LINEEYE

OPTIONAL KIT

FOR MULTI PROTOCOL ANALYZER

LE-8200A / LE-8200

CAN/LIN Communications Expansion Kit

OP-SB87

Instruction Manual

Instruction

Thank you for your purchase of OP-SB87.

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 equire 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 !!

Here, the important content has been described, for preventing the people who will use the object products and other people from being damaged and preventing damage of properties, and for using safely and correctly.

Before using, please read the main contents after you understand the following contents (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.

⚠ Caution　Should the device be used without following these symbols, there is a possibility of accidents, such as a injury , and material damage occurring.

	⚠ Warning
🚫	● 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 should a liquid or foreign substance get into the analyzer. This may result in an electric 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.

	⚠ Caution
🚫	●Do not leave the analyzer in the following conditions. Strong magnetic field, static electricity or dusty place. Temparature and humidity above the specification. Condenscendingly place. Not flat, or shaking place. Place with leaking water or electricity. Place affected by direct sun or near the fire .

Contents

Chapter 1 Before Using the Product

1.1 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

☑   DB9 Monitor cable (LE-009M1)   2

☑   3-line Probe cable (LE-3LP)   2

☑   8-line Probe cable(LE-8EX)   1

☑   Line State sheet B   1

☑   Instruction manual (This book)   1

☑   Customer 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.

DB9 Monitor cable

3-line Probe cable

8-line Probe cable

Interface board

Line State sheet B
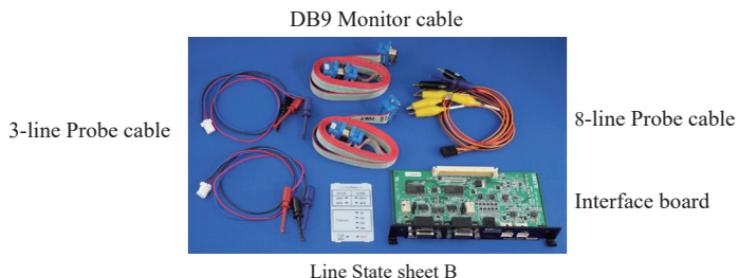
1.2 Overview

OP-SB87 is the expansion kit which makes it possible to measure CAN/LIN communication.

■ Monitor Function

Monitors CAN communications up to 1Mbps and LIN communications up to 26Kbps. This product supports to high speed CAN (ISO11898 conformity), low speed CAN (ISO11519-2 conformity) and LIN (ISO9141 conformity). Moreover, you can switch to high speed CAN, low speed CAN or LIN communications for the each port.

■ Simulation Function

Transmit the data frame and remote frame of CAN (standard format or expansion format) which is set by user by one touch press.

Performs master/slave simulation in the case of LIN.

1.3 Panel Description
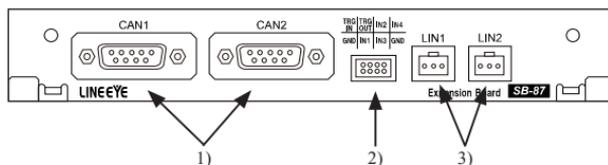
	Name	Function
1)	DSUB 9pin connector	Measurement port for CAN 1 / CAN 2
2)	Header 8pin connector	External input/output port
3)	Header 3pin connector	Measurement port for LIN

Dsub9pin connector

Pin Number	Signal Name	Meaning
1	--	
2	CAN Low	Bus signal of CAN (low)
3	SG	Signal ground
4	--	
5	FG	Frame ground
6	--	
7	CAN High	Bus signal of CAN (high)
8	--	
9	IN	General-purpose input

Header 3 pin connector

Probe Cable	Signal Name	Meaning
Lead wire of red	Vbat	9-18V
Lead wire of blue	LIN_Bus	Bus signal of LIN
Lead wire of	SG	Signal ground

Header 8 pin connector

External I/O cable	Signal Name	Meaning
Lead wire of black	GND	Signal ground
Lead wire of brown	TRG IN	External trigger input
Lead wire of red	TRG OUT	External trigger output
Lead wire of orange	IN1	General-purpose input1
Lead wire of orange	IN2	General-purpose input2
Lead wire of orange	IN3	General-purpose input3
Lead wire of orange	IN4	General-purpose input4
Lead wire of black	GND	Signal ground

Chapter 2 Basic Operation

2.1 Preparation

<Insert the interface board>
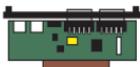
Exchange the standard interface board to OP-SB87.

1) Turn off the analyzer.
2) Screw off M3 screws on the interface board of analyzer.
3) Take the board off pulling the handles of the interface board.
4) Insert the interface expansion board (OP-SB7XC) into the slot ompletely.
5) Screw it on using M3 screws.

When the analyzer is turned on the power, pre-installed firmware "OP-SB7XC" is started.

📄 Please check the latest firmware from LINEEYE web page. To update the firmware, download the latest firmware "opsb7xc_fw2_vxxx" and software for transferring firmware "LE8FIRM V1.10 or later".

→ https://www.lineeye.co.jp/index.html
→ Please refer to the manual of "software for transferring firmware" for more details.

■ Automatic Choice of Firmware

Once the firmware for CAN/LIN is installed, everytime you want to measure CAN/LIN communications, you only need to change the expansion board (OP-SB87) and trun on the power of analyzer (the appropriate firmware is automatically chosen).

<Line State Sheet>

Change the line state sheet to that of OP-SB87.
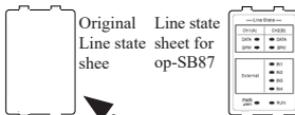
1) Remove the original line state sheet.
2) Fit the line state sheet of OP-SB87 instead of the removed one.

   📖 Take care not to lose the detached sheet.

Original Line state shee   Line state sheet for op-SB87

<Line State LED>
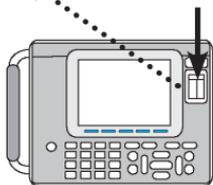
The following is the lighting when the attached line state LED is installed.
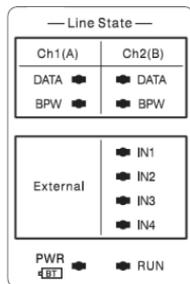
Sheet	LED	Bus Level	Meaning
DATA	ON	Dominant	Turns on the light corresponding to the bus level of CAN/ LIN.
	OFF	Recessive	
BPW	ON	About 10V	Inputs (9V-18V) from 9pin for CAN interface, orLIN Vbat (9V-18V)
	OFF	Under 3V	
IN1-IN4	ON	Above 2.3V	External Input (-15V ～ +15V)
	OFF	Under 1.0V	

<Connection to the Target Devices>

It is possible to use 2 measuring channels of CAN or LIN separately.

Connect Channel1(Ch1) to the port of CAN1 or LIN1, and Channel2(Ch2) to the port of CAN2 or LIN2, using the cables for CAN or LIN attatched for the this product.

■ CAN

Able to use CH1 (CAN or LIN) and CH2 (CAN or LIN) simultaneously.

DSUB 9pin branch cable
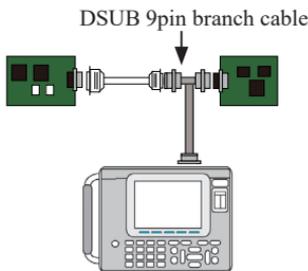
Setting of Terminator

The jumper pin makes it possible to connect the terminator in the CAN communications.

（Factory setting: terminator OFF）

JP1 (1-2 short): Connect the terminator (120 Ohm) to CAN1 port.

JP2 (1-2 short): Connect the terminator (120 Ohm) to CAN2 port.

■ LIN

3-line Probe cable
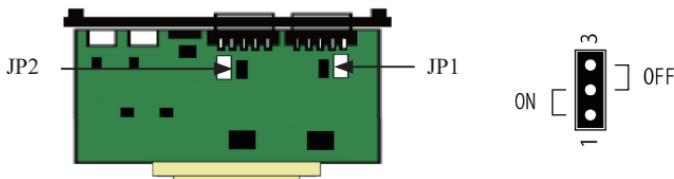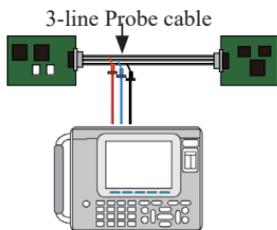
■ External Signal I/O terminal

The analyzer measure two channels, Ch1 (CAN or LIN) and Ch2 (CAN or LIN), simultaneously .

□Analog and Digital input (IN1 to 4)

Connect the terminals of the external signal I/O cable (IN1 to 4) to the target devices, using the attached 8-line probe cable. There are mark tubes (IN1 to 4) on the cable.
The analyzer measures/displays the voltage (unit: V) and the digital values of 4 target points along with the communication data. (Threshold, H=1: above 2.3V , L=0: under 1.0V)
Refer to "Chapter 4 Explanation of Display" for more details.

□Trigger input-output (TRG IN, TRG OUT)

Connect the brown cable (TRG IN) and red cable (TRG OT) of the 8-line probe cable to the target external signals used for trigger function.
Refer to "Chapter 5 Trigger" for more details.

<Pin arrangements>

TRG IN	TRG OUT	IN2	IN4
GND	IN1	IN3	GND

2.2 Setting of Interface

Measuring ports need to be set for measuring CAN or LIN communications. Press "5: Interface" at the top menu.
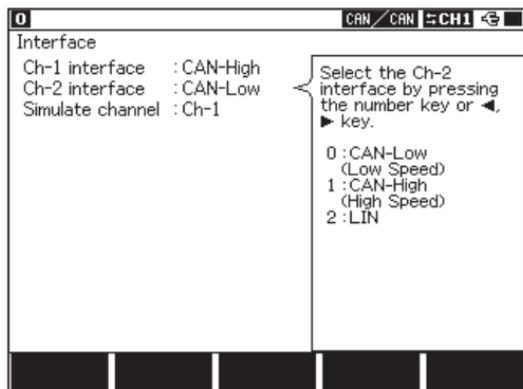
□ Ch1 interface/Ch2 interface
Select the interface for channel1 (Ch-1) and channel2 (Ch-2).

CAN-Low : Low speed
CAN communication
ISO11519-2 conformity

CAN-High : High speed
CAN communications
ISO11898 conformity

LIN : LIN communication
ISO91414 conformity

□ Simulate channel
Select the channel for simulation.

2.3 Setting of Communication Condition

The setting of analyzer is required following the communication condition (protocol, communication speed etc.) of the target devices. Press [0] or [1] key at the top menu to display the configuration screen for setting.

Setting of CAN Communications
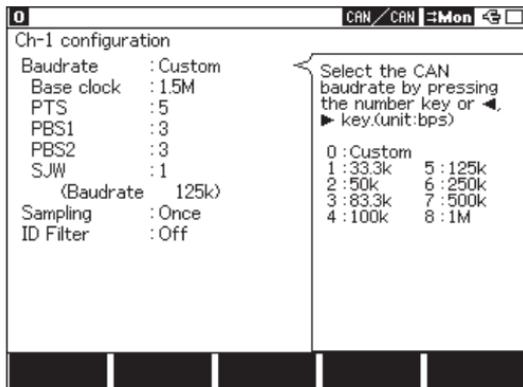
[0] `CAN / CAN ⧉Mon ⧉□` Ch-1 configuration Baudrate : Custom Base clock : 1.5M PTS : 5 PBS1 : 3 PBS2 : 3 SJW : 1 〈Baudrate 125k〉 Sampling : Once ID Filter : Off ⌐ Select the CAN baudrate by pressing the number key or ◀, ▶ key.(unit:bps) 0 : Custom 1 : 33.3k 5 : 125k 2 : 50k 6 : 250k 3 : 83.3k 7 : 500k 4 : 100k 8 : 1M	□ Baudrate Selects the communication speed. The analyzer will start measuring following the bit timing which has been preset. The sampling point (a bit timing) is set at the position of 75% of a bit. If you set "Baudrate" to "Custom", you can change a bit timing.

SS	PTS	PBS1	PSB2
1Tq	5Tq	3Tq ▲	3Tq

Sampling

Tq : Time counter (Time Quantum)

Base clock	:	Sets the standard clock (Frequency of Tq). (250kHz to 12MHz)
PTS	:	Sets the propagation time segment. (in decimal)
PBS1	:	Sets the fase buffer segment1. (in decimal)
PBS2	:	Sets the fase buffer segment2. (in decimal)
SJW	:	Sets the resynchronization jump width. (in decimal)

Communication speed (Baudrate) will automatically be determined based on those settings.

The setting range of PTS/PTS1/PTS2/SJW is related to the following.

PBS1 : If PTS < 2	3 to 8,	If PTS > 2	2 to 8
PBS2 : If PTS + PBS1 < 4	3 to PBS1,	If PTS + PBS1 > 4	2 to PBS1
SJW : If PBS2 < 3	1 to PBS2,	If PBS2 > 3	1 to 4

Make sure not to set and measure at more than 1Mbps for the combination of bit timing.

□ Sampling : Sets the number of times to sample a bit (Once / 3 Times).

Make sure not to set and measure at more than 1Mbps for the combination of bit timing.

□ ID Filter

Sets valid/invalid (On/Off) of the ID filter and selects its filter type.

Off: All the filters will be invalid.

Acceptance: The acceptance filter will be valid and it captures only the frames which corresponds with the ID set by bit unit.

Pass: The pass filter will be valid and it captures only the frames which corresponds with the IDs (Max. 8) set in HEX.

Cut: The cut filter will be valid and it does NOT capture the frames which corresponds with the IDs (Max. 8) set in HEX.

Pass&Cut: The pass filter and the cut filter will be valid.

All filter on: All the filters will be valid.

When you select any option other than "Off", [F2](Acceptance), [F3](Pass), [F4](Cut) will appear. Then configure the filter condition at the setting display.
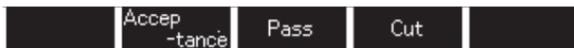
■ Acceptance filter

It captures corresponding ID frames by the hardware filter.

Input the number by bit unit ("0", "1", "*", and Don't care).

Set numbers from ID28 to ID18 (ID17 to ID0 should be Don't care) when it is standard format.

Set numbers from ID28 to ID0 when it is extended format.
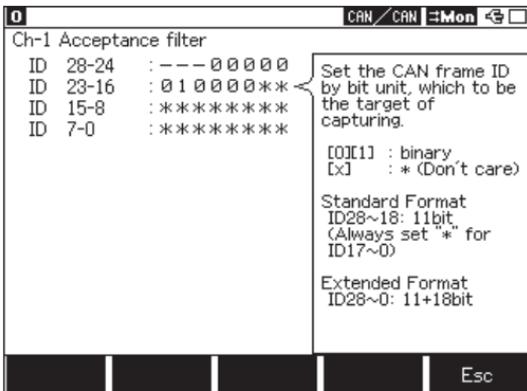
Example) If you want to display the frames which have 010 for ID when it is standard format.

ID 28 to 24: ---00000

ID 23 to 16: 010000**

ID 15 to 8: ********

ID 7 to 0: ********

Note: 00400000h to 0043FFFFh will also be captured when extended formats are mixed with standard formats.

□ Pass filter

It captures corresponding ID frames by the software filter.

Select format type from "Standard" or "Extended" at Frame type, then input ID in HEX ("0" to "F", "*", Don't care). (You can set up to 8 pass filters.)

Set numbers from the scope of ID:0 to 7FFh when it is standard format.

Set numbers from the scope of ID:0 to 1FFFFFFFh when it is extended format.
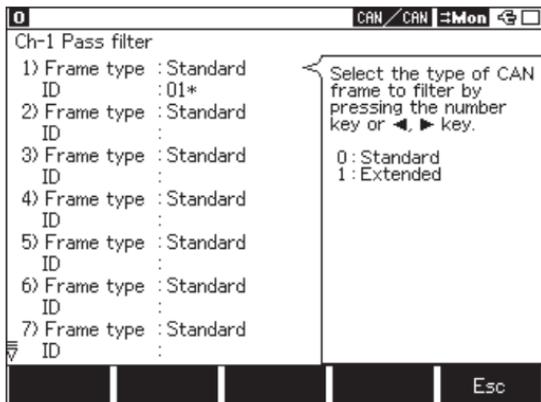
Example) If you want to capture frames which have 010h to 01Fh for its IDs when it is standard format.

1)Frame type: Standard

ID: 01*

Note: When the pass filter is valid and no ID has been input, all the ID frames will not be captured.

□ Cut filter

It does not capture corresponding ID frames by the software filter.

Select format type from "Standard" or "Extended" at Frame type, then input ID in HEX ("0" to "F", "*", Don't care). (You can set up to 8 filters.)

Set numbers from the scope of ID:0 to 7FFh when it is standard format.

Set numbers from the scope of ID:0 to 1FFFFFFFh when it is extended format.
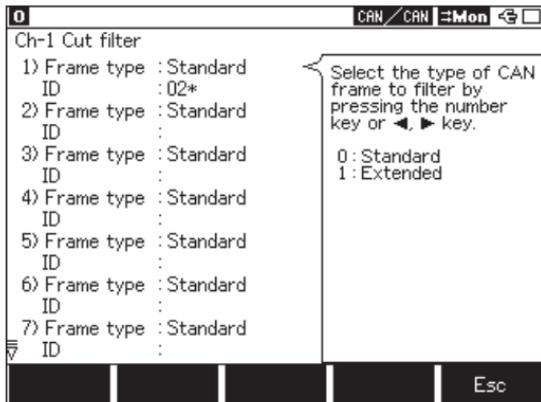
Example) If you will not capture frames which have 020h to 02Fh for its IDs when it is standard format.

1)Frame type: Standard

ID: 02*

Note: When the cut filter is valid and no ID has been input, all the ID frames will be captured.

Setting LIN Communication Condition

□ Baudrate :

Selects communication speed from 2400bps, 9600bps and 19200bps, or sets arbitrary speed (from 1600 to 26000bps).

□ ID filter:

Sets ID filter. Sets from 5 bits to 0 bit (excluding parity) of ID by 0, 1 and *(Don't care), and displays only matched ID.

e.g.)

--00000 ⇒ Displays only 00 of ID.

--00001 ⇒ Displays only 01 of ID.

--0000* ⇒ Displays only 00 and 01 of ID.

□ Frame end :

Sets whether the end of the message frame is performed at the detection of non-communication time "Time" which is more than the setting value of "Frame end time", or performed at setting value of data length "ID". Selects "ID" for normal use.

If "ID" is selected, press [F5] "ID setting". And then set DLC and the calculation method of check sum for each ID.

□ Frame end time :

It is displayed when the end of the message frame is set at "Time". Sets "Frame end time" by 1 to 99999ms. If there is no following data within the time which is set from the end of the data you monitored, it will be considered as the end of the message frame.

  * It is supported on firmware Ver1.07 or above. Proper value will be set automatically after

  selecting the baud rate.

□ Checksum :

It is displayed when the message frame is set at "Time". Selects whether you perform the checksum calculation by Classic or Enhanced. It cannot be for each ID. Moreover, calculation from ID3C to 3F will be by Classic.

□ ID setting :

Change the screen by pressing [F5], and set data length (DLC:0 to 8 bytes) of each frame and the checksum calculation (Classic,Enhanced) of ID00

to 3F.

2.4 Start and End of the Measurement

■ ONLINE: Online monitor function

■ ANALOG: Analog monitor function (*1)

■ MANUAL: Simulation function

  *1: Refer to "Chapter 3 Analog Monitor Function".

Start measuring:

Press [Run].

The analyzer starts measuring, displays the data on the screen and saves in the capture buffer.

Stop measuring:

Press [Stop].

Chapter 3 Analog Monitor Function

Record four external signals (voltage) at specific cycle (1ms - 10min).
Record measured data since the last sampling, and analyze measured data corresponding to the external signals. (It is supported on firmware Ver1.07 or above)

3.1 Setting of Analog Monitor

Select "ANALOG" at the top menu, then select "7: Analog options".
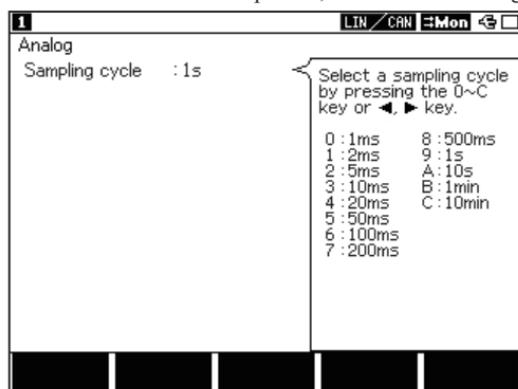
Sampling cycle: Select sampling cycle (1ms – 10min).

Attention:
For Analog Monitor function, select time stamp either from "HMS" or "MS1ms". If the time stamp is set as "100us", "10us" or "1us", it will be changed to "MS1ms" automatically. When starting the measurement, Analog Data display will be appeared. If it has only analog data, other colums excepting "Time" and "I1234" will be blanks.

Chapter 4 Explanation of Display

LCD Display

Display	Meaning
Time	Displays the time (time stamp) when the frame is received. Press [F1] to display the difference of time stamps compared to the previous time stamp. ("Time" on the screen is changed to " △ Time")[*1]
Ch	Displays the channel received. (1:CH1, 2:CH2)
(Br-Sy-)ID	At the time of CAN, displays the ID of the frame received.
	At the time of LIN, displays the bit number of "Syncbreakno", and the values of "Syncfield" and "Identifer" in hex. [*2]
Type	Displays a type of the frame received.

<table>
<tr><td>DATA</td><td>Data frame of CAN</td></tr>
<tr><td>REM</td><td>Remore frame of CAN</td></tr>
<tr><td>ERR</td><td>Error frame of CAN</td></tr>
<tr><td>FRM</td><td>Frame of LIN</td></tr>
<tr><td>ILL</td><td>Frame which is out of LIN standard [*3]</td></tr>
</table>

Display	Meaning
DL	At the time of CAN, displays the contents of data length code in decimal.
	For LIN, data length set on the Configuration ID setting is displayed. (Does not display anything if frame end is set as "Time".)
St	Displays whether the condition of the frame is normal or abnormal.

<table>
<tr><td>G</td><td>Normal Frame</td></tr>
<tr><td>B</td><td>SynchBreak error of LIN (When Dominant is 10bit)</td></tr>
<tr><td>S</td><td>SynchField error of LIN (At the times other than "55h")</td></tr>
<tr><td>P</td><td>Parity error of LIN</td></tr>
<tr><td>L</td><td>Data length error of LIN</td></tr>
<tr><td>R</td><td>When the data of the Response of LIN is less than 1byte</td></tr>
<tr><td>C</td><td>CRC error of CAN / Checksum error of LIN</td></tr>
<tr><td>A</td><td>ACK error of CAN</td></tr>
<tr><td>E</td><td>Error frame of CAN</td></tr>
<tr><td>F</td><td>Form Error of CAN (When CRC or ACK delimiter is 0)</td></tr>
</table>

Display	Meaning
Data	Displays the contents of the data field in hex.
l1234	Displays the status of the external input in binary. (0=Low, 1=High)
FC	Displays the contents of CRC in CAN, or the contents of checksum in LIN. By pressing [F3], "l1234" and "FC" are changed.

□ Other display

| FE | Framing error (When the stop bit is Dominant.) [*4] |

*1: Maximum timestamp is described as following, and it returns to zero.

Unit	Maximum	Meaning	Time	Available Function
1usec	134.217.727	134S/217.727msec	Relative time	ONLIN / MANUAL
10usec	1342.177.27	1342S/177.27msec	Relative time	ONLIN / MANUAL
100usec	13421.772.7	13421S/772.7msec	Relative time	ONLIN / MANUAL
MS1m	59:59:999	59M/59S/999msec	Absolute time	ONLIN / ANALOG / MANUAL
HMS	23:59:59	23H/59M/59S	Absolute time	ONLIN / ANALOG / MANUAL

*2: By pressing [F2]"RAW", the data presentation with the parity and that of without it are changed.

*3: In case that the part of the header (SynchBreak, SynchField, Identifer) is not normal, the frame is treated as illegal.
When the data of the frame which is not LIN frame is captured before Break, it is displayed at DATA part.

*4: By pressing [F2]"RAW", the framing error display and the data display are changed.

The type of screen display is changed by pressing [Data].

< Data display screen >

The frames of CAN or LIN are displayed in the order of measured time.

◆Color code
Ch1: Yellow
Ch2: Green

* It is displayed in white color if there is only analog data.

◆ Change of display

1 [F1]key : Change of Time display

"Time"(the elapsed time from the measurement start) and " ⊿ Time"(the elapsed time from the previous frame) are changed by pressing [F1].

2 [F2]key : RAW

Whether ID presentation of LIN with the parity or without the parity, and the display of framing error in HEX or not in HEX are changed by pressin [F2].

3 [F3]key : Change of display FC or I1234

By pressing [F3], "FC" and "I1234" are changed.

FC: Displays the contents of CRC in CAN, or the contents of checksum in LIN.

I1234: Displays the status of the external input in binary.   (I1234=IN1 to 4   0=Low, 1=High)

< Analog display screen >

The measured volage values of signals from IN1 to 4 are displayed in the order of received time. (unit : V).

Ch1: Yellow

Ch2: Green

* It is displayed in white color
  if there is only analog data.

< Logic analyzer display screen >
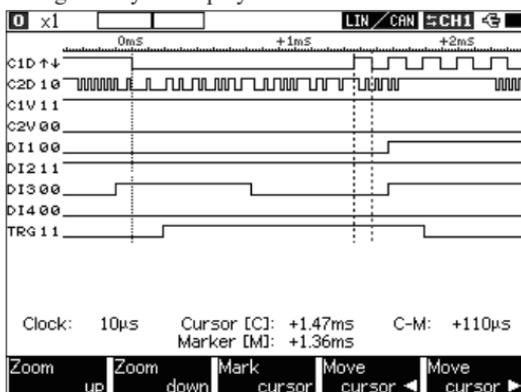
The condition of each signal is displayed in the digital waveform.

C1D: Data bus of Ch1
C2D: Data bus of Ch2
C1V: General-purpose input of Ch1 (*1)
C2V: General-purpose input of Ch2 (*1)
DI1: General-purpose input (*2)
DI2: General-purpose input (*2)
DI3: General-purpose input (*2)
DI4: General-purpose input (*2)
TRG: External trigger input (*2)

 For the logic analyzer display, set "Wavemonitor" to "On" at "Wavemonitor" setting screen before measuring.

*1 : Dsub 9-pin (At the time of CAN measurement) / Vbat of 3-pin connector (At the time of LIN measurement)

*2 : 8-pin connector (IN1,IN2,IN3,IN4,TRG IN)

Chapter 5 Trigger

When a specific factor (Factor) is detected during measurement operation, specific operation (Action)

can be performed. At the top menu, press [2] "Trigger" to select the trigger.

Validate or invalidate each trigger by pressing [F1] and [F2]. (The trigger is valid when check box has a check mark.)

□ Factor

Factor	Content
Error	Executes the trigger by an error of the communication.
	Break : Considers as an error when Dominant of Break field is 10bit (LIN).
	Sync : Considers as an error when the value of Sync field is other than 55(h) (LIN).
	Parity : Parity Error (LIN)
	Checksum : Checksum Error (CAN/LIN)
	Framing : Framing Error (when the stop bit is Dominant) (LIN).
Data	Executes the trigger when the specific data frame is received.
	Sets the reception channel (Target), ID (*1), and the contents of the data.
	(Settable for Don't care and a bit mask.)
Remote	Executes the trigger when the specific remote frame of CAN is received.
	Sets the reception channel and ID.
Time/Count	Executes the trigger when the timer or the counter reaches the value being set.
TRG IN	Executes the trigger by the input condition of TRG IN.
	(It is an inside and they are +5V and a 12Kohm pull-up.)
External	Executes the trigger by the logical condition of external trigger inputs (from IN1 to 4).
	(Settable for Don't care , 1 and 0.)

*1 : Set ID filter from an upper bit. In the case of CAN, set ID from ID28 to ID18 at the time of Standard Format. (Make sure you set *(Don't care) from ID17 to ID0.) Moreover, in the case of LIN, set ID from ID26 to ID21. (Make sure you set *(Don't care) from ID20 to ID0.)

(ID28(P1) and ID27(P0) are settable as well.)

(e.g.)

CAN Standard Format ID023

ID 28-24	–	–	–	0	0	0	0	0
ID 23-16	1	0	0	0	1	1	*	*
ID 15-8	*	*	*	*	*	*	*	*
ID 7-0	*	*	*	*	*	*	*	*

CAN Expansion Format ID00000023

ID 28-24	–	–	–	0	0	0	0	0
ID 23-16	0	0	0	0	0	0	0	0
ID 15-8	0	0	0	0	0	0	0	0
ID 7-0	0	0	1	0	0	0	1	1

LIN ID23

ID 28-24	–	–	–	*	*	1	0	0
ID 23-16	0	1	1	*	*	*	*	*
ID 15-8	*	*	*	*	*	*	*	*
ID 7-0	*	*	*	*	*	*	*	*

□ Action

Action	Content
Buzzer	Sounds the buzzer.
Stop	Stops the measurement. Quick : Stops the measurement immediately. 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.
Save	Saves the data of before and after the trigger specified by the Offset.
Timer	Controls the timer. Start : Starts the timer. Stop : Stops the timer. Restart : Clears and restarts the timer.
Counter	Controls the counter. Increment : Adds 1 to the counter. Clear : Sets 0 for the counter.
Trigger Switch	Controls another trigger state. Disable : Sets invalid for another the trigger. Enable : Sets valid for another the trigger. Change : Changes invalid or valid of the trigger state. Disable <--> Enable
Send	Executes the control of the data which is set on CAN data table. Sets the transmission data table for control , the contents of the control (Transmit or Stop), and the time (Response) from the occurrence of the trigger to the control.
TRG OUT	Outputs the low pulse(about 1msec) to the external trigger terminal. (It is an inside and they are +5V and a 12Kohm pull-up.)

Chapter 6 Simulation

6.1 CAN Simulation

Register the transmission data in the simulation data tables, and then send them by pressing [0]-[F] keys, which correspond to the tables.

6.1.1 Preparation
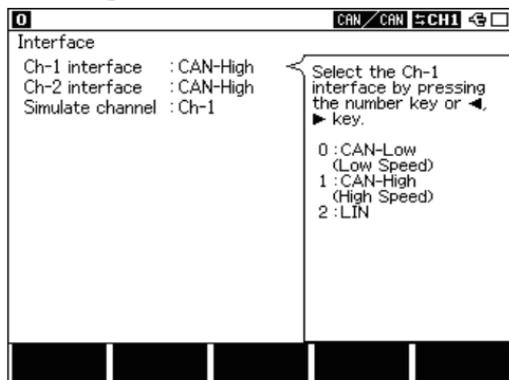
At the top menu, press [5]"Interface" and select the simulation channel that you use CAN-High or CAN-Low as interface.
(Only one channel is available for simulation.)
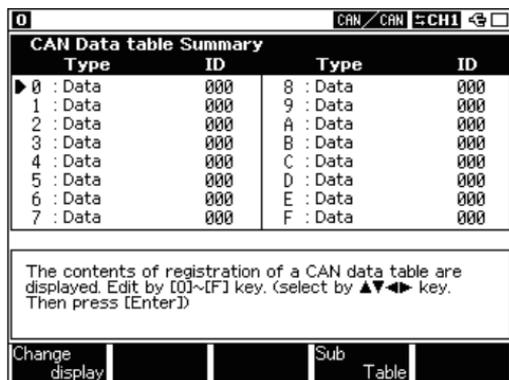
At the top menu, press [9]"Data send table" and select the data table number ([0] to [F]) to register the transmission data. Up to 16 tables can be registered as main tables.

[Display Change]: Switch the screen to display TYPE and ID.
[Sub Table]: Switch the screen to display summary of sub tables.

6.1.2 Registration of the transmit data
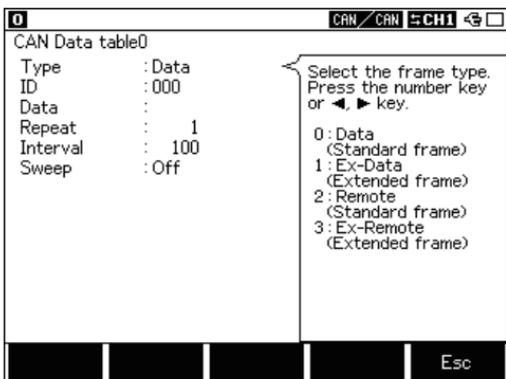
□ Type :Sets the type of the frame.
  Data(the data frame of the standard format)
  Ex-Data(the data frame of the expansion format)
  Remote(the remote frame of the standard format)
  Ex-Remote(the remote frame of the expansion format)

□ ID: Sets 11bit (Standard format) or 29bit (Expansion format) of ID in HEX.

□ Data: Sets data in the data field up to 8 data in HEX when selecting the data frame.

□ DLC: Sets the number of byte of data for request in decimal when selecting the remote frame.

□ Repeat: Sets the number of times to repeat transmission of the frame. When 0 is set, repeats transmission.

□ Interval: Sets the interval of time when transmitting repeatedly from 1 to 99999ms .

□ Sweep: Selects On or Off of the sweep (changes continuously).
  When it is set at On, then set the parameter which is necessary to for sweep.

◆Endian: Sets the storing order (Little, Big) of data for sweep.

(e.g.) Setting 0123h

Big | 01h | 23h | Little | 23h | 01h |

◆Size: Selects the size of data you let sweep from 8bit or 16bit.
    The lower 8 and 16bit of data being swept are set, and the upper of that is ignored.
    (e.g) For SIZE: 8, if data being swept is 256 (100h), 00h is set.

◆Position: Sets the position of the data field to insert data you let sweep.

(e.g.) Data field

At the time of Size: 16 Position: 1, sweeps the highlighted parts of data.
The data set in the Data clause is transmitted excluding the data you let sweep.
Set in the range of the number of data which has been set in the Data clause(MAX 8 bites).

◆Initial: Sets the initial value of the data you let sweep in a decimal number (-32768 to 65535).
◆Time1: Sets the time you let change from an initial value to the following target value (VALUE1).
 (0 to 999999ms)
◆Value1: Sets the first target value(Value1) in a decimal number.
◆Time2: Sets the time you let change from Value1 to the second target value (Value2).
 (0 to 999999ms)
◆Value2: Sets the secomd target value(Value2) in a decimal number.
◆Time3: Sets the time you let change from Value2 to the third target value (Value3).
 (0 to 999999ms)
◆Value3: Sets the third target value(Value3) in a decimal number.

The relation between a target value and the time is as following.
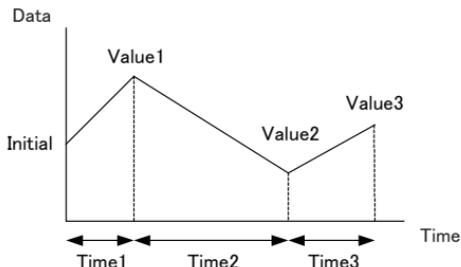
6.1.3 Sub table for CAN data (firmware Ver1.09 or above)

There are 16 tables (Table 0-F) in the CAN simulation tables as main tables, and sub tables follow the main tables described below.

Main Table	Sub Table				
Table 0	Table 0-0	Table 0-1	…	Table 0-F	Table 0 Group
Table 1	Table 1-0	Table 1-1	…	Table 1-F	Table 1 Group
:	:	:	:	:	:
Table F	Table F-0	TableF-1	…	Table F-F	Table F Group

Pressing the keys, which correspond to the main tables, also sends the sub tables up to 16 kinds after sending the main table. Configurations of sub tables include "on/off"(valid/invalid sub tables) and "delay" settings beside the same configurations with main tables. The defaults of sub tables are all "off". If sub tables are unnecessary, use the main tables only.

To set the sub tables, select the main table number in the CAN Data table Summary, and then press [F4]. (or [Shift]+[0]to[F] key)

Select the sub table number ([0]to[F]) from the "CAN Data tableX subtable Summary" display.

[Change display]: Switch the "CAN Data tableX subtable Summary" to display Data, Type&ID or Use&Delay.

[Main table]: Return to the main table summary.

At the summary display;
[Shift]+[F3]: Copy the data table in the inner memory.
(Copied data in the inner memory will be erased when turning off the power.)
[Shift]+[F4]: Paste the data table.
(When copying from main table to sub table; the setting will be "Use: On" and "Delay: 0".)
(When copying from sub table to main table; the setting of "Use" and "Delay" will be ignored.)

CAN Data Subtable0-0

Use	: On
Delay	: 0
Type	: Data
ID	: 000
Data	:
Repeat	: 1
Interval	: 100
Sweep	: Off

Select On/Off of the
use of a subtable.
Press the number key
or ◄, ► key.

0 : Off
1 : On

Esc
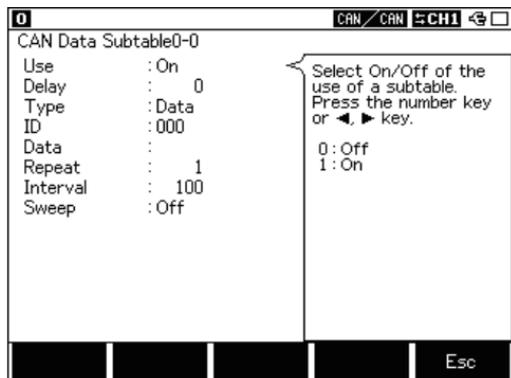
Use: Set "On" to use the sub table.
Delay: Set the delay time (msec) to send the first frame.
For example, Delay: 10

```
┌─────────────────┐
│  Table0  Send   │
└─────────────────┘
   │                              ┌─────────────────┐
   │         10msec          ───► │ Table0-0  Send  │
                                  └─────────────────┘
```

For mode details, refer to the "6.1.2 Register transmission data".

<Example of sub table>
Send Table 0, Table 0-0, Table 0-1 at specified cycle.

	Table 0	Table 0-0	Table 0-1
Use	-	On	On
Delay	-	10	20
Type	Data	Data	Data
ID	001	002	003
Data	00	01	02
Repeat	0	0	0
Interval	100	100	100
Sweep	Off	Off	Off

(Settings of Table 0-2 to 0-F are all off.)

Image of transmission timing.
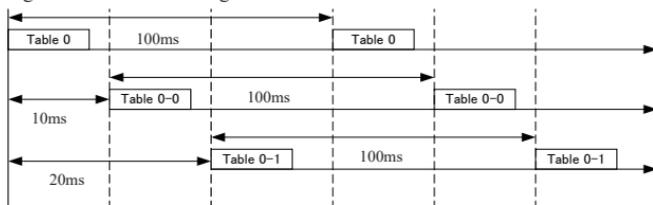
```
┌─────────────────────────────────────────────────────┐
│ 0        0                    CAN／CAN ⇆CH1 ⬸□       │
├─────────────────────────────────────────────────────┤
│ � Time    Ch(Br-Sy→)ID Type DL St      Data    I1234 │
│                                                       │
│ --:--:---    1      001 DAT  1  G 00           1100  │
│ 00:00:010    1      002 DAT  1  G 01           1100  │
│ 00:00:010    1      003 DAT  1  G 02           1100  │
│ 00:00:080    1      001 DAT  1  G 00           1100  │
│ 00:00:010    1      002 DAT  1  G 01           1100  │
│ 00:00:010    1      003 DAT  1  G 02           1100  │
│ 00:00:080    1      001 DAT  1  G 00           1100  │
│ 00:00:010    1      002 DAT  1  G 01           1100  │
│ 00:00:010    1      003 DAT  1  G 02           1100  │
│ 00:00:080    1      001 DAT  1  G 00           1100  │
│ 00:00:010    1      002 DAT  1  G 01           1100  │
│ 00:00:010    1      003 DAT  1  G 02           1100  │
│ 00:00:080    1      001 DAT  1  G 00           1100  │
│ 00:00:010    1      002 DAT  1  G 01           1100  │
├─────────────────────────────────────────────────────┤
│ Change        RAW    Change              Find         │
│ time display         FC/I1234                  setup  │
└─────────────────────────────────────────────────────┘
```

<Notice of CAN simulation>
When receiving frame from other device, the analyzer replies ACK while CAN simulation.
However, the analyzer does not reply ACK when transmitting frames or no ACK reply from other node on the CAN bus. Also, it does not reply ACK when configurations of time in the multiple tables are duplicated.

The smaller table number will send data first, if duplicating the delay time with other tables.

6.1.4 Start and Stop Simulation

■ Start measuring
1. Press [Run].
2. Transmit frames by pressing the [0] to [F] keys corresponding to the transmission table.
   (Transmit the sub table if it is valid.)
   Press another numeral key during transmitting the frames repeatedly to transmit another frame.
3. Press the same key again while pressing [Shift] to stop the transmission.
   (It stops transmitting the sub tables as well.)

■Stop measuring
Press [Stop].

6.2 LIN Simulation

Register data in the data table and transmit it as Master or Slave simulation setting.

6.2.1 Preparation
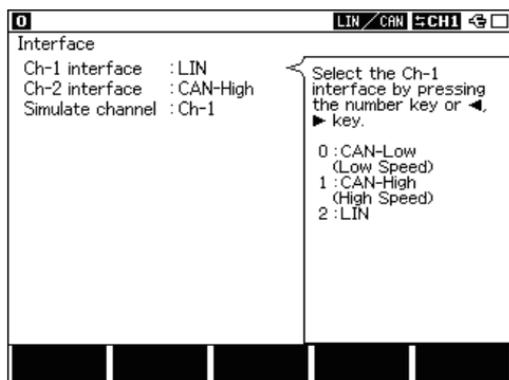
At the top menu, press [5]"Interface" and set the simulation channel that you use as LIN as interface.
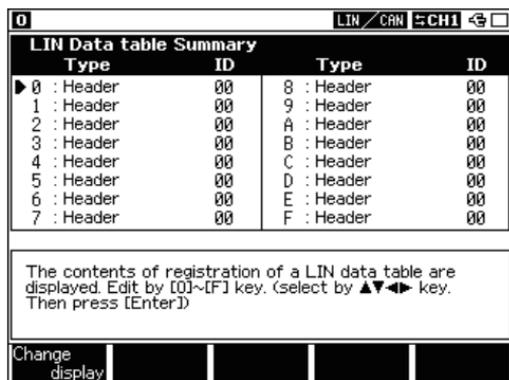
At the top menu, press [9]"Data send table" and select the data table number [0] to [F] in the "LIN Data table Summary display". Up to 16 kinds of tables can be registered.

6.2.2 Register transmission table
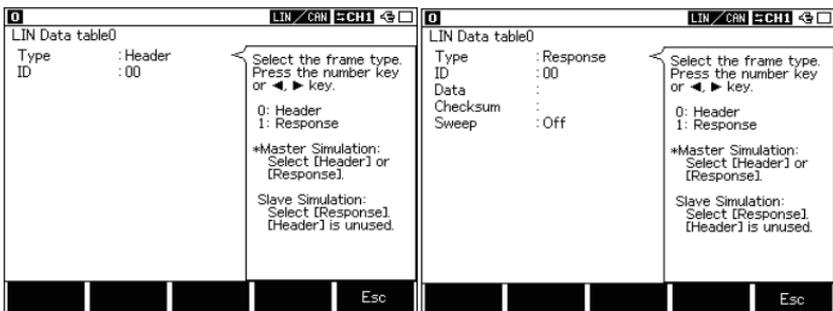
□ Type   : Selects whether you send the header or the response of the frame .

As it is different with combination of a simulation mode and a type,

please look at the following table.

	Simulation Mode	
Type	Master	Slave
Header	Transmits only Header (Receives Response)	No transmission
Response	Transmits Header and Response	Transmits only Response

(The message with "*"mark is the setting for simulation mode.)

□ ID   : Sets ID (excluding Parity) which is transmitted at the time of the master simulation in HEX.
Sets ID (excluding Parity) which is responded at the time of the slave simulation
in HEX as well.

> < Attention >
> At the time of a slave simulation, when ID of the table data has been set repeatedly, data
> with a small table number is transmitted.

□ Data   : Sets data up to 8 data in HEX.

□ Checksum : Sets the checksum in HEX.
If it is not inputting, it is automatically calculated and transmitted, by the checksum
calculation method which has been set in Configuration at the time of transmission.
Moreover, by pressing [F1] , you can set the value calculated by the checksum
calculation method which has been set in Configuration.

□ Sweep   : Selects On or Off of the sweep (changes continuously).
In the case of LIN, Sweep is started when ID is matched.
To learn more about Sweep, please read "5.1 CAN Simulation".

6.2.3 LIN Simulation mode

At the top menu, press [A]"LIN simulate" to set the configuration of Master or Slave mode.
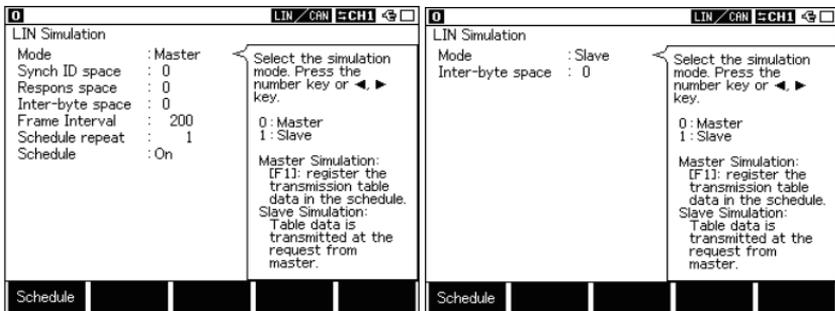
□ Mode :

Selects a mode (Master, Slave).

□ Synch ID Space : (Master mode only)

When the master mode is selected, sets the Synch ID space (interval

between SYNCH field and ID field) from 0 to 99 bit.

□ Respons Space : (Master mode only)

When the master mode is selected, sets the response space (interval

between Header and Response) from 0 to 99 bit.

□ Inter-Byte Space :

Sets the inter-byte space (interval of each data of response) from 0 to 99.

□ Frame Interval : (Master mode only)

Sets the interval of transmitting the frame on the schedule from 3 to 99999ms.

Set the longer value than length of the frame.
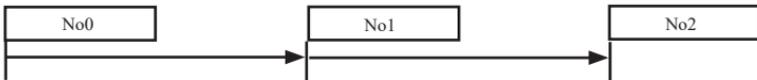
□ Schedule repeat : (Master mode only)

Sets the repetition frequency of schedule (data from No.0 to F) from 0 to 99999. When 0 is set, transmits repeatedly.

□ Schedule : (Master mode only)

Select On or Off of the schedule transmit function.

On : Transmits the LIN frame set at the schedule table in the number order of the schedule.

Off : Transmits the registered LIN frame by pressing the key ([0] to [F]) corresponding to the

table number.

The schedule table is set by [F1].

6.2.4 Schedule table (Master mode only)

```
┌─────────────────────────────────────────────────┐
│ 0                            LIN／CAN  CH1  ⊕□    │
│  Schedule Table                                   │
│ ┌──────┬─────────┬─────────ErrorOption──────────┐ │
│ │  No  │ TableNo │  Parity  │  Break  │  Synch  │ │
│ ├──────┼─────────┼──────────┼─────────┼─────────┤ │
│ │ No0  │ Table0  │    □     │    —    │    —    │ │
│ │ No1  │ Table1  │    □     │    —    │    —    │ │
│ │ No2  │ -None-  │    □     │    —    │    —    │ │
│ │ No3  │ -None-  │    □     │    —    │    —    │ │
│ │ No4  │ -None-  │    □     │    —    │    —    │ │
│ │ No5  │ -None-  │    □     │    —    │    —    │ │
│ │ No6  │ -None-  │    □     │    —    │    —  ▽ │ │
│ │ No7  │ -None-  │    □     │    —    │    —    │ │
│ ├───────────────────────────────────────────────┤ │
│ │ Select the schedule number with ▲ or ▼ key,   │ │
│ │ and set the transmission table. Cursor is     │ │
│ │ moved by the ◄ or ► key and the error setting │ │
│ │ is possible.                                   │ │
│ │ [0]~[F] : TableNo, [Del] : delete             │ │
│ ├───────────────────────────────────────────────┤ │
│ │Table │Enable☑ │Disable□ │         │    Esc    │ │
│ │ Edit │        │         │         │           │ │
│ └───────────────────────────────────────────────┘ │
└─────────────────────────────────────────────────┘
```

< Schedule table >

□ Table No :

Selects the LIN data table by [0] to [F] key in which the transmit data is registered.
Press [F1]"Table Edit" to edit the setting.

□ Parity :

Press [F2] when transmitting the parity error.
The value of the error which reversed the parity value is transmitted.
Press [F3] to add the normal parity to the transmit data.

□ Break :

When you transmit such as the error of Break field, the number of the bit is set within 0 ~ 99 bit.
It becomes 13 bit when you set nothing.
(Attention: Set the bit number, and it will be the break signal of max. 6ms.)

□ Synch :

When you transmit such as the error of Synch field, data is set in HEX.
It becomes 55 (h) when you set nothing.

[Esc] Return to the former screen.

For example; Master Simulation.

Transmits data of 2 bytes (41h, 42h) to the slave node (ID=02), then transmits the header of ID=03.
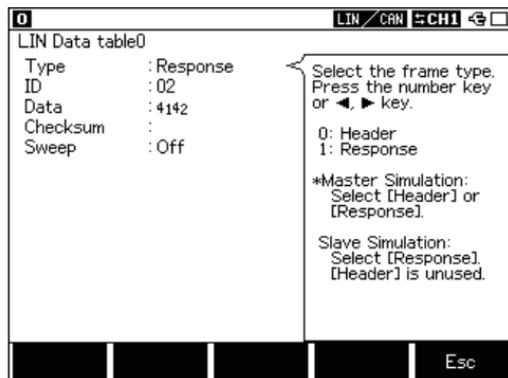
(1)

Sets 2 bytes of data (41h,42h) in the LIN data table0 to transmit to the slave node (ID = 02).

Type : Response
ID   : 02
Data : 41, 42
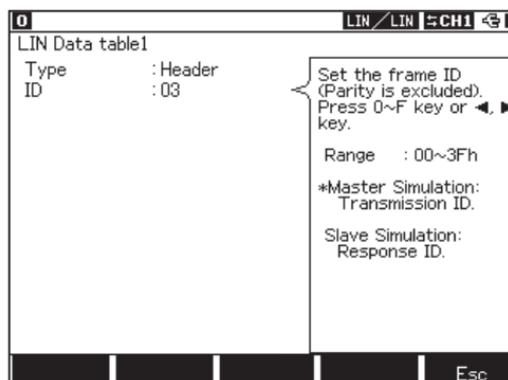
(2)
Set LIN Data table1 to transmit the Header (ID=03).
Type: Header
ID: 03
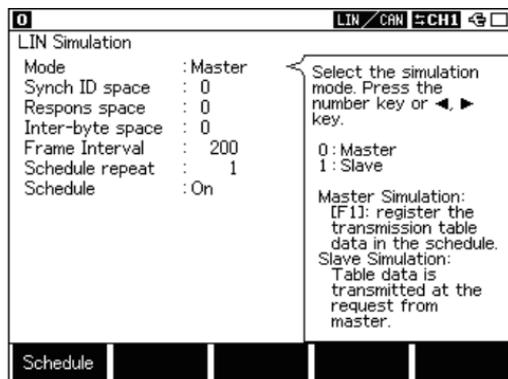
(3)
Select Master mode in the LIN simulation setting.

```
┌────────────────────────────────────────────┐
│ 0                    LIN╱CAN ⇆CH1 ⊕□        │
│ ▛ Schedule Table                            │
│ ┌────┬────────┬──────────────────────────┐ │
│ │    │        │      ErrorOption          │ │
│ │ No │TableNo │ Parity │ Break │ Synch   │ │
│ ├────┼────────┼────────┼───────┼─────────┤ │
│ │No0 │ Table0 │  □     │  —    │  —      │ │
│ │No1 │ Table1 │  □     │  —    │  —      │ │
│ │No2 │ -None- │  □     │  —    │  —      │ │
│ │No3 │ -None- │  □     │  —    │  —      │ │
│ │No4 │ -None- │  □     │  —    │  —      │ │
│ │No5 │ -None- │  □     │  —    │  —      │ │
│ │No6 │ -None- │  □     │  —    │  —      │ │
│ │No7 │ -None- │  □     │  —    │  —    ▽ │ │
│ └────┴────────┴────────┴───────┴─────────┘ │
│ Select the schedule number with ▲ or ▼ key,│
│ and set the transmission table. Cursor is   │
│ moved by the ◄ or ► key and the error       │
│ setting is possible.                        │
│ [0]~[F] : TableNo, [Del] : delete           │
│ Table                                       │
│    Edit Enable☑ Disable□          Esc       │
└────────────────────────────────────────────┘
```

(4)

Press [Schedule] and register the table number as following.

   No.0: Table 0
   No.1: Table 1

Transmit data by [Run] key, if the schedule setting is On.

Transmit data table by [0] to [F] key corresponded to the data table, if the schedule setting is Off.

●Slave mode

Transmits data of 2bytes (43h, 44h) when ID from the master is 03.

There is not the schedule table for Slave mode.

```
┌────────────────────────────────────────────┐
│ 0                    LIN╱LIN ⇆CH1 ⊕■        │
│ LIN Data table0                             │
│ Type      : Response  ┌─────────────────┐  │
│ ID        : 03        │Select the frame  │  │
│ Data      : 4344      │type.             │  │
│ Checksum  :           │Press the number  │  │
│ Sweep     : Off       │key or ◄, ► key.  │  │
│                       │                  │  │
│                       │0: Header         │  │
│                       │1: Response       │  │
│                       │                  │  │
│                       │*Master Simulation:│ │
│                       │ Select [Header] or│ │
│                       │ [Response].      │  │
│                       │                  │  │
│                       │Slave Simulation: │  │
│                       │ Select [Response].│ │
│                       │ [Header] is unused│ │
│                       └─────────────────┘  │
│                                             │
│        │        │        │        Esc       │
└────────────────────────────────────────────┘
```

Set items as follows:

   Type: Response
   ID: 03
   Data: 43, 44

Transmit data when receiving a request from Master after pressing [Run] key.

6.2.5 Start and Stop LIN Simulation

■Start measuring

Notice: Cannot supply 12V from your analyzer. Please make sure you supply external Vbat.

<Master Simulation>

1. Press [Run].

2. When the schedule is "On", it transmits data in the order from a small number of the schedule number
   for the number of time, which has set on "Repeat".
   When the schedule is "Off", it transmits data by pressing [0] to [F] key corresponding to the schedule
   table.

<Slave Simulation>

1. Press [Run].

2. Transmit the data table when it receives a request of transmission from the master and also matches
   ID set at the LIN table data. (Data does not transmit without a request from the master.)

<Wake-Up>

Transmit "80h" as a wake-up signal by pressing [End/x] key and transmit dominant for 0.25usec or
more (*) by pressing [Top/Del] key while simulation.

* It is supported on firmware Ver1.07 or above. Dominant time stands for a total of 0.25usec or more
  per a bit as a communication speed.

■Stop measuring

Press [Stop].

Chapter 7 Use of Data

7.1 Finding Data

Using the FIND function make it possible to search for specific data.

Displays the measured data and press [F5]"Find setup". Then press [F5] for forward search or press [Shift]+[F5] for backward search. (At the data display screen, press [E] for forward search or press [F] for backward search.

Factor

Item	Meaning
Trigger	Searches for data which matches the trigger condition.
Error	Searches for the error . (Break, Sync, Parity,Checksum, Framing)
	At "Traget", search channels (Selectable of Both , Ch-1 , Ch-2).
Data	Searches for the specific data frame.
	Able to set a reception channel, ID, and the contents of a data field. [*1]
	(Settable for Don't care and a bit mask)
Remote	Searches for the specific remote frame of CAN.
	Able to set a reception channel and ID.
	(Settable for Don't care and a bit mask)
Time stamp	Searches for a time stamp. [*2]
	Able to specify the range of time for search(Min time , Max time).
External	Searches for logic conditions of external input(IN1 ~ 4).

*1:   Checksum cannot be searched for LIN. To learn more about setting of ID, read "Chapter 4 Trigger".

*2:   It is available only when time stamp resolution is set as "HMS" or "MS1ms" in the "Record Control".

Action

Item	Meaning
Display	Displays data which matches the search condition at the head of LCD.
Count	Displays the number of times which matches the search condition.

7.2 Printing Data

Recorded data and the setting contents can be printed as the following format.

<e.g. Printing Result of Measurement>

```
*=[LE-8200]=====[2008-09-01 16:17:07]=*
*  CH1 PROTOCOL: CAN                    *
*       BAUDRATE:250k                   *
*  CH2 PROTOCOL: LIN                    *
*       BAUDRATE:9600                   *
*===================================*

----TM------CH------ID--TYPE--DLC-ST-----DATA---------FC--I1234
024.586.298  1       123 DAT   5  G  3031323334        651A 1111
024.686.301  1       123 DAT   5  G  3031323334        651A 0111
024.693.020  2 13-55-33 FRM         4142434445464745 DC   1111
024.711.763  2 13-55-10 FRM         4142             7C   1111
024.736.134  1       234 REM   5  G                   CA1C 1111
024.786.303  1       123 DAT   5  G  3031323334        651A 1111
024.868.026  2 13-55-33 FRM         4142434445464745 DC   1111
024.886.306  1       123 DAT   5  G  3031323334        651A 1111
```

<e.g. Printing Result of CAN Transmission Table>

```
*=[LE-8200]=====[2008-08-02 15:57:02]=*
* CAN DATA TABLE                        *
*===================================*

--TYPE---------ID---DATA/DLC---------REPEAT-INTERV-ENDIAN-SIZE-POS
0:DATA          010 4142434445464748    1    100
1:EXDATA   12345678 3132333435363738    0     10 LITTLE  16    2
   V0=   182 T1= 10000 V1= 19998 T2= 20000 V2= 32100 T3= 30000 V3=   108
2:REMOTE        321 DLC=2               1    100
3:EXREMOTE 12345678 DLC=0               0    100
4:DATA          000                     1    100
5:DATA          000                     1    100
6:DATA          000                     1    100
7:DATA          000                     1    100
8:DATA          000                     1    100
9:DATA          000                     1    100
A:DATA          000                     1    100
```

```
*=[LE-8200]=====[2008-08-01 15:10:57]=*
* LIN DATA TABLE                       *
*===================================*

--TYPE---------ID---DATA/DLC---------C--ENDIAN-SIZE-POS
0:HEADER       00
1:RESPONSE     01   0102              03 LITTLE   8   0
   V0=     0 T1=  1000 V1=    15 T2=  1000 V2=     0 T3=  1000 V3=    15
2:RESPONSE     3C   0000000000000000 FF
3:RESPONSE     03   0102                 LITTLE  16   0
   V0=     0 T1=999999 V1= 65535 T2=999999 V2=-32768 T3=999999 V3= 65535
4:HEADER       00
5:HEADER       00
6:HEADER       00
7:HEADER       00
```

Chapter 8 Specification

Item	Content
Applicable Analyzer	LE-8200A/LE-8200
Measurement Interface	CAN: Conforming to ISO11898/ISO11519-2 standards[*1] (DSUB 9-pin female connector x 2) LIN: Conforming to ISO9141 (header 3-pin connector x 2)
Transceiver	CAN: TJA1050/1054 or equivalent LIN: TJA1021 or equivalent
No. of measurement channels	2 channels of CAN/LIN, or 1 CAN and 1 LIN.
Expansion protocol	CAN, DeviceNet[*2], LIN (Rev1.1, 1.2, 1.3, 2.0, 2.1)
Baud Rate (bps)	CAN: 20kbps to 1Mbps LIN: 1600bps to 26kbps
Monitor Function	CAN: Standard/Expansion format, bit timing arbitrary settings LIN: Frames can be divided by non-communication time or data length specified for each ID. Arbitrary baud rate setting is possible
ID Filter	Only acceptance ID (bitmask can be specified) can be recorded for each channel. You can specify 8 path IDs and 8 cut IDs, and filter by AND condition with acceptance ID[*3].
Time stamp	9-digit display. Real-time/difference-time display. Resolution: hour/minute/second, minute/second/1ms, 100μs, 10μs, 1μs can be specified.
Trigger function	OR operation and sequence operation are available by specifying up to 8 conditions and actions.
Trigger Condition	Error (Break, Sync, Parity, Framing, Checksum) [*4], specific data frame (Channel, ID, data, data bitmask), specific remote frame(channel, ID), timer coincidence, counter coincidence, external signal logic, external signal input
Trigger Action	Measurement stop, saving in a memory card, timer control, counter control, specification CAN data transmission, buzzer, enable/disable trigger condition, external trigger output
Simulation function	Transmit pre-registered test frames (CAN: max. 272 kinds, LIN: max. 16 kinds) by key operation. It can automatically increase/decrease (sweep)[*5] the data of the specified position in the data field.
CAN test	Multiple frames selected by key operation can be transmitted at each specified cycle (number of transmissions can also be specified)
LIN test	Master mode: transmit test frame in the specific order. Slave mode: transmit when ID frame is matched. (response time is selectable) Communication error test: Parity error presence, BREAK field length (13 bits when not specified), SYNC field value (55h when not specified) can be specified
External signal input	Real-time display of external signal status of 4 channels by the LED Signal logic and voltage value can be recorded in conjunction with data Signal voltage value can be continuously measured at a specified cycle (measurement range: ±15V, measurement accuracy: ±1%FS)

*1: It is selectable by changing the internal relay or analyzer setting.

*2: Only raw data can be displayed.

*3: Available only for CAN.

*4: These items are valid only for LIN except checksum error.

*5:   Endian, initial value, three-step target value, and the time to target can be specified.

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.

LINEEYE CO., LTD.