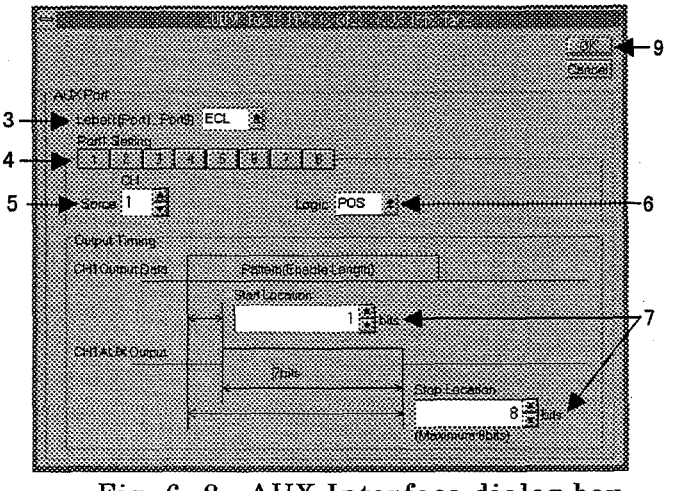


Fig. 6.-8 AUX Interface dialog box

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3. Select output levels of all ports from the Level drop-down list box.

ECL	Outputs from all ports at the ECL level[1].
TTL	Outputs from all ports at the TTL level[2].

4. Press the button of the target port.

5. Enter the number of the channel to be connected to the port, in the Source spin box.

6. Select a port logic from the Logic drop-down list box.

7. Set the output timing. Enter start and stop locations in the Start Location and Stop Location spin boxes respectively. The stop location must not exceed the current enable length. To check the current enable length, open the Setup/Pattern panel.

8. Perform steps 4 through 7 as many times as the number of ports to be set.

9. This completes the setting. Press the OK button to make the new setting effective.

[1] ECL Level ··· High : -0.9V, Low : -1.7V
[2] TTL Level ··· High : 5.0V, Low : 0.0V

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6.3.2 Setting AUX outputs when the pattern output mode is PON

When the pattern mode is PON, the PPG unit is possible to transmission an AUX output signal synchronized a burst trigger signal. There are nine AUX outputs, Port1 to Port9. The Port9 is the result of ORing Port1 to Port8. You can select a channel which provides the standards for port signal output timings, among CH1 to CH16. This section explains the procedure for setting AUX outputs when the pattern mode is PON. For details on how to set the pattern mode, see Section 5.3, "Making Setting for PON Measurement."

1. Open the Setup: AUX I/F panel.

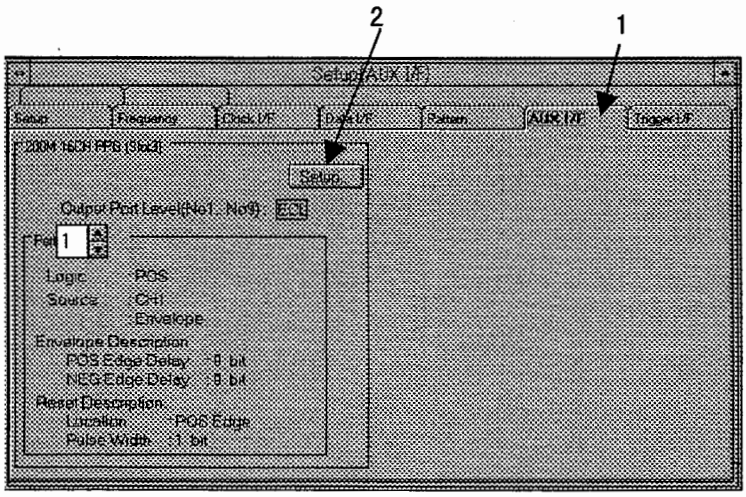


Fig. 6.-9 Setup: AUX IF panel (PON mode)

2. Press the Setup button. The AUX Interface dialog box will open.

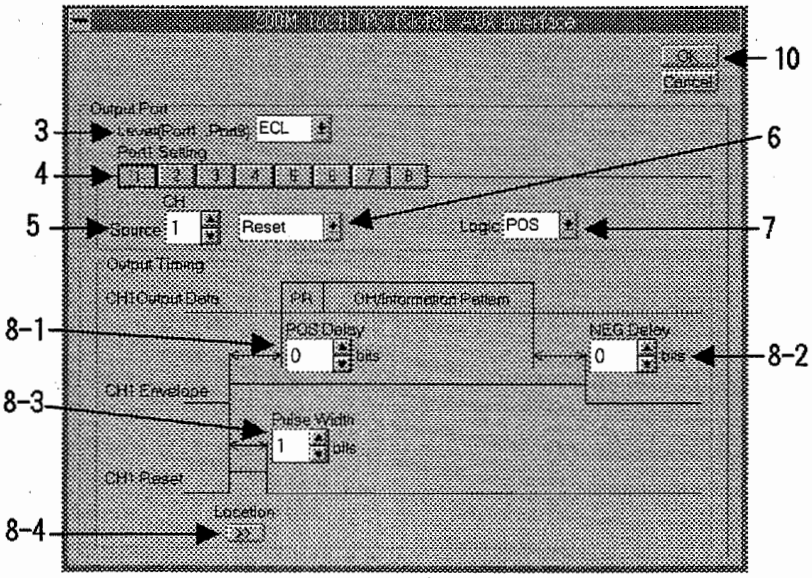


Fig. 6.-10 AUX Interface dialog box (PON mode)

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3. Select output levels of all ports from the Level drop-down list box.

ECL	Outputs from all ports at the ECL level[3].
TTL	Outputs from all ports at the TTL level[4].

4. Press the button of the target port.

5. Enter the number of the channel that provides the standards for port signal output timings, in the Source spin box.

   You cannot select a channel which has not been set as an effective channel. To check the currently enabled channels, open the Setup:Pattern panel. For details on the setting procedure, see Section 5.3.4, "Setting a PON send pattern."

6. Select a port output type from the Source drop-down list box.

Envelope	A signal synchronized with the source channel pattern
Reset	A pulse signal synchronized with the Envelope signal

7. Select a port logic from the Logic drop-down list box.

8. Set the output timings of Envelope and Reset signals. Make the following settings using the Output Timing group box.

   8-1. Set the Envelope signal start location with the delay from the data output start location. Enter a delay value in the POS delay spin box.

   8-2. Set the Envelope signal stop location with the delay from the data output stop location. Enter a delay value in the NEG delay spin box.

   8-3. Enter the pulse width of the Reset signal in the Pulse Width spin box.

   8-4. Set the Reset signal location. Pressing the Location button will toggle between the rising and falling locations of the Envelope signal.

9. Perform steps 4 through 8 as many times as the number of ports to be set.

The channel selected as a source channel in step 5 provides a reference data output. Valid setting ranges are shown below. Note that the following condition must be met:

$$(\text{POS delay} - \text{NEG delay}) + 1 \leqq \text{Pattern length}$$

Setting item	Valid setting range
POS Delay	-64 bits to +9999 bits (in 1-bit steps)
NEG Delay	-64 bits to +9999bits (in 1-bit steps)
Pulse Width	1 bit to 16 bits (in 1-bit steps)

[3] ··· High : -0.9V, Low : -1.7V
[4] ··· High : 5.0V, Low : 0.0V

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10. This completes the setting. Press the OK button to make the new setting effective.

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6.4Setting the Trigger Output

The MU163020B 200M Pulse Pattern Generator (hereafter called the PPG unit) has one Trigger Output and 16 Burst Trigger Outputs.
This section explains the procedure for setting the Trigger Output.

Note

When Delay(Mode1) is selected, the settings made here are ignored because a Delay Trigger is output from the Trigger Output unconditionally.

1. Open the Setup: Trigger I/F panel. The setting state is shown in the Trigger Output group box.

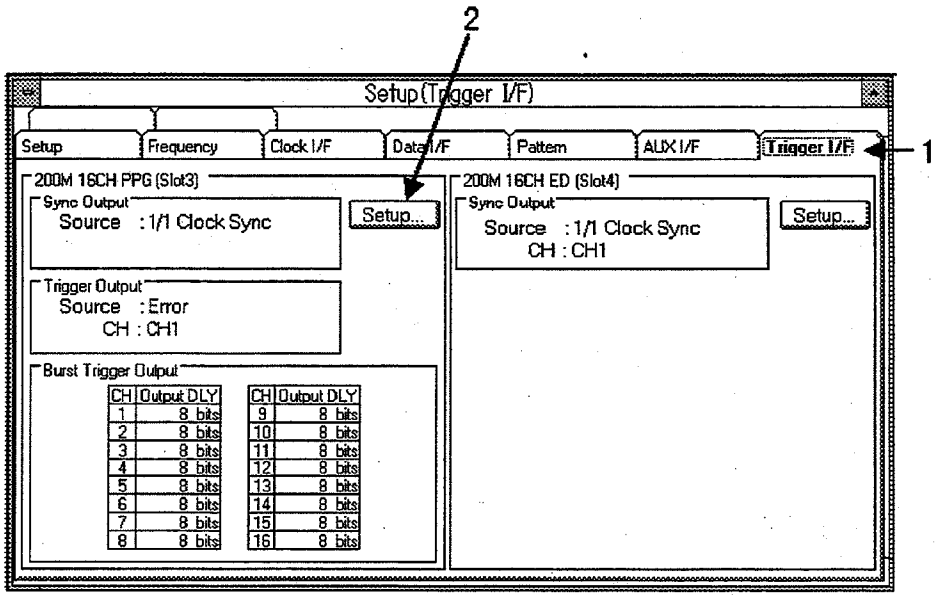


Fig. 6.-11 Setup: Trigger I/F panel

2. Press the Setup button in the PPG unit group box. The Trigger Interface dialog box will open.

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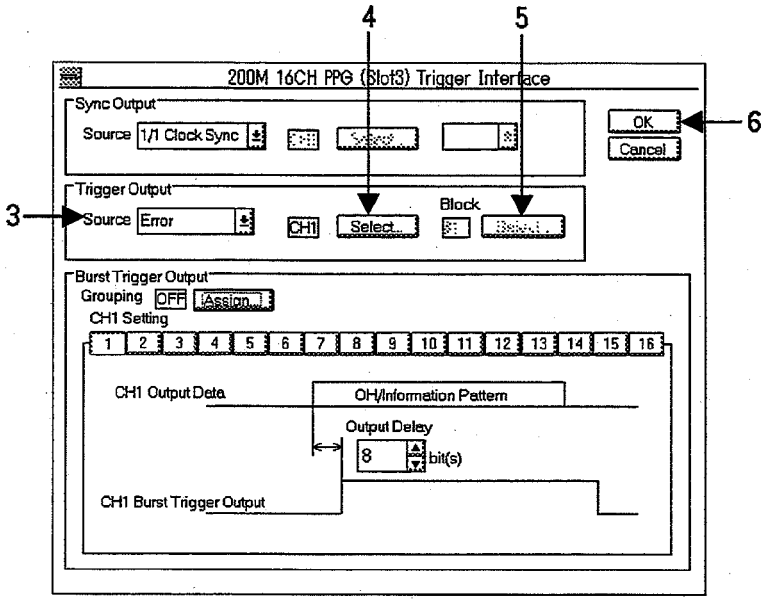


Fig. 6.-12 Trigger Interface dialog box

3. Select an output signal type from the Source drop-down list box in the Trigger Output group box.

Error	Output a pulse signal when an error occurs.
Block Timing	Output the signal that went high while the specified block was being sent.

4. Set the channel that provides the standard for the output signal. Press the Select button (1) in the Trigger Output group. The CH Select dialog box will open. Select the option button of the channel you want to select, then press the OK button.

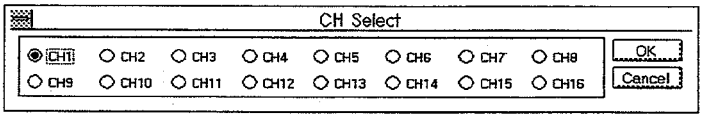


Fig. 6.-13 CH Select dialog box

Note

When you have selected Block Timing in step 3, the following restrictions are placed on the selection of channels:

(1) When the pattern mode is PON, the buttons of the channels not selected as effective channels (Enable CHs) cannot be pressed.

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5. When you have selected Block Timing in step 3, specify a signal output block. Press the Select button (2) in the Trigger Output group box to open the Block Select dialog box. Select a block with by pressing the corresponding option button, then press the OK button.

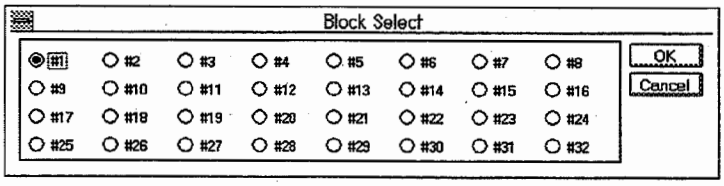


Fig. 6.-14 Block Select dialog box

This completes the setting. Press the OK button to make the new setting effective.

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6.5 Setting the SYNC Output

This section explains how to set the signal output from the SYNC Output of the MU163020B 200M 16CH Pulse Pattern Generator (hereafter called the PPG unit) or the MU163040B 200M 16CH Error Detector (hereafter called the ED unit).

1. Open the Setup: Trigger I/F panel.

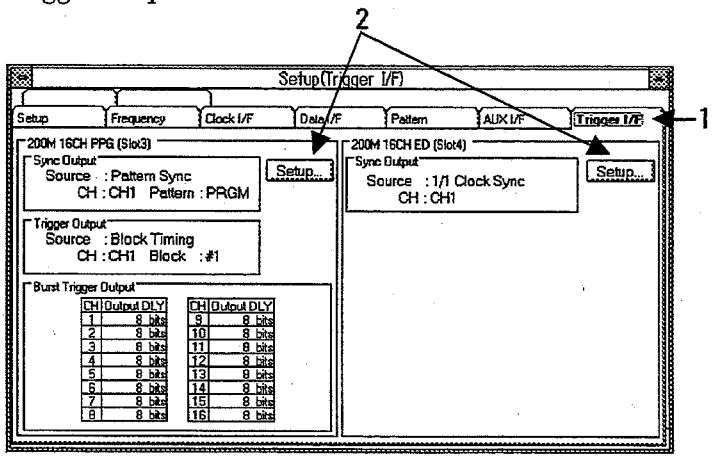


Fig. 6.-15 Setup: Trigger I/F panel

2. Press the Setup button in the group box of the target unit. The Trigger Interface dialog box will open.

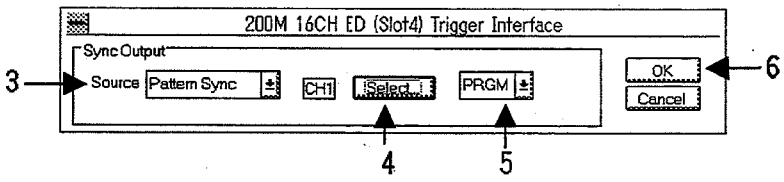


Fig. 6.-16 Trigger Interface dialog box (ED unit)

3. Select the signal to be output from the SYNC Output, from the Source drop-down list box (1).

1/1 Clock Sync	Output a clock signal.
1/8 Clock Sync	Output a signal which is one eighths of the clock signal.
Pattern Sync	Output an 8-bit pulse signal in sync with the pattern cycle.

4. If you have selected Pattern Sync in step 3, select the channel whose pattern is used to synchronize the SYNC Output signal. Press the Select button to open the CH Select dialog box. but the above setting is impossible, if you select "1/1Clock Select Sync" or "1/8 Clock Sync " in step3 with PPG unit.

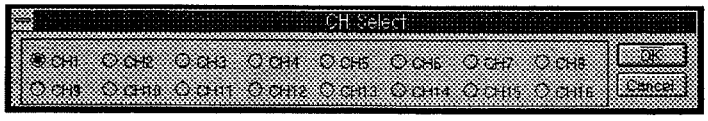


Fig. 6.-17 CH Select dialog box

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4-1 Select a channel by pressing the corresponding option button, then press the OK button. In the PON measurement mode, only enabled channels can be selected.

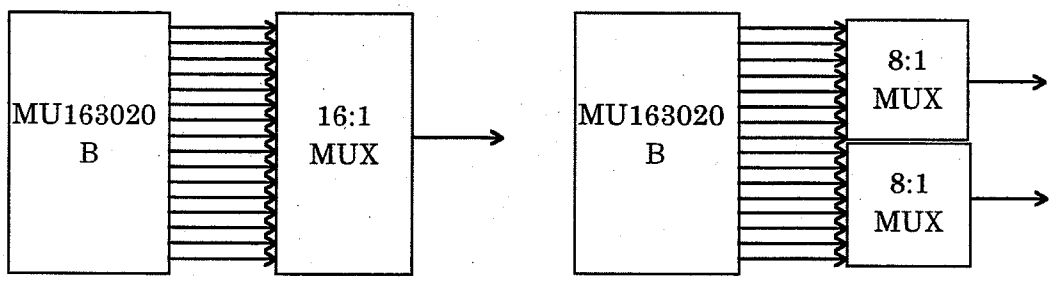
5. When the pattern mode is PON or the pattern of the channel selected in step 4 is MIX, select a PRGM or PRBS pattern with which the SYNC Output signal is to be synchronized, from the Source drop-down list box (2).

6. This completes the setting. Press the OK button to make the new setting effective.

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6.6Performing MUX Externally for PRBS Patterns

The MU163020B 200M 16CH Pulse Pattern Generator unit can send patterns with the phase shifted to perform 16:1 or 8:1 MUX externally.



MUX can be performed only when the send patter is set as follows:

When channels whose PRBS pattern has the same number of rows are combined as follows:

- Channels 1 through 16
- Channels 1 through 8
- Channels 9 through 16

If the above conditions are met, the Phase Difference button in the Pattern dialog box becomes effective, allowing you to set a phase difference.

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1. Open the Setup: Pattern panel.

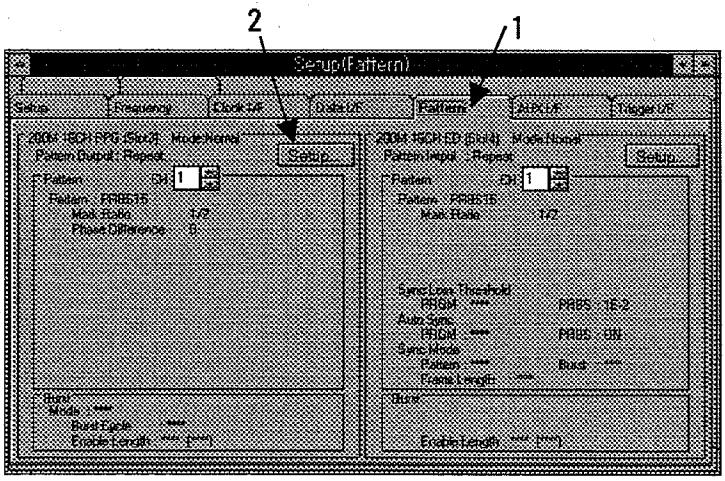


Fig. 6.-18 Setup: Pattern panel

2. Press the Setup button in the PPG unit group box. The Pattern dialog box will open.

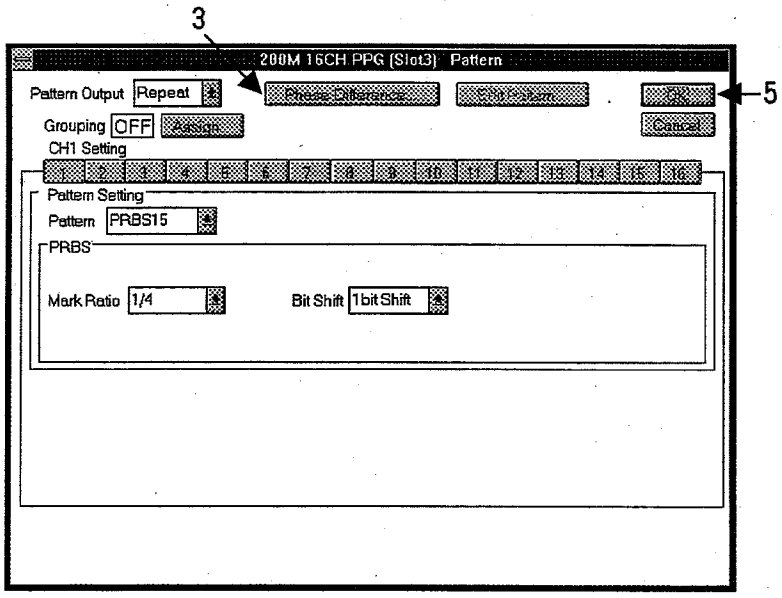
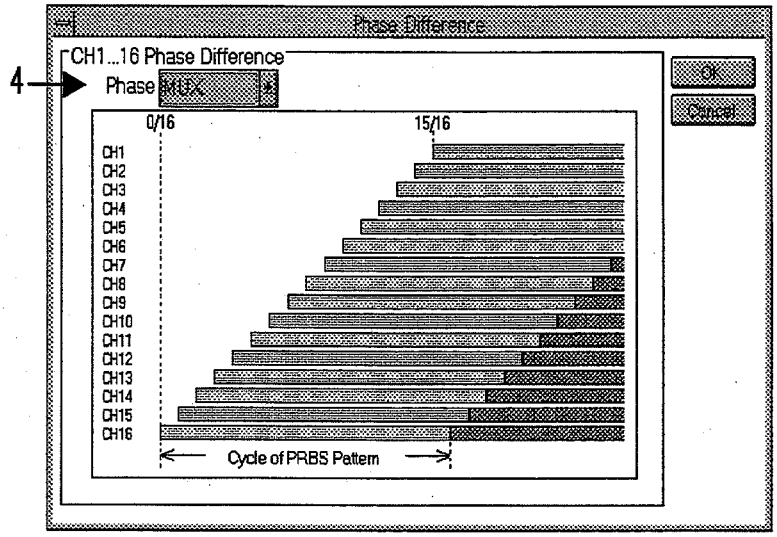


Fig. 6.-19 Pattern dialog box

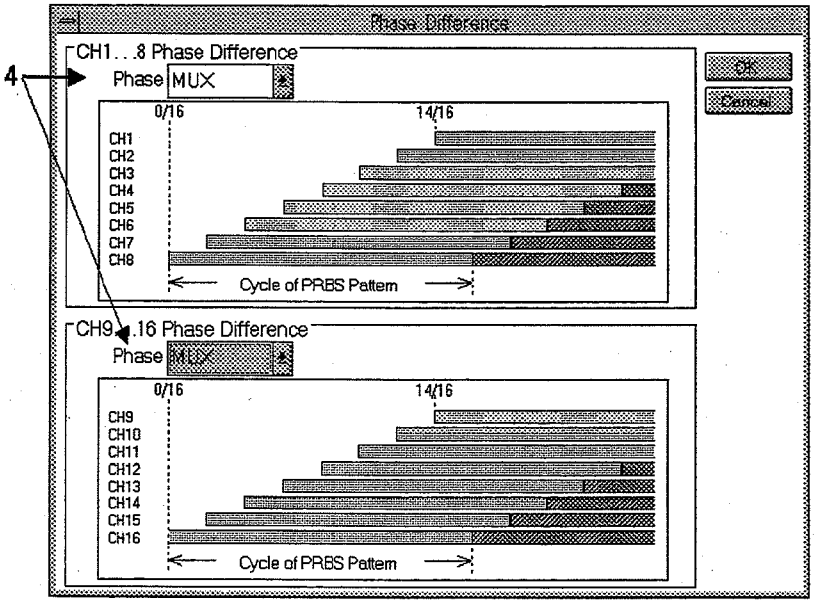
When the pattern setting conforms to the previously stated condition, the Phase Difference button is effective. For how to make pattern-related settings, see Section 5.2, "Setting a Send/Receive Pattern."

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3. Press the Phase Difference button. The Phase Difference dialog box will open.



(a) 16:1 MUX



(b) 8:1 MUX

Fig. 6.-20 Phase Difference dialog box

4. Select MUX from the Phase drop-down list box. To cancel the phase shifted pattern output function, select None. If you selected it, press OK buttern.

5. This completes the setting. Press the OK button to make the new setting effective.

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6.7Eye Margin Diagram

6.7.1 Functions

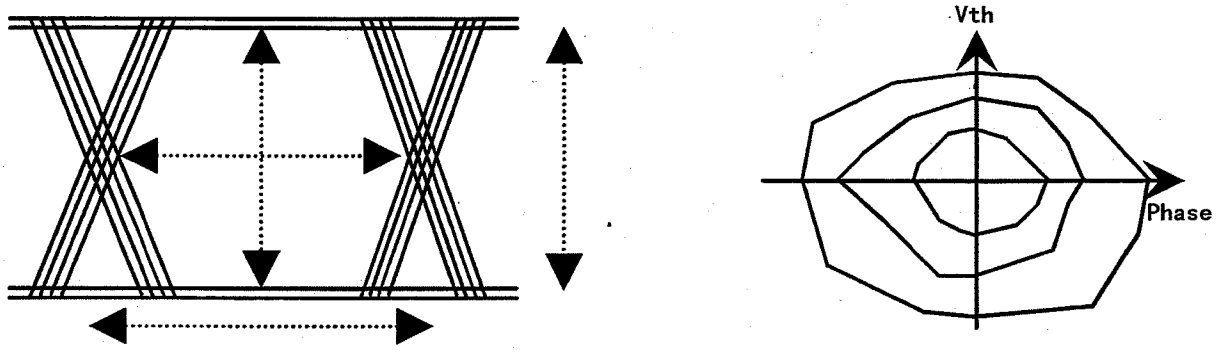
The MU163040B 200M 16CH Error Detector (hereafter called the ED unit) has a margin measurement function and a diagram measurement function to measure eye margins.

(1) Margin measurement

Threshold voltages and phases which are within the specified error rate range are measured. Both the threshold voltage and phase can be measured at the same time. The threshold is measured, starting with the threshold voltage set for the data interface. The phase is measured, starting with the delay value set for the clock interface. The error rate setting range is from 10^{-3} to 10^{-9}. There are two error rate modes, Fine and Coarse. The number of measurement bits of the Fine mode is 100 time as many as the number of measurement bits of the Coarse mode.

(2) Diagram measurement

In the two-dimensional coordinate system (the X-axis represents threshold voltages and the Y-axis represents phases), the points where the error rate is as specified are plotted. Select the number of the points of the same error rate from 8, 16, 32, and 64.



(1) Margin measurement (2) Diagram measurement

Fig. 6.-21 Eye margin measurement

Note

For the channels for which the input data signal level is set to ECL, LVTTL,PECL, TTL, or CMOS on the Setup: Data I/F panel, only the phase margin can be measured.

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6.7.2 Setting margin measurement conditions

This section explains how to make the settings necessary for margin measurement.

1. Select Repeat as the pattern input/output mode.

   1-1 Select Normal from the drop-down list box of the unit used for margin measurement in the Pattern Mode group box on the Setup: Setup panel.

   1-2 To open the Pattern dialog box, press the Setup button of the unit used for delay measurement on the Setup: Pattern panel.

   1-3 Select Repeat from the Pattern Output or Pattern Input drop-down list box.

2. Open the Text Menu: Measurement panel.

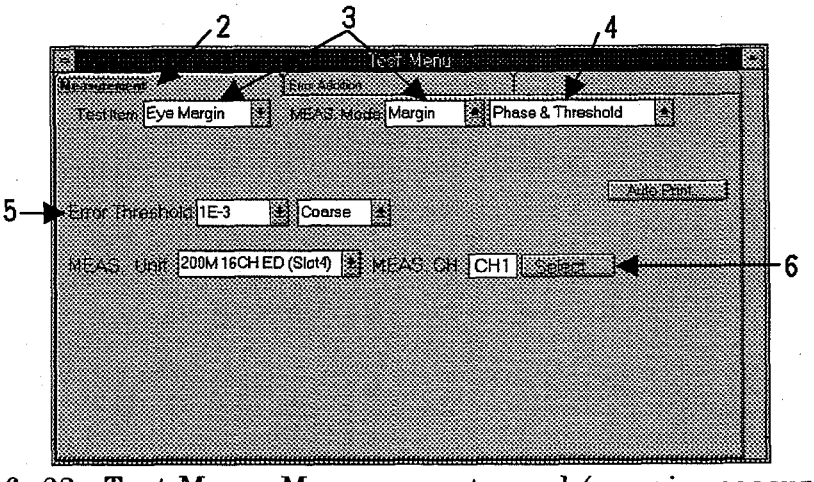


Fig. 6.-22 Test Menu: Measurement panel (margin measurement)

3. Select Eye Margin from the Test Item drop-down list box. Select Margin from the MEAS. Mode drop-down list box.

4. Select a subject of measurement from the MEAS. Mode drop-down list box.

Threshold	Measures the threshold voltage margin.
Phase	Measures the phase margin.
Threshold & Phase	Measures threshold and phase margins at the same time.

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5. Select an error rate and error rate accuracy from the Error Threshold drop-down list box. Relationships between the options shown in the drop-down list box and the error rates are as follows:

Table 6.-2 Error rates and accuracy

	Coarse	Fine
1E-3	$1/10^{-3}$	$100/10^{-5}$
1E-4	$1/10^{-4}$	$100/10^{-6}$
1E-5	$1/10^{-5}$	$100/10^{-7}$
1E-6	$1/10^{-6}$	$100/10^{-8}$
1E-7	$1/10^{-7}$	$100/10^{-9}$
1E-8	$1/10^{-8}$	$100/10^{-10}$
1E-9	$1/10^{-9}$	$100/10^{-11}$

6. Press the Select button to open the Measurement CH Select dialog box. Press the option button of the channel subject to measurement, then press the OK button.

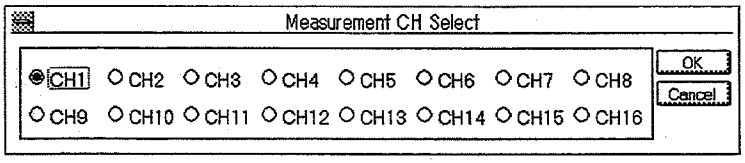


Fig. 6.-23 Measurement CH Select dialog box

7. This completes the setting. For how to start measurement, see Section 6.7.3, "Performing margin measurement."

Note

If you change the setting made on the Test Menu: Measurement panel after completion of measurement, then the result of the measurement completed directly before will be cleared.

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6.7.3 Performing margin measurement

The Result subwindow is used to start, stop, or monitor measurement. Open the Result subwindow after making sure that Test Menu: Measurement panel is set as follows:

- Eye Margin has been selected from the Test Item drop-down list box.
- Margin has been selected from the MEAS. Mode drop-down list box.

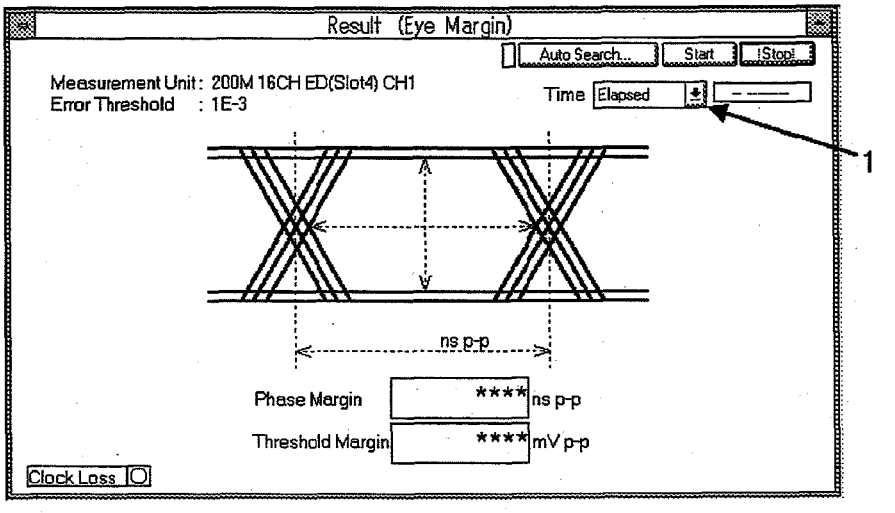


Fig. 6.-24 Result subwindow (margin measurement)

Pressing the Start button in the upper-right corner of the subwindow will start measurement. Pressing the Stop button will stop measurement. During measurement, the gauge is displayed to indicate that measurement is being performed. In the lower-left corner of the subwindow is the Clock Loss monitor lamp which lights up when clock loss occurs.

■ The procedure for displaying the measurement result is as follows:

2. Select a time display mode from the Time drop-down list box.

Elapsed	Displays the elapsed time.
Start	Displays the measurement start time.
Date & Time	Displays the current date and time.

Note

If an error rate exceeded specified one no the first measurement point when a Margin measurement start, measurement is a failure.

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6.7.4 Setting diagram measurement conditions

This section explains how to make the settings necessary for diagram measurement.

1. Select Repeat as the pattern input/output mode.

   1-1.Select Normal from the drop-down list box of the unit used for diagram measurement in the Pattern Mode group box on the Setup: Setup panel.

   1-2. To open the Pattern dialog box, press the Setup button of the unit used for delay measurement on the Setup: Pattern panel.

   1-3. Select Repeat from the Pattern Output or Pattern Input drop-down list box.

2. Open the Text Menu: Measurement panel.

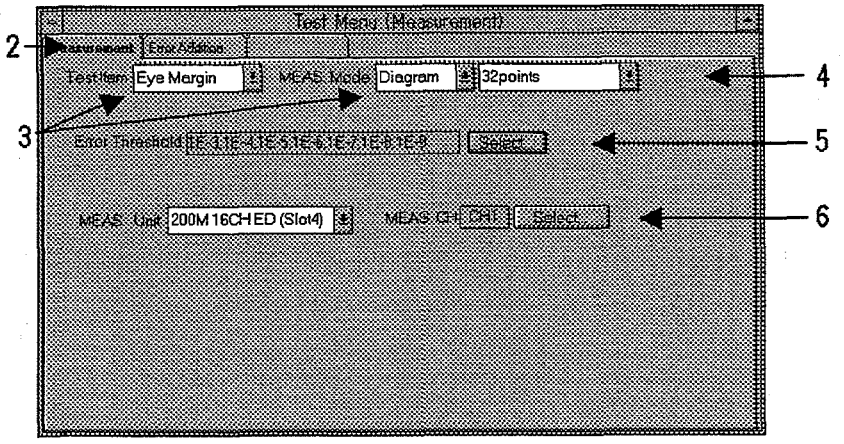


Fig. 6.-25 Test Menu: Measurement panel (diagram measurement)

3. Select Eye Margin from the Test Item drop-down list box. Select Diagram from the MEAS. Mode drop-down list box.

4. Select the number of the points of the same error rate (8, 16, 32, or 64) from the drop-down list box on the right of the MEAS. Mode drop-down list box.

5. Select an error rate. Press the Select button (1) to open the Threshold Select dialog box. After checking the error rate of the points to be plotted in the two-dimensional space shown in Fig. 6-21(b), press the OK button to close the Threshold Select dialog box.

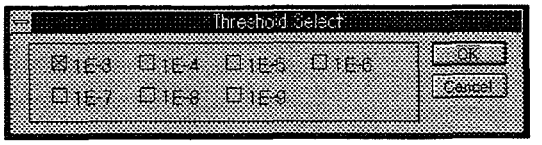


Fig. 6.-26 Threshold Select dialog box

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6. Press the Select button to open the Measurement CH Select dialog box. Press the option button of the channel subject to measurement, then press the OK button.

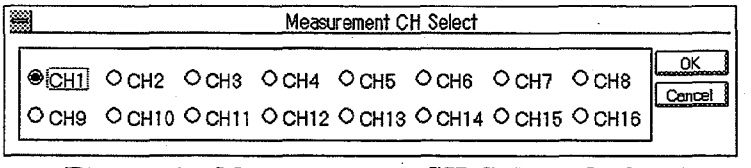


Fig. 6.-27 Measurement CH Select dialog box

7. This completes the setting. For how to start measurement, see Section 6.7.5, "Performing dialog Measurement."

Note

If you change the setting made on the Test Menu: Measurement panel after completion of measurement, then the result of the measurement completed directly before will be cleared.

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6.7.5 Performing diagram measurement

The Result subwindow is used to start, stop, or monitor measurement. Open the Result subwindow after making sure that Test Menu: Measurement panel is set as follows:

- Eye Margin has been selected from the Test Item drop-down list box.
- Diagram has been selected from the MEAS. Mode drop-down list box.

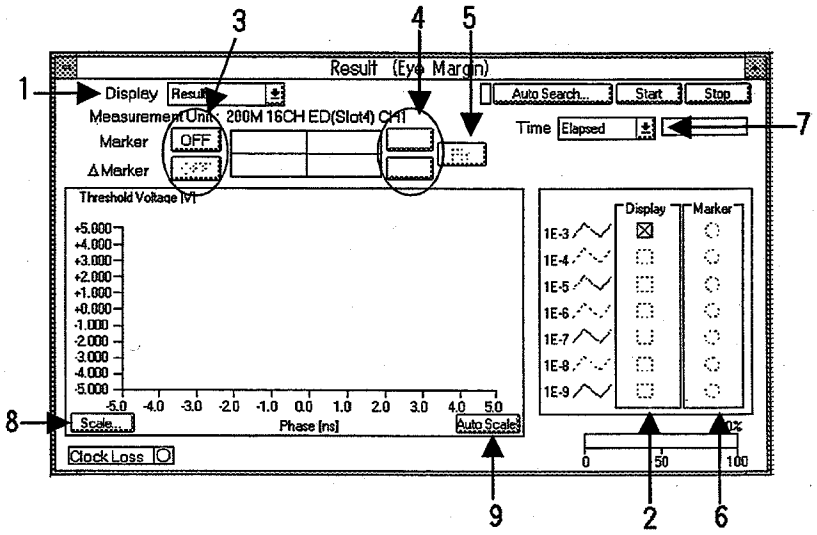


Fig. 6.-28 Result subwindow (diagram measurement)

Pressing the Start button in the upper-right corner of the subwindow will start measurement. Pressing the Stop button will stop measurement. During measurement, the gauge is displayed to indicate that measurement is being performed. In the lower-left corner of the subwindow is the Clock Loss monitor lamp which lights up when clock loss occurs.

Note

If an error rate exceeded specified one on first measurement point when a Diagram measurement start, measurement is a failure.

The Result subwindow allows you to change the scale of display of the measurement result or display a marker. In addition, you can switch between measurement results by specifying the corresponding error rates.

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■ The procedure for displaying the measurement result is as follows:

1. Select the measurement result you want to display, from the Display drop-down list box.

Result	Displays the result of the measurement completed directly before.
Recall Diagram	Displays the eye diagram measurement result read from the file. For how to read the measurement result, see Section 6.7.7, "Opening the diagram measurement result from the file."

2. Specify the error rate for the measurement result you want to display. Tick the corresponding error rate check button in the Display group box.

3. Turn on or off the marker. Press the button on the right of Marker or Δ Marker. Applications of the two marker are as follows:

Marker	A reference marker which indicates the absolute values of the threshold and phase at the marker position.
Δ Marker	A relative marker which indicates the distances of the threshold and phase from the reference marker.

4. Bring a marker into focus. Pressing the red cross button will bring the reference marker into focus. Pressing the blue cross button will bring the relative marker into focus. The marker in focus can be moved with arrow keys and rotary encoder.

5. Specify a marker movement mode. Press the button. The selected mode will appear on the button. There are the following two marker movement modes:

Fix	Moves the marker along plotted measurement result.
Free	Moves the marker within the display area irrespective of the measurement result.

6. When you have selected Fix, select the measurement result on which the marker is to be located. Select it by pressing the corresponding option switch in the Marker group box.

7. Select a time display mode from the Time drop-down list box.

Elapsed	Displays the elapsed time.
Start	Displays the measurement start time.
Date & Time	Displays the current date and time.

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8. Set the scales of the threshold axis and the phase axis respectively. Press the Scale button. The Scale dialog box will open.

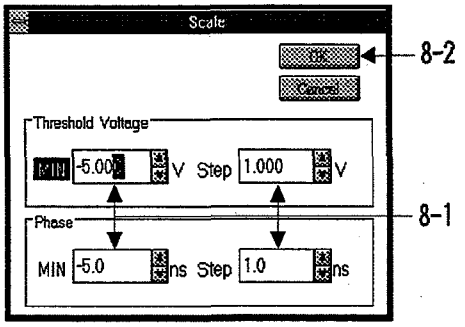


Fig. 6.-29 Scale dialog box

8-1. Enter the minimum values and graduations of the threshold and phase. The setting ranges are as follows:

Setting item	Setting range
MIN(Threshold)	-5.000 V to 4.950 V
Step(Threshold)	0.005 V to 1.000 V
MIN(Phase)	-5.0 ns to 4.0 ns
Step(Phase)	0.1 ns to 1.0 ns

8-2 Press the OK button to define the setting made above. To cancel them, press the Cancel button.

9. 8-1. To adjust the scale automatically so that the entire measurement result is included in the display area, press the Auto Scale button.

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■ Moving Markers

To move markers, use the arrow keys or rotary encoder at the front of the main unit. Marker movements depend on the selected movement mode. Functions of the marker movement keys are described below.

Fix mode	
Turing clockwise	Move the marker clockwise along the measurement points.
Turning counterclockwise	Move the marker counter clockwise along the measurement points.
↑、→key	Move the marker clockwise along the measurement points.
↓、←key	Move the marker counterclockwise along the measurement points.

Free mode	
Turning clockwise	Moves the marker to the right when ○ is displayed on the vertical bar of the marker. Moves the marker up when ○ is displayed on the horizontal bar of the marker.
Turning counterclockwise	Moves the marker to the left when ○ is displayed on the vertical bar of the marker. vertical bar of the marker. Moves the marker down when ○ is displayed on the horizontal bar of the marker.
↓key	Move the marker down.
↑key	Move the marker up.
←key	Move the marker to the left.
→key	Moves the marker to the right.
Shift + Enter	Change the ○ position.
Clock size of the Markers	Change the ○ position.

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6.7.6 Saving the diagram measurement result

You can save the result of the eye diagram measurement made directly before, in a file.

1. Select Save from the File menu in the main window. The Save dialog box will open.

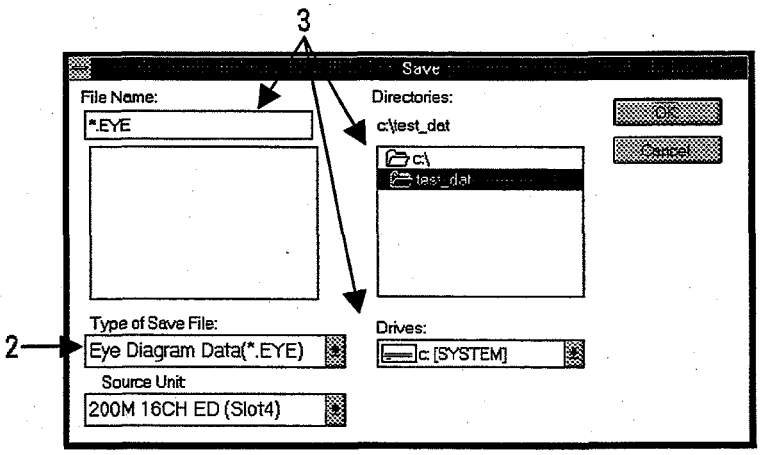


Fig. 6.-30 Save dialog box

2. Select Eye Diagram Data(*.eye) from the Type of Save File drop-down list box.

3. Specify the names of the drive, directory, and file, then press the OK button. Do not change the file name extension. You cannot use drive D to save the diagram measurement result.

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6.7.7 Opening the diagram measurement result saved in a file

You can open and display the diagram measurement result saved in a file. If a diagram measurement result file is opened, the result of the measurement made directly before will never be overwritten.

1. Select Open from the File menu in the main window. The Open dialog box will open.

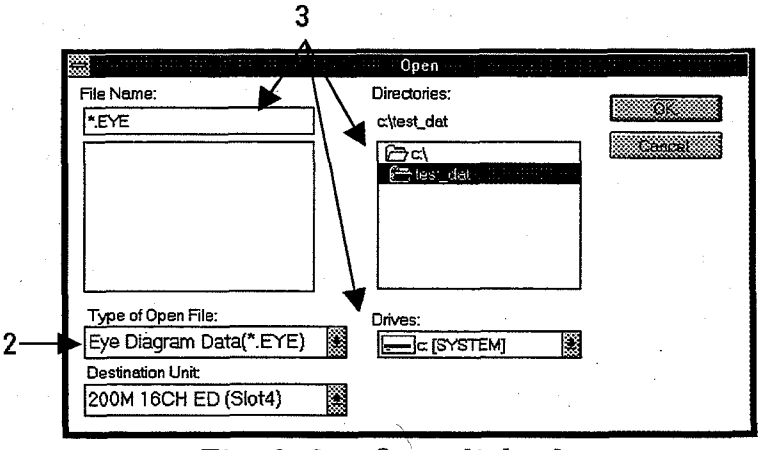


Fig. 6.-31 Open dialog box

2. Select Eye Diagram Data(*.eye) from the Type of Open File drop-down list box.

3. Specify the names of the drive, directory, and file, then press the OK button.

4. The opened measurement result can be displayed in the Result subwindow. Select Recall Diagram from the Display drop-down list box.

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6.7.8 Printing the measurement result

This section describes how to print out eye margin measurement result performed just before.

1. Open the Print dialog box by selecting Print in Tile menu of Mainwindow in finishing the measurement.

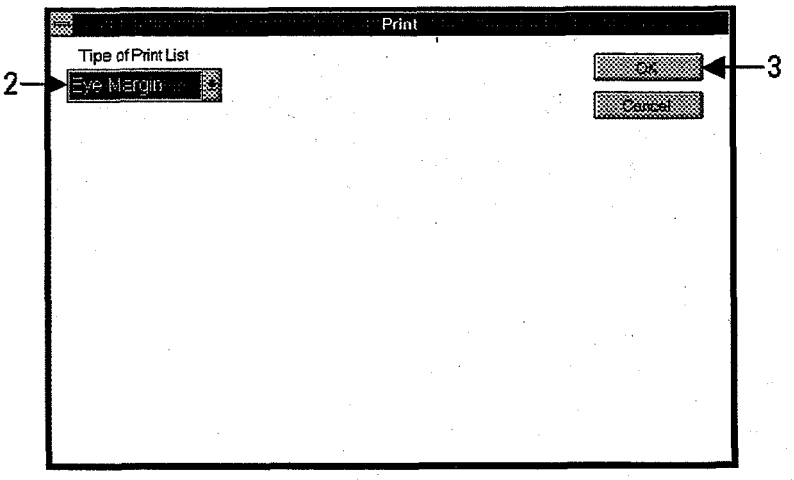


Fig. 6.-32 Print dialog box

2. Select the Eye Margin in Type of Print List drop down list box.

3. Press the OK button. Then the printing start.

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CHAPTER 7 APPLICABLE MEASUREMENT

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7.1.PDS Upstream Line (ONU→OSU) Test

This section describes an example of measurement when testing the PDS upstream line of 28.8Mb/s using sixteen optical network units (ONU) as shown in Fig 7-1.

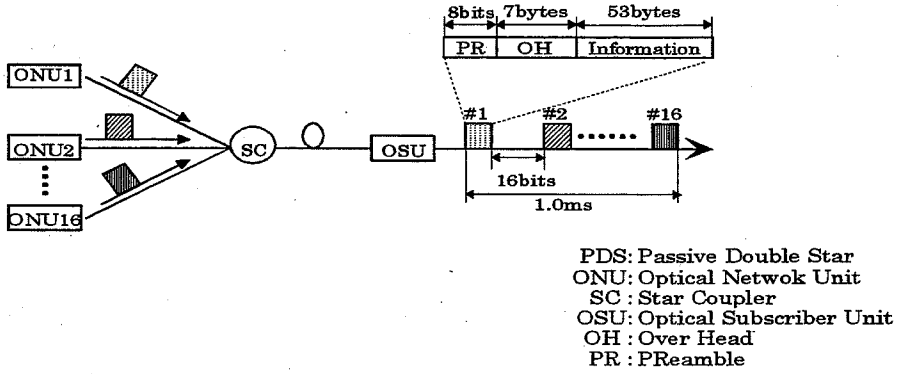


Fig 7-1 Example of PDS system

The description below assumes the unit configuration consisting of the followings:

Slot1 : MU163000A 200M clock generator unit
Slot3 : MU163020B 200M 16CH pulse pattern generator unit
Slot4 : MU163040B 200M 16CH error detector unit

(1) Setup

1. Connect the front panel as shown in Fig7-2. Establish the connection points to ONU and OSU as shown in Fig 7-3.

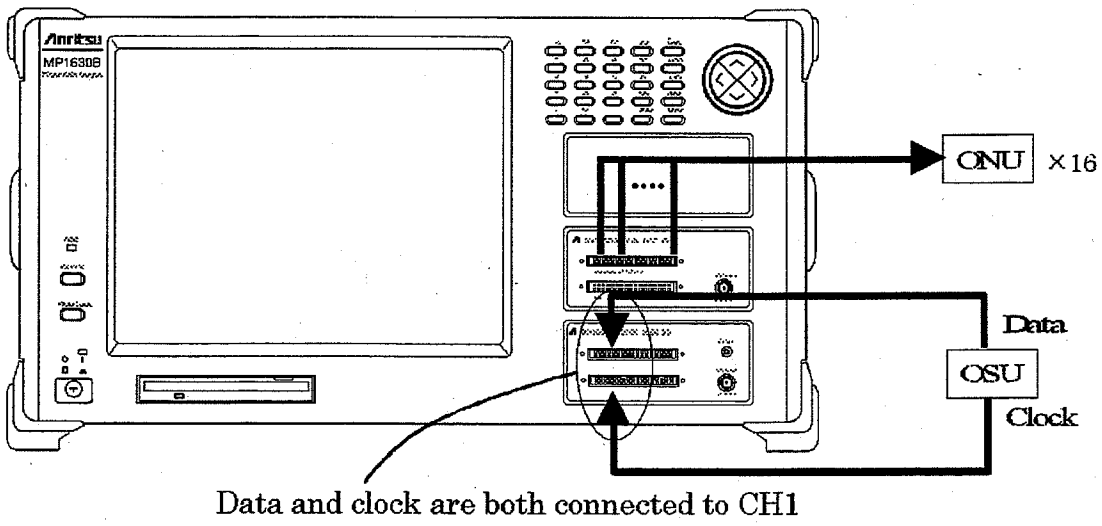


Fig7-2 Setup of front panel

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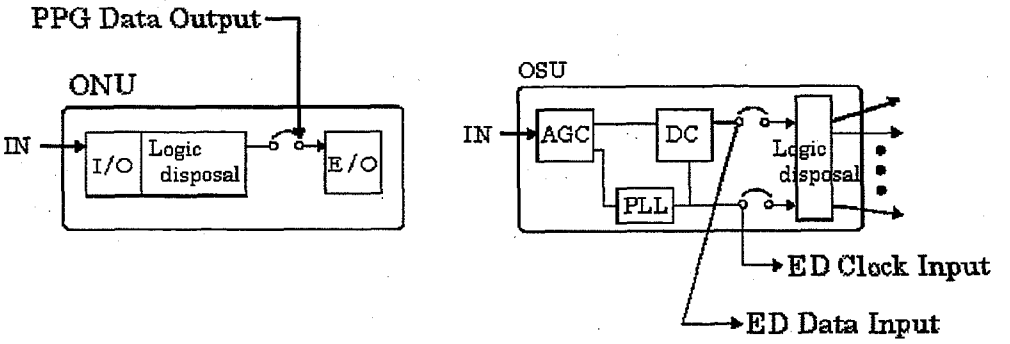


Fig 7-3 Connection points of ONU and OSU

2. Connect the back panel as shown in Fig 7-4.

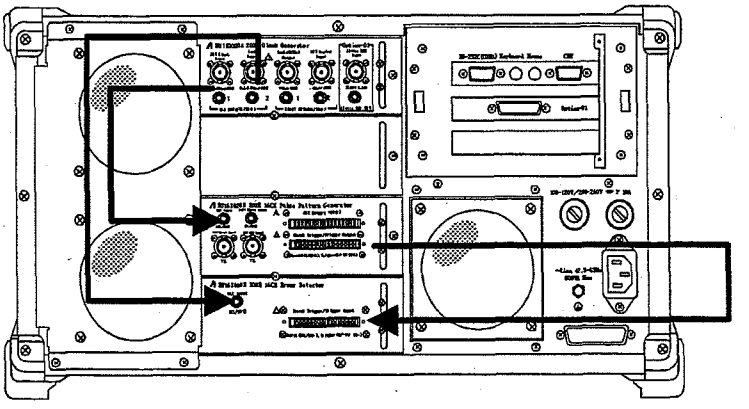


Fig 7-4 Setup of back panel

(2) Setting measurement conditions

1. Set each panel of the Setup sub-windows as shown in Table 7-1.

Table 7-1 Setting Setup sub-window (1/2)

Panel	Setting item	Set value	Reference
Setup	Pattern Common Setting	ON Sets the patterns for both PPG and ED units at the same time.	5.3.1 to 5.3.2
	Pattern Mode	PON	
	Data Output & Input Mode	Upside	
	Reference Clock	Clock1 Input Port	
	Clock Input Mode(ED)	Common(Clock1)	5.7
Frequency	Clock Source	INT	5.1※1
	Reference	INT	
	Frequency	28,800 kHz	

※1 MU163000A 200M Clock Generator Unit Operation Manual

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Table 7-1 Setting Setup sub-window (2/2)

Panel	Setting item	Set value	Reference
Clock I/F (PPG)	Grouping	ON→Sets all channels to one group.	6.1
	Polarity	POS	5.6.2
	Output Mode	Burst	
	Output	ON	
	Delay	※2	
	Level	TTL	
Clock I/F (ED)	Grouping	ON→Sets ALL channels to one group.	6.1
	Polarity	POS	
	Input Mode	Burst	
	Delay	※2	
	Termination	GND	
Data I/F (PPG)	Grouping	ON→ Sets ALL channels to one group.	6.1
	Output	ON	5.6.1
	Skew	※	
	Level	TTL	
Data I/F (ED)	Grouping	ON→ Sets ALL channels to one group.	6.1
	Level	TTL	5.6.3
Pattern (Common for PPG and ED)	Grouping	ON→ Sets ALL channels to one group.	6.1
	Enable CHs	16	5.3.4 — 5.3.6
	PR	8bits	
	PRGM Logic	POS	
	PRBS Pattern	PRBS15	
	Mark Ratio	1/2	
	Block	2	
	Block Detail	Column1 Length = 56 bits Column2 Length = 424 bits Column1 Pattern = PRGM Cokumn2 Pattern = PRBS	
	Auto Sync	Sets both PRGM and PRBS to ON	5.8
	Sync Threshold	Sets both PRGM and PRBS to 1E-2	
	Burst Sync Mode	EXT	
	Burst Mode	INT	5.3.3
	Burst Cycle	1.0ms	
	GT	16bits for all	

※2 Set Delay and Skew to appropriate values for synchronizing PPG with ED.

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2. Set the Test Menu sub-window panel as shown in Table 7-2.

Table 7-2 Setting Test Menu sub-window

Panel	Setting item	Set value	Reference
Measurement	Test Item	Error/Alarm	
	MEAS. Mode	Repeat	
	Meas. Time	00:00:00:10	5.10.2
	Error Detect Mode of all channels	ALL	
	Error Detect Block of all channels	ALL	

When setting the buzzer sounding or LED lighting conditions, set it in the dialog box opened by pressing the Buzzer or LED button, respectively.
When measuring EI, %EFI or error performance; set its measurement conditions in the dialog box opened by pressing the Setup button in the MEAS. Condition more information on setting, see section. "5.10.2 Setting measurement conditions."

3. Open and set the All panel of the Result sub-window as shown in Table7-3 to display the error count and alarm for all the channels.

Table7-3 Setting Result sub-window

Panel	Setting item	Set value	Reference
ALL	Display	Current	
	Error item to be displayed	Error Rate	5.10.3 (1)
	Time display mode	Elapsed	

Then press the Start button to start measurement.

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7.2Error Rate Measurement of Multiple Channel Optical Module

This section describes an example of measurement when testing the 8-channel E/O and O/E modules of 155.52 Mb/s (with electrical interface: ECL9).

The description below assumes the unit configuration consisting of the followings:

Slot1 : MU163000A 200M clock generator unit
Slot3 : MU163020B 200M 16CH pulse pattern generator unit
Slot4 : MU163040B 200M 16CH error detector

（1）Setup

1. Connect the front panel as shown in Fig7-5. The clock signal is looped back by the PPG and ED units.

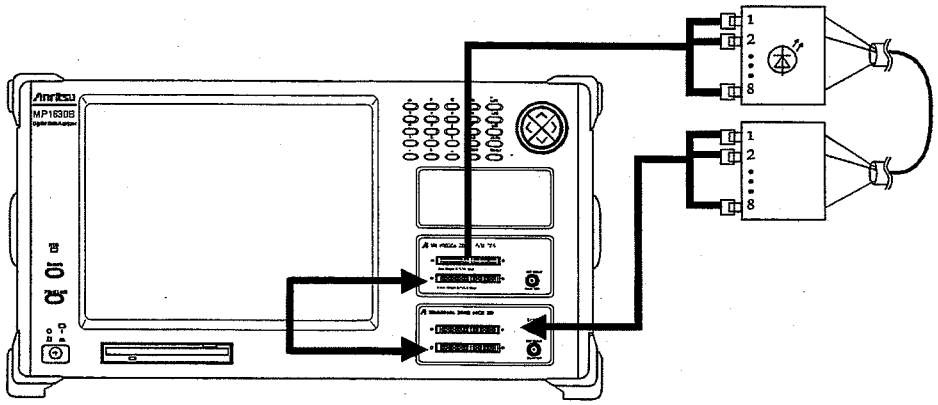


Fig7-5 Setup of front panel

2. Connect the back panel as shown inFig 7-6.

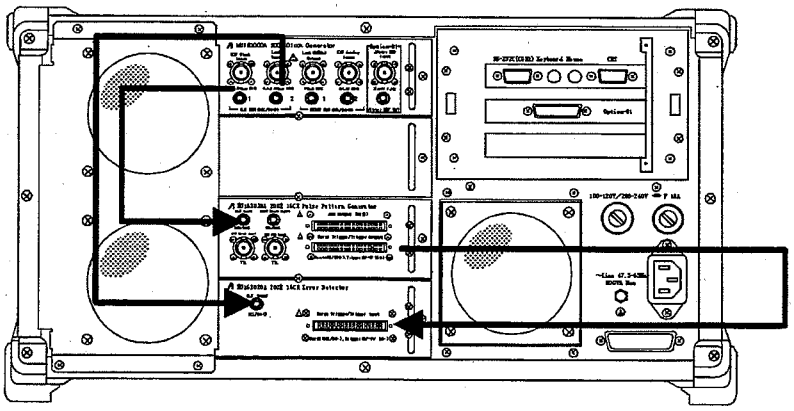


Fig 7-6 Setup of back panel

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(2) Setting measurement conditions

1. Set each panel of the Setup sub-window as shown in Table 7-4.

Table 7-4 Setting Setup sub-window

Panel	Setting item	Set value	Reference
Setup	Pattern Common Setting	ON Sets the patterns for both PPG and ED units at the same time.	5.3.1 to 5.3.2
	Pattern Mode	Normal	
Frequency	Clock Source	INT	5.1※1
	Reference	INT	
	Frequency	155,520 kHz	
Clock I/F (PPG)	Grouping	Sets channels 1 to 8 to group 1.	6.1
	Polarity	POS	5.6.2
	Output	ON	
	Delay	0.0 ns	
	Level	PECL※2	
Clock I/F (ED)	Grouping	Sets channels 1 to 8 to group 1.	6.1
	Polarity	POS	5.6.4
	Termination	+3V	
	Delay	0.0 ns	
Data I/F (PPG)	Grouping	Sets channels 1 to 8 to group 1.	6.1
	Output	ON	5.6.1
	Skew	0.0 ns	
	Level	PECL※2	
Data I/F (ED)	Grouping	Sets channels 1 to 8 to group 1.	6.1
	Level	PECL	5.6.3
Pattern	Grouping	Sets channels 1 to 8 to group 1.	6.1
	Pattern Output/Input	Repeat	5.2
	Pattern	PRBS15	
	Mark Ratio	1/2	
	Auto Sync(PRBS)	ON	5.8
	Sync Loss Threshold(PRBS)	1E-2	

※1 MU163000A 200M Clock Generator Operation Manual

※2 Set the termination to50 ohm to +3V on the DUT side.

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2. Set the Test Menu sub-window panel as shown in the Table 7-5.

Table 7-5 Setting Test Menu sub-window

Panel	Setting item	Set value	Reference
Measurement	Test Item	Error/Alarm	5.10.2
	MEAS. Mode	Repeat	
	Meas. Time	00:00:00:10 (10seconds)	
	Error Detect Mode (CH1 to CH8)	ALL	
	Detect Block(CH1 to CH8)	Selected	

When setting the buzzer sounding or LED lighting conditions, set it in the dialog box opened by pressing the Buzzer or LED button, respectively.

When measuring EI, %EFI or error performance; set its measurement conditions in the dialog box opened by pressing the Setup button in the MEAS. Condition group box.

For more information on setting, see section. "5.10.2 Setting measurement conditions."

3. Open and set the All panel of the Result sub-window as shown in Table 7-6 to display the error count and alarm for all channels.

Table 7-6 Setting Result sub-window

Panel	Setting item	Set value	Reference
ALL	Display	Current	5.10.3 (1)
	Error item to be displayed	Error Rate	
	Time display mode	Elapsed	

Then press the Start button to start measurement.

When doubtful if both signals of the Data input and Clock input are in the optimum-phase relationship, press the Auto Search button to open the Auto Search dialog. In such a case, set the phase only so as to be searched as shown in Table 7-7 because the signal level and pattern gave already been set.

Table 7-7 Setting Auto Search dialog box

—	Setting item	Set value	Reference
Auto Search	Mode	Phase	5.9
	PRBS Pattern Search	OFF	
	Unit & CH Select	Check on the channels 1 to 8 of Slot4	

Press the Start button on the Auto Search to start the auto searching.

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7.3Measurement of SDH Module

This section descries an example of measurement when measuring the pattern with the multiplexed frame composition of SDH/SONET.
Using the MIX pattern simplifies the setting of the frame structure. An example is given by the setting of the pattern that generates the STM-1 frame with the structure as shown in Fig7-7.

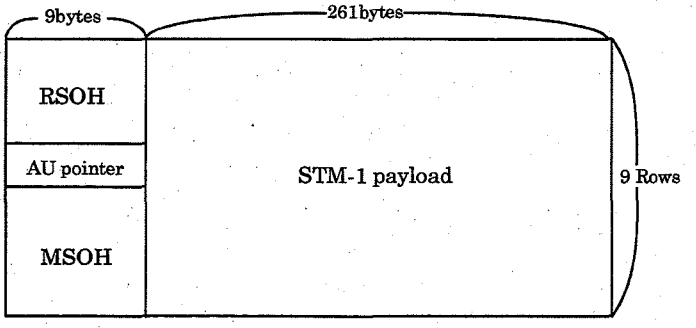


Fig7-7 STM-1 frame

The description below assumes that both PPG and ED performs measurement using channel 1 only, and the unit configuration is consisting of the followings:

Slot1 : MU163000A 200M clock generator unit
Slot3 : MU163020B 200M 16CH pulse pattern unit
Slot4 : MU163040B 200M 16CH error detector unit

(1) Setup

1. Connect the front panel as shown in Fig7-8. The clock signal is looped back by the PPG and ED units.

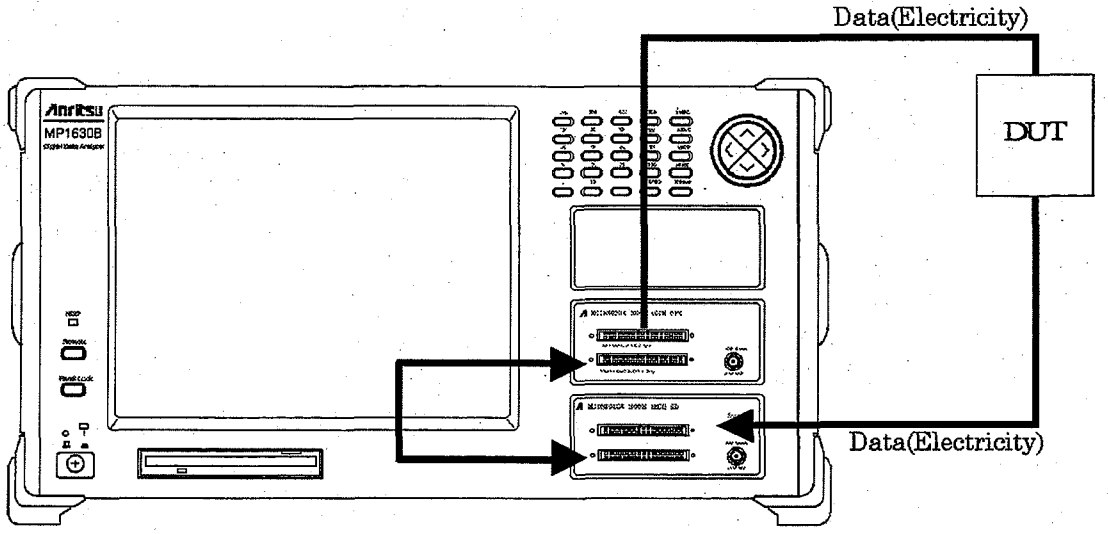


Fig7-8 Setup of front panel

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2. Connect the back panel as shown in Fig 7-9.

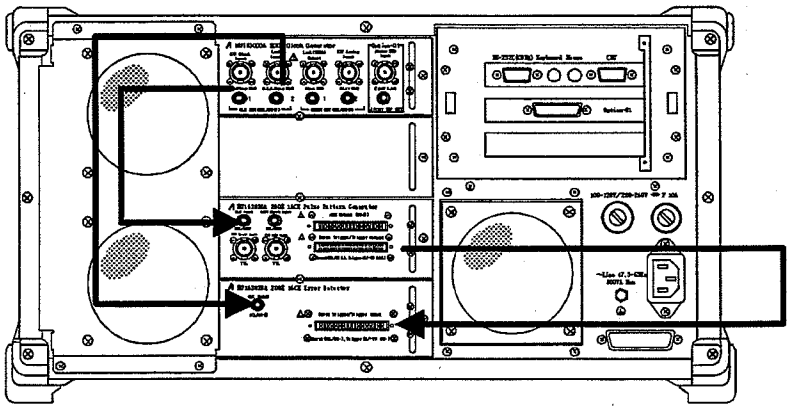


Fig7-9 Setup of front panel

(2) Setting measurement conditions

1. Set each panel of the Setup sub-window as shown in Table 7-8.

Table 7-8 Setting Setup sub-window(1/2)

Panel	Setting item	Set value	Reference
Setup	Pattern Common Setting	ON Sets the patterns for both PPG and ED units at the same time.	5.3.1 to 5.3.2
	Pattern Mode	Normal	
Frequency	Clock Source	INT	5.1※1
	Reference	INT	
	Frequency	155,520 kHz	
Clock I/F (PPG)	Grouping	OFF	6.1
	Polarity(CH1)	POS	5.6.2
	Output(CH1)	ON	
	Delay(CH1)	0.0 ns	
	Level(CH1)	ECL※2	
Clock I/F (ED)	Grouping	OFF	6.1
	Polarity(CH1)	POS	5.6.4
	Termination(CH1)	-2V	
	Delay(CH1)	0.0 ns	

※1 MU163000A 200M Clock generator unit Operation Manual

※2 Set the termination to 50 ohm to -2V on the DUT side.

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Table 7-8 Setting Setup sub-window(2/2)

Panel	Setting item	Set value	Reference
Data I/F (PPG)	Grouping	OFF	6.1
	Output(CH1)	ON	5.6.1
	Skew(CH1)	0.0 ns	
	Level(CH1)	ECL※2	
Data I/F (ED)	Grouping	OFF	6.1
	Level	ECL	5.6.3
Pattern	Grouping	OFF	6.1
	Pattern Output/Input	Repeat	5.2
	Pattern(CH1)	MIX	
	PRGM Logic	POS	
	PRBS Pattern	PRBS23	
	Mark Ratio	1/2	
	Row×Column	9 × 2	
	Block Detail	Column1 Length = 72 bits Column2 Length = 2,088 bits Column1 Pattern = PRGM Cokumn2 Pattern = PRBS	
	Auto Sync	Sets both PRGM and PRBS to ON	5.8
	Sync Loss Threshold	Sets both PRGM and PRBS to1E-2	
	Pattern Sync Mode	Normal	

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2. Set the Test Menu sub-window panel as shown in Table 7-9.

Table 7-9 Setting Test Menu sub-window

Panel	Setting item	Set value	Reference
Measurement	Test Item	Error/Alarm	
	MEAS. Mode	Repeat	
	Meas. Time	00:00:00:10 (10 Seconds)	5.10.2
	Error Detect Mode(CH1)	ALL	
	Detect Block(CH1)	Selected	
	Error Detected Block(s)	Column1: All OFF Column2: All ON ※1	

※1 In this setup, error rate of payload only is measured by removing the Column 1 block from the target of measurement.

When setting the buzzer sounding or LED lighting conditions; set it in the dialog box opened by pressing the Buzzer or LED button, respectively.
When measuring EI, %EFI or error performance; set its measurement condition in the dialog box opened by pressing the Setup button in the MEAS. Condition group box.
For more information on setting , see section."5.10.2 Setting measurement conditions."

3. Open and set the ALL panel of the Result sub-window as shown in Table 7-10 to display the error count and alarm for all the channels.

Table 7-10 Setting Result sub-window

Panel	Setting item	Set value	Reference
ALL	Display	Current	
	Error item to be displayed	Error Rate	5.10.3 (1)
	Time display mode	Elapsed	

Then press the Start button to start measurement.
When doubtful if both signals of the Data input and Clock input are in the optimum-phase relationship, press the Auto Search button to be searched as shown in Table 7-11 because the signal level and pattern have already been known and set.

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Table7-11 Setting Auto Search dialog box

—	Setting item	Set value	Reference
Auto Search	Mode	Phase	5.9
	PRBS Pattern Search	OFF	
	Unit & CH Select	Check on the channel 1 of Slot4.	

Press the Start button on the Auto Search to start the auto searching.

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CHAPTER 8 PERFORMANCE TEST

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8.1Outline

This chapter explains the procedure for testing whether the MU163020B 200M 16CH pulse pattern generator unit and MU163040B 200M 16CH error detector unit operate normally as a single device, respectively. The test items described in this chapter are as follows:

Testing MU163020B 200M 16CH pulse pattern generator unit

- Clock output interface
- Data output interface
- Burst trigger output interface
- AUX output interface
- Trigger output interface
- Sync output interface

Testing MU163040B 200M 16CH error detector unit

- Sync output interface
- Clock counter

When testing other functions, use a self-test software. The self-test software performs a functional test as a combination of the MU163020B 200M 16CH pulse pattern generator unit and MU163040B 200M 16Ch error detector unit.
For more information on the operation of the self-test software, see "CHAPTER 9 SELF-TEST."

Oscilloscope, frequency counter, clock generator are used in the procedure described in this chapter. The function performance which is required in each equipment is as follows.

(Oscilloscope)
Use the one that analog range is more than 1 GHz.

(Frequency counter)
Use the one that measurement range is 10kHz to 200MHz and resolution ability is less than 1 kHz. MF1600 series made by Anritsu is suitable.

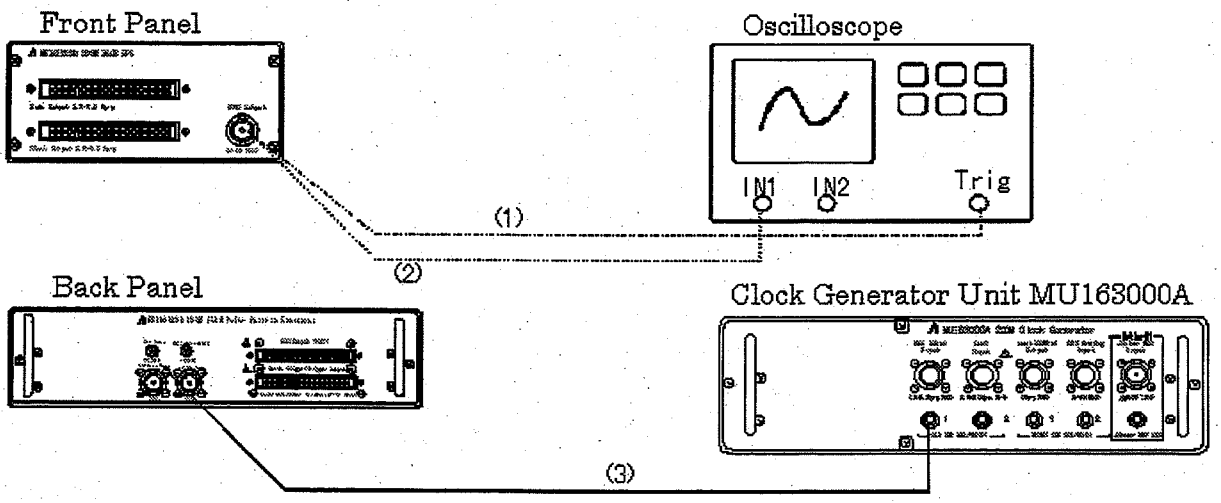
(Clock generator)
Use the one that output level is +4dBm to +10dBm/50ohm, frequency range is 10kHz to 200MHz, frequency accuracy is within ±2ppm. MU163000A of clock generator unit made by Anritsu for MP1630B.

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8.2Testing MU163020B 200M 16CH Pulse Pattern Generator

8.2.1 Sync Output Interface Test

The Sync output waveform of the MU163020B 200M 16CH pulse pattern generator is tested using an oscilloscope. The connection destination for each connector is shown in Fig8-1.



(1) Connect it to the trigger-input connector of an oscilloscope.
(2) Connect it to the signal-input connector of the oscilloscope.
(3) Connect it to the clock-output connector of the MU163000A 200M clock generator or of other clock generator.

Fig 8-1 Setup for testing Sync output

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the 0/-1V level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

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5. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level is within the range as shown in Fig 8-2.

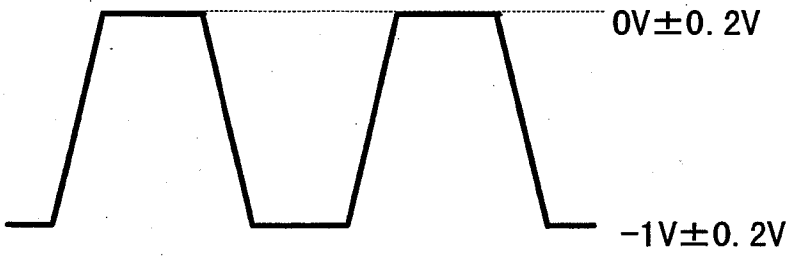
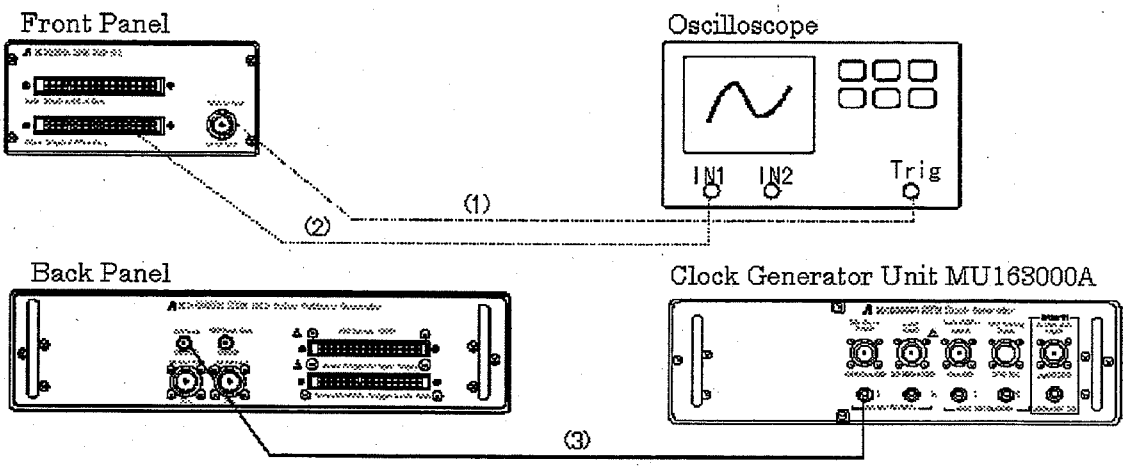


Fig 8-2 Specifications of Sync output waveform

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8.2.2 Clock Output Interface Test

The clock output waveform of the MU163020B 200M 16CH pulse pattern generator is tested using an oscilloscope. The connection destination for each connector is shown in Fig8-3.



(1) Connect it to the trigger-input connector of an oscilloscope.
(2) Connect it to the signal-input connector of the oscilloscope using the attached coaxial multi-pin cable with BNC connector.
(3) Connect it to the clock-output connector of the MU163000A 200M clock generator or of other clock generator.

Fig8-3 Setup for testing clock output

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(1) Testing TTL level signal

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the Level setting of the PPG unit (a target of the test) to "TTL" for all the channels using the "Setup:Clock I/F" panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the TTL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-4.

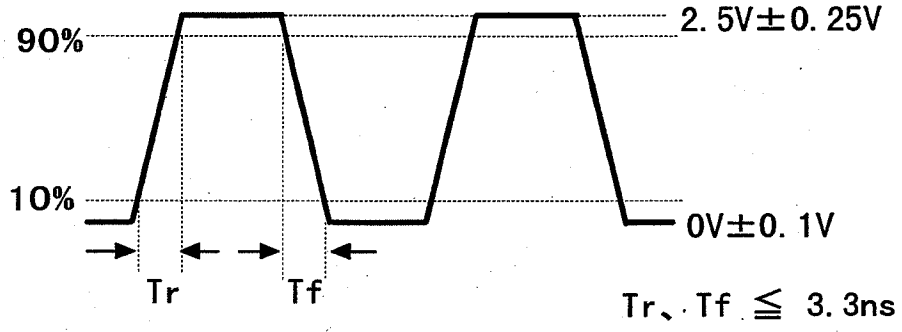


Fig8-4 Specifications of clock output waveform (TTL)

The level shown Fig 8-4 is a case that input impedance of oscilloscope is 50 ohm. It is a half level compared with a case that impedance is high.

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(2) Testing ECL level signal

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the Level setting of the PPG unit (a target of the test) to "ECL" for all the channels using the "Setup:Clock I/F" panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the ECL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate ECL terminator (50 ohm to -2V) corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-5.

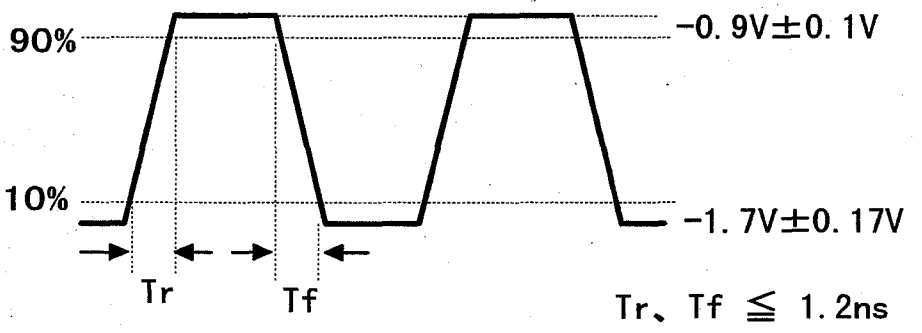


Fig8-5 Specifications of clock output waveform (ECL)

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(3) Testing PECL level signal

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the Level setting of the PPG unit (a target of the test) to "PECL" for all the channels using the "Setup:Clock I/F" panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the PECL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate PECL terminator (50 ohm to +3V) corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-6.

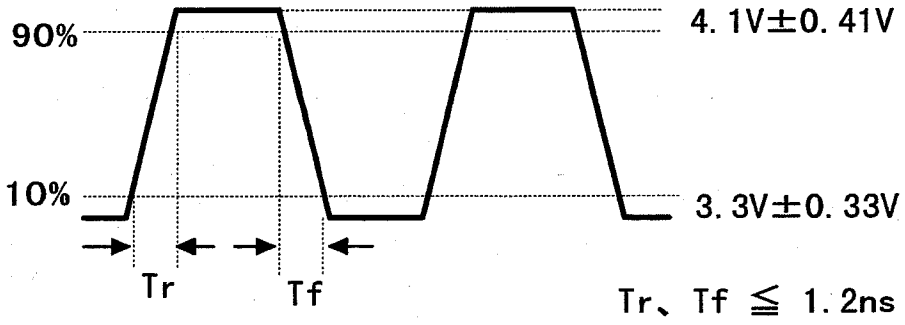


Fig8-6 Specifications of clock output waveform (PECL)

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(4) Testing LVTTL level signal

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the Level setting of the PPG unit (a target of the test) to "LVTTL" for all the channels using the "Setup:Clock I/F" panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the LVTTL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-7.

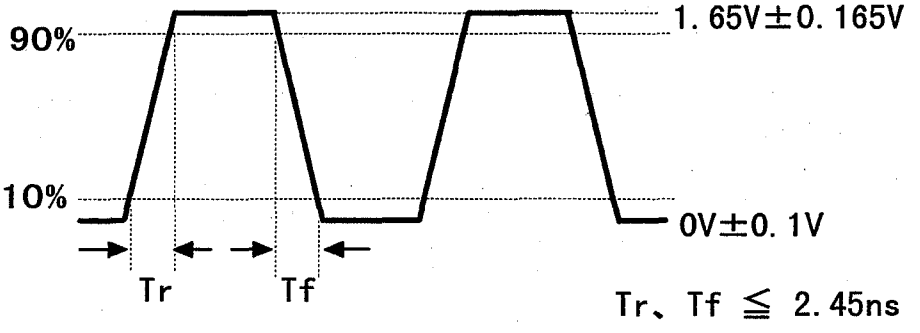


Fig 8-7 Specifications of clock output waveform (LVTTL)

The level shown Fig 8-7 is a case that input impedance of oscilloscope is 50 ohm. It is a half level compared with a case that impedance is high.

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(5) Testing VAR level signal (1/2)

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the clock interface setting of the PPG unit (a target of the test) for all the channels using the "Setup:Clock I/F" panel as shown below:

- Delay setting : Set -5.0ns.
- Level setting : Select「VAR」.
- Termination of DUT setting :Select「Open」.
- Amplitude setting : Set 0.50 Vpp.
- Offset setting : Set -4.500(Voh)

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the above-described levels are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-8.

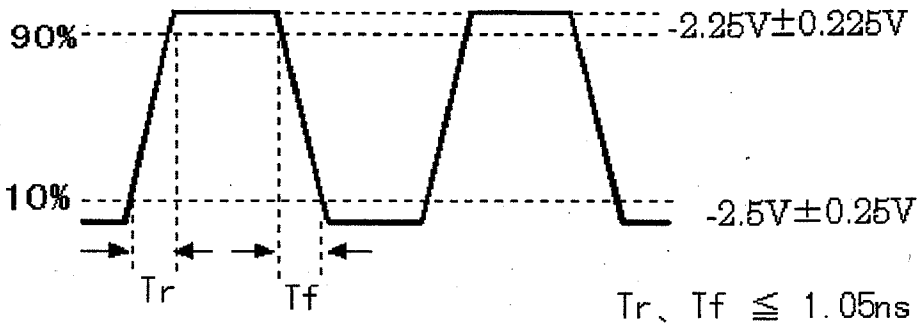


Fig8-8 Specifications of clock output waveform(VAR(1/2))

The level shown Fig 8-8 is a case that input impedance of oscilloscope is 50 ohm. It is a half level compared with a case that impedance is high.

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(6) Testing VAR level signal (2/2)

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the clock interface setting of the PPG unit (a target of the test) for all the channels using the "Setup:Clock I/F" panel as shown below:

- Delay setting : Set +5.0ns.
- Level setting : Select 「VAR」 .
- Termination of DUT setting :Select 「Open」 .
- Amplitude setting : Set 0.50 Vpp.
- Offset setting : Set +5,000(Voh)

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the above-described levels are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-9.

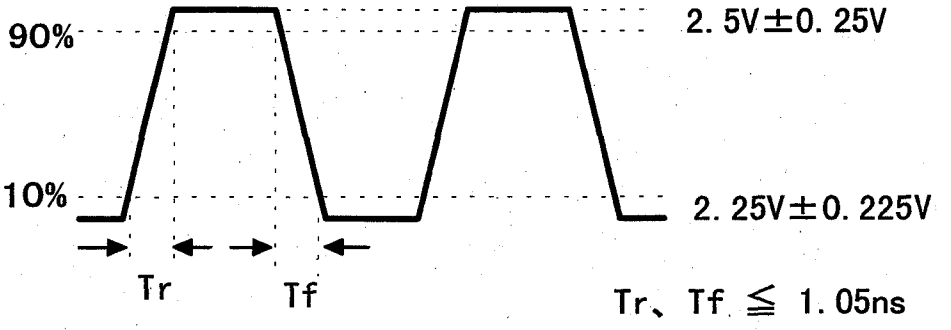


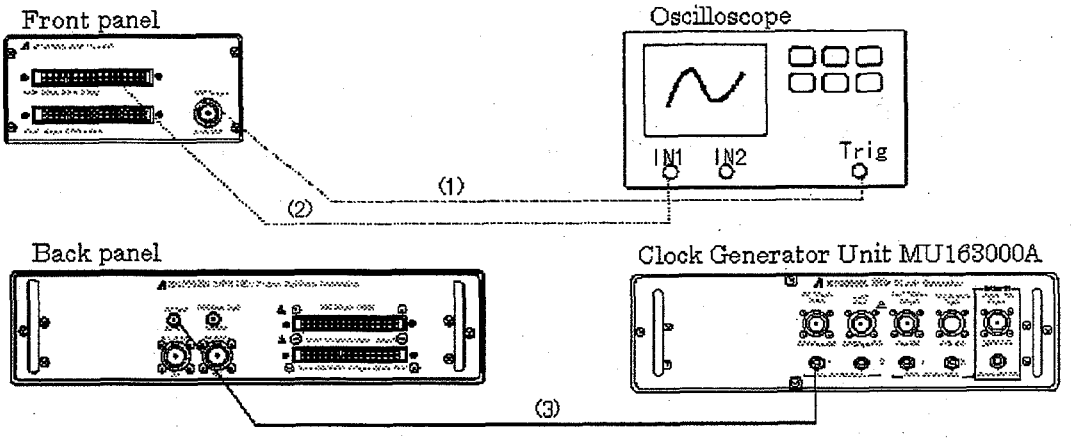
Fig8-9 Specifications of clock output waveform(VAR(2/2))

The level shown Fig 8-9 is a case that input impedance of oscilloscope is 50 ohm. It is a half level compared with a case that impedance is high.

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8.2.3 Data Output Interface Test

The data output waveform of the MU163020B 200M 16CH pulse pattern generator is tested using an oscilloscope. The connection destination for each connector is shown in Fig8-10.



(1) Connect it to the trigger-input connector of an oscilloscope.
(2) Connect it to the signal-input connector of the oscilloscope using the attached coaxial multi-pin cable with BNC connector.
(3) Connect it to the clock-output connector of the MU163000A 200M clock generator or of other clock generator.

Fig 8-10 Setup for testing data output

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(1) Testing TTL level signal

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the Level setting of the PPG unit (a target of the test) to "TTL" for all the channels using the "Setup:Data I/F" panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the TTL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-11.

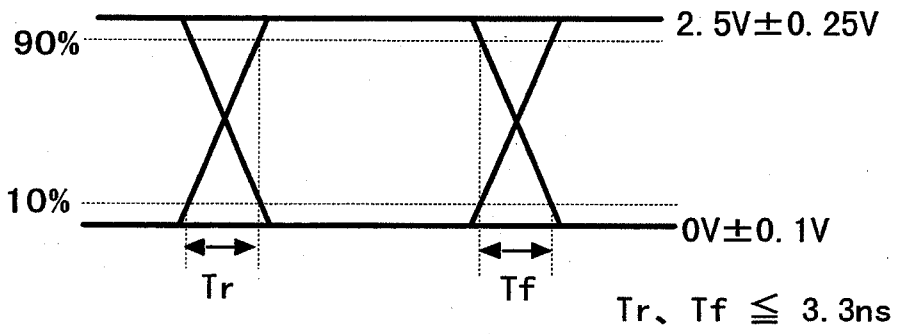


Fig8-11 Specifications of data output waveform(TTL)

The level shown Fig 8-11 is a case that input impedance of oscilloscope is 50 ohm. It is a half level compared with a case that impedance is high.

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(2) Testing ECL level signal

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the Level setting of the PPG unit (a target of the test) to "ECL" for all the channels using the "Setup:Data I/F" panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the ECL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate ECL terminator (50 ohm to -2V) corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-12.

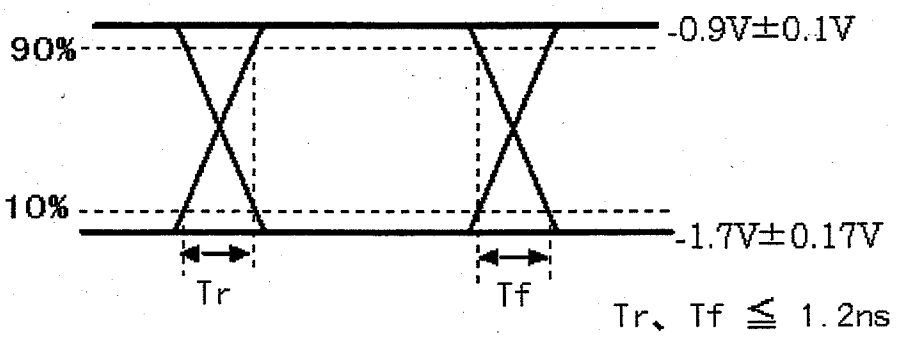


Fig8-12 Specifications of data output waveform(ECL)

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(3) Testing PECL level signal

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the Level setting of the PPG unit (a target of the test) to "PECL" for all the channels using the "Setup:Data I/F" panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the PECL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate PECL terminator (50 ohm to +3V) corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-13.

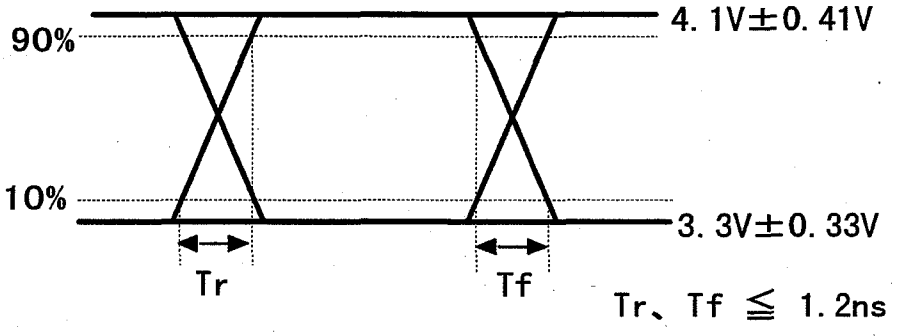


Fig8-13 Specifications of data output waveform(PECL)

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（4）Testing LVTTL level signal

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the Level setting of the PPG unit (a target of the test) to "LVTTL" for all the channels using the "Setup:Data I/F" panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the LVTTL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-14.

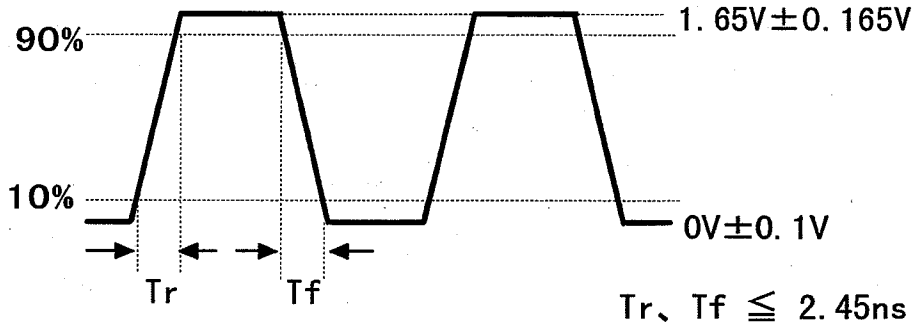


Fig 8-14 Specifications of clock output waveform (LVTTL)

The level shown Fig 8-14 is a case that input impedance of oscilloscope is 50 ohm. It is a half level compared with a case that impedance is high.

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(5) Testing VAR level signal (1/2)

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the clock interface setting of the PPG unit (a target of the test) for all the channels using the "Setup:Data I/F" panel as shown below:

- Delay setting : Set -5.0ns.
- Level setting : Select 「VAR」 .
- Termination of DUT setting :Select 「Open」 .
- Amplitude setting : Set 0.50 Vpp.
- Offset setting : Set -4.500(Voh)

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the above-described levels are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-15.

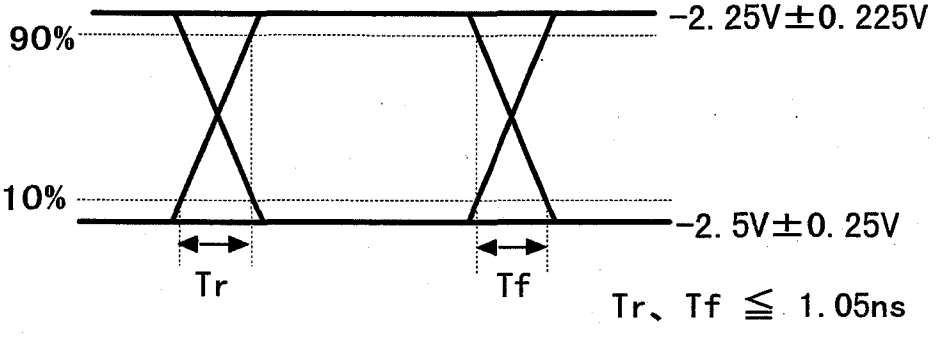


Fig8-15 Specifications of data output waveform(VAR(1/2))

The level shown Fig 8-15 is a case that input impedance of oscilloscope is 50 ohm. It is a half level compared with a case that impedance is high.

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(6) Testing VAR level signal (2/2)

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Set the clock interface setting of the PPG unit (a target of the test) for all the channels using the "Setup:Data I/F" panel as shown below:

- Delay setting : Set +5.0ns.
- Level setting : Select「VAR」.
- Termination of DUT setting :Select「Open」.
- Amplitude setting : Set 0.50 Vpp.
- Offset setting : Set +5,000(Voh)

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the above-described levels are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level and the rise/fall delay time are within the range as shown in Fig 8-16.

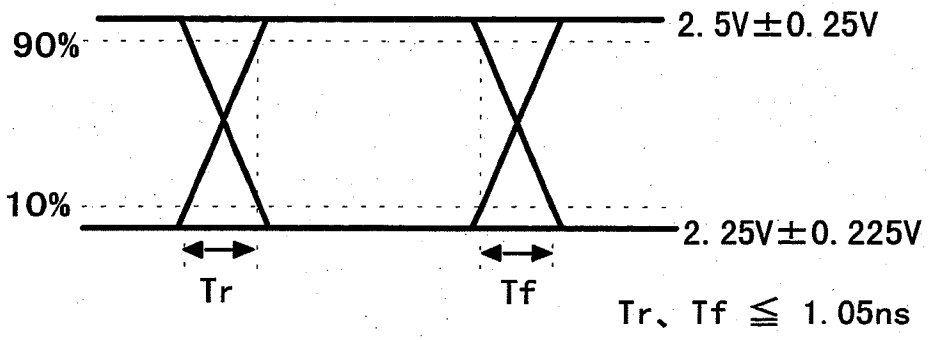


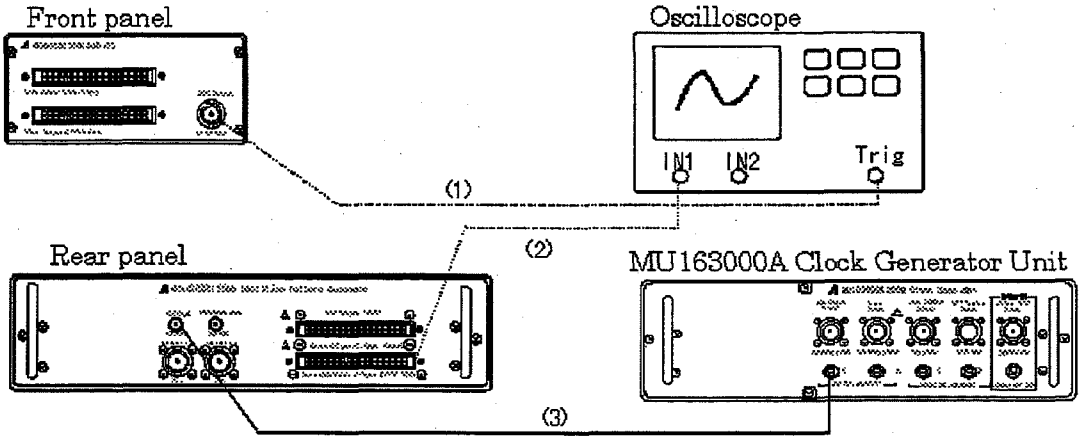
Fig8-16 Specifications of data output waveform(VAR(2/2))

The level shown Fig 8-16 is a case that input impedance of oscilloscope is 50 ohm. It is a half level compared with a case that impedance is high.

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8.2.4.Burst Trigger Output Interface Test

The clock output waveform of the MU163020B 200M 16CH pulse pattern generator is tested using an oscilloscope. The connection destination for each connector is shown in Fig8-17.



(1) Connect it to the trigger-input connector of an oscilloscope.

(2) Connect it to the signal-input connector of the oscilloscope using the attached coaxial multi-pin cable with BNC connector.

(3) Connect it to the clock-output connector of the MU163000A 200M clock generator or of other clock generator.

Fig 8-17 Setup for testing burst trigger output

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
5. Select Pattern Mode setting of the PPG unit to "PON" on Setup:Setup panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the ECL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate ECL terminator (50 ohm to -2V) corresponding to the input level rating of the oscilloscope.

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6. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level is within the range as shown in Fig 8-18.

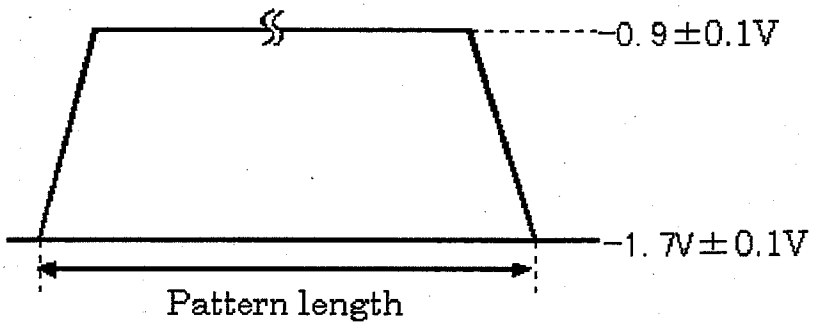
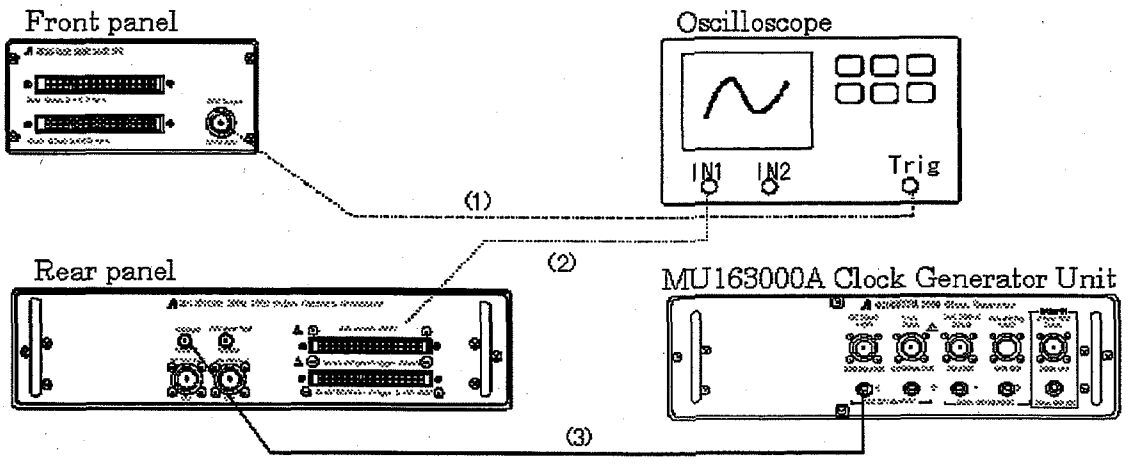


Fig 8-18 Specifications of burst trigger output waveform

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8.2.5.AUX Output Interface Test

The AUX output waveform of the MU163020B 200M 16CH pulse pattern generator is tested using an oscilloscope. The connection destination for each connector is shown in Fig8-19.



(1) Connect it to the trigger-input connector of an oscilloscope.

(2) Connect it to the signal-input connector of the oscilloscope using the attached coaxial multi-pin cable with BNC connector.

(3) Connect it to the clock-output connector of the MU163000A 200M clock generator or of other clock generator.

Fig 8-19 Setup for testing AUX output

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set Pattern Output setting of the PPG unit to "Burst" on Setup:Pattern panel.
4. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
5. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
6. Confirm that the display of Output Port Level (No1 to No9) of the PPG unit (a target of the test)is "ECL" on Setup:AUX I/F panel.

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CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the ECL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate ECL terminator (50 ohm to -2V) corresponding to the input level rating of the oscilloscope.

7. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level is within the range as shown in Fig 8-20.

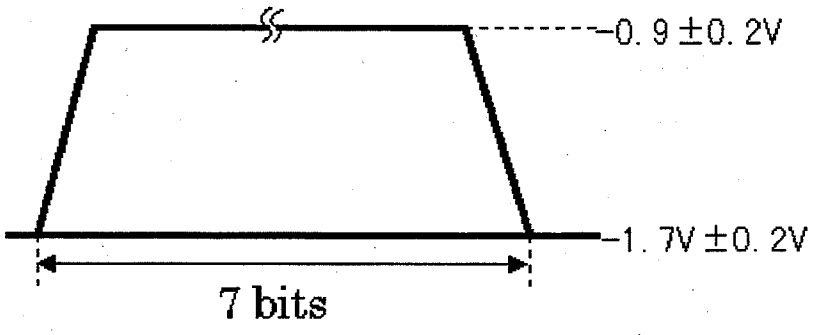


Fig 8-20 Specifications of AUX output waveform (ECL)

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(2) Testing TTL level signal

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set Pattern Output setting of the PPG unit to "Burst" on Setup:Pattern panel.
4. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
5. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
6. Select the level setting of the PPG unit (a target of the test) to "TTL" on Setup:AUX I/F panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the TTL level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Make input of oscilloscope high impedance certainly.

7. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level is within the range as shown in Fig 8-21.

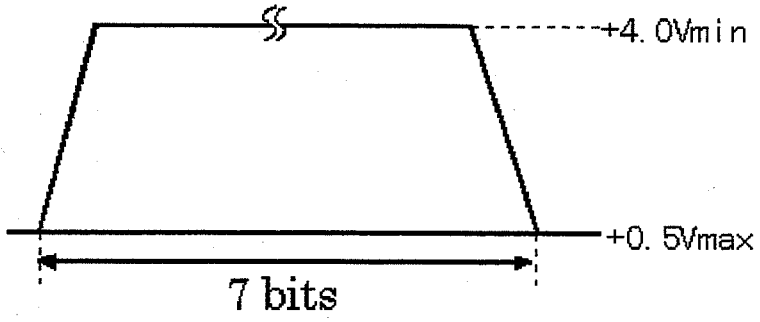
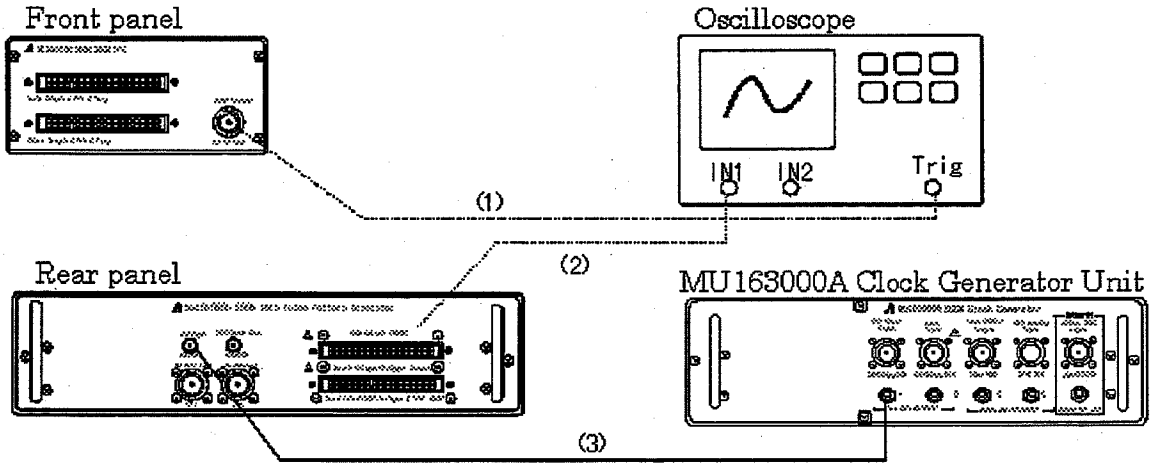


Fig 8-21 Specifications of AUX output waveform (TTL)

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8.2.6.Trigger Output Interface Test

The trigger output waveform of the MU163020B 200M 16CH pulse pattern generator is tested using an oscilloscope. The connection destination for each connector is shown in Fig8-22.



(1) Connect it to the trigger-input connector of an oscilloscope.

(2) Connect a pin which is the right most (pin No 17, 34 : refer to table 3.1(9)) to the signal-input connector of the oscilloscope using the attached coaxial multi-pin cable with BNC connector.

(3) Connect it to the clock-output connector of the MU163000A 200M clock generator or of other clock generator.

Fig 8-22 Setup for testing data output

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set Pattern Output setting of the PPG unit to "PON" on Setup:Setup panel.
4. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
5. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.
6. Select Trigger Output setting of the PPG unit (a target of the test) to "Block Timing" on Setup:Trigger I/F.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the 0/-1.0V level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

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7. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level is within the range as shown in Fig 8-23.

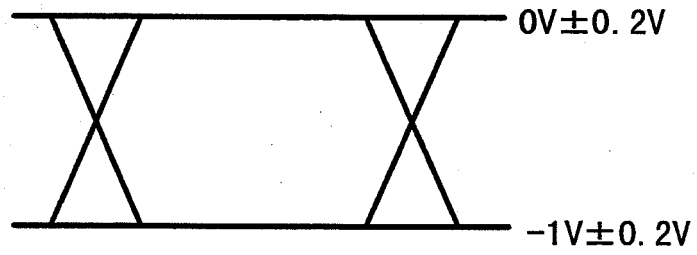


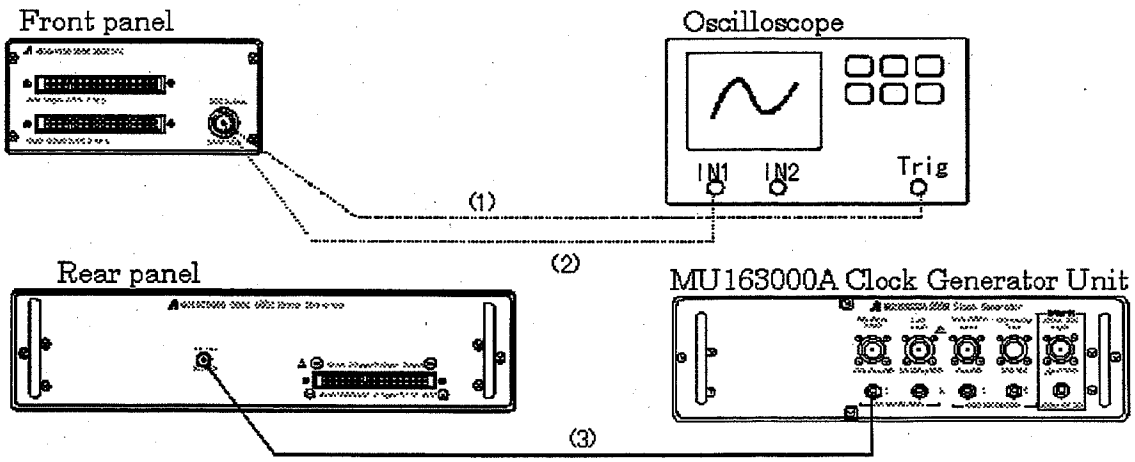
Fig8-23 Specifications of trigger output signal

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8.3.Testing MU163040B 200M 16CH Error Detector Unit

8.3.1. SYNC Output Interface Test

The SYNC output waveform of the MU163020B 200M 16CH pulse pattern generator is tested using an oscilloscope. The connection destination for each connector is shown in Fig8-24.



(1) Connect it to the trigger-input connector of an oscilloscope.

(2) Connect it to the trigger-input connector of the oscilloscope.

(3) Connect it to the clock-output connector of the MU163000A 200M clock generator or of other clock generator.

Fig 8-24 Setup for testing SYNC output

1. Remove all the connectors.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator unit, see section."5.1 Setting Frequency" of the MU163000A 200M Clock Generator unit Operation Manual. When using other product, see the operation manual attached to it.
4. Set Sync output setting of the PPG unit (a target of the test) to "1/1 Clock Sync" or "1/8 Clock Sync" on Setup:Trigger panel.

CAUTION ⚠

Before connecting the connectors, confirm that the oscilloscope is correctly set up. Otherwise, signals of the 0/-1V level are output directly to the oscilloscope, which may damage the input circuit of the oscilloscope. Use an appropriate attenuator corresponding to the input level rating of the oscilloscope.

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5. Connect a connector to the oscilloscope to display the output waveform of each channel. Confirm that the waveform level is within the range as shown in Fig 8-25

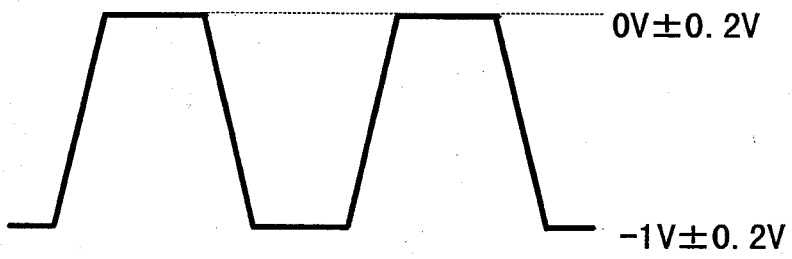
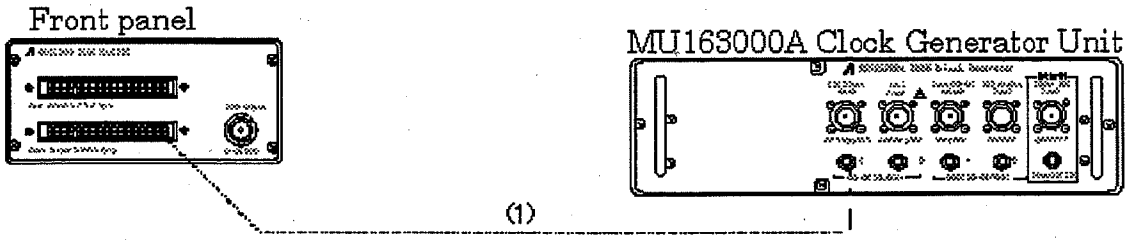


Fig 8-25 Specifications of SYNC output waveform.

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8.3.2.Clock Counter Test

The frequency counter function of the MU163040B 200M 16CH error detector is tested. The setup is shown in Fig 8-26.



(1) Connect it to the clock output connector of the clock generator using the attached coaxial multi-pin cable with SMA connector.

Fig 8-26 Setup for testing clock counter

1. Set the clock frequency to 200MHz. When using the MU163000A 200M clock generator, see section. "5.1 Setting Frequency" of the MU163000A 200M Clock Generator Unit Operation Manual. When using other product, see the operation manual attached to it.
2. Select Initialize on the File menu of the main window to initialize all the settings.
3. Open the "Result:All" panel and start error alarm measurement.
4. Confirm that the result of the frequency measurement of each channel is within the range of 200MHz±2kHz.
5. Change the frequency of the clock generator to 10 kHz. Then, confirm that the result of the frequency measurement of each channel is within the range of 10kHz±0.1Hz.

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CHAPTER 9 SELF-DIAGNOSIS

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9.1What is Self-Diagnosis?

Determine whether a device operates normally. The self-diagnosis function executes the tests below that do not require peripheral equipment.

1. Alarm detection and release test
   Tests whether the device detects alarms in cases where they occur and whether the device erroneously detects an alarm in a case where no alarm occurs.
2. Frequency accuracy test
   Tests whether the MU163000A 200M clock generator normally outputs the set frequency and the MU163040B 200M 16CH error detector normally measures a frequency.
3. Input-output interface test
   Tests whether the data output level of the MU163020B 200M 16CH pulse pattern generator and data input threshold voltage of the MU163040B 200M 16CH error detector are normal.
4. Pattern generation and measurement test
   Tests whether the data patterns generated by the MU163020B 200M 16CH pulse pattern generator and those measured by the MU163040B 200M 16CH error detector are normal.
5. Synchronous determination test
   Tests whether the synchronous determination circuit of the MU163040B 200M 16CH error detector operates normally.
6. Error addition and measurement test
   Tests whether an error detected by the MU163020B 200M 16CH pulse pattern generator is measured by the MU163040B 200M 16CH error detector to normally add an error and detect an error.

Note

The self-diagnosis function is limited for use as follows:

The self-diagnosis function is available only when the MU163020B 200M 16CH pulse pattern generator and MU163040B 200M 16CH error detector are mounted in the MP1630B digital data analyzer. Those units may be mounted in either of slot 3 and slot 4.

The self-diagnosis function is not available when the MP1630B digital data analyzer control software operates. In this case, be sure to exit the control software before executing the self-diagnosis program.

A test code number and message are displayed for each self-diagnosis item. For details on each self-diagnosis item, see Section 9.4, "Detail Operation."

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9.2Connecting Devices

This section explains how to connect signals between units used before executing the self-diagnosis function. The required units below are as follows:

1) MU163000A 200M clock generator
2) MU163020B 200M 16CH pulse pattern generator
3) MU163040B 200M 16CH error detector

The following paragraphs show how to connect signals of each unit.

- Connecting signals of the MU163000A 200M clock generator

Figure 9-1 shows the rear view of the MU163000A 200M clock generator and how to connect its signals. When not using the MU163000A clock generator, go to the next step.

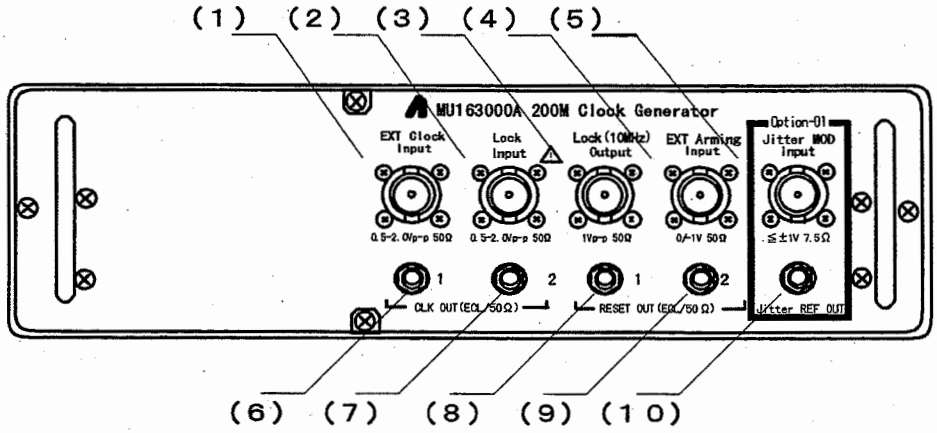


Fig. 9.-1 Rear view of clock generator

(6) CLK OUT 1

Connect to the CLK Input terminal on the rear of the MU163040B 200M 16CH error detector.

(7) CLK OUT 2

Connect to the CLK Input terminal on the rear of the MU163020B 200M 16CH pulse pattern generator.

To connect the input-output terminals in steps (1) to (5) and (8) to (10), do not connect cables.

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- Connecting signals of the MU163020B 200M 16CH pulse pattern generator

Figures 9-2 and 9-3 show the front and rear views of the pulse pattern generator and how to connect its signals.

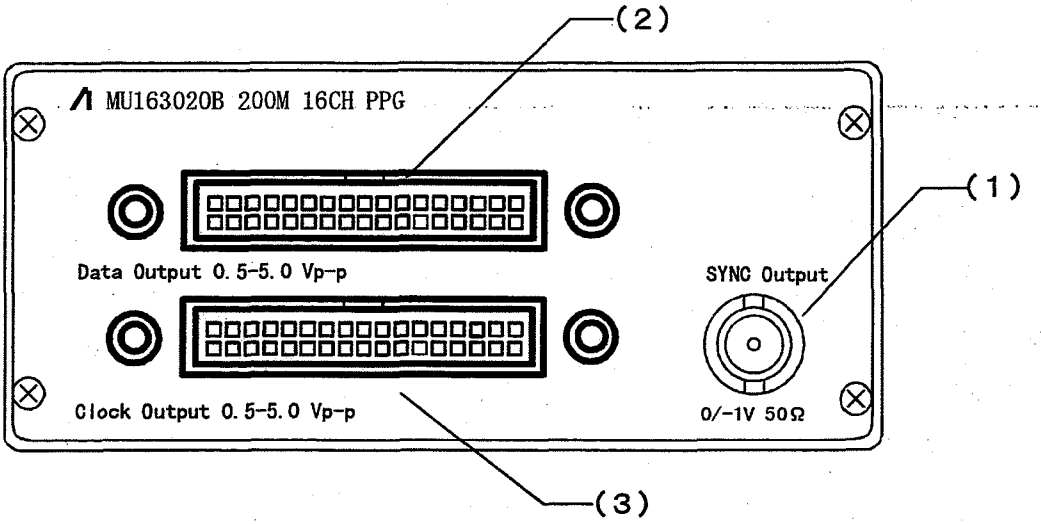


Fig. 9.-2 Front view of pulse pattern generator

(2) Data Output

Connect to the Data Input terminal on the front of the MU163040B 200M 16CH error detector.

(3) Clock Output

Connect to the Clock Input terminal on the front of the MU163040B 200M 16CH error detector.

Do not connect a cable to the output terminal in step (1).

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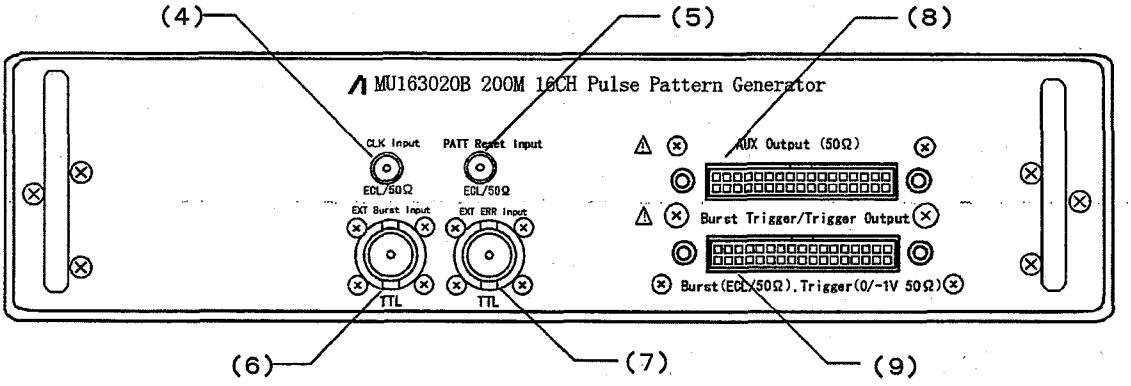


Fig. 9.-3 Rear view of pulse pattern generator

(4) CLK Input

Connect to CLK OUT1 on the rear of the MU163000A 200M clock generator. When not using the MU163000A, connect a clock (ECL/50 Ω) from an external clock source.

(9) Burst Trigger/Trigger Output

Connect to the Burst Trigger/Trigger Input on the rear of the MU163040B 200M 16CH error detector.

Do not connect a cable to the input-output terminals in steps (5) to (8).

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- Connecting signals of the MU163040B 16CH error detector

Figures 9-4 and 9-5 show the rear and front views of the error detector and how to connect its signals.

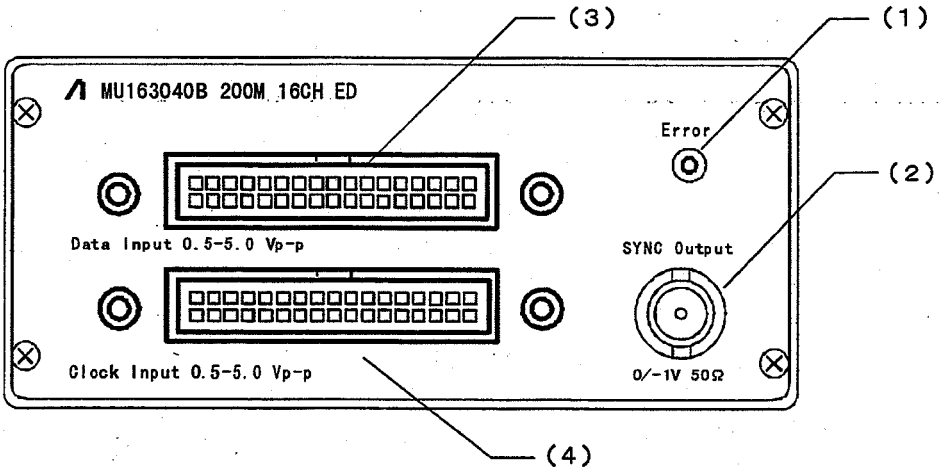


Fig. 9.-4 Front view of error detector

(1) Error LED.

(3) Data Input

Connect to the Data Output terminal on the front of the MU163020B 200M 16CH pulse pattern generator.

(4) Clock Input

Connect to the Clock Output terminal on the front of the MU163020B 200M 16CH pulse pattern generator.

Do not connect a cable to the output terminal in step (2).

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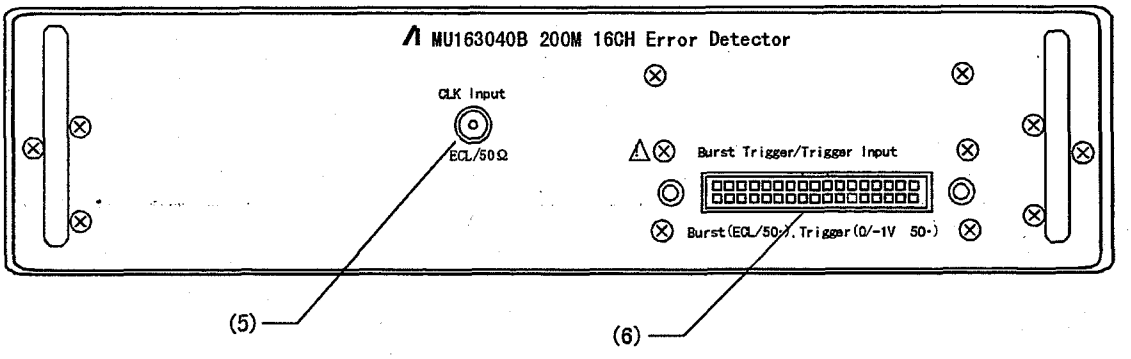


Fig. 9.-5 Rear view of error detector

(5) CLK Input

Connect to the CLK OUT2 terminal on the rear of the MU163000A 200M clock generator. When not using the MU163000A, this terminal need not be connected.

(6) Burst Trigger/Trigger Input

Connect to the Burst Trigger/Trigger Output on the rear of the MU163020B 200M 16CH pulse pattern generator.

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9.3Easy Operation

The self-diagnosis consists of the following four types of panels:

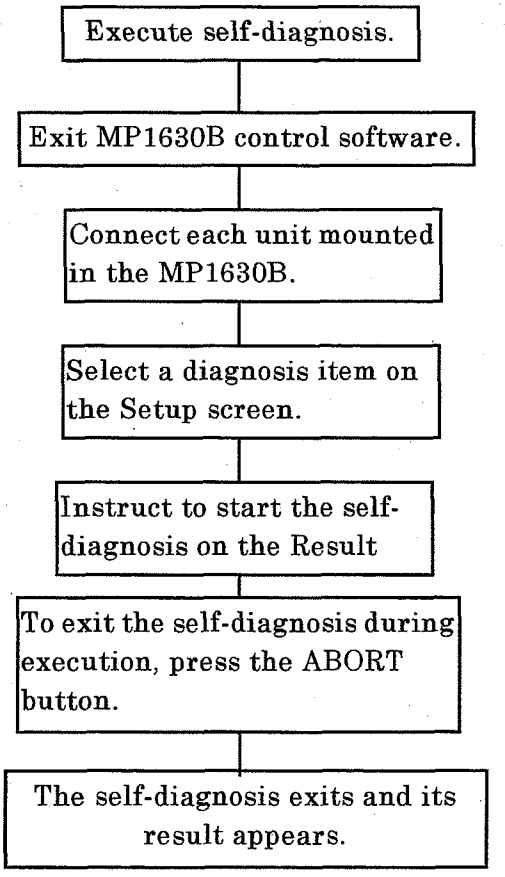
1) System panel
Displays the current state of the MP1630B.

2) Connection panel
Displays a connection diagram referenced to connect terminals on the front and rear of each unit depending on the current set state and device state.

3) Setup panel
Used to select the contents to be executed by the self-diagnosis program.

4) Result panel
Displays the self-diagnosis execution result.

The self-diagnosis is executed in the procedure below.



See Section 9.4.3.

See Section 9.4.4.

See Section 9.4.5.

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Note

The self-diagnosis is not available when the MP1630B control software operates. To execute the self-diagnosis, exit the MP1630B control software.

Further, when system operate mode is a state can measurement the power failure on the MP1630B control software in the System:System panel, depends on execution of self-diagnosis the pattern setting is clear up. For the system operate mode, see the Section 6.4,"Setting a system operate." in MP1630B Digital Data Analyzer Operation Manual.

The self-diagnosis is registered in the MP1630B group.

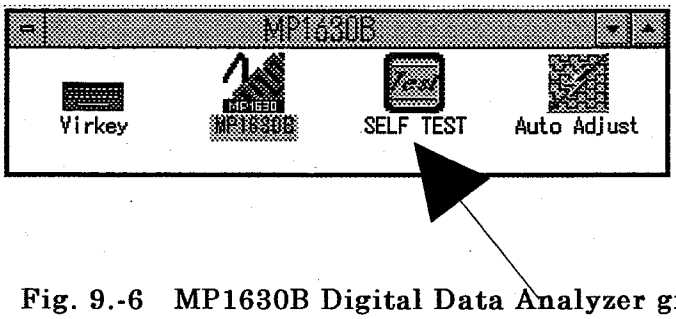


Fig. 9.-6 MP1630B Digital Data Analyzer group

The self-diagnosis is registered with icon name "MP1630B SELF TEST." Use this icon to start the self-diagnosis. For details on the screen operation and functions, see the subsequent chapters.

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9.4Detail Operation

This section explains how to operate the self-diagnosis screens.

9.4.1 Master window

Figure 9-7 shows the MP1630B Self-test master window.

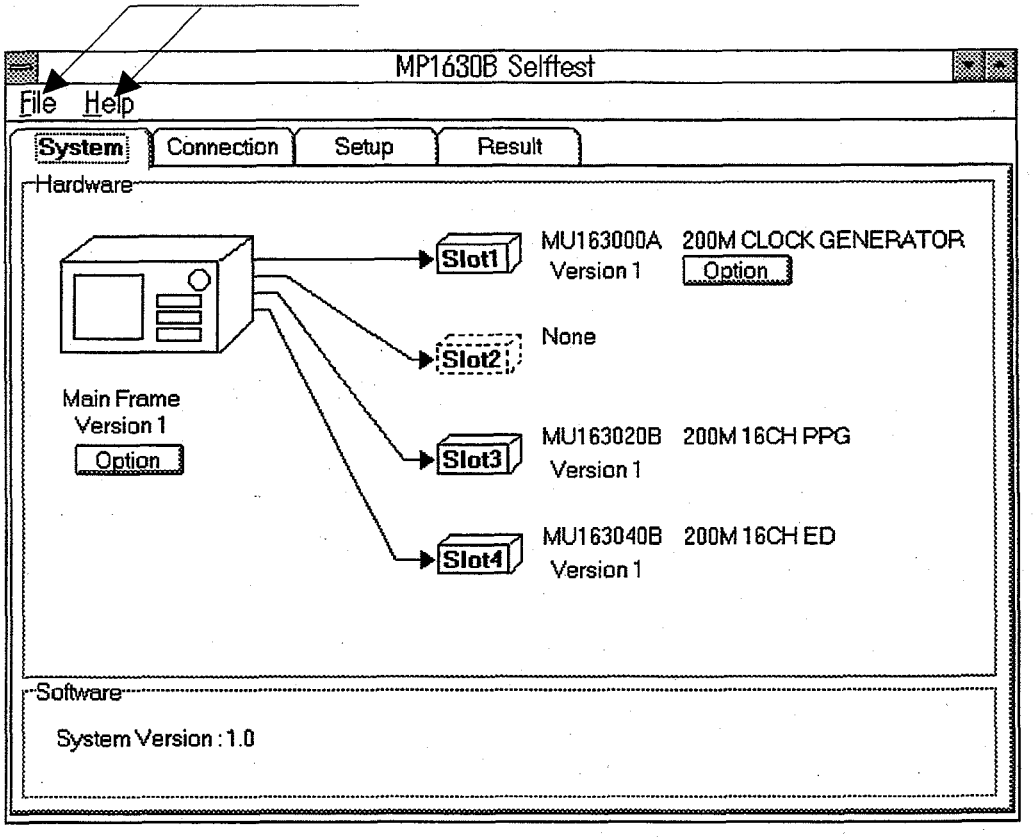


Fig. 9.-7 Master window screen

Menu configuration

- File pull-down menu

Save	Saves the self-diagnosis result in the test format by specifying a file name. Invalid when the self-diagnosis result does not exist.
Print	Outputs the self-diagnosis result to an external printer. Invalid when the self-diagnosis result does not exist.
Printer Setup	Sets an external printer.
Exit	Exits the self-diagnosis program.

- Help pull-down menu

About MP1630B Self-test	Displays self-diagnosis version information.

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9.4.2 System panel

Figure 9-8 shows the System panel.

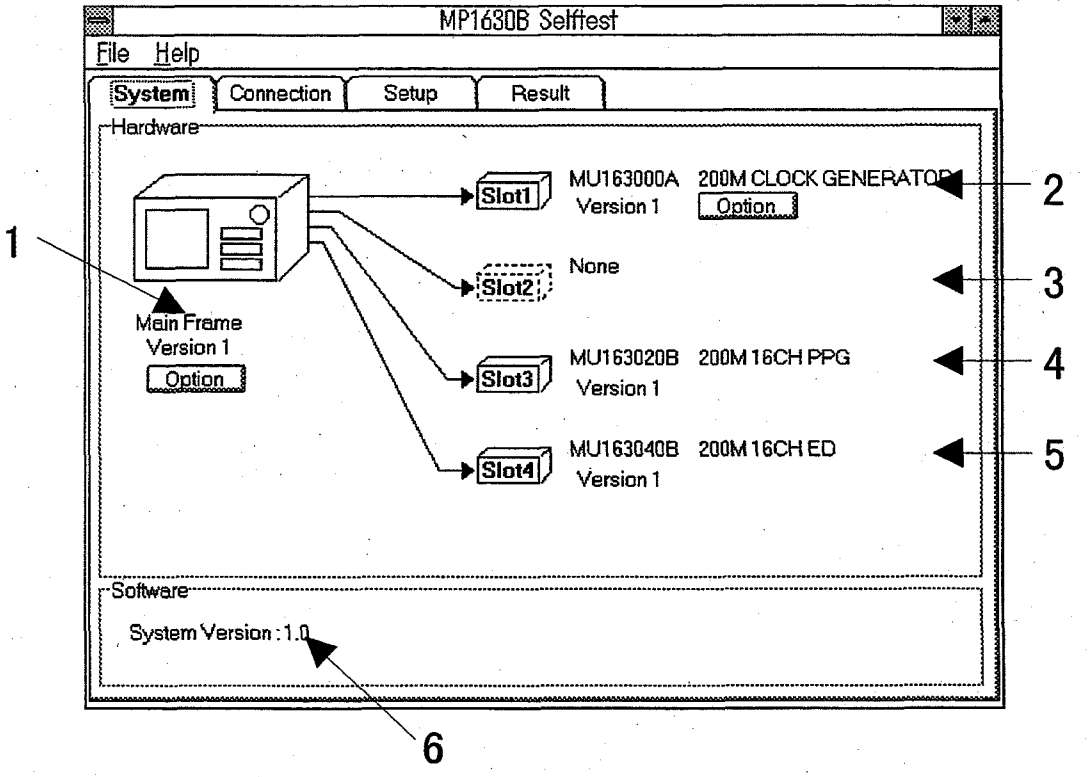


Fig. 9.-8 System panel

(1) Main Frame

Displays the supported options by pressing the version and option buttons on the main frame.

(2) Slot1

Displays the supported options by the version and option buttons of the unit mounted in slot 1.

(3) Slot2

Displays the supported options by the version and option buttons of the unit mounted in slot 2.

(4) Slot3

Displays the supported options by the version and option buttons of the unit mounted in slot 3.

(5) Slot4

Displays the supported options by the version and option buttons of the unit mounted in slot 4.

(6) Software Version

Displays the version of the self-diagnosis software.

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9.4.3 Connection panel

This section shows how to connect each mounted unit. Follow the contents displayed on the connection panel to connect signals between units. Figure 9-9 shows an example where the MU163000A is mounted in Slot1 and the MU163020B in Slot 3 and the MU163040B in Slot 4.

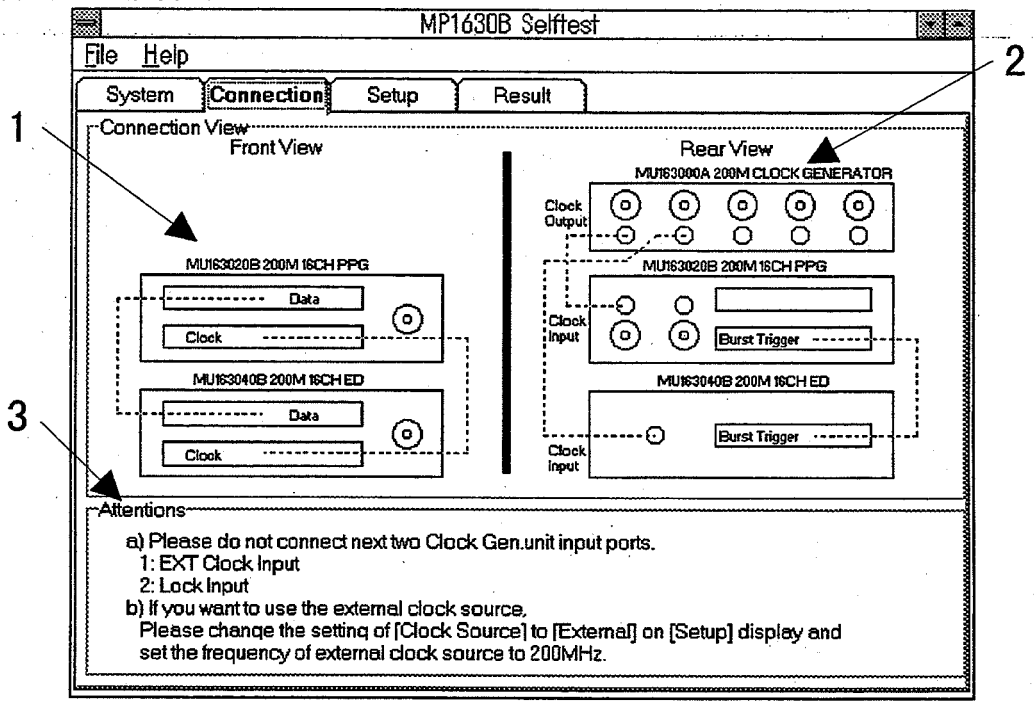


Fig. 9.-9 Connection panel

(1) Front View

Shows how to connect the connectors on the front panel.

(2) Rear View

Shows how to connect the connectors on the rear panel.

(3) Attentions

Lists cautions regarding connection.

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9.4.4 Setup panel

On the Setup panel, select a self-diagnosis execution item.

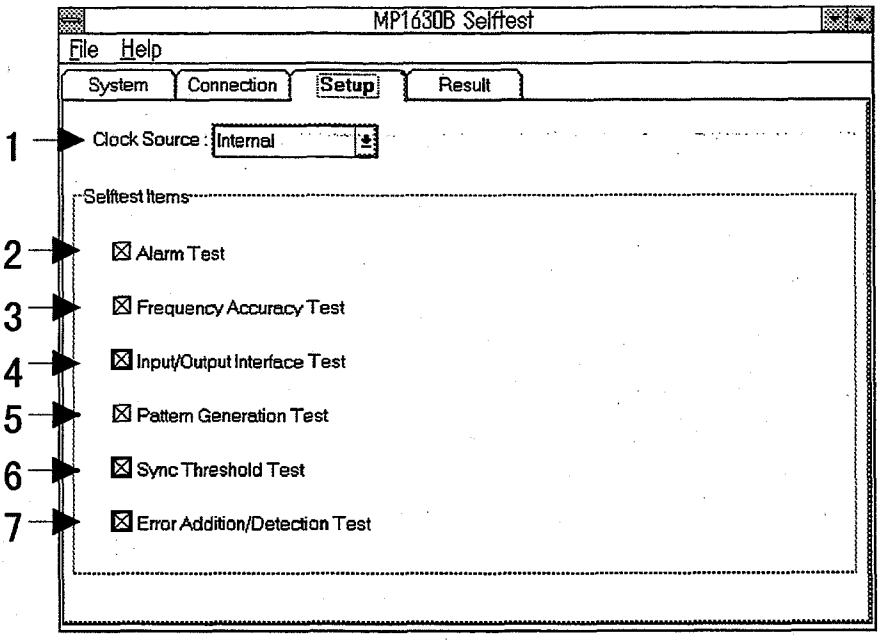


Fig. 9.-10 Setup panel

(1) Clock Source

Select the required clock source.

Internal	Uses the MU163000A clock generator as a clock source.
External	Uses an external clock source.

(2) Alarm Test

Check this item to execute the alarm detection and release test.

(3) Frequency Accuracy Test

Check this item to execute the frequency accuracy test.

(4) Input / Output Interface Test

Check this item to execute the input-output interface test.

(5) Pattern Generation Test

Check this item to execute the pattern generation and measurement test.

(6) Sync Threshold Test

Check this item to execute the MU163040B synchronous determination test.

(7) Error Addition/Detection Test

Check this item to execute the error addition and error measurement test.

Note

About half an hour is required to execute all self-diagnosis items.

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9.4.5 Result panel

The Result panel displays the start of the self-diagnosis and its result.

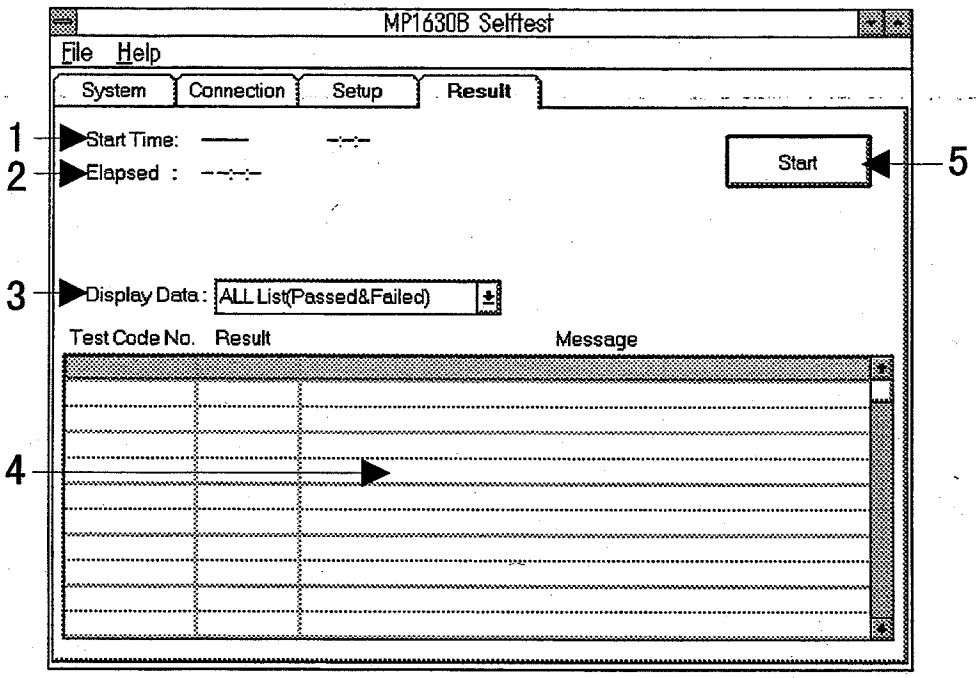


Fig. 9.-11 Result panel

(1) Start Time

Displays a measurement starting time.

(2) Elapsed

Displays a measurement lapsed time.

(3) Display Data

ALL List	Displays information about all self-diagnosis items on the result display screen below.
Error List	Displays a self-diagnosis item in which an error was detected on the result display screen below.

(4) Result display screen

Displays the self-diagnosis execution result.

Test Code No.	Displays a self-diagnosis execution number.
Result or error	Displays the execution result. Passed: Success, Failed: Failure
Message	Displays the contents of the executed self-diagnosis program.

(5) Start

Starts the self-diagnosis.

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9.5Displaying the Contents and Result of the Self-Diagnosis

Starting the self-diagnosis on the Result panel displays its execution status in the MP1630B Self-test dialog box shown in Figure 9-12.

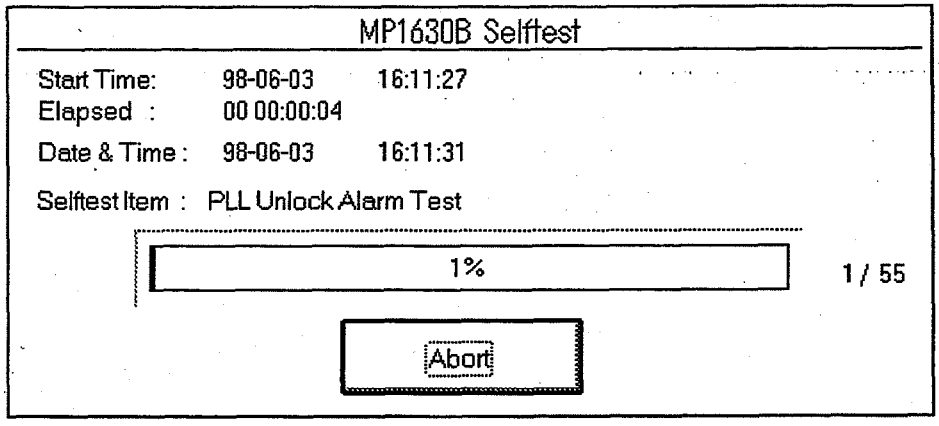


Fig. 9.-12 MP1630B Self-test dialog box

This dialog box indicates the self-diagnosis progress status. To stop the self-diagnosis, press the ABORT button.
Each self-diagnosis test item has a priority sequence. When an error occurs in a higher-level test parameter, the subsequent tests are not executed if impossible.

Note

Do not run other software product during execution of the self-diagnosis.

Tables 9-1 to 9-7 list the self-diagnosis parameters.

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Table 9-1 Alarm detection and release test

Parameter No.	Self-diagnosis processing contents	CG unit required or not
01-0101-01	Tests whether EXT Clock Loss can be detected when Clock Source of the MU163000A is EXT.	Required
01-0102-01	Tests whether PLL Unlock can be detected when Reference Clock of the MU163000A is EXT.	Required
01-0102-02	Changes the MU163000A frequency at 100 kHz-step intervals in the range from 100,000 MHz to 105,000 MHz and tests whether PLL Unlock occurs.	Required
01-0102-03	Changes the MU163000A frequency at 5 MHz-step intervals in the range from 105,000 MHz to 200,000 MHz and tests whether PLL Unlock occurs.	Required
01-0201-01	Tests whether PPG Clock Loss can be detected when Clock Source of the MU163000A is EXT.	Required
01-0201-02	Tests whether clocks are normally input to the MU163020B.	Not required
01-0301-01	Sets the MU163020B clock output OFF and tests all channels to check whether clock cut-off can be detected in the MU163040B.	Not required
01-0301-02	Tests all channels to check whether clocks are normally input to the MU163040B.	Not required
01-0302-01	Tests whether the MU163040B can detect ED Clock Loss when Clock Source of the MU163000A is EXT.	Required
01-0302-02	Tests whether Reference Clock input to the MU163040B is normal.	Required

※ The CG unit means the MU163000A clock generator. "Required" means that the test is executed at use of the MU163000A.

Table 9-2 Frequency accuracy test

Parameter No.	Self-diagnosis processing contents	CG unit required or not
02-0101-01	The frequency set by the MU163000A is input to the MU163040B via the MU163020B. Changes the frequency at 100 kHz-step intervals in the range from 100 MHz to 105 MHz and tests whether a differential error between that frequency and frequency value measured by the MU163040B is within ± 1 kHz.	Required
02-0101-02	The frequency set by the MU163000A is input to the MU163040B via the MU163020B. Changes the frequency at 5 MHz-step intervals in the range from 105 MHz to 200 MHz and tests whether a differential error between that frequency and frequency value measured by the MU163040B is within ± 1 kHz.	Required

※ The CG unit means the MU163000A clock generator. "Required" means that the test is executed at use of the MU163000A.

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Table 9-3 Input-output interface test (1/2)

Parameter No.	Self-diagnosis processing contents	CG unit required or not
03-0101-01	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as ECL.	Not required
03-0102-01	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as PECL.	Not required
03-0103-01	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:2.5Vp-p,Voh=2.5V MU163040B:Vth=1.25V,50 Ω GND terminal	Not required
03-0103-02	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:2.5Vp-p,Voh=2.5V MU163040B:Vth=0.75V,50 Ω GND terminal	Not required
03-0103-03	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:2.5Vp-p,Voh=2.5V MU163040B:Vth=1.75V,50 Ω GND terminal	Not required
03-0104-01	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:2.5Vp-p,Voh=1.25V MU163040B:Vth=0.00V,50 Ω GND terminal	Not required
03-0104-02	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:2.5Vp-p,Voh=1.25V MU163040B:Vth=0.50V,50 Ω GND terminal	Not required
03-0104-03	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:2.5Vp-p,Voh=1.25V MU163040B:Vth=-0.50V,50 Ω GND terminal	Not required
03-0105-01	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:2.5Vp-p,Voh=0.00V MU163040B:Vth=-1.25V,50 Ω GND terminal	Not required
03-0105-02	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:2.5Vp-p,Voh=0.00V MU163040B:Vth=-0.75V,50 Ω GND terminal	Not required

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Table 9-4 Input-output interface test (2/2)

Parameter No.	Self-diagnosis processing contents	CG unit required or not
03-0107-01	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:0. 5Vp-p,Voh=-2.00V MU163040B:Vth=-2.25V,50 Ω GND terminal	Not required
03-0105-03	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:2.5Vp-p,Voh=0.00V MU163040B:Vth=-1.75V,50 Ω GND terminal	Not required
03-0106-01	Executes the synchronous determination test using the input-output interface level of the MU163020B and MU163040B as VAR. MU163020B:0. 5Vp-p,Voh=2.50V MU163040B:Vth=-2.25V,50 Ω GND terminal	Not required

※ The CG unit means the MU163000A clock generator. "Required" means that the test is executed at use of the MU163000A.

Table 9-5 Pattern generation and measurement test

Parameter No.	Self-diagnosis processing contents	CG unit required or not
04-0101-01	Reads the previously saved set state when the MU163020B is connected directly to the MU163040B.	Not required
04-0101-02	Executes the PRBS pattern generation and measurement test.	Not required
04-0102-01	Reads the previously saved set state when the MU163020B is connected directly to the MU163040B.	Not required
04-0102-02	Executes the PRGM pattern generation and measurement test. The MU163040B determines the result in the Normal synchronization mode.	Not required
04-0103-01	Reads the previously saved set state when the MU163020B is connected directly to the MU163040B.	Not required
04-0103-02	Executes the PRGM pattern generation and measurement test. The MU163040B determines the result in the Frame synchronization mode.	Not required

※ The CG unit means the MU163000A clock generator. "Required" means that the test is executed at use of the MU163000A.

Table 9-6 Synchronous determination test

Parameter No.	Self-diagnosis processing contents	CG unit required or not

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05-0101-01	Executes the PRBS pattern synchronization determination test.	Not required
05-0101-02	Inserts a 1E-5 bit error in the MU163020B and tests whether a synchronization error occurs when Sync Threshold of the MU163040B is 1E-6.	Not required
05-0102-01	Executes the PRBS pattern synchronous determination test.	Not required
05-0102-02	Inserts a 1E-3 bit error in the MU163020B and tests whether synchronous lead-in occurs when Sync Threshold of the MU163040B is 1E-2.	Not required
05-0103-01	Executes the PRGM pattern synchronous determination test.	Not required
05-0103-02	Inserts a 1E-5 bit error in the MU163020B and tests whether a synchronization error occurs when Sync Threshold of the MU163040B is 1E-6.	Not required
05-0104-01	Executes the PRGM pattern synchronous determination test.	Not required
05-0104-02	Inserts a 1E-3 bit error in the MU163020B and tests whether synchronous lead-in occurs when Sync Threshold of the MU163040B is 1E-2.	Not required

※ The CG unit means the MU163000A clock generator. "Required" means that the test is executed at use of the MU163000A.

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Table 9-7 Error addition and error measurement test

Parameter No.	Self-diagnosis processing contents	CG unit required or not
06-0101-01	Executes the PRBS synchronous determination test.	Not required
06-0101-02	Adds a single error in the MU163020B and tests whether the MU163040B can detect Error Count = 1.	Not required
06-0102-01	Executes the PRBS synchronous determination test.	Not required
06-0102-02	Adds a 1E-3 error in the MU163020B and tests whether the MU163040B can detect Error Rate = 1E-3.	Not required
06-0103-01	Executes the PRBS synchronous determination test.	Not required
06-0103-02	Adds a 1E-9 error in the MU163020B and tests whether the MU163040B can detect Error Rate = 1E-9.	Not required
06-0104-01	Executes the PRGM synchronous determination test.	Not required
06-0104-02	Generates an insertion error pattern in the MU163020B and tests whether the MU163040B can detect an insertion error.	Not required
06-0105-01	Executes the PRGM synchronous determination test.	Not required
06-0105-02	Generates an erasure error pattern in the MU163020B and tests whether the MU163040B can detect an erasure error.	Not required

※The CG unit means the MU163000A clock generator. "Required" means that the test is executed at use of the MU163000A.

※In 06-0104 and 06-0105, the measurement is performed by intentionally setting different patterns to the MU163020B and MU163040B.

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10.

CHAPTER 10 MAINTENANCE

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10.1Daily Maintenance

1. If the surface of the unit is stained, wipe it with a cloth damped with synthetic detergent.
2. If dust settles on the surface of the unit, remove it with a vacuum cleaner.
3. If the mounted parts becomes loose, tighten screws with the specified tools.

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10.2Precautions for Storage

When storing this unit for a long period, follow the precautions given below.

1. Before storing this unit, remove dust and stain.
2. Avoid storing this unit in a place where the temperature becomes higher than +30℃ or lower than 5℃ or the humidity becomes higher than 75% or lower than 40%.
3. Do not store this unit in a place exposed to direct sunlight or heavy dust.
4. Do not store this unit in a place exposed to water splashes or active gases.
5. Do not store this unit in a place where oxidization could occur or in a place exposed to strong vibrations.

Recommended storing requirement

1. Temperature: 5℃ to 30℃
2. Humidity: 40% to 75%
3. Variation of temperature and humidity on a day is a few.

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10.3Transportation

When transporting this unit, use the original package if it has been stored. If you do not have the original package, pack the unit as described below. Be sure to put on clean gloves and handle the unit carefully so that the unit does not get scratched or dented.

1. Remove dust off the unit surface using a dry cloth.
2. Check screws for looseness and slipping out.
3. Cover the projections and easy-to-deform portions with protective materials and wrap the unit with a polyethylene sheet and moisture-proof paper.
4. Put the packed unit in the corrugated cardboard box and fasten the seams with adhesive tape. Crate the package depending on the transportation distance and method.

10.4Scraping

A gallium arsenic is contained in electronic circuit of the equipment. When you dispose the equipment, you must dispose of it, baled on a each local regulations and each national lows.

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APPENDIX

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1 SENDING AND RECEIVING PATTERNS

MP1630B enables you to select one of the following five types of sendable and receivable patterns:

(1) Programmable pattern (PRGM pattern)
(2) Pseudo random binary sequence pattern (PRBS pattern)
(3) Zero-substitution pattern (Zero-Subst pattern)
(4) MIX pattern
(5) Passive Optical Network pattern (PON pattern)

Item (5), PON pattern, is not in the same category with the other four patterns; however, it is regarded as one selectable pattern in this section.

PRGM pattern

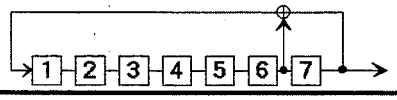
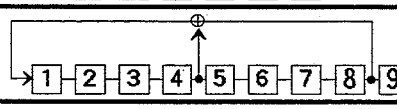
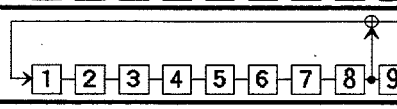
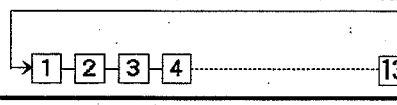
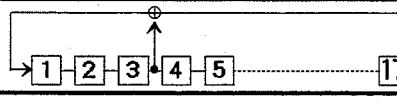
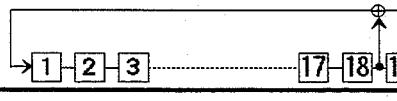
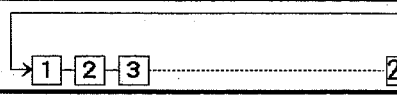
A pattern the user can specify arbitrarily. For a channel set in the PRGM pattern, a sent or received pattern can be edited using the Pattern Editor dialog box and Customize panel.

PRBS(Pseudo Random Binary Sequence)pattern

A pattern generated by the principle shown in Table 1. If successive N bits are selected in a bit array of the PRBS pattern having a 2^N - 1 cycle, the same bit array as this bit array does not exist in one cycle. In other words, the PRBS pattern has all assumable bit arrays other than 0. Using the PRBS pattern as a test signal, the user can execute the test under conditions similar to an actual signal that passes through a transmission line. For the PRBS output pattern, logical value 1 corresponds to low level and logical value 0 to high level.
The circuit shown in Figure 1 enables to set a PRBS pattern marking rate (logical value 1 generation probability in pattern) to 1/2, 1/4, and 1/8. As shown in Figure 1, there are two methods of generating the 1/4 and 1/8 marking rates: ANDing with a bit shifted by one bit and ANDing with a bit shifted by three bits. Inverting the logical value of these bits enables to generate a 1/2inv., 3/4, and 7/8 marking rates.

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Table 1 Pseudo random binary sequence pattern generation principle

Period	Generation polynomial	Pattern generation block diagram
2^7-1	$1+X^6+X^7$	
2^9-1	$1+X^5+X^9$	
$2^{11}-1$	$1+X^9+X^{11}$	
$2^{15}-1$	$1+X^{14}+X^{15}$	
$2^{20}-1$	$1+X^3+X^{20}$	
$2^{23}-1$	$1+X^{18}+X^{23}$	
$2^{31}-1$	$1+X^{28}+X^{31}$	

N : Shift register
⊕ : Exclusive-OR

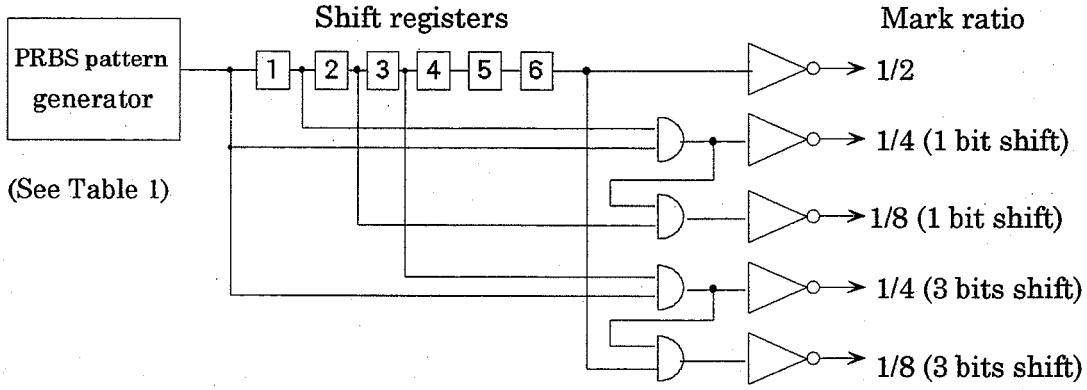


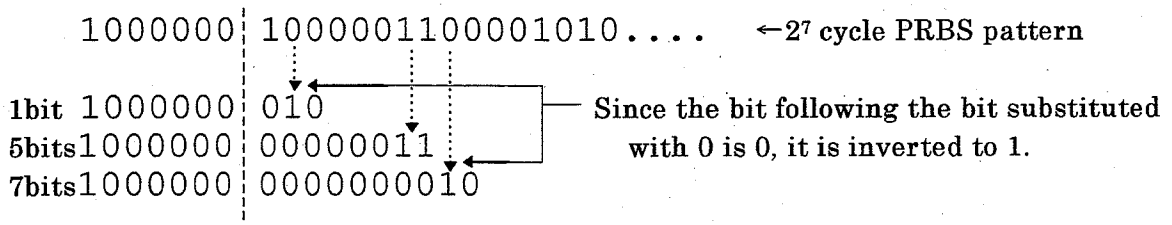
Figure 1 Marking rate 1/4, 1/8 generator circuit

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Zero-Subst pattern

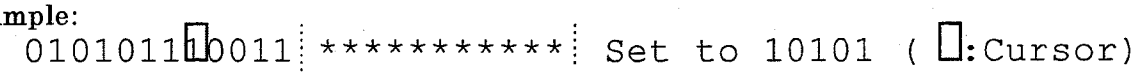
In this pattern, values following the longest successive 0s in a PRBS pattern in which a bit having a logical value 1 is added are substituted with logical value 0 by the specified number of bits. When the bit following the bit substituted with 0 is 0, it is inverted to 1.

Example: 2^7 cycle PRBS
The number of longest successive 0s is 7 - 1 = 6 bits, and the substitution with 0 begins with the position below.

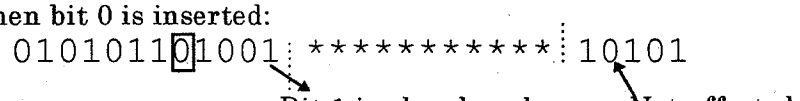


MIX pattern

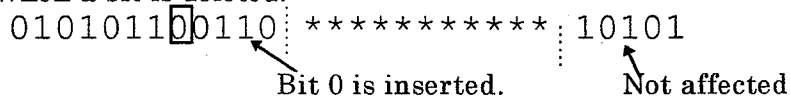
In this pattern, a programmable pattern (can be edited by the user) and pseudo random binary sequence pattern can be mixed by dividing a 1-cycle pattern to multiple blocks and assigning a PRGM or PRBS pattern to each block.
The number of blocks in a one-pattern cycle must be specified in a line x row format. A pattern type (PRGM or PRBS) assigned to each block and the number of bits in each block is limited for each row.
A block assigned to the PRGM pattern can be edited; however, the insertion or deletion of the PRGM pattern is valid only in the block.
Example:



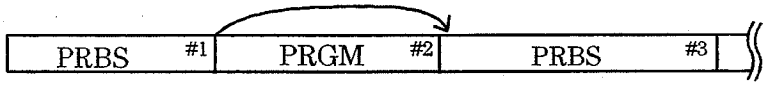
When bit 0 is inserted:



When a bit is deleted:



As shown below, even if a PRGM pattern block is inserted between PRBS pattern blocks, a PRBS signal is transferred from one PRBS pattern block to another one regardless of the PRGM pattern block.



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PON pattern

Used only for measurement in a subscriber system, passive optical network (PON). This pattern is also called a special version of the MIX pattern. Four patterns described above are sent from and received to one channel; the PON pattern means all patterns sent from and received to multiple channels.

Figure 2 gives an outline of PON. A signal between ONU and OSU is converted to parallel or serial data by the star coupler (SC) before transfer. A difference in time exists among patterns generated from each ONU; it is called a guard time (GT). A burst cycle means the duration from the time when a pattern is generated from the first ONU to the time when a pattern is generated from the same ONU.

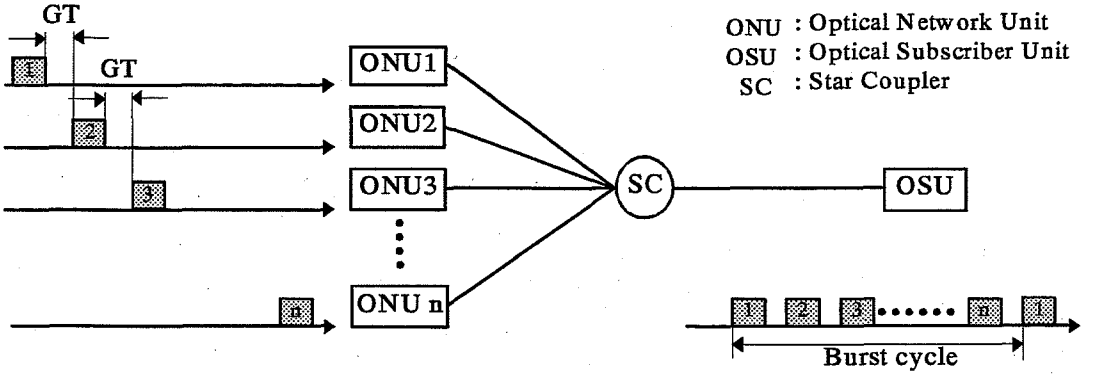


Figure 2 Passive optical network

In the MP1630B, the user can select a channel used to send and receive each pattern, and the channel is called a valid channel. The valid channel corresponds to ONU in PON. PON patterns are generated in ascending order of the valid channel numbers.

As shown in Figure 3, a pattern generated in one valid channel consists of three parts: a preamble (PR), overhead (OH), and information. This instrument sets OH and information together.

In the PR part, only the bit length can be specified. In an actual pattern, 1 and 0 are set alternately (e.g., 10101010 in eight bits).

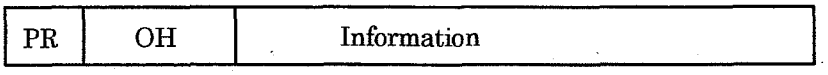


Figure 3 PON pattern format

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2 BURST PATTERN GENERATION PRINCIPLE

To generate a burst pattern, specify two attributes: burst cycle and enable length. As shown in Figure 4, the burst cycle means a cycle ranging from the restart of pattern generation to its next restart. The enable length means a duration in which a pattern is generated in the burst cycle.
A burst trigger signal is generated in the PPG unit according to the specified burst cycle and enable length. It is available to control the pattern generation.
Patterns generated successively are generically called a repeat pattern. In other words, the repeat pattern means a burst pattern having "burst cycle = enable length."

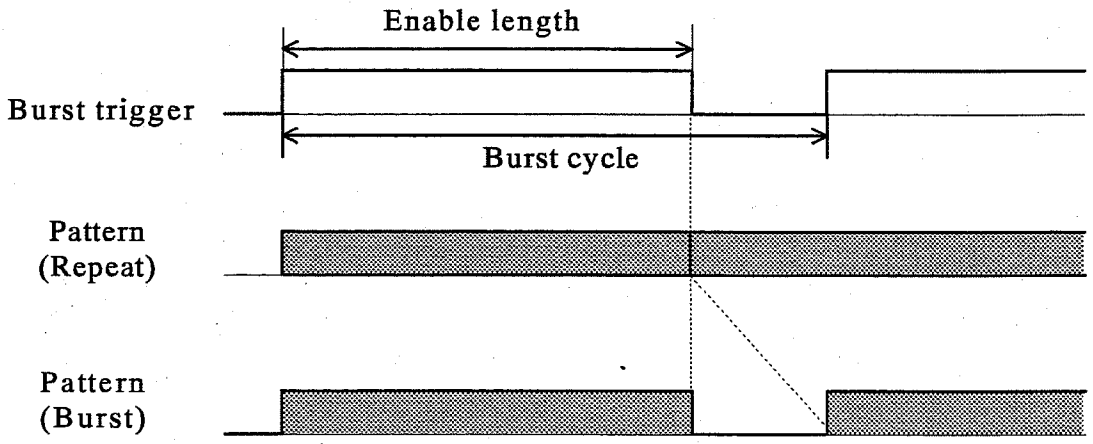


Figure 4 Burst pattern generation principle

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3 PRGM DATA MODE

When a pattern cycle is generated, there are two methods of generating a burst pattern at restart of a burst cycle. Selecting one of the items below as the data mode enables you to switch the pattern generation method.

Consecutive	At restart of a burst cycle, a pattern is generated consecutively after the previous burst cycle ended.
Restart	A pattern is generated from the head of a pattern cycle each time the burst cycle is restarted.

Figure 8 shows differences among PRGM patterns generated in the data mode.

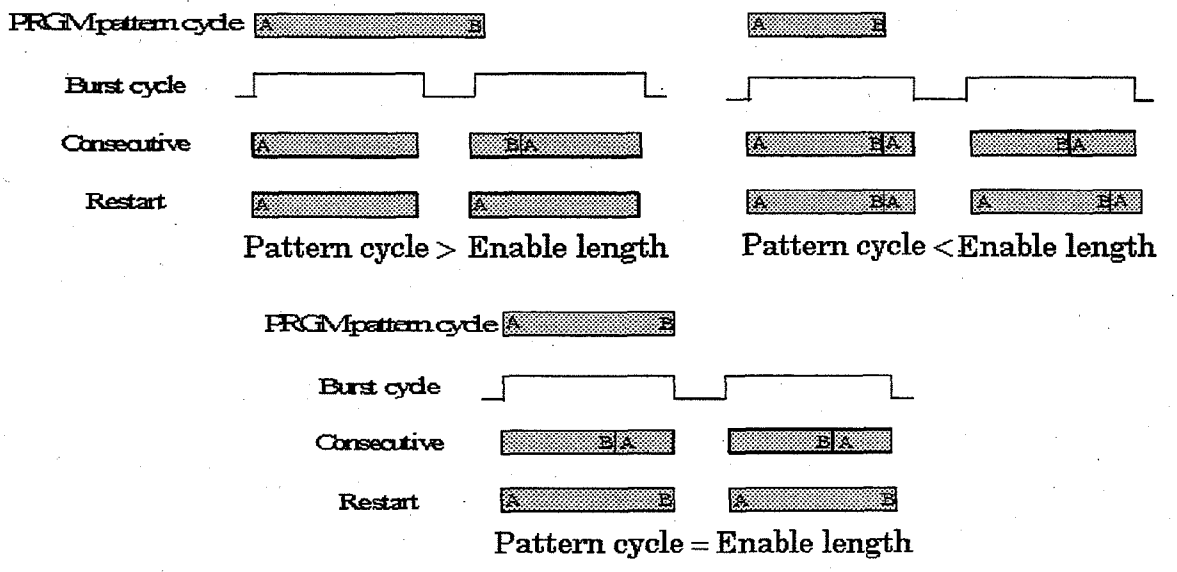
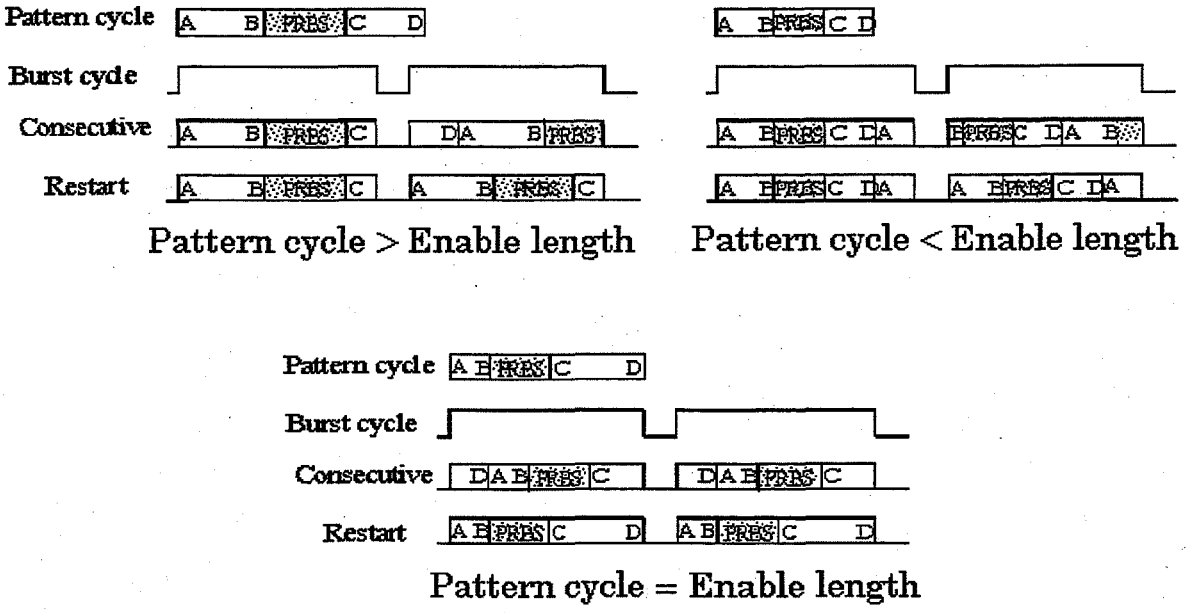


Figure 5 Differences among generated PRGM patterns

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Figure 6 shows differences among MIX patterns generated in the data mode.



(Pattern cycle > Burst cycle) (Pattern cycle < Burst cycle)

Figure 6 Differences among generated MIX patterns

The data mode can be selected for the PRGM and MIX patterns. However, it is not available for MIX pattern in which all blocks are set to PRBS.
For the PON pattern, the user need not recognize the data mode because the pattern cycle unconditionally matches the burst cycle.

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4 AUTO SYNC

Auto Sync n pattern cycle

Auto Sync is a function that automatically synchronizes a pattern received by the ED unit with a reference pattern in the ED unit. If an error rate exceeds a specific threshold value during measurement as Auto Sync is ON, the ED unit assumes that the synchronization of the input pattern with the reference pattern is released. In this case, the ED unit generates the Pattern Sync Loss alarm to stop the error count, recovers the synchronization, and restarts the error count.
When a PRBS and PRGM blocks are mixed in the MIX and PON patterns, the Auto Sync On or OFF switching mode and the threshold value for determining the release of synchronization can be specified for PRBS and PRGM blocks respectively.
In the Pattern Sync mode, there are two methods of recovering the synchronization.

Normal	Recovers the synchronization while comparing the input pattern with the reference pattern during one full cycle.
Frame	A synchronization recovery trigger is assumed to be a timing when the same pattern as a specified frame (some bits at the beginning of the reference pattern) appears in the input pattern.

As compared with Normal, Frame is available to release the synchronization at higher speed. When bit rows having the same pattern exist at different positions in a frame, the input pattern may abnormally synchronize with the reference pattern.
To select the Pattern Sync mode, the following restrictions are provided depending on pattern types:

PRGM pattern	Can be selected from the Normal and Frame modes.
PRBS and Zero-Subst patterns	Cannot be set. Valid in the Normal mode.
MIX pattern	The PRGM and PRBS blocks conform to the PRGM and PRBS patterns.
PON Pattern	Related with the synchronization of the burst cycle. See the next section.

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Auto Sync in burst cycle

To measure a burst pattern in the ED unit, the burst cycle must be synchronized. There are the following two methods of synchronizing the burst cycle in the Burst Sync mode.

INT	Generate a burst trigger signal in the ED unit and synchronize it with the burst cycle of the input pattern.
EXT	Uses a signal input from Burst Trigger Input on the rear panel as a burst cycle synchronized with the input pattern.

When the Burst Sync mode is INT, the ED unit assumes that the same bit row as of a specified frame (some bits at the beginning of the reference pattern) appears in the input pattern. Therefore, the burst cycle starting pattern must be at the head of the PRBM pattern and the Pattern Sync mode must be Frame. These restrictions are summarized for each pattern as follows:

PRGM pattern	INT is valid in the Burst Sync mode only when Restart is specified as the data mode. Frame is only valid in the Pattern Sync mode.
PRBS pattern	INT is invalid in the Burst Sync mode.
MIX pattern	INT is valid in the Burst Sync mode only when column 1 is set to PRGM and Restart is specified in the data mode. Frame is only valid in the Pattern Sync mode.
PON pattern	INT is valid in the Burst Sync mode only when PRGM is set to block 1. Frame is only valid in the Pattern Sync mode.

There is no restriction to specify EXT in the Burst Sync mode; however, the following restrictions are added to select the Pattern Sync mode:

PRGM and MIX patterns	When the data mode is Restart, the synchronization of a burst cycle has the same meaning as of the synchronization of a pattern cycle, and the specified Pattern Sync mode is ignored.
PRBS pattern	Not affected.
PON pattern	Cannot be specified. Supported only in Normal.

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5 RELATIONSHIPS AMONG AMPLITUDE, OFFSET, AND TERMINAL

When the data output and clock output levels are set to Variable, they are uniquely determined depending on two values: offset voltage (Voh, Vth, or Vol) and amplitude.

When amplitude and Voh are already specified:

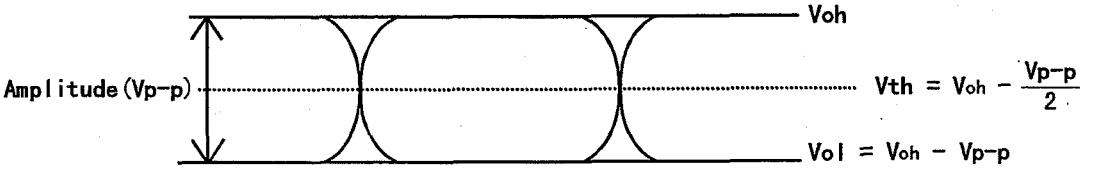


Figure 7

When amplitude and Vth are already specified:

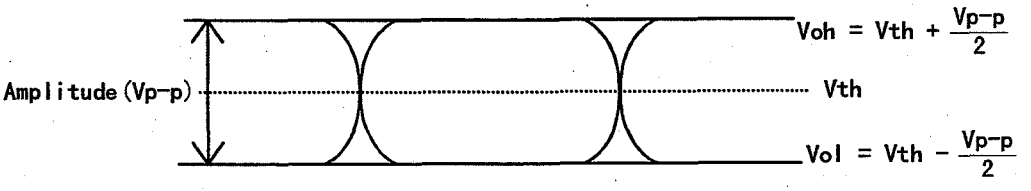


Figure 8

When amplitude and Vol are already specified:

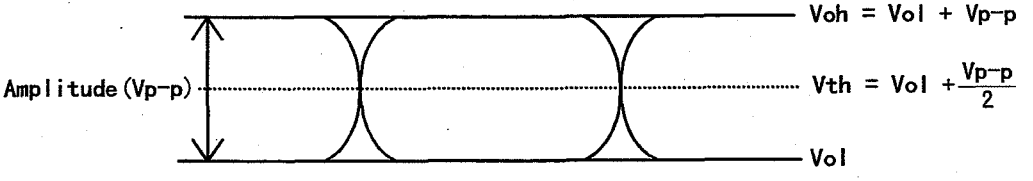


Figure 9

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The amplitude settable range varies depending on the specified terminal values. Table 2 lists the correspondence between the amplitude and terminal values.

Table 2 Amplitude settable range at data and clock output levels

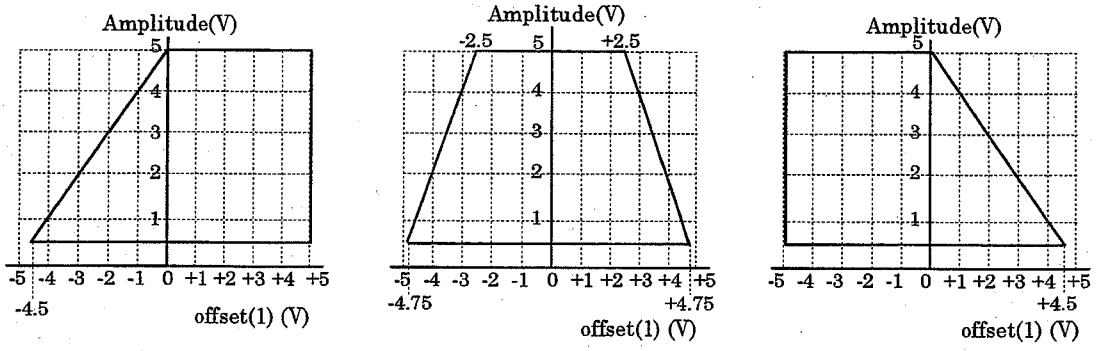
Terminal value	Settable range
Open	0.500 to 5.000 Vpp
50ohm to GND	0.250 to 2.500 Vpp
50ohm to -2V	0.250 to 2.500 Vpp
50ohm to +3V	0.250 to 2.500 Vpp

The upper limit of Voh and the lower limit of Vol vary depending on the terminal values. Table 3 lists the correspondence between the settable levels and terminal values.

Table 3 Level valid range at data output and clock output levels

Terminal value	Valid range
Open	-5.0000 to 5.000 V
50ohm to GND	-2.5000 to 2.5000 V
50ohm to -2V	-3.5000 to 1.5000 V
50ohm to +3V	1.0000 to 4.0000 V

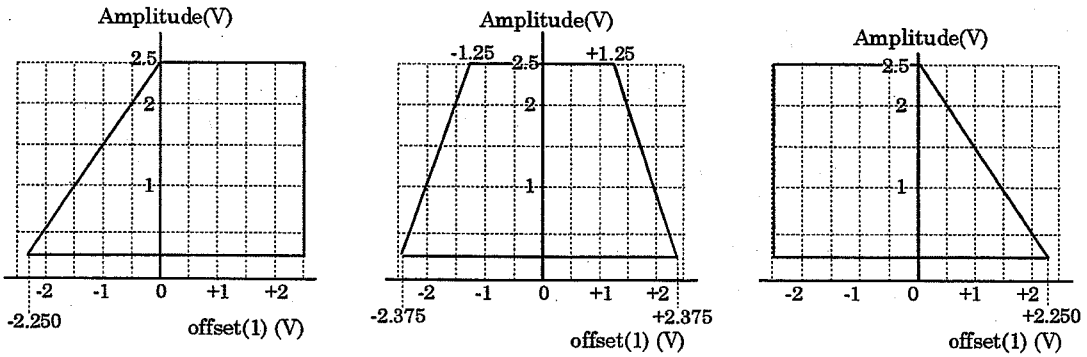
Figures 10 and 13 show the amplitude and offset settable range for each terminal value.



(a) For Voh (b) For Vth (c) For Vol

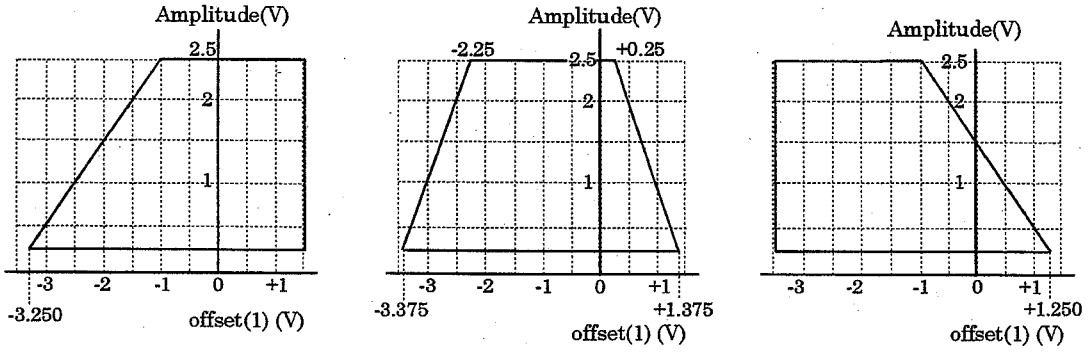
Figure 10 Relationships between amplitude and offset when terminal is open

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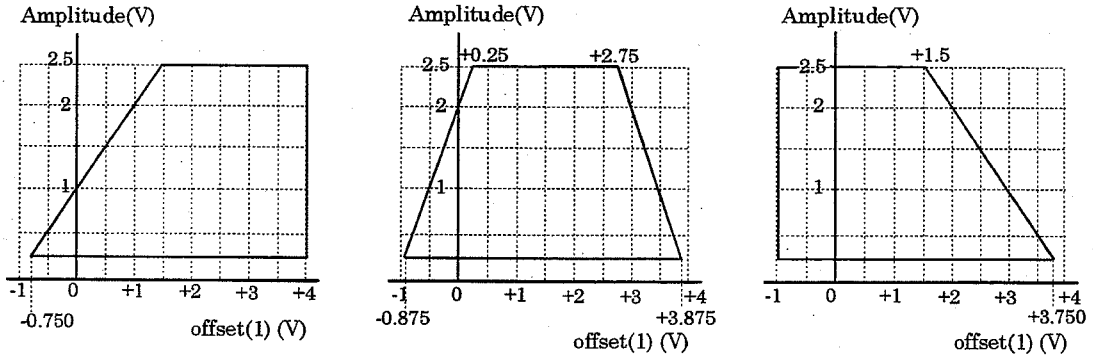
(a) For Voh (b) For Vth (c) For Vol

Figure 11 Relationships between amplitude and offset when terminal is set to 50 ohms to GND



(a) For Voh (b) For Vth (c) For Vol

Figure 12 Relationships between amplitude and offset when terminal is set to 50 ohms to -2 V



(a) For Voh (b) For Vth (c) For Vol

Figure 13 Relationships between amplitude and offset when terminal is set to 50 ohms to +3 V

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6 ERROR ADDITION

There are five methods of adding an error to a pattern sent from the PPG unit. These methods are different depending on whether (1) a burst trigger signal for controlling the error addition is set to burst, (2) it is generated internally or externally, and (3) how it is handled.
The error addition method can be selected in the Error Addition dialog box. This section explains how to add an error in each method, using combinations of three mode combo boxes as the respective method names.

1. Normal/INT/Single

A 1-bit error is inserted at a timing when the Single button is pressed while the lamp on the side of the Error Addition button lights on.

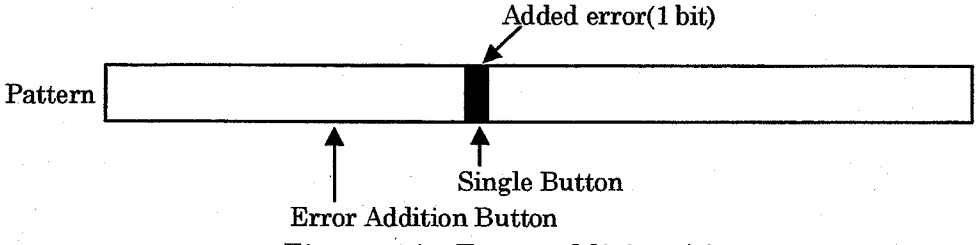


Figure 14 Error addition (1)

2. Normal/INT/Cyclic

An error is successively added with the specified rate after the Error Addition button is pressed.

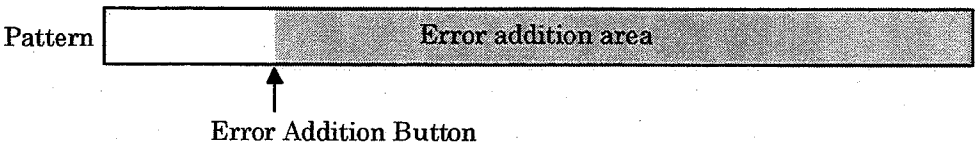


Figure 15 Error addition (2)

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3. Normal/EXT

A 1-bit error is added synchronously with the leading edge of a pulse signal sent from the EXT ERR Input connector on the rear panel of the PPG unit.

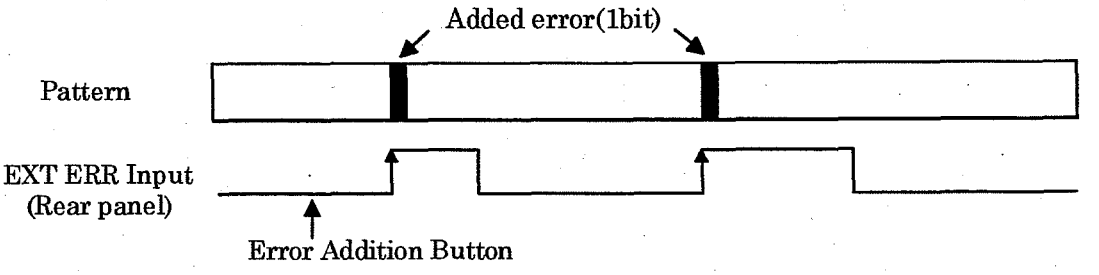


Figure 16 Error addition (3)

4. Burst/INT/Repeat

An error is added with the specified rate while the burst trigger signal is in the enabled state from the timing when the Error Addition button was pressed. The burst trigger signal is decided by specifying Enable Length and Burst Cycle.

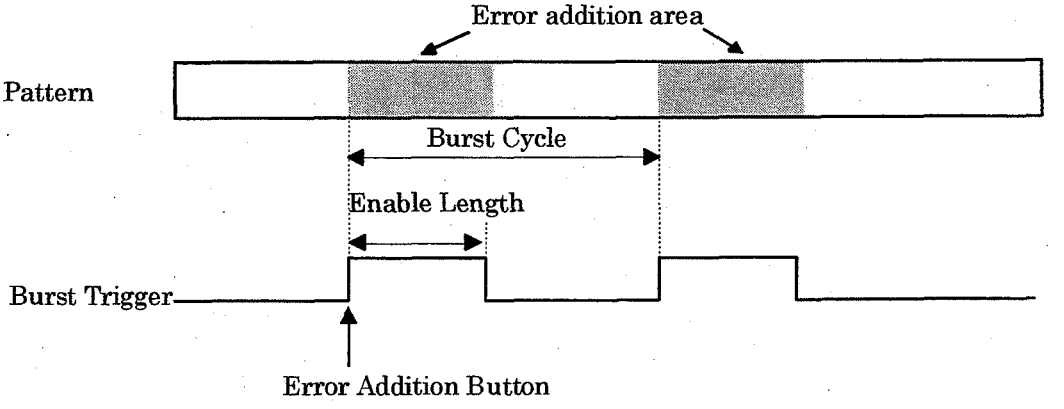


Figure 17 Error addition (4)

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5. Burst/EXT/Level

An error is added with the specified rate in the duration in which a pulse signal input from the EXT ERR Input connector on the rear panel of the PPG unit is in the enabled state.

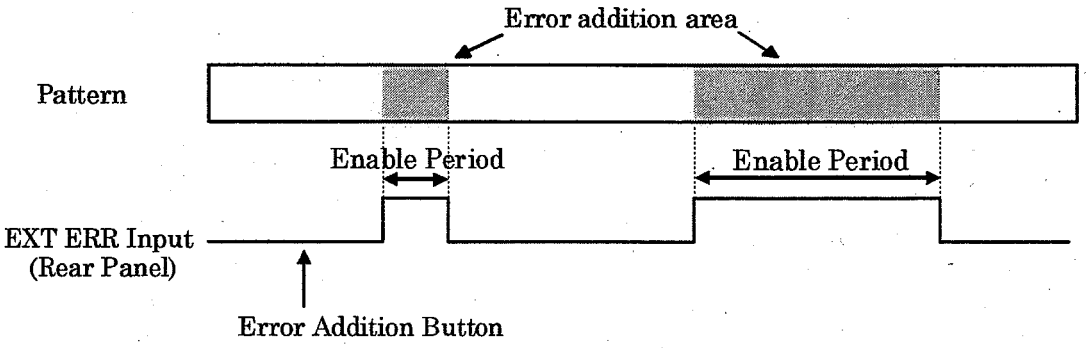


Figure 18 Error addition (5)

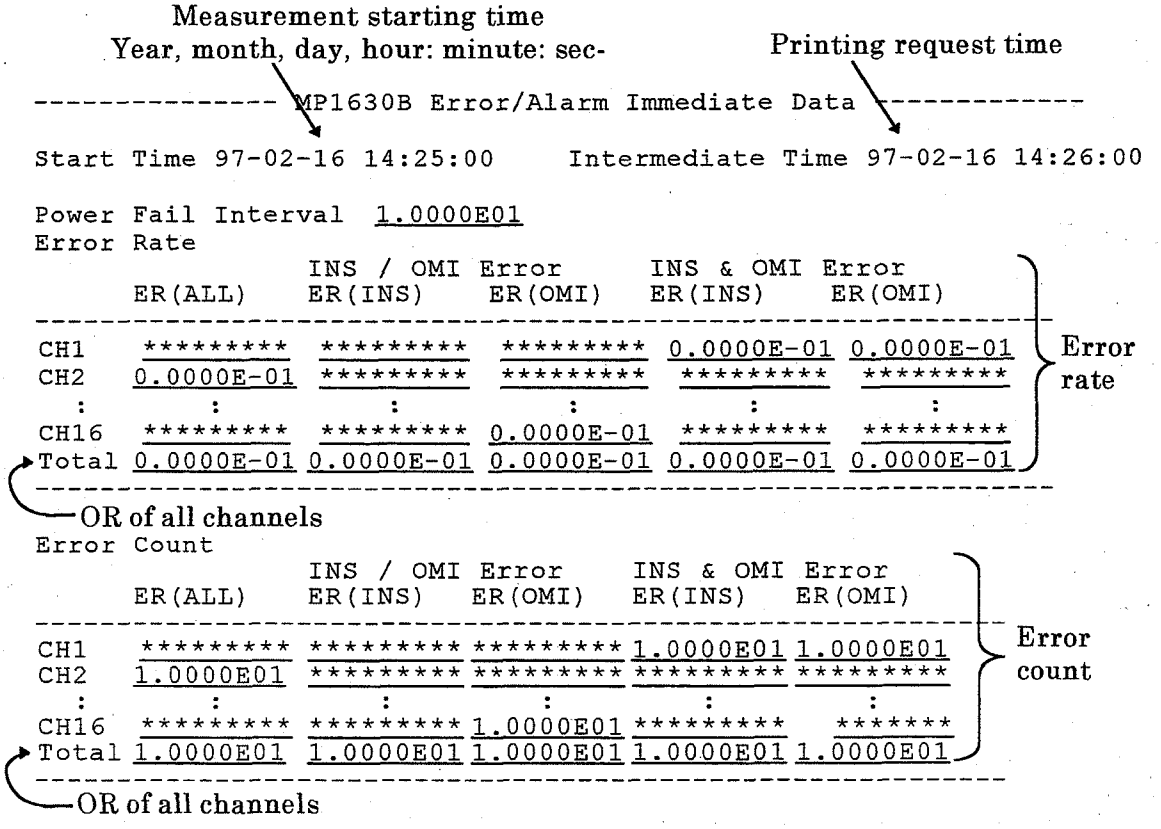
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7. PRINTER OUTPUT FORMAT

● **Error/Alarm measurement immediate data**

This section shows a printing format used when File-Print is selected on the master window menu to specify Error/Alarm output while an error alarm is measured by the MU163040B 16CH error detector.
In this section, it is assumed that one MU163040B is inserted in slot 4. The output contents vary depending on a unit configuration.

Note: The underlined values vary depending on the set values and measurement conditions.



To be continued

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```
Error(EI,%EFI)
          EI          %EFI
----------------------------
CH1   1.0000E01 0.0001%
CH2   1.0000E01 0.0001%
  :       :         :
CH16  1.0000E01 0.0001%
----------------------------
```

Error interval, % error free interval

```
Threshold EI
      >1E-3       >1E-4      ···  >1E-8       =<1E-8
-------------------------------------------------------
CH1   1.0000E01 1.0000E01  ···  1.0000E01  1.0000E01
CH2   1.0000E01 1.0000E01  ···  1.0000E01  1.0000E01
  :       :         :        :        :         :
CH16  1.0000E01 1.0000E01  ···  1.0000E01  1.0000E01
-------------------------------------------------------
```

Threshold error interval

```
Threshold %EFI
      >1E-3    >1E-4      ···  >1E-8     =<1E-8
-----------------------------------------------
CH1   0.0001%  0.0001%   ···  0.0001%  0.0001%
CH2   0.0001%  0.0001%   ···  0.0001%  0.0001%
  :       :        :        :        :         :
CH16  0.0001%  0.0001%   ···  0.0001%  0.0001%
-----------------------------------------------
```

Threshold, % error free interval

```
Error Performance
     ES        %ES       EFS       %EFS      SES
-------------------------------------------------------
CH1  1.0000E0  0.0001%   1.0000E0  0.0001%   1.0000E0
     1                    1                   1
CH2  1.0000E0  0.0001%   1.0000E0  0.0001%   1.0000E0
     1                    1                   1
  :      :         :         :         :         :
CH16 1.0000E0  0.0001%   1.0000E0  0.0001%   1.0000E0
     1                    1                   1
-------------------------------------------------------
Error Performance
     %SES      US        %US       DM        %DM
-------------------------------------------------------
CH1  0.0001%   1.0000E0  0.0001%   1.0000E0  0.0001%
               1                   1
CH2  0.0001%   1.0000E0  0.0001%   1.0000E0  0.0001%
               1                   1
  :      :         :         :         :         :
CH16 0.0001%   1.0000E0  0.0001%   1.0000E0  0.0001%
               1                   1
-------------------------------------------------------
```

Performance

```
Alarm Interval      (PRBS)    (PRGM)
      Clock Loss Sync  Loss Sync  Loss
-----------------------------------------
CH1   1.0000E01  1.0000E01 1.0000E01
CH2   1.0000E01  1.0000E01 1.0000E01
  :       :         :         :
CH16  1.0000E01  1.0000E01 1.0000E01
-----------------------------------------
```

Number of alarm generation intervals

```
Clock Frequency
-------------------
CH1     200 000 000Hz
CH2     200 000 000Hz
  :         :
CH16    200 000 000Hz
-------------------
```

Frequency

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- **Pattern**

(Time output example)

Unit name

```
-------------------- MP1630B 200M 16CH ED Pattern-----------------------

0      |0         10          20          30          40          50          60
--------+---------+----------+----------+----------+----------+----------+----------+---
+
CH1 |1001010101010100101010101010101011110101111111111111010010101100101 0|
CH2 |1000100101111111111111111111111111111111111111111111001101111000010010000|
CH5 |0010101000000010100100100101010101001010100101010100000100101001010 1|
:
CH16
    |1010010101001010010010100101000001001010010101010001000100011111010 1|
--------+---------+----------+----------+----------+----------+----------+----------+---
+

65     |0         10          20          30          40          50          60
------+---------+----------+----------+----------+----------+----------+----------+---
CH1   |1010001010101000011111100000101001111010100010111000111010110100 01|
CH2   |0100111101010011010100010011101010101010010101001000010100101010 10|
CH5   |*****************************************00111101110010010111 11|
:
CH16  |1010100100000101001111110101010100100001000001011110100000000100 11|
------+---------+----------+----------+----------+----------+----------+----------+---
```

Address of bit on the upper left corner

PRBS bit

(Output in State mode)

Unit name

```
--------MP1630B 200M 16CH ED Pattern--------

         CH1              CH16
+-------+-----------------+-------+----+
|     1| 0101001100010100 | 5314 | T. |
|     2| 0000011110100101 | 07A5 | .. |
|     3| 0100000101***0*0 | 4162 | Ab |
|    : |         :        |   :  |    |
                                   :
|    68| **************** | **** | ** |
|    69| **************** | **** | ** |
+-------+-----------------+-------+----+
```

A PRBS bit is output with an asterisk (*).

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(Output in Dump mode)

In this example, 200 is specified for the number of bits on each line in the Pattern Editor dialog box.

Unit name Output

```
----------------MP1630B 200M 16CH ED Pattern (CH1)-----------------

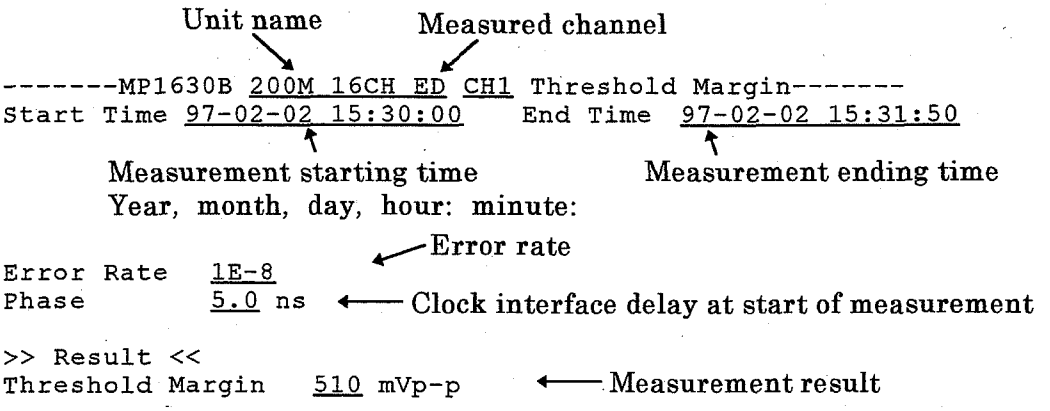
      0                        64                       128
    + ----------------------+-----------------------+------------ +
      ---------
   0| 00 0A 3C EE 53 21 01 0E 48 FF C9 CC 67 85 4D 66 21 01 0E 48 FF |
      AA 09 F0
 192| 01 02 03 55 CD CD E7 00 35 7E 54 A0 0B 5B 54 22 21 01 0E 48 FF |
      AA 09 F0
 384| DD CB 5E 90 26 71 A9 BA EE 87 77 20 00 03 FE 6D 21 FF AA 01 0E |
      48 09 F0
 576| DD CB 5E 90 26 71 A9 BA EE 87 77 20 00 03 FE 6D 21 01 0E 48 FF |
      AA 09 F0
    + ----------------------+-----------------------+------------ +
      ---------


      0                        64                       128
    + ----------------------+-----------------------+------------ +
      ---------
 768| 00 0A 3C EE 53 21 01 0E 48 FF C9 CC 67 85 4D 66 21 01 0E 48 FF |
      AA 09 F0
 960| 01 02 03 55 CD CD E7 00 35 7E 54 A0 0B 5B 54 22 21 01 0E 48 FF |
      AA 09 F0
1152  DD CB 5E 90 26 71 A9 BA EE 87 77 20 00 03 FE 6D 21 FF AA 01 0E |
    | 48 09 F0
1346  DD CB 5E 90 26 71 A9 BA EE 87 77 20 00 03 FE 6D 21 01 0E 48 FF |
    | AA 09 F0
    + ----------------------+-----------------------+------------ +
      ---------
                                        :
                                        :
```

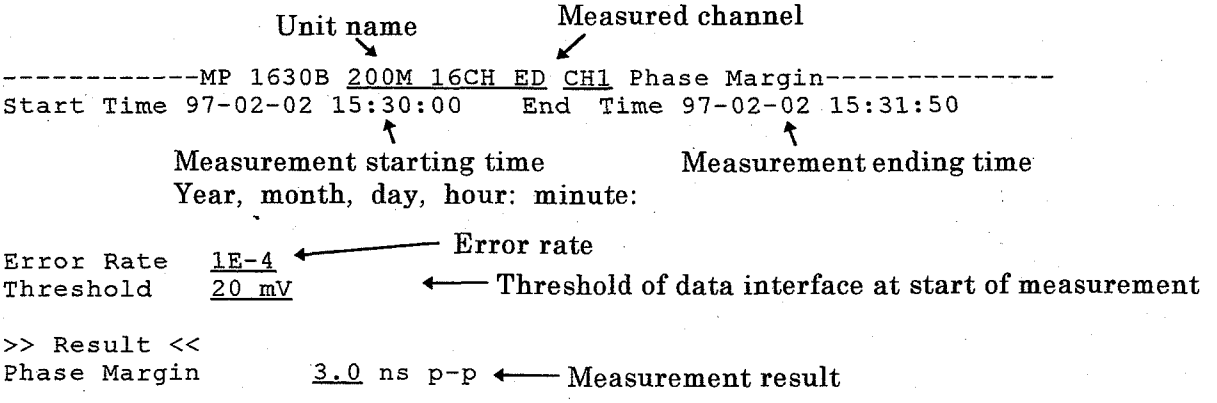

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- **Eye margin measurement result**

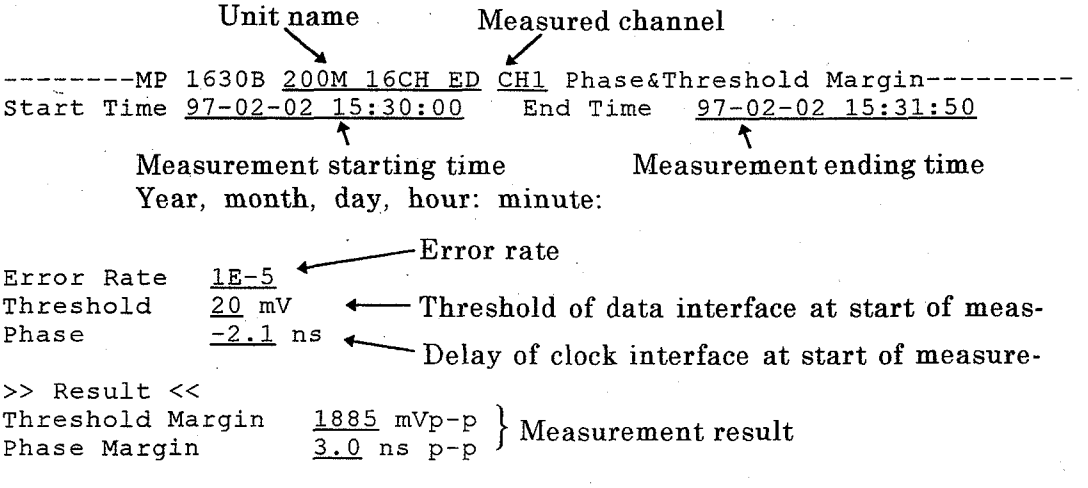
(At measurement of threshold margin)



(At measurement of phase margin)

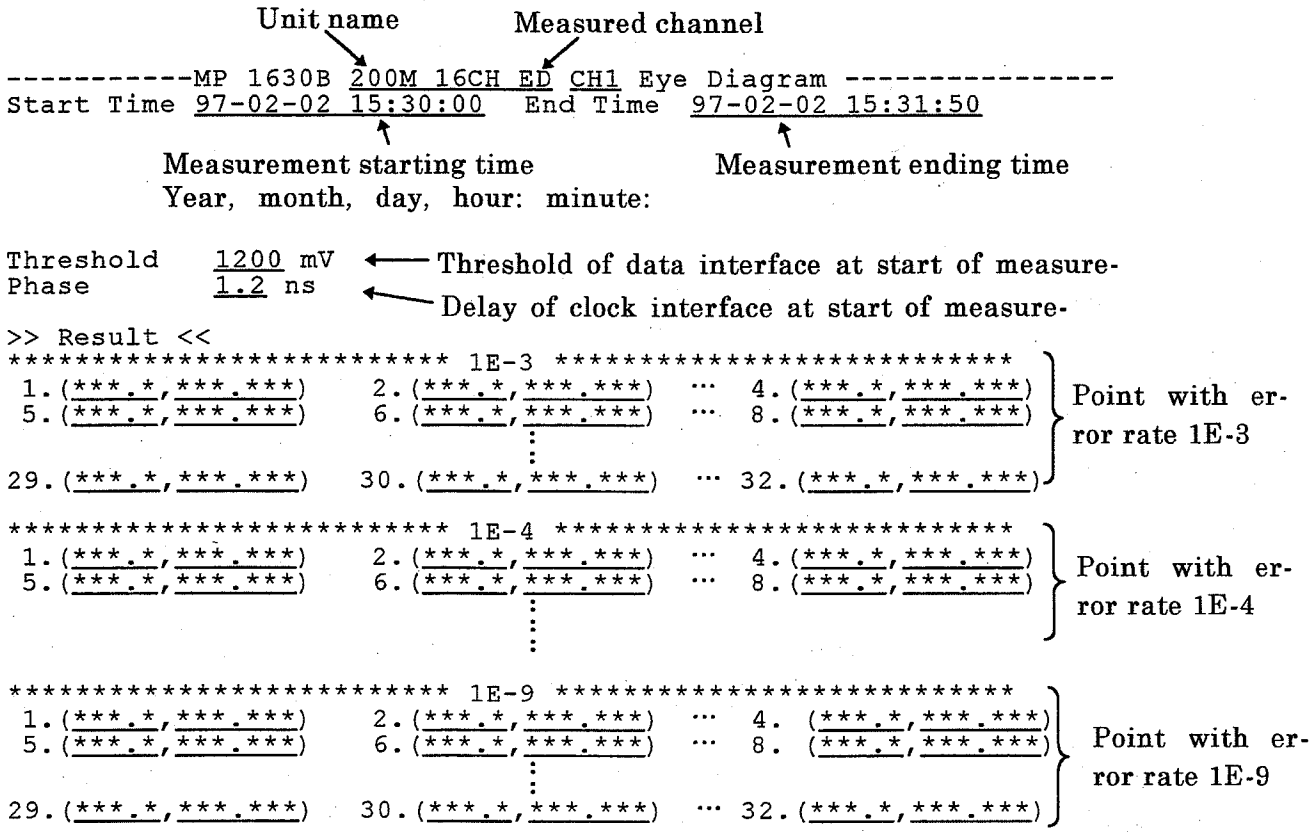


(At measurement of Phase & Threshold)



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(At measurement of eye diagram)
Each point of the measurement result is output as a flat coordinate, assuming that the phase is specified for axis X and the threshold voltage for axis Y.



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- **Delay measurement (mode 1) result**

This section shows the printing format of the delay measurement (mode 1) result.

```
------------------ MP1630B 200M 16CH ED Delay --------------------

Mode : Mode1 / Time          Unit name
Unit : 200M 16CH ED
Start Time 97-02-16 14:25:00        End Time 97-02-16 14:26:00

                    Measurement starting time      Measurement ending time
>> Result <<       Year, month, day, hour: minute: second
CH     Delay
-----------------------
  1     Failed
  2      99.9us
  3    Time out
  4    ********
  5    ********
  6       10.0us
  7     Failed
  8     99.9us
  9    Time out
 10    ********
 11    ********
 12       10.0us
 13    ********
 14    ********
 15    --------
 16    --------
-----------------------
```

Measurement result
The contents of each message are as follows:
Failed: The measurement failed because an alarm occurred.
Time Out: The measurement failed because of time-out.
「*******」: A channel not measured
「-------」: The measurement result is not printed out because the measurement was stopped.

- **Delay measurement (mode 2) result**

This section shows a printing format of the delay measurement mode 2) result.

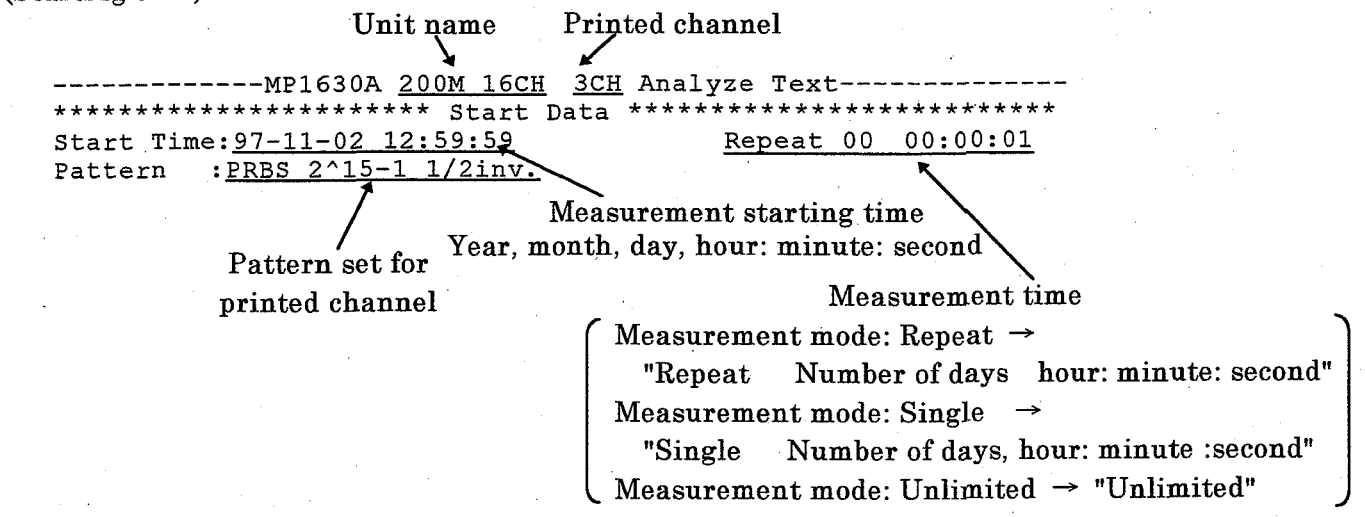
```
---------------- MP1630B 200M 16CH ED Delay (3CH)-----------------

Mode : Mode2 / Time              Pattern : PRBS7 <---- Detected pattern
Unit : 200M 16CH ED(Slot4)CH5
Start Time 97-02-16 14.25:00   End Time 97-02-16 14:26:00
>> Result <<
   Delay = 33.3us
                    Measurement starting time      Measurement ending time
                    Year, month, day, hour: minute:
      Measurement result
```

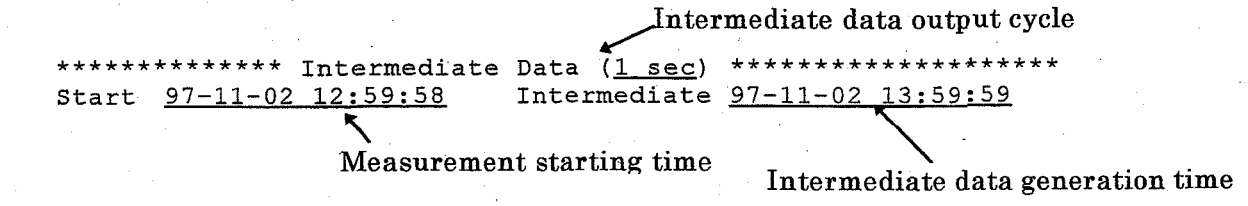

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Error/Alarm measurement Analysis Text data

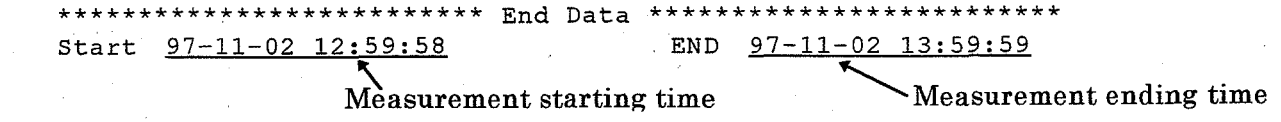
(Starting data)



(Intermediate data header part)



(Measurement ending data header part)



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(Intermediate and measurement ending data common part)

```
Alarm Interval
Power Fail                    1.0000E01
Clock Loss                    1.0000E01
Pattern Sync Loss(PRGM)  1.0000E01
Pattern Sync Loss(PRBS)  1.0000E01
Error
ER     1.0000E-10               EI  1.0000E01
EC     1.0000E01              %EFI  0.0001%
Error Interval
>1E-3  1.0000E01,0.0001%  >1E-7  1.0000E01,0.0001%
>1E-4  1.0000E01,0.0001%  >1E-8  1.0000E01,0.0001%
>1E-5  1.0000E01,0.0001% =<1E-8  1.0000E01,0.0001%
>1E-6  1.0000E01,0.0001%
Error Performance
EC     1.0000E01
ES     1.0000E01              %ES  0.0001%
EFS    1.0000E01              %EFS  0.0001%
SES    1.0000E01              %SES  0.0001%
US     1.0000E01              %US  0.0001%
DM     1.0000E01              %DM  0.0001%
Clock Frequency
   200 000 000  (Hz)
```

Alarm generation interval

Error rate, error interval
Error count, % error free interval

Threshold
Error interval or
% error free interval

Performance

Frequency measurement result

(1-second data)

```
************************ 1sec Data ************************
Time   97-11-02 13:59:59
ER       1.0000E-10          EC     1.0000E01
```

At generation of intermediate

Error rate

Error count

(Immediate alarm measurement)

Power cut-off time, recovery time

```
<<  Power Failure              97-11-02 14:59:59  >>
<<  Power Recovery             97-11-02 14:59:59  >>
```

Clock cut-off time, recovery time

```
<<  Clock Loss                 97-11-02 14:59:59  >>
<<  Clock Recovery             97-11-02 14:59:59  >>
```

Asynchronization (PRGM) time, recovery time

```
<<  Pattern Sync Loss(PRGM)          97-11-02 14:59:59  >>
<<  Pattern Sync Recovery(PRGM)      97-11-02 14:59:59  >>
```

Asynchronization (PRBS) time, recovery time

```
<<  Pattern Sync Loss(PRBS)          97-11-02 14:59:59  >>
<<  Pattern Sync Recovery(PRBS)      97-11-02 14:59:59  >>
```


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8 DETAILS ON ERROR ALARM MEASUREMENT

● Measurement terms

(1) Error rate

$$\frac{\text{Number of error pulses to be measured in specified}}{\text{Number of clocks to be measured in specified}}$$

(2) Number of errors

Number of error pulses in specified time

(3) Number of error intervals (EI)

Number of intervals including one or more error pulses in specified measurement time

The interval time is 10 ms, 500 ms, or 1 sec.

(4) Error free interval rate (%EFI)

A rate of the total number of intervals with the number of intervals excluding intervals having one or more error pulses in specified measurement time. The error free interval rate is obtained from EI in the expression below.

$$\%EFI = \left(\frac{\text{Number of measured intervals - EI}}{\text{Number of measured intervals}} \right) \times 100\%$$

The interval time is 10 ms, 500 ms, or 1 sec.

(5) Number of power cut-off intervals

Number of intervals in which power cut-off occurred.

(6) Number of clock cut-off intervals

Number of intervals in which clock cut-off occurred.

(7) Number of asynchronization cut-off intervals

Number of intervals in which asynchronization occurred. For the MIX or PON pattern, this number is counted separately in the PRBS and PRGM parts.

(8) Threshold EI

Number of intervals in which the 1-second average error rate satisfies the threshold conditions below in the specified measurement time

1-second average error rate $> 10^{-3}$、$> 10^{-4}$、$> 10^{-5}$、$> 10^{-6}$、$> 10^{-7}$、$> 10^{-8}$、$\leqq 10^{-8}$

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(9) Threshold %EFI

A rate of the total number of intervals with the number of intervals in which the 1-second average error rate does not satisfy the threshold conditions shown in item (8) in the specified measurement time. This rate is obtained from threshold EI in the expression below.

$$\text{Threshold \%EFI} = \left(\frac{\text{Number of measurement intervals - Threshold EI}}{\text{Number of measurement intervals}} \right) \times 100\%$$

(10) Phase Error

Only when an ED unit setting are Pattern mode "PON" and Data Input mode "Upside" and a clock phase isn't suitable to a data, regulate the clock phase of the ED unit for restored to the error.

- **Error performance data**

A parameter used to estimate the transmission line defined in ITU-T (old CCITT) Recommendation G821. The range from the start of measurement to the end of measurement is divided into an operating and non-operating periods in 1-second intervals. Various items are mainly obtained in the operating period.

(1) Definition of operating and non-operating periods

When a non-operating interval of which 1-second average error rate exceeds the non-operating threshold is continued for 10 seconds, the non-operating period begins; the 10 seconds is included in the non-operating period.
When a non-operating interval of which 1-second average error rate does not exceed the non-operating threshold is continued for 10 seconds in the non-operating period, the non-operating period ends and the 10 seconds is included in the non-operating period.

(2) Non-operating threshold and DM threshold

The non-operating threshold and DM threshold can be selected on the Measurement Condition dialog box (see Figure 5-72).

Non-operating threshold = 10^{-3}, DM threshold = 10^{-6}
Non-operating threshold = 10^{-4}, DM threshold = 10^{-8}

(3) Measurement items

• Error count (EC)
A bit error count value in measurement duration

• Error second (ES)
Total number of intervals in which one or more bit errors occurred in the operating period

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- Error free second (EFS)
  Total number of intervals in which no bit error occurred in the operating period

- Severe error second (SES)
  Total number of intervals in which a bit error exceeding the non-operating threshold occurred in the operating period
- Non-operating time (US)
  When SES continues for 10 seconds or more, its beginning is assumed to be the beginning of the non-operating time. If other than SES continues for 10 seconds or more, the part preceding its beginning is assumed to be the end of the non-operating time. When a measurement cycle ends and the next one starts while deciding whether the non-operating time starts or ends, the decision counter is reset at the start of measurement.

- Degraded minutes (%DM)
  This system obtains an error rate every 60 packets excluding SES above, in operating intervals calculated for the operating time. The degraded minutes means the total number of packets of which the error rate exceeds the DM threshold. One is added to a duration in which 60 seconds is not satisfied at the end of measurement if the duration exceeds the DM threshold.

- Error second rate (%ES)
  A rate of all intervals calculated for the operating time with error intervals calculated for the operating time

- Error free second rate (%EFS)
  A rate of all intervals calculated for the operating time with error free intervals calculated for the operating time

- Severe error second rate (%SES)
  A rate of all intervals calculated for the operating time with non-operating intervals calculated for the operating time

- Non-operating time ate (%US)
  A rate to a measurement time in non-operating time

- Degraded minutes rate (%DM)
  An error rate is obtained every 60 packets excluding SES above in operating intervals calculated for the operating time. A rate of all packets with the number of packets of which error rate exceeds the DM threshold

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- **Measured data processing at alarm occurrence**

(1) Power cut-off

Power cut-off processing is valid only when it is specified. For details on specifying power cut-off processing, refer to Section 6.4, "System Operations" in the MP1630B Digital Analyzer Operation Manual.
If power cut-off occurs during measurement, data measured until just before the interval in which cut-off occurred is held while the power is cut off.

(a) Error measurement
This system excludes the number of clocks and number of errors calculated in the interval in which power cut-off occurred. After power cut-off was recovered, measurement is continued if measured data is held correctly.

(b) Interval and threshold interval measurements
This system includes the intervals in which power cut-off occurred and intervals in which power cut-off is continued in the number of power cut-off intervals, and does not include other items.
After power cut-off was recovered, measurement is continued if measured data is held correctly.

(c) Error performance
An interval that was being decided at occurrence of power cut-off is not calculated for the non-operating and operating times.
After power cut-off was recovered, measurement is restarted from the initial state.

(2) Clock cut-off

When clock cut-off occurs during measurement, the user can select one of the following two methods:

(a) Excluding clock cut-off processing from calculation

(i). Error measurement
The number of clocks and number of errors calculated in the interval in which clock cut-off occurred are not calculated.

(ii).Interval and threshold interval measurements
The interval in which clock cut-off occurred is calculated only for the clock cut-off interval, not other items.

(iii).Error performance
The interval in which clock cut-off occurred is not calculated for the non-operating and operating times. Neither is an interval that was being decided calculated for non-operating and operating times.
After clock cut-off is recovered, measurement is continued from the initial state.

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(b) Including clock cut-off processing in calculation

(i). Error measurement
The number of clocks and number of errors calculated in the interval in which clock cut-off occurred are not calculated.

(ii).Interval and threshold interval measurements
The interval in which clock cut-off occurred is calculated as a clock cut-off interval and included in the total number of intervals; however, it is not included in the number of threshold EIs.

(iii).Error performance
The interval in which clock cut-off occurred is calculated for a non-operating interval. If the interval is calculated for an operating time, it is also included in the number of error and severe error seconds.

(3) Asynchronization

When an asynchronization occurred during measurement, the user can select one of the following two methods:

(a) Excluding asynchronization processing from calculation

(i). Error measurement
The number of clocks and number of errors calculated in the interval in which asynchronization occurred are not calculated.

(ii).Interval and threshold interval measurements
The interval in which asynchronization occurred is calculated only for the asynchronization interval, and not for other items.

(iii).Error performance
The interval in which asynchronization occurred is not calculated for non-operating and operating times. Neither is an interval that was being decided calculated in non-operating and operating times.
After asynchronization is recovered, measurement is continued from the initial state.

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(b) Including asynchronization processing in calculation

(i). Error measurement

The number of clocks and errors measured in the interval in which asynchronization occurred are not calculated.

(ii).Interval and threshold interval measurements

The interval in which asynchronization occurred is calculated as an asynchronization interval and included in the total number of intervals; however, it is not included in the number of threshold EIs.

(iii).Error performance

The interval in which asynchronization occurred is assumed to be a non-operating interval. If the interval is calculated for an operating time, it is also included in the number of error and severe error seconds.

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● Measurement relation setting contents and error measurement range

The range in which the MU163040B measures errors for each channel varies depending on the setting contents related to measurement.

(1) Measurement pattern and error measurement

When the measurement pattern is the PON pattern, the GT and PR parts are excluded from the error measurement range.

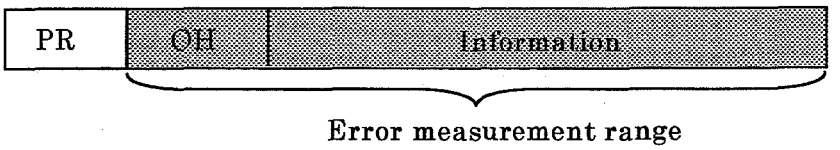


Figure 19 PON pattern error measurement range

(2) Burst pattern measurement range

To measure a burst pattern, the setting range is limited to a burst cycle. The internal burst cycle means a duration specified by the enable length. The external burst cycle means a high-level duration of a pulse signal input to the Burst Trigger/Trigger Input connector on the rear panel.

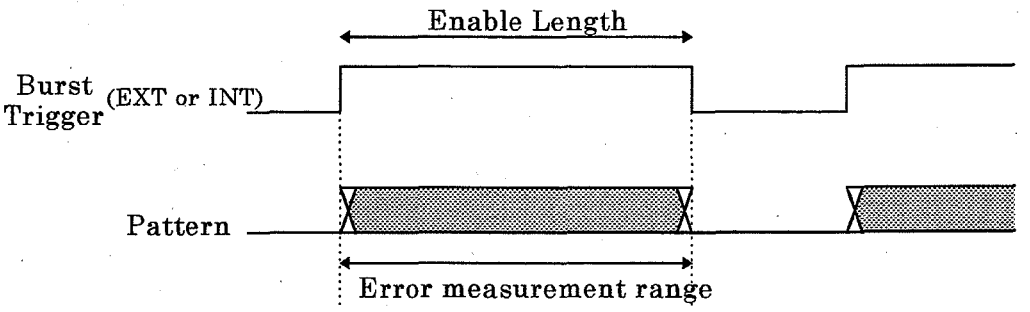


Figure 20 Burst pattern error measurement range

Error measurement is not performed for bits in a duration outside the burst cycle. The number of clocks used as a denominator to calculate the error rate is not measured outside the burst cycle.

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(3) Error detection block and error measurement

The measurement range varies depending on an error detection block and setting contents. The MIX and PON patterns can be specified in blocks; therefore, the user can select whether error measurement is performed in blocks.

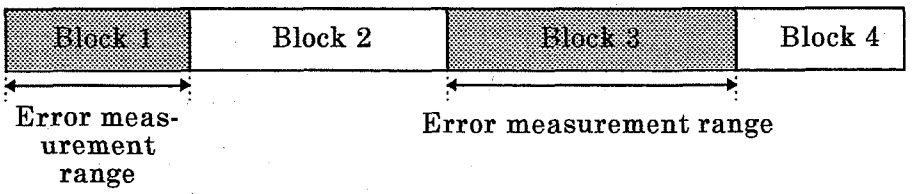


Figure 21 Error measurement ranges for PON patterns

As shown in this figure, when blocks 1 and 3 are set to ON as error detection blocks, error measurement is performed for blocks 1 and 3. Therefore, errors included in blocks 2 and 4 are not measured.

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9 FOR A SYNCHRONOUS THRESHOLD VALUE

Show a threshold of Sync Gain→Sync Loss and Sync Loss→Sync Gain, when you selected a Sync Loss Threshold.

• PRBS

Sync Loss Threshold	Sync Gain→Sync Loss	Sync Loss→Sync Gain
1E-2	256／10000(2.56E-2)	1／10000(1E-4)
1E-3	256／100000(2.56E-3)	1／100000(1E-5)
1E-4	256／1000000(2.56E-4)	1／1000000(1E-6)
1E-5	256／10000000(2.56E-5)	1／10000000(1E-7)
1E-6	256／100000000(2.56E-6)	1／100000000(1E-8)
1E-7	256／1000000000(2.56E-7)	1／1000000000(1E-9)

• When you selected in addition to Auto in PRGM

Sync Loss Threshold	Sync Gain→Sync Loss	Sync Loss→Sync Gain
1E-2	256／10000(2.56E-2)	1／10000(1E-4)
1E-3	256／100000(2.56E-3)	1／100000(1E-5)
1E-4	256／1000000(2.56E-4)	1／1000000(1E-6)
1E-5	256／10000000(2.56E-5)	1／10000000(1E-7)
1E-6	256／100000000(2.56E-6)	1／100000000(1E-8)
1E-7	256／1000000000(2.56E-7)	1／1000000000(1E-9)

• When you selected Auto in PRGM

Pattern Length (Sync Loss Threshold)	Sync Gain→Sync Loss	Sync Loss→Sync Gain
2 to 256(1E-3)	256／80000(3.2E-3)	4／80000(5E-5)
256 to 2560(1E-4)	256／800000(3.2E-4)	4／800000(5E-6)
2561 to 25600(1E-5)	256／8000000(3.2E-5)	4／8000000(5E-7)
25601 to 262144(1E-6)	256／80000000(3.2E-6)	4／80000000(5E-8)

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10 MODES DESCRIBED IN THIS DOCUMENT

In this book, the phrase, "... Mode", is used frequently. This section explains the meaning of each mode.

System operation mode (Power cut-off measurement enabled or disabled state)

Switches whether power cut-off is measured. For details on setting, see Section 6.4, "Specifying System Operations" in the MP1630B Digital Analyzer Instructions Manual. When the system operation mode is in the power cut-off measurement enabled state, the operations below are inhibited to protect the disk system in the hard disk.

(1) PRGM pattern editing by pattern editor
(2) Analyze data recalling
(3) Data save into hard disk
(4) Printing PEREM

Pattern mode (PON or Normal)

Select PON to send and receive a PON pattern. To send and receive other than the PON pattern, select Normal.
When PON is selected as a pattern mode, the PON pattern is assumed to be specified, and the configuration of the Setup: Pattern panel is largely different from that of Normal.
To select a pattern mode, use the Setup: Setup panel.

Pattern Output mode (Burst or Repeat | Downside or Upside)

The meaning varies depending on the pattern mode.

(Pattern mode = Normal)

To send a burst pattern in the PPG unit, select Burst. To successively send patterns instead of the burst pattern, select Repeat.
To select the Pattern Output Mode, use the Pattern dialog box opened from the group box corresponding to the PPG unit on the Setup: Pattern panel.

(Pattern mode = PON)

To send patterns from the PPT unit to each ONU in parallel, select Upside. To send valid channel patterns from the CH1 to the OSU in serial, select Downside.

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Pattern Input mode (Burst or Repeat | Downside or Upside)

The meaning varies depending on pattern modes.

(Pattern mode = Normal)

To receive burst patterns in the ED unit, select Burst. To receive successively generated patterns instead of burst patterns, select Repeat.
To select Pattern Input Mode, use the Pattern dialog box opened from the group box corresponding to the ED unit on the Setup: Pattern panel.

(Pattern mode = PON)

To receive patterns to the ED unit via each ONU in parallel, select Downside. To receive serial patterns from each ONU to the CH1 of the ED unit via the OSU, select Upside.

PRGM Data mode (Restart or Consecutive)

Indicates a PRGM pattern generation method in burst pattern. For details, see Appendix 3, "PRGM Data Mode."
To select Data Mode, use the Pattern dialog box opened from Setup: Pattern.

Pattern Sync mode (Normal or Frame)

Indicates a method used when the ED unit synchronizes a reference pattern with a received pattern. For details, see Appendix 4, "Auto Sync."
To select Pattern Sync Mode, use the Pattern dialog box opened from the group box corresponding to the ED unit on the Setup: Pattern panel.

Burst Sync mode (INT or EXT)

Indicates a method used when the ED unit synchronizes a reference and received patterns with a burst cycle. For details, see Appendix 4, "Auto Sync."
To select Burst Sync mode, use the Pattern dialog box opened from the group box corresponding to the ED unit on the Setup: Pattern panel.

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Display mode (Time or State or Dump)

Indicates a format used to display a pattern to be edited in the Pattern Editor dialog box. For details, see Section 5.4.1, "Selecting Display Mode."
To select a display mode, use the Pattern Editor dialog box.

Measurement mode (Untimed or Repeat or Single | Margin or Diagram)

Has the following two meanings:

(1) To perform measurement in the range from a time when the START button is pressed to a time when the STOP button is pressed regardless of the time, select Unlimited. To repeat measurement in specified cycles, select Repeat. To perform the specified measurement cycle only once, select Single.
(2) Indicates a method of measuring an eye margin.
To select measurement mode, use the Test Menu: Measurement panel.

Error detection mode (OFF, ALL, INS, OMI, or INS&OMI)

Indicates a type of errors detected during error and alarm measurement. For details, see Section 5.10, "Measuring Error and Alarm."

Clock Input mode (Normal or Common (Clock1)or Common (Reference))

When a one-signal clock is only obtained for multiple data items sent from a measured unit, select Common(Clock1). Selecting Common(Clock1) distributes a clock generated from the CH1 to all other channels. To independently input signals from each channel, select Normal. Selecting Common(Reference)distributes a clock generated from the MU163000A Clock Generated unit to all other channels. To independently input signals from each channel. Select Nomal.
To change Clock Input mode, use the Setup: Setup panel.

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11 INITIAL SET VALUE LIST

This section lists the initial values of set items related to the MU163020B 200M 16CH pulse pattern generator and MU163040B 200M 16CH.
The set items related to units not inserted in this instrument do not appear on the screen.

Table 4 Initial set value list (1/7)

Panel name	Group box name	Set item name	Initial set value
Setup: Setup	Pattern Mode	200M 16CH PPG	Normal
		200M 16CH ED	Normal
	Clock&Data Connection 200M 16CH ED	Clock Input Mode	Normal
	Slot3&Slot4 Common Setting	Pattern	OFF
Setup:Clock I/F	200M16CH PPG: Display CH*	Polarity	POS
		Output Mode	Repeat
		Output	ON
		Delay	0
		Level	VAR
		Termination of DUT	50ohm to GND
		Amplitude	2.000
		Offset	+1.000
			Voh
	200M 16CH ED: Display CH*	Polarity	POS
		Input Mode	Repeat
		Delay	0
		Termination	GND
Setup:Data I/F	200M 16CH PPG: Display CH*	Output	ON
		Skew	0
		Level	VAR
		Termination of DUT	50ohm to GND
		Amplitude	2.000
		Offset	+1.000
			Voh

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Table 4 Initial set value list (2/7)

Panel name	Group box name	Set item name	Initial set value
Setup: Data I/F (continued)	200M 16CH ED: Display CH*	Level	VAR
		Threshold	0
		Termination	GND
Setup:Pattern	200M 16CH PPG Mode:Normal	Pattern Output	Repeat
	200M 16CH PPG Mode:Normal: Display CH*	Pattern	PRBS15
		Mark Ratio	1/2
		Bit Shift	1bit Shift
		Phase Difference	None
	(At selection of Zero-Subst pattern)	Pattern	Zero-Subst
		Pattern Length	2^7
		Zero-Length	7
		Logic	POS
	(At selection of PRGM pattern)	Pattern	PRGM
		Pattern Length	8
		Logic	POS
	(At selection of MIX pattern)	Pattern	MIX
		PRGM Logic	POS
		PRBS Pattern	PRBS15
		PRBS Mark Ratio	1/2
		PRBS Bit Shift	1bit Shift
		Block Row	1
		Block Column	2
		Block Length	8
	200M 16CH PPG Mode:Normal: Burst Setting	Mode	INT
		Burst Cycle	10.0
		Enable Length	8
		PRGM Data Mode	Restart

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Table 4 Initial set value list (3/7)

Panel name	Group box name	Set item name	Initial set value
Setup: Pattern (continued)	200M 16CH ED Mode:Normal	Pattern Input	Repeat
	200M 16CH ED Mode:Normal: Display CH*	Pattern	PRBS15
		Mark Ratio	1/2
		Bit Shift	1bit Shift
	(At selection of Zero-Subst pattern)	Pattern	Zero-Subst
		Pattern Length	2^7
		Zero-Length	7
		Logic	POS
	(At selection of PRGM pattern)	Pattern	PRGM
		Pattern Length	8
		Logic	POS
	(At selection of MIX pattern)	Pattern	MIX
		PRGM Logic	POS
		PRBS Pattern	PRBS15
		PRBS Mark Ratio	1/2
		PRBS Bit Shift	1bit Shift
		Block Row	1
		Block Column	2
		Block Pattern	PRGM
		Block Length	8
	200M 16CH ED Mode:Normal: Burst Setting	Auto Sync PRGM	ON
		Auto Sync PRBS	ON
		Sync Loss Threshold PRGM	1E-2
		Sync Loss Threshold PRBS	1E-2
		Burst Sync Mode	EXT
		PRGM Data Mode	Restart
		Frame Length	8bits
		Enable Length	8

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Table 4 Initial set value list (4/7)

Panel name	Group box name	Set item name	Initial set value
Setup: AUX I/F	200M 16CH PPG Display Port*	Level	ECL
		Source	*
		Logic	POS
		Start Location	1
		Stop Location	8
Setup:Trigger I/F	200M 16CH PPG: Sync Output	Source	1/1 Clock Sync
			CH1
			PRBS
	200M 16CH PPG: Trigger Output	Source	Error
			CH1
			#1
	200M 16CH PPG: Burst Trigger Output	Output Delay	0
	200M 16CH ED: Sync Output	Source	1/1 Clock Sync
			CH1
			PRGM
Test Menu: Measurement	–	Test Item	Error/Alarm
		MEAS. Mode	Repeat
		MEAS. Time	00:00:00:01
		Timed Start	OFF
	200M 16CH ED: Display CH*	Mode	ALL
		Block	ALL
	MEAS. Condition	EI/%EFI Interval	500ms
		Performance	ON
		Threshold EI/%EFI	ON
		Power Fail	ON
(At selection of eye margin test parameter)	–	Test Item	Eye Margin
		MEAS. Mode	Margin
			Phase & Threshold
		Error Threshold	1E-3
			Coarse

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Table 4 Initial set value list (5/7)

Panel name	Group box name	Set item name	Initial set value
Test Menu: Measurement (At selection of eye margin test parameter)	–	Test Item	Eye Margin
		MEAS. Mode	Diagram
			16points
		Error Threshold	1E-3
(At selection of Delay(Mode1) test menu)	–	Test Item	Delay(Model1)
		MEAS. Mode	Repeat / Time
	200M 16CH PPG	Pattern Insertion Cycle	1s
	200M 16CH ED	Time Out	0.5s
(At selection of Delay(Mode2) test menu)	–	Test Item	Delay(Model2)
		MEAS. Mode	Repeat
	200M 16CH PPG	Pattern Insertion Cycle	1s
	200M 16CH ED	Time Out	0.5s
		Detected Pattern	PRBS7
Test Menu: Error Addition	200M 16CH PPG	Mode	Normal/INT/Cyclic
		Rate	1E-3
		Burst Cycle	1
		Enable Length	20
		Addition	ON
		Additional Block	ALL
Test Menu: Analyze	Analyze Data: Trace Text	Start Data	ON
		Intermediate Data	ON
		End Data	ON
		1s Data	ON
		Alarm Occur / Recover Time	ON

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Table 4 Initial set value list (6/7)

Panel name	Group box name	Set item name	Initial set value
Test Menu: Analyze (continued)	Analyze Data: Trace Text: Intermediate Data	Error Rate/Count	ON
		Threshold EI/%EFI	ON
		Performance Count	ON
		Performance %	ON
		Alarm Interval	ON
		Clock Frequency Data	ON
		Interval Time	1s
	Analyze Data: Trace Text: End Data	Error Rate/Count	ON
		Threshold EI/%EFI	ON
		Performance Count	ON
		Performance %	ON
		Alarm Interval	ON
		Clock Frequency Data	ON
	Analyze Data: Trace Text:1s Data	Threshold	None
Result: ALL	–	Display	Current
			Error Rate
		Time	Elapsed
		Unit	200M 16CH ED (Slot4)
Result: Normal	–	Display	Current
		Time	Elapsed
		Unit	200M 16CH ED (Slot4)
			CH1
Result: Zoom	–	Display	Current
		Time	Elapsed
	Display1	Unit	200M 16CH ED (Slot4)
		CH	CH1
		Item	Error Rate
	Display2	Unit	200M 16CH ED (Slot4)
		CH	CH1
		Item	Error Count
	Display3	Unit	200M 16CH ED (Slot4)
		CH	CH1
		Item	Pattern Sync Loss

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Table 4 Initial set value list (7/7)

Panel name	Group box name	Set item name	Initial set value
	Display4	Unit	200M 16CH ED (Slot4)
		CH	CH1
		Item	Clock Loss
Result: Monitor		Display	Current
		Time	Elapsed
Analyze		Mode	Trace Text
		Unit	200M 16CH ED (Slot4)
			CH1
Customize	Setup1	Item	Frequency
		Unit	200M CG
	Setup2	Item	Clock/Amplitude
		Unit	200M 16CH PPG (Slot3)
		CH	CH1
	Setup3	Item	Clock/Delay
		Unit	200M 16CH ED (Slot4)
		CH	CH1
	Setup4	Item	OFF
		Unit	OFF
	Setup5	Item	OFF
		Unit	OFF
	Setup6	Item	OFF
		Unit	OFF
	Pattern Edit	Unit	200M 16CH PPG (Slot3)
		CH	CH1
		Offset	0
	Result	Unit	200M 16CH ED (Slot4)
		CH	CH1
		Item	Error Rate

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12. Entry table of performance test result

Test position : _____ Report No. : _____

_____ Date : _____

_____ The person in charge of test : _____

Equipment name : MU163020B Pulse Pattern generator unit

Manufacture No. : _____ The surroundings temperature : _____ ℃

Power frequency : _____ Hz Relative humidity : _____ %

Special mention items :

_____

_____

_____

_____

MU163020B Pulse Pattern generator unit No. : 1/23 Date : _____

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Synchronous output interface test				+/-50mV	
1) 1/1 Clock Sync					
V_{OH}	-0.2V		+0.2V		
V_{OL}	-1.2V		-0.8V		
2) 1/8 Clock Sync					
V_{OH}	-0.2V		+0.2V		
V_{OL}	-1.2V		-0.8V		
Clock output interface test				+/- 50mV +/- 300ps	
1) TTL level(50 Ω to GND)					
ch1 : V_{OH}	+2.25V		+2.75V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		3.3ns		
Tf(10-90%)	———		3.3ns		
ch2 : V_{OH}	+2.25V		+2.75V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		3.3ns		
Tf(10-90%)	———		3.3ns		
ch3 : V_{OH}	+2.25V		+2.75V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		3.3ns		
Tf(10-90%)	———		3.3ns		
ch4 : V_{OH}	+2.25V		+2.75V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		3.3ns		
Tf(10-90%)	———		3.3ns		
ch5 : V_{OH}	+2.25V		+2.75V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		3.3ns		
Tf(10-90%)	———		3.3ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit　　No. : 2/23 Date :

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface test					+/-50mV	
（continued）					+/- 300ps	
1)TTL level(50 Ω to GND)		+2.25V		+2.75V		
ch6 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	+2.25V		+2.75V		
ch7 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	+2.25V		+2.75V		
ch8 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	+2.25V		+2.75V		
ch9 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	+2.25V		+2.75V		
ch10 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	+2.25V		+2.75V		
ch11 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	+2.25V		+2.75V		
ch12 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	+2.25V		+2.75V		
ch13 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	+2.25V		+2.75V		
ch14 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	+2.25V		+2.75V		
ch15 :	V_{OH}	-0.1V		+0.1V		
	V_{OL}	———		3.3ns		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)					

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MU163020B Pulse Pattern Generator Unit No. : 3/23 Date : _____

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface test (continued)				+/-50mV +/- 300ps	
1)TTL level(50 Ω to GND)					
ch16 : V_{OH}	-0.2V		+2.25V		
V_{OL}	-1.2V		-0.1V		
Tr(10-90%)	-0.2V		———		
Tf(10-90%)	-1.2V		———		
Clock output interface test (continued)				+/-20mV +/- 200ps	
2)ECL level(50 Ω to -2V)					
ch1 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch2 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch3 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch4 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch5 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch6 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch7 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch8 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 4/23 Date :

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface (continued)				+/-25mV +/- 200ps	
2)ECL level(50 Ω to -2V)					
ch9 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch10 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch11 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch12 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch13 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch14 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch15 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch16 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.87V		-1.53V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
Clock output interface test (continued)				+/100mV +/- 300ps	
3)PECL level(50 Ω to +3V)					
ch1 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		

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MU163020B Pulse Pattern Generator Unit No. : 5/23 Date : _____

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface test (continued)					+/100mV +/-300ps	
3)PECL level50 Ω to +3V)						
ch2 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch3 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch4 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch5 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch6 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch7 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch8 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch9 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch10 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch11 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 6/23 Date : _____

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface test (continued)				+/100mV +/- 300ps	
3)PECL level(50 Ω to +3V)					
ch12 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch13 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch14 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch15 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch16 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
Clock output interface test (continued)				+/- 25mV +/- 200ps	
4)LVTTL level(50 Ω to GND)					
ch1 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch2 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch3 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch4 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		

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MU163020B Pulse Pattern Generator Unit No. : 7/23 Date : _____

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface test (continued)				+/-25mV +/- 200ps	
4)LVTTL level50 Ω to GND)					
ch5 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch6 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch7 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch8 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch9 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch10 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch11 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch12 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch13 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 8/23 Date : _____

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface test (Continued)				+/- 25mV +/- 200ps	
4)LVTTL level(50 Ω to GND)					
ch14 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch15 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch16 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
Clock output interface test (continued)				+/- 50mV +/- 300ps	
5)VAR level 1(50 Ω to GND)					
ch1 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch2 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch3 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch4 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch5 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch6 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		

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MU163020B Pulse Pattern Generator Unit No. : 9/23 Date : _____

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface test (continued)					+/-50mV +/- 300ps	
5)VAR level 1(50 Ω to GND)						
ch7 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch8 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch9 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch10 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch11 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch12 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch13 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch14 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch15 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch16 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 10/23 Date :

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface test (continued)					+/- 50mV +/- 300ps	
5)VAR level 2(50 Ω to GND)						
ch1 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch2 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch3 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch4 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch5 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch6 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch7 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch8 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch9 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch10 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		

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MU163020B Pulse Pattern Generator Unit No. : 11/23 Date : _____

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock output interface test (continued)					+/-50mV +/- 300ps	
5)VAR level 2(50 Ω to GND)						
ch11 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch12 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch13 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch14 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch15 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch16 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
Data output interface test					+/-50mV +/- 300ps	
1) TTL level (50 Ω to GND)						
ch1 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch2 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch3 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 12/23 Date : _____

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface (continued)					+/-50mV +/- 300ps	
1) TTL level(50 Ω to GND)						
ch4 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch5 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch6 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch7 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch8 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch9 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch10 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch11 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch12 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch13 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		

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MU163020B Pulse Pattern Generator Unit No. : 13/23 Date : _____

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface test (continued)					+/-50mV +/- 300ps	
1) TTL level (50 Ω to GND)						
ch14 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch15 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
ch16 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		3.3ns		
	Tf(10-90%)	———		3.3ns		
Data output interface test (continued)					+/-20mV +/- 200ps	
2)ECL level (50 Ω to -2V)						
ch1 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch2 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch3 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch4 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch5 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch6 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 14/23 Date : _____

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface test (continued)					+/-20mV +/- 200ps	
2)ECL level 50 Ω to -2V)						
ch7 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch8 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch9 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch10 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch11 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch12 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch13 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch14 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch15 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		

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MU163020B Pulse Pattern Generator Unit No. : 15/23 Date : _____

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface test (continued)					+/-20mV +/- 200ps	
2)ECL level 50 Ω to -2V)						
ch16 :	V_{OH}	-1.0V		-0.8V		
	V_{OL}	-1.87V		-1.53V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
Data output interface test (continued)					+/100mV +/- 300ps	
3) PECL level (50 Ω to +3V)						
ch1 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch2 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch3 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch4 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch5 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch6 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch7 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		
ch8 :	V_{OH}	+3.69V		+4.51V		
	V_{OL}	+2.97V		+3.63V		
	Tr(10-90%)	———		1.2ns		
	Tf(10-90%)	———		1.2ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 16/23 Date :

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface test (continued)				+/-100mV +/- 300ps	
3) PECL level (50 Ω to +3V)					
ch9 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch10 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch11 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch12 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch13 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch14 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch15 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
ch16 : V_{OH}	+3.69V		+4.51V		
V_{OL}	+2.97V		+3.63V		
Tr(10-90%)	———		1.2ns		
Tf(10-90%)	———		1.2ns		
Data output interface test (continued)				+/-25mV +/- 200ps	
4) LVTTL level (50 Ω to GND)					
ch1 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		

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MU163020B Pulse Pattern Generator Unit No. : 17/23 Date :

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface test (continuec)					+/-25mV +/- 200ps	
4) LVTTL level (50 Ω to GND)						
ch2 :	V_{OH}	+1.485V		+1.815V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		2.45ns		
	Tf(10-90%)	———		2.45ns		
ch3 :	V_{OH}	+1.485V		+1.815V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		2.45ns		
	Tf(10-90%)	———		2.45ns		
ch4 :	V_{OH}	+1.485V		+1.815V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		2.45ns		
	Tf(10-90%)	———		2.45ns		
ch5 :	V_{OH}	+1.485V		+1.815V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		2.45ns		
	Tf(10-90%)	———		2.45ns		
ch6 :	V_{OH}	+1.485V		+1.815V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		2.45ns		
	Tf(10-90%)	———		2.45ns		
ch7 :	V_{OH}	+1.485V		+1.815V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		2.45ns		
	Tf(10-90%)	———		2.45ns		
ch8 :	V_{OH}	+1.485V		+1.815V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		2.45ns		
	Tf(10-90%)	———		2.45ns		
ch9 :	V_{OH}	+1.485V		+1.815V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		2.45ns		
	Tf(10-90%)	———		2.45ns		
ch10 :	V_{OH}	+1.485V		+1.815V		
	V_{OL}	-0.1V		+0.1V		
	Tr(10-90%)	———		2.45ns		
	Tf(10-90%)	———		2.45ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 18/23 Date :

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface test (continued)				+/-25mV +/- 200ps	
4) LVTTL level (50 Ω to GND)					
ch11 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch12 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch13 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch14 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch15 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
ch16 : V_{OH}	+1.485V		+1.815V		
V_{OL}	-0.1V		+0.1V		
Tr(10-90%)	———		2.45ns		
Tf(10-90%)	———		2.45ns		
Data output interface test (continued)				+/-50mV +/- 300ps	
5) VAR level 1(50 Ω to GND)					
ch1 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch2 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch3 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		

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MU163020B Pulse Pattern Generator Unit No. : 19/23 Date :

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface test (continued)					+/-50mV +/- 300ps	
5) VARlevel1(50 Ω to GND)						
ch4 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch5 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch6 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch7 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch8 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch9 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch10 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch11 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch12 :	V_{OH}	-2.475V		-2.025V		
	V_{OL}	-2.75V		-2.25V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 20/23 Date : _____

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface (continued)				+/-50mV +/- 300ps	
5) VAR level 1(50 Ω to GND)					
ch13 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch14 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch15 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch16 : V_{OH}	-2.475V		-2.025V		
V_{OL}	-2.75V		-2.25V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
Data output interface test (continued)				+/-50mV +/- 300ps	
5) VAR level 2(50 Ω to GND)					
ch1 : V_{OH}	+2.25V		+2.75V		
V_{OL}	+2.025V		+2.475V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch2 : V_{OH}	+2.25V		+2.75V		
V_{OL}	+2.025V		+2.475V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch3 : V_{OH}	+2.25V		+2.75V		
V_{OL}	+2.025V		+2.475V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch4 : V_{OH}	+2.25V		+2.75V		
V_{OL}	+2.025V		+2.475V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
ch5 : V_{OH}	+2.25V		+2.75V		
V_{OL}	+2.025V		+2.475V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		

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MU163020B Pulse Pattern Generator Unit No. : 21/23 Date : _____

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface test (continued)					+/-50mV +/- 300ps	
5) VAR level 2(50 Ω to GND)						
ch6 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch7 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch8 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch9 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch10 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch11 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch12 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch13 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch14 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		
ch15 :	V_{OH}	+2.25V		+2.75V		
	V_{OL}	+2.025V		+2.475V		
	Tr(10-90%)	———		1.05ns		
	Tf(10-90%)	———		1.05ns		

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12. Entry table of performance test result

MU163020B Pulse Pattern Generator Unit No. : 22/23 Date : _____

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Data output interface test (continued)				+/-50mV +/- 300ps	
5) VAR level 2(50 Ω to GND)					
ch16 : V_{OH}	+2.25V		+2.75V		
V_{OL}	+2.025V		+2.475V		
Tr(10-90%)	———		1.05ns		
Tf(10-90%)	———		1.05ns		
Burst trigger output interface test				+/-20mV	
ch1 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch2 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch3 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch4 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch5 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch6 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch7 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch8 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch9 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch10 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch11 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch12 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch13 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch14 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch15 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		
ch16 : V_{OH}	-1.0V		-0.8V		
V_{OL}	-1.8V		-1.6V		

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MU163020B Pulse Pattern Generator Unit No. : 23/23 Date : _____

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
AUX output interface test				+/-20mV	
1)ECL level (50 Ω to -2V)					
ch1 : V_{OH}	-1.1V		-0.7V		
V_{OL}	-1.9V		-1.5V		
ch2 : V_{OH}	-1.1V		-0.7V		
V_{OL}	-1.9V		-1.5V		
ch3 : V_{OH}	-1.1V		-0.7V		
V_{OL}	-1.9V		-1.5V		
ch4 : V_{OH}	-1.1V		-0.7V		
V_{OL}	-1.9V		-1.5V		
ch5 : V_{OH}	-1.1V		-0.7V		
V_{OL}	-1.9V		-1.5V		
ch6 : V_{OH}	-1.1V		-0.7V		
V_{OL}	-1.9V		-1.5V		
ch7 : V_{OH}	-1.1V		-0.7V		
V_{OL}	-1.9V		-1.5V		
ch8 : V_{OH}	-1.1V		-0.7V		
V_{OL}	-1.9V		-1.5V		
2)TTL level (High impedance)	4.0V		-------		
ch1 : V_{OH}	-------		0.5V		
V_{OL}	4.0V		-------		
ch2 : V_{OH}	-------		0.5V		
V_{OL}	4.0V		-------		
ch3 : V_{OH}	-------		0.5V		
V_{OL}	4.0V		-------		
ch4 : V_{OH}	-------		0.5V		
V_{OL}	4.0V		-------		
ch5 : V_{OH}	-------		0.5V		
V_{OL}	4.0V		-------		
ch6 : V_{OH}	-------		0.5V		
V_{OL}	4.0V		-------		
ch7 : V_{OH}	-------		0.5V		
V_{OL}	4.0V		-------		
ch8 : V_{OH}	-------		0.5V		
V_{OL}					
Trigger output interface test				+/-20mV	
V_{OH}	-0.2V		+0.2V		
V_{OL}	-1.2V		-0.8V		

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12. Entry table of performance test result

Test position : _____ Report No. : _____

_____ Date : _____

_____ The person in charge of test : _____

Equipment name : MU163040B Error Detector unit

Manufacture No. : _____ The surroundings temperature : _____ ℃

Power frequency : _____ Hz Relative humidity : _____ %

Special mention items :

_____

_____

_____

_____

MU163040B Error Detector Unit No. : 1/2 Date : _____

Test name	Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Synchronous output interface test				+/-20mV	
	-0.2V		+0.2V		
1) 1/1 Clock Sync	-1.2V		-0.8V		
V_{OH}	-0.2V		+0.2V		
V_{OL}	-1.2V		-0.8V		
2) 1/8 Clock Sync					
V_{OH}					
V_{OL}					
Clock counter				+/- 10Hz	
1)200MHz ch1	199,998,000Hz		200,002,000Hz		
ch2	199,998,000Hz		200,002,000Hz		
ch3	199,998,000Hz		200,002,000Hz		
ch4	199,998,000Hz		200,002,000Hz		
ch5	199,998,000Hz		200,002,000Hz		
ch6	199,998,000Hz		200,002,000Hz		
ch6	199,998,000Hz		200,002,000Hz		
ch7	199,998,000Hz		200,002,000Hz		
ch8	199,998,000Hz		200,002,000Hz		
ch9	199,998,000Hz		200,002,000Hz		
ch10	199,998,000Hz		200,002,000Hz		
ch11	199,998,000Hz		200,002,000Hz		
ch12	199,998,000Hz		200,002,000Hz		
ch13	199,998,000Hz		200,002,000Hz		
ch14	199,998,000Hz		200,002,000Hz		
ch15	199,998,000Hz		200,002,000Hz		
ch16	199,998,000Hz		200,002,000Hz		

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MU163040B Error Detector Unit No. : 2/2 Date :

Test name		Specification the minimum	result	Specification the maximum	Measurement uncertainty	Pass or fail
Clock counter test (continued)					+/-0.01Hz	
2)10kHz	ch1	9,999.9Hz		10,000.1Hz		
	ch2	9,999.9Hz		10,000.1Hz		
	ch3	9,999.9Hz		10,000.1Hz		
	ch4	9,999.9Hz		10,000.1Hz		
	ch5	9,999.9Hz		10,000.1Hz		
	ch6	9,999.9Hz		10,000.1Hz		
	ch6	9,999.9Hz		10,000.1Hz		
	ch7	9,999.9Hz		10,000.1Hz		
	ch8	9,999.9Hz		10,000.1Hz		
	ch9	9,999.9Hz		10,000.1Hz		
	ch10	9,999.9Hz		10,000.1Hz		
	ch11	9,999.9Hz		10,000.1Hz		
	ch12	9,999.9Hz		10,000.1Hz		
	ch13	9,999.9Hz		10,000.1Hz		
	ch14	9,999.9Hz		10,000.1Hz		
	ch15	9,999.9Hz		10,000.1Hz		
	ch16	9,999.9Hz		10,000.1Hz		

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12. Entry table of performance test result

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