

LINEEYE

OPTIONAL KIT
FOR MULTI PROTOCOL ANALYZER

TTL/I2C/SPI Expansion Kit

OP-SB5GL

Instruction Manual

The 6th Edition

Instruction

Thank you for your purchase of OP-SB5GL.

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.	
	<ul style="list-style-type: none">• 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.
	<ul style="list-style-type: none">• Stop using the analyzer when a liquid or foreign substance get into the analyzer. This may result in an electric shock or fire. <p>→ Immediately switch off the analyzer and unplug it.</p>
	<ul style="list-style-type: none">• 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.
	<ul style="list-style-type: none">• Do not put the analyzer in fire or heat them. This may result in a injury and fire due to overheating or explosion.
	<ul style="list-style-type: none">• 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.	
	<ul style="list-style-type: none">• Do not leave the analyzer in the following conditions. 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.

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Chapter 1 Before Using the Product

1.1 Overview

OP-SB5GL is an interface expansion set equipped with two measurement ports for RS-232C (V.24) and TTL / C-MOS signal level communication. It supports not only general UART but also synchronous communication such as HDLC/SDLC which requires send/receive clock signals of 1.8V/2.5V/3.3V/5V power source system, I2C (*1), and SPI (*2) communication. This product is ideal to monitor and test the communication status by directly probing the communication lines on the printed circuit board communication LSI or wireless modules.

Applicable Analyzer: LE-3500XR, LE-2500XR, LE-3500R, LE-2500R,
LE-3500, LE-2500, LE-1500

*1: LE-1500 does not support I2C.

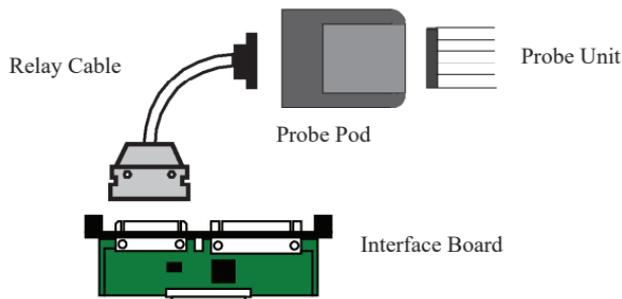
*2: LE-2500 and LE-1500 do not support SPI.

1.2 Unpacking

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

- The product has not been damaged during transit.
- You have received all the standard accessories listed below.
 - ☑ Interface Board 1
 - ☑ Probe Pod 1
 - ☑ Probe Unit 1
 - ☑ Relay Cable 1
 - ☑ Instruction Manual 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 the old firmware of LE-3500, LE-2500, LE-1500

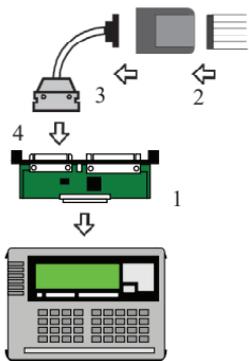
If the version displayed on the opening screen of the analyzer is Version 1.03 or earlier, update to the latest version.

<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.

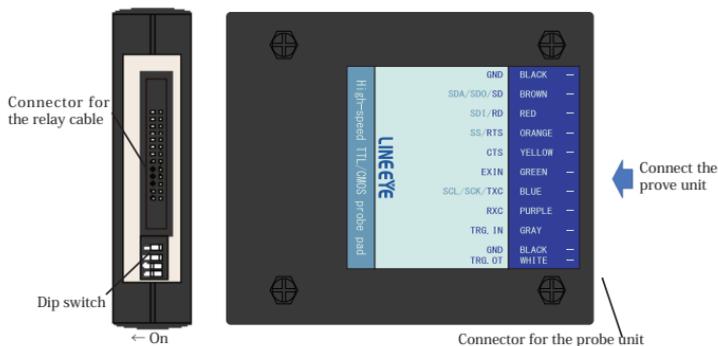


- 1) Turn off the power of the analyzer, remove the screw of the interface board attached to the analyzer, and pull it straight to remove. Then insert the interface board of this product along the guide rails in the expansion slots as far as it will go and secure with the original screws.
- 2) Connect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

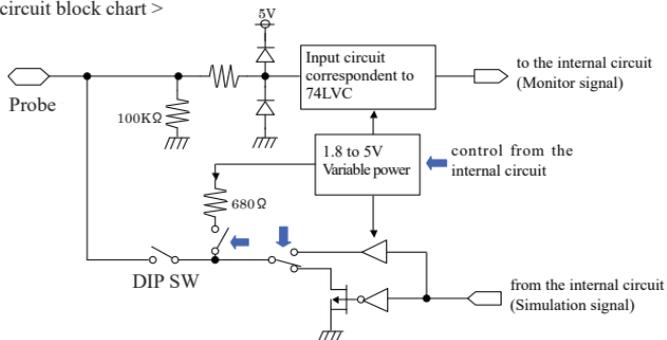
■ Probe pod



SW No.	Function	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

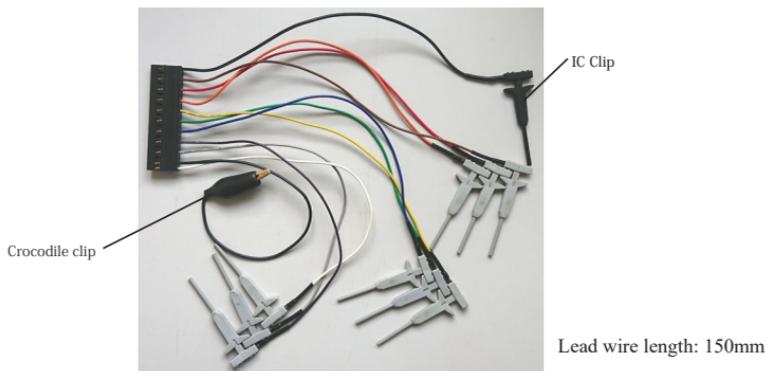
■ When monitoring, turn off all the SW2 to 4. During simulation, turn on the signal switch to be output.

< Input/Output circuit block chart >



■ Probe unit

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



[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, SDA input/output for I2C, 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}	RS
Yellow	CTS	Input of control line CTS	CS
Green	EXIN	Input of an external signal ^{(*)4}	CI
Blue	TXC / SCK / SCL	Input/output of SD data synchronous clock ^{(*)2} ^{(*)3} Input/output of SPI SCK / I2C SCL ^{(*)1}	ST1/ST2
Purple	RXC	Synchronous clock input of RD data ^{(*)2}	RT
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 necessary 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 "ST1" or "ST2". Also, when outputting the clock synchronized with the SD signal from the TXC, set the communication clock setting of the analyzer to "ST1".

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

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

2.2 Explanation of Each Part

ASYNCR

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

SYNCR / 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	SIMULATION		
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.

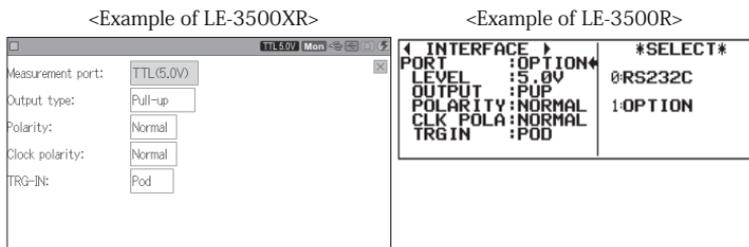
*2: It is based on the setting of "CLOCK" in "CONFIG".
O: ST1, I:ST2

*3: It is different by the simulation mode.
Master:O, Slave:I

*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.



Measurement port PORT

Select TTL(5.0V) / TTL(3.3V) / TTL(2.5V) / TTL(1.8V) for LE-3500XR/LE-2500XR.
Select “OPTION” for the other models when monitoring by the TTL/C-MOS port.

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 OUTPUT

Select the type of output circuit from PUP, NO-PUP, CMOS according to the target device on simulating.
PUP is the output of open collector with the pull-up resistor.
NO-PUP is the output of open collector with no pull-up resistor.
CMOS is the CMOS push-pull output.
☑ Select PUP or NO-PUP on I2C. Not CMOS.

Polarity 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 CLK POLA

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.

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 TRIGGER IN1 terminal of the sub board.

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] "CONFIG" 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
IrDA	IrDA Communications* ²
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: Can work only when using with OP-SB6G.

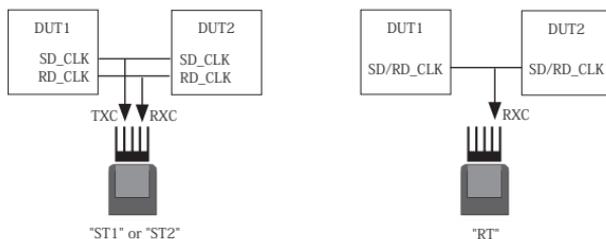
*3: Not available for LE-2500/LE-1500.

*4: Receive clock only when receiving/transmitting data.

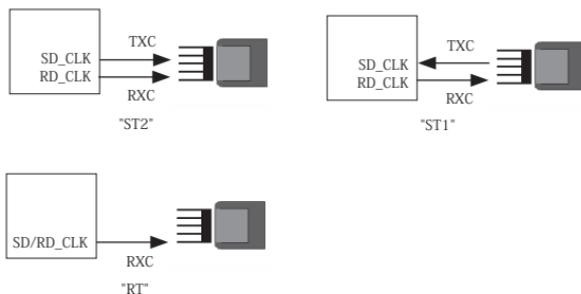
< Setting CLOCK >

Refer to the following figures.

< Monitor >

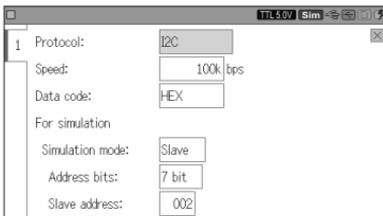


< Simulation >



< Setting of I2C >

<Example of LE-3500XR>



<Example of LE-3500R>



Protocol PROTOCOL

Set to "I2C."

Speed 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 resistors and the performance of the device.

Datacode CODE

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

For simulation SIM MODE

Select Master or Slave for simulation.

No need to set for monitoring.

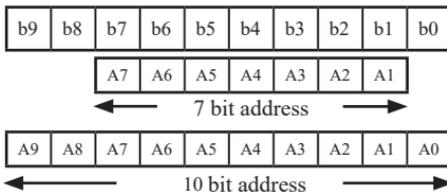
Address bit ADDR BIT

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

Slave address SLV ADDR

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

Input data



The relation between address and input data is the left figure.

(Example) In case of inputting "123":

If "7bits setting,"

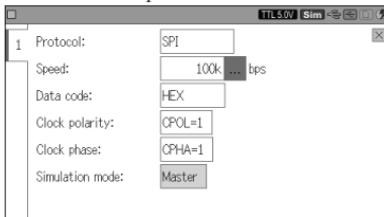
"0010001" is input.

If "10bits setting,"

"0100100011" is input.

<Setting SPI >

<Example of LE-3500XR>



<Example of LE-3500R>

CONFIGURATION	*SELECT*
PROTOCOL : SPI	0:SLAVE
SPEED : 100k	1:MASTER
CODE : HEX	
CPOL : 1	
CPHA : 1	
SIM MODE : MASTER	

Protocol PROTOCOL

Set to "SPI".

Speed SPEED

Set the speed up to 2.048Mbps for Simulation mode.

Set the speed for Monitor mode.

Clock polarity CPOL

Select the clock polarity.

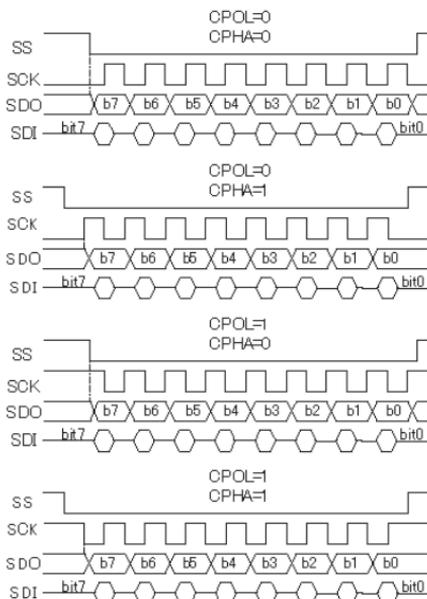
Clock phase CPHA

Select the clock phase.

Simulation mode SIM MODE

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

It is not necessary to set for Monitor mode.

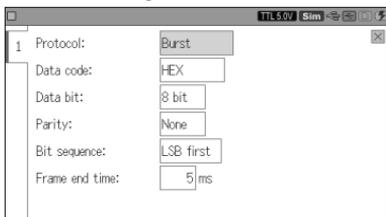


The relationship between Clock and Data is changed by CPOL and CPHA setting.

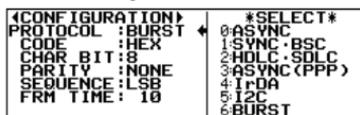
SPI considers as one frame between the SS falling edge and SS raising edge.

< Setting of BURST >

<Example of LE-3500XR>



<Example of LE-3500R>



Protocol PROTOCOL

Set to "BURST."

Datacode CODE

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

Databit CHAR BIT

Select the data length from 7 or 8 bits.

Parity PARITY

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

Bit sequence SEQUENCE

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

Frame end time FRM TIME

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

When the analyzer measures 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.

For the detail, refer to the instruction manual for the analyzer.

■ 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]

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.
TM / CT MAT	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.
TRIG SW	Validate or invalidate the other trigger function.
SEND	Sends the specified data.
OT2	Output the pulse to the TRIGGER OT2 terminal.

< Line Control >

When using TTL / C-MOS port, only RTS / CTS / CI(EXIN) / EX(TRG IN) of the control lines can be the trigger function.

- When you use LE-2500R or LE-3500R, use TRG IN of the probe pod.
- When you use external input connector of the expansion board, the external trigger cable "LE-4TG" (optional) is needed.

< Non-acknowledge >

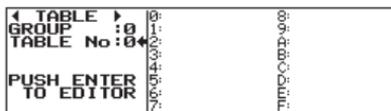
Non-acknowledge of I2C can be the factor of the trigger function.

By selecting Error of the trigger and setting PRTY / 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.



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>

In case of I2C, the data to be registered is different in the master mode and the slave mode.

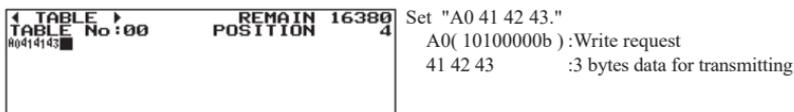
Master mode

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.

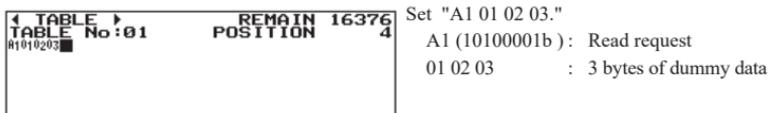
(Example 1)

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



(Example 2)

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

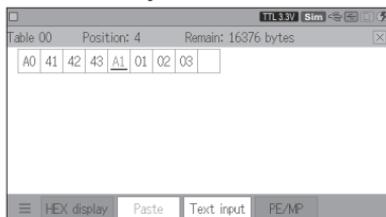


(Example 3)

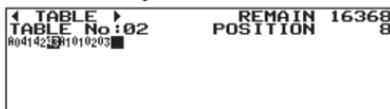
When transmits the 3 byte data (41h, 42h, 43h) to the slave address (7bit) 1010000b and then receives data for 3bits from the slave.

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] + [E].

<Example of LE-3500XR>



<Example of LE-3500R>



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

- To insert a re-start sequence, push [SHIFT]+[E] 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".

SIM MODE : SLAVE
ADDR BIT : 7 BIT
SLV ADDR : 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 >

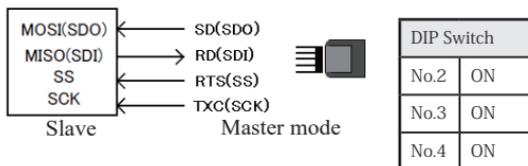
Set "CLOCK " to "ST1" at "CONFIG", when outputting clock from the analyzer.
In addition, set No.2 and 4 of DIP switch ON.

< SPI >

Master Mode

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

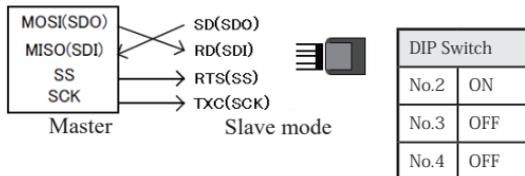
Connect SD to MOSI, RD to MISO, RTS to SS, and TXC to SCK.



Slave Mode

Set No.2 DIP switch ON.

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



3.2 Start and End of the Simulation

■ 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 unacknowledged.

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 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

e.g.) Print of Data

```
*=[LE-3500]===== [2008-08-20 14:19:06]=*
* MONITOR DATA
* PROTOCOL: I2C
* CODE : HEX
* PRINT CODE : HEX
*-----*

SD: { IDLE } [ TMSP ] F200414243 F200 F3010203 { IDLE } [
 [ 0026 ] [151104]>>F200414243>>F200>>F30102##<< [ 0007 ] [1
RD: -----

SD:TMSP ] F200414243 F200 F3010203 { IDLE } [ TMSP ] F2
51104]>>F200414243>>F200>>F30102##<< [ 0007 ] [151104]>>F2
RD: -----

SD:00414243 F200 F3010203 { IDLE } [ TMSP ] F200414243
00414243>>F200>>F30102##<< [ 0005 ] [151104]>>F200414243>>
RD:-----

SD:F200 F3010203 { IDLE } [ TMSP ] F200414243 F200 F301
F200>>F30102##<< [ 0005 ] [151104]>>F200414243>>F200>>F301
RD:-----

SD:0203 { IDLE } [ TMSP ] 00414243 { IDLE } [ TMSP ] 0041
02##<< [ 0013 ] [151104]>>00414243<< [ 0006 ] [151104]>>0041
RD:---

SD:4243 { IDLE } [ TMSP ] 00414243 { IDLE } [ TMSP ] 0041
4243<< [ 0005 ] [151104]>>00414243<< [ 0005 ] [151104]>>0041
RD:---

SD:4243 { IDLE } [ TMSP ] 00414243 { IDLE } [ TMSP ] 02
4243<< [ 0005 ] [151104]>>00414243<< [ 0033 ] [151104]>>##<<
RD:---

SD: { IDLE } [ TMSP ] 02 { IDLE } [ TMSP ] 02 { IDLE } [ TM
 [ 0005 ] [151104]>>##<< [ 0005 ] [151104]>>##<< [ 0005 ] [151
```

< 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 Translation

```

*=[LE-3500]=====[2008-08-20 14:16:29]=*
* MONITOR DATA (I2C FRAME DUMP) *
* PROTOCOL: I2C *
* CODE : HEX *
* =====*

--TM-----ADDRESS/DATA-----
151104 01a00a=>41a42a43a 01a00a<=01a02a03n
151104 00a41a42a43a
151104 00a41a42a43a
151104 00a41a42a43a
151104 00a41a42a43a
151104 00a41a42a43a
151104 02n
151104 02n
151104 02n
151104 02n
151104 02n
151104 01a00a=>41a42a43a 01a00a<=01a02a03n
151104
151104
151104
151104
151104

```

- Time stamp, address, direction (send/receive) and data are printed in order.
- The format of the title part is different for other models.
- When using LE-2500XR / LE-3500XR you can convert it to text / CSV file by using PC link software.

Chapter 5 Specifications

Analyzer	LE-3500XR, LE-2500XR, LE-1500XR, LE-3500R, LE-2500R, LE-3500, LE-2500, LE-1500
Interface	RS-232C, TTL / CMOS (for I2C ^{*1} and SPI ^{*2})
Probe Signal	SD (SDA/SDO), RD (SDI), RTS (SS), CTS, EX IN, TXC (SCL/SCK), RXC, Trigger IN, Trigger OUT (Length of lead: 170mm)
Protocol	ASYN, ASYN-PPP, SYNC(BSC), HDLC(SDLC), BURST, I2C ^{*1} , SPI ^{*2}
Test function	Monitor / Simulation / BERT ^{*3}
Communication speed	ASYN, ASYN-PPP, SYNC, BURST : 50bps ~ 2.048Mbps ^{*4} HDLC : 50bps to 2.048Mbps ^{*4} on standard, 115.2Kbps to 10Mbps on using OP-FW10G ^{*5} SPI : 50bps to 2.048Mbps ^{*4,6} , 115.2Kbps to 10Mbps on using OP-FW10G ^{*7} 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 ($0V \leq V_{in} \leq 5V$) (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 ^{*8} : OC (Open collector) with the pull-up resistor of 680 Ω , 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 ^{*9}
Size and Weight	Probe Pod body size : 78(W) \times 92(D) \times 22(H) mm Relay cable length : 800mm Weight : about 100g
Power	Supplied from the analyzer's body
Temperature	Operation : 0 to 40 $^{\circ}$ C Storage : -10 to 50 $^{\circ}$ C

*1: LE-1500 does not support I2C.

*2: SPI is not supported by LE-2500 and LE-1500.

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

*4: It depends on the spec of the analyzer.

*5: Applied in the half duplex. MAX 5Mbps in the full duplex.

*6: MAX 5Mbps (Monitor) or 2.048Mbps (Simulation), when the continuous transfer speed is within 100 bytes.

*7: Applied in the monitor mode with OP-FW10G (Version 2.00 or later). In the simulation mode, the speed is up to 5Mbps.

*8: Set from the analyzer. Outputting of CMOS is recommended on simulation of which speed is more than 2Mbps.

*9: 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.

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