sLory

User Manual

Revision History

Revision Date	Document Ver.	Pages Revised	Revised/Added/Removed	Details of Revision
2018.08.20	1.0	All	-	New
2018.12.27	1.1	All	Added	Content of Encryption Added
2018.03.11	1.2	All	Added	Description on DC-Jack type LED Operation Added
2019.10.15	1.3	All	Added	Description on Same Packet Reception (Wireless), STX/ETX Function Added
2020.05.29	1.4	17~19, 28	Revised/Added	Index Revised Cover, p3, Certifications Added
2020. 09.01	1.5	All	Added	Setup Utility LoRaConfig Description Added
2021. 03.19	1.6	All	Added	Setup Utility LoRaConfig App Description Added

Contents

Please be sure to read this manual before using and use the product safely and accurately.

• Pictures and photos in the manual may be different from the physical, and the document is subject to change without notice to improve performance. For the last information, please visit our website (www.sysbas.com).

• To view frequently asked questions and answers, please visit our website and find Support -Technical Support -FAQ section.

• Documents can be downloaded from the product page or Download section.

• Sellers or users should be aware of the fact that this device is intended for industrial use(Class A), not for residential use.

• This device has a potential for radio interference during use and may receive harmful interference from other devices.

• Warranty policy is included in the product packaging.

• The exchange/return of the device can be handled by the procedure described in the Warranty Policy.

1. LoRa Technology

There is a term called IoST(Internet of Small Things) as a concept of narrowing the scope of IoT. It is a technology that connects small objects which measure and process small amount of simple information such as temperature, humidity, weight and location through a wireless network. LTE-class wireless communication technology is costly and wasteful of bandwidth itself for these small items. So LPWA technology as a network for small internet has emerged and LoRa technology is the most popular wireless technology among them.
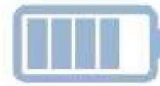
- LoRa is an abbreviation of Long Range, optimized for IoT due to low standby power and low module cost, using 900MHz of unlicensed frequency band.
- LoRa is a wireless technology of LoRa signal, a type of LPWA(Low Power Wide Area) wireless communication technology.
- LoRa can connect equipment up to 20km in open areas.
- LoRa saves time and money by eliminating the need to lay cables over long distance

Benefits that users can gain from using LoRa technology are:

- Long distance communication(up to 20km) with low installation cost
- Simple access procedure for quick installation and application
- Low-power communication which allows battery operation outdoors
- Secure through encrypted communication

2. Components

Box

sLory (with Ejector pin)

5V DC Adapter

Female Pin

2.5dBi Antenna
(SMA Reverse Polarity Plug)

| Components	Ordering Information
sLory-1010DIL/ALL, Ejector pin, 5V DC Adapter, 2.5dBi Antenna, Download Guide, Warranty Policy	sLory-1010DIL/ALL (DC-Jack Type)

3. Product

LED

- RDY (Red): When in operating mode, LED flashes every 0.5 seconds. (The pre-June 2020 version is Yellow)
- RDY (Red): When in setup mode, LED flashes rapidly every 0.1 seconds.
- SRL (Red): Flashes when serial data is sent and received, turns off when there is no transmission.
- LNK (Green): Flashes when data is sent and received by wireless LoRa, turns off when there is no transmission.

* An error occurs when the power level is lower than the rated voltage, and RDY, LNK LEDs turn on and the operation stops.

Switch
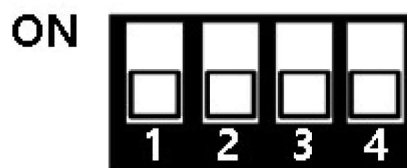
- No. 1: It is setup mode when it is ON, operating mode(default) when it is OFF.
- No. 2: RS422 mode when it is ON, RS232 mode if no.3 switch is also OFF at the same time.
- No. 3: RS485 mode when it is ON, RS232 mode if no.2 switch is also OFF at the same time.
- No. 4: Not in use.

Connector

DC Adapter, LoRa Antenna Connector   Serial Port(RS232/RS422/RS485)

- PWR: Connect 5V 1A DC Adapter included in the package
  (internal diameter: 3.47mm, outer diameter 1.35mm)
- LoRa Antenna Connector: Connect the 2.5dBi Gain Load Antenna included in the package
- RST: Button for rebooting sLory
- Serial Port(RS232/RS422/RS485): Serial port that can be communicated

(Please refer to the Appendix for pin specifications)

4. Function

sLory converts short-distance, wired serial communication to a long-distance, wireless LoRa communication and performs the following functions.

1) Converts serial signals to wireless

Connects to a USB port on the PC and converts USB BUS signals to LoRa signals which is a long range (up to 20 km) and wireless.

2) Low Power Running

sLory is a low-power product powered by 5V DC of VBUS USB power and 1.5W power consumption. If it is difficult to supply power at all times in the field, it is possible to operate by supplying power using solar panels and batteries.

3) Network Configuration

sLory is basically a 1:1 communication device. With connecting uLory or LoryGate devices, users can also build their own 1:N network without paying the communication charge to a carrier. For more information on utilizing method of this function, please refer to CH5. Connection.

※ Same packet received wirelessly within 3 seconds will be ignored.

5. Connection

PC - Device Connection (sLory - sLory)

Between two equipment communicates through serial port, with sLory attached to each end, wireless communication is available.

Wireless is delivered to all nearby passable destinations, so the address of the target to communicate with is required. It is just like the recipient's information is required for mailing. LoryNet numbers each devices and identify them as a DNo(Device Number).

Dno is a unique identification number that each sLory has. With this number, data can be passed to the desired sLory even if there are multiple sLorys. When DNo is a starting point, it becomes the unique SID(Source ID) of sLory itself. And when DNo is a destination, it becomes the DID(Destination ID) of the other party's sLory.

For sLory to communicate 1:1 as shown above, the DID value of destination must be entered. When the DID is set to the SID of the counterpart sLory, then serial data is sent to the serial port of the counterpart sLory via LoRa network.

*For detailed setup methods for sLory, please refer to the "Example of Using Setup Method " in Ch.7 Settings.

PC - Device Connection (uLory - sLory)

When you connect uLory to a USB port on your PC and install the driver in the Windows environment, COMx port, which is a seral communication port is created. A PC with a serial port can also communicate with sLory, not only uLory(Please refer to the sLory-sLory connection described above).

Wireless is delivered to all nearby passable destinations, so the address of the target to communicate with is required. It is just like the recipient's information is required for mailing. LoryNet numbers each devices and identify them as a DNo(Device Number).

DNo is a unique identification number that each uLory/sLory has. With this number, data can be passed to the desired sLory even if there are multiple sLorys.

For sLory to communicate 1:1 as shown above, the DID value of destination must be entered. When the DID is set to the SID of the counterpart sLory. If counterpart uLory's SID is set to DID, serial data is sent to the serial port of the counterpart uLory via LoRa network.

*For detailed setup methods for sLory and uLory, please refer to the "Example of Using Setup Method " in Ch.7 Settings.

*More information about uLory can be found on our website(www.sysbas.com).

PC – Multiple Device Connection (uLory – a number of sLorys)
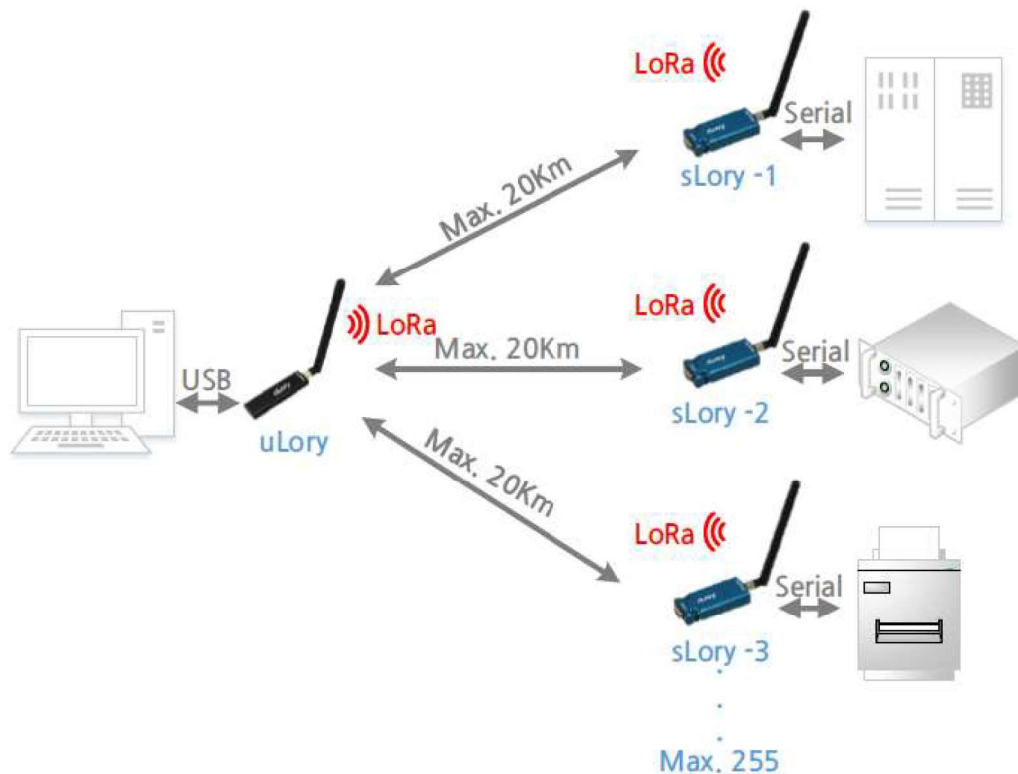
Multiple connection is a way to communicate wirelessly with multiple sLorys by plugging our uLory into a USB port on your PC. Multiple connection requires applications that runs on PC. DNo(Device Number) is a unique number of sLory. It is a necessary resource for communication between sLorys.

For sLory to communicate 1:n as shown above, the DID must be entered in sLory as the Destination ID to communicate with. In order for uLory to communicate with multiple sLorys, the DID of uLory can be set to Broadcast ID so that it can be received from all sLorys.

Boardcast ID is a function that sends serial data to all products connected via wireless LoRa, sending serial data regardless of whether the other party receives it or not, just like a radio.

The key point of the setup method below is to set the CH(Channel) as same as SF(Spreading Factor), set the DID of uLory as the Broadcast ID, and the DID of sLory-1,2,3 to head the SID of uLory so that they can communicate 1:n.

*For detailed setup methods for sLory and uLory, please refer to the ""Example of Using Setup Method ” in Ch.7 Settings.

Network Connection (PC – Internet – LoryGate – sLory)

On the control PC, you can access the LoryGate installed on the Internet network and communicate with the local sLory. LoryGate is a device that can communicate LAN to LoRa using Internet network.

LoryGate provides an Ethernet interface to LoRa and serves as a gateway connecting the LoRa network to the Ethernet network. It also collects data from various sensor nodes scattered in LoRa network and pass them to server. LoryGate can act as a simple server which can be accessed without complex server, and can communicate with devices connected to LoRa network through Ethernet network.

In the diagram above, you can connect to LoryGate from your PC by accessing COM port which is VCP(Virtual COM port) or by socket connection as "LoryGate's IP + socket port number".

The socket connection method supports "TCP (UDP) Server", which is a server mode that allows access by waiting for socket connection, and "TCP (UDP) Client", which is a client mode that access the PC application of the other party.

Destination ID must be entered on sLory/LoryGate's DID. So if DID of LoryGate and sLory is set to the opposite SID, serial data can be transmitted through LoRa network to the socket access port of the counterpart LoryGate for communication.

*More information about LortGate can be found on our website(www.sysbas.com).

6. Get Started

All communication equipment requires a setup process to fit into the communication environment and select the required functions before use. To work properly, sLory also needs to know the characteristics of the communication target and set it accordingly.

Preparing Settings Using LoRaConfig

As sLory is a wireless communication device, its signals are transmitted to all nearby reachable wireless equipment. So you need to specify the equipment to connect to by setting the parent destination equipment ID(DID), channel number(CH), spreading factor(SF) and relay mode.

To view or set the settings of sLory, you can use the **LoRaConfig App** on Android Smartphone or **LoRaConfig Utility** on Windows PC, or connect directly to the **COM port** and set it up using AT Commands.
[Tip] We recommend using LoRaConfig, which is easy-to-use setup utility.

Using LoRaConfig App

(1) Connect sLory to a USB port on your smartphone

This manual describes with a USB port.

Connect the RS232 port on the sLory to the USB port on your smartphone, and power on the sLory.

At this point, you can connect using our Multi-1/μUSB RS232 or Multi-1/USB-CRS232 device, depending on the USB port type of your smartphone.
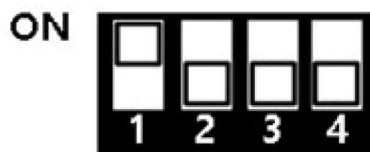
![SYSTEMBASE logo]

(2) Turn sLory Setup Switch no.1 On

Turn on SW1 in sLory to change to setup mode. The RDY LED flashes every 0.2 seconds.

(3) Run LoRaConfig App

The initial screen below appears when you run the LoRaConfig App.
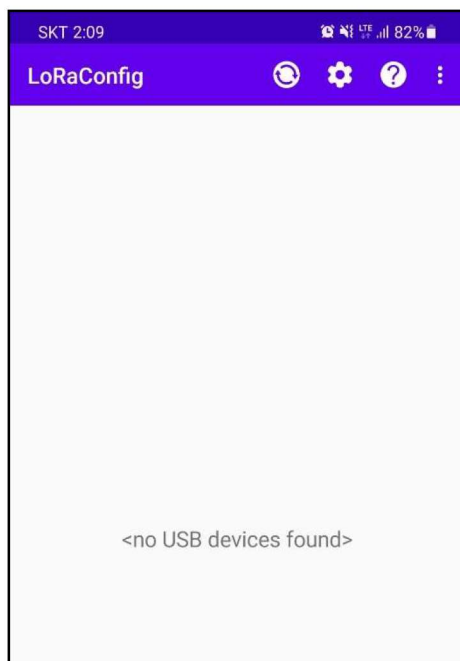
Connect the powered sLory using our Multi-1/µUSB RS232 or Multi-1/USB-CRS232 depending on the USB port type of your smartphone. If Multi-1/µUSB RS232 or Multi-1/USB-CRS232 is connected properly to the USB port, the list is output as shown on the screen below.
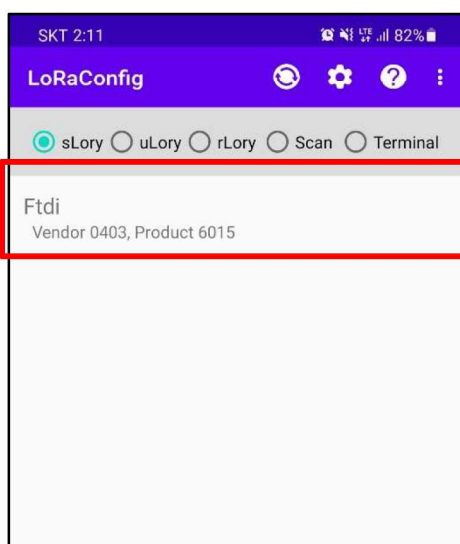
Select the Setting menu icon from the menu to set it to the serial status value of the connected sLory.

The default value of sLory is 9600-8-N-1.
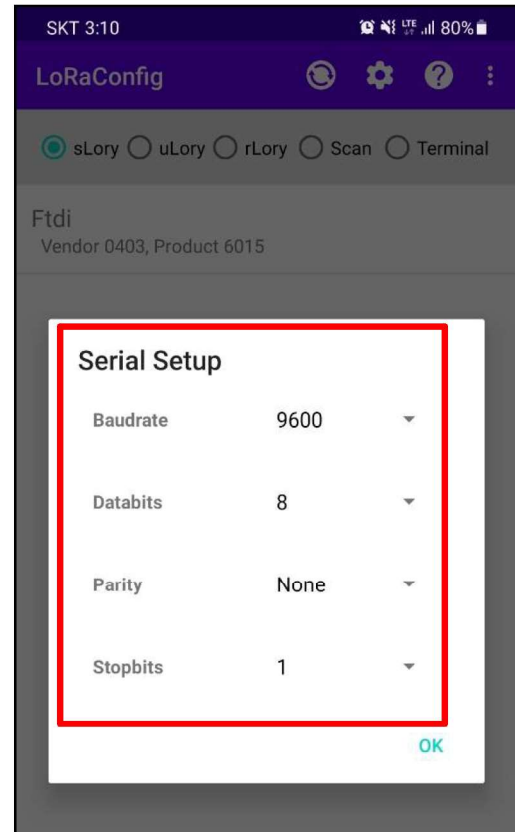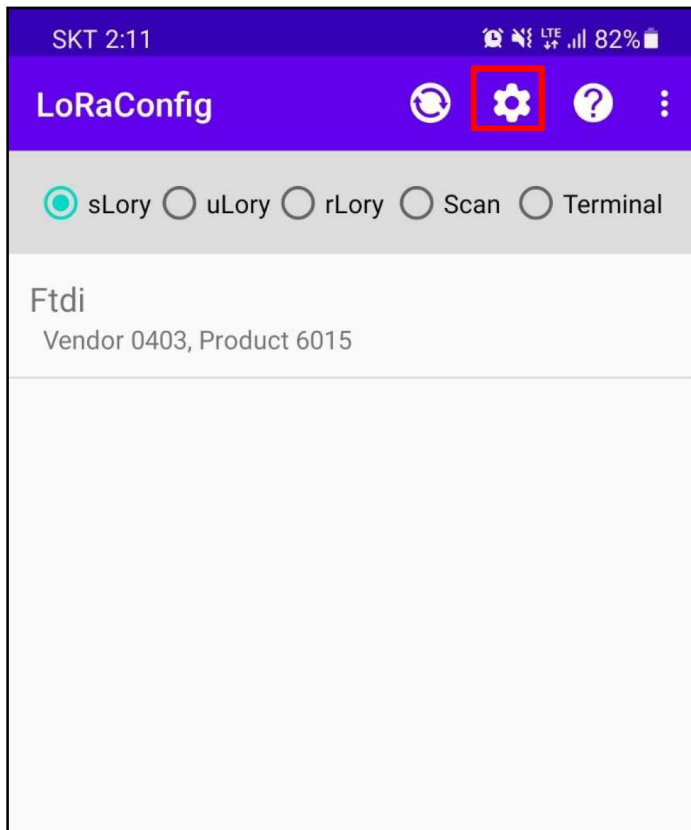
[Caution] Serial properties of the LoRaConfig App must be set according to the serial settings of sLory.

Select the Device to 'sLory' and select the device among the list as below.
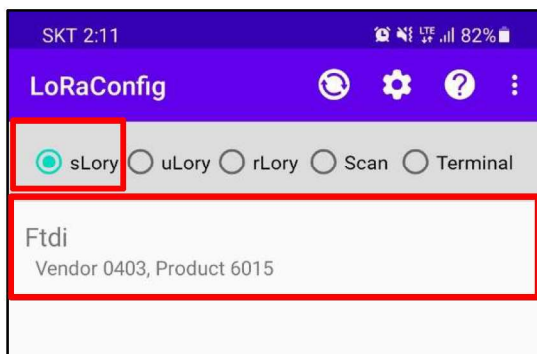
Using LoRaConfig

[Tip] The following contents are as same as in the LoRaConfig manual.

LoRaConfig utility and manual can be downloaded from Download menu in the sLory page from SystemBase website.

(1) Plug sLory into RS232port on a PC

This manual describes with RS232 port.

Connect the RS232 port of sLory to the RS232 port on the PC, and apply power to the sLory.

[Caution] To set PC while using RS422/RS485, your PC must have RS422/RS485 port. If your PC has RS232 ports, you must change the LoRa product to RS232 port to set them up.

(2) Turn sLory Setup Switch no.1 On
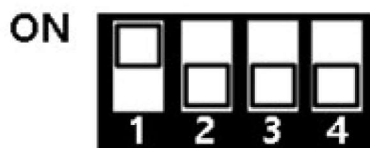
Turn on SW1 in sLory to change to setup mode. The RDY LED flashes every 0.2 seconds.

(3) Run LoRaConfig

Before running the LoRaConfig utility, to know the serial port number of the product connected to the PC, please check the connected COM number in "Port (COM & LPT)" in Device Manager.

You can see the product is connected to COM3 on the PC in the example figure below.
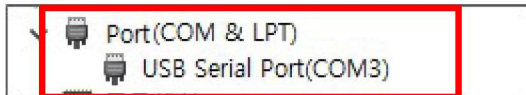
Run the LoRaConfig utility and select **sLory** from the Device menu for sLory setup.
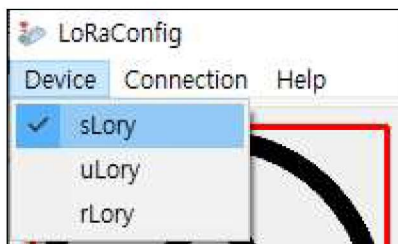
[Caution] As LoRaConfig does not know which product it is connected to, so user must select the device. Without this process, the product information may not be accurately recalled.

Select device as rLory and click **Connect** in the Connection menu.

The Comport setup windows will pop up as shown below. Please enter the correct port number, speed(Baudrate), parity and so on, and click **Connect** button to try to connect with the product.
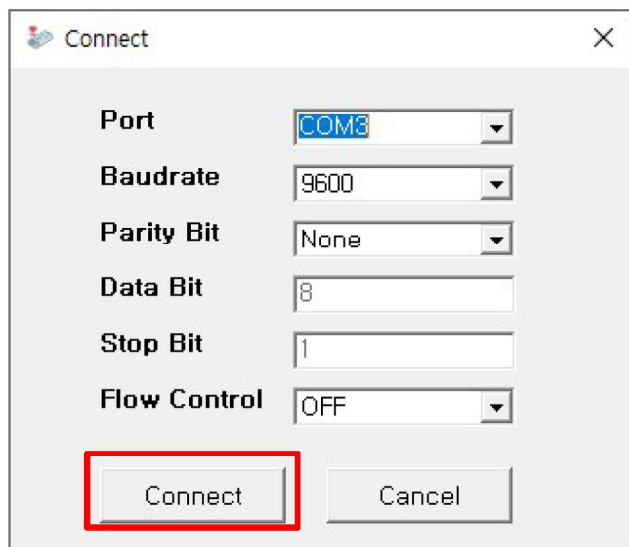
Using COMport Directly

(1) Connect sLory to RS232 port on PC

*This manual describes with RS232 port.

Plug uLory into the USB port on the PC to power on uLory.

(2) Turn On rLory Switch(SW) No.1
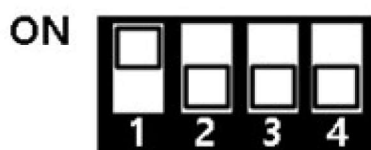
Turn on SW1 of sLory to change to setup mode. The RDY LED will flash rapidly every 0.2 seconds.

(3) Open RS232 Port on PC

- Open the COMport on PC with a program that can open it
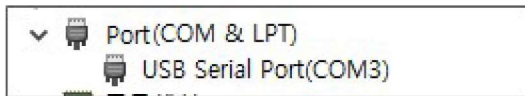
If the RS232 port installed on the PC is COM3(you can check it from Device Manager)

-When opening RS232 port with Tera Term program, open at default 9600-8-1-N (Speed-data bit-stop bit-parity bit) as shown below.

<Setup window before opening RS232 port>
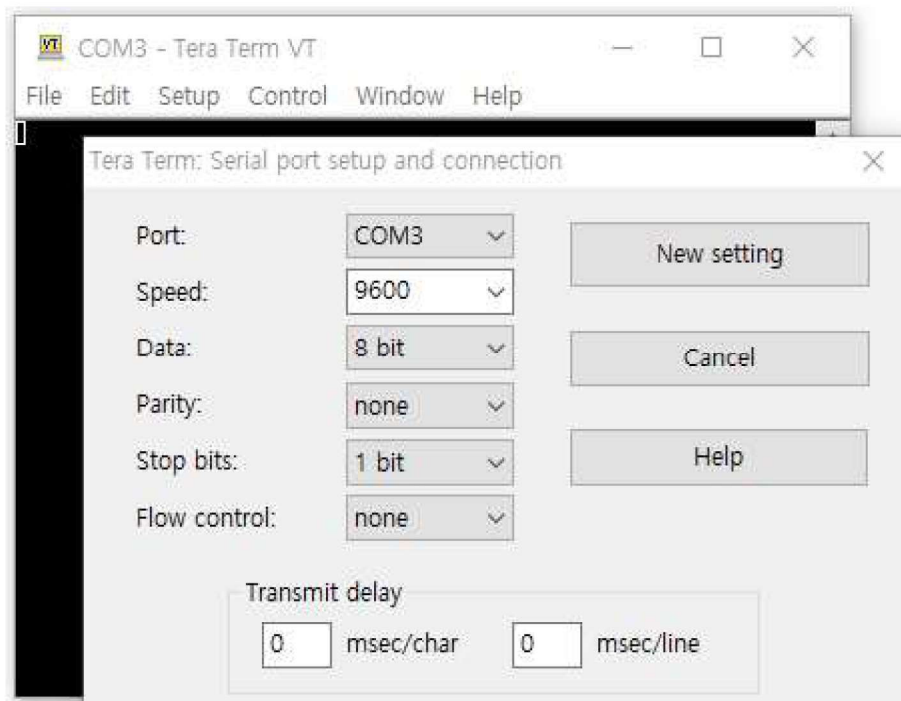
*This manual used the example of setting up via general Tera Term program.

- Once the connection is completed, enter in the terminal window. Then the message will be printed as below and you will be able to enter the AT Command for setups.

If there is no RS232 port on PC, please use USB to Serial converter.

USB to RS232 converter is sold separately by SystemBase.

* For more information on Multi-1/USB RS232, please visit our website(www.sysbas.com).

7. Settings

Setup Using LoRaConfig App

You can set the following in the LoRaConfig App connected with the equipment:

(1) Refreshing

You can read the information of sLory again by clicking Refresh button in the upper right menu.
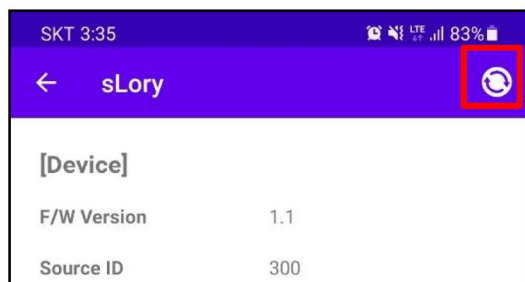
(2) LoRa Setting

Device

The Device section is a section where you can check and change information related to the equipment(F/W Version, Source ID, Destination ID). Press [Save] button to save the changes when changing the Destination ID(1~16777215, 16777215: Broadcast).

LoRa

The LoRa section is where you can check information related to LoRa, such as country code, LoRa channel and Spreading Factor. You can change the LoRa channel and the Spreading Factor here. To save the changes, please press the [Save] button.

Encryption

The Encryption section provides encryption-related features. The AES Key and AES IV input box do not appear when Encryption is 'OFF'. They appear only when the Encryption function is 'ON'.
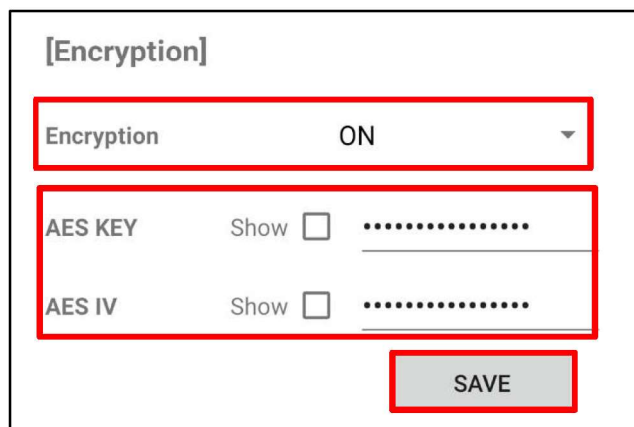
Check the show box to see the characters you entered.

You can save the current encryption settings by pressing the [SAVE] button.

For saving settings, exactly 16 digits must be entered for AES Key and AES IV(Initialization Vector).

(3) Serial Setting

Serial

The Serial section where you can check information related to the Serial, such as Baudrate, Parity, Data bits, Stop bits, H/W Flow Control, etc.

Baudrate, Parity, and H/W Flow Control can be changed among these.

Press the [Save] button to save changes(Databits: 8 and Stopbits: 1 of sLory are fixed values).

Packet

You can view and change the Packet information in the Packet section, such as Message Timeout, Message Size, STX Length, STX(Hex), ETX Length, ETX(Hex).

The value of Message Timeout is stored in 10ms. (56=50ms, 123=120ms)

STX(Hex), ETX(Hex) entries can be checked and entered if the value of STX Length and ETX Length is greater than 1. The value entered at this time is the Hex value.

Please press the [Save] button to save changes.

Setup Using LoRaConfig

- You can set it as below through the connected LoRaConfig.

[Tip] The following contents is as same as in the LoRaConfig manual.

LoRaConfig utility and manual can be downloaded from Download menu in the rLory page from SystemBase website.
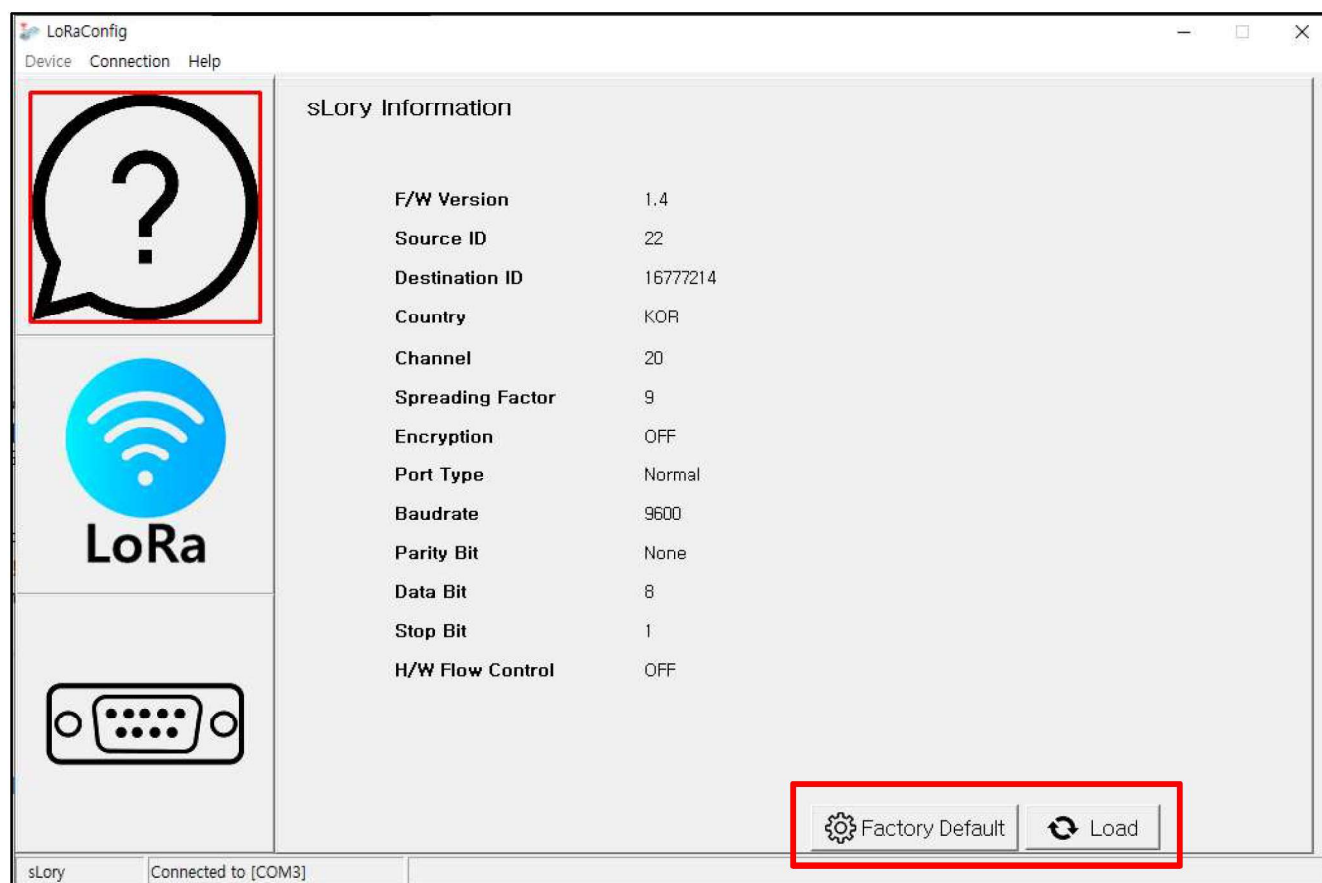
(1) Information

Click the button below the left menu to go to the information screen.

In the Information menu, you can check the default setting information of sLory.

Click **Load** to read the current status from the product and display it on the screen.

As the **Factory Default** is a return button to factory status, please carefully select it and execute.
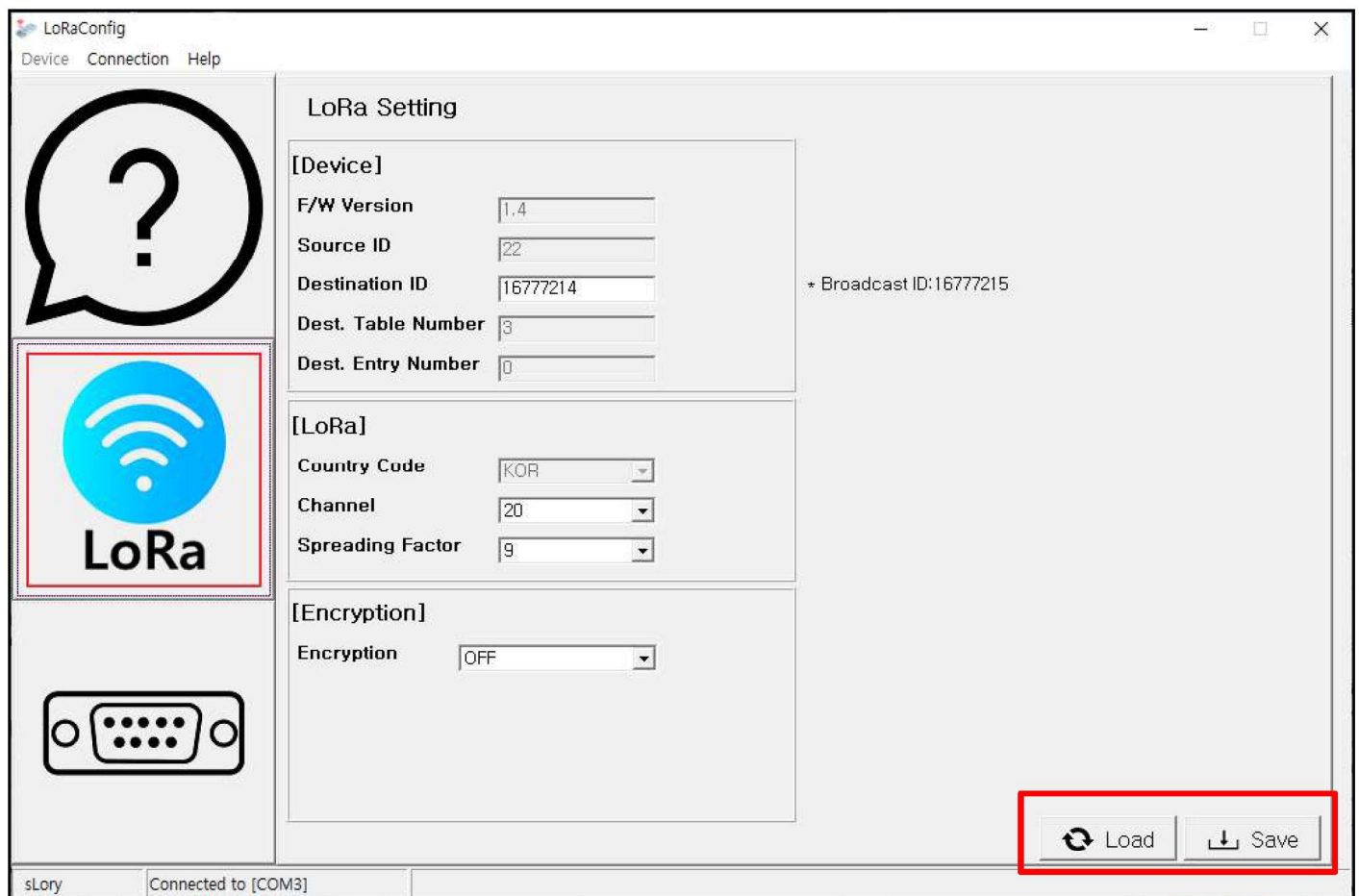
(2) LoRa

Click the 'LoRa' button below the left menu to move to the LoRa screen.

In the LoRa menu, you can check and modify information related to LoRa settings of sLory. It is divided into Device, LoRa and Encryption sections.

Click the **Load** button to retrieve the current status.

After modifying the settings, please click **Save** button to apply the change to the product.

Device

The Device section allows you to view and change equipment-related settings(F/W Version, Source ID, DID).

LoRa

You can check and change the LoRa related settings such as country code, LoRa channel and Spreading Factors in LoRa section.

Encryption

Encryption section provides encryption related functions.

When Encryption is **OFF**, the AES Key and AES IV input item do not appear. They will only appear when the Encryption value is **ON**.

Click the **show** checkbox to view the character you entered.

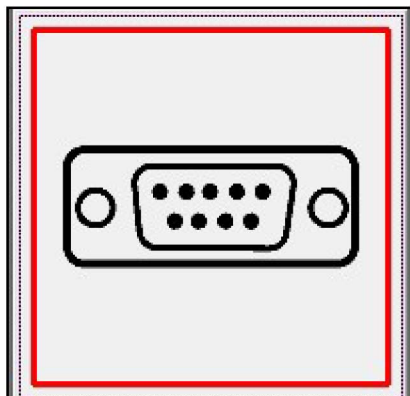You can view the current encryption settings by pressing **Load** button.

In order to save settings, the AES Key and AES IV(Initialization Vector) must be exactly 16 digits.

The Save button batch saves the changed settings of Device, LoRa, and Encryption.
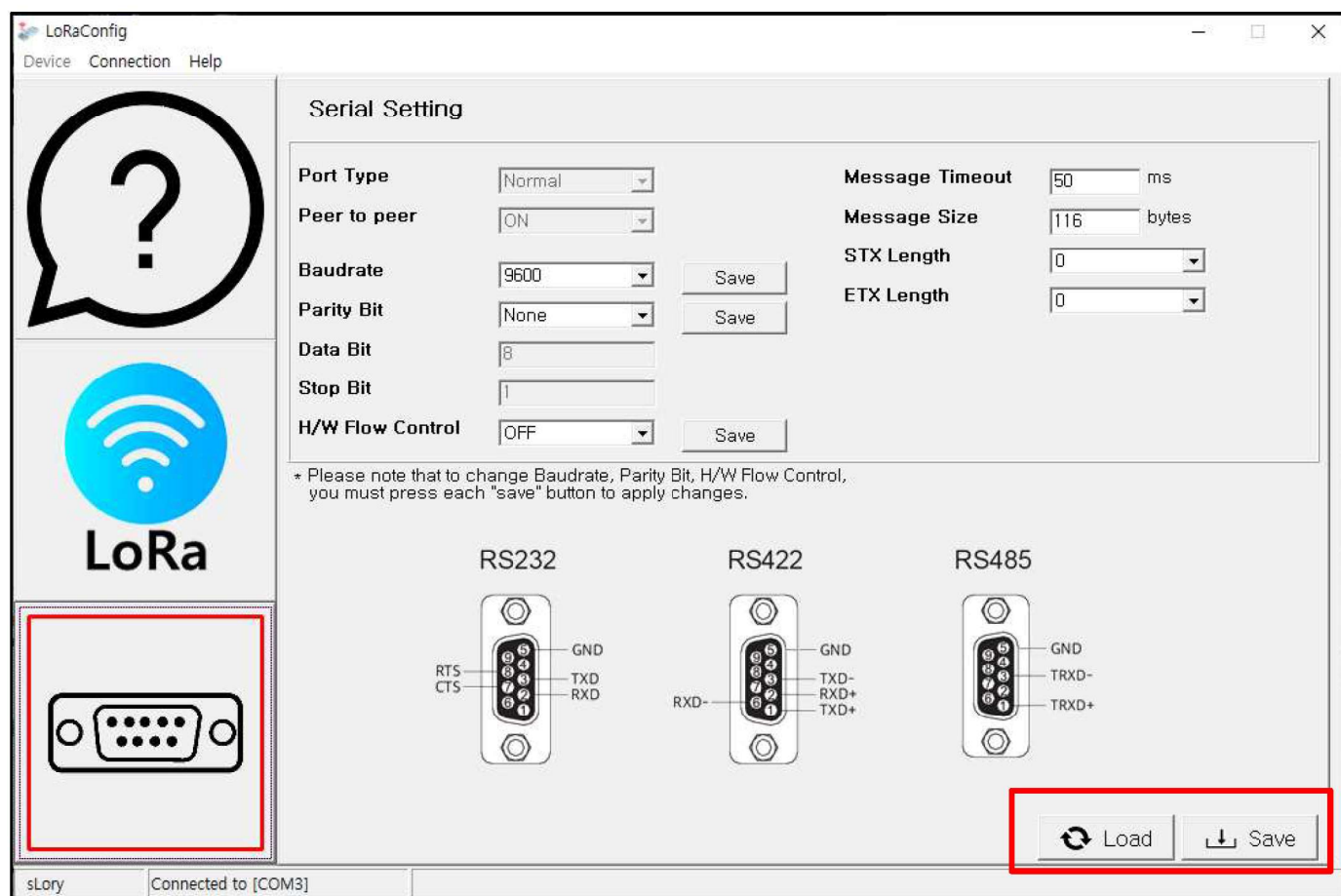
(3) Serial

Click the DB9 shaped button among the left menu to move to the Serial setup screen.

In the Serial menu, you can check and modify the serial information of sLory.

Click **Load** button to read the current status from the product and display it on the screen.

After modifying the settings, please click **Save** button to apply the change to the product.

[Caution] Each **Save** buttons must be pressed respectively when changing the Baudrate, Parity Bit and H/W Flow Control value to apply. Also, as communication settings have been changed together when these settings were changed, it will revert to Connect state with the modified value after disconnection. Reconnect it to use normal setting function.

The Save button at the bottom saves the remaining items(Message Timeout, Message Size, STX/ETX related settings listed on the right) except for the three items: Baudrate, Parity Bit and H/W Flow Control.
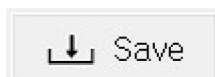
Once all set and saved, disconnect the port with **Disconnect** and switch **OFF** the switch no.1 to change to operation mode.
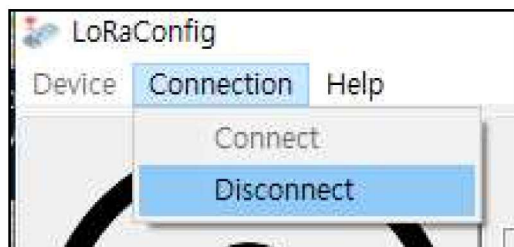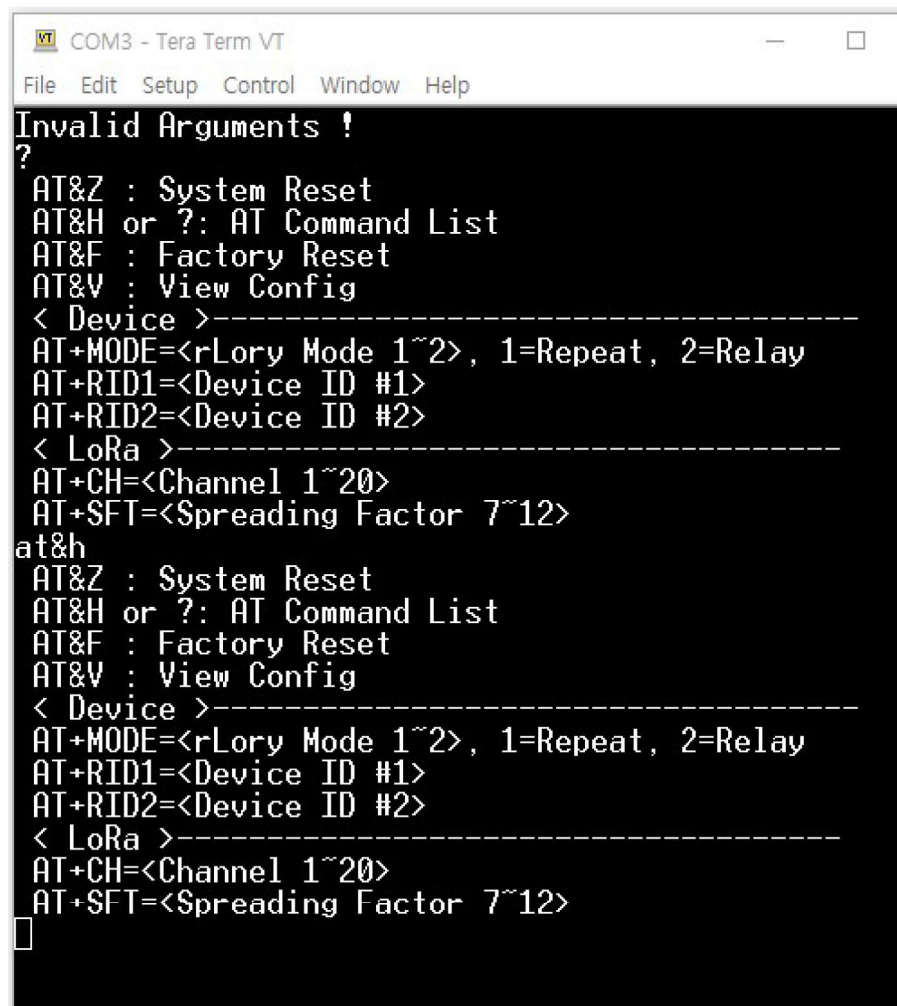
Setup Using COM Port directly

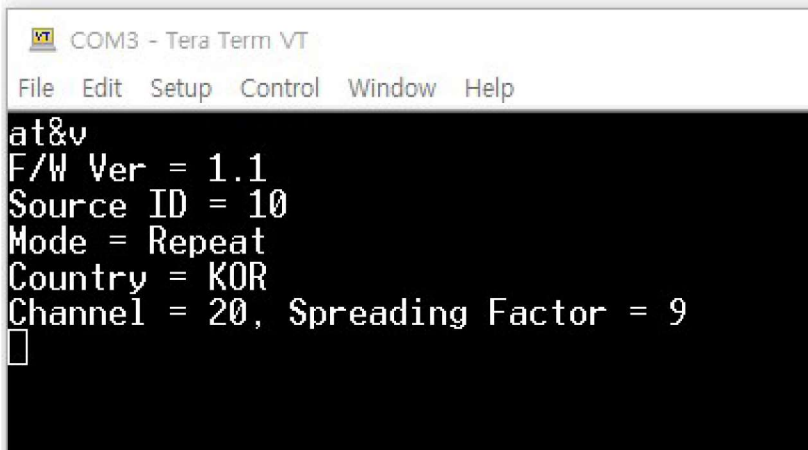Entering in the terminal window of the opened RS232 port will output the message as below.

Entering ? or at&h will give you an example of a command that you can refer to the AT command.

Enter at&v to check the setting value.

If the destination equipment is DID: 123, CH:20, SF:9, the setting AT Command is as follows;

AT+DID=123

AT+CH=20

AT+SFT=9

*For detailed AT Command, please refer to the AT Command List in the Appendix below.

Once setup is completed, turn off switch 1 to change to operating mode. The RDY LED will flashes every 1 second.
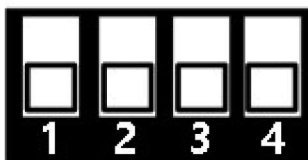
Example of Using Setup Method

Based on the above information, we explained the setting method that can be easily set up through various connections. The setting of DID, CH, and SF can make sLory communicate with the counterpart LoRa devices, so you can understand how to set the configuration below as an example.

1:1
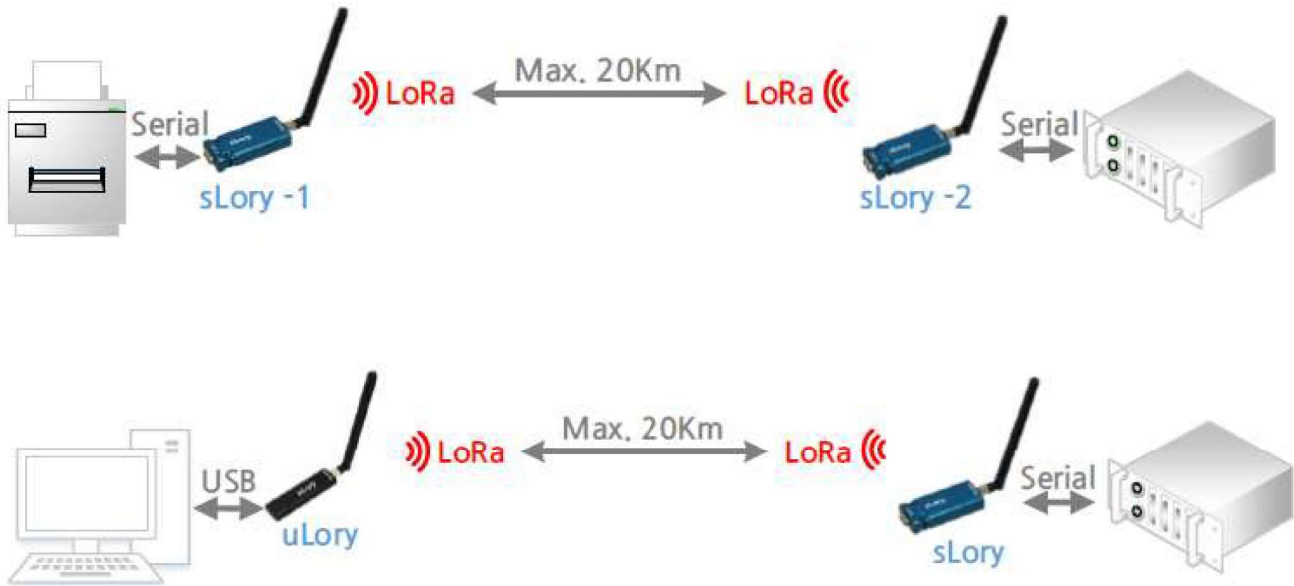
To setup 1:1 connection

Type	sLory -1 (or ulory)	sLory-2
SID, DID	SID: 123, DID:456	SID: 456, DID:123
CH, SF	CH: 20, SF: 9	CH: 20, SF: 9
AT Command	AT+DID=456 AT+CH=20 AT+SFT=9	AT+DID=123 AT+CH=20 AT+SFT=9

* Setting values are examples to help understanding. The values may vary depending on the product/field.

If CH and SF are set as same and DID are set to each other's SID as the above setting, 1:1 communication will be enabled.

1:N
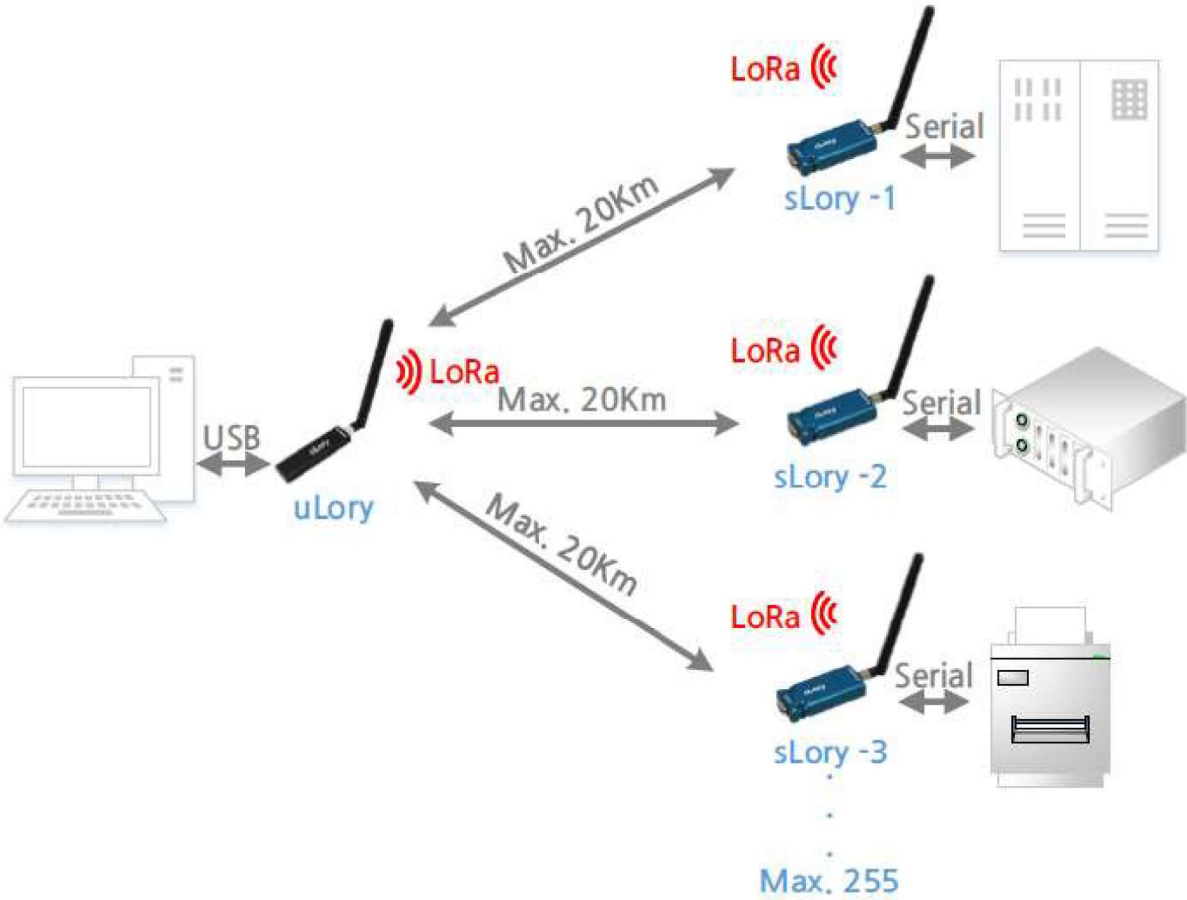
To setup multiple connection

Type	uLory main	sLory -1	sLory -2	sLory -3
SID, DID	SID: 123, DID:16777215	SID: 456, DID:123	SID: 567, DID:123	SID: 678, DID:123
CH, SF	CH: 20, SF: 9	CH: 20, SF: 9	CH: 20, SF: 9	CH: 20, SF: 9
AT Command	AT+DID=16777215 AT+CH=20 AT+SFT=9	At+DID=123 AT+CH=20 AT+SFT=9	At+DID=123 AT+CH=20 AT+SFT=9	At+DID=123 AT+CH=20 AT+SFT=9

* Setting values are examples to help understanding. The values may vary depending on the product/field.

In the above setting, uLory data is transferred to sLory-1,2,3 and sLory-1,2,3 data is transferred to uLory, enabling 1:N communication.

8. Powering by Battery

Battery

Portable Battery: 10,000mAh	Solar Panel: 5V 21W
Model: GOSARI MT10000 Manufacturer: Yeonhwa Media Co., LTd. 　　　http://www.gosarifriends.com/	Model: ALLPOWERS-C 21W Solar Photovoltaic Panel Manufacturer: ALLPOWERS Industrial International Ltd 　　　http://www.iallpowers.com/

How to Connect/Use

This is a test of whether sLory can be used while charging with a portable battery and solar panel. This test is provided to share information about the operation of the sLory with our customer.

When only using as a secondary battery

Connect one lithium-polymer battery (model name: GOSARI MT10000) as shown below.

Connect and run the battery using USB port of the battery and the power adapter connection on sLory.
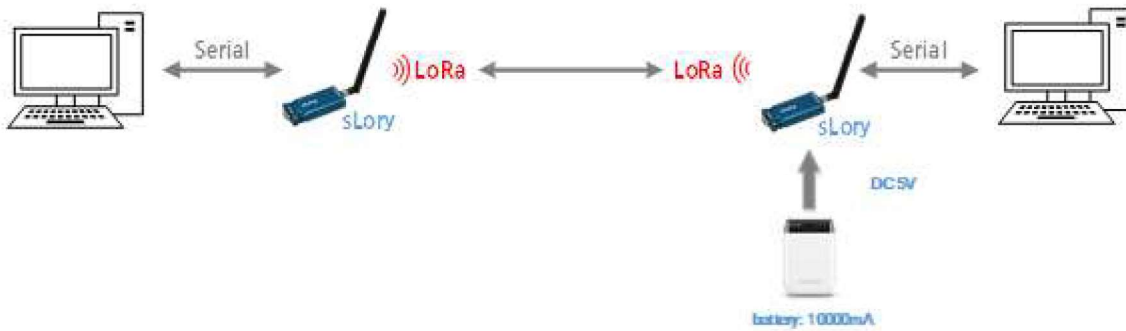
We confirmed that the test results show that it runs for 41 hours if only one 10,000 mA secondary battery of is used.

When using solar panel and two portable batteries together (one for charging and one for use)

Connect two lithium-polymer batteries (model name: GOSARI MT10000) which can be charged and discharged at the same time as shown below.
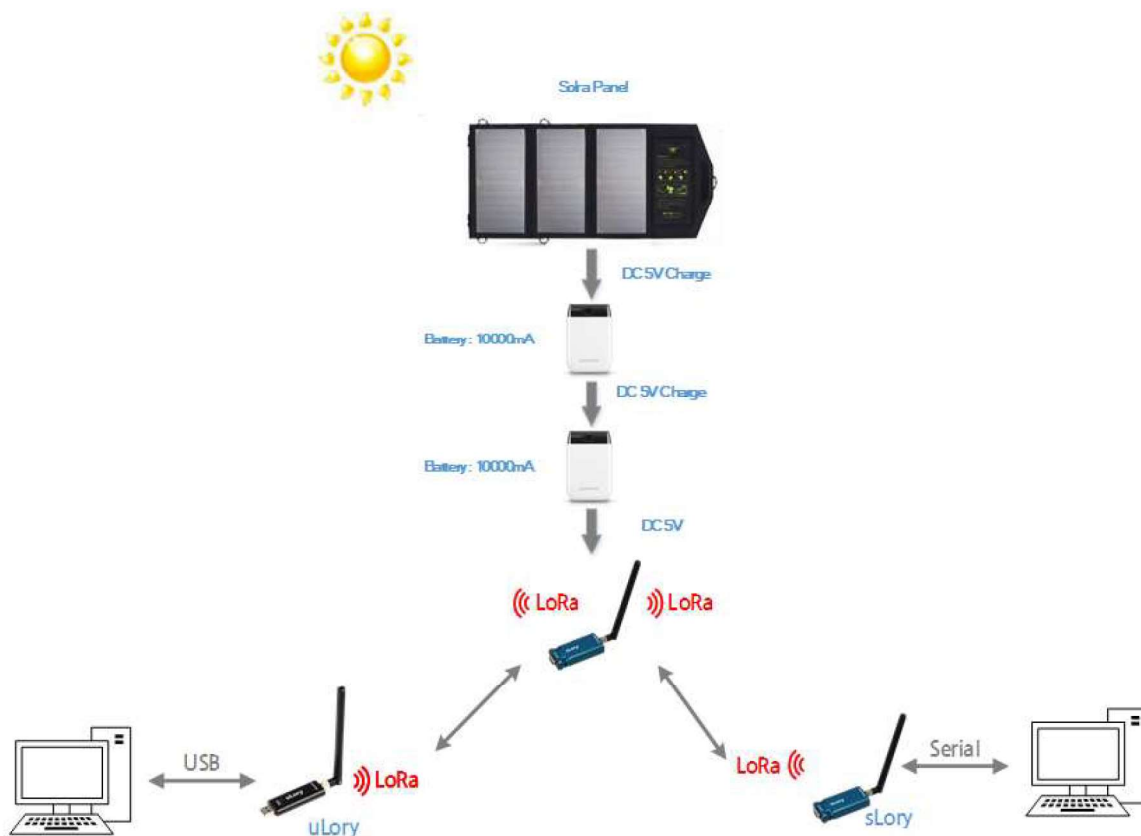
Connect the USB port to the solar panel and the USB port of the charging-purpose secondary battery. Charging-purpose battery is then connected to the use-purpose battery. And connect the use-purpose secondary battery to the sLory and communicate with the counterpart LoRa device.

The use-purpose secondary battery can be charged continuously by charging-purpose battery and solar panel connected which charges each batteries. It can also be powered by charging-purpose battery and use-purpose secondary battery for more than 40 hours at night when solar charging is not possible. Therefore, the solar panel can be fully used up to its rechargeable time.

Battery Usage Test Results

Case	Battery Type	Capacity	Environment	Data Speed/length/frequency	Usable Time
1	Lithium-polymer Portable Battery	1 Battery: 10,000mAh	Temperature: 2℃	Speed: 9,600bps Real Data Length: 10Byte Frequency: Once a Minute	41 hours
2	Solar Panel + Lithium-polymer Portable Battery	Solar Panel: 21W 2 Batteries: 10,000mAh	Temperature: 2℃	Real Data Length: 10Byte Frequency: Once a Minute	Unlimited

* The above test results are self-tested by the SystemBase.

Class A equipment

Sellers or users should be aware of the fact that this device is intended for industrial use(Class A), not for residential use.

This device has a potential for radio interference during use and may receive harmful interference from other devices.

-----------------------Appendix-----------------------

1. Specification

Category	Item	Specification
LoRa Port	Frequency Band	917 ~ 923MHz (ISM Band)
	Bandwidth	125KHz
	Security	AES 128 Encryption (Default: Disabled)
	Antenna	+2.5dBi
Serial Port	Interface	RS232/422/485
	Speed	Max. 921.6Kbps
	Circuit Protection	±15kV ESD Protection
Display	LED	LNK, SRL, RDY
Operating Environment	Temperature	-40 ~ 85℃ (-40 ~ 185℉)
	Humidity	5 ~ 95% Non-Condensing
Power	Adapter	DC 5V 1A
	Power Consumption	1.5W
Hardware	Dimension	34.9(W) x 90.15(L) x 16.5(H)mm
	Weight	40.5g

2. Dimension

unit : mm
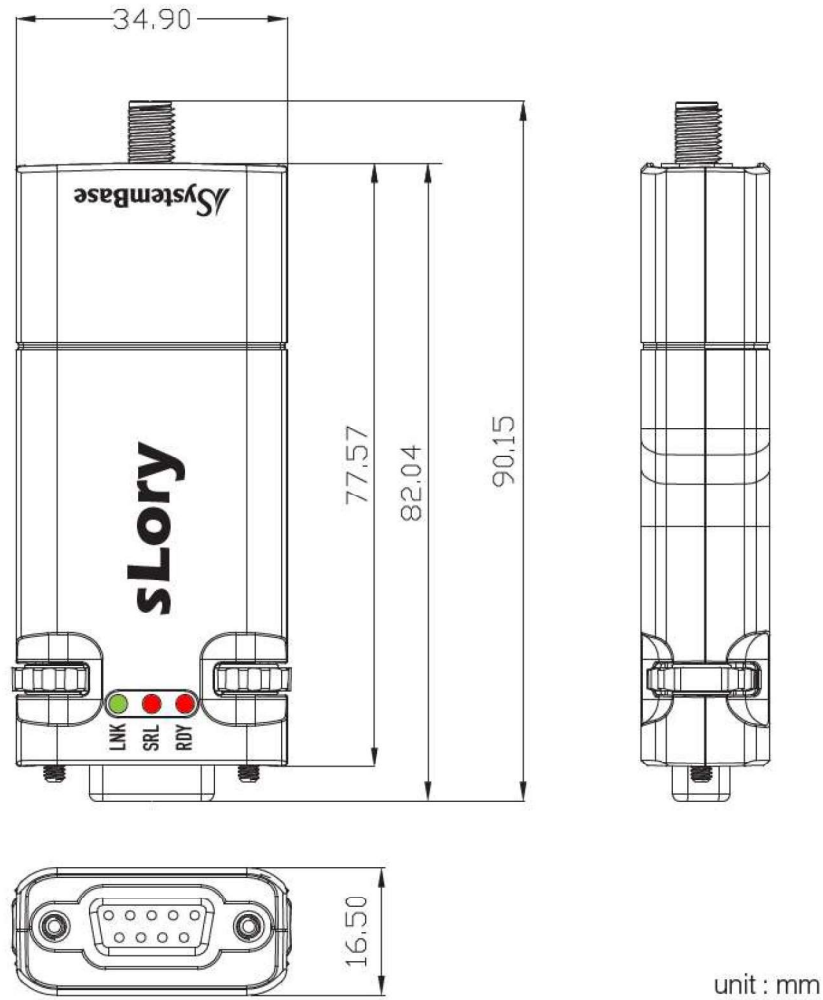
*Please note that pre-June 2020. version RDY is Yellow

3. Serial Port Pin Specifications
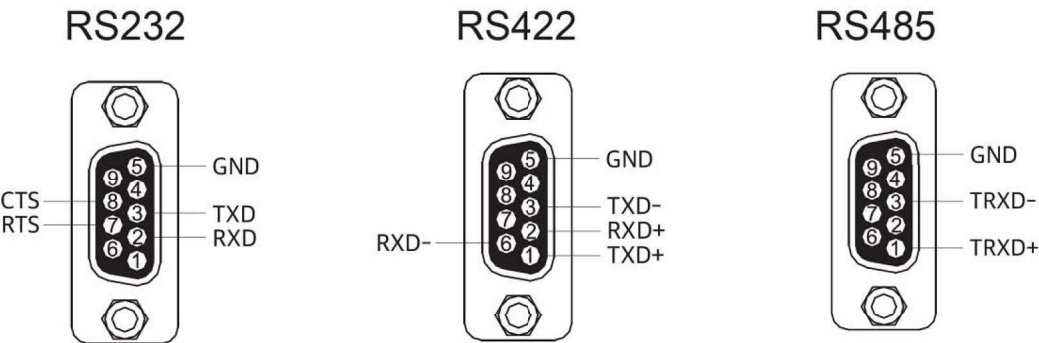
Pin No.	RS232	RS422	RS485
1	-	TXD+	TRXD+
2	RXD	RXD+	-
3	TXD	TXD-	TRXD-
4	-	-	-
5	GND		
6	-	RXD-	-
7	RTS	-	-
8	CTS	-	-
9	-	-	-

4. AT Command

4.1 General Command

Command	Default(Range)	Description
AT&Z	-	Restart the device
AT&F	-	Initialize all settings and show the initial value on the screen
AT&V	-	Show the current setting
AT&H or ?	-	Show the list of commands
AT&E	-	Shows the current AES KEY, AES IV. However, the initial AES KEY and AES IV values are not shown. Only the changed AES KEY and AES IV values are shown.
AT+PTYPE=〈Mode〉	1(0~1) 0 = LoryNet Mode 1 = General Communication Mode	0: Setting for connection and communication with LoryNet platform 1: Default value of setting for General Data Communication
AT+PTP	1(0~1) 0 = OFF (LoryNet Table Communication) 1 = ON (Peer to Peer)	0: Setting for LoryNet Table Communication 1: Default value of setting for General Data Communication
AT+DID= 〈Destination ID〉	16777214(1~16777215) (16777215 is a Broadcast ID)	Enter the ID of the device to communicate with

4.2 LoRa Setting Command

Command	Default(Range)	Description
AT+CH=〈Channel No〉	20(1~20) 1=917.3MHz 2=917.9MHz 3=918.5MHz 4=919.1MHz 5=919.7MHz 6=920.3MHz 7=920.7MHz 8=920.9MHz 9=921.1MHz 10=921.3MHz 11=921.5MHz 12=921.7MHz 13=921.9MHz 14=922.1MHz 15=922.3MHz 16=922.5MHz 17=922.7MHz 18=922.9MHz 19=923.1MHz 20=923.3MHz	Change LoRa channel. * Ch(channel) is subdivided value of Lora frequency area from 1 to 20.
AT+SFT=〈Spreading Factor〉	9(7~12)	Change LoRa Spreading Factor. *SF(spreading factor) is the value dividing the number of radio frequency modulation from 7 to 12. If SF is low, the amount of data that can be transferred increases but the distance becomes shorter, and if SF is high, it will be opposite.
AT+AES=〈Encryption〉	0(0, 1) 0=OFF 1=ON	0: Disable the encryption function. 1: Activate the encryption function.
AT+AESKEY=〈KEY〉	-	Entering a new Key value (16 Bytes) will output the message "You must also type IV (Initialization Vector) [16 Bytes]". Continuously enter the IV value (16 bytes). Enter the password 16byte and enter the IV value

		16byte to set the password.

4.3 Serial Setting Command

Command	Default(Range)	Description
AT+PAB=⟨Parity Bit⟩	N(N,O,E) N=None, O=Odd, E=Even	Set Parity Bit
AT+BAU=⟨Baud rate⟩	6(0~13) 0=600bps, 1=1200bps, 2=2400bps, 3=3600bps, 4=4800bps, 5=7200bps, 6=9600bps, 7=19200bps, 8=38400bps, 9=57600bps, 10=115200bps, 11=230400bps, 12=460800bps, 13=921600bps	Set Baud Rate
AT+SER=⟨Interface⟩	1(1~3) 1=RS232 2=RS422 3=RS485	Set Serial Interface
AT+HF=⟨Hardware Flow Control⟩	0(0, 1) 0=OFF, 1=RTS/CTS	Set Flow Control
AT+DMT=⟨Time⟩	5(1~255) Unit: 10ms Example) 5=50ms	Used when collecting serial data and sending it wirelessly. Wait for the next data after the last data has transmitted from Serial, and then after specific period of time, transmit data read in the meantime to LoRa
AT+STXL=⟨Length⟩	0(0~3) Unit: byte	Set STX(Start of text) which sLory recognizes as

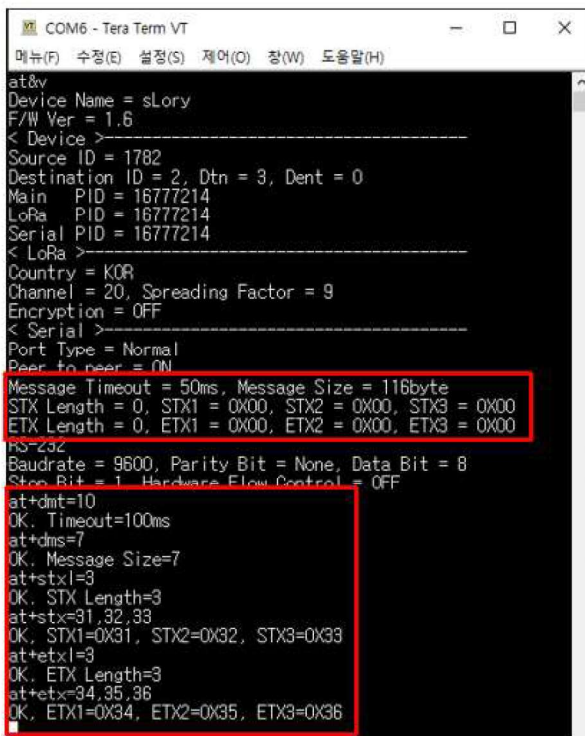|	0=Not used	the start of the data when receiving serial data for wireless transmission.
AT+STX=〈STX1〉 AT+STX=〈STX1〉,〈STX2〉 AT+STX=〈STX1〉,〈STX2〉, 〈STX3〉	00(00~7F)	Unlike typical STX functions, it sets STX(Start of text) which sLory recognizes as the start of the data when receiving serial data for wireless transmission. Refer to the ASCII code table and enter 0x from the Hex value corresponding to the character you want to use as ETX. You must first set the length at AT+ETXL=〈Length〉 and enter the length you want to use.
AT+ETXL=〈Length〉	0(0~3) Unit: byte 0= Not used	Set ETX(End of text) which sLory recognizes as the end of the data when receiving serial data for wireless transmission.
AT+ETX=〈ETX1〉 AT+ETX=〈ETX1〉,〈ETX2〉 AT+ETX=〈ETX1〉,〈ETX2〉, 〈ETX3〉	00(00~7F)	Unlike typical ETX functions, it sets ETX(End of text) which sLory recognizes as the end of the data when receiving serial data for wireless transmission. Refer to the ASCII code table and enter 0x from the Hex value corresponding to the character you want to use as ETX. You must first set the length at AT+ETXL=〈Length〉 and enter the length you want to use.
AT+DMS=〈Length〉	0(0~116) Unit: byte	Send the data wirelessly once the data is received as long as you set.

Example of using STX/ETX functions

Among the conditions under which sLory receives serial data before transmitting data wirelessly, if Time(Message Timeout), STX, ETX and Length(Message Size) functions are used simultaneously, device will be affected by three functions. If at least one condition is met, the data will be transmitted. Applying priority is Time, STX/ETX, and Length.

Unlike typical STX/ETX, the functions supported by sLory devices are as below.

Example 1)

If you set Time=100, STXL=3, ETXL=3, STX=31(1), 32(2), 33(3), ETX=34(4), 35(5), 36(6), Length=7 as below.

* When setting Timeout, the unit is 10ms, so if you want to set it to 100 ms as shown in the example above, please enter 10.

The at&v command allows you to view the changed settings, as shown on the left below.

After setting it up, turn off the 1st switch on the back of the product to switch to the operation mode.

If "**123a456**bcdefghijklmn456abcdf456" is entered at 1 second intervals, then the "**123a456**" which meets

Length: 7byte and STX: 123/ETX: 456 conditions will be recognized as a packet and sent wirelessly.

Example 2)
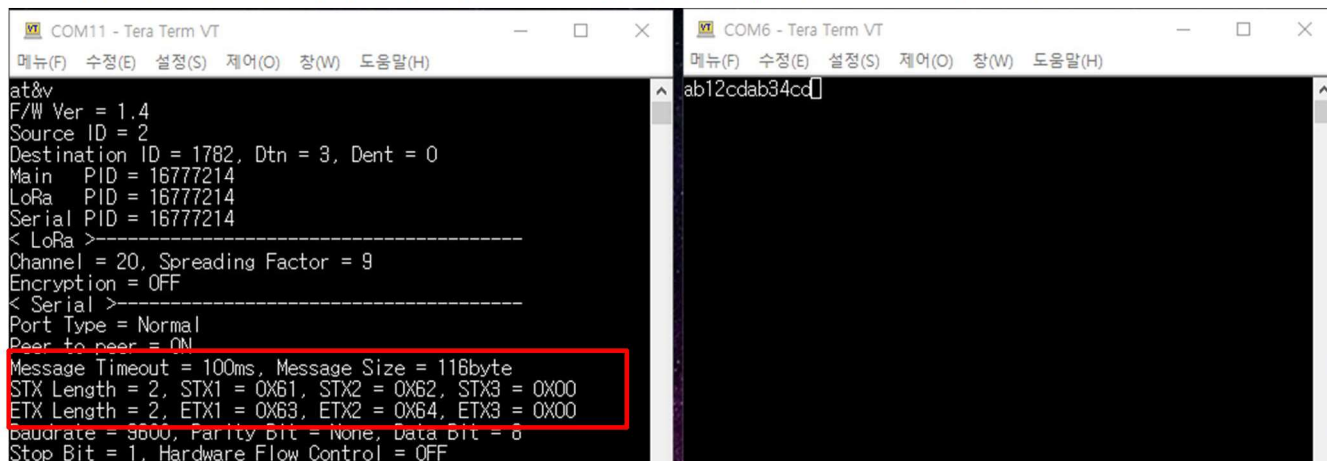
If you set Time=100, STXL=2, ETXL=2, STX=61(a), 62(b), ETX=63(c), 64(d).

The at&v command allows you to view the changed settings, as shown on the left below.

If " **ab12cdef**34567**ab34cdef**g890" is entered at 1 second intervals, then the "**ab12cdab34cd**" which meets Time:

100ms and STX: ab/ETX: cd conditions will be recognized as a packet and sent wirelessly.

* Please refer to the ASCII Table below for Hex and Char values.

5. ASCII Table

DEC	HEX	OCT	Char	DEC	HEX	OCT	Char	DEC	HEX	OCT	Char
0	00	000	Ctrl-@ NUL	43	2B	053	+	86	56	126	V
1	01	001	Ctrl-A SOH	44	2C	054	,	87	57	127	W
2	02	002	Ctrl-B STX	45	2D	055	-	88	58	130	X
3	03	003	Ctrl-C ETX	46	2E	056	.	89	59	131	Y
4	04	004	Ctrl-D EOT	47	2F	057	/	90	5A	132	Z
5	05	005	Ctrl-E ENQ	48	30	060	0	91	5B	133	[
6	06	006	Ctrl-F ACK	49	31	061	1	92	5C	134	W
7	07	007	Ctrl-G BEL	50	32	062	2	93	5D	135	]
8	08	010	Ctrl-H BS	51	33	063	3	94	5E	136	^
9	09	011	Ctrl-I HT	52	34	064	4	95	5F	137	_
10	0A	012	Ctrl-J LF	53	35	065	5	96	60	140	`
11	0B	013	Ctrl-K VT	54	36	066	6	97	61	141	a
12	0C	014	Ctrl-L FF	55	37	067	7	98	62	142	b
13	0D	015	Ctrl-M CR	56	38	070	8	99	63	143	c
14	0E	016	Ctrl-N SO	57	39	071	9	100	64	144	d
15	0F	017	Ctrl-O SI	58	3A	072	:	101	65	145	e
16	10	020	Ctrl-P DLE	59	3B	073	;	102	66	146	f
17	11	021	Ctrl-Q DC1	60	3C	074	<	103	67	147	g
18	12	022	Ctrl-R DC2	61	3D	075	=	104	68	150	h
19	13	023	Ctrl-S DC3	62	3E	076	>	105	69	151	i
20	14	024	Ctrl-T DC4	63	3F	077	?	106	6A	152	j
21	15	025	Ctrl-U NAK	64	40	100	@	107	6B	153	k
22	16	026	Ctrl-V SYN	65	41	101	A	108	6C	154	l
23	17	027	Ctrl-W ETB	66	42	102	B	109	6D	155	m
24	18	030	Ctrl-X CAN	67	43	103	C	110	6E	156	n
25	19	031	Ctrl-Y EM	68	44	104	D	111	6F	157	o
26	1A	032	Ctrl-Z SUB	69	45	105	E	112	70	160	p
27	1B	033	Ctrl-[ESC	70	46	106	F	113	71	161	q
28	1C	034	Ctrl-W FS	71	47	107	G	114	72	162	r
29	1D	035	Ctrl-] GS	72	48	110	H	115	73	163	s
30	1E	036	Ctrl-^ RS	73	49	111	I	116	74	164	t
31	1F	037	Ctrl_ US	74	4A	112	J	117	75	165	u
32	20	040	Space	75	4B	113	K	118	76	166	v
33	21	041	!	76	4C	114	L	119	77	167	w
34	22	042	"	77	4D	115	M	120	78	170	x
35	23	043	#	78	4E	116	N	121	79	171	y
36	24	044	$	79	4F	117	O	122	7A	172	z
37	25	045	%	80	50	120	P	123	7B	173	{
38	26	046	&	81	51	121	Q	124	7C	174		
39	27	047	'	82	52	122	R	125	7D	175	}
40	28	050	(	83	53	123	S	126	7E	176	

6. Spreading Factor

Spreading Factor is the value of how wide the spectrum can be spread by the Spreading Code in the original data signal band. This allows multiple radio signals to be distributed across a wide band of frequencies that are strong against external electromagnetic noises when they are shared in competition with one radio channel, thereby reducing data distortion caused by noise.

narrowband signal   spread spectrum signal
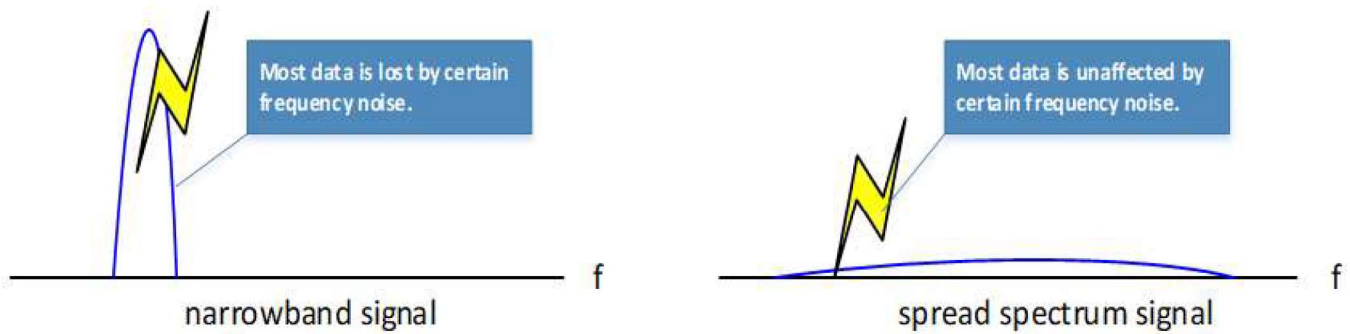
The principle of this approach is to transmit binary data signals, which will be transmitted, by modulating them with another binary code(bit pattern) called the Spreading Code, spreading them across the frequency of use. At this point, the greater the value of the spreading code, the greater the possibility that it will be restored to its original data. This value of the spreading code is the Spreading Factor.

principle of spreading signal
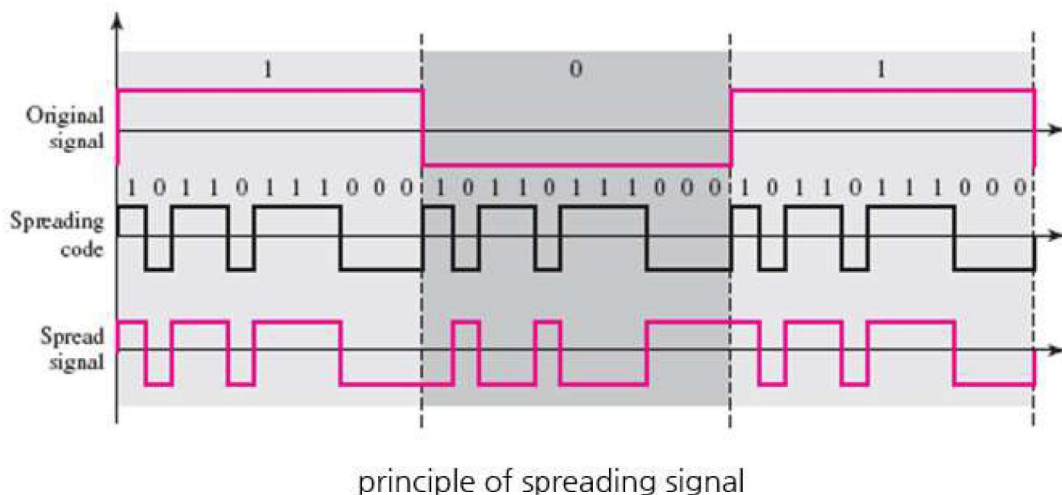
The higher the value of the Spreading Factor, the stronger the noise and the greater the range of distance, but the lower the transmission speed inversely.

Ch(channel) is subdivided value of Lora frequency area from 1 to 20.

SF(spreading factor) is the value dividing the number of radio frequency modulation from 7 to 12.

If SF is low, the amount of data that can be transferred increases but the distance becomes shorter, and if SF is high, it will be opposite.

7. Certification

- **KC**

  Number: R-CRM-STB-sLory1010DILA

  Test Item: KS X 3123:2017, Science and Technology Policy Division No. 2018-4, Enforcement Decree of the Radio Wave Act No. 28464

- **FCC**

  Number: PROSLORY1010DILA

  Test Item: FCC 47 CFR Part 15 subpart C 15.247, ANSI C63.10-2013

- **TELEC**

  Number: JN1000 i01

  Test Item: MIC Notification NO.88, Annex 43, ARIB STD-T108 V1.2

8. Copyright

www.sysbas.com

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