LINEEYE

[3000V High-voltage Resistant Isolation Type]
Interface Converter
USB ⇔ Serial Conversion Model
Instruction Manual

SI-35USB / SI-35USB-2

The latest instruction manual is in the attached CD as PDF format.

(2nd edition)

Introduction

Thank you for your purchase of SI series. To use it correctly, you are advised to read and understand this instruction manual thoroughly. Keep this together with the warranty.

■■ Notice ■■

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- 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.
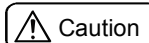
Safety Information

Be sure to read the following.

LINEEYE has developed and manufactured this product for purpose of using with electrical devices such as a computer, a personal device, a measurement device, semiconductor manufacturing equipment, a vending machine, a sequencer, display equipment and so on. LINEEYE does not manufacture this product under the purpose of using with equipment, which may cause malfunction to do harm to the human body: control equipment for nuclear, aircraft equipment, life maintenance equipment, traffic signals, etc. Therefore, LINEEYE makes no guarantee with the mentioned-above use. If you use this product for the purposes mentioned above, please contact LINEEYE considering safety like Fail Safe under your responsibilities.

Danger Level
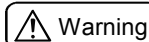
| ⚠ Warning	There is a possibility of getting a serious injury or a death if the device is not used properly.
⚠ Caution	There is a possibility of getting an injury or material damage if the device is not used properly.

* "Injury" indicates injury, burn, an electric shock, or the like which does not require hospitalization or the extended hospital visit. "Material damage" indicates damage related to a house, a building, furniture, apparatus, livestock or a pet.

⚠ Warning
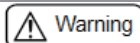
- Do not disassemble or modify the converter .

  This may cause overheating, a fire, an electric shock, injury or unit malfunction.

- Stop using the converter immediately when smoke, smells, or unusual sound emanates from itself.

  Continuous use may cause a burn, fire, or electric shock.

- Keep the products dry. Keep them away from water.

  Failure to do so may cause overheating, an electric shock, or unit malfunction.

- Do not insert the metal scrap or the rubbish such as lead wires into the opening.

  Doing so may cause overheating, an electric shock, or unit malfunction.

- Never touch the converter and AC adapter with wet hands.

  Doing so may cause an electric shock.

- Never use the converter in the place where an inflammable gas leaks.

  Doing so may cause ignition.

- Do not conduct the installation or wiring work when power is applied.

  Doing so may cause an electric shock or unit malfunction.

- Do not use the damaged cables.

  Doing so may cause fire by overheating.

⚠ Caution
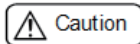
- Do not install the converter in the unstable or vibrating place.

  Doing so may cause unit malfunction or injury.

- Do not install the converter in any temperature and humid places, or any places which has the extreme temperature change.

  Doing so may cause unit malfunction.

- Do not install the converter in any places exposed to direct sunlight.

  Doing so may cause a burn or unit malfunction by overheating.

- Be sure not to short-circuit the pins on the connector.

  Doing so may cause unit malfunction or injury.

■■■ Contents ■■■

Chapter 1 Before Using the Product

1-1. Overview

This unit is an interface converter that converts PC's USB port to an RS-422, or RS-485 port. A photo coupler and an isolation transformer electrically isolate the USB port from the conversion port, which is ideal for FA equipment and medical equipment that require high safety and reliability. It is able to access the USB port as a COM port using the application software by virtual COM port driver.

1-2. Specification

Specifications

	SI-35USB-2	SI-35USB
Conversion	USB ⇔ RS-422/485	
USB Interface	USB1.1/2.0, full speed transmission B onnector	
Serial Interface	RS-422/485	
	5 pole terminal block (5.08mm press-to-screw pitch type[*1]) Rated torque/ Screw size: 0.25Nm/M3	
	Built-in terminater ON/OFF. Line monitor, Auto driver control.	
Asynch Type	Asynch	
Baud Rate	300 to 3Mbps[*2]	
Data Frame	Data bits[7or8] + Parity[Even/Odd/none] + Stop bits[1/2]	
Flow Control	Xon/off, RTS/CTS[*3] (supported by COM port emulator)	
Surge Protection	15KV ESD	
Isolation Protection	3000Vdc	
System Requirements	PC: PC/AT compatible with USB port (DOS/V PC) OS:Microsoft Windows 10/8.1/8/7 [*4]	
LED	Transmission: TXD, Reception: RXD, Power: PWR	
Power	USB Bus power, DC5V±10%, Max. 100mA	
Temperature	In operation: -20 to 60°C, In storage: -20 to 75°C	
Humidity	10 to 90%RH (No condensation)	
Standard	CE (Class A), EMC (EN61326-1:2013)	-
Dimension & Weight	58(W)×80(D)×22.5(H)mm Approx. 160g	65(W)×90(D)×22(H)mm Approx. 200g
Mounting Method	Attachement using M3 screw hole on the bottom face, installation to a DIN rail by SI-DIN70, magnet attachment by SI-MG70, or wall-hanging by SI-WM1.	
Composition	USB cable (1.8m), Utility CD, Instruction manual, Warranty.	

*1: Single wire: 0.2-2.5 mm^2. Stranded wire: 0.2-1.5 mm^2, AWG24 to 14. Refer to [3-4 Cable Connection] for more details.

*2: Speed is established in application software. Certain speed beyond 1.2Mbps cannot be established.

*3: Tuis unit can control the transmission timing by using the line monitor function (refer to [3-1])

*4: Supports 32bit/64bit of Windows 10/8.1/8/7. We do not support any problems occurred on Windows Vista/XP.

1-3. Unpacking and Product Composition

Make sure of the following when unpacking the product:

Converter	: 1
USB cable	: 1
Utility CD-ROM	: 1
Instruction Manual	: 1
Warranty	: 1

Please let your LINEEYE distributor or LINEEYE know if you find any damage to the product caused by transportation, or if there are accessories lacking.

1-4. CD-ROM Included

This CD-ROM includes the document file such as the instruction manual, and driver for Windows to connect it to the PC, and software for communication loop-back test. There are two folders for Windows driver for your appropriate OS.

| Folder name	Supported OS
/siusb_drivers/new	Windows 10/8.1/8/7
/siusb_drivers/old	Windows Vista/XP (we confirmed the driver works on these OSs but will not support them.)

1-5. Mounting Arrangement

Place this unit in the flat and stable place. To mount it onto the other device, use the M3 screw holes in the bottom face. To mount it on a DIN rail (SI-DIN70 is required), use the M3 screw holes and tight it together with DIN rail mounting plate (SI-DIN70).
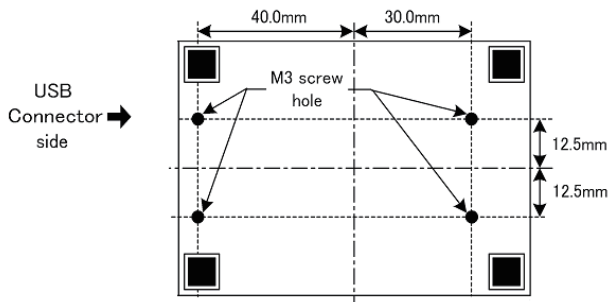
Notice: Use the screws that can be inserted less than 6mm from the surface line.
If it is inserted deeper, it may damage the circuit.

With a wall bracket (SI-WM1, optional), you can fix the converter to a wall by screwing from the upper side of the bracket or hooking it to screws or nails hammered into the wall.

Wall bracket (SI-WM1)
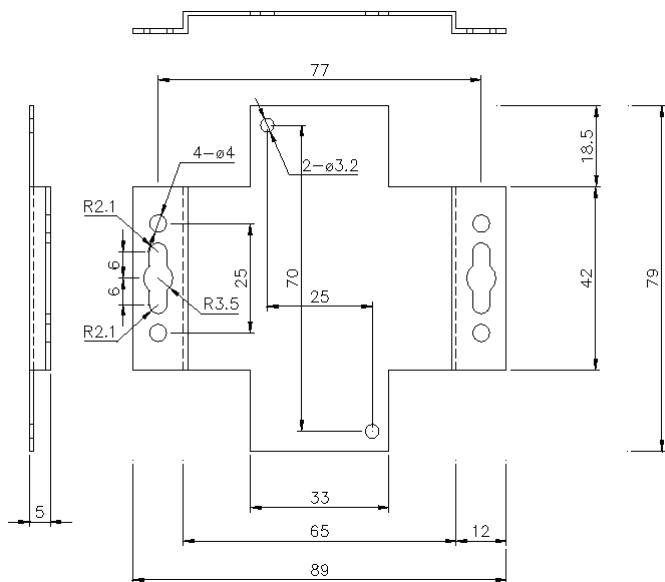
Two φ3.2 holes are for attaching this bracket on the backside of the converter, other holes on each side of the bracket are for attaching on the wall.

Using the magnet to fix

With the magnet (SI-MG70, optional), you can fix the converter to a metal wall such as steel wall. The magnet is attached to the converter by screwing the two magnet plates to the bottom side of converter.

Chapter 2 Driver Installation and Usage

When connecting this converter to a USB port of the PC for the first time, an installation of the driver is necessary for the USB port.

If your PC has several USB ports, it is recommend using the specific USB port. Because driver installation is necessary for each USB port to which you connect this converter for the first time.

2-1. Driver Installation for Windows 10/8.1/8/7 (32bit/64bit)

When you connect the converter by USB cable with a PC which is connected with Internet, automatically the driver will be installed.

Note: When the installation does not start automatically, use Windows Update and renew the OS of the PC.

2-2. Manual Installation of the Driver for Windows

When the PC is not connected with Internet or the installation does not start automatically, install the drivers in the CD-ROM (the USB driver and the virtual COM port driver).

Note: Only when you use it with Windows Vista or XP, use the drivers in the folder ￥siusb_drivers ￥old. (Please note that we do not support for Windows Vista and XP.)

Note: Please do not connect the converter to the USB port and PC until the procedure6 is completed.

1. Insert the attached CD-ROM into the CD-ROM Drive of PC.

2. Run "setup.exe" file in "/siusb_drivers/new" folder in the CD-ROM. The following message appears, and then click "Yes" button.
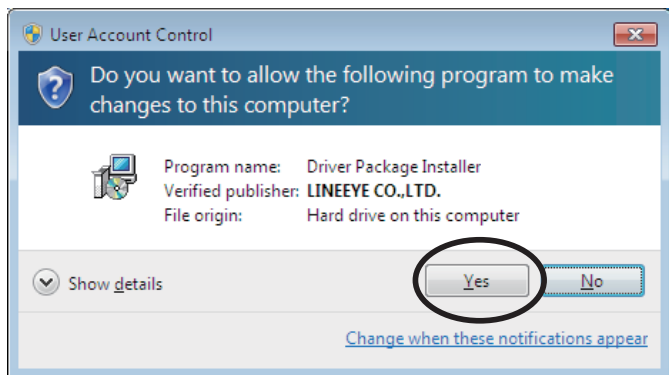
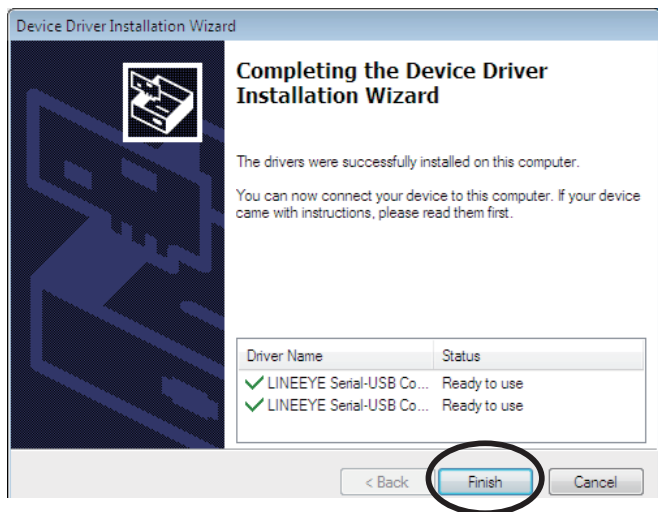3. Click "OK" to start install of the driver package.
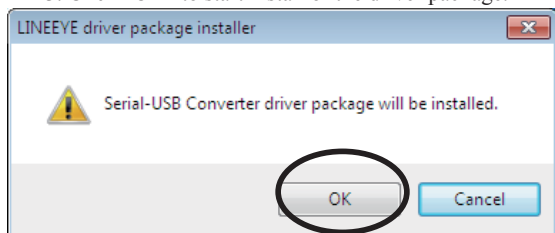
4. Then the installation wizard runs. Click "Next" button.
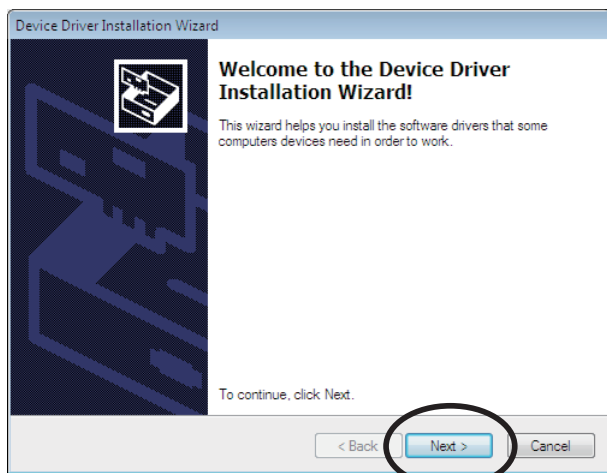
Two drivers are installed automatically.

5. Click "Finish " button to finish the installation of the driver package.
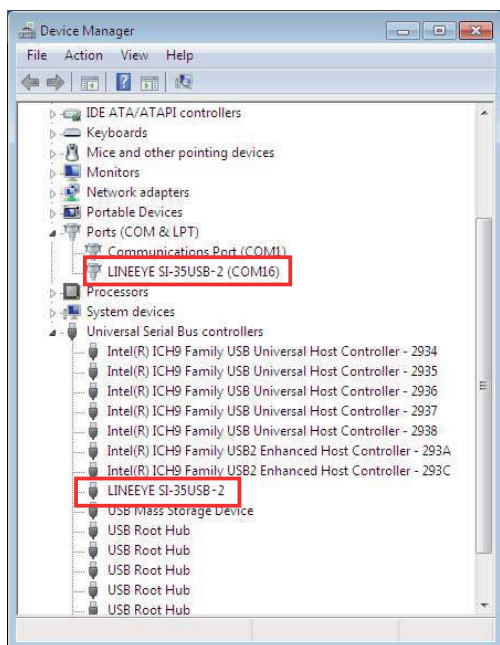

6. Connect the USB connector to the USB port.

The driver Installation has completed.

2-3. The Way to Confirm the Installed Driver

From "Start" menu -> "Control Panel " -> ("Hardware and Sound" in case of Windows7), run "Device Manager".
Confirm that the name of the converter is shown in the items of Ports (COM & LPT) and Universal Serial Bus Controllers.

2-4. Usage of Virtual COM Port Driver

After the installation of the drivers, the serial port of the converter can be accessed from application software in the same way as Windows standard COM port.

[Precautions for usage]
*Virtual COM port number is the number shown in the Ports (COM & LPT) items of the device manager when this converter is connected with PC.

*Soon after the connection of this converter to a USB port or when starting PC, conditions of RTS and DTR of virtual COM port vary for several seconds depending on the OS. This situation occurs because of "Plug and Play" recognition procedure of Windows. In actual use, please confirm the influence for connected devices.

Virtual COM port number and ON/OFF of "Plug and Play" recognition can be changed from virtual COM port property of device manager. For further detail, please refer to technical guides of Windows.

Chapter 3 Usage

3-1. Overview and Features

SI-35USB/SI-35USB-2 is a USB converter that converts USB port of PC into RS-422/
RS-485, which enables to transmit for a long distance and multi-drop bus connection.
This device is suitable for use in situations in which security and reliability are needed
because the GND of the port of RS-422/485 and the GND of the USB port are electrically
isolated with high-voltage resistant insulation
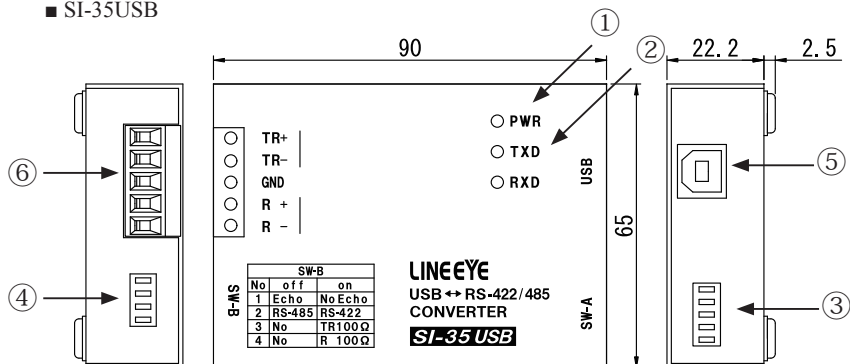
Block diagram
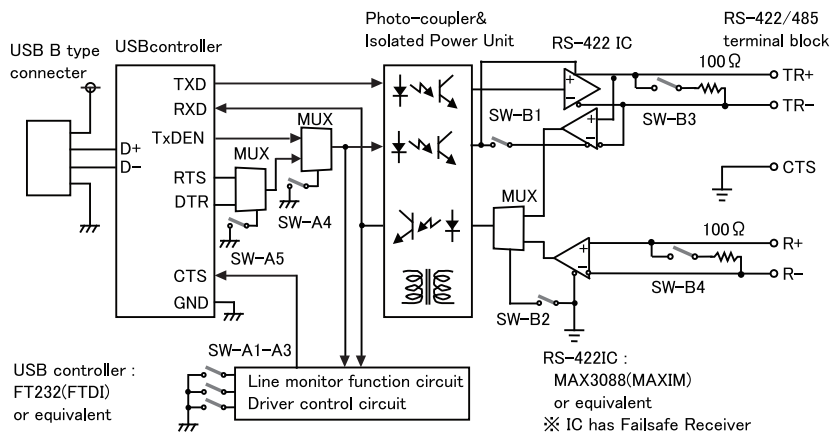
< Line Monitoring Function >

RS-485 communications of two-wire half duplex is required to send data after confirming
that any devices have not sent data into the RS-485 line.
The line monitoring function detects that any devices have not sent data into the RS-485
line, and allows CTS signal to be active and inform it.

RS-485 Line Condition	Flow Control Condition
The period of time from when to detect a space bit of the data in the RS-485 line sent by another device, to when not to get to continuously detect a space bit over internal timer time of the converter, while the converter is not sending data.	While the RTS/CTS flow control of virtual COM port is activated, CTS signal will be non-active. Transmission from the converter to RS-485 line will be prohibited.
Other conditions	While the RTS/CTS flow control of virtual COM port is activated, CTS signal will be active. Transmission from the converter to RS-485 line will be permitted.

■ SI-35USB

■ SI-35USB-2
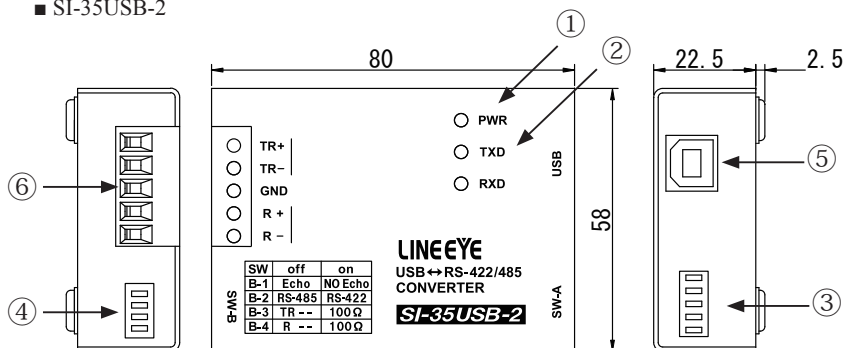
(1)	Power Supply LED	Lights when USB bus power is supplied
(2)	Data Status LED	Indicates a data transmission/ reception status for RS-422/485.Blinks the TXD LED if there is data from USB to RS-422/485.Blinks the RXD LED if there is data from RS-422/485 to USB.
(3)	Dip Switch (SW-A)	Selects the line monitoring function and driver control.
(4)	Dip Switch (SW-B)	Selects the communication method, terminator, etc.
(5)	USB Connector	Standard B Connect to USB port of PC
(6)	RS-422/485 Terminal Block	5.08mm pitch 5 pole terminal block (Press-to-screw type)

5 Pole Terminal Block Pin Assignment for RS-422/485

Terminal No.	Name	Full Duplex Mode *1		Half Duplex Mode *1	
		I/O Direction *2	Description	I/O Direction *2	Description
1	TR+	Out	Transmission Data +	I/O	Transmission/ Reception Data +
2	TR-	Out	Transmission Data –	I/O	Transmission/ Reception Data –
3	GND	-	Signal Grand *4	-	Signal Grand *4
4	R+	In	Reception Data +	-	Cannot use *3
5	R–	In	Reception Data –	-	Cannot use *3

*1 Can switch by the dip switch.

*2 "Out" means a direction to output signals from the converter.
    "In" means a direction to input signals to the converter.
    "I/O" means both directions to input and output.

*3 Do not connect anything when using the half duplex mode.

*4 Connect GND to prevent devices from over voltage damage.

3-3. Hardware Setup

The two dip switches on the converter allows you to conduct the following setups: the line monitoring function, the driver control method, terminator enable/disable, and echo back enable/disable.

■ SW-A No. 1-3 (Baud Rate Setup)

When using the line monitoring function or RS-485 driver control by RTS/DTS signal (when SW-A No.4 is ON), set this converter referring to the table below depending on the speed.

Speed (bps) [ ] indicates a representative example.	SW-A			Internal Timer *1(usec)
	No.1	No.2	No.3	
Over 9600 [9600]	OFF	OFF	OFF	1350
Over 19200 [19200]	ON	OFF	OFF	677
Over 38400 [38400, 57600]	OFF	ON	OFF	338
Over 76800 [76800, 115.2k]	ON	ON	OFF	169
Over 150k	OFF	OFF	ON	85
Over 300k	ON	OFF	ON	42
Over 300 [300, 600, 1200]	OFF	ON	ON	43200
Over 2400 [2400, 4800]	ON	ON	ON	5400

*1 The internal timer is accurate at +10 to -10%.

■ SW-A No.4-5 (Driver control)

Selects the control method in the RS-422/485 driver control line of the converter: manual or auto.

SW-A	Meaning	OFF	ON
No.4	RS-422/485 transmission driver control	Auto	Manual
No.5	Driver control signal (Manual mode)	DTR	RTS

□ When SW-A No.4 is OFF (Auto mode)

When using RS-485 (half duplex mode) normally set it as Auto mode. Right before starting the transmission of data string from the converter to RS-485 line, the driver turns to active. After finishing the transmission, the driver promptly turns to non-active.

□When SW-A No.4 is ON (Manual mode)

Control the sending driver by RTS/DTR signal from virtual COM port selected by SW-A No.5. By activating RTS/DTR signal before sending data, the driver immediately turns to active. After finishing the transmission of data and turning RTS/DTR into non-active, the driver turns to non-active after reaching the time of internal timer. Use this mode to keep the driver active on the RS-422 line.

□When SW-A No.5 is OFF (DTR)

Control the driver by DTR signal when SW-A No.4 is ON (Manual mode).

□When SW-A No.5 is ON (RTS)

Control the driver by RTS signal when SW-A No.4 is ON (Manual mode).

* When SW-A No.4 is off, both on and off are acceptable for No.5.
  Example: The driver control for the data of 31H, 9600bps, SW-A No.1-4 off/off/off(1.35mS)/on is as the following figure.
* RTS and DTR for driver control should be selected by SW-A No.5.
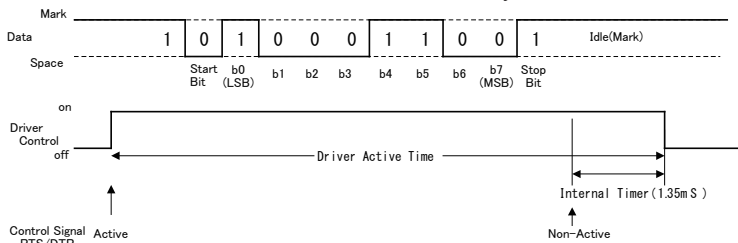
SW-B	Meaning	OFF	ON
No.1	Echo reception of transmission data	With echo back	Without echo back
No.2	Select a line mode	RS-485 (half duplex)	RS-422(full duplex)
No.3	Terminal control between TR+ and TR-.	TR signalWithout terminal control	TR signalWith terminal control(100 ohm)
No.4	Terminal control between R+ and R-.	R signal Without terminal control	R signalWith terminal control(100 ohm)

■ SW-B No.1 (Echo Back Setup)
When you communicate in the half duplex RS-485 mode, setting this switch to ON prohibits the data, which is sent from the converter to the RS-485 line,from being echoed back to the USB host.
Therefore, while the driver is active, the ON setting makes the receiver non-active. The full duplex RS-422 mode does not echo back data even when this switch is in the OFF setting.

■ SW-B No.2 (Line Mode)
Selects the RS-422/485 line specification which is connected to the converter.
・OFF (Half Duplex) Setting
  This setting makes the converter operate in the half duplex RS-485 mode.
  Communicated data is sent and received through TR+ and TR- terminals.
・ON (Full Duplex) Setting
  This setting makes the converter operate in the full duplex RS-422 mode.
  Communicated data is sent from TR+ and TR- terminals, and is received to R+ and R- terminals.

■ SW-B No.3 (Terminal End Between TR+ and TR-)
Setting this switch to ON inserts the terminator 100 ohm between TR+ and TR- in a direction of parallel.

■ SW-B No.4 (Terminal End Between R+ and R-)
Setting this switch to ON inserts the terminator 100 ohm between R+ and R- in a direction of parallel.

Note: For RS-485 communication, terminating registers on both sides of the line should be on. When the line is connected by multi-point connection, turn on only the terminating registers of the devices on both end of the line. For RS-422 communication, turn on only the terminating register of differential receiver (R+ and R-). When multiple receivers are connected with a driver by daisy chain, turn on only the terminating register of the farthest receiver. The terminating registers prevent the signal reflection of long-distance transmission and enhance noise immunity of the line.

3-4 .Cable Connection

■ USB

Confirm the USB port you connected when installing the attached driver, and connect the converter to the port with attached USB cable or USB cable compliant with USB standard. (Refer to "Chapter 2")

The driver for this converter is needed for each USB port with which you connect the converter for the first time. Please do not connect to the different USB port.

Please do not connect to a USB hub, which only uses bus power, and do not have any other power supply. It may cause the insufficient of power and LINEEYE cannot have operation guarantee.
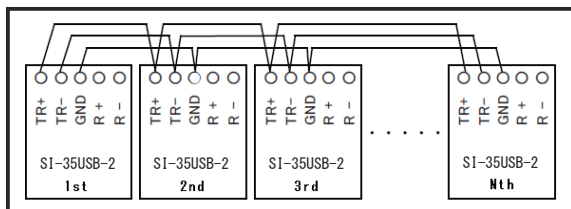
■ RS-422/485

After confirming the RS-422/485 specification (signal definition, inverse signal/non-inverse signal, I/O and so on) of the target device, connect to the device by using proper cable.

An example of 1:1 full duplex mode connection with RS-422 device (LINEEYE SI-20FA).
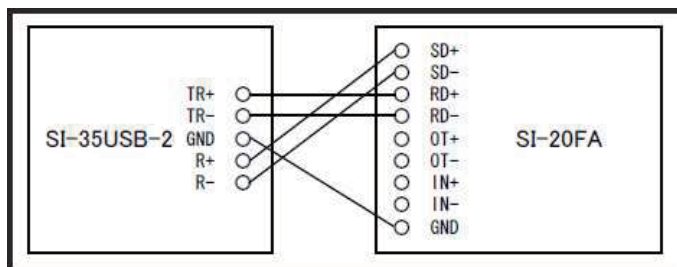
An example of N:N connection between RS-485 devices (between SI-35USB-2)

*Maximum of 128 devices can be connected if constituted only by SI-35USB/SI-35USB-2. (tested by LINEEYE)

[Applicable RS-422/485 cable]
Cable of which conductor size should be AWG24-14, single wire 0.2- 2.5mm2, twisted cable 0.12- 1.5mm2, L=6mm can be removed. If using the ferrule terminal, ferrule diameter should be 1.5mm or less. Following are the recommendation

Cable: UL2464 signal cable shield twisted pair AWG24-22.
Ferrule terminal: Phoenix Contact Inc. "AI0.25-8YE AWG24", "AI0.75-8GY AWG18"
                   JST Mfg. Co., Ltd." TUB-05 AWG26-22"

[Precautions for connection]
When using twisted pair cable, make pairs with cables of same signal pairs (for example, pair like TR+ and TR-). To prevent the devices from over voltage damage, be sure to connect GND.

<Transfer Distance>
The faster communication speed is, the shorter the transfer distance for RS-422/485 is. See the table below and set communication speed following the actual distance.

Distance (m)	Speed (bps)
200	~230.4K
600	~115.2
1200	~57.6K
2400	~9600

Note: the maximum of the actual communication speed changes depending on conditions: environments like noise, cable features used, etc. For actual use, be sure to conduct a communication test to check.

Chapter 4 Warranty and After-sales Service

4-1. Troubleshooting

If you have any trouble in actual use of this converter in your system, please check the connections of cables and the setting of COM port number. In case you still do not find the cause of the trouble, please prepare the software (LEcom Test) with which you can check sending and receiving of data. Then run a loop-back test like following example to find if there is defect or not. ("LEcom Test" supports only Japanese Windows)
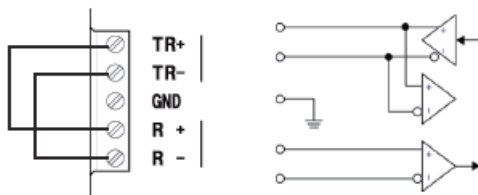
4-2. Loop-back Test by Communication Software

The following example is a case by Tera Term (freeware).
(Note: Tera Term is not supported by LINEEYE. Procedure may be different depending on the version of the software.)

1. Make a loop-back setting referring to following tables depending on the model of the converter.

■ RS-422 (full duplex) loop-back test

| SW-A			SW-B		
No.1	OFF		No.1	ON	With echo back
No.2	OFF		No.2	ON	RS-422
No.3	OFF		No.3	ON	TR with terminal control
No.4	OFF	Auto	No.4	ON	R with terminal control
No.5	OFF				

In case you do the test when SW-A No.4 is on, you need to make DTR signal active by the communications software before sending data.

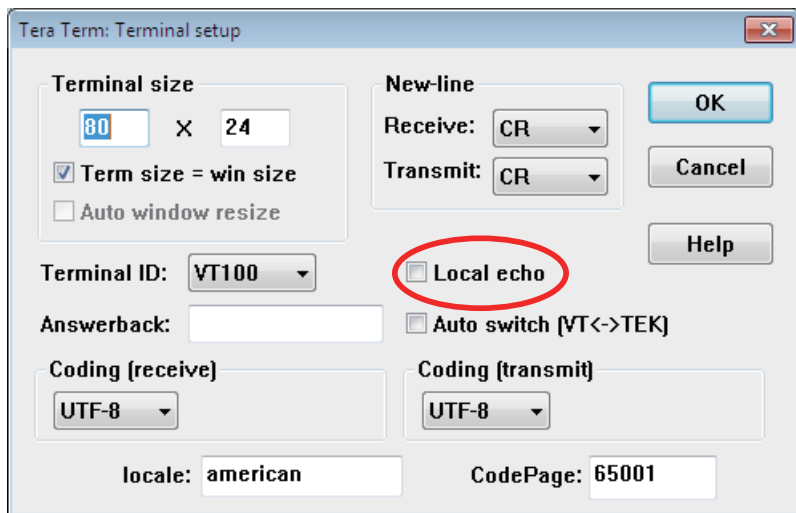■ RS-485 (half duplex) loop-back test.

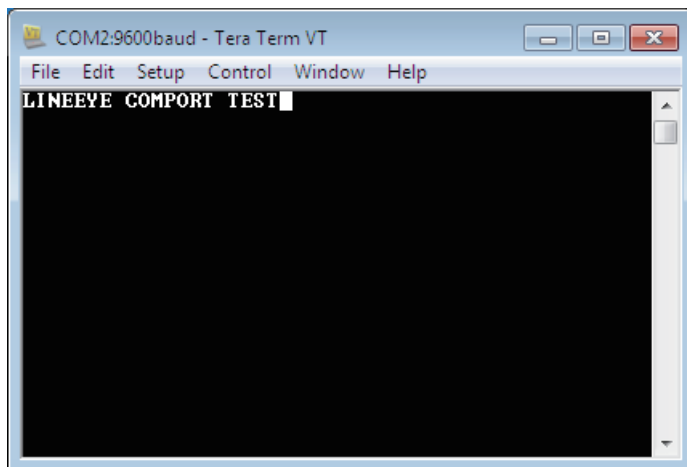| SW-A			SW-B		
No.1	OFF		No.1	OFF	With echo back
No.2	OFF		No.2	OFF	RS-485
No.3	OFF		No.3	ON	TR with terminal control
No.4	OFF	Auto	No.4	OFF	R without terminal control
No.5	OFF				
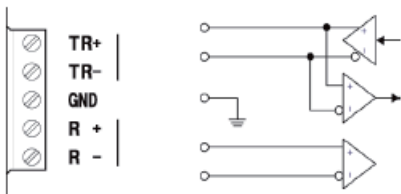
2. Run Tera Term and select the serial port of the converter. And set the communication speed if you need.
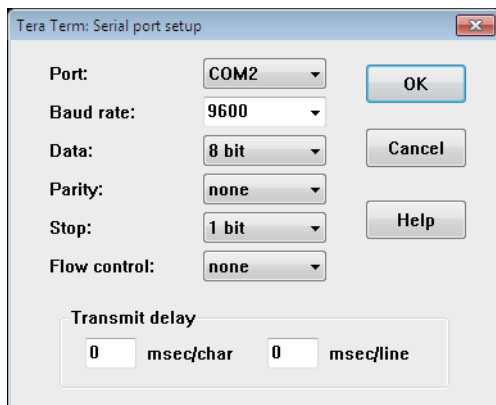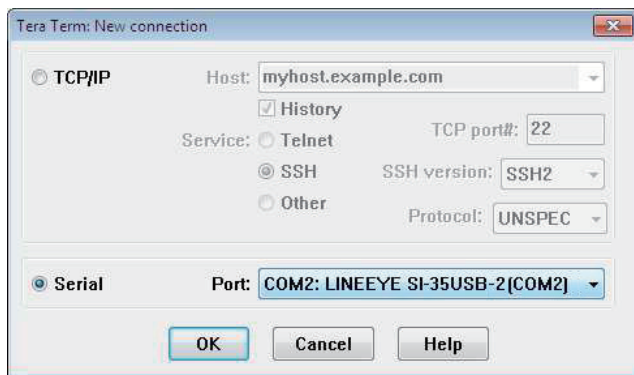
3. Confirm the box "Local echo" is not checked.

4. Confirm that characters entered from the keyboard are displayed.

4-3 Warranty and Repair

■ Warranty
Within a period of 12 months from the date of shipment, LINEEYE warrants that your purchased products (excepting consumable parts such as the batteries and software) are free of charge from any defects in material and workmanship, only when the products are operated in accordance with procedures described in the documents supplied by LINEEYE.
If the defects exist during the Warranty period, please send back the products to LINEEYE distributors or LINEEYE office. LINEEYE will repair or exchange them at no charge. In this case, the shipping charge will be at your own expense.

◆ The foregoing warranties are the sole warranties given by LINEEYE. Above warranties shall not be applied to the products that have been modified, repaired or altered (excepting by LINEEYE employees) or that have been subjected to unusual physical or electrical stress, misuses, abuse, negligence or accidents.
LINEEYE disclaims all other warranties including the warranties of merchantability, fitness for some particular purposes and noninfringement of third party right. LINEEYE cannot promise that the software is error-free or will operate without any interruption. When you have some errors while operating the software, please refer to the contents and modified programs shown on our web page (http://www.lineeye.com). Please download it from there.

□ Repair
LINEEYE will repair the products at your own expense. For malfunction, please contact the LINEEYE distributors where you purchased at. Or, contact us directly. If your product needs to be repaired, please read details about a repair on our web page and ask for a repair.

4-4. After-Sales Service

Our web site contains information about this product. In addition, LINEEYE provides a support for technical questions by Mail Form (click "contact us" on our web site).

For supports, the user registration is required. Please be sure to register from the registration page on our web site.

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)

LINEEYE