LINEEYE

MULTI PROTOCOL ANALYZER

OPTIONAL KIT FOR LE-8200A/LE-8200

TTL/I2C/SPI Expansion Kit

OP-SB85L

Instruction Manual

The 4th Edition

Instruction

Thank you for your purchase of OP-SB85L.

To use it correctly, you are advised to read and understand this instruction manual thoroughly. Keep this together with the warranty. If you encounter any problems, you will find helpful information in this manual.

NOTICE

- It is prohibited to reprint or duplicate any part of the whole of this instruction manual without prior permission from LINEEYE.

- The content of this instruction manual and specifications of the products are subject to change without any notice.

- This instruction manual has been designed and edited with great care to give you all necessary information. If you have any questions, feel free to direct your inquiries to LINEEYE.

- LINEEYE makes no warranty or guarantee, either expressed or implied with respect to its quality, performance, merchantability, or fitness for a particular purpose. LINEEYE shall not be liable for direct, in-direct, special, incidental, or consequential damages resulting from any defect in the product. The warranty and remedies set forth above are exclusive and in lieu of all others.

USER LIMITATION

This product is not intended to be incorporated into systems that require extremely high reliability and safety, such as aerospace equipment, trunk communication equipment, nuclear power control equipment, and medical equipment related to life support. Therefore, do no use for those purposes.

Safety Information

Read this first !!

This Safety Information includes the following important information in order to not only have you learn the right way to use the products, but also prevent you from causing damage to people and property. Before using, please read the main contents after you understand the following symbols & marks.

⚠ Warning:	Should the device be used without following these symbols, there is a possibility of accidents, such as a death or a serious injury, occurring.
🚫	● Stop using the analyzer immediately when smoke or smells emanate from itself. Continuous use may result in an electric shock, a burn and/ or fire.
🚫	● Stop using the analyzer when a liquid or foreign substance get into the analyzer. This may result in an electrick shock or fire. ⇒ Immediately switch off the analyzer and unplug it.
🚫	● Do not disassemble, modify or repair analyzer. This may result in a injury, an electric shock, fire, explosion and/or a breakdown due to overheating.
🚫	● Do not put the analyzer in fire or heat them. This may result in a injury and fire due to overheating or explosion.
🚫	● Never plug or unplug the AC adapter in wet hands. ● Do not subject the analyzer to extreme conditions.

⚠ Caution:	Should the device be used without following these symbols, there is a possibility of accidents, such as a injury , and material damage occurring.
🚫	● Do not leave the analyzer in the following conditions. It may cause heating, burn, electric shock, and malfunction. Strong magnetic field, static electricity or dusty place. Temperature and humidity above the specification. Where condensation occurs. Not flat, or shaking place. Place with leaking water or electricity. Place affected by direct sun or near the fire . * Please do not leave the analyzer in a car during a heat summer.

Contents

Chapter 1 Before Using the Product

1.1 Overview

OP-SB85L is the interface expansion kit of LE-8200, that has the port to measure communication of TTL / CMOS signal level and the one to measure the voltage of high speed analog input. The port for TTL / CMOS supports for the measurement of the communication of TTL / CMOS level of that power supply system is from 1.8V to 5V. So it is suitable for monitoring the communication between the LSI and the interface IC on the printed circuit board by directly probing into the line. It supports for the protocol of not only UART and HDLC but also I2C and SPI on monitoring and simulating. Furthermore, it has BURST measuring mode that is for sampling data at all clock edges.

> Applicable Analyzer : LE-8200A, LE-8200

1.2 Unpacking

When you unpack the product, make sure of the following:

· The product has not been damaged during transportation.
· You have received all the standard accessories listed below.

□	Interface Board	1
□	Probe Pod	1
□	Probe Unit	1
□	Relay Cable	1
□	3 line probe cable	1
□	Instruction Manual (This book)	1
□	Registration Card / Warranty	1

Please contact your LINEEYE distributors if you find any damage to the product caused by transportation, or if there are accessories lacking.
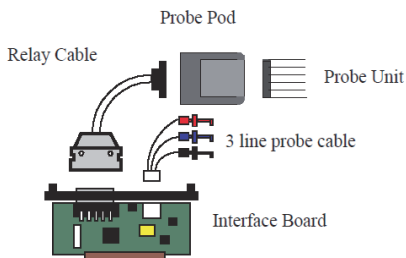
1.3 Installation of Firmware

As the pre-installed standard firmware of the analyzer supports this option, you do not need to install any other firmware to use it.

□ For old firmware
    If the version displayed on the opening screen of the analyzer is Version 1.22 or older, update to the latest version.

<How to update the firmware>
    The latest version of the standard firmware and the software for update(Le8firm) are available on LINEEYE website (https://www.lineeye.com/html/download_update.html). Please refer to the manual of Le8firm for how to update it.

1.4 Set the product to the analyzer

Attach this option to the analyzer by the following procedure.
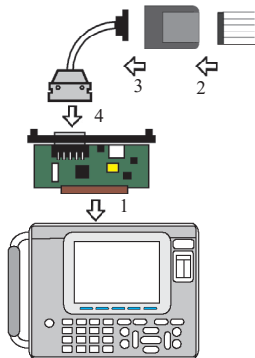
1) Turn off the power of the analyzer, remove the screw of the interface board attached to the analyzer, and pull it straight to remove. Then insert the interface board of this product along the guide rails in the expansion slots as far as it will go and secure with the original screws.

2) Connect the probe pod and probe unit so that the display color of the pod surface label and the lead wire color of the unit match.

3) Connect the probe pod and the relay cable.

4) Connect the relay cable to the TTL/C-MOS connector of the interface board.

Chapter 2 Basic Operation

2.1 Explanation of Each Part

■Probe pod

Connector for the relay cable

Dip switch

← On

Connect the prove unit

Connector for the probe unit

High-speed TTL/CMOS probe pad

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GND	BLACK	—
SDA/SDO/SD	BROWN	—
SDI/RD	RED	—
SS/RTS	ORANGE	—
CTS	YELLOW	—
EXIN	GREEN	—
SCL/SCK/TXC	BLUE	—
RXC	PURPLE	—
TRG. IN	GRAY	—
GND	BLACK	—
TRG. OT	WHITE	—
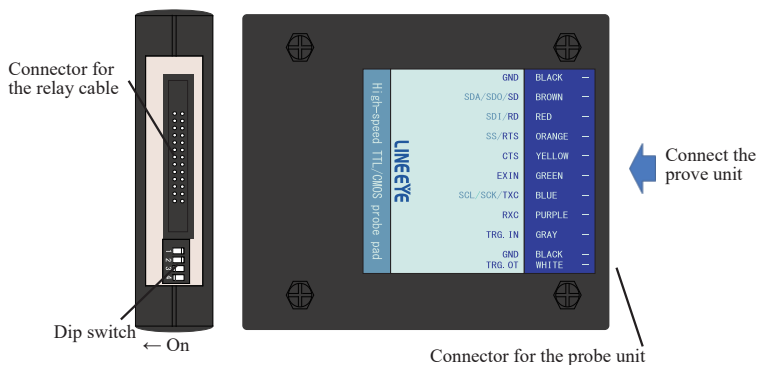
[Definition of DIP Switch]

SW No.	Function OFF ON	OFF	ON
1	External trigger output polarity	H pulse	L pulse
2	SD output ON/OFF	Circuit not connected	Circuit not connected
3	RTS output ON / OFF	Circuit not connected	Circuit not connected
4	TXC output circuit ON/OFF	Circuit not connected	Circuit not connected

When monitoring, turn off all the SW2 to 4. During simulation, turn on the signal switch to be output.

<Input/Output circuit block chart>

5V

Input circuit correspondent to 74LVC

to the internal circuit (Monitor signal)

Probe

100KΩ

1.8 to 5V Variable power

control from the internal circuit

680Ω

DIP SW

from the internal circuit (Simulation signal)
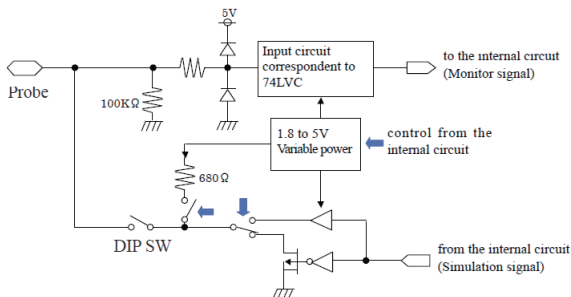
■Probe unit

Connect so that the color notation on the probe pod matches the lead color.

IC Clip

Crocodile clip

Lead wire length: 150mm
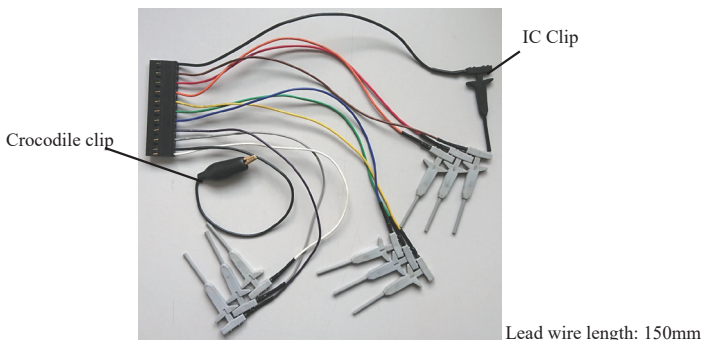
[Signal definition of the probe unit]

Color of Probe Unit Cable	Signal Name	Meaning	LED[*5]
Black	GND	Signal Ground	-
Brown	SD/SDO/SDA	Monitor input for SD data, Output on simulating, SPI MOSI (SDO) / I2C SDA input/output [*1]	SD
Red	RD/SDI	Input of reception data, MISO(SDI) input for SPI.	RD
Orange	RTS/SS	Monitor input and simulation output of control line RTS, SS input/output for SPI. [*1]	RTS
Yellow	CTS	Input of control line CTS	CTS
Green	EXIN	Input of an external signal [*4]	RI
Blue	TXC/SCK/SCL	Input/output of SD data synchronous clock [*2] [*3] Input/output of SPI SCK / I2C SCL [*1]	TXC1 TXC2
Purple	RXC	Synchronous clock input of RD data [*2]	RXC
Gray	TRG .IN	Input of an external trigger signal	-
Black	GND	Signal ground	-
White	TRG .OT	External trigger output, when a trigger matches it outputs a 1ms pulse.	-

*1: Becomes the output terminal when simulating. Do not connect to the power supply of target devices directly. Doing so may result in unit malfunction.

*2: It is not neccessary to connect for asynchronous communications.

*3: When monitoring the SD signal in synchronization with the signal input to the TXC, set the communication clock setting of the analyzer to "TXC_IN". Also, when outputting the clock synchronized with the SD signal from the TXC, set the communication clock setting of the analyzer to "TXC_OUT".

*4: It is used as input of control line RI in the analyzer.

*5: Line state LED on the analyzer body. They light when the corresponding signal is active.

Hold the signal to be measured with the IC clip of the probe unit.

ASYNC

Probe Pod	I/O direction *1		Color of the lead wire	Measuring Object
	MONITOR	SIMULATON		
SD	I	O*4	BROWN	TxD
RD	I	I*4	RED	RxD
GND	-	-	BLACK	Signal Ground

SYNC / HDLC

Probe Pod	I/O direction *1		Color of the lead wire	Measuring Object
	MONITOR	SIMULATON		
SD	I	O*4	BROWN	TxD
RD	I	I*4	RED	RxD
TXC	I	I / O *2	BLUE	TXC
RXC	I	I	PURPLE	RXC
GND	-	-	BLACK	Signal Ground

I2C/ BURST

Probe Pod	I/O direction *1		Color of the lead wire	Measuring Object
	MONITOR	SIMULATON		
SD	I	O*4	BROWN	SDA
TXC	I	I / O *3	BLUE	SCL
GND	-	-	BLACK	Signal Ground

SPI

Probe Pod	I/O direction *1		Color of the lead wire	Measuring Object
	MONITOR	SIMULATON		
SD	I	O*4	BROWN	MOSI
RD	I	I*4	RED	MISO
RTS	I	I /O*3	ORANGE	SS
TXC	I	I / O *3	BLUE	SCK
GND	-	-	BLACK	Signal Ground

*1 : I: Input to the analyzer., O: Output from the analyzer.

*2 : It is based on the setting of "Clock" in "Configuration".

O : TXC_OUT, I : TXC_IN

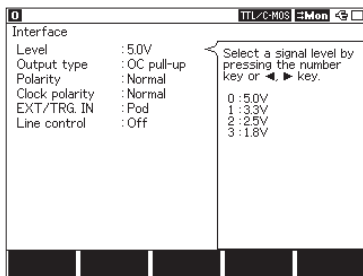*3 : It is different by the simulation mode.

O : Master, I : Slave

*4 : The direction of outputting is fixed. Arrange the connection without any collision.

2.3 Interface Port Setting

To measure communications of TTL/C-MOS level and I2C, the setting of the measurement port is required. To set the measurement port, press [1] on the top menu ([MENU]). Then, the "Interface" screen like below will appear.

```
┌─────────────────────────────────────┐
│ 0              TTL/C-MOS ▣Mon ⦿□      │
│ Interface                             │
│ Level          : 5.0V    ┌──────────┐ │
│ Output type    : OC pull-up│Select a signal level by│
│ Polarity       : Normal  │pressing the number│
│ Clock polarity : Normal  │key or ◄, ► key.│
│ EXT/TRG. IN    : Pod      │0 : 5.0V │
│ Line control   : Off      │1 : 3.3V │
│                          │2 : 2.5V │
│                          │3 : 1.8V │
│                          └──────────┘ │
│                                       │
└─────────────────────────────────────┘
```

□Level

Select the signal voltage level of the target device.

Depending on the hardware to measure, select 5.0V, 3.3V, 2.5V or 1.8V.

🗎 Select 5.0V or 3.3V on Simulating I2C.

□Output type

Select the type of output circuit from OC pull-up, OC No-PLUP, CMOS according to the target device on simulating.

OC pull-up is the output of open collector with the pull-up resister.

OC No-PLUP is the output of open collector with no pull-up resister.

CMOS is the CMOS push-pull output.

🗎 Select OC pull-up or OC No-PLUP on I2C. Not CMOS.

□Polarity

Set the polarity of all signals.

Normal is selected generally. On Invert, polarities of all signals will be inverted.

🗎 Select Normal on I2C.

□Clock polarity

Set the polarity for clock.

Select Normal or Invert according to the target device.

🗎 On Invert the polarity of the clock signal only will be inverted.

□EXT/TRG.IN

Set the input terminal of the external trigger. Select "Pod" on using the TRG IN terminal of the probe pod, or "Panel" on using the TRG IN terminal of the sub board.

□Line Control

When set to On, the control line changes during simulation with the time in the table below (0-9.999 seconds msec unit).

① RTS on time ,   ② SD send time,   ③ RTS off time

```
            ①              ③
         ◄──►          ◄──►
RTS  ─────┐    ┌──────────────┐    ┌─────
         └────┘              └────┘

CTS  ─────────┐              ┌──────────
             └──────────────┘

              ②
           ◄──►
SD   ────────────┌──┬──┬──┐──────────────
                 │  │  │  │
```
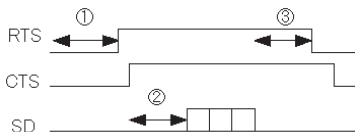
2.4 Communication Condition Setting

You need to set the measurement conditions according to the communication conditions such as the target protocol and speed. The basic communication conditions are set on the [0] "Configuration screen from the top menu screen ([MENU]).

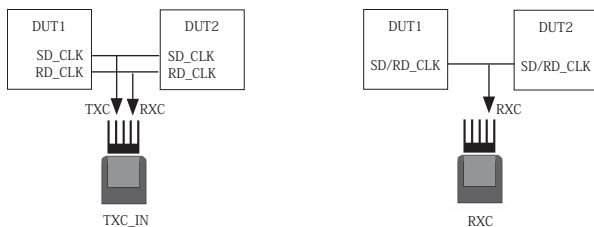| ASYNC	Asynchronous[1]
SYNC/BSC	Character Synchronous[1]
HDLC/SDLC	Bit Synchronous[1]
ASYNC-PPP	Point to Point Communications[1]
MODBUS	Modbus RTU/ASCII Communications
PROFIBUS	Profibus-DP Communications
I2C	Inter Integrated Circuit Communications
SPI	Serial Peripheral Interface Communications[3]
BURST	Clock Synchronous Communications[4]

[1] : Please read the instruction manual of analyzer.

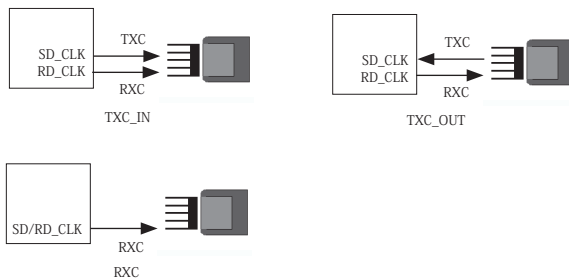[2] : Receive clock only when receiving/transmitting data.

<Setting Clock>

Refer to the following figures.
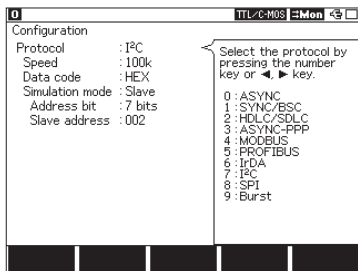
<Monitor>

<Simulation>

<Setting of I2C>

Configuration
Protocol   : I²C
Speed   : 100k
Data code   : HEX
Simulation mode : Slave
  Address bit   : 7 bits
  Slave address : 002

Select the protocol by pressing the number key or ◄, ► key.

0 : ASYNC
1 : SYNC/BSC
2 : HDLC/SDLC
3 : ASYNC-PPP
4 : MODBUS
5 : PROFIBUS
6 : IrDA
7 : I²C
8 : SPI
9 : Burst

□Protocol

　Set to "I2C."

□Speed

　Select the speed from 50000, 100k, 200k, 384k, 417k, 1Mbps when the simulation master mode is used. No need to be set on monitoring.

　▤ This is the maximum speed of transferring data.The speed of real communications will be slower than that, because of the effect of the pull-up resisters and the performance of the device.

□Data Code

　Select the display code from ASCII , EBCDIC, EBCDIK , JIS7 , JIS8 or HEX.

□Simulation Mode

　Select Master or Slave for simulation. No need to set for monitoring.

□Address bit

　Select the address length from 7 bits or 10 bits. This is used on the slave mode of simulation.

□Slave Address

　Inputs the address corresponding to 7 bits or 10 bits in a hexadecimal. This is used on the slave mode of simulation.

Input data

| b9 | b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |

| | | A7 | A6 | A5 | A4 | A3 | A2 | A1 | |
◄――――――― 7 bit address ―――――――►

| A9 | A8 | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 |
◄―――――――――― 10 bit address ――――――――――►
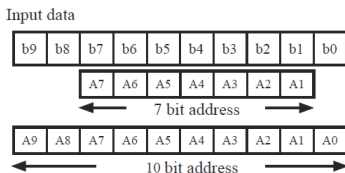
The relation between address and input data is the left figure.

(Example) In case of inputting "123":
　　If "7bits setting,"
　　　"0010001"is input.
　　If "10bits setting,"
　　　"0100100011" is input.

<Setting SPI>
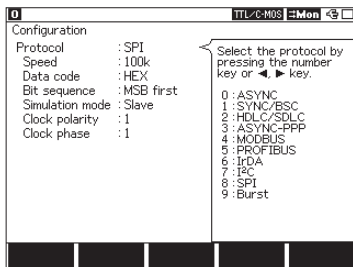
□Protocol

    Set to "SPI".

□Speed

    Set the speed up to 4Mbps for Simulation mode.

    Set the speed for Monitor mode.

□Data code

    Select the display code from ASCII, EBCDIC, EBCDIK JIS 7, JIS 8, or HEX.

□Simulation mode

    Select "Master" or "Slave" for Simulation mode.

□Clock polarity (CPOL)

    Select the clock polarity.

□Clock phase (CPHA)

    Select the clock phase.

<Setting of BURST>

```
[0]                            TTL/C-MOS  ≡Mon
Configuration
  Protocol        : Burst         Select the protocol by
   Data code      : HEX           pressing the number
   Data bit       : 8 bits        key or ◄, ► key.
   Parity         : None
   Bit sequence   : LSB first     0 : ASYNC
   Frame end time :  10           1 : SYNC/BSC
                                  2 : HDLC/SDLC
                                  3 : ASYNC-PPP
                                  4 : MODBUS
                                  5 : PROFIBUS
                                  6 : IrDA
                                  7 : I2C
                                  8 : SPI
                                  9 : Burst
```
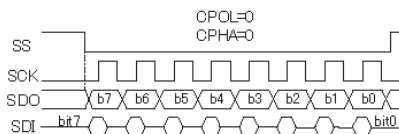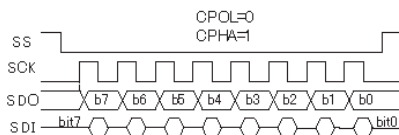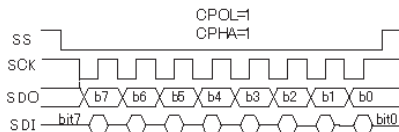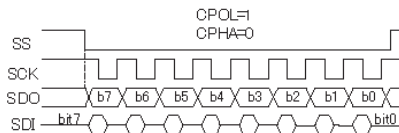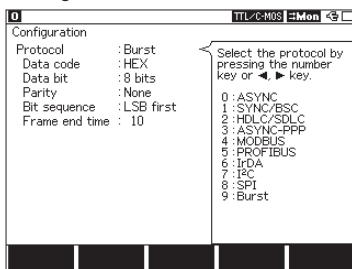
□Protocol

Set to "BURST."

□Data code

Select the display code from ASCII, EBCDIC, EBCDIK JIS 7, JIS 8, or HEX.

□Data bit

Select the data length from 7 or 8 bits.

□Parity

Select the parity bit from None, Odd, Even, Mark, Space, or MP.

□Bit sequence

Select the order to transmit data from LSB first (from the lower bit) or MSB first (from the upper bit).

□Frame end time

Set the time of non-communication condition considered to be the frame end from 1 to 100m seconds.

▤ When the analyzer meausres time more than "FRM TIME", it will add the timestamp on the top of the frame.

2.5 Start and End of Monitoring

Set the analyzer operation mode to ONLINE for the monitor function.

Make sure that all of the dip switches No. 2 to 4 on the probe pod are all turned off.

■Start of Measurement

Press [RUN].

The measurement starts and then it displays the data on the screen and captures the data in the capture buffer.

■Stop Measurement

Press [STOP]

<Note>

When monitoring a large amount of data at a high communication speed (3 Mbps or more), the measured data may not be displayed on the screen. This is because the display processing cannot be executed due to the heavy load of data processing, and it is not because of a device error. Press [Stop] to display the data.

▤ For the selectable monitor display of the communication protocol when the standard board is installed, see the instruction manual of the analyzer.

<I2C>

The meanings of special symbols displayed for I2C are as follows:

Special Symbol	Data & Meaning
▶	I2C start sequence and restart sequence
▶	I2C stop sequence
D8	I2C non acknowledge
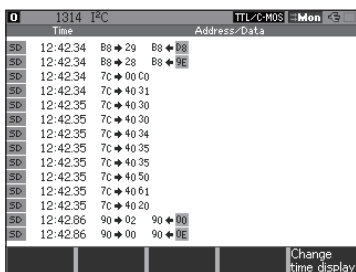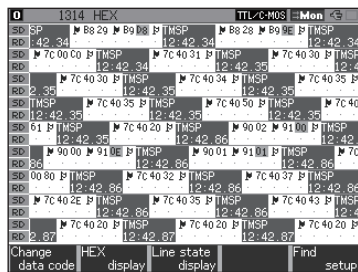
If "Protocol" in "Configuration" is set to "I2C", the normal data display screen will be switched to the translation display screen for I2C, by pressing [Data].

The meanings of translation displayed for I2C are as follows:

Display	Meaning
TM	Desplay time of received data.[*1]
←	Indicate transmission (write) from master.
→	Indicate reception (read) to master.
Address / Data	Display the slave address and data per the slave address in HEX.[*2]
D8	Indicate non-acknowledgement.

[*1] : When "Time Stamp" of "Record & Display Control" from the condition menu is in the OFF setting, the time is not displayed.

[*2] : The number of characters can be displayed up to 19bytes. Also, if a special address is designate, the direction of transmission/reception is not displayed.

<SPI>

While measuring SPI, it is possible to have "Frame Diaplay" by pressing [Data] button.

11
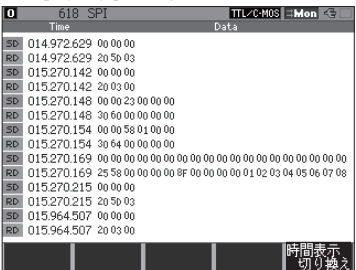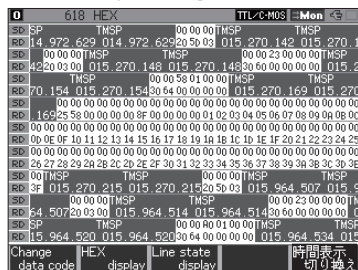
2.6 Usage of the Trigger Function

You can use the trigger function for this product as same as that of the standard interface board. For the detail, refer to the instruction manual for the analyzer.

🗎 To learn more detail about this, read the instruction manual attached

Factor : Trigger Factor	
Error	The various error is made to be a factor.
Character	The detection of the character string of max at 8 characters is made to be a factor.
Line	The condition of the control line is made to be a factor.
Time/Count	The condition of inside timer and counter is made to be a factor.
Idle time	The condition of the non-communication is made to be a factor.

Action : Trigger Action	
Buzzer	Sounds the buzzer.
Stop	Stops measuring.
Save	Saves the data to the memory card.
Timer	Controls the inner timer.
Counter	Controls the inner counter.
Trigger switch	Validate or invalidate the other trigger function.
Send	Sends the specified data.
TRG OUT	Output the pulse to the TRG OUT terminal.

<Line Control>

For the control line trigger RTS / CTS / CI(EXIN) / EX(TRG IN) are available.
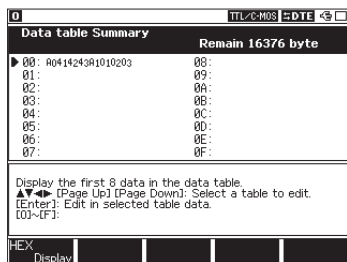
<Non-acknowledge>

Non-acknowledge of I2C can be the factor of the trigger function. By selecting Error of the trigger and setting Parity / MP to On, the non-acknowledge condition can be the trigger factor.

Chapter3 Simulation

3.1 Registration of Transmission Data

To register data to be transmitted, press [9] ("Data send table") and then select the table number you wish to set or modify. It is possible to register 160 kinds of transmission data in the 00 to 9F tables.

```
0                          TTL/C-MOS  DTE
Data table Summary
                          Remain 16376 byte
▶ 00: A0414243A1010203    08:
  01:                     09:
  02:                     0A:
  03:                     0B:
  04:                     0C:
  05:                     0D:
  06:                     0E:
  07:                     0F:

Display the first 8 data in the data table.
▲▼◀▶ [Page Up] [Page Down]: Select a table to edit.
[Enter]: Edit in selected table data.
[0]~[F]:

HEX
    Display
```

By pushing [0] to [F] you can move to data table edit display which corresponds with the number you push. Total of 16384 characters can be registered in the tables. For the further details for the registration of transmission data, refer to the manual of the analyzer.

<Attention>
In case of BURST, the simulation function can not be utilized.

<I2C>

The operation differs depending on the setting of Simulation mode of [Menu], [0] "Configuration".

□Master mode

Set a slave address first(with read or write bits), and then set transmission/reception data.
To receive data, set dummy data (User-defined) for the number of data being received.

(Example 1) In case of transmitting 3 bytes data (41h, 42h, 43h) to the slave address of 7 bits, "1010000b":

```
0                          TTL/C-MOS  DTE
Data table 00             Remain  16380 byte
                          Position      4

A0414243■




Edit by [0]~[F],▲▼◀▶ key.
[Del]:Delete
[Enter]:select the range
[Shift]:change the edit function

HEX    Input           Edit
    Display    Mode         Option
```
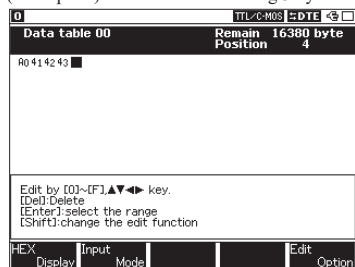
Set "A0 41 42 43."

A0(10100000b) :Write request
41 42 43   :3 bytes data for transmitting

(Example 2) In case of receiving 3 bytes data from the slave address of 7 bits, "1010000b":

```
0                          TTL/C-MOS  DTE
Data table 01             Remain  16376 byte
                          Position      4

A1010203■




Edit by [0]~[F],▲▼◀▶ key.
[Del]:Delete
[Enter]:select the range
[Shift]:change the edit function

HEX    Input           Edit
    Display    Mode         Option
```
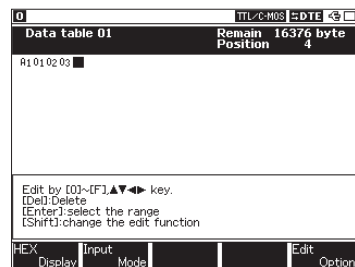
Set "A1 01 02 03."

A1 (10100001b) : Read request

01 02 03   : 3 bytes of dummy data

(Example 3)When transmits the 3 byte data (41h, 42h, 43h) to the slave address (7bit) 1010000b and then receives data for 3bits from the slave.

Set "A0 41 42 43 A1 01 02 03" and set the cursor on the address data part of 'A1', then configure the re-start sequence by [SHIFT] + [F2].

A0(10100000b)	: Write request
41 42 43	: Transmission data 3bytes
A1 (10100001b)	: Re-start + Read request
01 02 03	: Any dummy data 3bytes

```
┌────────────────────────────────────────┐
│█                   TTL/C-MOS ＝DTE ◀▶□  │
│ Data table 02        Remain  16368 byte │
│                      Position      3    │
│ A0 41 42 ▓8 A1 01 02 03                  │
│                                          │
│                                          │
│                                          │
│                                          │
│ Edit by [0]~[F],▲▼◀▶ key.               │
│ [Del]:Delete                             │
│ [Enter]:select the range                 │
│ [Shift]:change the edit function         │
│─HEX──┬─Input──┬──────┬──────┬─Edit───────│
│ Display  Mode                    Option  │
└────────────────────────────────────────┘
```
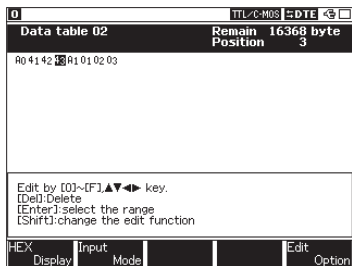
● To insert a re-start sequence, push [SHIFT]+[F2] at the data where you want to insert it.
● The start sequence and stop sequence will be automatically added at the beginning and the end of the registered data.
● When receives data, set dummy data equivalent to the data amount you want to receive.

□Slave mode

Set the data, which is sent by request from the master, at the data table. When receives by the request from the master, set any dummy data. Data tables which 1byte or more has been set can be used for reception of all the data sent from the master and for the transmission data of byte number requested by the master.

(Example)

When this device transmits/receives by the slave address (7 bits) 1010000b and transmits (31h, 32h, 33h) by a send request (3byte) from the master.

Set "31 32 33" to the data table and configure with followings at "Configuration".

Simulation mode	: Slave
Address bit	: 7 bit
Slave address	: 0A0

● If there is no data at the data table, communication cannot be done.

<Note> ●In the case of I2C, data amount can be registered at the table is limited to 127 bytes. (The data which exceeds the limit will be disregarded.)

●When execute a simulation of I2C, make sure to turn the dip-switches No.2 and No.4 to ON.
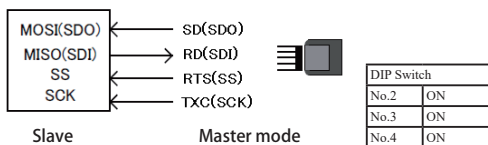
<ASYNC>

Set No.2 of DIP switch ON for outputting the data.

<SYNC / HDLC>

Set "Clock " to"TXC_OUT"at "Configuration", when outputting clock from the analyzer. In addition, set No.2 and 4 of DIP switch ON.

<SPI>

□Master Mode

Set No.2, No.3, No.4 DIP switch ON.

Connect SD to MOSI, RD to MISO, RTS to SS, and TXC to SCK.

DIP Switch	
No.2	ON
No.3	ON
No.4	ON

□Slave Mode

Set No.2 DIP switch ON.

Connect SD to MISO, RD to MOSI, RTS to SS, and TXC to SCK.

DIP Switch	
No.2	ON
No.3	OFF
No.4	OFF
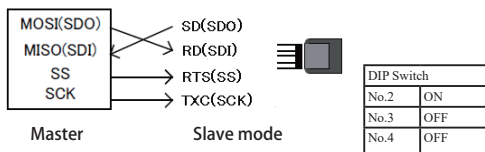
■Start simulation

Press [RUN].

When the measurement starts, the data is displayed on the screen while data is saved in the capture buffer. The action with chosen simulation function will be executed.

<Attention>
Only RTS/CTS can be used in the control line. Other control line is invalid.

■End of simulation

Press [STOP].

<I2C>

Only manual mode will be operated. Only a part of command in program mode will be operated. Other simulation function cannot be used.

□Master mode

When the key which corresponded to the table number is pressed, the transmission and reception will be started.

The stop sequence is generated when finished transmission and reception of all registration data or observed non-acknowledge from the slave.

Also, when received registered dummy data at the master reception, it becomes nonacknowledged.

□Slave mode

When the key which corresponded to the table number is pressed, the transmission and reception will be started,

The data is sent out following the SCL, when there is a transmit demand from the master until the stop sequence is detected.

(In case of the slave mode, as long as there is no demand from the master(as long as the address does not match), the operation of transmitting and receiving does not start. And, this analyzer does not conduct transmission and reception, when the stop sequence is once received.)

・Procedure at master mode and slave mode

1) Press [RUN].
2) Press the key which corresponded to the table number.
3) Repeat "2" if conducts transmission and reception again.
4) Press [STOP] to finish simulation.

<SPI>

It can be used only in Manual mode and some commands in Program Mode. Other modes cannot be used.

□Master Mode

Start simulation and then press the registered table number key. It makes SS(RTS) active and start data transmission/reception. When it finishes data transmission, it makes SS non-active.

□Slave Mode

Start simulation and then press the registered table number key for data transmission/ reception. Transmit data following SS and SCK(TXC) from the Master.

・Steps of Master Mode and Slave Mode

    1) Press [RUN]
    2) Press registered table number key.
    3) Go back to "2" if repeating transmission/reception.
    4) Press [STOP] to end the simulation.

Chapter 4 Bit Error Rate Test(BERT)

By selecting "BERT" at the top menu, you can use the bit error rate test.

The bit error rate test is available for ASYNC and SYNC.

<SYNC>

Set "Clock " to"TXC_OUT" at "Configuration". Set No.2 and 4 of DIP switch ON, when the clock is output from the analyzer.

In case in which the clock supplied from the target devices is input to this analyzer using TXC, set "Clock " to "TXC_IN"at communication condition(in this case, set No. 4 of DIP switch OFF).

And, the data is received by synchronizing to the clock input from RXC of the probe pod.

▤ The details are in the manual of analyzer.

4.1 Start and finish of measuring

■Start measuring

Press [Run].

□Transmission:　　Send test patterns from SD.

□Reception:　　　"Sync.search" is displayed, until the synchronization is established
by the detection of the Initial pattern.
The display of "Sync.search" will be disappeared after the
established synchronization and error bits, etc. will be measured.

■Finish of measuring

Press [Stop].

The analyzer stops measuring, but keeps sending test patterns until [Menu] is pressed.

Chapter 5 Analog Wave Monitor Function

Analog wave monitor function measures the voltage value (range: ±12V) with the time resolution (max 25nsec), using the 3 line probe cable.

▤ To use this function, you need to have LE-8200A/LE-8200 and the expansion board(OP-SB85L series).

5.1 Connection

1. Connect the 3 line probe cable to the expansion board like the figure.
2. Pick the measuring object using the 3 line probe cable.

LE-8200/LE-8200A
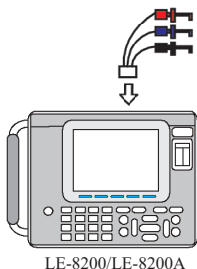
Probe (red) : Pick the measuring object.
          (Corresponding to AI1)

Probe (blue) : Pick the measuring object.
          (Corresponding to AI2)

Probe (black) : Pick GND of the measuring object.

-Attention-

The absolute maximum rating of the analog measurement is ± 25V. Please do not use for above the rating.

5.2 Setting

1. From the top menu, press [4] to display the setting screen of the analog wave monitor function.
   By pressing [F1] to switch to the digital wave monitor screen.

2. Make the analyzer calibrated if necessary.
   ▤ 5.6 Calibration

3. Set the necessary settings.
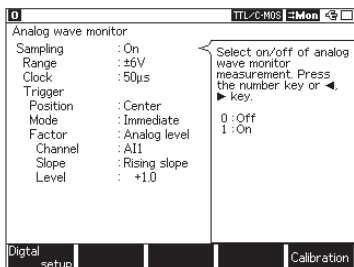
□Sampling

Select On/ Off of the analog wave monitor function.

□Range

Select the measuring range of the voltage level

□Clock

Sets the sampling clock.

(Please set the value of about 1/100 in the sampling clock which you want to measure.)

Trigger Conditions:

When the trigger is satisfied, the analog waveform measurement function fetches the measurement result into the memory and stops the measurement. Here set the conditions for establishing the trigger.

□Position

Set the position of trigger in the sampling memory.

Before : Capture more data which exists before the trigger condition is satisfied.

Center : Capture the same amount of data in before and after the trigger condition is satisfied.

After : Capture more data which exists after the trigger condition is satisfied.

□Mode

Immediate : Trigger can be satisfied soon after measurement starts.

Full :Trigger can be satisfied after capturing full in the sampling memory.

Select "Full" if "Position" is set to be"Before" or "Center".

Continuous :The analyzer repeats waiting the event for trigger and displaying the data after the trigger is satisfied. This is the real time display of Analog waveform while measuring.

□Factor

Set the trigger condition of the analog monitoring function.

If the trigger condition is satisfied, analyzer stops measuring and saves the data in the memory .

⇒ When Factor is "Analog level"

Voltage value of analog input becomes a trigger condition of the analog wave monitoring function.

□Channel

Set a channel to apply the trigger. AI1 stands for Channel1, and AI2 stands for Channel2.

□Slope

Set a slope to apply the trigger. Select "Rising slope"or "Falling slope" .

□Level

Select the voltage level to be the trigger condition.

⇒ When Factor is "Online"

The condition set at trigger function will be the trigger condition of the analog wave monitor function.

Bit pattern, communication error of the communication line can be a factor of trigger.

□Trigger No.

Select a trigger number.

📄 To learn more detail about the trigger function, read「2.6 Usage of the Trigger Function」or the instruction manual of analyzer.

5.3 Control of Measuring

The analyzer can display the analog waveform on its screen after the measurement, if ” Immediate”or ” Full” is selected on “Mode”.

1) Select “on” at the analog wave monitoring function, and press [Run].
2) Press [Stop] to stop measuring.
   - ▤ If the trigger condition is not still formed in the time when [Stop] is pressed, the trigger point will not appear.
3) Press [Data] for several times to change the screen to the analog waveform.

If “Continuous“ is selected on “Mode“, the analog wave monitoring can be seen even while measuring.

1) Press [Run] after making the function of the analog waveform active.
2) Press [Data] for several times to change the screen to the analog waveform.
   - ▤ If the sampling clock is set to low speed like 1 ms, it may takes several seconds until the analog waveform screen appears.

5.4 Control of Measuring Screen
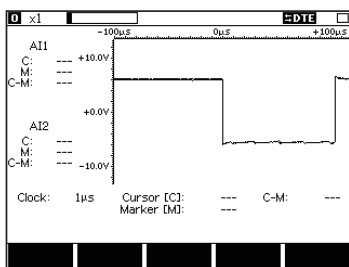
Press [Data] several times to display the analog wave screen(left).

Press [←] or [→] to scroll the screen right and left.

By pressing them for a while to scroll the screen faster.

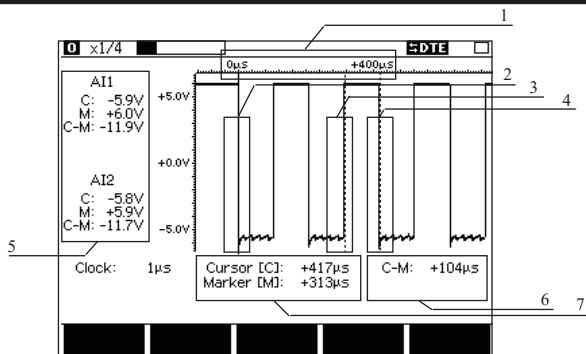Press [Page / Up] or [Page / Down] to go to next page.

■Enlarge / Reduce the screen

Data on the screen can be enlarged or reduced. (1, × 1/2, × 1/4, × 1/8, × 1/16)

Press [F1] to enlarge ,or press [F2] to reduce.

■Control of Cursor

Press [F4] or [F5] to move the cursor. Press [F3] to mark the cursor line.

5.5 Description of the Measurement Screen

1. Elapsed time since the trigger condition is satisfied.

2. Trigger point (red line)

3. Marker point (broken line of red)

4. Cursor point (broken line of blue)

5. Cursor point, Marker point and voltage difference between two points.

6. Time between the points of cursor and marker

7. Time of cursor point and marker point.

5.6 Calibration

There is a simple calibration for the analog wave monitoring function.

It is recommended to be finished before measurement.

1) From the top menu, press [4] to display the screen of the analog wave monitor function.

   Press [F1] to switch to the digital wave measurement.

2) Press [F5] to display the screen of calibration.

3) Connect the AI1(red probe) and AI2(blue probe) to GND(black probe).

4) Press [Run] to start calibration.

5) After the calibration, press [Menu] to go back to the top menu.

Chapter 6 Printing

When measured data is printed, the I2Cstatus is printed like the table mentioned below.

Normal Data Printing of I2C

Symbol	Meaning
>>	Start sequence, and restart sequence
<<	Stop sequence
##	Non-acknowledge

Printing though Translation Display of I2C

Symbol	Meaning
=>	Transmission and retransmission from master
<=	Reception to master
a	Acknowledge
n	Non-acknowledge

e.g. Print of Data

```
*=[LE-8200A]====[2012-08-20 14:19:06]=*
* Model   : LE-8200A               *
* Version : 1.22.01                *
* Extension : OP-SB85              *
* Serial No.: 37404001             *
* Start time: 2012-08-20 13:12:34  *
* Stop time : 2012-08-20 13:12:43  *
*----------------------------------*
* MONITOR DATA                     *
* PROTOCOL: I2C                    *
* CODE   : HEX                     *
* IDLE TM : OFF   TM STAMP: MS10m  *
*         PRINT CODE : HEX         *
*==================================*

SD:TMSP] B829 B9D8 [TMSP] B828 B99E [TMSP] 7C00
   24234]>>B829>>B9##<<[124234]>>B828>>B9##<<[124234]>>7C00
RD: -------    -------    ---


SD:C0 [TMSP] 7C4031 [TMSP] 7C4030 [TMSP] 7C4030
   C0<<[124234]>>7C4031<<[124235]>>7C4030<<[124235]>>7C4030
RD:--    -----    -----    ----


SD: [TMSP] 7C4034 [TMSP] 7C4035 [TMSP] 7C4035
   <<[124235]>>7C4034<<[124235]>>7C4035<<[124235]>>7C4035<<
RD: -    -----    -----    -----


SD:[TMSP] 7C4050 [TMSP] 7C4061 [TMSP] 7C4020 [
   [124235]>>7C4050<<[124235]>>7C4061<<[124235]>>7C4020<<[1
RD:    -----    -----    -----


SD:TMSP] 9002 9100 [TMSP] 9000 910E [TMSP] 9001
   24286]>>9002>>91##<<[124286]>>9000>>91##<<[124286]>>9001
RD: -------    -------    ---
```

e.g. Print of Translation

```
*=[LE-8200A]====[2012-08-20 14:16:29]=*
* Model   : LE-8200A               *
* Version : 1.22.01                *
* Extension : OP-SB85              *
* Serial No.: 37404001             *
* Start time: 2012-08-20 13:12:34  *
* Stop time : 2012-08-20 13:12:43  *
*----------------------------------*
* MONITOR DATA (I2C FRAME DUMP)    *
* PROTOCOL: I2C                    *
* CODE   : HEX                     *
* IDLE TM : OFF   TM STAMP: MS10m  *
*==================================*


------TM------------------------ADDRESS/DATA--------------------------
SD: 12 42 34 B8a=>29a B8a<=D8n
SD: 12 42 34 B8a=>28a B8a<=9En
SD: 12 42 34 7Ca=>00aC0a
SD: 12 42 34 7Ca=>40a31a
SD: 12 42 35 7Ca=>40a30a
SD: 12 42 35 7Ca=>40a30a
SD: 12 42 35 7Ca=>40a34a
SD: 12 42 35 7Ca=>40a35a
SD: 12 42 35 7Ca=>40a35a
SD: 12 42 35 7Ca=>40a50a
SD: 12 42 35 7Ca=>40a61a
SD: 12 42 35 7Ca=>40a20a
SD: 12 42 86 90a=>02a 90a<=00n
SD: 12 42 86 90a=>00a 90a<=0En
SD: 12 42 86 90a=>01a 90a<=01n
SD: 12 42 86 7Ca=>00a80a
SD: 12 42 86 7Ca=>40a32a
SD: 12 42 86 7Ca=>40a37a
SD: 12 42 86 7Ca=>40a2Ea
SD: 12 42 86 7Ca=>40a35a
SD: 12 42 86 7Ca=>40a43a
SD: 12 42 87 7Ca=>40a20a
SD: 12 42 87 7Ca=>40a20a
SD: 12 42 87 7Ca=>40a20a
```

📄 Time stamp, address, direction (send/receive) and data are printed in order.

Chapter 7 Specifications

Applicable Analyzer	LE-8200A/LE-8200
Interface	TTL / CMOS (for I2C and SPI)
Probe Signal	SD (SDA/SDO) , RD (SDI) , RS (SS) , CS , EX IN , SD CLK (SCL/SCK) , RD CLK , Trigger IN , Trigger OUT (Length of lead:170mm)
Protocol[*1]	ASYNC, ASYNC-PPP, SYNC(BSC), HDLC(SDLC), BURST, I2C, SPI
Test function[*1]	Monitor / Simulation / BERT[*1]

Communication speed	ASYN, ASYNC-PPP, SYNC, BURST : 50bps ~ 4Mbps[*2]
	HDLC : 50bps to 4Mbps[*2] on standard,
	  115.2Kbps to 12Mbps[*3] on using OP-FW12G/OP-FW12GA
	SPI : 50bps to 2.15Mbps[*4],
	  115.2Kbps to 20Mbps[*5] on using OP-FW12G/OP-FW12GA
	I2C : max. 1Mbps (On simulation 50K, 100K, 200K, 384K, 417K, 1Mbps)

Signal level	Selectable from 5.0V/3.3V/2.5V/1.8V of power supply system
Input Impedance	100K Ω (0V $\leq$ Vin $\leq$ 5V) (Acceptable Input range : -1V to +7V)
Input Level Threshold	Setting of 5.0V High: Min 3.5V Low: Max 1.5V Setting of 3.3V High: Min 2.0V Low: Max 0.8V Setting of 2.5V High: Min 1.7V Low: Max 0.7V Setting of 1.8V High: Min 1.2V Low: Max 0.6V
Output circuit	The followings are selectable[*6]: OC(Open collector)with the pull-up resistor of 680Ω, OC(Open collector)without pull-up resistor, Push-pull output of CMOS
Output Level Voltage	High level : Min Selectable signal level - 0.4V Low level:Max 0.5V[*7]

Analog Waveform	Measure signal voltage of 2 channels and display in analog waveform
	
	  Input : IC clips of probe cable
	  Measurement Range : ±12V/ ±6V selectable
	                              (8bit resolution, Acceptable input voltage : ±25V)
	  Sampling : 1ms - 25ns, 15 steps
	  Record length : 4K point

Digital Waveform	Sampling : 1ms - 10ns sampling, 16 steps
Size and Weight	Probe Pod body size : 78(W) × 92(D) × 22(H)mm , Relay cable length : 800mm Weight : about 100g
Power	Supplied from the analyzer's body
Temperature	Operation:0 to 40°C Storage:-10 to 50°C

*1: In BURST(Mode for sampling data at all clock edges), only the monitor mode is supported. I2C and SPI do not have the BERT function.

*2: Applied in the half duplex. In the full duplex 2.15Mbps at Max.

*3: Applied in the half duplex. In the full duplex 6Mbps at Max.

*4: MAX 20Mbps(Monitor) or 4Mbps(Simulation), when the continuous transfer speed is within 1K bytes.

*5: Applied in the monitor mode. In the simulation mode, the speed is up to 12Mbps.

*6: Set from the analyzer. CMOS outputting is remcommended on simulation of which speed is more than 2Mbps.

*7: Applied when the current is 4 mA.

There is a registration page on our web site.

(https://www.lineeye.com)

Please register your product for further support.

We will provide you the firmware update information

and sales information etc.

LINE EYE CO., LTD.

M-40SB85LE/OP