5870B

GNSS Time & Frequency Generator

Operation Instructions

Document Version: 2025-10-14

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Safety Requirements

Thank you for choosing our product. Please read this manual carefully before using the instrument for the first time. It will help you operate the instrument proficiently.

We continuously improve our products; therefore, the instrument you are using may differ slightly from this manual. If any changes are made, we will inform you by providing supplementary documentation. Should you have any questions, please contact our after-sales service department.

> **WARNING:** Input and output terminals may carry voltage. Electrical sparks may be generated when connecting or disconnecting test leads and power cords. Exercise caution to avoid electric shock. Always prioritize personal safety.

Prevent Fire or Personal Injury

- Use appropriate power cords. Only use power cords that are specific to this product and meet its specifications.
- Product grounding. This product must be grounded through the grounding wire of the power cord, and the grounding post on the product chassis must also be grounded. To prevent electric shock, the grounding conductor must be connected to earth ground. Before connecting to the input or output terminals of this product, ensure that the product is properly grounded.
- Observe all terminal ratings. To prevent fire or electric shock hazards, please pay attention to all ratings and markings of this product. Before connecting this product, please read this user manual for further information on the rated values.
- Do not operate when a malfunction is suspected. If you suspect that this product is damaged, please contact our maintenance personnel and do not continue to operate it.
- Do not operate in humid environments.
- Do not operate in explosive environments.
- Keep the product surface clean and dry.

Safety Precautions

The product manufacturer has ensured complete safety under correct usage conditions when designing this product.

- Please carefully follow the safety guidelines in this manual to avoid personal injury or damage to the instrument.
- Be sure to operate and use the instrument according to the instructions in this manual.
- This instrument does not contain hazardous substances.
- Instrument maintenance must be performed by qualified technicians only.

A. Panel Instructions

1. Front Panel

The front panel features five LED indicators:

- Power: Single green indicator. The green light remains on when the device is powered on; otherwise, it stays off.
- Status: Single green indicator. The light is on when the device is functioning normally, and off when abnormal.
- Locked: Single green indicator. When the internal crystal oscillator is locked to the external reference, the green light remains on; otherwise, it stays off.
- Time: After the device output time becomes valid, it flashes at a frequency of 1 Hz; otherwise, it remains off.
- Reset: Reset button. Press and hold for 5 seconds to restore the internal state of the device to its factory default configuration.

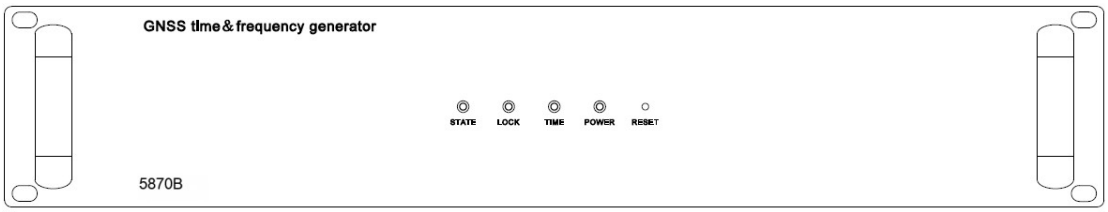


Figure 1: Front Panel Diagram

2. Rear Panel

The rear panel of the GNSS time frequency generator host includes the following connectors: Grounding Post, Power Switch, AC Power Input, GNSS Antenna Input Interface (x1), 10 MHz Output Interface (x6), TOD Interface (x1), NTP Network Timing Output Interface (x3), and Monitoring Network Interface (x1).

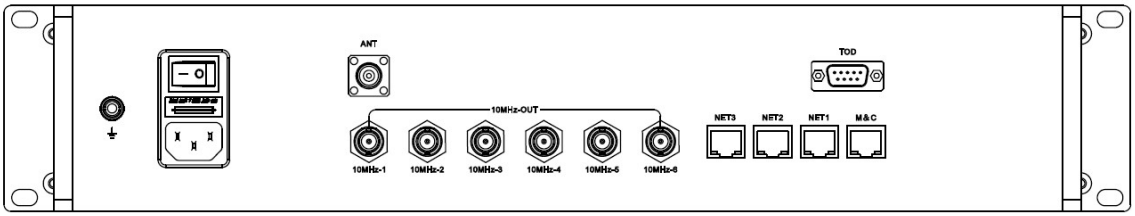


Figure 2: Rear Panel Diagram

Rear panel connector definitions are listed in the following table:

No.	Connector	Signal	Type	Pin	Signal	Direction	Note
1	Antenna	RF signal	TNC	Core	RF_SIG	Input	
1				Shell	GND		
2	10MHz-OUT	Sine	BNC	Core	10MHz	Output	x6
2				Shell	GND		
3	TOD	RS232	DB9	Pin 2	RX	In/Out	
3				Pin 3	TX		
3				Pin 5	GND		
3				Shell	GND		
4	NTP (x3)	Gigabit	RJ45	-	-	Bidirectional	
5	Monitor	Gigabit	RJ45	-	-	Bidirectional	

B. Use and Operation

1. Device Overview

The GNSS time frequency generator features a built-in oven-controlled crystal oscillator (OCXO) and a GNSS receiver module. It receives satellite data signals through an antenna to perform frequency disciplining and local time calibration. The device outputs 1 channel of TOD signal, 6 channels of 10 MHz frequency standard signal, and 4 channels of NTP network signal. Each network port supports web management, NTP timing, SNMP, TCP/UDP, and Telnet functions; however, they cannot operate on the same network segment simultaneously.

2. Startup Preheating

The GNSS time frequency generator contains a built-in oven-controlled crystal oscillator. After the device is powered on, the system allocates a 10-minute preheating period to ensure that the physical components of the OCXO have reached stable operating conditions before frequency disciplining can begin.

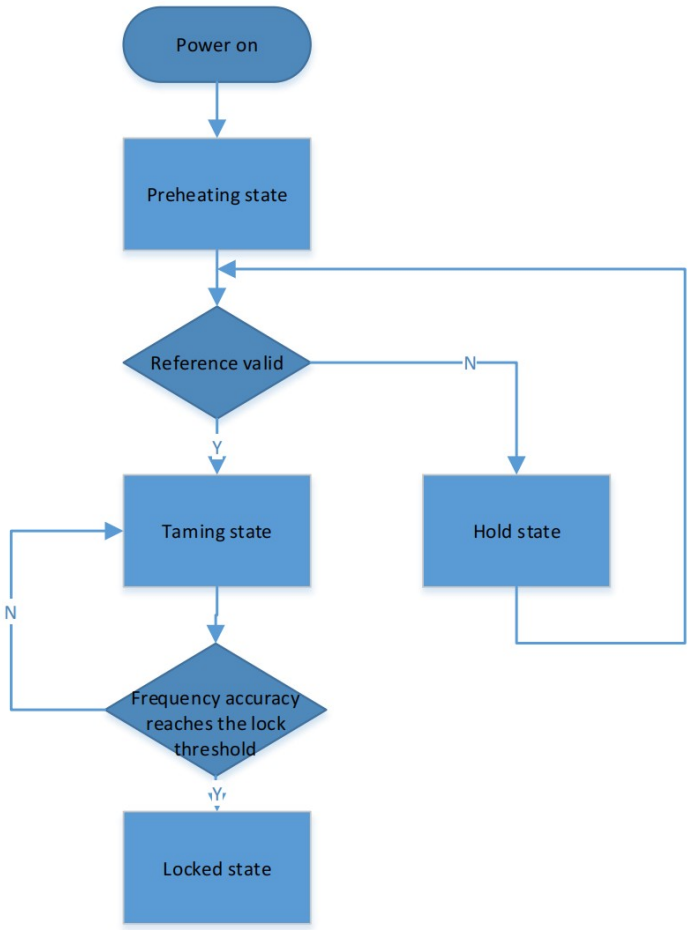
3. Working Status

As shown in the workflow below, the device enters a preheating state by default after being powered on. During this period, the device performs only time calibration with an external reference and does not adjust the internal frequency source.

After the preheating period, if a valid reference is available, the device enters the frequency disciplining state. When the accuracy of the internal frequency source reaches the lock threshold, it transitions to the locked state.

After preheating, if all references are invalid, the device enters the holdover state.

Condition	State	Description
Power On	Preheating	Time calibration only; frequency disciplining not active
Preheating + Valid ref	Disciplining	Internal frequency source being adjusted to reference
Preheating + Invalid ref	Holdover	Using stored calibration parameters
Freq accuracy in threshold	Locked	OCXO locked to external reference



Work status flowchart

Table 1: Working Status Flowchart

4. Reference Source Selection

The device can receive GNSS satellite references for time-frequency calibration. The satellite signal can be configured as any of the four operating frequencies: BDS, GPS, GLONASS, and GALILEO, and can also operate in any combination mode.

The device supports two reference source selection modes: automatic and manual. In automatic mode, the device automatically selects the currently valid reference for frequency and time calibration. In manual mode, users can select the desired reference source. When selecting manually, ensure that the reference signal is properly connected before the operation.

5. Operation Instructions

5.1 SNMP Operation

5.1.1 Opening the Software

Open the SNMP test software MibBrowser by double-clicking browser.bat in the software directory.

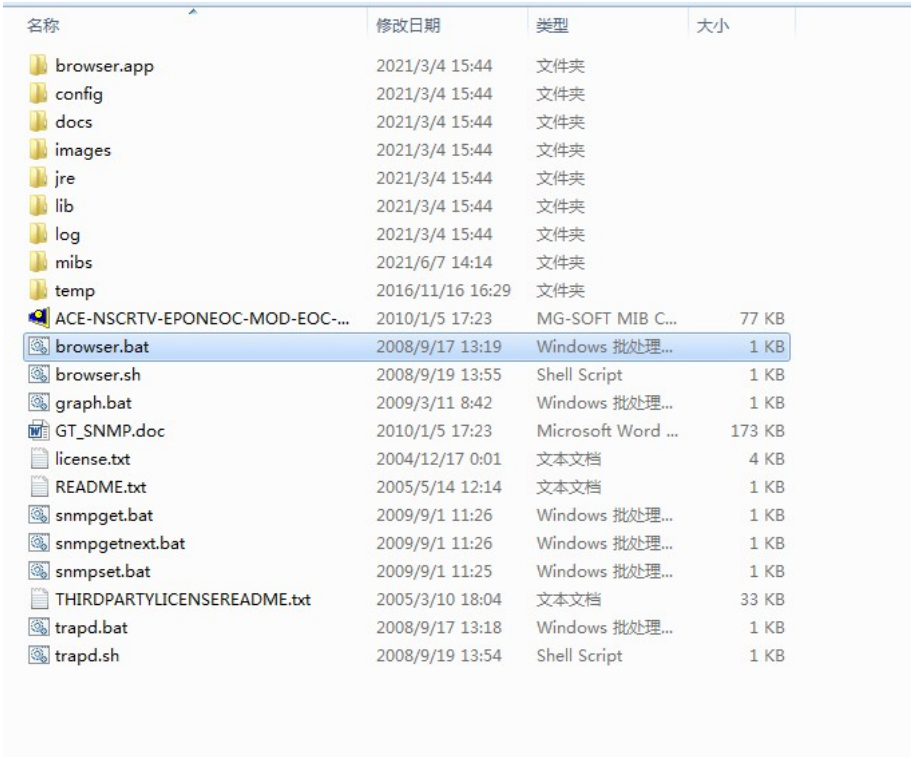


Figure 3: SNMP Software Directory - Double-click browser.bat

5.1.2 Loading MIB Files

Click File -> Load MIBs. In the dialog box that appears, select the 5870B.my file and click Open to load the MIB file.

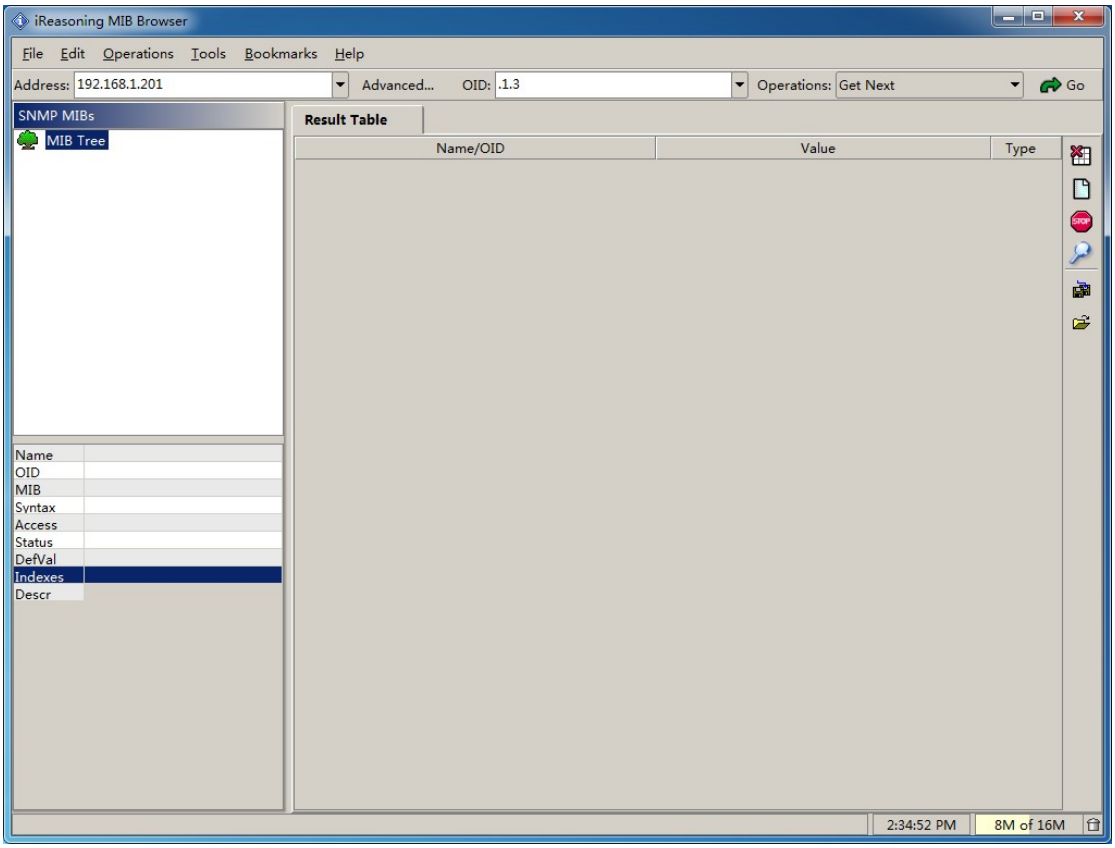


Figure 4: MIB Browser Main Interface

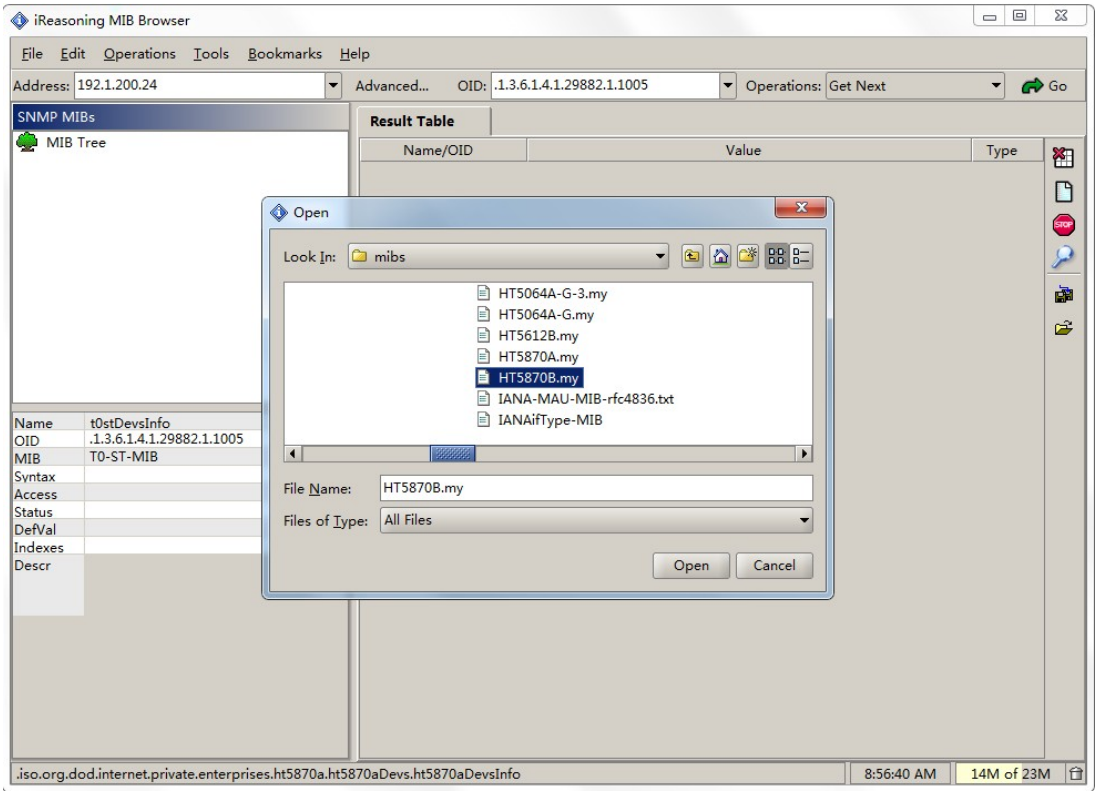
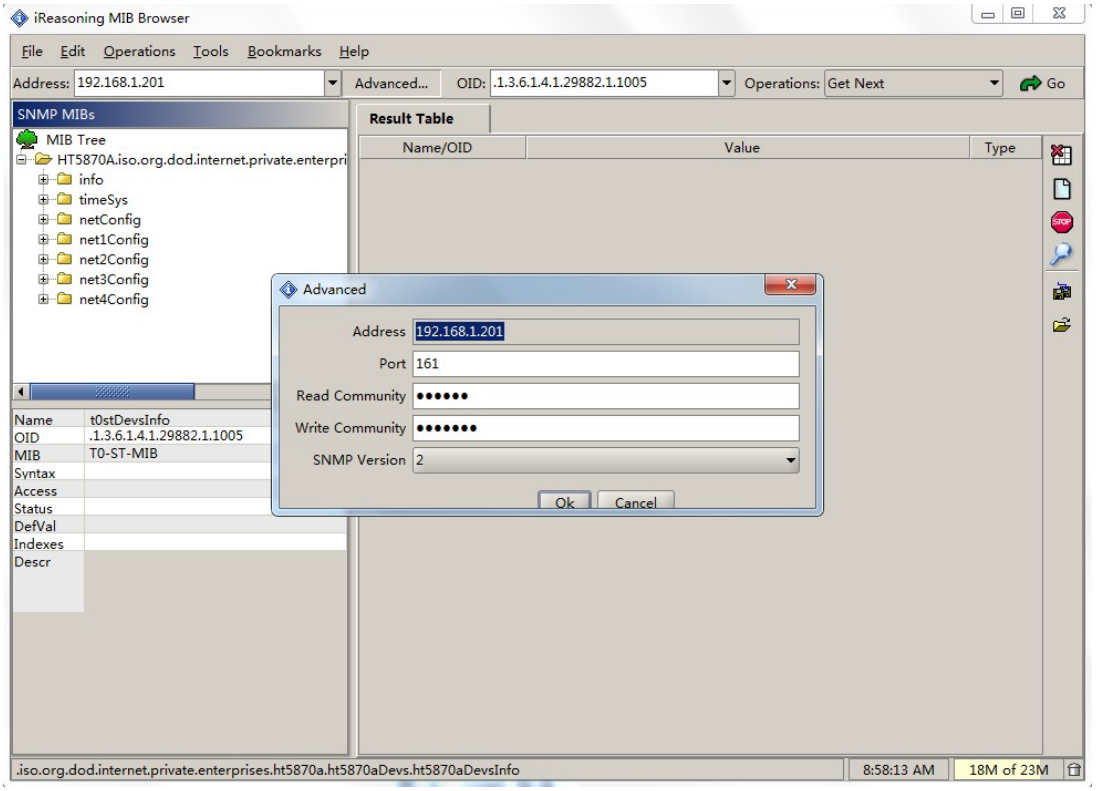


Figure 5: Loading the MIB File

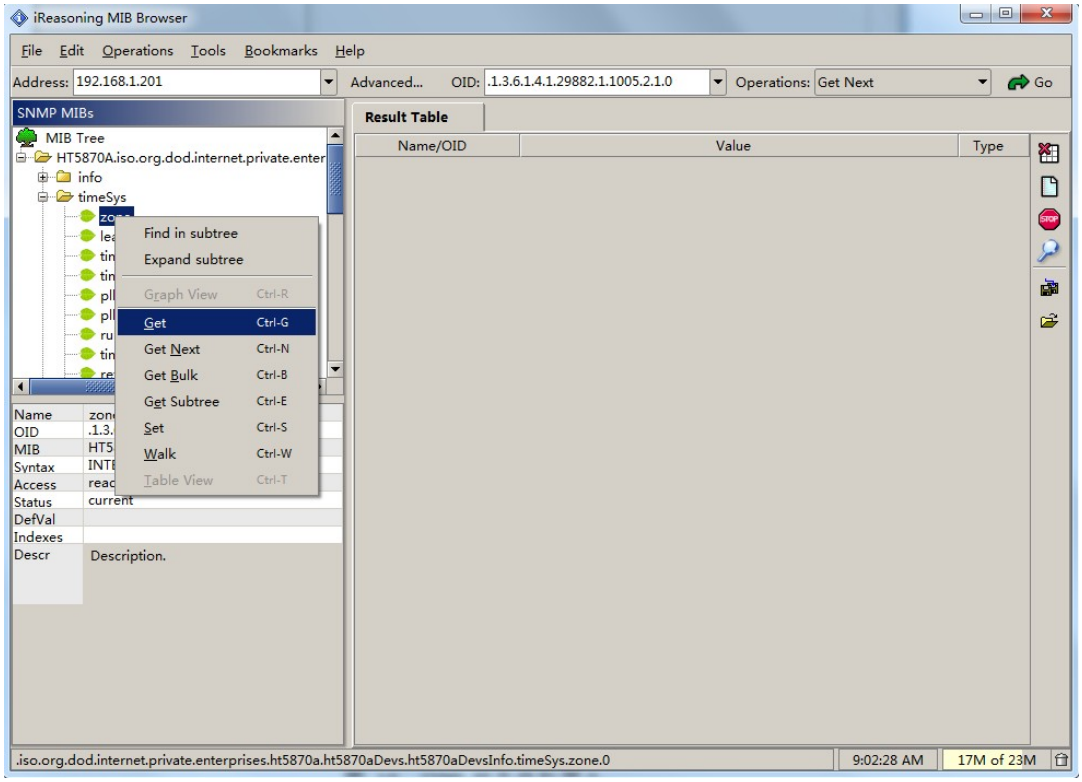
5.1.3 Software Configuration

Enter the device's SNMP network port IP address in the Address field. Click Advanced, set Read Community and Write Community to "public" and "private" respectively, select SNMP Version 2, and click OK to complete the configuration.

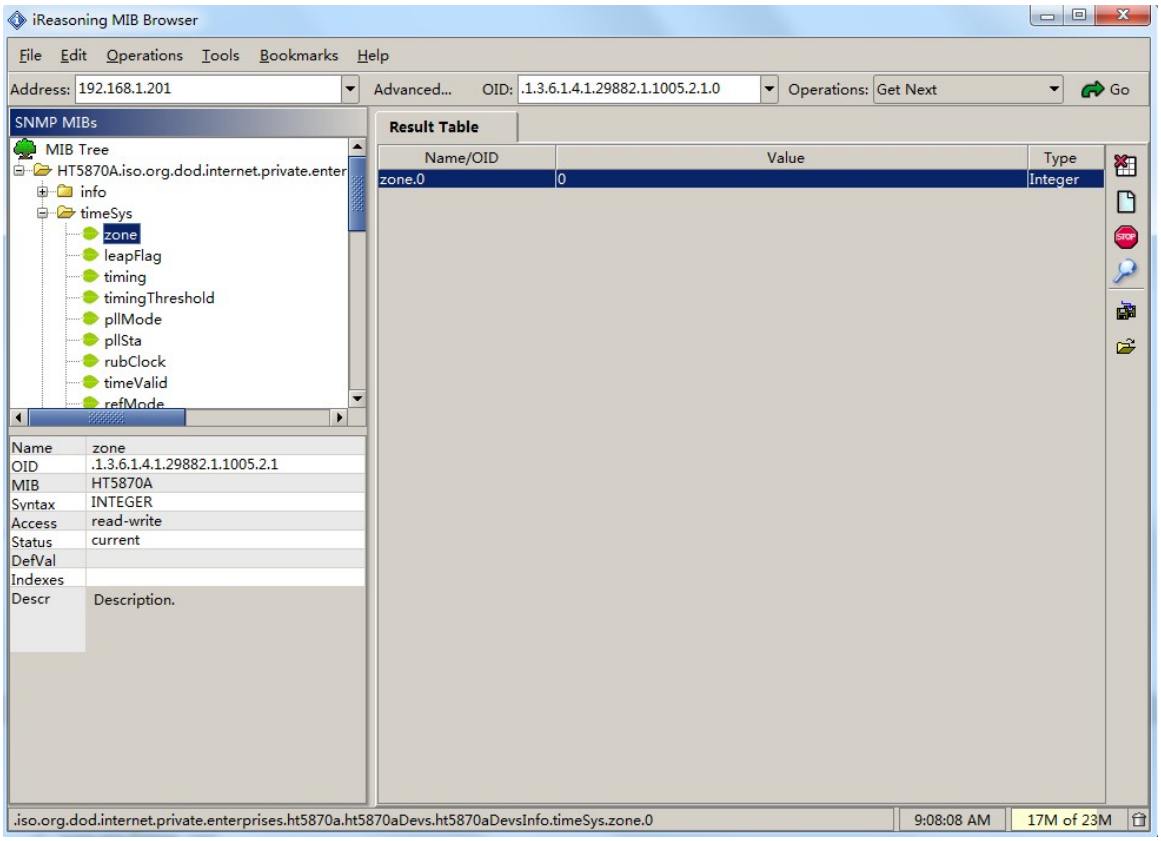


5.1.4 Obtaining Status and Settings

To check the read and write functions of SNMP on the device, click on timeSys, right-click on the zone node, and select Get in the pop-up dialog to obtain the node value.

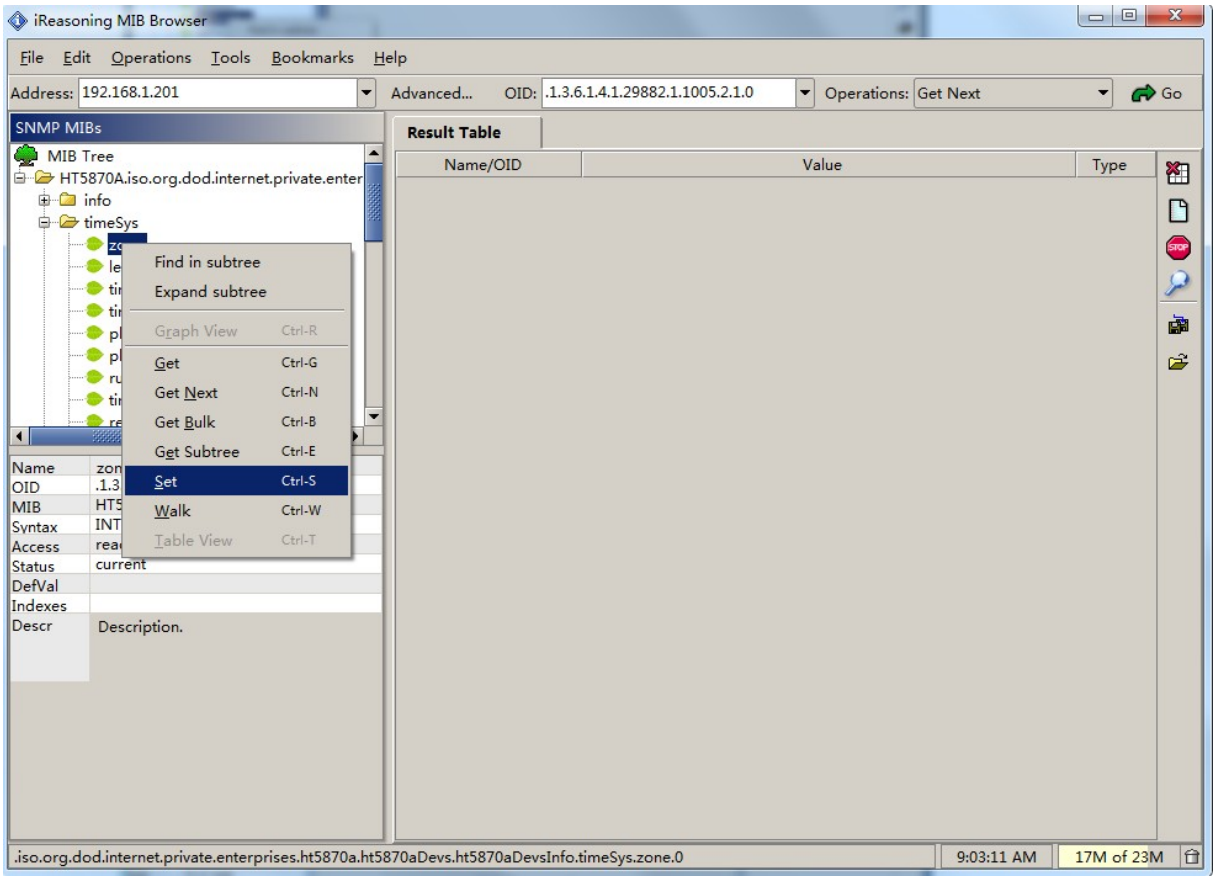


SNMP Status acquisition diagram 1

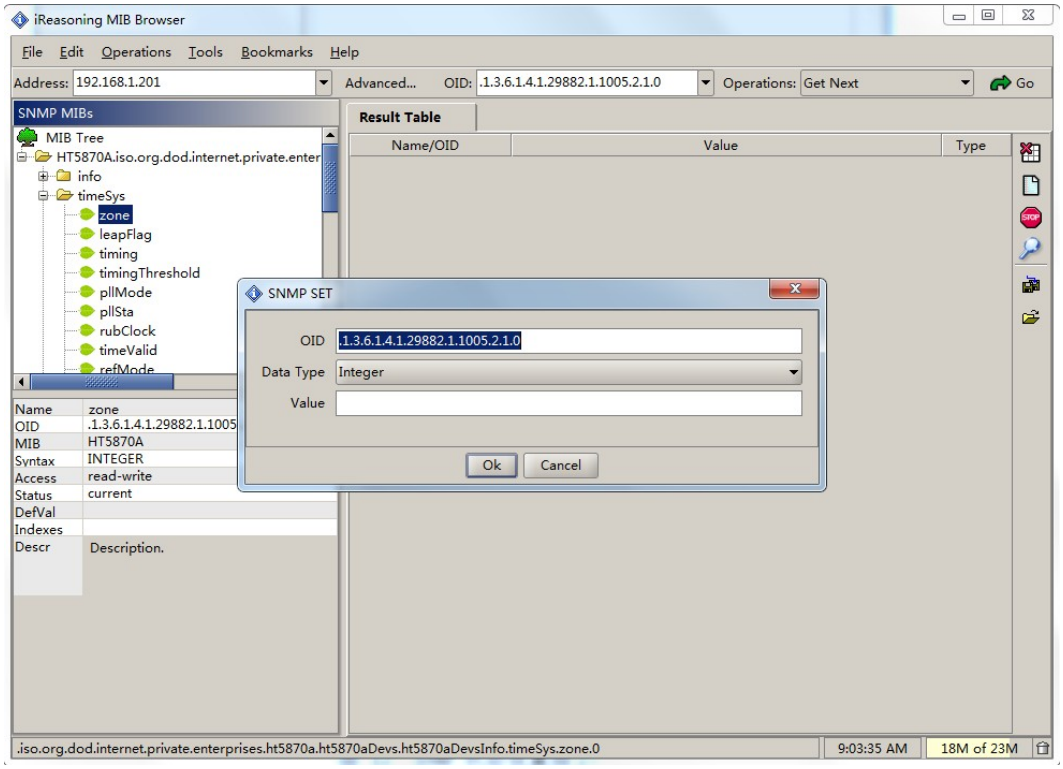


SNMP Status acquisition diagram 2

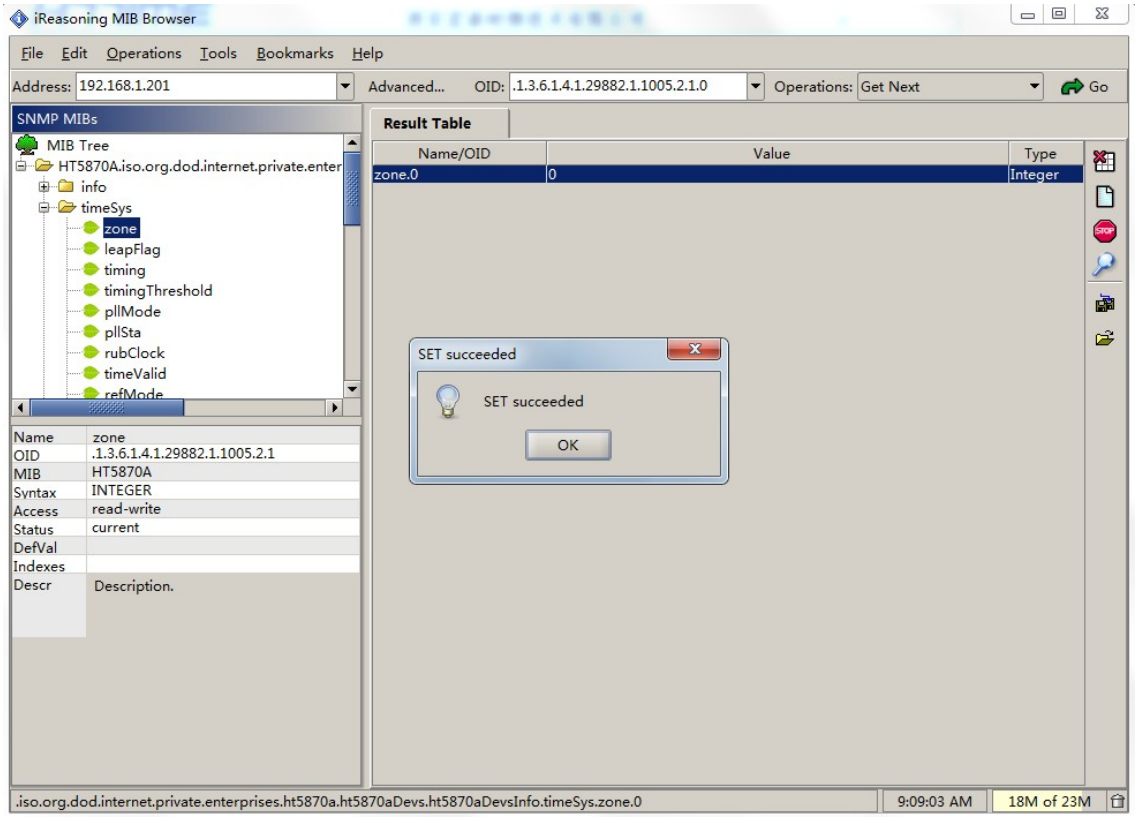
To verify the read and write functions, right-click on the zone node and select Set in the pop-up dialog to set the node value.



SNMP Status acquisition diagram 1

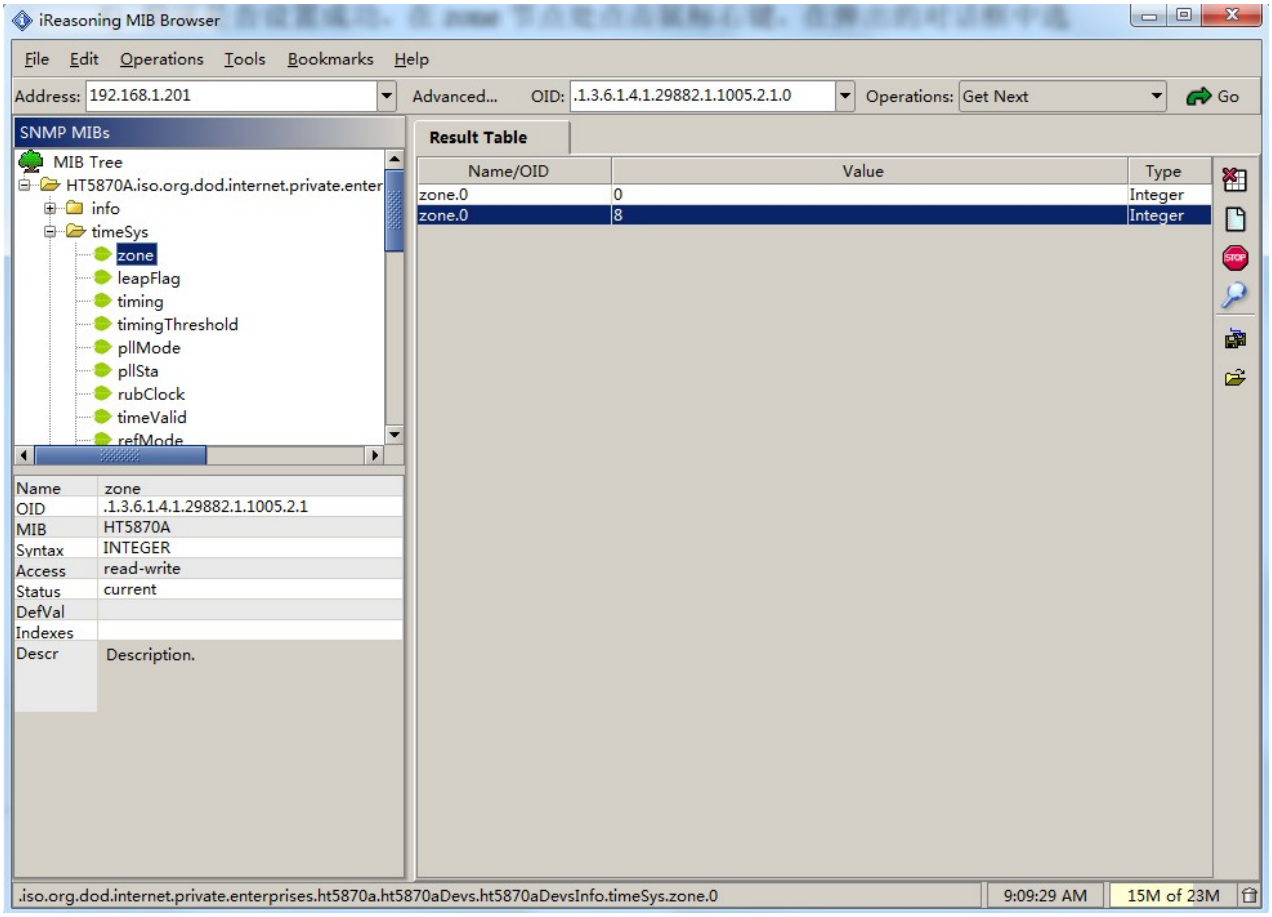


SNMP Status acquisition diagram 2



SNMP Status acquisition diagram 3

To verify if the setting was successful, right-click on the zone node and select Get to retrieve the node value again.



SNMP Status acquisition diagram 4

5.1.5 Other Node Settings

Similar to Step 5.1.4 above, specific node operations can be performed according to the protocol definitions. Note that some nodes are read-only, some are write-only, and some are readable and writable.

5.2 SNMP Protocol Definition

a) BDS/Time System Information Management

Info OID: .1.3.6.1.4.1.29882.1.1005.1.x

No.	Name	Definition	Format	Length	R/W	Description
1	productDate	Factory date	OCTET STR	0-32 B	R	
2	serialNumber	Serial number	INTEGER	4 B	R/W	
3	bdState	BDS status	INTEGER	4 B	R	0: Invalid, 1: Valid
4	lockSatNumber	Locked sats	INTEGER	4 B	R	Number of locked satellites
5	lon	Longitude	OCTET STR	0-32 B	R	Format: dddff.xxxxxx E
6	lat	Latitude	OCTET STR	0-32 B	R	Format: ddff.xxxxxx N
7	alt	Altitude	OCTET STR	0-32 B	R	Unit: meters
8	utcDate	UTC date	OCTET STR	0-32 B	R	Example: 2016:06:26
9	utcTime	UTC time	OCTET STR	0-32 B	R	Example: 13:12:34
10	AntSta	Antenna status	INTEGER	4 B	R	0: Invalid, 1: Valid

timeSys OID: .1.3.6.1.4.1.29882.1.1005.2.x

No.	Name	Definition	Format	Length	R/W	Description
1	zone	Time zone	INTEGER	4 B	R/W	Range: -12 to +12
2	leapFlag	Leap second	INTEGER	4 B	R/W	0: None, 1: +, 2: -
3	timing	Timing mode	INTEGER	4 B	R/W	0: Auto, 1: Manual
4	timingThreshold	Threshold	INTEGER	4 B	R/W	Range: 0-100s
5	pllMode	PLL mode	INTEGER	4 B	R/W	0: Discipline, 1: Free run
6	pllSta	PLL state	INTEGER	4 B	R	1: Disc, 2: Hold, 3: Preheat, 4: Lock
7	rubClock	Clock status	INTEGER	4 B	R	0: Unlocked, 1: Locked
8	timeValid	Time validity	INTEGER	4 B	R	0: Invalid, 1: Valid
9	refMode	Reference mode	INTEGER	4 B	R/W	0: Auto, 1: Manual
10	ref	Current ref	INTEGER	4 B	R/W	0: Inv, 1: GNSS, 2: 1PPS+TOD
11	refSta	Reference status	OCTET STR	0-32 B	R	Reserved/GNSS/1PPS+TOD
12	phaseDiff	Phase diff	INTEGER	4 B	R	Unit: ns
13	freqAccuracy	Freq accuracy	OCTET	0-32 B	R	Example: +1.3E-12

No.	Name	Definition	Format	Length	R/W	Description
			STR			
14	daValue	VCO value	INTEGER	4 B	R	0-65536 (0-5V)
15	phaseShift	Phase shift	INTEGER	4 B	R/W	Unit: 1ns
16	pulseWidth	Pulse width	INTEGER	4 B	R/W	10000-500000000 ns
17	singleSync	Single sync	INTEGER	4 B	W	1: Valid
18	setClock	Clock setting	OCTET STR	0-32 B	W	yyyymmddhhmmss
19	temperature	Temperature	INTEGER	4 B	R	Unit: Celsius
20	b_code_delay	B-code delay	INTEGER	4 B	R/W	Unit: 1ns
21	recv_mode	Receiver mode	INTEGER	4 B	R/W	Bit 0-3: BDS/GPS/GLO/GAL

b) Network Management - Target IP and Port

netConfig OID: .1.3.6.1.4.1.29882.1.1005.3.x

No.	Name	Definition	Format	Length	R/W	Description
1	netTargetIP	Target IP	OCTET STR	32 B	R/W	Null-terminated string
2	netTcpPort	TCP port	INTEGER	4 B	R/W	Default: 2000
3	netUdpPort	UDP port	INTEGER	4 B	R/W	Default: 3000
4	netTargetPort	Target port	INTEGER	4 B	R/W	Default: 3001

c) Network Port 1 Management

net1Config OID: .1.3.6.1.4.1.29882.1.1005.4.x

No.	Name	Definition	Format	Length	R/W	Description
1	net1IPAddr	IP address	OCTET STR	32 B	R/W	Null-terminated string
2	net1Mask	Subnet mask	OCTET STR	32 B	R/W	Null-terminated string
3	net1GateWay	Default gateway	OCTET STR	32 B	R/W	Null-terminated string

d) Network Port 2 Management

net2Config OID: .1.3.6.1.4.1.29882.1.1005.5.x

No.	Name	Definition	Format	Length	R/W	Description
1	net2IPAddr	IP address	OCTET STR	32 B	R/W	Null-terminated string
2	net2Mask	Subnet mask	OCTET STR	32 B	R/W	Null-terminated string
3	net2GateWay	Default gateway	OCTET STR	32 B	R/W	Null-terminated string

e) Network Port 3 Management

net3Config OID: .1.3.6.1.4.1.29882.1.1005.6.x

No.	Name	Definition	Format	Length	R/W	Description
1	net3IPAddr	IP address	OCTET STR	32 B	R/W	Null-terminated string
2	net3Mask	Subnet mask	OCTET STR	32 B	R/W	Null-terminated string
3	net3GateWay	Default gateway	OCTET STR	32 B	R/W	Null-terminated string

f) Network Port 4 Management

net4Config OID: .1.3.6.1.4.1.29882.1.1005.7.x

No.	Name	Definition	Format	Length	R/W	Description
1	net4IPAddr	IP address	OCTET STR	32 B	R/W	Null-terminated string
2	net4Mask	Subnet mask	OCTET STR	32 B	R/W	Null-terminated string
3	net4GateWay	Default gateway	OCTET STR	32 B	R/W	Null-terminated string

5.3 WEB Operation

Through the device's network monitoring port, you can log in using a web browser to view and configure device status and settings.

5.3.1 Login

After the device is powered on, connect the monitoring network port to your computer. Open a web browser, enter the device IP address, and input the username "admin" and password "123456".

Figure 6: WEB Login Interface

5.3.2 Work Status Menu

Click the "Device Monitor" menu on the left side of the page to view and configure device operating status information.

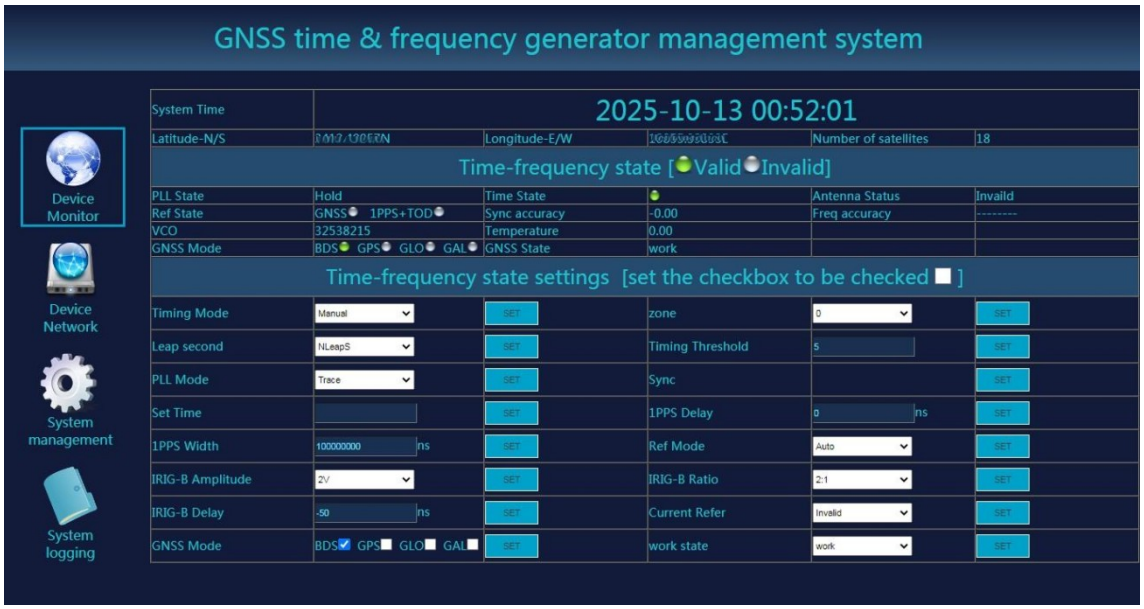


Figure 7: Work Status Menu

5.3.3 Network Settings Menu

Click the "Device Network" menu on the left side of the page to view and configure network port information.

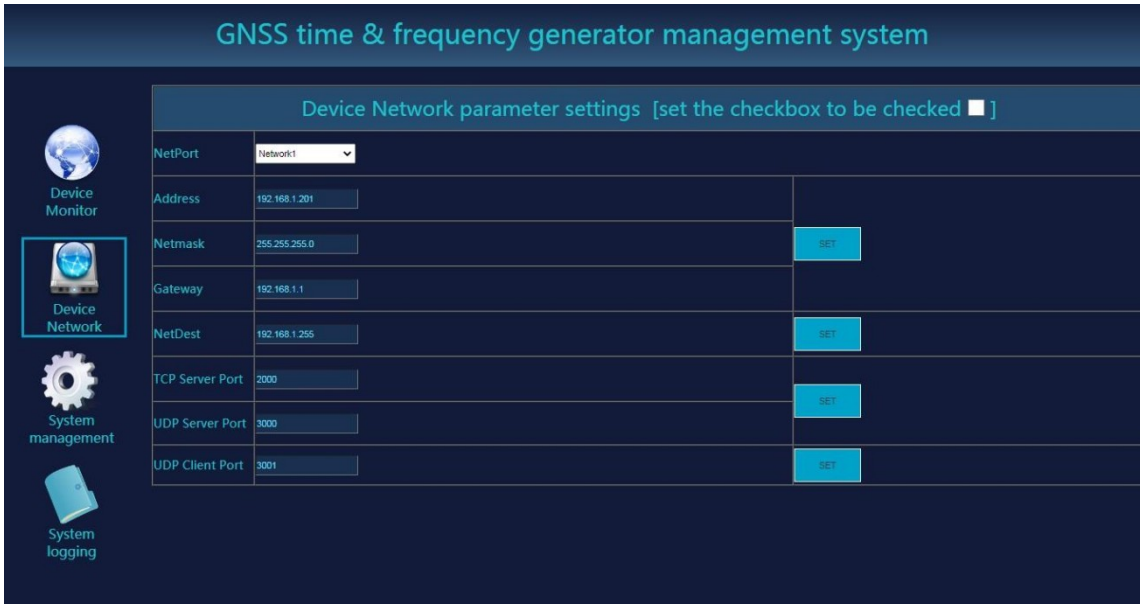


Figure 8: Network Settings Menu

5.3.4 System Management Menu

Click the "System Management" menu on the left side of the page to view device version information and perform remote firmware upgrades.

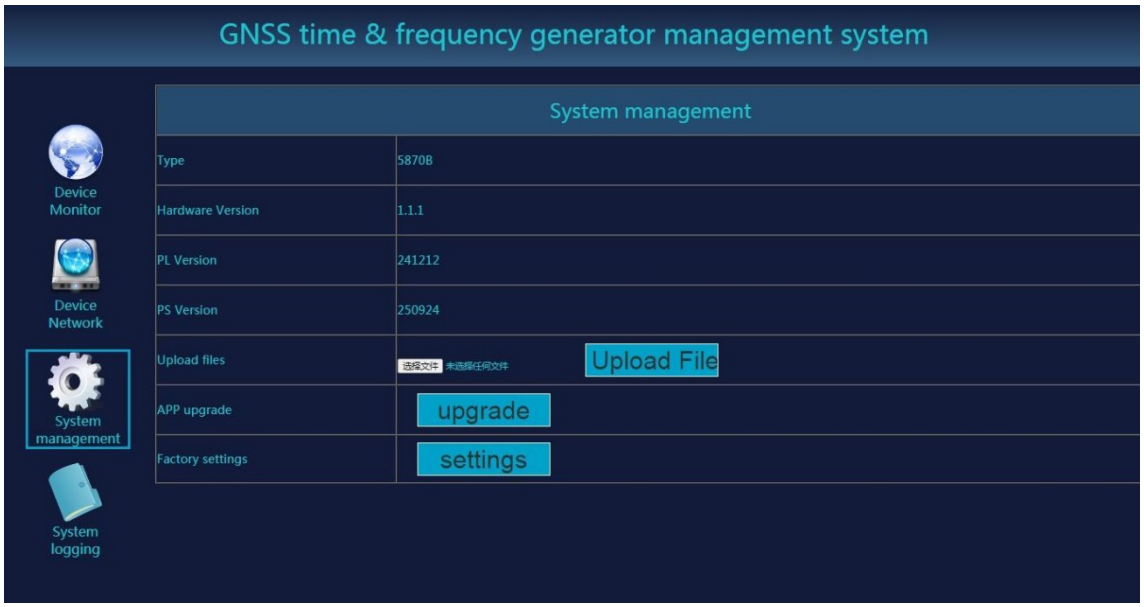


Figure 9: System Management Menu

5.3.5 Log Menu

Click the "System Logging" menu on the left side of the page to view operation log information.

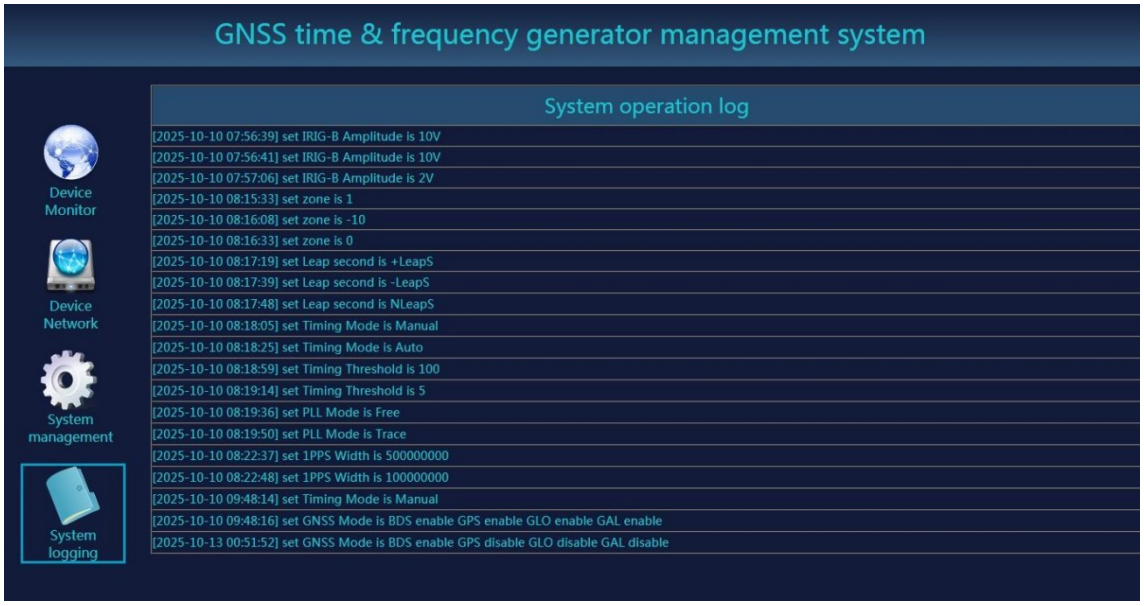


Figure 10: System Log Menu

6. Routine Operating Procedures

Preparation Before Power-On

1. Remove the instrument from the packaging box and place it on a flat operating table or rack.

2. Connect the grounding post of this unit securely to the power system ground.
3. Connect the power cord securely to the local power input interface. Turn on the power switch on the front panel and use a multimeter to measure the static resistance between the live wire and ground wire, and between the neutral wire and ground wire of the power cord plug. An open-circuit state is considered normal. Then turn off the power switch.

Power-On Procedure

1. Connect the power cord securely to the power outlet and turn on the device power switch. Observe whether the power indicator on the front panel is normal.
2. After the device completes its self-test, the "Status" indicator should be green and steadily lit.

C. Maintenance and Troubleshooting

1. Daily Maintenance

During daily use, handle the device with care to avoid vibration and impact while powered on. Ensure good grounding at all times and verify that the power supply is functioning properly. Regularly clean and maintain the exterior of the instrument.

2. General Fault Handling

- Device cannot be powered on: Check whether the power cord is properly connected. When using AC power, verify that the external power supply is functioning properly.
- Abnormal satellite acquisition: Check whether the antenna of the host device is in good contact, and ensure that the antenna installation location has a clear view of the sky.

D. Transportation and Storage

The product is packed and transported in a special packing box with anti-vibration soft foam lining. The product should not move inside the packaging box to ensure it is not damaged during transportation. The product should be placed horizontally during transportation and must not be exposed to rain.

The warehouse where products are stored should have good ventilation and maintain a dry environment. There should be no acidic or corrosive gases indoors, and no strong mechanical vibration.

E. Communication Protocol

The output protocol can be transmitted through the network and control serial port. The network communication protocol supports both TCP and UDP formats.

1. Output Protocol

1.1 Network Status Protocol

Format	$HTN,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>*xx\r\n	
Example	$HTN,1,0,192.168.1.201,255.255.255.0,192.168.1.1,192.168.1.210,3000,2000,2001*xx\r\n	
No.	Definition	Instruction
$HTA	Frame header	$HTN
Delimiter	‘,’	comma
<1>	Module Number	1：Network port 1； 2：Network port 2； 3：Network port 3； 4：Network port 4；
<2>	Information type （ n char ）	0: The working status of the module, with variable length
<3>	IP address（n char）	192.168.1.201
<4>	Subnet Mask（n char）	255.255.255.0
<5>	Default gateway（n char）	192.168.1.1
<6>	Target address（n char）	192.168.1.210
<7>	TCP port number（n char）	3000
<8>	UDP port number（n char）	2000
<9>	UDP Target port number（n char）	2001
Delimiter	‘*’	
Verification	xx	XOR sum, the XOR sum of all data between '$' and '*', except for '$' and '*'.
Frame end	\r\n	Enter and wrap

1.2 Version Information

Format	$HTV,<1>,<2>,<3>,<4>*xx\r\n	
Example	$HTV,5100,1.1.1,241129,241129*7F\r\n	
No.	Definition	Instruction
$HTV	Frame header	$HTV
Delimiter	‘,’	comma
<1>	Type（n char）（Type）	5100
<2>	Hardware version（n char）（Hardware Version）	1.1.1
<3>	PL version（n char）（PL Version）	241129
<4>	PS version（n char）（PS Version）	241129

1.3 System Working Status Output

Format	$HTF,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,<10>,<11>,<12>,<13>,<14>,<15>,<16>,<17>,<18>,<19>,<20>,<21>,<22>*xx\r\n	
Example	$HTF	ASCII code
No.	‘ ’ ,	comma
<1>	time zone（n char）	z: Time zone, variable length, such as 8 indicates the East 8 zone, -11 indicates the west 11 zone
<2>	Leap second（1 char）	0 indicates no leap second, 1 indicates positive leap second, and 2 indicates negative leap second.
<3>	Timing Mode（1 char）	0: Automatic, 1: Manual
<4>	Time threshold (n char)	0: indicates 0. 100: indicates 100.
<5>	PLL Mode (1 char)	0: tame, 1: run freely
<6>	PLL State(1 char)	1: Taming, 2: Hold, 3: Preheat, 4: Lock
<7>	NC	NC
<8>	Time status (1 char)	0: Invalid, 1: Valid;
<9>	Reference mode (1 char)	0: Automatic, 1: Manual
<10>	Current reference source (1 char)	0: Invalid; 1: GNSS; 2:1PPS+TOD；

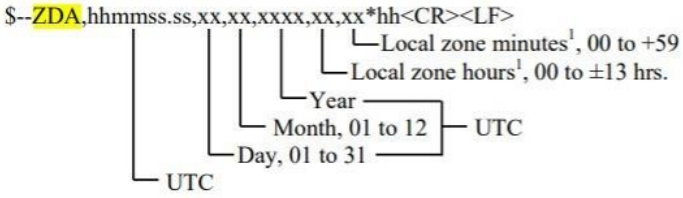
<11>	Reference state (6 char)	0: Invalid, 1: Valid; In turn: Reserved, receiver, 1PPS+TOD
<12>	Sync accuracy	unit :ns，For example, 100 indicates 100ns, -100 indicates -100ns
<13>	Freq accuracy（8 char）	When the calculated value is valid, such as ± 1.0E-12; When the calculated value is invalid, such as:--------
<14>	VCO（n char）	
<15>	1PPS Delay compensation (n char)	Reserved. Unit 1 indicates 1ns
<16>	1PPS Width (n char)	10000~500000000，Unit ns
<17>	Temperature	-25℃~+100℃
<18>	IRIG-B Delay (n char)	Unit 1 indicates 1ns
<19>	GNSS Mode (1 char)	Bit0~bit3： Identify separately: BDS、 GPS、 GLO、 GLE 0：disable，1：eable
<20>	NC	NC
<21>	NC	NC
<22>	Antenna Status（1 char）	0: not connected (Invaild), 1: normal (Vaild), 2: Fault (Fault)
Delimiter	‘*’	
Verification	xx	XOR sum, the XOR sum of all data between '$' and '*', except for '$' and '*'
Frame end	\r\n	Enter and wrap

1.4 Receiver Protocol

The receiver output protocol complies with the NMEA 0183 standard. The device defaults to outputting three message types: GGA, ZDA, and RMC.

ZDA – Time & Date

UTC, day, month, year and local time zone.



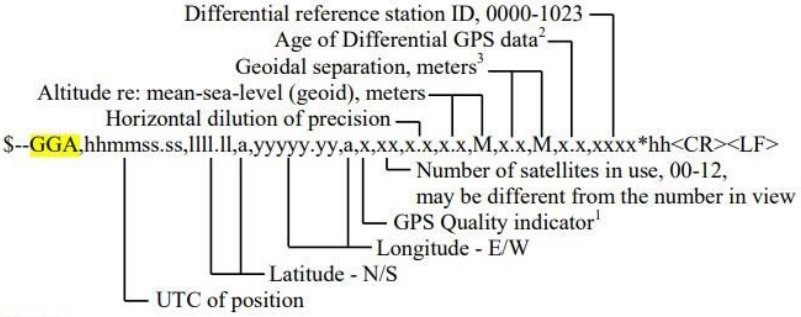
Notes:

1) Local time zone is the magnitude of hours plus the magnitude of minutes added, with the sign of local zone hours, to local time to obtain UTC. Local zone is generally negative for East longitudes with local exceptions near the International Date Line.

   For Example: At Chatham Is. (New Zealand) at 1230 (noon) local time on June 10, 1995 :
   $GPZDA,234500,09,06,1995,-12,45*6C<CR><LF>
   In the Cook Islands at 1500 local time on June 10, 1995:
   $GPZDA,013000,11,06,1995,10,30*4A<CR><LF>

GGA – Global Positioning System Fix Data

Time, position and fix related data for a GPS receiver.



Notes:

1) GPS Quality Indicator: All GPS quality indicators in heading 1-5 are considered valid. The GPS quality indicator filed shall not be a null field
   0 = Fix not available or invalid
   1 = GPS SPS Mode, fix valid
   2 = Differential GPS, SPS Mode, fix valid
   3 = GPS PPS Mode, fix valid
   4 = Real Time Kinematic. System used in RTK mode with fixed integers
   5 = Float RTK. Satellite system used in RTK mode, floating integers
   6 = Estimated (dead reckoning) Mode
   7 = Manual Input Mode
   8 = Simulator Mode
   The GPS Quality Indicator field shall not be a null field.

RMC – Recommended Minimum Specific GNSS Data

Time, date, position, course and speed data provided by a GNSS navigation receiver. This sentence is transmitted at intervals not exceeding 2-seconds and is always accompanied by RMB when a destination waypoint is active.

RMC and RMB are the recommended minimum data to be provided by a GNSS receiver. All data fields must be provided, null fields used only when data is temporarily unavailable.

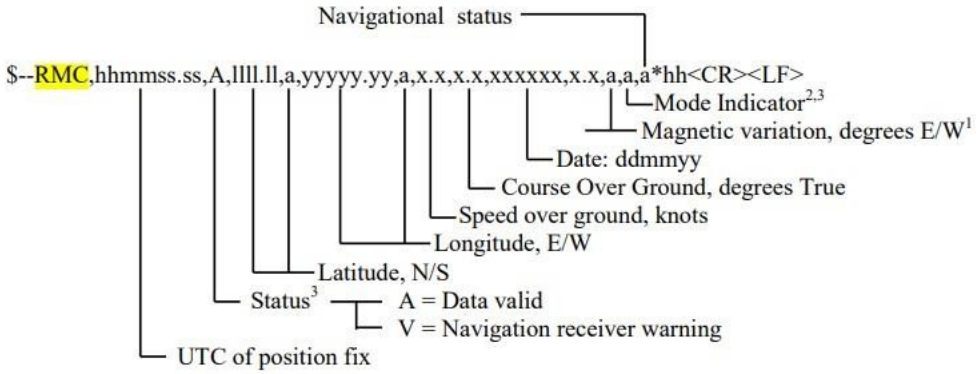


Figure 11: NMEA GGA Protocol Format

1.5 ZDA Time Information

Format	$HTZDA,<1>,<2>,<3>,<4>,<5>,<6>*xx\r\n	
Example	$HTZDA,073216.00,26,03,2021,00,01*xx\r\n	
No.	Definition	Instruction
Frame header	$HTZDA	ASCII code (ZDA time is standard UTC time)，
Delimiter	‘,’	comma
<1>	hhmmss.ss	hh: hour; mm: minute; ss: second
<2>	dd	dd:day
<3>	mm	mm:month
<4>	yyyy	yyyy:year
<5>	00	Reserved
<6>	00	01 ： Valid ， 00 Invalid
Delimiter	‘*’	
Verification	Xx	XOR sum, the XOR sum of all data between '$' and '*', except for '$' and '*'.
Frame end	\r\n	Enter and wrap

2. Control Protocol

The control protocol can be sent to the module through the network and control serial port. The network communication protocol supports both TCP and UDP formats.

2.1 Network Status Settings

Format	$HTSETN,<1>,<2>,<3>*xx\r\n	
Example	$HTSETN,1,2,192.168.1.210*xx\r\n	
No.	Definition	Instruction
$HTA	Frame header	$HTSETN
Delimiter	‘,’	comma
<1>	Module Number	1：network port 1； 2：network port 2； 3：network port 3； 4：network port 4；
<2>	Setup command (n char)	2: The target address of the module is variable in length
<3>	Target Address (n char)	192.168.1. 201
Delimiter	‘*’	
Verification	xx	XOR sum, the XOR sum of all data between '$' and '*', except for '$' and '*' .
Frame end	\r\n	Enter and wrap

Format	$HTSETN,<1>,<2>,<3>,<4>*xx\r\n	
Example	$HTSETN,1,3,3000,2000*xx\r\n	
No.	Definition	Instruction
$HTA	Frame header	$HTSETN
Delimiter	‘,’	comma
<1>	Module Number	1：network port；
<2>	Setup command (n char)	3: The port number of the module is variable in length
<3>	TCP server port number (n char)	3000
<4>	UDP server port number (n char)	2000
Delimiter	‘*’	
Verification	xx	XOR sum, the XOR sum of all data between '$' and '*', except for '$' and '*'.
Frame end	\r\n	Enter and wrap

Format	$HTSETN,<1>,<2>,<3>*xx\r\n	
Example	$HTSETN,1,4,2001*xx\r\n	
No.	Definition	Instruction

$HTA	Frame header	$HTSETN
Delimiter	‘,’	comma
<1>	Module Number	1：network port;
<2>	Setup command (n char)	4: The UDP target port number of the module, with variable length
<3>	UDP target port number（n char）	2001
Delimiter	‘*’	
Verification	xx	XOR sum, the XOR sum of all data between '$' and '*', except for '$' and '*'.
Frame end	\r\n	Enter and wrap

2.2 System Parameter Settings

Format	$HTSETF,<1>,<2>,<3>*xx\r\n		
Frame header	$HTSETF	ASCII code	
Delimiter	‘,’	comma	
	Time synchronization setting	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	01: Time synchronization mode setting; (Power off storage)
	<2>	x	0: Automatic; 1: Manual operation; (default automatic)
	Time zone setting	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	02: Time zone Settings. (Save after power failure)
	<2>	±xx	Time Zone value (Default 0 time zone)
	Leap second setting	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	03: Leap second setting; (Save after power failure)
	<2>	x	0: No leap seconds, 1: Positive leap seconds, 2: Negative leap seconds (default no leap seconds)
	Threshold setting	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	04: Threshold Settings. (Save after power failure)
	<2>	xx	Threshold

	Phase lock mode Settings	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	05: phase lock mode setting; (Save after power failure)
	<2>	x	0: taming, 1: free running (default taming)
	Single synchronization Settings	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	06 ： Single synchronization Settings ；
	<2>	x	1: valid; Other invalid
	Clock setting	$ HTSETF,<1>,<2>*xx\r\n	

	<1>	xx (Information identification)	07 ： time setting;
	<2>	yyyymmddhhmmss	Year Month Day Hour Minute Second
	1PPS Delay setting	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	08 ： Phase shift setting;
	<2>	x	The byte length is variable, for example, -10 indicates -10ns, and the phase shift range is ±500ms
	Pulse width setting	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	09: Pulse width setting; (Save after power failure)
	<2>	x	The byte length is variable. For example, 10000 indicates 10us, and the pulse width ranges from 10us to 500ms
	Reference source selection mode setting	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	10 ： Reference source selection mode setting
	<2>	xx	0: Automatic; 1: Manual operation; (default automatic)
	Reference source selection setting	$ HTSETF,<1>,<2>*xx\r\n	

	<1>	xx (Information identification)	16 ： Reference source selection setting
	<2>	x	1:GNSS; 2:1PPS+TOD;
	Reset instruction	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	26:Reset instruction（Restore factory settings）
	<2>	x	1: reset. Other: invalid
	IRIG-B delay	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	28:B-code delay correction command
	<2>	x	Variable length
	Receiver operating mode	$ HTSETF,<1>,<2>*xx\r\n	
	<1>	xx (Information identification)	50 ： Receiver working mode setting
	<2>	x	Bit 0~bit 3: Identify separately: BDS、GPS、GLO、GAL 0：disable，1：enable Example：3 Identify BDS+GPS mode， 8 Identify GAL mode
Delimiter	'*'		
Verification	xx	XOR sum, the XOR sum of all data between '$' and '*', except for '$' and '*'.	
Frame end	\r\n	Enter and wrap	

3. Verification Calculation Method

The communication protocol uses ASCII code format. XOR checksum is used for verification. The following provides a detailed description of the checksum calculation method with examples.

The checksum consists of two bytes and is the XOR sum of all data between the '$' and '*' characters, excluding the '$' and '*' characters themselves.

Example: Sending the ASCII command '$MZMSG,1,20240819,120130,200030,52100,,,,,*4D\r\n'

Step 1. Gather all data between '$' and '*'. Convert 'MZMSG,1,20240819,120130,200030,52100,,,,,' to hexadecimal: 4D 5A 4D 53 47 2C 31 2C 32 30 34 38 31 39 2C 31 32 30 31 33 30 2C 32 30 30 30 30 33 2C 2C 2C 2C 2C

Step 2. XOR all the converted hexadecimal bytes sequentially to obtain a single byte '4D' (hexadecimal).

Step 3. Convert the hexadecimal result to two ASCII bytes, '4D' (uppercase letters required).

Step 4. The checksum xx is therefore calculated as '4D'.

Step 5. The final correct command to send is:
'$MZMSG,1,20240819,120130,200030,52100,,,,,*4D\r\n'

Thank You

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