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OPTIONAL KIT  
FOR MULTI PROTOCOL ANALYZER LE-3500

Firmware for High-speed HDLC/SPI Communications

**OP-FW10G**

**Instruction Manual**

2nd Edition

# Instruction

Thank you for your purchase of OP-FW10G.

To use it correctly, you are advised to read and understand this instruction manual thoroughly.

This instruction manual explains about OP-FW10G Version 2.00 or later.

Keep this together with the warranty. If you encounter any problems, you will find helpful information in this manual.

## Notice

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- 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

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This product has been developed for the purpose of using as the analyzer only.

When you use this product with the following devices that are required to function with a high degree of reliability, safety and accuracy, use it under considering the safe design of the system in order to maintain reliability and safety for that system;

\*Devices that are directly related to transportation such as airplanes, trains, cars etc.

\*Devices for crime prevention and disaster privension.

\*Each kind of safety devices and so on.

This product has not been developed for the use that needs exclusivity high reliability and safety: aerospace apparatus, trunk communication apparatus, nuclear control apparatus, medical apparatus related with life maintenance etc. Therefore, do no use for those purposes.

## Firmware

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Firmware for high-speed HDLC/SPI communications (OP-FW10G) is contained in the CD-ROM.

## Firmware License Agreement

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LINEEYE CO., LTD. (LINEEYE) grants you to use the firmware program and the documents under the terms of this license agreement. And you are consenting to be bound by and are becoming a party to this agreement.

To use the firmware, you need to agree to this license agreement.

### 1. Copyright

LINEEYE holds the copyright on this firmware.

### 2. Grant of License

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### 3. Copy, Analysis, Modification

This firmware must not be reproduced, analyzed or modified in any form unless prescribed in the manual.

### 4. Upgrade

This firmware may be upgraded without any advance notice because of technical progress of hardware or software.

LINEEYE provides the upgraded firmware with the upgrade fee. For upgrade, only licensed user can have upgrades.

### 5. Limitation of Liability

In no event shall LINEEYE be liable for any loss of business or profits, or for any direct, indirect, incidental or consequential damages arising from products of this firmware or analyzer.

Besides LINEEYE shall not be liable damages arising from the equipment.

### 6. General

If any provision of the agreement is held invalid, such provision shall be removed from this license agreement.

### 7. Support

LINEEYE supports functions, operation and only the problem on this firmware.


### 8. Notice







Any matter not specified in this agreement will be governed by and constructed in accordance with copy right law and related laws.



LINEEYE CO., LTD.

# Safety Information

## Read this first !!

Here, for users of the object products, the important contents to the way which previously prevents hazard to the human and damage of the property and teaches safely use has been described. Before using, please read the main contents after you understand the following contents (symbols & marks).  :Prohibition

 <b>Warning</b> · Should the device be used without followings, there is a possibility of accidents, such as a death or a serious injury, occurring.	
	<ul style="list-style-type: none"><li>● 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.</li></ul>
	<ul style="list-style-type: none"><li>● Stop using the analyzer when a liquid or foreign substance get into the analyzer. This may result in an electric shock or fire.</li></ul> <p>→ Immediately switch off the analyzer and unplug it.</p>
	<ul style="list-style-type: none"><li>● Do not disassemble, modify or repair the analyzer. This may result in a injury, an electric shock, fire, explosion and/or a breakdown due to overheating.</li></ul>
	<ul style="list-style-type: none"><li>● Do not put the analyzer in fire or heat them. This may result in a injury and fire due to overheating or explosion.</li></ul>
	<ul style="list-style-type: none"><li>● Never plug or unplug the AC adapter in wet hands.</li><li>● Do not subject the analyzer to extreme conditions.</li></ul>

 <b>Caution</b> · Should the device be used without followings, there is a possibility of accidents, such as a injury , and material damage occurring.	
	<ul style="list-style-type: none"><li>● Do not leave the analyzer in the following conditions.<ul style="list-style-type: none"><li>Strong magnetic field, static electricity or dusty place.</li><li>Temperature and humidity above the specification. Condenscendingly place.</li><li>Not flat, or shaking place.</li><li>Place with leaking water or electricity.</li><li>Place affected by direct sun or near the fire .</li></ul></li></ul> <p>*Please do not leave the analyzer in a car during a heat summer.</p>

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# Chapter 1 Before Using the Product

## 1.1 Unpacking

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

- The product has not been damaged during the transit.
    - You have received all the standard accessories listed below.
- |  |        |
|--|--------|
| <input checked="" type="checkbox"/> Firmware (CD-ROM)              | 1      |
| <input checked="" type="checkbox"/> Instruction Manual (This book) | 1      |
| <input checked="" type="checkbox"/> Registration Card / Warranty   | 1 each |

 Please keep the CD-ROM at the safe place. You will need it when upgrading.

 Please let us know if you find any damage to the product caused by the transit, or if there are any accessories lacking.

## 1.2 Introduction

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OP-FW10G is the firmware to monitor and simulate the bit-sync communications (HDLC/SDLC/X.25/CC-Link) and SPI communications at high speed. The interface are for RS-422/485 (RS-530) and TTL.

-  Please read the manual of the analyzer for details.

## Functions

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### ■ On-line Monitor Function

Monitor HDLC/SPI Communications at On-line (max. speed 10Mbps).

Support full duplex ( ~ 5Mbps) / half duplex( ~ 10Mbps), time stamp display, ID Filter, trigger function.

### ■ Simulation Function

Transmit the registered data at the max. speed of 10Mbps.

# Chapter 2 Basic Operation

## 2.1 Preparation Before Measuring

### Installation of Firmware

Install OP-FW10G firmware to measure high-speed HDLC.

■ Connect the analyzer to the PC

Connect the AUX port of the analyzer and the COM port of the PC, or connect the USB ports of the analyzer and the PC.

<Attention>

To use the USB port of the analyzer, you need to install the USB driver.  
The USB driver is contained in the utility CD of the analyzer.  
Refer to the manual of analyzer about how to install it.

■ Setting of the analyzer

If using the AUX port as connection, set AUX (RS-232C) condition of the analyzer as follows.

Speed: 115200/23040, Data bit: 8, Parity: None, X-control: Off

(Set the same speed as PC setting. <transfer software: le8firm>)

Turn off the power of the analyzer and then turn on the power while pressing [Shift] + [LOAD/SAVE]

Firmware loader of the analyzer will start.

■ Execute the transferring software “le8firm.exe”.

Click “le8firm.exe” in CD-ROM attached to the analyzer twice.

■ Transfer the firmware

1) Select a connection method from “USB” or “Serial.”

2) Click [Next].

3) Click [Select] and select the firmware file “OPFA10G.FW2.”

4) Click [Start] to start transmission. “Complete” will appear when completing the transmission.

5) Click [Close] to close the transferring software.

■ Reboot the analyzer

“Firmware write succeeded” will appear when completing the transmission of firmware.

Reboot the analyzer to use OP-FW10G firmware.

<Attention>

Never turn off the power of the analyzer while transferring firmware. Otherwise, transferring program may not be completed correctly and you may need to send back your analyzer to LINEEYE.

## Choosing the Appropriate Firmware

After installing OP-FW10G firmware, you can choose ordinary measurement mode (standard firmware for the analyzer), or OP-FW10G mode.

- Ordinary measurement mode: Turn on the analyzer, while pushing [SHIFT]+[0].
- High-speed measurement mode: Turn on the analyzer, while pushing [SHIFT]+[3].

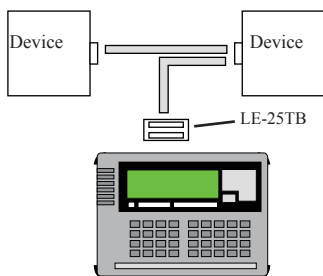
Save your important data in the CF cards before changing the firmware mode. It will initialize the analyzer and erase all data when the analyzer changes the measuring mode.

## Connection to the Target Devices

### <RS-232C>

Connect the target device to RS-232C port of analyzer using the monitor cable (LE-25M1).

### <RS-422/485 (RS-530)>

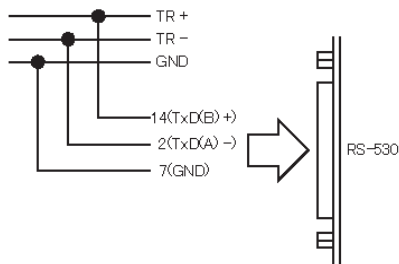


Connect to the target devices, using Dsub 25pin terminal block (LE-25TB).

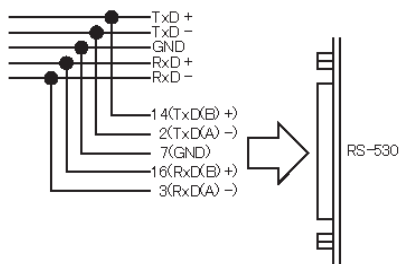
Half-duplex	Connection: 2(TxD_A), 14(TxD_B), 7(GND)
Full-duplex	Connection: 2(TxD_A), 14(TxD_B), 3(RxD_A), 16(RxD_B), 7(GND)

If you need the terminal control, make the DIP switch to be ON on the interface board.

### <Half duplex Monitor>



### <Full duplex Monitor>

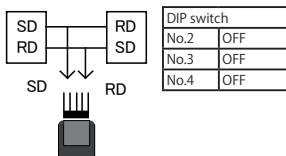


 When simulating at half duplex, set "MODE" to "DTE", and "DRVCTRL" to "AUTO".

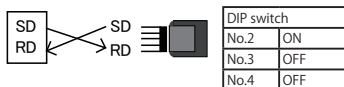


## ■ HDLC

On monitoring

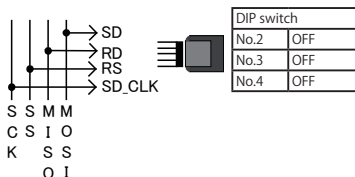


On simulating



## ■ SPI

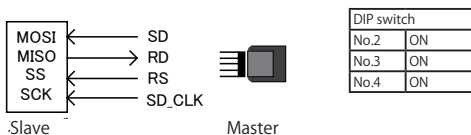
On monitoring



On simulating

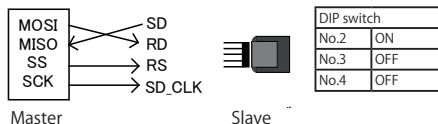
### □ Master mode

Connect SDO (SD) to MOSI, SDI (RD) to MISO, SS (RTS) to SS, SCK (TXC) to SCK.



### □ Slave mode

Connect SDO (SD) to MISO, SDI (RD) to MOSI, SS (RTS) to SS, SCK (TXC) to SCK.



## 2.2 Analyzer Setting

### 2.2.1 Interface Port Setting

<Standard Board>

<b>INTERFACE</b> PORT : RS530 MODE : DTE V35 MODE : OFF DRVCTRL : OFF HALF-DUP : OFF	<b>*SELECT*</b> 0:RS232C 1:RS530
---	--

From top menu,  
press [1] "Interface".

- PORT : Select "RS-530" when using high-speed mode.
- MODE : Select the data line(TxD/RxD) for output when simulating.
- V35 MODE : Set On when measuring V.35.
- DRVCTRL : Select driver control when simulating.

Setting	Driver Control
Off	Always become active when simulation starts.
Manual	Become non-active right after simulation starts. Become active only ER (DTR) signal (MODE : DTE) or CD signal (MODE : DCE) is active.
Auto	Become non-active when simulation starts. Become active when transmitting data and become non-active after finishing data transmission.

- HALF-DUP:
  - ON (half duplex) makes Tx/D data to be the target. It is possible to display data in 2 lines (SD and RD side) if using the ID Filter when measuring half duplex.
  - OFF (full duplex) makes data to display in Tx/D and Rx/D as it is inputted.

<OP-SB5G/OP-SB5GL>

<b>INTERFACE</b> PORT : OPTION LEVEL : 5.0V OUTPUT : PUP POLARITY : NORMAL CLK POLA : NORMAL TRG IN : POD	<b>*SELECT*</b> 0:RS232C 1:OPTION
---	---

From top menu,  
press [1] "Interface".

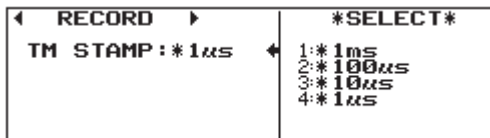
- PORT : Select "OPTION" when using high-speed mode.
- LEVEL : Select the signal voltage level of target device.  
Select 5.0V, 3.3V, 2.5V or 1.8V according to the hardware of target device.
- OUTPUT : Select the type of output circuit (Pull-up, No Pull-up, CMOS) according to the target device. Pull-up is the output of open collector with the pull-up resistor.  
No Pull-up is the output of open collector with no pull up resistor.  
CMOS is the CMOS push-pull output.
- POLARITY : Set the polarity of all signals. Normal is selected generally.  
On Invert, polarities of all signals will be inverted.
- Clock Polarity : Set the polarity for clock.
- TRG IN : Set the input terminal of the external trigger. Select "Pod" to use the TRG IN terminal of the probe pod, or "Panel" to use the TRG IN terminal of the sub board.

ⓘ When using OP-SB5G, the following terms are invalid.

Level: 2.5V, 1.8V      Output type: CMOS

## 2.2.2 Time Stamp

Record and display the receiving time of the flag(top of the frame) as elapsed time from the beginning of the measurement.



Press [3], [1] at the top menu to set the time stamps.

Select time from 1ms, 100us, 10us, 1us.



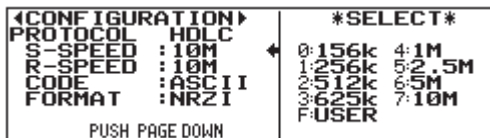
eg.) If selecting 100us; 0.2619s

The max. count of time stamp is 524287. After that it will go back to 0.

## 2.2.3 Setting of Communication Conditions

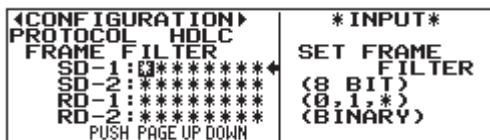
Set appropriate communication conditions of the analyzer, such as speed and so on. Set the communication condition from "CONFIGURATION."

< HDLC >



Set the communication condition from the top menu and push [0].

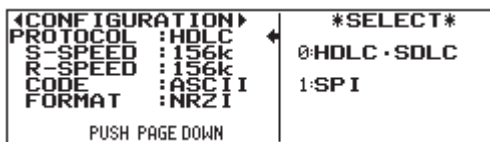
- S-SPEED : Set the communication speed in the SD(TxD) side. (RD will be automatically set) Set any 4 effective digits from pushing [F].
- R-SPEED : Set the communication speed in the RD(RxD) side(only different from SD side).
- CODE : Set the display code to display in the LCD.
- FORMAT : Select the format either from NRZ/NRZI.



Set the ID Filter to measure specific ID frames by pressing [PAGE DOWN], and set 0, 1, or \*(don't care). ID Filter can be set any 2 continuous data.

- SD-1 : Set the ID Filter for the first receiving data in the SD side in bit. ID Filter can be set 2 sequential data by SD-1 and SD-2.
- SD-2 : Set the ID Filter for the second receiving data in the SD side in bit.

- RD-1 : Set the ID Filter for the first receiving data in the RD side in bit.  
ID Filter can be set 2 sequential data by RD-1 and RD-2.
- RD-2 : Set the ID Filter for the second receiving data in the RD side in bit.
- It can not monitor only a frame of one data.



Push [PAGE DOWN] to set following settings.

- IDLE MOD : Set output conditions of IDLE signal between frames when simulating.  
Select from MARK(mark condition), or FLAG(flag pattern).
- LEADING : Set numbers of starting flags when simulating(range: 1 to 10).
- FRAME : Set the specification of the frame translation. Select from SDLC, SDLCCE, X.25, X.25E or LAPD.
- PACKET : Set the specification of packet translation. Select from X.25 or LAPD.

< ID Filter and HALF-DUP setting >

- Following table describes the relationship between receiving frames and ID filter / Half Duplex ON, OFF.
- When proceeding simulation and HALF-DUP is OFF, every frames transmitted by analyzer are monitored regardless of ID Filter setting.

Half duplex	ID Filter	LCD
Off	Don't care setting in both SD and RD.	Display TxD in the SD, and RxD in the RD.
	Non-don't care setting either in SD or RD, or both SD and RD.	Display TxD matched with ID Filter in the SD. Display RxD matched with ID Filter in the RD.
On	Don't care setting in both SD and RD.	Display TxD frames in the SD.
	Non-don't care setting either in SD or RD.	Display TxD if it is matched with ID Filter. Everything else is displayed at where don't care was set.
	Set except don't care in both SD and RD.	Display TxD matched with ID Filter in the SD or RD.

e.g.) SD/RD monitor display when half duplex is On and ID Filter is as follows.

SD-1 : 00110000 (30h) RD-1:\*\*\*\*\* (don't care)

SD-2 : 00110001 (31h) RD-2:\*\*\*\*\* (don't care)

Frame on TxD line

FLAG	30h	31h	32h	33h	FLAG	FLAG	41h	42h	43h	44h	FLAG
------	-----	-----	-----	-----	------	------	-----	-----	-----	-----	------



Display in SD

FLAG	30h	31h	32h	33h	FLAG
------	-----	-----	-----	-----	------

Display in RD

FLAG	41h	42h	43h	44h	FLAG
------	-----	-----	-----	-----	------

e.g.) SD/RD monitor display when half duplex is Off (full duplex) and ID Filter is as follows.

SD-1 : 00110000 (30h)

RD-1:0100\*\*\*\*

SD-2 : 00110001 (31h)

RD-2:\*\*\*\*\* (don't care)

Frame on Tx'd line

FLAG	30h	31h	32h	33h	FLAG
------	-----	-----	-----	-----	------

FLAG	41h	42h	43h	44h	FLAG
------	-----	-----	-----	-----	------

Frame on Rx'd line

FLAG	30h	31h	32h	33h	FLAG
------	-----	-----	-----	-----	------

FLAG	41h	42h	43h	44h	FLAG
------	-----	-----	-----	-----	------

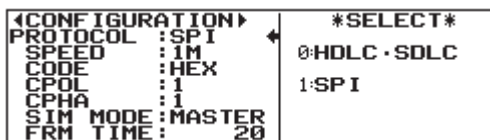
Display in SD

FLAG	30h	31h	32h	33h	FLAG
------	-----	-----	-----	-----	------

Display in RD

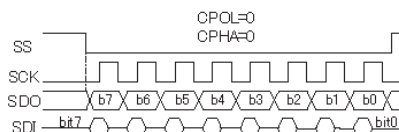
FLAG	41h	42h	43h	44h	FLAG
------	-----	-----	-----	-----	------

## < SPI >

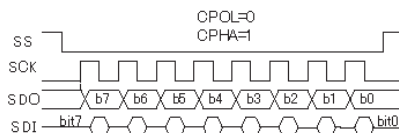


From Top menu,  
press [0] "Configuration".

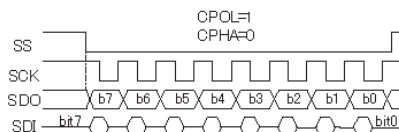
- **SPEED** : Set speed up to 10Mbps. This setting is required for the simulation master mode.  
(No need to set for monitoring.)
- **CODE** : Set the display code.



- **CPOL** : Set the clock polarity.
- **CPHA** : Set the clock phase.
- **SIM MODE** : Select Master or Slave for simulation. (No need to set for monitoring.)

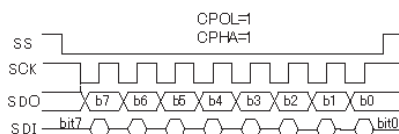


By setting of CPOL and CPHA, the clock and the data operate in the timing of the left figure.



### ■ FRM TIME

Set the frame end time (unit: 0.1μs).  
This is used in the case in which SS signal does not change per one frame.  
At the moment when the clock signal does not change for the time set here, time stamp will be added to the data.  
When "0" is set here, this function will not work.



# Chapter 3 Starting Measurement

## 3.1 Start/Stop

From top menu, select a function and press [RUN]. To stop measuring, press [STOP].

- **ONLINE** : Online Monitor Function.
- **MANUAL** : Simulation Function.

## 3.2 Register Transmission Data for Simulating

Select “MANUAL” from top menu and press [9] to register the data table.

Select the table number where you wish to register data.

☞ For more details, please read the instruction manual of the analyzer.

## 3.3 Simulation

Press [RUN] to start simulating. Press numerical key corresponding to the data table to transmit registered data. From the top menu, push [A] and you can set REPEAT and IDLE TIME mode.

- **REPEAT** : On Repeat                      Off Send only once
- **IDLE TM** : Select the interval of transmission from 0 to 99999ms (for repeat).

☞ Even you set “IDLE TM” to “0”, it may take some time to process data before transmitting again.

## 3.4 Trigger



The analyzer will stop measuring (ACTION), when it find the specific Factor. Select the trigger from the top menu and press [2].

When you want to change the FACTOR and ACTION, press the numerical key where trigger is assigned. Pushing [SHIFT] + [Number key(trigger is assigned)] makes the trigger valid or invalid.

(☑ indicates the trigger valid)

### ☞ FACTOR Setting

The effective ( with the check mark ) factor functions on trigger factor of the following 4 sets under the OR condition.

- ☐ **TRIGGER0** : match character line in SD(TxD).
- ☐ **TRIGGER1** : match character line in RD(RxD).
- ☐ **TRIGGER2** : find errors in SD and RD.
- ☐ **TRIGGER3** : find level “0” in external trigger input (TRG IN).

< TRIGGER 0, 1 >

TRIGGER 0		*INPUT*
FACTOR	SD CHAR	SET 0~8
MODE	:SINGLE	CHARACTER
CHAR	D1:3031	(00~FF, *, W0~W2)
	D2:4142	(HEX CODE)
MASK	W0:*****	W0~W2=SHIFT*0~2
	W1:*****	1=SHIFT*F
	W2:*****	

- **MODE**  
Select single or sequential actions.  
Single action means when CHAR D1 or D2 happens, the trigger will work. Sequential action means when D2 happens after D1 happened, the trigger will work.

#### ■ CHAR

Set the character lines. Up to 8 characters can be set each in D1 and D2. Also \*(don't care) or bit masks (don't care in a bit, W0/W1/W2) can be set.

< TRIGGER 2 >

TRIGGER 2		*SELECT*
FACTOR	ERROR	0:OFF
FCS	:ON	1:ON
ABORT	:ON	FCS ERROR
SHORT FR	:ON	

Trigger Factor(FACTOR):  
FCS: Frame Check Sequence  
ABORT: 7 or more continuous bits of "1."  
SHORT FR: Frame of less than 3 characters.

<TRIGGER 3>

Detecting low level of TRIGGER IN1(the external trigger input) will be the trigger factor.

## Action Setting

Set the amount of capturing data when the trigger was found. 4 kinds of Actions can be set.

TRIGGER		*SELECT*
ACTION	STOP	0:QUICK
OFFSET	:QUICK	1:BEFORE
		2:CENTER
		3:AFTER

QUICK :Stop after capturing 16 data.  
BEFORE :Stop after capturing 10% of the capture memory.

CENTER : Stop after capturing 50% of the capture memory.  
AFTER : Stop after capturing 90% of the capture memory.

- Selecting one Action is set for all triggers (Trigger 0-3).

## 4.1 Change the Screen Display

< Standard Display >

TMSP	SH	00	TMSP	EX SH SH	00	TMSP	SH	01
004450			009450			013950		
D1 SH4	00	TMSP	EX 2FF SH D3	00	TMSP	SH	R01	"
		017200			022950			
01 2345600			TMSP	SH	R01	"	01 2345600	
		025450						
		ASC				156K	156K	

Measured data will be displayed in the LCD with the time stamp information. It is possible to switch the display to translation display or dump display. Press [DISPLAY MODE] to switch display.

### < Frame Translation Display >

-	TM	AD	TYPE	--	NS	PF	NR	DATA	--	FC
→	004450	01	(2F)		0	0				0000
→	009450	03	INFO		0	0	0	01		0000
→	013950	01	INFO		0	0	0	10108		0000
→	017700	03	INFO		1	1	1	FF0213		0000
→	022950	01	INFO		1	1	2	1122303132		0000
→	025450	01	INFO		1	1	2	1122303132		0000
					0	F	-SDI	C-		156K

### Standard Display

1

Frame Translation Display \*1  
(Dump Display) \*2

1

Packet Translation Display \*1

< Packet Translation Display >

[illegible]

\*1: Push [ZOOM/CODE] to change the specification of translation.

\*2: Push [HEX] to change to Dump Display.

< Dump Display >

```

- TM - DATA - FC
004450 0127
009450 030101
013950 0111110106
017700 0332FF0213
022950 0152112230313233343536
025450 0152112230313233343536
      0 - HEX -      156k/ 156k

```

At the time of translation display or dump display, push [SHIFT]+[TIME/COUNT] to switch the elapsed time stamp(-TM-) to difference of time stamps(-dT-).



## ■ SPI

< Standard Display >



< Dump Display >



The measured data is displayed with time stamp.

And the display can be changed to the translation display or the dump display to analyze the data.

Press [DISPLAY MODE] to change the display.

Standard display



Dump display

On the dump display, two kinds of time stamp are available to display by pressing

[SHIFT]+[TIME/COUNT].

One is elapsed time stamp (-TM-), and the other is time difference compared to the one before (-dT-).

## 4.2 Data Search

Search the specific data from recorded data.

< Search Condition >

- TRIGGER : Search the data matched Trigger Factor.
- ERROR : Search FCS, abort and short frame.  
(set individually ON/OFF)  
Select the target line at "TARGET" (Both, SD, RD).
- CHARACTER : Search the matched character lines (\*(don't care), bit masks).

< Action >

DISPLAY: Display the matched data on the top of LCD.

COUNT : Display the numbers of matched data on the right side of the bottom in the LCD.

## 4.3 Print

Print the recorded data and the settings in appropriate format with variety displays.

Display the data that you wish to print and press [PRINT]. Type how many pages to print and press [ENTER].

# Chapter 5 Specification

## 5.1 Analyzer Specification

Item	Specification	
Interface	RS-422/485 (RS-530) * 1, TTL * 2, SPI * 2	
Protocol	HDLC, SDLC, X.25, CC-Link (NRZ/NRZI format, AR clock), SPI	
Speed	Speed range of half-duplex	115.2kbps-10Mbps * 3
	Speed range of full-duplex	115.2kbps-5Mbps * 3
	Setting steps	User-set: 4 effective digits
Error Check	FCS Error (CRC-ITU-T) , Abort , Short Frame	
On-line Monitor	Time stamps	6 digits , 0 to 524287 Selectable in 1mS, 100μS, 10μS or 1μS
	ID Filter (HDLC)	Able to set 2 characters (don't care, bit masks available )
Simulation	Transmission data table	16K data (divisible in 16)
	MANUAL mode	Data can be sent continuously and transfer interval can be set.
Trigger	Set up to 8 characters (don't care and bit masks available). When 2 individual or sequential actions, errors or falling edge of the external trigger input are found, the analyzer automatically stops monitoring.	
Data Search	Search any trigger data, error data and character lines	

\* 1 : When using the Standard Board.

\* 2 : OP-SB5GL or OP-SB5G is required.

\* 3 : OP-SB5G is required for high-speed TTL/SPI simulation.

## 5.2 RS-530 Port Specification

Pin No.	Signal	Signal name	Input/Output		
			ONLINE	MANUAL	
				DTE	DCE
1	FG	Frame ground	-	-	-
2	TxD(A)	Transmission data (-)	I	O	I
3	RxD(A)	Receiving data (-)	I	I	O
4	RTS(A)	Request of transmission(-)	I	O	I
5	CTS(A)	Capable of transmission(-)	I	I	O
6	DSR(A)	Data set ready(-)	I	I	O
7	SG	Signal ground	(I)	(I)	(I)
8	DCD(A)	Data/Channel receiving carrier detect (-)	I	I	O
9	RXC(B)	Receiving signal element/timing	I	I	O
10	DCD(B)	Data/Channel receiving carrier detect (+)	I	I	O
11	TXC1(B)	Transmission signal element/timing (+)	I	O	I
12	TXC2(B)	Transmission signal element/timing (+)	I	I	O
13	CTS(B)	Capable of transmission (+)	I	I	O
14	TxD(B)	Transmission data (+)	I	O	I
15	TXC2(A)	Transmission signal element/timing (-)	I	I	O
16	RxD(B)	Receiving data (+)	I	I	O
17	RXC(A)	Receiving signal element/timing	I	I	O
18	None		-	-	-
19	RTS(B)	Request of transmission (+)	I	O	I
20	DTR(A)	Data terminal ready (-)	I	O	I
21	None		-	-	-
22	DSR(B)	Data set ready (+)	I	I	O
23	DTR(B)	Data terminal ready (+)	I	O	I
24	TXC1(A)	Transmission signal element/timing (-)	I	O	I
25	None		-	-	-

I: Input to the analyzer, O: Output from the analyzer

## 5.3 Probe Pod (OP-SB5G/OP-SB5GL)

Cable Color	Signal name	Definition / Meaning
BLACK	GND	Signal GND
BROWN	SDA/SDO/SD	Monitoring input and simulation output of SD data * 1 SDO(MOSI) input/output of SPI * 2
RED	SDI/RD	Input of RD data SDI(MISO) input of SPI * 2
ORANGE	SS/RTS	SS input/output of SPI * 2
YELLOW	CTS	not connected
GREEN	EXIN	Input of external signal
BLUE	SCL/SCK/TXC	SCK input/output of SPI * 2
PURPLE	RXC	not connected
GLAY	TRG.IN	Input of external trigger signal
BLACK	GND	Signal GND
WHITE	TRG.OUT	not connected

\* 1 : This is output terminal on simulation. Do not connect the power supply to the target device directly.

It may result of the product malfunction.

\* 2 : This is used for SPI communication.

The card packed with the product is the user registration card for Japanese customers.

For overseas customers, there is a registration page on our web site. ([www.lineeye.com](http://www.lineeye.com))

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