TESCOM

TC-2800A GNSS Signal Generator

Operation Manual

R20151118

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파트 I.

General Information

1.General Information

This chapter covers the instrument warranty, specifications, key features, and safety consideration.

1.1 WARRANTY

TESCOM warrants that this product is free from defects in terms of materials and workmanship for a period of one (1) year from the date of shipment. During the warranty period, TESCOM will -- at its discretion -- either repair or replace products that prove to be defective.

For the warranty service or repair, the Customer must notify TESCOM of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. The Customer shall be responsible for packaging and shipping the defective product to the service center designated by TESCOM. The Customer shall prepay the shipping charge to a TESCOM designated service center, and TESCOM shall pay the shipping charge to return the product to the Customer. In case the Customer is located outside of Korea, the Customer is responsible for all shipping charges including freight, taxes, and any other charge if the product is returned for service to TESCOM.

Limitation of warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate malignance by the Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, accident, or abnormal conditions of operation.

TESCOM`s responsibility to repair or replace defective products is the sole and exclusive remedy provided to the Customer in case of breach of this warranty. TESCOM will not be liable for any indirect, special, incidental, or consequential damages regardless of whether TESCOM served advance notice of the possibility of such damages.

1.2 Safety Consideration

Review the following safety precautions to avoid injury and prevent damage to this product or any pro duct connected to it

1.2.1 Injury Precautions

Use the Appropriate Power Cord

To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload

To avoid electric shock or fire hazard, do not apply voltage beyond the specified range to a ter minal.

Ground the Product

This product is grounded through the grounding conductor of the power cord. In case no grou nd is available at the power outlet, providing a separate grounding path to the instrument is rec ommended by connecting wire between the instrument ground terminal and earth ground to a void electric shock or instrument damage. Before making connections to the input or output ter minals of the product, make sure that the product is properly grounded.

Do Not Operate Without Covers

To avoid electric shock or product damage, do not operate this product with the protective cov ers removed.

Do Not Operate in Wet/Damp Conditions

To avoid injury or fire hazard, do not operate this product in wet or damp conditions.

Do Not Use in a Manner Other than That Specified by the Manufacturer

1.2.2 Product Damage Precautions

Use Appropriate Power Source

Do not operate this product using a power source that applies more than the specified voltage. Main supply voltage fluctuations should not exceed 10 % of the nominal voltage.

Provide Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate in case of Suspected Failures

If you think there is damage to this product, have it inspected by qualified service personnel.

Environmental Conditions

Refrain from using this equipment in a place subject to considerable vibration, direct sunlight, o utdoors, and where the ground is not level. Likewise, do not use it where the ambient temperat ure is beyond the range of 5 C - 40 C and altitude is more than 2000 m. The maximum relative humidity is 80 % for temperatures up to 31 C, decreasing linearity of up to 50 %, and relative h umidity at 40 C, and Over voltage Installation Category II for the main supply (Pollution Degree 2).

1.2.3 Safety Symbols and Terms

These terms may appear in this manual.

WARNING

Warning statements describe the conditions or practices that could result in injury or loss of life.

CAUTION

Caution statements describe the conditions or practices that could result in damage to this prod uct or other property.

Symbols on the Product

The following symbols may appear on the product:

Power ON

Power OFF

WARRING / CAUTION

Indicates earth(ground) terminal

1.3 TESCOM Sales and Service Office

If you have difficulty with the product, call or write to our Technical Support specialists at:

NOTICE

TESCOM Company Limited
927 Unitechvil, 142, Ilsan-ro, Ilsandong-gu, Goyang-si, Gyunggi-do, Korea [ZIP 10442]
TEL.: 82-31-920-6600
FAX: 82-31-920-6607
Email: tescom-sales@tescom.org
http://www.tescom.co.kr

1.4 Instruction and Key Features

Product description

The TESCOM TC-2800A GNSS signal generator is designed to measure the quality of the receiver in the production line by generating GPS and GLONASS signals. The user can set the signal conditions throug h the frontal LCD and keypad without PC, and the signal generator supports USB interfaces and comm ands for automatic production. Lightweight and slim, the product is the size of half the rack/2U; thus s aving installation space.

TC-2800A is an economically efficient, optimal solution for the reliable measurement of C/NO and rece ption sensitivity of single or multiple DUTs in the GNSS receiver production line.

Key Features

- Single-channel GPS L1 C/A
- Single-channel GLONASS L1 C/A
- Single-channel BeiDou B1
- CW mode
- Wide dynamic power range from 0 to -130 dBm
- Signal data display through color LCD
- Easy control through frontal keypad without PC
- Remote control through RS-232C
- Easy firmware upgrade through USB port
- Lightweight and slim, size of half the rack/2U

1.5 제품사양

1.5.1 Signal Specification

GPS Signal	
Range	L1 C/A channel
Frequency	1575.42 MHz
PRN	1 ~ 32
GLONASS Signal	
Range	L1 C/A channel
Frequency	1602.00 MHz KΔf1, K = -7 ~ 6, f1 = 562.5 kHz
Channels	K = -7 ~ 6
BeiDou Signal	
Range	B1 channel
Frequency	1561.098 MHz
PRN	1 ~ 37
Modulation	
	BPSK (Bipolar Phase Shift Keying)
Harmonics	
In-Band	-40 dBc (20 MHz)
Out-Band	-35 dBc
Phase Noise	
RMS	< 0.6 Deg (100 Hz ~ 100 kHz)
Spot	< -70 dBc/Hz @ 1 kHz
Frequency Accuracy	
	±1 ppm/year @ operating temperature

NOTICE

To the BeiDou test, S2800A-30 software option is required. And TC-2800A version of firmware, must be Ver V3.0 or more. Refer to System Information for details.

1.5.2 Power Specification

Output Level	
Signal Range	0 dBm to -130 dBm
Resolution	0.1 dB
Accuracy	< ±1.0 dB (output level > -100 dBm) < ±1.5 dB (output level ≤ -100 dBm)
VSWR	
	< 1.3, Typ. • output level ≤ -40 dBm: < 1.3 • -40 dBm < output level ≤ -10 dBm: < 1.6 • -10 dBm < output level ≤ 0 dBm: < 2.2

1.5.3 Remote Control

Port	
	USB to Serial (Virtual)
Driver	
	Silicon Laboratories CP210x USB to UART Bridge (http://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx)

1.5.4 Interface

RF Port	
OUT	N Type , 50 Ohm, DC isolated (> 0.1 MHz)
Reference Port	
IN	BNC Type, 10 MHz < ±10 ppm, 0 dBm to 10 dBm @ 50 Ohm
OUT	BNC Type, 10 MHz < ±1 ppm, 8 dBm ± 2 dB @ 50 Ohm

1.5.5 Miscellaneous

Physical	
Dimension	210(w) x 342(d) x 88(h) mm
Weight	6 kg

Packing	
Size	335(w) x 454(d) x 145(h) mm
Weight	approx.7 kg
Line Voltage	
Input	100 - 240 VAC, 50/60 Hz
Power	< 45 W
Operation Temperature	
Operation	5 ℃ to 40 ℃
Storage	-10 ℃ to 60 ℃

파트 II.

Installation

2.Installation

This section provides the information needed to install the TC-2800A GNSS Tester, including information pertinent to initial inspection, power requirements, environment, upgrade, storage, and shipment.

2.1 Initial Inspection

This section provides information for verifying proper shipment of the TC-2800A GNSS Tester.

Product Condition and Accessory Check

1. Upon receipt of the TC-2800A GNSS Tester, check for damage that could have occurred during shi pment.

2. Check whether you have received all the standard accessories supplied with TC-2800A as listed in t able below.

표 2-1 TC-2800A Accessory List

NO.	Part Number	Name	Specification	Qty.
1	4006-0005	RF Cable	RG400S, N(m) to SMA(m), 2 m	1
2	4008-0021	USB Cable	USB A to USB B, 1.8 m	1
3	4007-0002	BNC Cable	RG58, BNC(m)-BNC(m), 35 cm	1
4	4010-0002	Power Cable	Power Cable, 2 m	1
5	3407-0005	Connector	N(m) to SMA(f) Adaptor	1
6	G99923A	Attenuator	30 dB 0.5 W ,N Type (DC to 6000 MHz)	1
7	G92063A	Antenna	GPS Antenna	1
8	3806-002	Operating Manual, CD		1

⚠CAUTION

To avoid hazardous electrical shock, do not perform electrical tests when there are signs of ship ping damage to the equipment.

2.2 Power Requirement

This Tester is a portable instrument, requiring no physical installation other than connection to a power source.

표 2-2 Power Requirement

Characteristic	Requirement
Input voltage	100 VAC - 240 VAC
Input current	0.5 A
Frequency	50/60 Hz
Power Consumption	Less than 45 watts

If AC power is beyond the range of operation, the equipment may malfunction or sustain permanent d amage. Main supply voltage fluctuations should not exceed 10% of the nominal voltage.

2.3 Operating Environment

Refrain from using this equipment in a place subject to considerable vibration, direct sunlight, outdoor, and where the ground is not level. Likewise, do not use it in areas where the ambient temperature is be yond the range of 5 °C ~ 40 °C, and altitude is more than 2000 m.

The maximum relative humidity is 85 % for temperatures up to 31 °C, decreasing linearity to 50 % rela tive humidity at 40 °C. (Over voltage Installation Category II for main supply; Pollution Degree 2)

The storage temperature range for this equipment is -10 °C ~ 60 °C, when this equipment is not used f or a long period of time, store in a dry place away from direct sunlight by covering with vinyl or placing in a cardboard box.

2.4 Carrying Handle and Caution for Moving

As shown below, TC-2800A is fixed by foot; the user can transport the device using the handler on the side.

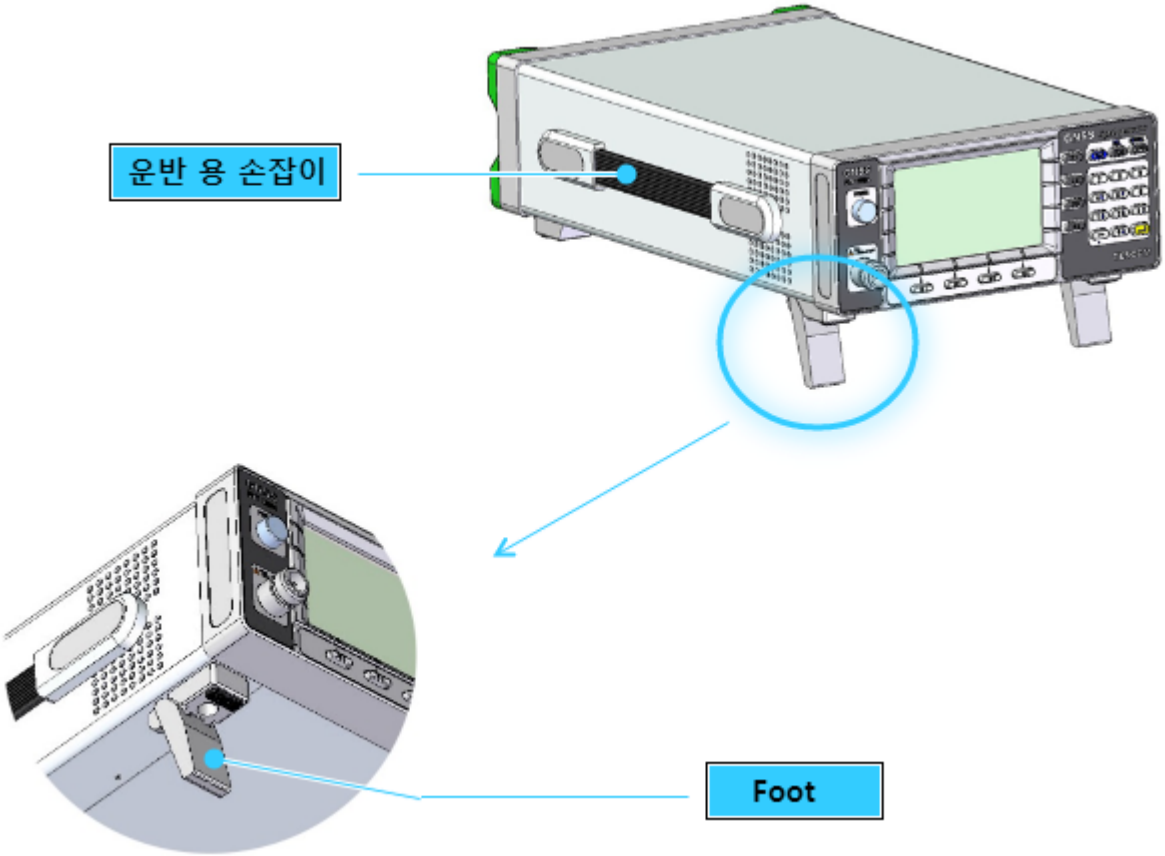


그림 2-1 Carrying Handle

2.5 Firmware Upgrade

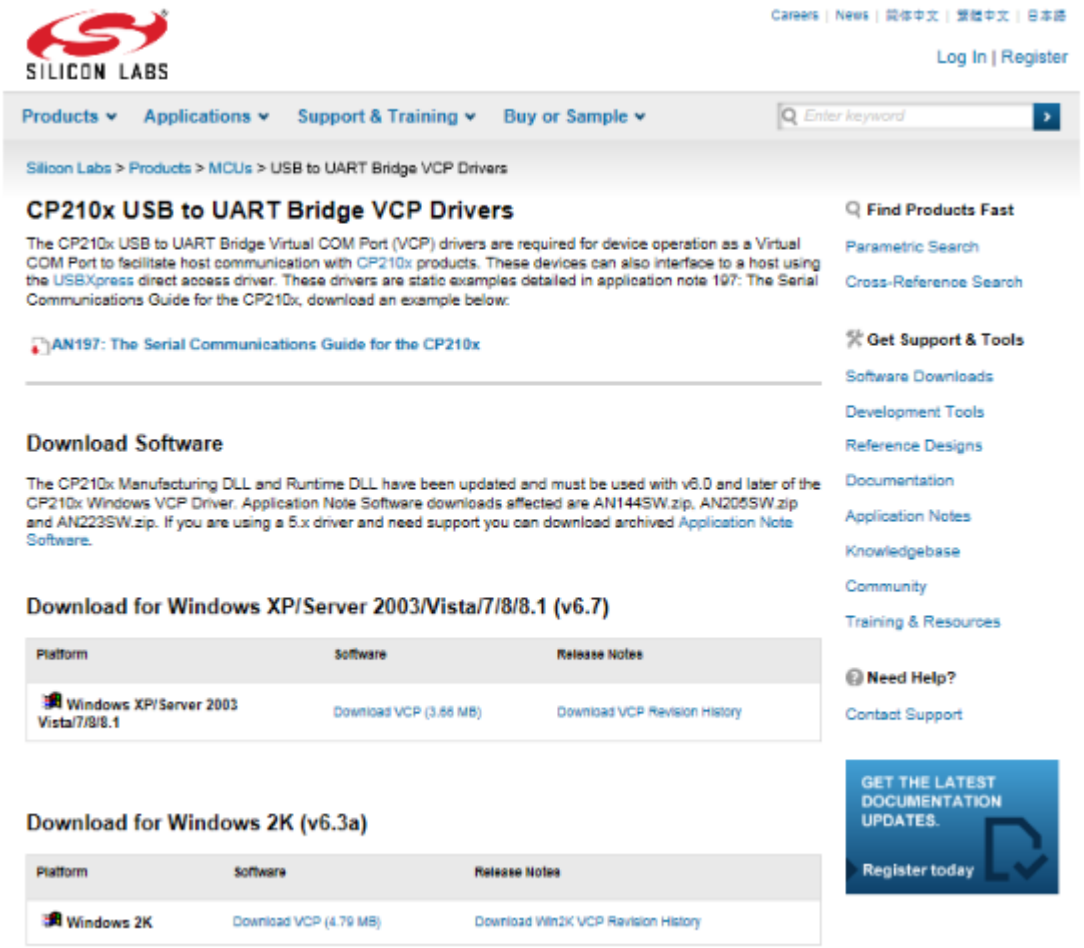
TC-2800A adopted the flash ROM so that the user can easily upgrade the device through the PC without replacing the ROM. By executing the file of the upgraded version, the user can easily perform upgrading. The automatic upgrade program may be downloaded from the TESCOM website or requested via email. Upgrade programs are provided for free.

2.5.1 TC-2800A USB Driver Installation

TC-2800A communicates with the PC through the USB cable. Actually, USB-to-serial converter is used for communication. Therefore, upon the installation of the driver, a COM port will be configured on t he PC.

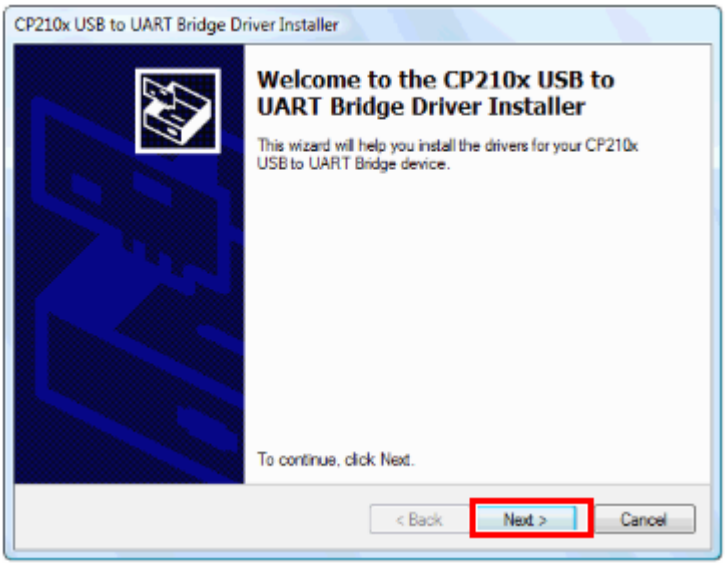
USB driver may be downloaded by accessing the MTP200A product CD or Silicon Labs website.(http://www.silabs.com) And to download and install the USB Driver Kit corresponding to the computer OS.

You can find the most up-to-date drivers for your system here, from Silicon Labs.

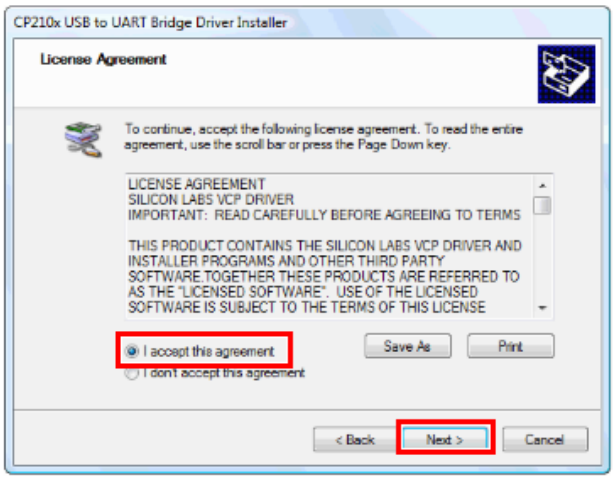


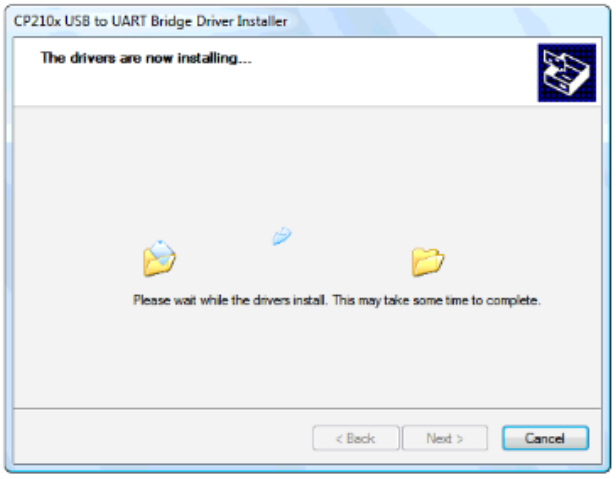
Detailed installation instructions of the USB driver, please refer to the following.

1. Extract the downloaded file "CP210x_VCP_Windows.zip" into a designated folder. In the designa ted folder, a folder labeled "CP210x_VCP_Windows" will be created. In the folder labeled "CP210 x_VCP_Windows", double click the "Cp210xVCPInstaller_x86.exe" with 32-bit OS, or the "Cp210 xVCPInstaller_x64.exe" with 64-bit OS. After a few moments, the following window is displayed.

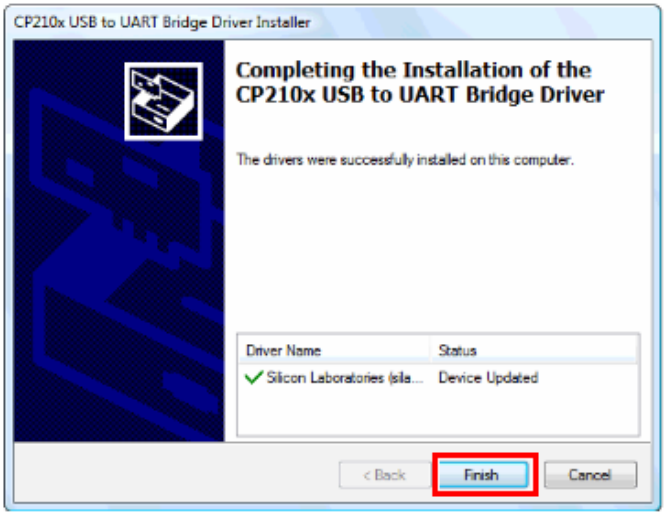


2. The following "License Agreement" window is displayed; please confirm its contents.

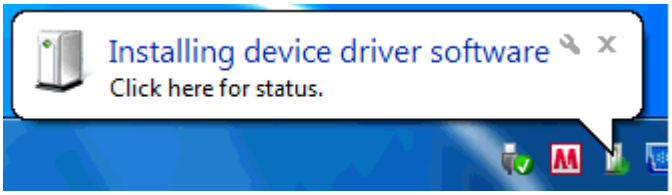




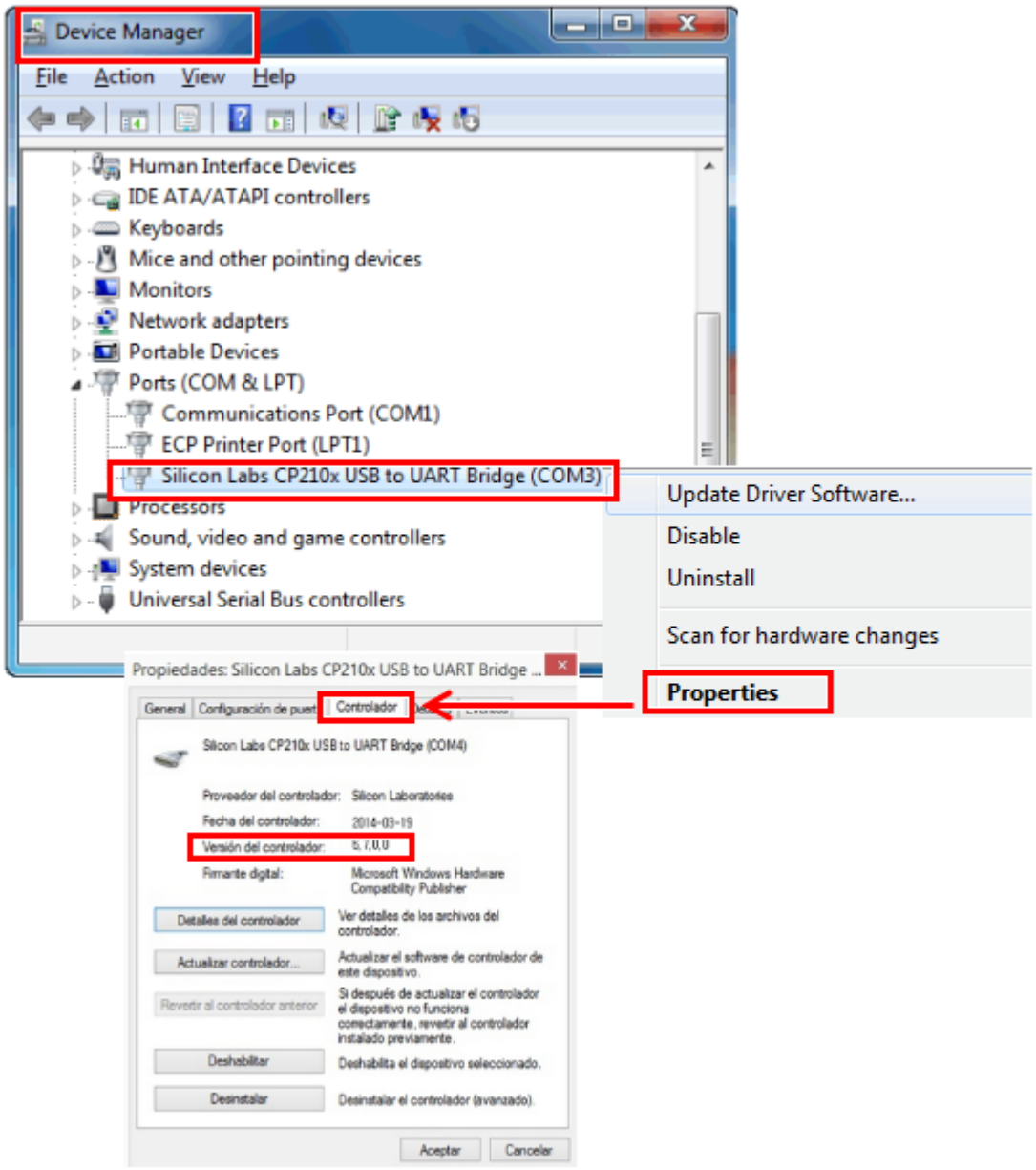
3. Wait until the installation is completed. After a few moments, the following window is displayed. Click [Finish] to complete installation and exit.



4. Connecting the TC-2800A to a PC
   A. USB cable between the USB port on the rear side of TC-2800A using the provided USB cable to the USB port of the PC. Then, turn on TC-2800A.
   B. Turn the TC-2800A power ON, then connect it to a PC via a connection cable for the transce iver. The PC will detect new hardware, and the following message is displayed.(The message may vary depending upon the operating system.)The installation of the device driver softwar e will start automatically.



5. Confirming the COM port number
   A. Open the "Device Manager" to confirm which COM port number is assigned for connection with the device.
   B. Click the Windows [Start] button
   C. Right-click [Computer], then click [Properties].
   D. Click [Device Manager] in the displayed window.
   E. Click “Ports (COM & LPT)” to extend it, then you can find “Silicon Labs CP210x USB to UART Bridge (COMxx)”.The “COMxx” number is different depending on your PC.
   F. Right-click [Silicon Labs CP210x USB to UART Bridge], then [Properties].
   G. Click "Controlador" then check the version.



NOTICE

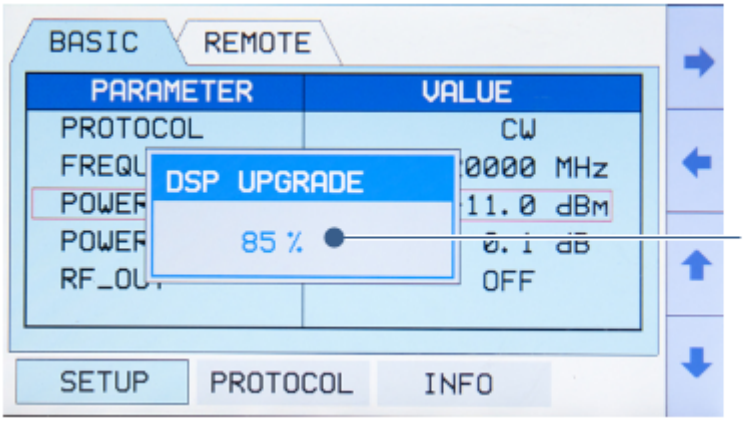
The latest version of driver is 6.7.0.0, if the lower version of the driver has been installed, pleas e update to the latest version.

2.5.2 TC-2800A Firmware Upgrade Sequence

1. USB cable between the USB port on the rear side of TC-2800A using the provided USB cable to t he USB port of the PC. Then, turn on TC-2800A.

2. Run the TC-2800A download program, TC-2800A Downloader XX.exe, on the PC. The version of the execution file will be displayed. When the following screen is displayed, upgrade will start:

3. During the upgrade, the progress shall be displayed on the TC-2800A GUI screen.



Upgrade progress status display

Displays the part that is currently being upgraded and the progress rate

4. Once downloading is completed, turn off TC-2800A and disconnect the cable. Afterward, turn o n TC-2800A. The new firmware version and date will be displayed on the start screen.

⚠CAUTION

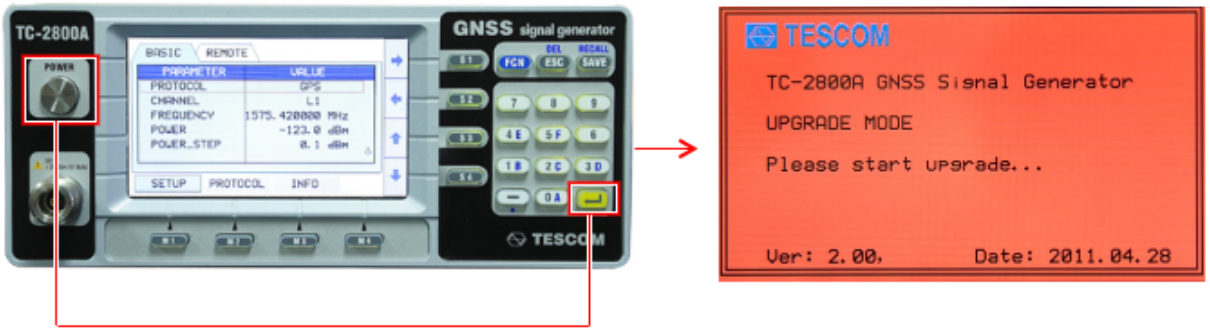
1. In case downloading fails, try again by referring to “Emergency Upgrade”

2. To start downloading the program, .NET Framework 2.0 must be installed on the PC (usually exists on Windows XP or upper-version OS PC as a default). Otherwise, download from the Microsoft homepage.

2.5.3 Emergency Upgrade

In case an error occurs during firmware upgrade, try again as shown below.

1. Press Enter on the front panel of TC-2800A and boot in Emergency Upgrade mode.



Press Enter + Power

Emergency Upgrade Mode

2. Perform upgrade in general upgrading order.

3. After upgrade is completed, reboot TC-2800A.

파트 III.

Operation

3.Operation

This section describes the basic concepts and details of operating the TC-2800A GNSS Tester. Understand ing the basic concepts of TC-2800A helps you use it effectively. Basic Operations quickly shows you how TC-2800A is organized and gives some very general operating instructions.

3.1 Front Panel View

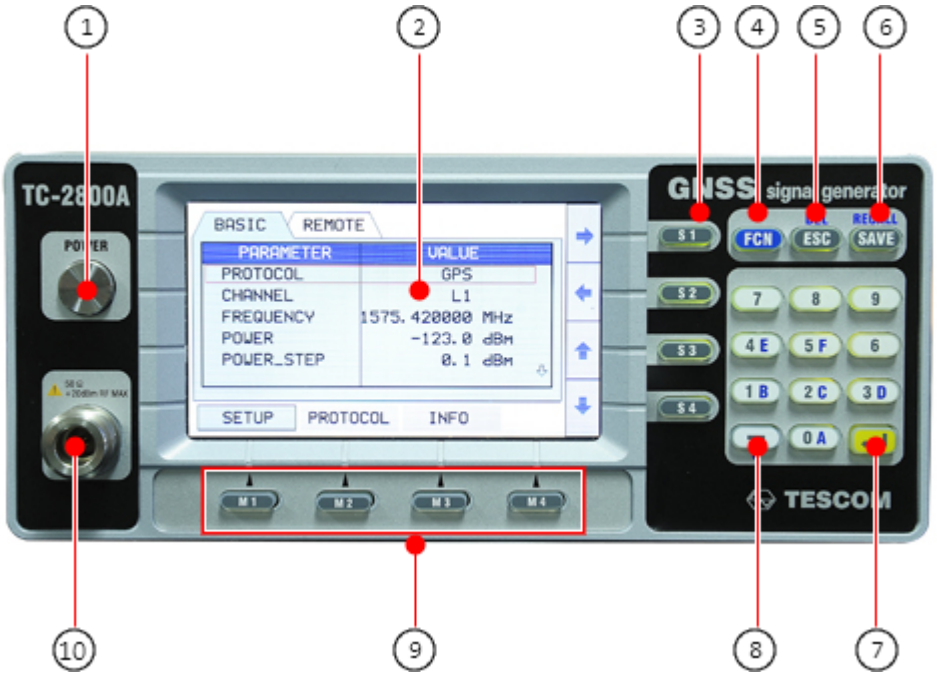


그림 3-1 TC-2800A Front Panel

① Soft Switch

② LCD Display

③ (S1) ~ (S4) : Cursor movement

④ (FCN) : Access second functions

⑤ (ESC) : Return to the previous state

⑥ (SAVE) : Setting values are stored

⑦ (ENT) : Used to enter the chosen function or accept input

⑧ (—) : Minus Input

⑨ (M1) ~ (M4) : Menu Key

⑩ N-type RF connector

3.2 Rear Panel View

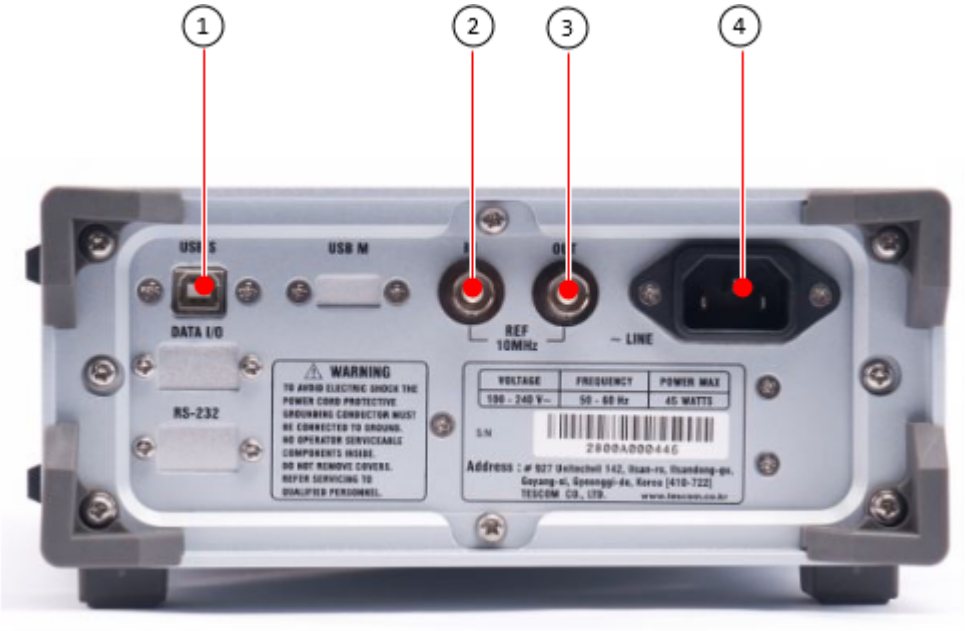


그림 3-2 TC-2800A Rear Panel

① USB Port for Remote Control and Firmware Upgrade

② 10 MHz Reference Input

③ 10 MHz Reference Output

④ Power Input

3.3 Basic Operations

3.3.1 Main Screen Selection

The TC-2800A GNSS Tester has a tree-type menu structure, and each major parameter setting screen can be selected by pressing the M1 ~ M3 keys. The following shows the description of each test screen and key:

표 3-1 Main Screen Selection

Major Screen	Description	Hot Key
Setup	Set the frequency band, channel, and output of the signal.	M1
Protocol	Set or change protocol-related parameters.	M2
INFO	Check the product firmware version and the serial number.	M3

3.3.2 Data Entry and Selection

1. Select the screen tab using the S1~S2 soft keys on the left side of the GUI screen. The soft keys function as arrow keys.
2. Move the cursor to the field to be changed using the S3~ S4 soft keys on the right side of the GUI screen. The soft keys function as up/down arrow keys.
3. Press  **(ENT)** and enter the input mode. Select the value by using the arrow keys or by pressing the numeric key.
4. After entering the field value, press  **(ENT)** to finish.
5. Press  **(ESC)** to cancel or edit during editing.

3.3.3 Soft Key

Soft keys are shortcut keys for the operator to move the cursor to the field.

A total of eight soft keys -- M1 ~ M4 on the right side -- S1 ~ S4 on the right side -- are provided. The user can select the field by pressing the corresponding soft key.

3.4 GUI Screen

The TC-2800A GUI allows the user to set all parameters on a single screen for measurements. Users do not need to switch between screens; thus ensuring convenience of measurement.

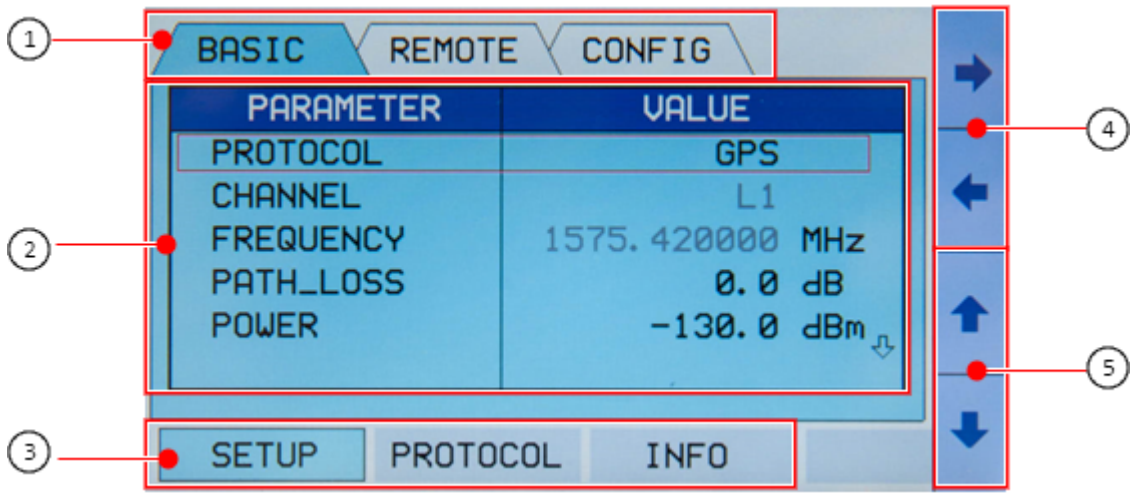


그림 3-3 TC-2800A GUI Screen

① Screen tab display: Activated tabs are displayed in blue.

② Parameter setting screen

③ Main function selection: Select each menu by pressing M1 ~ M3 on the lower side.

④ Screen tab setting: Select each menu by pressing S1 ~ S2 on the right side.

⑤ Parameter selection and setting: Select each menu by pressing S3 ~ S4 on the right side.

3.5 Menu Structure

TC-2800A menus are in three-depth tree structure as shown below. Depending on the selection, i.e., GPS, GLONASS or BeiDou, different parameters may be displayed.

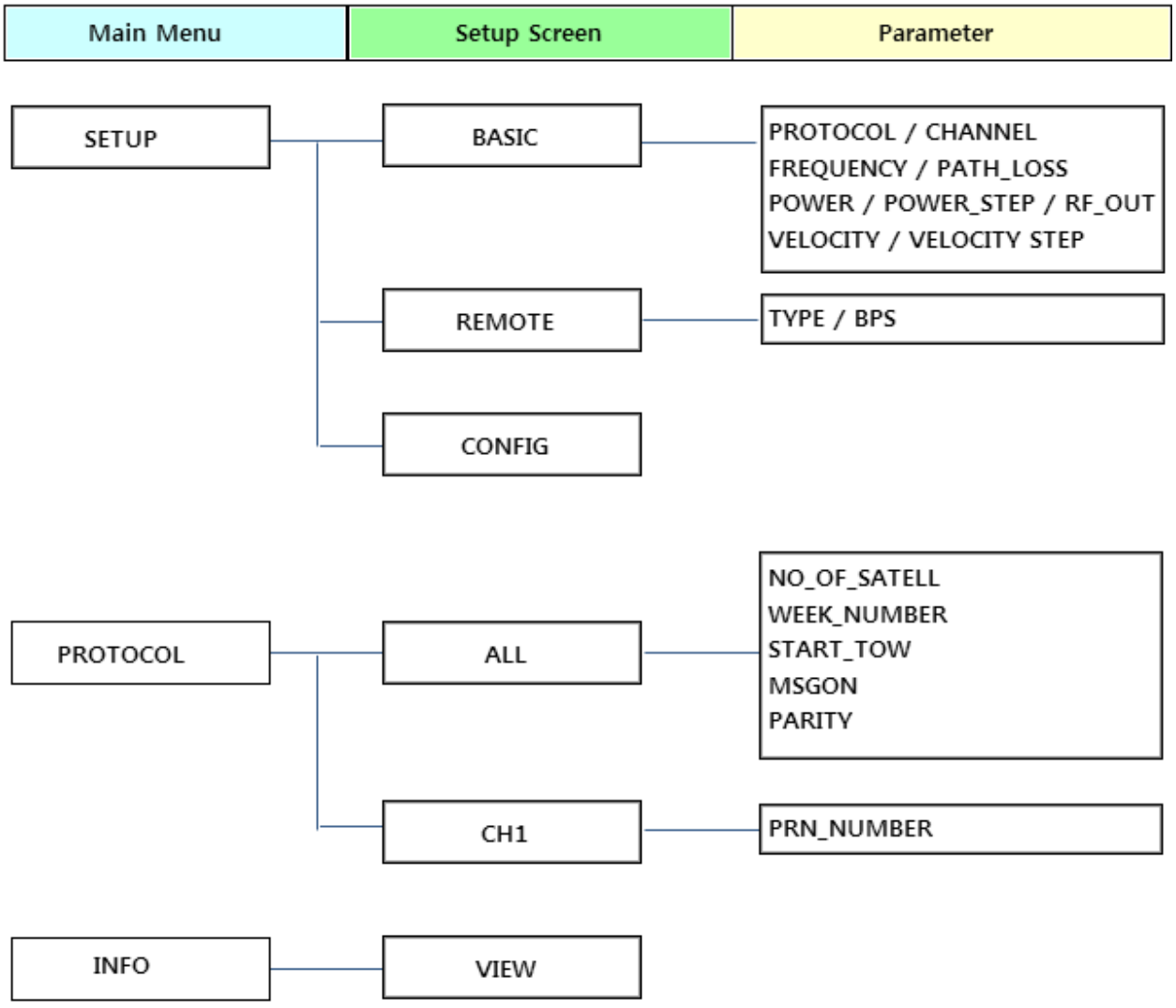


그림 3-4 GPS Menu Structure

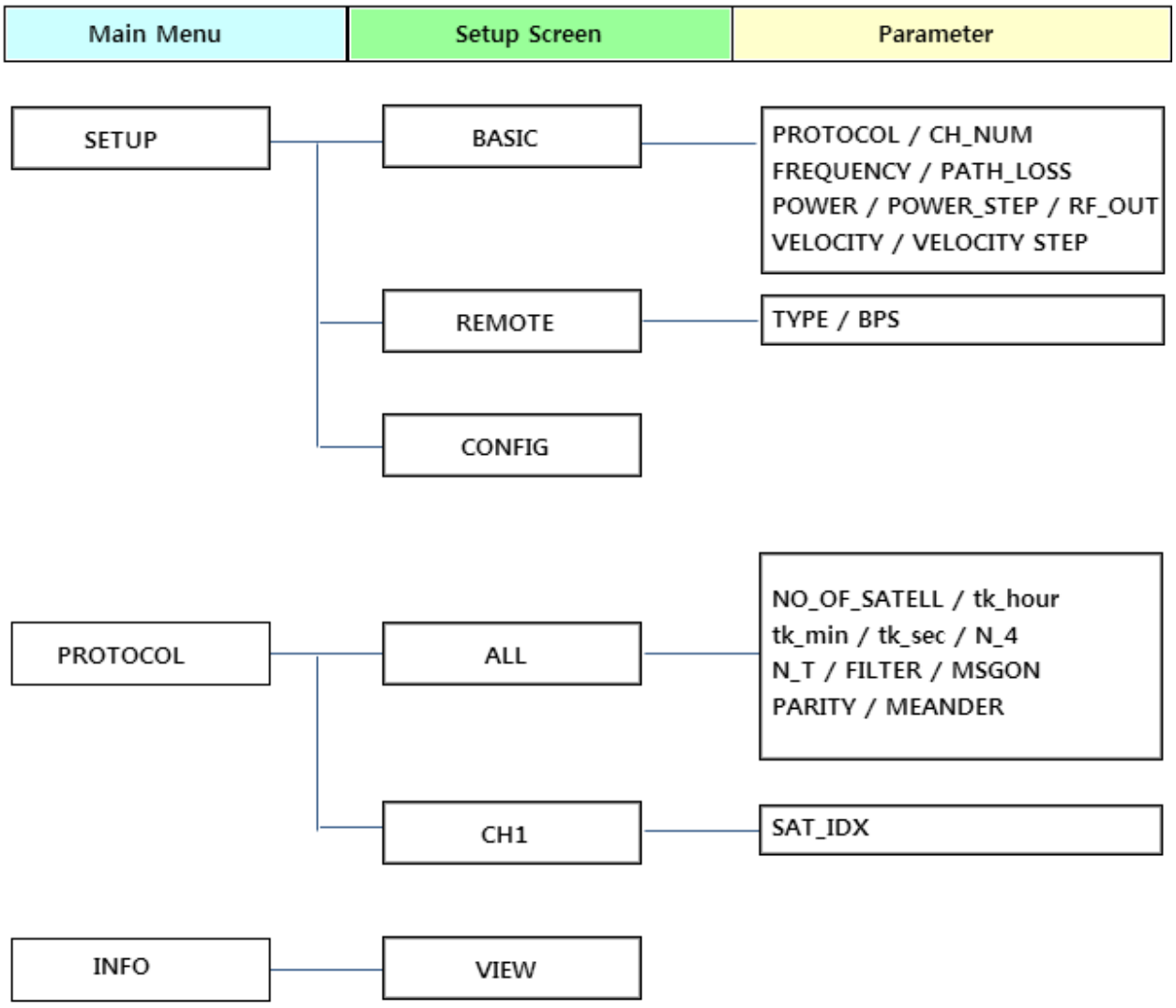


그림 3-5 GLONASS Menu Structure

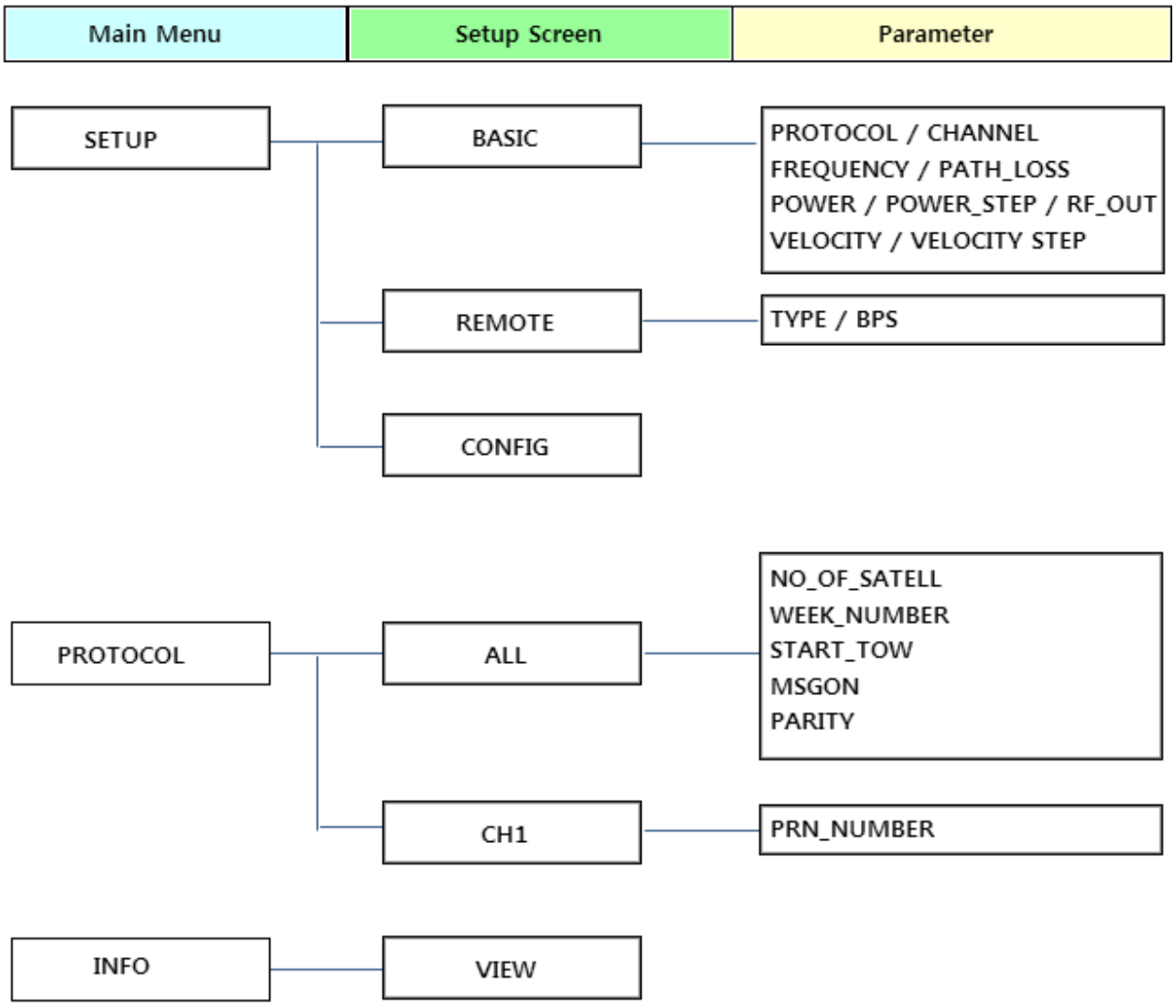


그림 3-6 BeiDou Menu Structure

3.6 Test Configuration

The figure below shows a general configuration required for measurement by the GNNS receiver. Most GNSS receivers are equipped with antennas; thus, the radiation test is more often used than the RF con duction test. Moreover, to minimize signal interferences for accurate measurement, TEM cell or shield box is used.

3.6.1 Test Configuration Using TEM Cell

The TEM cell has a similar environment to that of the anechoic chamber; thus providing an optimal co ndition for DUT radiation measurement. Through such configuration, DUT sensitivity can be measured.

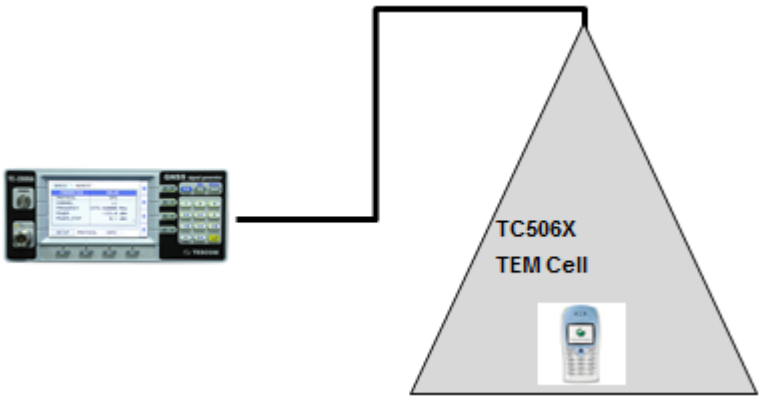


그림 3-7 Tag Test Configuration Using TEM Cell

3.6.2 Test Configuration Using Shield Box

A configuration using the shield box and the antenna coupler is simpler and more suitable for mass pr oduction than the configuration using the TEM cell. Note, however, that the RF characteristics may res ult in distortion; thus requiring caution. Comparable measurement for DUT is required for Go/NoGo t ests

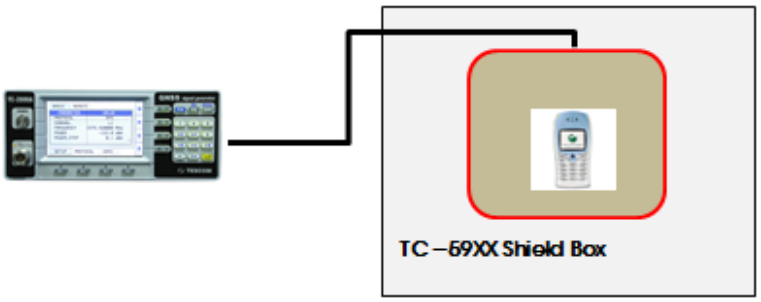


그림 3-8 Tag Test Configuration Using Shield Box

3.7 GPS Signal Transmission

3.7.1 GPS Protocol Selection

TC-2800A supports GPS, GLONASS and BeiDou through GNSS. Select the PROTOCOL parameter for GPS measurement.

- SETUP (M1) → Select BASIC Tab

Select the SETUP menu by pressing the M1 key and Basic tab by pressing the S2 key. Afterward, select GPS as the PROTOCOL parameter value.

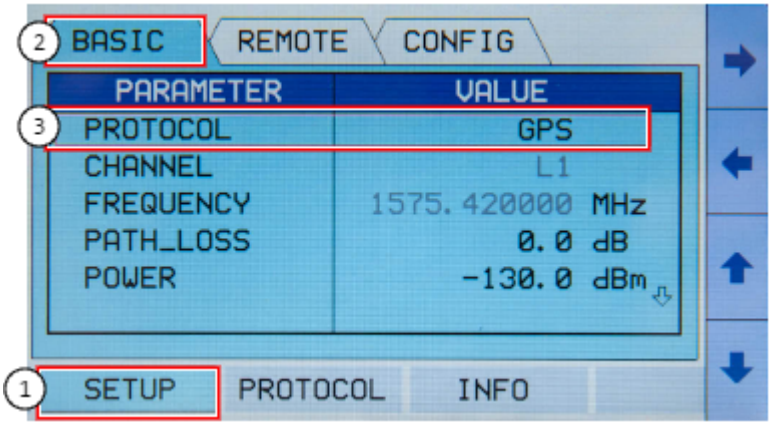


그림 3-9 GPS Protocol Selection Screen

표 3-2 GPS-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:PROT:TYPE GPS		Sets the protocol as GPS
AT%READ:PROT:TYPE?	GPS, CW, GLONASS, BeiDou	Checks the protocol setting

3.7.2 RF Parameter Setup

The user can set RF-related parameters such as channel band, frequency, and output power.

- SETUP (M1) → Select BASIC Tab

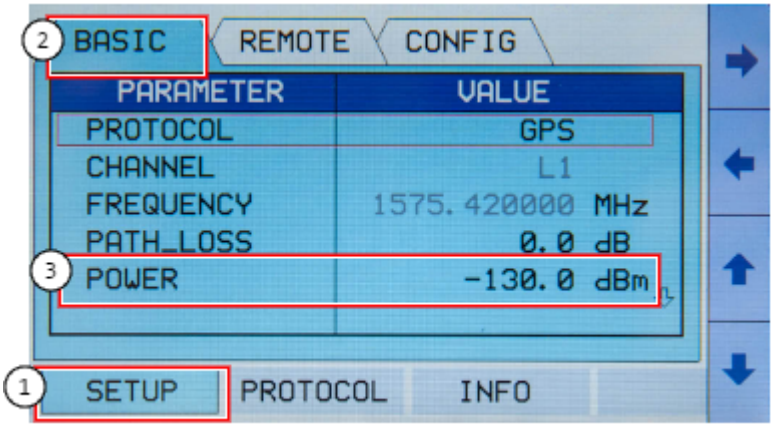


그림 3-10 GPS RF Parameter Setup Screen

NOTICE

When entering the output power using the up/down arrows (S3 or S4), the user can use “Cursor” or “Step” mode. The user can choose the mode by selecting the Power parameter and pressing M1 or M2 on the lower side in input mode. In “Cursor” mode, the user can go to the digit to change using the right/left keys (S3 or S4) and increase/decrease the value by one using the up/down keys (S3 or S4). In “Step” mode, the user can increase/decrease the value by as much as the defined setting in [Power_Step] using the up/down keys (S3 or S4).

표 3-3 GPS RF-related Parameter

Parameter	Input Range	Description
CHANNEL	L1	Displayed upon GPS selection; sets the channel band Fixed to L1 upon GPS selection
FREQUENCY		Sets the frequency; fixed according to the channel
POWER	0.0 ~ -130.0 dBm	Sets the output power Changes the input range based on the Path_Loss selection
POWER_STEP	0.1 ~ 10.0 dB	Basic increase/decrease unit by the selection of up/down keys (S3 or S4) in “Step” mode for output power setting

표 3-4 GPS RF-related RS-232 Command List

COMMAND	Range	Description
AT%READ:FREQ?		Checks the frequency
AT%CONF:POW	0.0 ~ -130.0	Sets the power of Setup->SG
AT%READ:POW?	0.0 ~ -130.0	Checks the power of Setup->SG
AT%CONF:RF_OUT	ON, OFF	Turns on/off the RF output
AT%READ:RF_OUT?	ON, OFF	Checks the RF output status

3.7.3 Path Loss Setup

The user can define the loss between TC-2800A and DUT connection or loss occurring during the use of the attenuator. The power input range changes as much as the path loss setting.

- SETUP (M1) → Select BASIC Tab

표 3-5 GPS PATH_LOSS

Parameter	Input Range	Description
PATH_LOSS	0 ~ 50 dB	Compensation for total power loss between the tester and DUT; set in dB unit

표 3-6 GPS Path Loss-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:PATH_LOSS	0 ~ 50	Sets the compensation for power loss
AT%READ:PATH_LOSS?	0 ~ 50	Checks the compensation for power loss

NOTICE

The power input range changes as much as the path loss setting.
EX.)
PATH LOSS: 0 (Power Input Range: 0 ~ -130 dBm)
PATH LOSS: 50 (Power Input Range: -50 ~ -180 dBm)

3.7.4 Doppler Velocity Setup

The user can set the Doppler velocity of the GPS satellite in m/s. The output frequency changes in con nection with the Doppler effects as follows:

Frequency offset = - (Doppler_shift [m/s])/ 299792458.0[m/s] x 1575.42 MHz

- SETUP (M1) → Select BASIC Tab

표 3-7 GPS VELOCITY

Parameter	Input Range	Description
VELOCITY	-15000 ~ 15000	Sets the satellite Doppler velocity
VELOCITY_STEP	1 ~ 10000	Basic increase/decrease unit by the selection of up/down keys (S3 or S4) in “Step” mode for velocity setting

표 3-8 GPS Velocity-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:VCTY?	-15000 ~ 15000	Sets the Doppler velocity
AT%READ:VCTY?		Checks the Doppler velocity setting

3.7.5 RF ON /OFF Setup

The user can turn on/off the signal output through the **RF_OUT** parameter. OFF is the default status w hen the device is turned on.

- SETUP (M1) → Select BASIC Tab

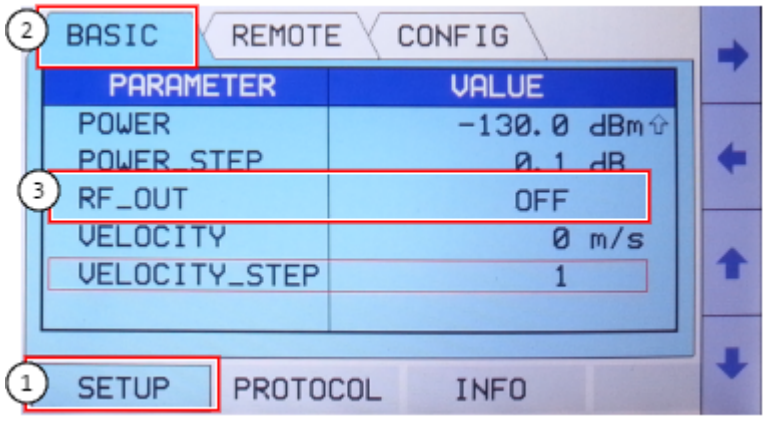


그림 3-11 RF ON/OFF Setup Screen

- Turns on the RF signal: RF_OUT ON
- Turns off the RF signal: RF_OUT OFF

표 3-9 GPS RF ON/OFF

Parameter	Input Range	Description
RF_OUT	ON, OFF	Turns on/off the signal output

표 3-10 GPS RF On/Off-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:RF_OUT	ON, OFF	Turns on/off the RF output
AT%READ:RF_OUT?	ON, OFF	Checks the RF output status

3.7.6 GPS Protocol Parameter Setup

- Protocol (M2) → ALL and CH1 Tab Selection

Select the Protocol menu by pressing the M2 key and All or CH1 tab by pressing the S1 or S2 key.

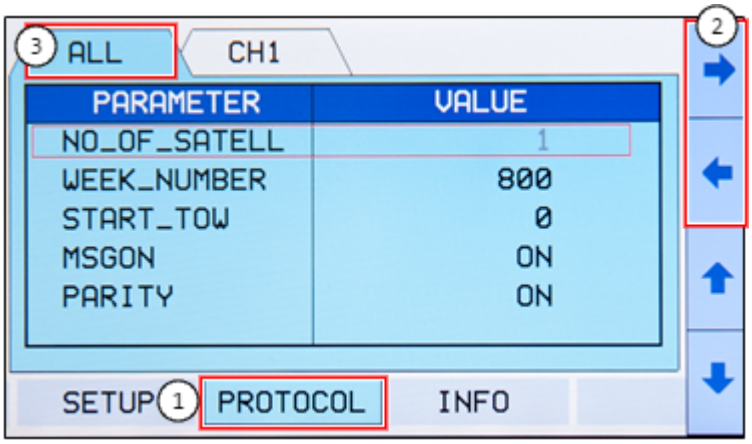


그림 3-12 GPS Protocol Parameter Screen (ALL Tab)

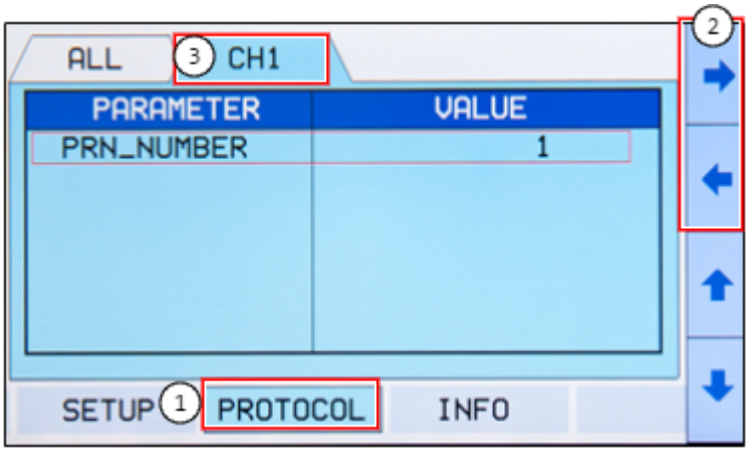


그림 3-13 GPS Protocol Parameter Screen (CH1 Tab)

TC-2800A can set the following GPS-related parameters for signal transmission:

표 3-11 GPS Protocol Parameter

Parameter		Input Range	Description
ALL	NO_OF_SATELL	1	Number of GPS satellites that TC-2800A is currently sending. GPS signal is 1575.42 MHz L1 channel, and multiple channels can send signals. Each satellite sends navigation messages using its own PRN (Pseudo-Random Number) code. TC-2800A can send a maximum of one satellite signal.
	WEEK_NUMBER	0 ~ 1023	Navigation message parameter of the GPS satellite. Displays the number of weeks from January 6, 1980. The value has been rolled over on August 22, 1999; as of December 15, 2010, the value is 590.
	START_TOW	0 ~ 100799	Navigation message parameter of the GPS satellite. Displays the time of the week (TOW). Based on this value, the navigation message increases by one for each sub-frame; displayed through the RF output.
	MSGON	ON/OFF	Turns on/off the signal message
	PARITY	ON/OFF	Turns on/off the hamming parity of the signal
CH1	PRN_NUMBER	1 ~ 32	Displays the PRN code of the satellite sent by TC-2800A

표 3-12 GPS Protocol-related RS-232 Command List

COMMAND	Range	Description
AT%READ:PROT:ALL:NO_OF_SATELL?	1	Checks NO_OF_SATELL of Protocol → ALL
AT%CONF:PROT:ALL:WEEK_NUM	0 ~ 1023	Sets Week_Number of Protocol → ALL
AT%READ:PROT:ALL:WEEK_NUM?		Checks Week_Number of Protocol → ALL
AT%CONF:PROT:ALL:START_TOW	0 ~ 100799	Sets Start_TOW of Protocol → ALL
AT%READ:PROT:ALL:START_TOW?		Checks Start_TOW of Protocol → ALL
AT%CONF:PROT:ALL:MSG	ON, OFF	Sets the Message On/Off of GPS or GLONASS
AT%READ:PROT:ALL:MSG?		Checks the Message On/Off status of GPS, GLONASS or BeiDou
AT%CONF:PROT:ALL:PARITY	ON, OFF	Sets the Parity On/Off of GPS, GLONASS or BeiDou
AT%READ:PROT:ALL:PARITY?		Checks the Parity On/Off status of GPS, GLONASS or BeiDou
AT%CONF:PROT:CH1:PRN_NUM	1 ~ 32	Sets PRN_Number of Protocol → CH1
AT%READ:PROT:CH1:PRN_NUM?		Checks PRN_Number of Protocol → CH1

3.8 GLONASS Signal Transmission

TC-2800A supports GPS, GLONASS and BeiDou through GNSS. For GLONASS measurement, Select the PROTOCOL parameter.

- SETUP (M1) → Select BASIC Tab

Select the SETUP menu by pressing the M1 key and Basic tab by pressing the S2 key. Afterward, set the Protocol parameter as GLONASS.

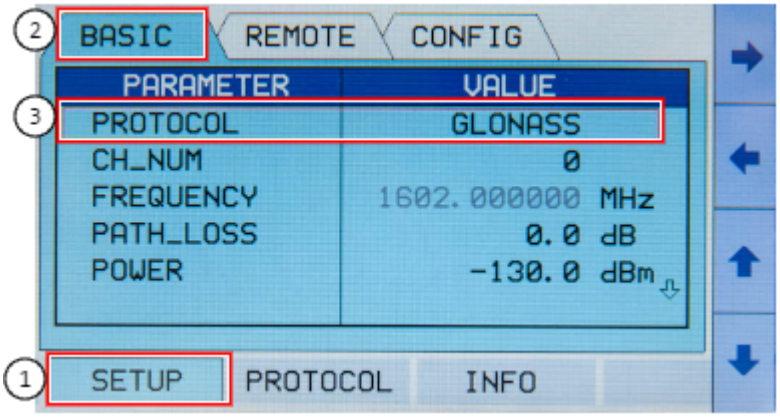


그림 3-14 GLONASS Protocol Selection Screen

표 3-13 GLONASS-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:PROT:TYPE GLONASS		Sets the protocol as GLONASS
AT%READ:PROT:TYPE?	GPS, CW, GLONASS, BeiDou	Checks the protocol setting

3.8.1 RF Parameter Setup

The user can set RF-related parameters such as channel band, frequency, and output power.

- SETUP (M1) → Select BASIC Tab

NOTICE

When entering the output power using the up/down arrows (S3 or S4), the user can use “Cursor” or “Step” mode. The user can choose the mode by selecting the Power parameter and pressing M1 or M2 on the lower side in input mode. In “Cursor” mode, the user can go to the digit to change using the right/left keys (S3 or S4) and increase/decrease the value by one using the up/down keys (S3 or S4). In “Step” mode, the user can increase/decrease the value by as much as the defined setting in [Power_Step] using the up/down keys (S3 or S4).

표 3-14 GLONASS RF-related Parameter

Parameter	Input Range	Description
CH_NUM	-7 ~ 6	Displayed upon GLONASS selection; sets the channel band Fixed to L1 upon GLONASS selection
FREQUENCY		Sets the frequency; fixed according to the channel
POWER	0.0 ~ -130.0 dBm	Sets the output power Changes the input range based on the Path_Loss selection
POWER_STEP	0.1 ~ 10.0 dB	Basic increase/decrease unit by the selection of up/down keys (S3 or S4) in “Step” mode for output power setting

The frequency of the GLONASS channel is calculated as shown below.
Frequency = 1602 MHz + (n x 0.5625) MHz, n=Channel Number

표 3-15 GLONASS RF-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:SETUP:BASIC:CH_NUM	-7~6	Sets the channel number of GLONASS
AT%READ:SETUP:BASIC:CH_NUM?		Checks the channel number of GLONASS
AT%READ:FREQ?		Checks the frequency
AT%CONF:POW	0.0 ~ -130.0	Sets the power of Setup → SG
AT%READ:POW?	0.0 ~ -130.0	Checks the power of Setup → SG

3.8.2 Path Loss Setup

The user can define the loss between TC-2800A and DUT connection or loss occurring during the use of the attenuator. The power input range changes as much as the path loss setting.

- SETUP (M1) → Select BASIC Tab

표 3-16 GLONASS PATH_LOSS

Parameter	Input Range	Description
PATH_LOSS	0 ~ 50 dB	Compensation for total power loss between the tester and DUT; set in dB unit

표 3-17 GLONASS Path Loss-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:PATH_LOSS	0 ~ 50	Sets the compensation for power loss
AT%READ:PATH_LOSS?	0 ~ 50	Checks the compensation for power loss

NOTICE

The power input range changes as much as the path loss setting.
EX.)
PATH LOSS: 0 (Power Input Range: 0 ~ -130 dBm)
PATH LOSS: 50 (Power Input Range: -50 ~ -180 dBm)

3.8.3 Doppler Velocity Setup

The user can set the Doppler velocity of the GPS satellite in m/s. The output frequency changes in con nection with the Doppler effects as follows:

Frequency offset = - (Doppler_shift [m/s])/ 299792458.0[m/s] x 1575.42 MHz

- SETUP (M1) → Select BASIC Tab

표 3-18 GLONASS VELOCITY

Parameter	Input Range	Description
VELOCITY	-15000 ~ 15000	Sets the satellite Doppler velocity
VELOCITY_STEP	1 ~ 10000	Basic increase/decrease unit by the selection of up/down keys (S3 or S4) in “Step” mode for velocity setting

표 3-19 GLONASS Velocity-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:VCTY?	-15000 ~ 15000	Sets the Doppler velocity
AT%READ:VCTY?		Checks the Doppler velocity setting

3.8.4 RF ON /OFF Setup

The user can turn on/off the signal output through the **RF_OUT** parameter. OFF is the default status w hen the device is turned on.

- SETUP (M1) → Select BASIC Tab

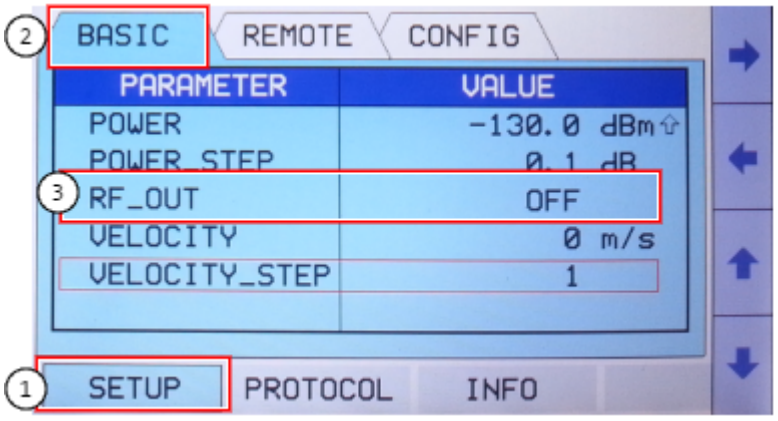


그림 3-15 RF ON/OFF Setup Screen

- Turns on the RF signal: RF_OUT ON
- Turns off the RF signal: RF_OUT OFF

표 3-20 GLONASS RF ON/OFF

Parameter	Input Range	Description
RF_OUT	ON, OFF	Turns on/off the signal output

표 3-21 GLONASS RF On/Off-related RS-232 Command List

COMMAND	Range	설 명
AT%CONF:RF_OUT	ON, OFF	Turns on/off the RF output
AT%READ:RF_OUT?	ON, OFF	Checks the RF output status

3.8.5 GLONASS Protocol Parameter Setup

- Protocol (M2) → ALL and CH1 Tab Selection

Select the Protocol menu by pressing the M2 key and ALL or CH1 tab by pressing the S1 or S2 key.

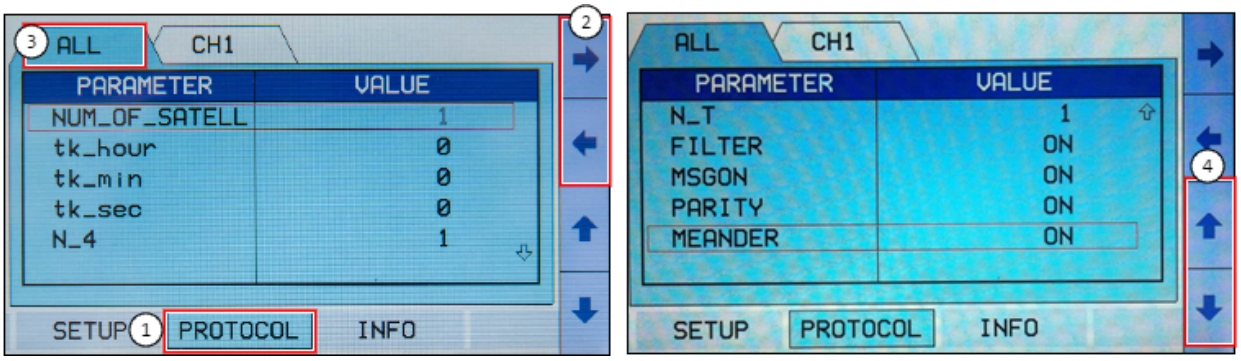


그림 3-16 GLONASS Protocol Parameter Setup Screen (ALL Tab)

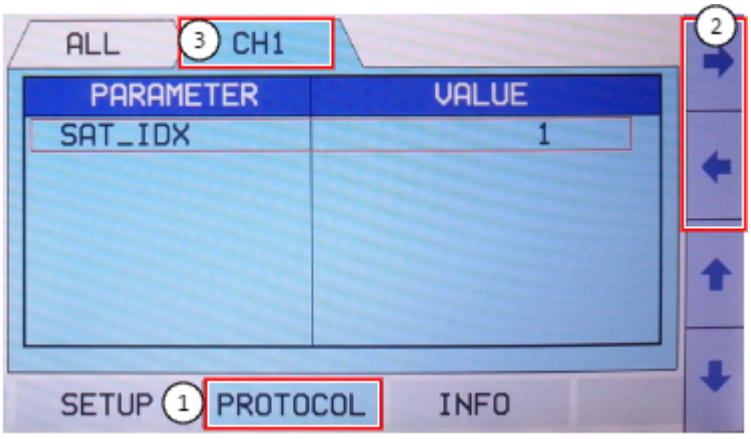


그림 3-17 GLONASS Protocol Parameter Setup Screen (CH1 Tab)

TC-2800A can set the following GLONASS-related parameters for signal transmission:

표 3-22 GLONASS Protocol Parameter

Parameter		Input Range	Description
ALL	NUM_OF_SATELL	1	Number of Glonass satellites that TC-2800A is currently sending; at present, TC-2800A can send up to one satellite signal
	tk_hour	0 ~ 23	Hour data in the tk parameter of ephemeris
	tk_min	0 ~ 59	Minute data in the tk parameter of ephemeris
	tk_sec	0(0 second), 1 (30 seconds)	Second data in the tk parameter of ephemeris
	N_4	1 ~ 31	Calendar date setting based on the leap year
	N_T	1 ~ 1461	Four-year figure setting for the leap year
	FILTER	ON/OFF	Turns on/off the band-limiting filter
	MSGON	ON/OFF	Turns on/off the signal message
	PARITY	ON/OFF	Turns on/off the hamming parity of the signal
	MEANDER	ON/OFF	Turns on the meander coding of the signal
CH1	SAT_IDX	1 ~ 24	Displays the ID code of the satellite sent by TC-2800A

NOTICE

Date data can be calculated using each parameter for GLONASS as shown below.

Y=1996+4*(N_4-1)+(J-1), where,

If 1 <= NT <= 366; J = 1;

If 367 <= NT <= 731; J = 2;

If 732 <= NT <= 1096; J = 3;

If 1097 <= NT <= 1461; J = 4.

표 3-23 GLONASS Protocol-related RS-232 Command List

COMMAND	Range	Description
AT%READ:PROT:ALL:NO_OF_SATELL?	1	Checks NO_OF_SATELL of Protocol → ALL
AT%CONF:PROT:ALL:TK_HOUR	0~23	Sets Hour data for tk parameter setting
AT%READ:PROT:ALL:TK_HOUR?	0~23	Checks Hour data for tk parameter setting
AT%CONF:PROT:ALL:TK_MIN	0~59	Sets Minute data for tk parameter setting
AT%READ:PROT:ALL:TK_MIN?		Checks Minute data for tk parameter setting
AT%CONF:PROT:ALL:TK_SEC	0 or 1	Sets Second data for tk parameter setting
AT%READ:PROT:ALL:TK_SEC?		Checks Second data for tk parameter setting
AT%CONF:PROT:ALL:N_4	1~31	Sets the four-year unit for leap years
AT%READ:PROT:ALL:N_4?		Checks the four-year unit for leap years
AT%CONF:PROT:ALL:N_T	1~1461	Sets the four year-based calendar day for leap years
AT%READ:PROT:ALL:N_T?		Checks the four year-based calendar day for leap years
AT%CONF:PROT:ALL:MSG	ON, OFF	Turns on/off the Message of GPS, GLONASS or BeiDou
AT%READ:PROT:ALL:MSG?		Checks on/off the Message of GPS, GLONASS or BeiDou
AT%CONF:PROT:ALL:PARITY	ON, OFF	Turns on/off the Parity of GPS, GLONASS or BeiDou
AT%READ:PROT:ALL:PARITY?		Checks the Parity On/Off setting of GPS, GLONASS or BeiDou
AT%CONF:PROT:ALL:MEANDER	ON, OFF	Turns on/off the MEANDER Coding of GLONASS
AT%READ:PROT:ALL:MEANDER?		Checks the MEANDER Coding On/Off Setting of GLONASS
AT%CONF:PROT:CH1:SAT_IDX	1 ~ 24	Sets SAT_IDX of Protocol → CH1
AT%READ:PROT:CH1:SAT_IDX		Checks SAT_IDX of Protocol → CH1

3.9 BeiDou Signal Transmission

3.9.1 BeiDou Protocol Selection

TC-2800A supports GPS, GLONASS and BeiDou through GNSS. Select the PROTOCOL parameter for Bei Dou measurement.

NOTICE

To the BeiDou test, S2800A-30 software option is required. And TC-2800A version of firmwar e, must be Ver 3.00 or more. Refer to System Information for details.

- SETUP (M1) → Select BASIC Tab

Select the SETUP menu by pressing the M1 key and Basic tab by pressing the S2 key. Afterward, set t he Protocol parameter as BeiDou.

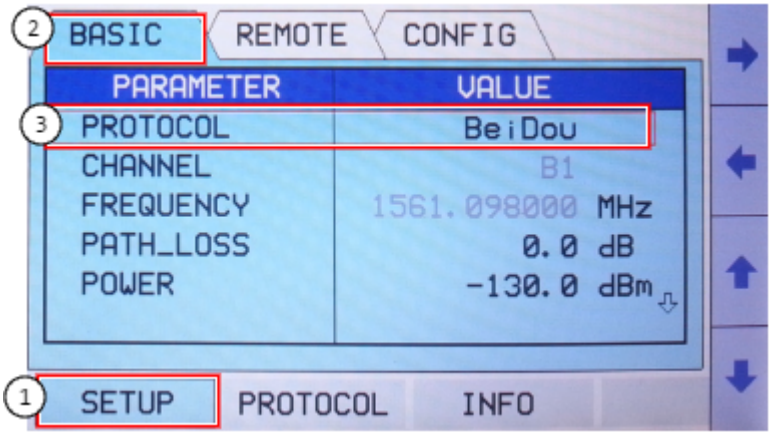


그림 3-18 BeiDou Protocol Selection Screen

표 3-24 BeiDou-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:PROT:TYPE BeiDou		Sets the protocol as BeiDou
AT%READ:PROT:TYPE?	GPS, CW, GLONASS, BeiDou	Checks the protocol setting

3.9.2 RF Parameter Setup

The user can set RF-related parameters such as channel band, frequency, and output power.

NOTICE

TC-2800A supports BeiDou B1 (1561.098 MHz) channel.

- SETUP (M1) → Select BASIC Tab

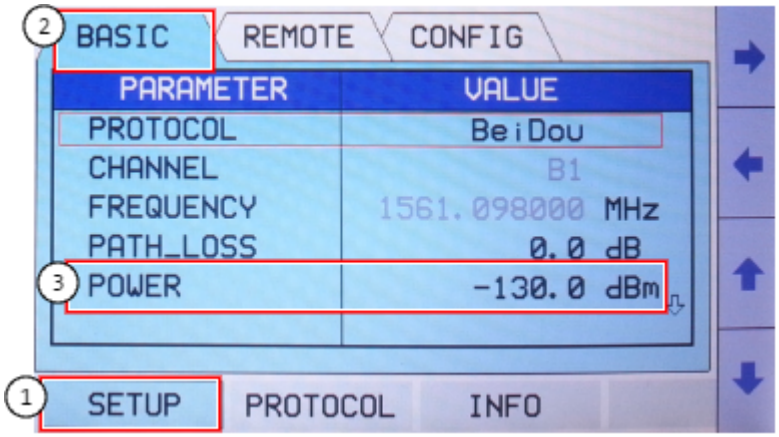


그림 3-19 BeiDou RF Parameter Setup Screen

NOTICE

When entering the output power using the up/down arrows (S3 or S4), the user can use “Cursor” or “Step” mode. The user can choose the mode by selecting the Power parameter and pressing M1 or M2 on the lower side in input mode. In “Cursor” mode, the user can go to the digit to change using the right/left keys (S3 or S4) and increase/decrease the value by one using the up/down keys (S3 or S4). In “Step” mode, the user can increase/decrease the value by as much as the defined setting in [Power_Step] using the up/down keys (S3 or S4).

표 3-25 BeiDou RF-related Parameter

Parameter	Input Range	Description
CHANNEL	B1	Displayed upon BeiDou selection; sets the channel band Fixed to B1 upon BeiDou selection
FREQUENCY		Sets the frequency; fixed according to the channel BeiDou when selected, frequency is fixed to 1561.098 MHz.
POWER	0.0 ~ -130.0 dBm	Sets the output power Changes the input range based on the Path_Loss selection
POWER_STEP	0.1 ~ 10.0 dB	Basic increase/decrease unit by the selection of up/down keys (S3 or S4) in “Step” mode for output power setting

표 3-26 BeiDou RF-related RS-232 Command List

COMMAND	Range	Description
AT%READ:FREQ?		Checks the frequency
AT%CONF:POW	0.0 ~ -130.0	Sets the power of Setup → SG
AT%READ:POW?	0.0 ~ -130.0	Checks the power of Setup → SG
AT%CONF:RF_OUT	ON, OFF	Turns on/off the RF output
AT%READ:RF_OUT?	ON, OFF	Checks the RF output status

3.9.3 Path Loss Setup

The user can define the loss between TC-2800A and DUT connection or loss occurring during the use of the attenuator. The power input range changes as much as the path loss setting.

- SETUP (M1) → Select BASIC Tab

표 3-27 BeiDou PATH_LOSS

Parameter	Input Range	Description
Path_LOSS	0 ~ 50 dB	Compensation for total power loss between the tester and DUT; s et in dB unit

표 3-28 BeiDou Path Loss-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:PATH_LOSS	0 ~ 50	Sets the compensation for power loss
AT%READ:PATH_LOSS?	0 ~ 50	Checks the compensation for power loss

NOTICE

The power input range changes as much as the path loss setting.

EX.)

PATH LOSS: 0 (Power Input Range: 0 ~ -130 dBm)

PATH LOSS: 50 (Power Input Range: -50 ~ -180 dBm)

3.9.4 Doppler Velocity Setup

The user can set the Doppler velocity of the BeiDou satellite in m/s. The output frequency changes in c onnection with the Doppler effects as follows:

Frequency offset = - (Doppler_shift [m/s])/ 299792458.0[m/s] x 1575.42 MHz

- SETUP (M1) → Select BASIC Tab

표 3-29 BeiDou VELOCITY

Parameter	Input Range	Description
VELOCITY	-15000 ~ 15000	Sets the satellite Doppler velocity
VELOCITY_STEP	1 ~ 10000	Basic increase/decrease unit by the selection of up/down keys (S3 or S4) in “Step” mode for velocity setting

표 3-30 BeiDou Velocity-related RS-232 Command List

COMMAND	Range	Description
AT%CONF:VCTY?	-15000 ~ 15000	Sets the Doppler velocity
AT%READ:VCTY?		Checks the Doppler velocity setting

3.9.5 RF ON /OFF Setup

The user can turn on/off the signal output through the **RF_OUT** parameter. OFF is the default status w hen the device is turned on.

- SETUP (M1) → Select BASIC Tab

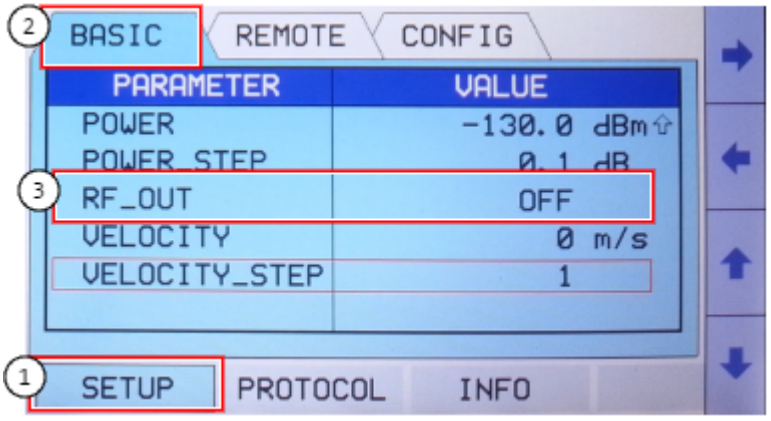


그림 3-20 RF ON/OFF Setup Screen

- Turns on the RF signal: RF_OUT ON
- Turns off the RF signal: RF_OUT OFF

표 3-31 BeiDou RF ON/OFF

Parameter	Input Range	Description
RF_OUT	ON, OFF	Turns on/off the signal output

표 3-32 BeiDou RF On/Off-related RS-232 Command List

COMMAND	Range	설 명
AT%CONF:RF_OUT	ON, OFF	Turns on/off the RF output
AT%READ:RF_OUT?	ON, OFF	Checks the RF output status

3.9.6 BeiDou Protocol Parameter Setup

- Protocol (M2) → ALL and CH1 Tab Selection

Select the Protocol menu by pressing the M2 key and ALL or CH1 tab by pressing the S1 or S2 key.

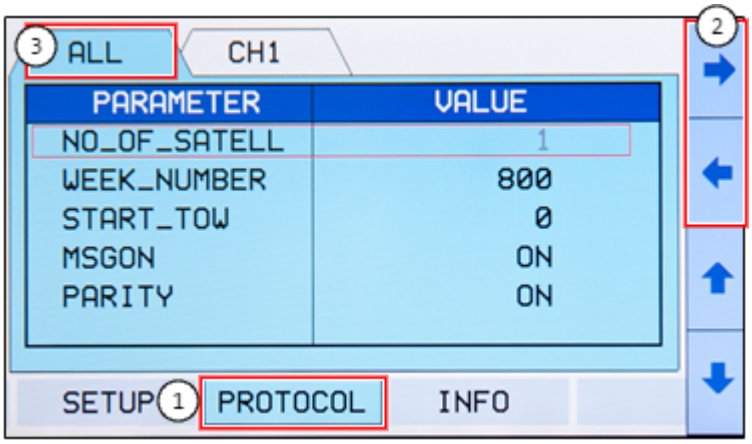


그림 3-21 BeiDou Protocol Parameter Screen (ALL Tab)

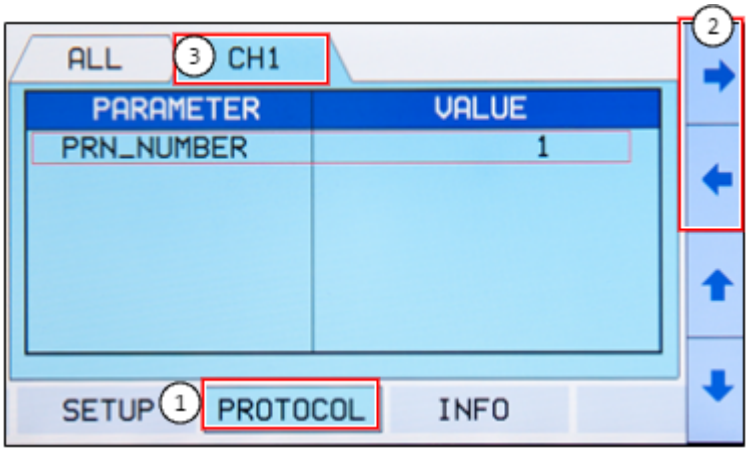


그림 3-22 BeiDou Protocol Parameter Screen (CH1 Tab)

TC-2800A can set the following BeiDou-related parameters for signal transmission:

표 3-33 BeiDou Protocol Parameter

파라미터		Input Range	Description
ALL	NO_OF_SATELL	1	Number of BeiDou satellites that TC-2800A is currently sending. BeiDou signal is 1561.098 MHz B1 channel, and multiple channels can send signals. Each satellite sends navigation messages using its own PRN (Pseudo-Random Number) code. TC-2800A can send a maximum of one satellite signal.
	WEEK_NUMBER	0 ~ 1023	Navigation message parameter of the BeiDou satellite. Displays the number of weeks from January 6, 1980. The value has been rolled over on August 22, 1999; as of December 15, 2010, the value is 590.
	START_TOW	0 ~ 100799	Navigation message parameter of the BeiDou satellite. Displays the time of the week (TOW). Based on this value, the navigation message increases by one for each sub-frame; displayed through the RF output.
	MSGON	ON/OFF	Turns on/off the signal message
	PARITY	ON/OFF	Turns on/off the hamming parity of the signal
CH1	PRN_NUMBER	1 ~ 32	Displays the PRN code of the satellite sent by TC-2800A

표 3-34 BeiDou Protocol-related RS-232 Command List

COMMAND	Range	Description
AT%READ:PROT:ALL:NO_OF_SATELL?	1	Checks NO_OF_SATELL of Protocol → ALL
AT%CONF:PROT:ALL:WEEK_NUM	0 ~ 1023	Sets Week_Number of Protocol → ALL
AT%READ:PROT:ALL:WEEK_NUM?		Checks Week_Number of Protocol → ALL
AT%CONF:PROT:ALL:START_TOW	0 ~ 100799	Sets Start_TOW of Protocol → ALL
AT%READ:PROT:ALL:START_TOW?		Checks Start_TOW of Protocol → ALL
AT%CONF:PROT:ALL:MSG	ON, OFF	Sets the Message On/Off of GPS, GLONASS or BeiDou
AT%READ:PROT:ALL:MSG?		Checks the Message On/Off status of GPS, GLONASS or BeiDou
AT%CONF:PROT:ALL:PARITY	ON, OFF	Sets the Parity On/Off of GPS, GLONASS or BeiDou
AT%READ:PROT:ALL:PARITY?		Checks the Parity On/Off status of GPS, GLONASS or BeiDou
AT%CONF:PROT:CH1:PRN_NUM	1 ~ 32	Sets PRN_Number of Protocol → CH1
AT%READ:PROT:CH1:PRN_NUM?		Checks PRN_Number of Protocol → CH1

3.10 System Information

- INFO (M3) → Select View Tab

Select the INFO menu by pressing M3 . The VIEW tab will then be displayed with the serial number and firmware version.

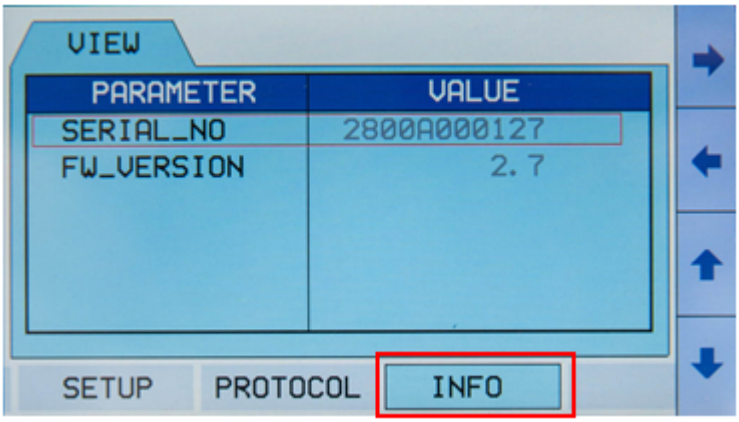


그림 3-23 System Information Screen

3.11 Storage and Calling of Device Setting and Configuration

This function is used to save the current field values in one buffer for later uses. The user can save up to 10 configurations. With this function, the user can save frequently used settings and configurations. Saving and calling setting and configuration data can be made as follows:

3.11.1 Save

1. Enter important field values and finish the setting.
2. Select SAVE (SAVE)
3. Select the number to save on the popup window and press the ENT (ENT) key.

3.11.2 Recall

1. Select the FCN (FCN) + SAVE (SAVE) key.
2. Select the number to call on the popup window.

> **CAUTION**
> Rebooting will call the latest setting. Note, however, that RF_OUT will always be OFF regardless of the previous setting.

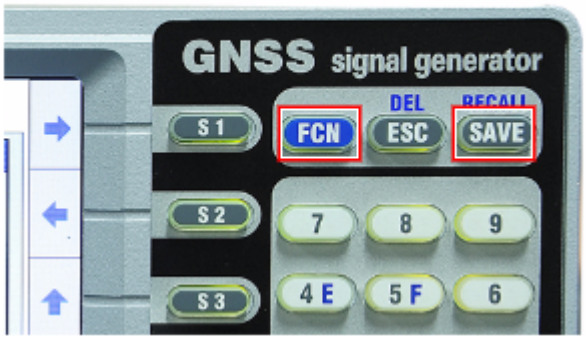


그림 3-24 Storage and Calling of Device Setting and Configuration

3.12 System Preset

[Preset] will affect all settings made by the user. [Preset] will initialize all settings to factory settings. Th e following is the preset procedure:

1. Select the FCN (**FCN**) + SAVE (**SAVE**) key.

2. Select “Preset” on the popup window and press the ENT (**ENT**) key.

표 3-35 Default Parameter Values

Parameter	Input Range	Default Value
PROTOCOL	GPS, GLONASS, BeiDou, CW	GPS
CHANNEL	L1	L1
CH_NUM	-7~6	0
FREQUENCY	1550 ~ 1610 MHz (CW signal outp ut)	1575.42 MHz
PATH_LOSS	0 ~ 50 dB	0.0 dB
POWER	0 ~ -130.0 dBm	-130 dBm
POWER_STEP	0.1 ~ 10 dB	0.1
RF_OUT	ON,OFF	OFF
VELOCITY	-15000~15000	0 m/s
VELOCITY_STEP	1~10000	1
NO_OF_SATELL	1	1
WEEK_NUMBER	0 ~ 1023	800
START_TOW	0 ~ 100799	0
PRN_NUMBER	1 ~ 32	1
NO_OF_SATELL	1	1
tk_hour	0 ~ 23	0
tk_min	0~59	0
tk_sec	0 (0 second), 1 (30 second)	0
N_4	1 ~ 31	1
N_T	1 ~ 1461	1
FILTER	ON/OFF	ON
MSGON	ON/OFF	ON
PARITY	ON/OFF	ON
MEANDER	ON/OFF	ON

파트 Ⅳ.

Performance Test

4.Performance Test

This section contains information on how to keep the instrument in good working order and check its ov erall performance.

4.1 General Information

The procedures in this chapter allow the verification of the electrical performance of TC-2800A. It cont ains procedures suitable for determining if the functions of TC-2800A are adjusted properly and wheth er it meets the performance characteristics as warranted. These tests do not require access to the interi or of the instrument.

The setup drawings at the beginning of each test procedure show the test configuration needed for ea ch test. To perform the test procedures, you need to know the basic TC-2800A operation. You should be familiar with the front panel, various test screens, and knob operation. The test procedures give criti cal instrument settings and connections but not the manufacturing test specification.

4.1.1 Recommended test equipment

The equipment required for the performance tests are listed in the table below. Any equipment that s atisfies the critical specifications in the table may substitute the recommended model.

The performance tests are based on the assumption that the recommended test equipment is used. S ubstituting with alternative test equipment may require the modification of some procedures.

표 4-1 Measurement List for the User's Device Diagnosis

Description	Minimum Specification	Model
Power Meter		HP 437B
Spectrum Analyzer	100 kHz to 6.5 GHz, up to -150 dBm	N9030A
Power Sensor	-20 to -70 dBm, 100 kHz to 26.5 GHz	HP-8485A
Power Sensor	27 to -30 dBm, 100 kHz to 4 GHz	HP-8482A

Description	Minimum Specification	Model
Frequency Counter	±0.1 ppm, 10 Hz ~ 2 GHz, 9 digit	HP-53181A
Pre Amp	MiniCircuits, Gain : +30 dB	ZKL-2R5

⚠CAUTION

Unless specified otherwise, a warm-up period of 2 hours is required for these tests.

4.1.2 TC-2800A Initial Setup

NOTICE

Before starting measurement, set TC-2800A as described below.
In signal generator mode, no cable loss is assumed (Path Loss = 0).

1. Turn on the power.
2. Preheat for two hours.
3. Press FCN (FCN) + SAVE (SAVE) on the upper part of the screen and select “Preset” on the popup window for initialization.

4.2 TC-2800A Performance Test

4.2.1 CW Mode

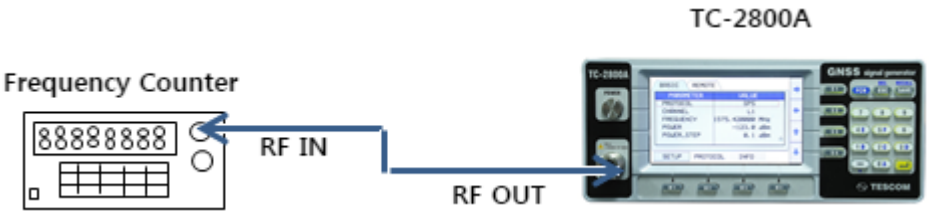
4.2.1.1 Frequency Generator Accuracy

> Specification: GPS_L1 (1575.42 MHz) < ±1 ppm, GLONASS_0 (1602.00 MHz) < ±1 ppm ,
> BeiDou_B1 (1561.098 MHz) < ±1 ppm
> Objective: To measure the accuracy of the output signal level

NOTICE

If you don't have a BeiDou option(S2800-30), test for BeiDou_B1 (1561.098 MHz) is omitted.

1. Test Setup: Connect the equipment as shown in the figure below.



2. Set the controls of TC-2800A as follows
   A. PROTOCOL: CW
   B. CHANNEL: GPS_L1
   C. FREQUENCY: 1575.42 MHz
   D. POWER: 0 dBm
   E. RF_OUT: ON

3. Press the Freq Ch 2 key of the Frequency Counter

4. Read the frequency from the Frequency Counter.

표 4-2 CW Mode Frequency Accuracy

TC-2800A Channel	TC-2800A Frequency [MHz]	Frequency Counter measurement Result [MHz]
GPS_L1	1575.42 MHz	
GLONASS_0	1602.00 MHz	
BeiDou_B1	1561.098 MHz (옵션)	

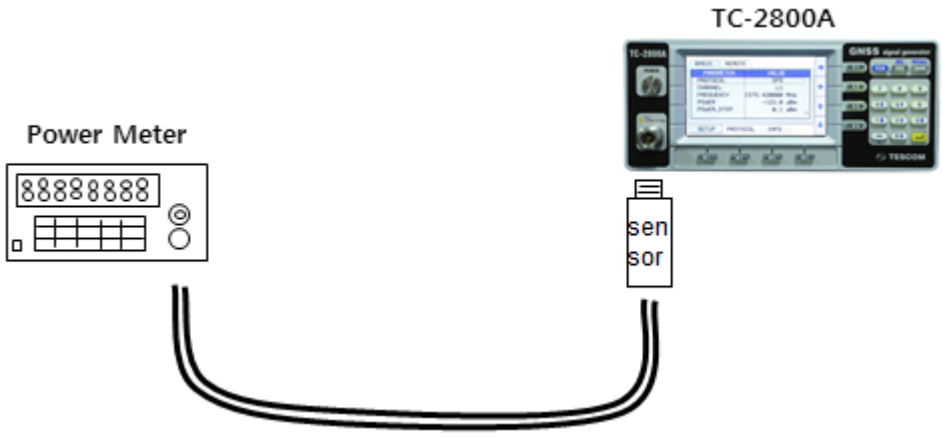
4.2.1.2 CW Mode Power Accuracy (Power Sensor)

> Specification: ≤ ±1 dB
> Objective: To measure the accuracy of the output signal level

NOTICE

If you don't have a BeiDou option(S2800-30), test for BeiDou_B1 (1561.098 MHz) is omitted.

1. Test Setup: Connect the equipment as shown in the figure below.



2. Set the controls of TC-2800A as follows
   A. PROTOCOL: CW
   B. CHANNEL: GPS_L1
   C. FREQUENCY: 1575.42 MHz
   D. POWER: 0 dBm
   E. RF_OUT: ON

3. Set the TC-2800A frequency and power as shown below and record the data measured by the power meter.

표 4-3 CW Mode Power Accuracy (Power Sensor)

TX Power Level	Frequency		
	1575.42 MHz (GPS_L1)	1602.00 MHz (GLONASS_0)	1561.098 MHz (BeiDou_B1(Optional))
0 dBm			
-10 dBm			
-20 dBm			
-30 dBm			
-40 dBm			
-50 dBm			

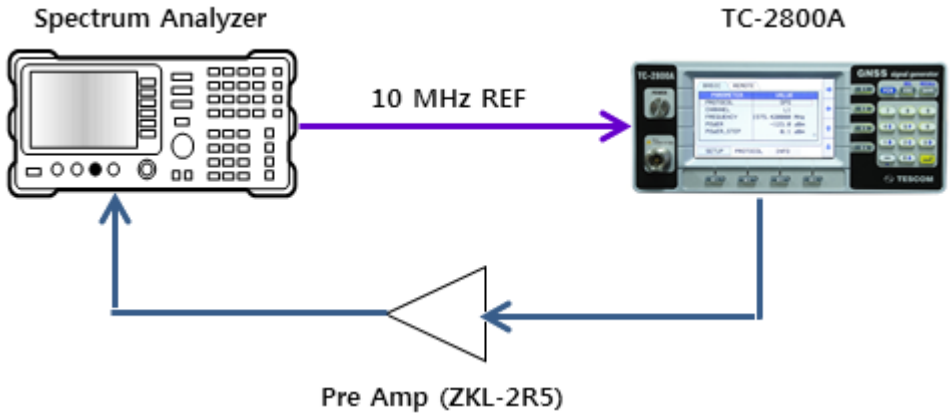
4.2.1.3 CW Mode Power Accuracy (Spectrum Analyzer)

> Specification: ±1 dB ⟩ -100 dBm, ±1.5 dB ≤ -100 dBm
> Objective: To measure the accuracy of the output signal level

NOTICE

If you don't have a BeiDou option(S2800-30), test for BeiDou_B1 (1561.098 MHz) is omitted.

1. Test Setup: Connect the equipment as shown in the figure below.



2. Set the controls of TC-2800A as follows
   A. PROTOCOL: CW
   B. CHANNEL: GPS_L1
   C. FREQUENCY: 1575.42 MHz
   D. POWER: -60 dBm
   E. RF_OUT: ON

3. Set the controls of Spectrum Analyzer as follows
   A. MODE: Spectrum Analyzer
   B. FREQUENCY: 1575.42 MHz
   C. SPAN: 100 Hz
   D. RBW, VBW: AUTO
   E. AVG: 20
   F. MARK: Peak Search

4. Measure the output power in SA using the marker.

5. In Pre Amp On mode, use the delta marker of the spectrum analyzer for measurement. In other words, when measuring -120 dBm, convert the measurement result at -110 dBm for Pre Amp Off and record it.

표 4-4 CW Mode Power Accuracy (Spectrum Analyzer)

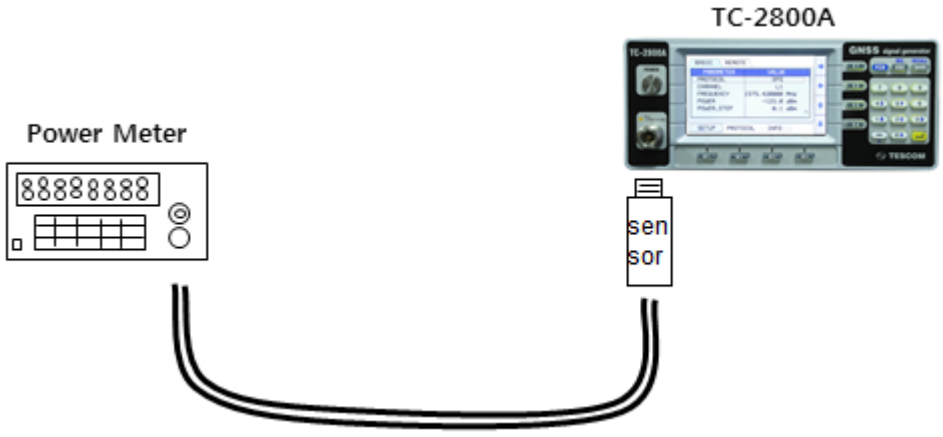
TX Power Level	Measurement Result		
	1575.42 MHz (GPS_L1)	1602.5625 MHz (GLONASS_0)	1561.098 MHz (BeiDou(Optional))
-60 dBm (Pre Amp OFF)			
-70 dBm (Pre Amp OFF)			
-80 dBm (Pre Amp OFF)			
-90 dBm (Pre Amp OFF)			
-100 dBm (Pre Amp OFF)			
-110 dBm (Pre Amp OFF)			
-120 dBm (Pre Amp ON)			
-130 dBm (Pre Amp ON)			

4.2.2 Signal Mode

4.2.2.1 GPS Signal Mode Power Accuracy

> Specification: ≤ ±1 dB
> Objective: To measure the accuracy of the output signal level

1. Test Setup: Connect the power sensor to the RF Out port of TC-2800A as shown below.



2. Set the controls of TC-2800A as follows.
   A. PROTOCOL: GPS
   B. CHANNEL: L1
   C. FREQUENCY: 1575.42 MHz
   D. POWER: 0 dBm
   E. RF_OUT: ON
   F. VELOCITY: 0 m/s

3. Set the TC-2800A frequency and power as shown below and record the data measured by the p ower meter.

표 4-5 GPS Mode Power Accuracy (Power Sensor)

TX Power Level	Measurement Result
	1575.42 MHz (L1 Channel)
0 dBm (8482A Power Sensor)	
-10 dBm (8482A Power Sensor)	
-20 dBm (8482A Power Sensor)	
-30 dBm (8485A Power Sensor)	
-40 dBm (8485A Power Sensor)	
-50 dBm (8485A Power Sensor)	

파트 V.

Programming Guide

5.Programming Guide

The PC may control TC-2800A remotely through the RS232C interface using a comprehensive set of com mands. This section provides the necessary information to operate TC-2800A under RS232C control.

5.1 Basic Setup

5.1.1 Cable Connection and Driver Installation

1. Install the USB driver
2. Connect to the PC through the provided USB cable.

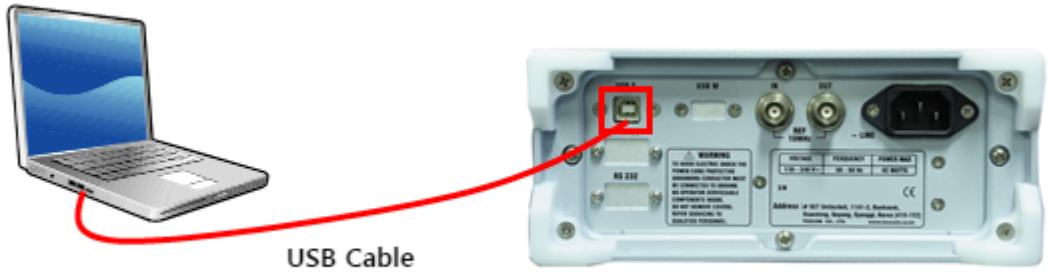


그림 5-1 Cable Connection for Remote Control

NOTICE

TC-2800A communicates with the PC through the USB cable. Actually, USB-to-serial converter is used for communication. Therefore, upon installation of the driver, a COM port will be confi gured on the PC.

5.1.2 TC-2800A Setup

- Setup (M1) → Select Remote Tab

Select the Setup menu by pressing the M1 key and Remote tab by pressing S1.

Type is fixed to USB2RS232C; the user can set the communication speed BPS depending on the need.

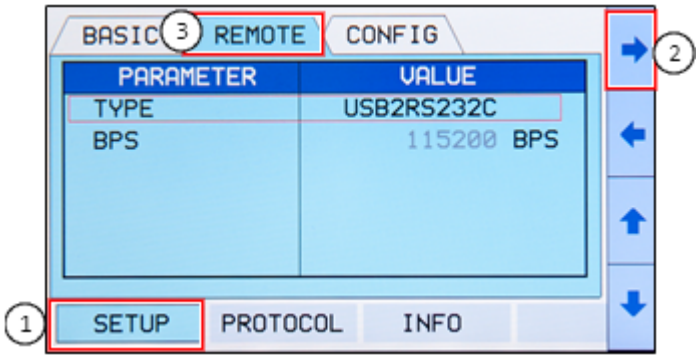


그림 5-2 Remote Setup Screen

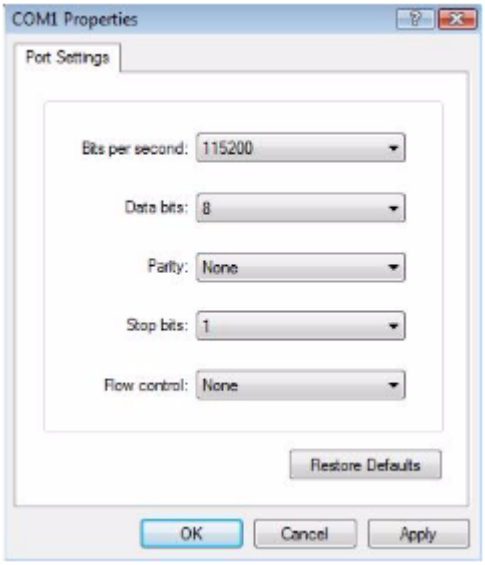
표 5-1 Remote 설정 파라미터

Parameter	Input Range	Description
Type	USB2RS232C	Select the device type to connect. Fixed to USB2RS232C.
BPS	115200	Set the data transmission speed. The data transmission speed must be the same on the PC. Fixed to 115000.

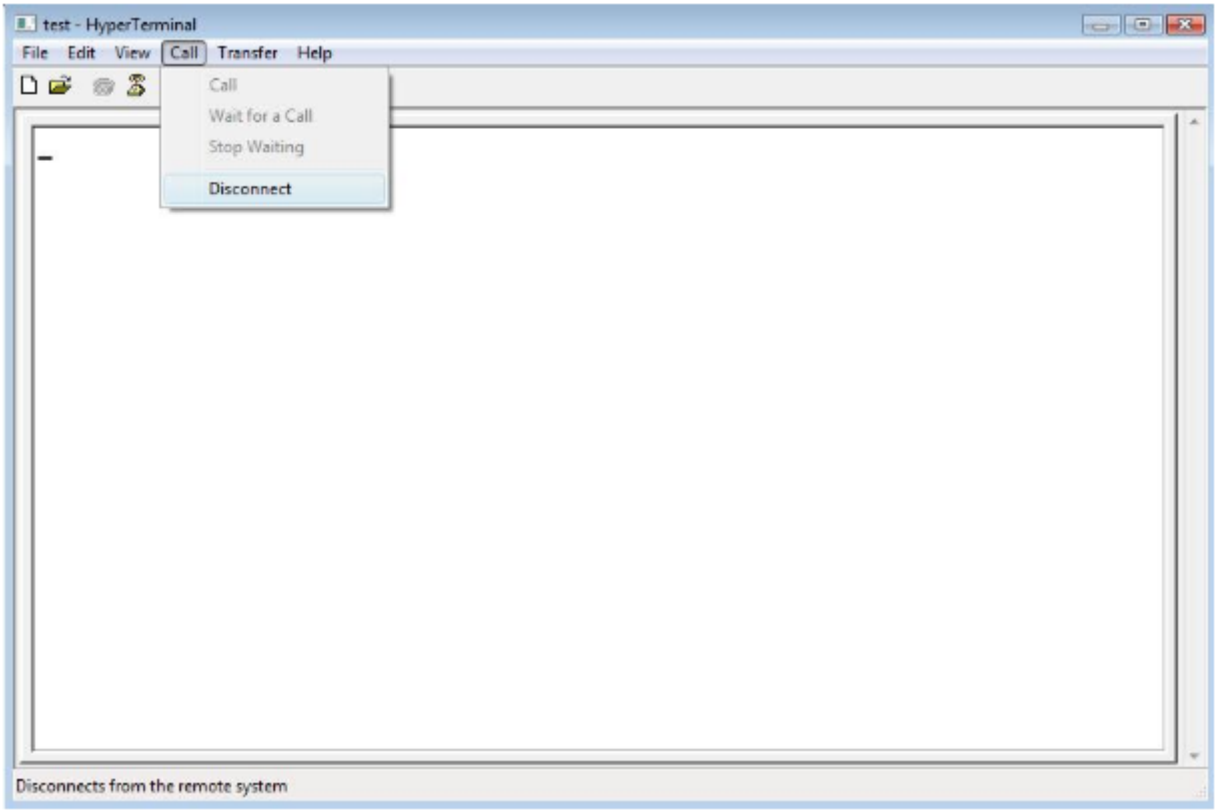
5.1.3 Checking the Connection Status

The user can check the connection status between the PC and TC-2800A and connection status using the Hyper Terminal of Microsoft.

1. Check the COM Port number where the USB to RS232C driver is installed on the Device Manager program of the PC.
2. Select Start → Program → Auxiliary Programs → Communication → Hyper Terminal.
3. Enter “RS232 Test” in the Name Field and click OK.
4. Check the modem to be used for connection and set the COM port number.
5. Set the COM Port as shown below and click OK.

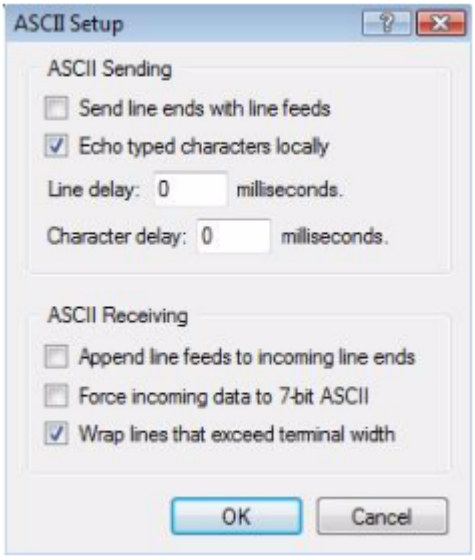


6. Select the Call - Disconnect menus.



7. Select File → Properties tab and click the ASCII Setting button.

8. Select the fields to add LF at the end of the line and to display the inputted characters on the scre en.



9. Type any character and press Enter. In case of normal connection, an unknown command error w ill be displayed. If the user enters a command such as “AT%CONF:RF_OUT ON” and presses Enter, OK will be displayed as a response.

5.2 Writing the RS-232C Control Program for Windows

5.2.1 Programming Instructions

1. Set the port (COM1-COM4).
2. Set Baud Rate, Parity Bit (None), Data Bit (8-bit), and Stop Bit (1-bit).
3. Open the port (COM1-COM4).
4. Send the RS-232C command to the serial port.
5. Check the command execution status on the TC-2800A screen.
6. Once the command is executed, a response will arrive. After the response is received, the next signal will be sent.

5.2.2 Notes for Programming

1. Use colons between commands.
2. Blank space is not allowed except as a parameter value.
3. For command transmission, LF (Line Feed, Chr (10)) is sent with each command.
4. For the Write command, “ACK” to the query command will be sent as response. After receiving a response, send the command.

5.3 RS-232C Command List

표 5-2 RS-232C Command List

COMMAND	Range	Description
AT%READ:FREQ?		Checks the frequency
AT%CONF:PATH_LOSS	0 ~ 50	Sets the compensation for power loss
AT%READ:PATH_LOSS?	0 ~ 50	Checks the compensation for power loss
AT%CONF:POW	0.0 ~ -130.0	Sets the power of Setup->SG
AT%READ:POW?	0.0 ~ -130.0	Checks the power of Setup->SG
AT%CONF:RF_OUT	ON, OFF	Turns on/off the RF output
AT%READ:RF_OUT?	ON, OFF	Checks the RF output status
AT%CONF:VCTY	-15000 ~ 15000	Sets the Doppler velocity
AT%READ:VCTY?		Checks the Doppler velocity setting
AT%CONF:PROT:TYPE GPS		Sets the protocol as GPS
AT%CONF:PROT:TYPE CW		Sets the protocol as CW
AT%CONF:PROT:TYPE GLONASS		Sets the protocol as GLONASS
AT%CONF:PROT:TYPE BeiDou		Sets the protocol as BeiDou
AT%READ:PROT:TYPE?	GPS, CW, GLONASS, BeiDou	Checks the protocol setting
AT%READ:PROT:ALL:NO_OF_SATELL?	1	Checks NO_OF_SATELL of Protocol->ALL
AT%CONF:PROT:ALL:WEEK_NUM	0 ~ 1023	Sets Week_Number of Protocol->ALL
AT%READ:PROT:ALL:WEEK_NUM?		Checks Week_Number of Protocol->ALL
AT%CONF:PROT:ALL:START_TOW	0 ~ 100799	Sets Start_TOW of Protocol->ALL
AT%READ:PROT:ALL:START_TOW?		Checks Start_TOW of Protocol->ALL
AT%CONF:PROT:CH1:PRN_NUM	GPS: 1 ~ 32 BeiDou: 1 ~37	Sets PRN_Number of Protocol->CH1
AT%READ:PROT:CH1:PRN_NUM?		Checks PRN_Number of Protocol->CH1
AT%CONF:LCD	ON, OFF	Turns on/off the LCD screen
AT%READ:LCD?	ON, OFF	Checks the LCD screen power status
AT%READ:SERIAL?		Reads the serial number of TC-2800A
AT%READ:OPTION?	GPS,GLONASS or G PS,GLONASS BeiDou	Reads the option of TC-2800A
AT%READ:IDN?		Reads the firmware version of TC-2800A
AT%RST		Resets the devices
AT%CONF:SETUP:BASIC:CH_NUM	-7~6	Sets the channel number of GLONASS
AT%READ:SETUP:BASIC:CH_NUM?		Checks the channel number of GLONASS
AT%CONF:PROT:CH1:SAT_IDX	1~24	Sets the satellite number of GLONASS
AT%READ:PROT:CH1:SAT_IDX?		Checks the satellite number of GLONASS
AT%CONF:PROT:ALL:TK_HOUR	0~23	Sets Hour data for tk parameter setting
AT%READ:PROT:ALL:TK_HOUR?	0~23	Checks Hour data for tk parameter setting

COMMAND	Range	Description
AT%CONF:PROT:ALL:TK_MIN	0~59	Sets MINUTE data for tk parameter setting
AT%READ:PROT:ALL:TK_MIN?		Checks MINUTE data for tk parameter setting
AT%CONF:PROT:ALL:TK_SEC	0 or 1	Sets Second data for tk parameter setting
AT%READ:PROT:ALL:TK_SEC?		Checks Second data for tk parameter setting
AT%CONF:PROT:ALL:N_4	1~31	Sets the four-year unit for leap year setting
AT%READ:PROT:ALL:N_4?		Checks four-yearly unit for leap year setting.
AT%CONF:PROT:ALL:N_T	1~1461	Sets the calendar day for the leap year setting
AT%READ:PROT:ALL:N_T?		Checks the calendar day for the leap year settin g
AT%CONF:PROT:ALL:MSG	ON, OFF	Turns on/off the messages
AT%READ:PROT:ALL:MSG?		Checks the message on/off status
AT%CONF:PROT:ALL:PARITY	ON, OFF	Turns on/off the parity
AT%READ:PROT:ALL:PARITY?		Checks the parity on/off status
AT%CONF:PROT:ALL:MEANDER	ON, OFF	Sets the MEANDER Coding On/Off
AT%READ:PROT:ALL:MEANDER?		Checks the MEANDER Coding On/Off
AT%READ:EXT_PPS?	ON, OFF	Checks IO_1 SYNC of TC-2800A
AT%READ:EXT_REF?	ON, OFF	Checks 10M REF_CLK
AT%CONF:SETUP:BASIC:CW_CH_NUM	GPS_L1, GLONASS_ -7 ~ GLONASS_+6, BeiDou_B1	Sets the CW output channel
AT%READ:SETUP:BASIC:CW_CH_NUM?		Checks the CW output channel