Tunable Semiconductor Laser

TSL-570

Operation Manual

santec

Notes to Users

2) Information in this Operation Manual is subject to change without notice.
3) Information of this Operation Manual is prepared with careful examination, however, in the event of any mistake, please contact us.

Notes in Bringing This Product Out of Japan

1) When this product is brought out of Japan, some laws or regulations of a destination country may prohibit this product from being used there. In such countries, the use of this product may lead to punishment. Please note, that in such cases Santec Corporation shall not be held responsible in anyway.
2) When this product is exported (or brought out of Japan), if this product is applicable to a strategic material specified in “Foreign Exchange and Foreign Trade Control Law”, then required is an export permit of the Japanese Government under the law.

Introduction

Thank you very much for your having purchased our product, Tunable Semiconductor Laser TSL Series. This Operation Manual contains information necessary for the operation of TSL-570, and it is intended for those with sufficient knowledge enough to of laser danger and its safe control. Before operating TSL-570, you should first read thoroughly through this Operation Manual and become familiar to its contents. After reading this Operation Manual, keep it at your fingertip for easy reference at any time.

NOTE

The packing materials and box of this product are needed for long-term storage or transportation; keep them in a safe place after unpacking the product.

How to Read the Manual

Before operating TSL-570, please carefully read this Operation Manual. This Operation Manual consists of 11 Chapters:

Chapters 1 to 4 illustrate the outline of this product, safety precautions, and installation of the product.

SANTEC recommends that Chapter 1 to 4 should be read carefully before proceeding to the following chapters.

Chapters 5 to 7 describe how to operate the product.

Chapter 8 to 11 describes to maintain the products' performances.

NOTE

Before using this product, please carefully read this Operation Manual.

Explanation of Terms

The meanings of the following terms used in this Operation Manual are defined as below:

(1) Meaning

	**DANGER**	This indicates pressing DANGER, and if it is not avoided, personnel death or serious injury may result; therefore, it is the most emphasized special information.
	**WARNING**	This indicates potential danger, and if it is not avoided, personnel death or serious injury may result; therefore, it is special information.
	**CAUTION**	This indicates potential danger, and if it is not avoided, mild or slight injury may result; therefore, it is special information. It also indicates potential danger leading to only physical damage.
NOTE	**NOTE**	This section only indicates supplementary explanations of the text and thus other than DANGER, WARNING, and CAUTION.

(2) Importance of Information

From the above meanings, the priority of the terms here are as shown below:

DANGER > **WARNING** > **CAUTION** > **NOTE**

Contents

1. Safety Notes

1.1. Intended use

This product is designed to measure the optical characteristics.
Do not use this product for anything other than as an optical measuring instrument. If this product is used in a manner not specified in this manual, the protection provided by this product may be impaired.

1.2. Safety Markings

This product is marked with this warning symbol when it is necessary for the user to refer to the instructions in the manual.

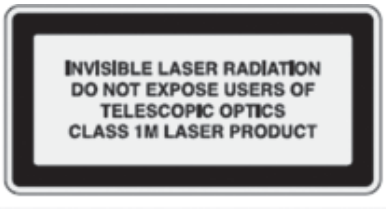
This warning symbol is marked on products which have a laser output.

1.3. Laser Class

This product is classified class 1M laser product according to IEC 60825-1 (2014).

Laser Type:	External Cavity Diode Laser
Laser Class:	1M IEC60825-1(2014)
Output Power:	< 50mW
Laser Diameter:	10μm
Numerical aperture:	0.1
Wavelength:	1200-1700nm

Laser Safety Labels

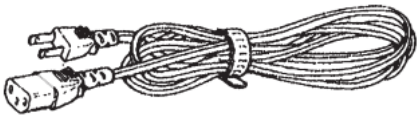


This product radiates class 1M invisible laser. Do not look at the tip of optical output connector using optical instruments like magnifiers or microscopes. The laser radiation can seriously damage your eyesight. Please pay attention to handling of laser.

2. Product Composition

This product is composed of the TSL-570 body and accessories. Check to make sure that all the following items are included.

TSL-570 body x1



Power code x1

Interlock terminator x1

Operation Manual & Software x1

Inspection report x1

Check to make sure that the product body and the accessories have no scratches or stains. If any item is found to have scratches or stains, please contact us.

3. Panel Descriptions

3.1. Front Panel

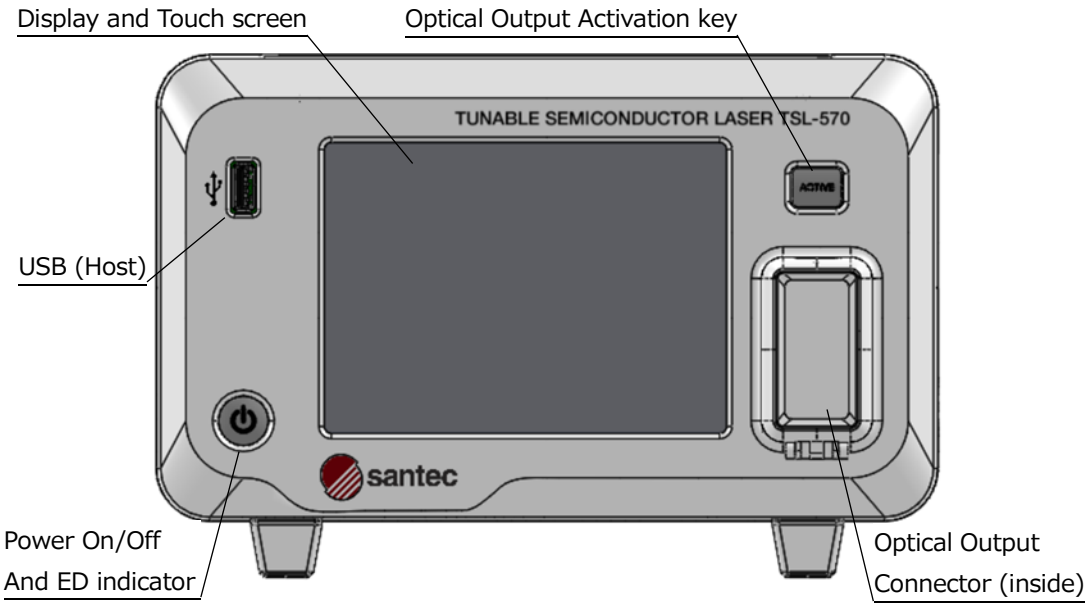


Figure 3-1. Front Panel

3.2. Rear Panel

3.3.

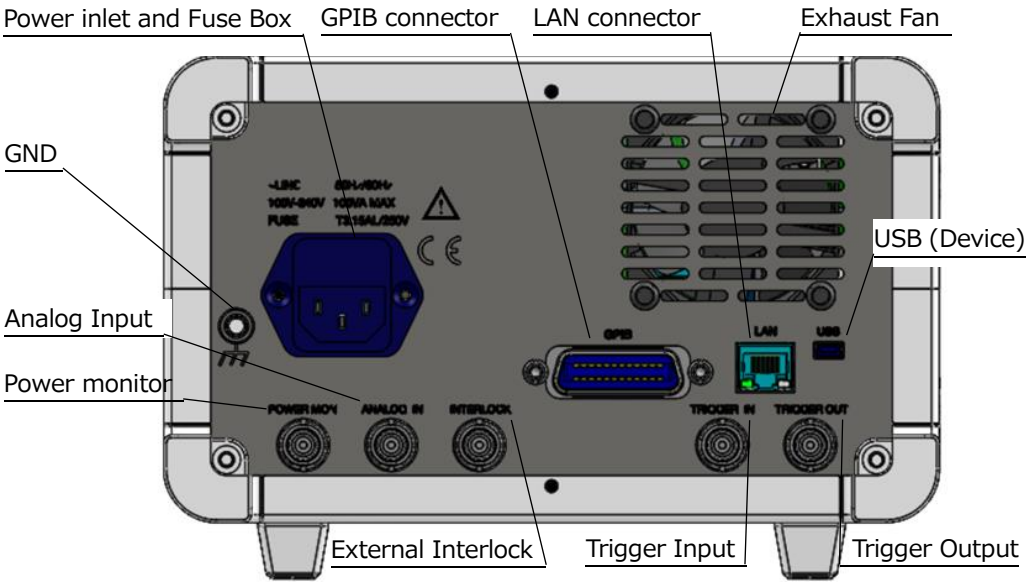


Figure 3-2. Rear Panel

NOTE

It is recommended to use the GND terminal as a signal GND. It is effective in stabilizing the reference potential between devices when constructing a measurement system that connects multiple devices, such as the Swept Test System (STS) linked to our MPM series/PCU/OSU/MBU.

3.3. Side Panel

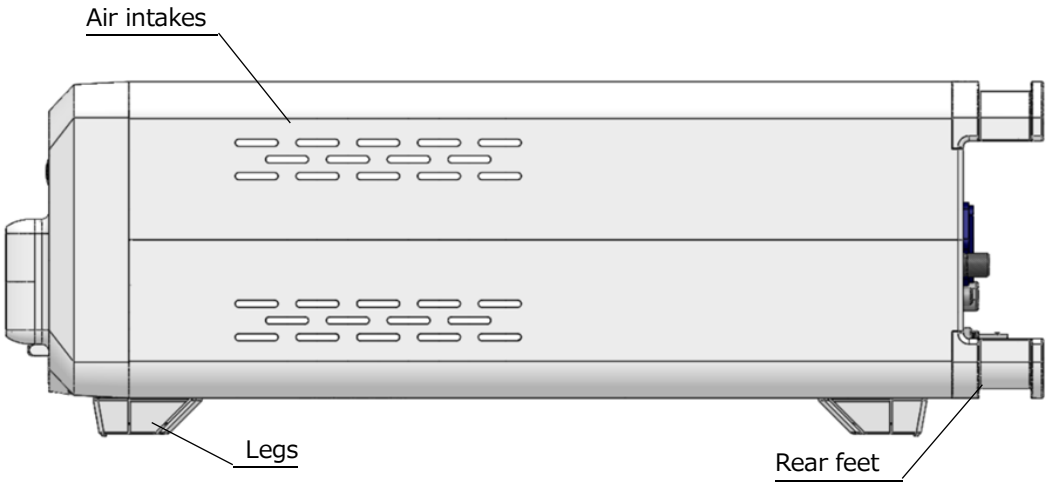


Figure 3-3. Side Panel

4. Installation

4.1. Operating Environments

Pay attention to the following guidelines for safe, trouble-free operation.
This product is a high-precision device and be designed to be used indoors (Pollution Degree 2).

- Do not place over a height of 2,000 meter.
- Do not place in direct sunlight.
- Do not place under high temperature and high humidity.
- Do not place in an environment with dust, dirt, salt, or corrosive gas.
- Do not place in an area subject to large vibrations.
- Do not place in an area subject to noise by electric field, magnetic field, etc.
- Do not place in an area where the unit is subject to falling objects landing on it.
- Do not place with possible exposure to water.

Be sure to install the TSL-570 in a level place (less than 5 degree). It is recommended to install this product on a vibration-proof base. The unit may not operate correctly if the device is set in an inclined position.
The mainframe of the TSL-570 weighs about 7kg. Please ensure that the table or shelf upon which it is installed has sufficient strength. Clearance of 5 cm at the rear and the side of the unit should be allowed for proper ventilation. And the air intakes are located at the bottom and the side of the device. Please do not remove the rubber legs, in order to secure airflow.

4.2. Power Supply

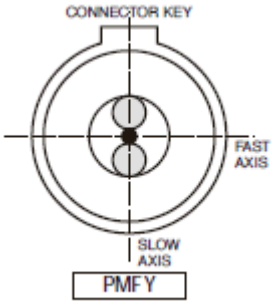
This product uses a 3-line power cord and plug with a protective ground line. Power cord may be attached and detached. Connect it to the power source socket at the rear panel. Use the power cord supplied with the product. Do not use the inappropriate power code. This product complies with overvoltage category Ⅱ and can operate between 100 to 120Volts or 200 to 240 Volts, and 50 to 60Hz AC Line. Temporary over voltage (TOV) is 1,500 Volts. Use two surge resistant type fuses. T3.15AL/250V (100–120V/ 200-240V) (Refer to "9-3. Replacing Fuses").

CAUTION

This product is grounded by the ground line in the supplied power cable. This product must be properly grounded to avoid electrical shock and other dangers. Please make sure that this product is properly grounded to avoid electrical shock. In addition, please place this product in a location that allows the user to easily unplug the power cable from the power socket on the rear panel, in case of any device malfunction.

4.3. Optical Output

The TSL-570 has polarization maintaining fiber (PMF) outputs. The PMF is the panda type, with polarization axis in alignment with connector key (slow axis).

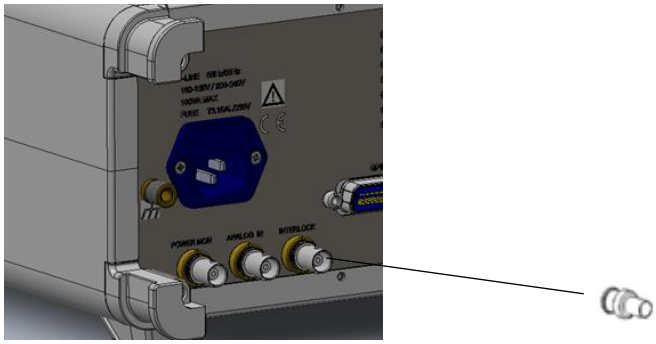


4.4. Interlock

This product is equipped with a terminal for connecting an external interlock circuit.

A terminator is connected to the interlock terminal at the time of factory shipment (or included as an accessory). If an external interlock is used, remove the terminator and connect a circuit to the interlock terminal. The Laser is output only when there is a short circuit. The Laser turns off when the circuit is open. If you want the Laser to light up again, short the circuit, and then perform Laser output operation (Refer to “5-2. Laser output”).

If you don’t use your own interlock circuit, please connect the terminator to the terminal (BNC) indicated as “⚠”. If you use your own interlock circuit, please connect the interlock circuit to the terminal indicated “INTERLOCK”. Keep the removed terminator so it does not become lost.



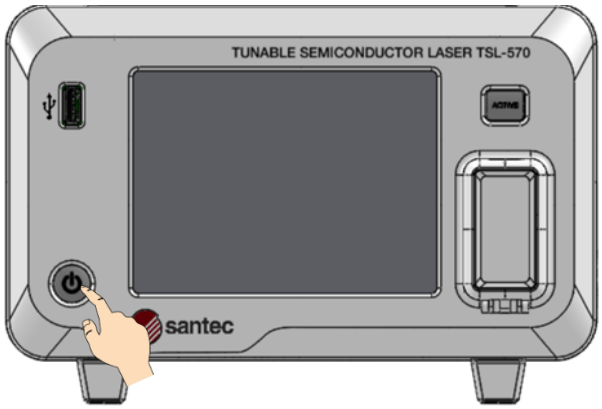
NOTE

Make sure to use this product only with the terminator connected when an external interlock is not used. The Laser is not output unless the terminator is connected. When "⚠" is indicated in the display of the front panel, the interlock circuit is in open state.

5. Basic Operation

5.1. Turning on the Unit

1. Press the Power ON/OFF key at the lower left of the front panel.



2. The LED of the power ON/OFF key will turn green, and initialization will last for about 60 seconds.
3. Wavelength and power values are displayed on the main display.

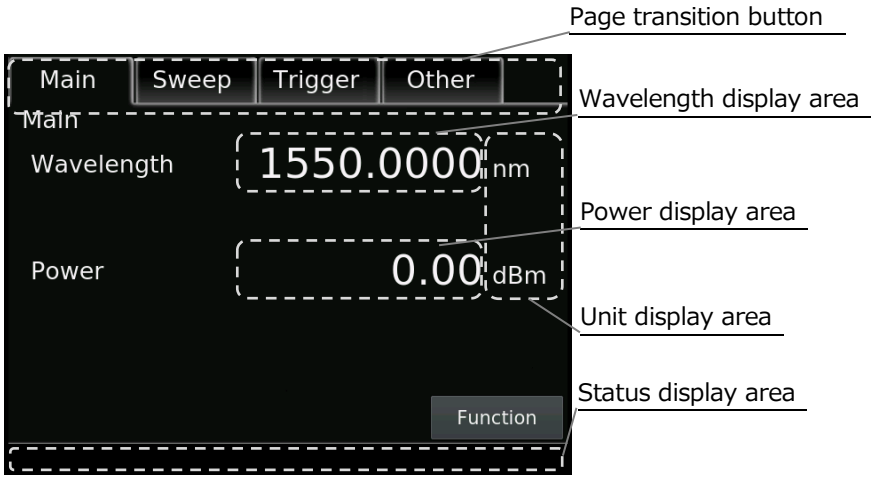
NOTE

Immediately after startup, "Warming up" is displayed on the LCD screen, and depending on the usage environment, it may be displayed for about 30 to 60 minutes.

5.2. LCD display and Operation

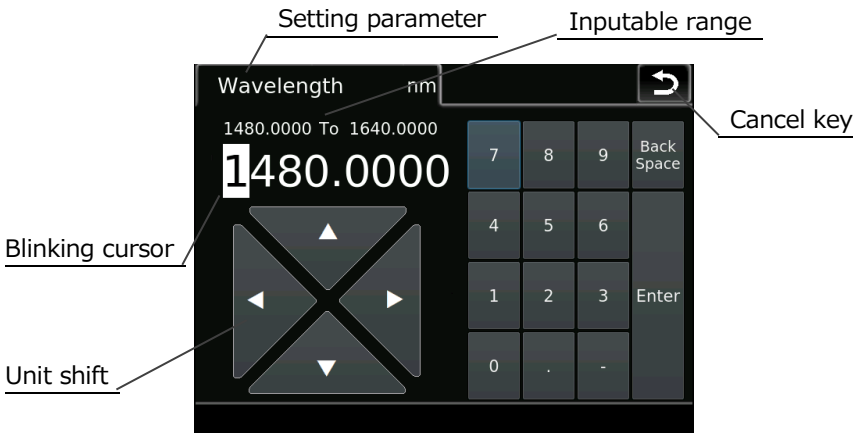
5.2.1. Screen Configuration

The Main screen is the original screen of this device. When the power is turned on, it is possible to first transition and read the status of the device. You can also transition to all function pages from the page transition button. For details, refer to "5.3.3 Menu Transition".



5.2.2. Numeric Keypad Input Screen Configuration

1. Select the blinking cursor in the digit you want to enter.
   The blinking cursor can be moved with the unit shift key.
   Alternatively, you can select by directly touching the number.
2. Enter the value with the numeric keypad. All digits must be entered for the integer part. When changing the value one by one, the operation of the unit shift key is also available.
   After inputting the value, press the ENTER key to set the value. When inputting out of the specification range, the value in the enterable range will turn yellow.
3. After setting, return to the Main screen.

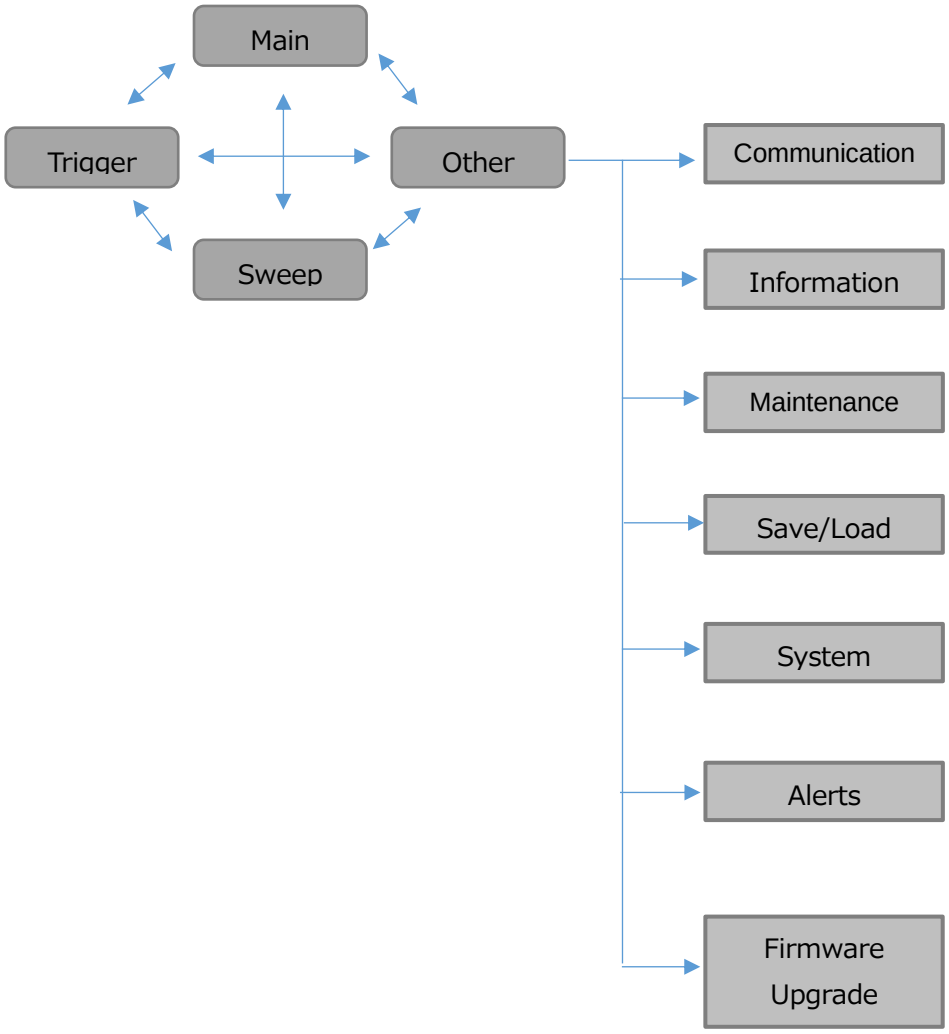


NOTE

This product can be operated the screen by connecting a mouse to the USB (Host) port. Then, the scroll wheel can allow the user to change the input value.

5.2.3. Menu screen transition

The screen transition diagram of this device is shown. The "Main", "Sweep", and "Trigger" settings that are mainly used can be easily switched back and forth, and detailed settings can be changed from the "Other" screen.
Please refer to the configuration diagram below.

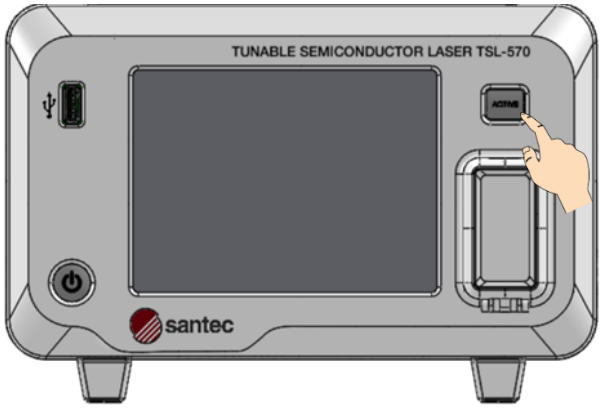


5.3. Laser Output

CAUTION

Make sure that the optical fiber is connected correctly to the optical output connector before performing LD output.

1. Press the Optical Output Activation key. The key top turns green and the optical output becomes active. Laser is output from the optical output connector during the LED illuminate. While preparing to turn on laser, the “ACTIVE” key blinks.
2. Press the Optical Output Activation key again to turn off optical output. Laser output is interrupted and the LED turns off.

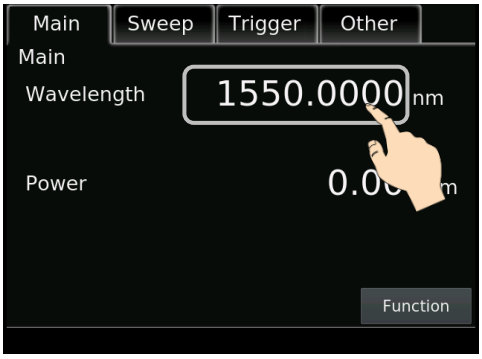


NOTE

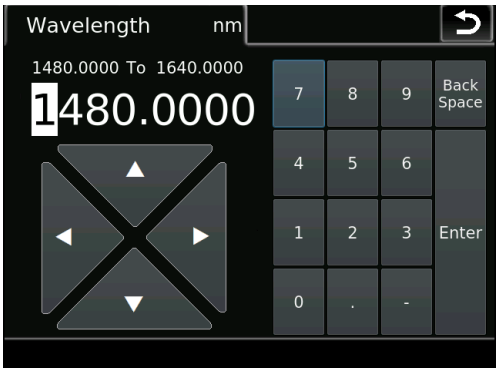
When “⚠” is displayed on the main screen of the front panel, the interlock circuit is open and the Laser is not output.

5.4. Setting the Wavelength

1. Touch the number displayed to the right of Wavelength on the main screen.



2. The Numeric Keypad Input Screen appears, and it transitions to the state where the wavelength can be set.



3. Input a value according to “5.2.2”. When inputting out of the specification range, the value in the enterable range will turn yellow.

■ Changing the Unit of the Wavelength

1. Touch the unit on the wavelength setting screen.

2. The input unit is changed.

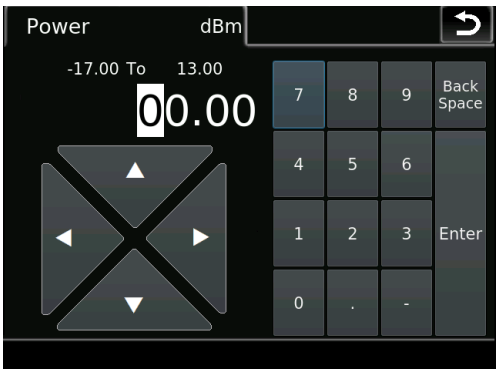
3. To return to the previous unit, touch Unit again.

   When setting the unit to Frequency, other settings are displayed for the frequency. However, the following parameters do not change. Sweep Speed setting is fixed at the Wavelength unit [nm/s]. Step width is fixed at the Wavelength [nm].

5.5. Setting the Output Power

1. Touch the unit on the Power setting screen.

2. The Numeric Keypad Input Screen appears, and it transitions to the state where the power can be set.



3. Input a value according to “2-2”.
   Range: -15dBm to +13dBm

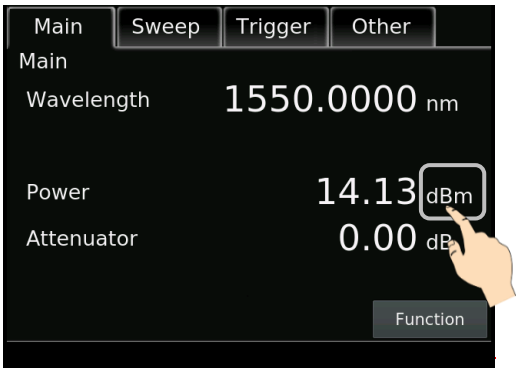
NOTE

When a value is set that is greater than the maximum power, “⚠” is displayed on the screen. The wavelength and power accuracy are not guaranteed while “⚠” is displayed. Please decrease the setting power so that “⚠” turns off.

■ Changing the Unit of the Power

(1) Touch the unit on the power setting screen.
(2) The display/input unit is changed. All units will be changed on all screens, including this screen.
(3) Do the same operation when switching back to the original setting.

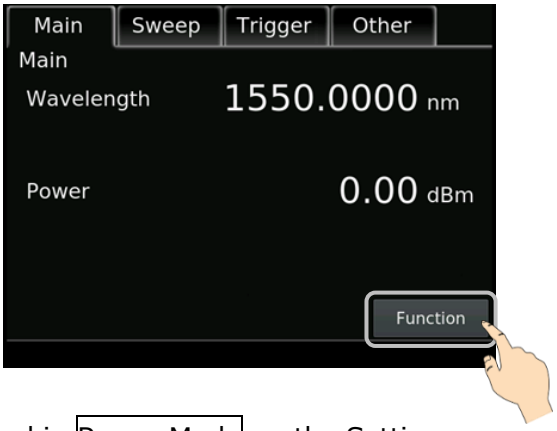
When setting the unit to mW (linear scale), other settings are displayed for the mW (linear scale). However, the following parameters do not change.
In case of Manual mode, the Attenuator value setting is fixed at the Attenuator [dB].



■ Switching the Optical Power Control Mode

The power control of the optical output can be switched between Auto and Manual. In auto control mode (Auto), the power of the output light is kept constant by feedback from the output power value measured at the self-contained power meter. The attenuator is controlled automatically. In manual control mode (Manual), the injection current to the LD is controlled to be kept constant.

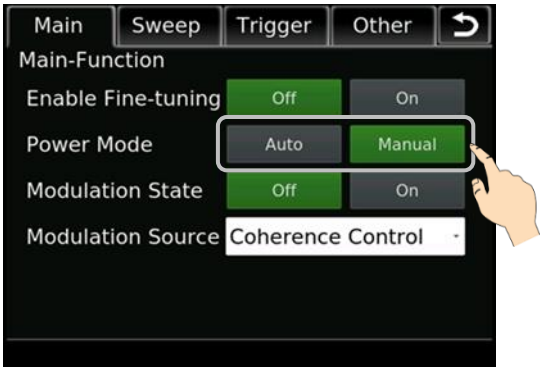
(1) Touch Function on the Main screen.



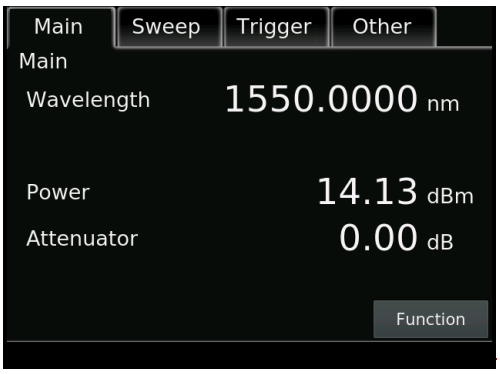
(2) It can be selected in Power Mode on the Setting screen.

"Auto" Auto Power control mode

"Manual" Manual control mode by internal attenuator



(3) Power mode is a manual control mode when "Attenuator" is displayed on the main screen.

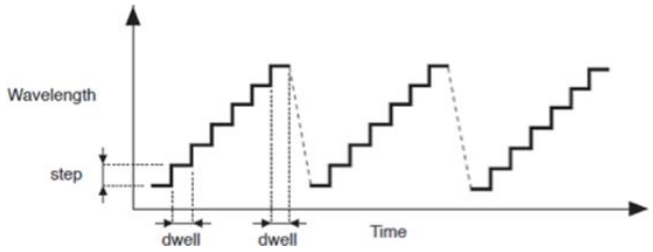
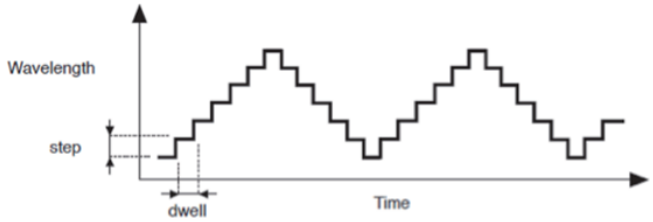
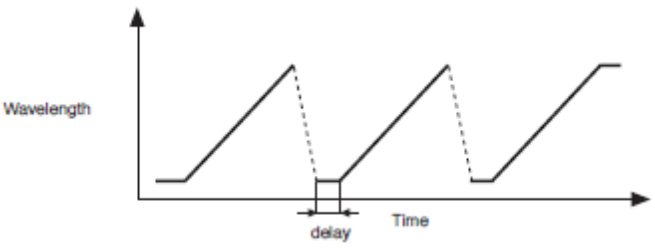


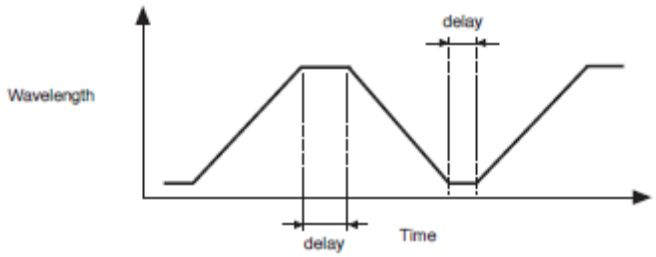
5.6. Setting the Wavelength Sweep

This section describes the wavelength sweep settings. This product has two sweep modes: continuous sweep and step sweep. Make the following settings to operate correctly in each mode.

Continuous sweep: A mode that continuously changes the wavelength within the specified wavelength range.

Step sweep: A mode that changes the wavelength within the specified wavelength range with the specified feed width.

(A) Step and One way	Perform one-way sweep with step operation. Change the wavelength from the start wavelength to the stop wavelength with the wavelength interval set by STEP and the wait time set by Dwell. When the wavelength returns to the start wavelength, the speed and time are not controlled.
	
(B) Step and Two way	Perform two-way sweep with step operation. Change the wavelength from the start wavelength to the stop wavelength with the wavelength interval set by STEP and the wait time set by Dwell. Afterwards, change the wavelength from the end wavelength to the start wavelength in the same manner.
	
(C) Cont. and One way	Perform one-way sweep by changing the wavelength continuously. Change the wavelength from the start wavelength to the stop wavelength with the speed set by Speed and return to the start wavelength. The wait time between each sweep is set by Delay. It does not include the time to return to the start wavelength.
	
(D) Cont. and Two way	Perform two-way sweep by changing the wavelength continuously. Change the wavelength from the start wavelength to the stop wavelength with the speed set by Speed. Afterwards, change the wavelength from the stop wavelength to the start

	wavelength in the same manner. The wait time between each sweep is set by Delay.
	

Continuous sweep setting

Setting parameter	Unit	Description	
Start	nm (THz)	Start wavelength	
Stop		Stop wavelength	
Speed	nm/s	Sweep speed	
Cycle	times	Number of wavelength sweeps	
Delay	sec	The wait time between each sweep in continuous sweep operation	
Step Width	nm	The interval of the trigger signal output	
Start Trigger	-	Sweep start procedure setting	
Constant Mode	-	Calculation setting of the trigger output	
		Wavelength	The trigger is periodic output in wavelength using the internal wavelength monitor.
		Time:	The trigger is periodic output in time.
Timing Mode	-	Timing setting of the trigger output	
		NONE	Trigger signal is not output.
		STOP	Trigger signal is output at sweep completion.
		START	Trigger signal is output when sweep starts.
		STEP	Trigger signal is output at a constant interval (wavelength or time) during sweep

Step sweep setting

Setting parameter	Unit	Description	
Start	Nm (THz)	Start wavelength	
Stop		Stop wavelength	
Step		The interval (wavelength) of step sweep	
Cycle	times	Number of wavelength sweeps	
Dwell	sec	Amount of time spent during each step	
Timing Mode	-	Timing setting of the trigger output	
		NONE	Trigger signal is not output.

		STOP	Trigger signal is output at sweep completion.
		START	Trigger signal is output when sweep starts.
		STEP	Trigger signal is output at a constant interval (wavelength) during sweep

The flow of the sweep operation is as follows.

1. Set to the start wavelength
2. Sweep operation
3. Stop at the stop wavelength

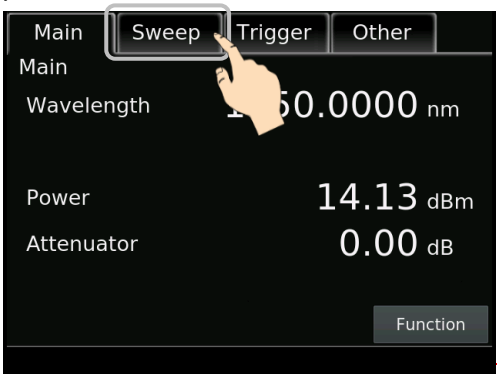
In the case of continuous sweep, when each sweep is completed, the wavelength returns to the start wavelength and the operation is executed for the number of cycles.

NOTE

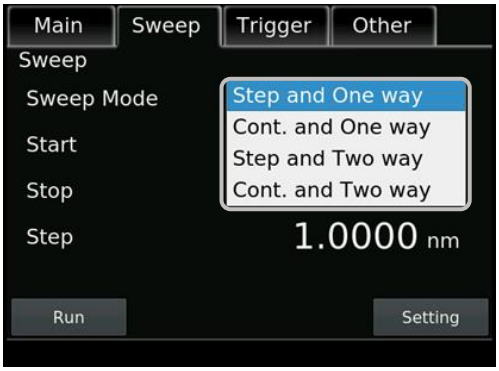
When stopping sweep operation in the middle, follow "5-6-6 Stop Sweep". The number of sweeps displayed returns to 0 when the number exceeds 1000. If the mode is set to Two way, one round trip counts as two.

5.6.1. Continuous sweep setting

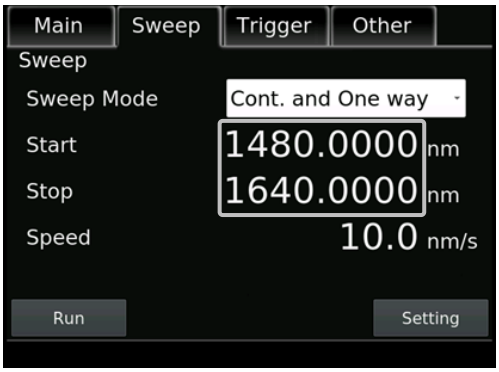
1. Touch the “Sweep” tab.



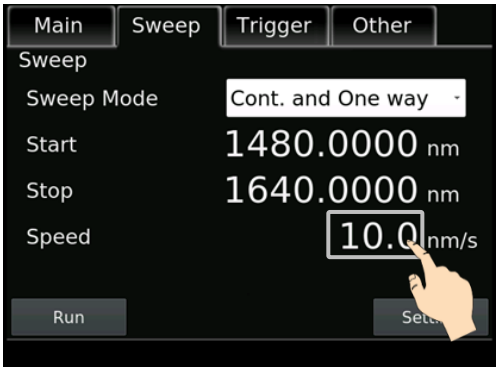
2. After the screen switches to the Sweep setting screen, set Sweep Mode. The Continuous sweep has one-way operation "Cont and One way" and two-way operation "Cont and Two way".



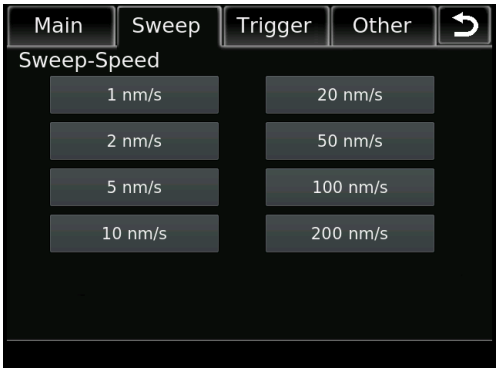
3. Input the sweep start wavelength and sweep stop wavelength according to "5-4. Setting the wavelength".



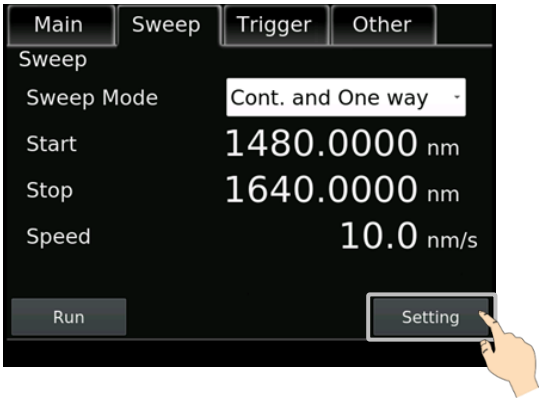
4. Touch the number on the right side of Speed to more to the sweep speed setting screen.



5. Select a sweep speed from the Sweep Speed setting screen.



6. Touch the “Setting” on the Sweep setting screen to perform detailed settings.



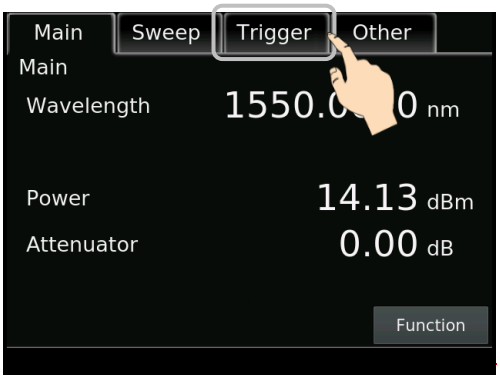
7. Set the following parameters on the detailed setting screen.

Parameter	Unit	Description
Cycles	times	Set the Number of wavelength sweeps. After each sweep completes, the wavelength is set at the stop wavelength. If the mode is set to Two way, one round trip counts as two. When setting the Cycles to “0” (Zero), the sweep times is infinite.
Delay	sec	Set the wait time between each sweep in continuous sweep operation.
Step width	nm	Set the interval of the trigger signal output.

5.6.2. Trigger setting for continuous sweep

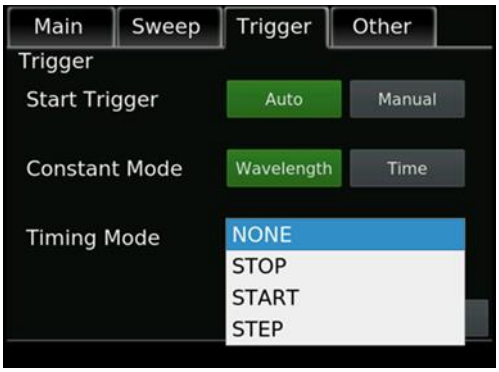
Set the trigger setting for continuous sweep.

1. Touch the “Trigger” tab.



2. Set each parameter at the Trigger setting screen.

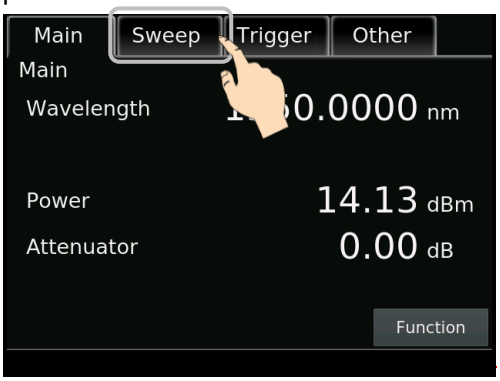
Setting parameter		Description
Start Trigger	Auto	The sweep is started by command / screen operation
	Manual	The sweep is started by the external signal input. Sweep is also executed by command / screen operation.
Constant Mode	Wavelength	Trigger signal is periodic output in wavelength using the calculation of the internal wavelength monitor.
	Time	Trigger signal is periodic output in time.



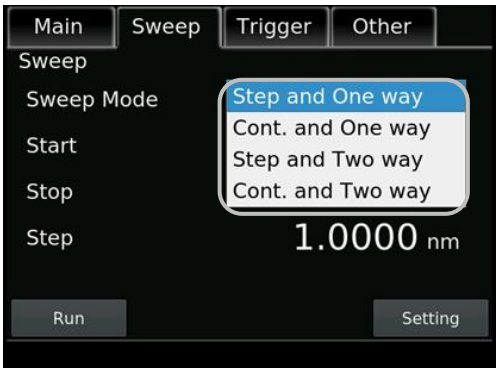
Setting parameter		Description
Timing mode	NONE	Trigger signal is not output.
	STOP	Trigger signal is output at sweep completion.
	START	Trigger signal is output when sweep starts.
	STEP	Trigger signal is output at a constant interval (wavelength or time) during sweep.

5.6.3. Step sweep setting

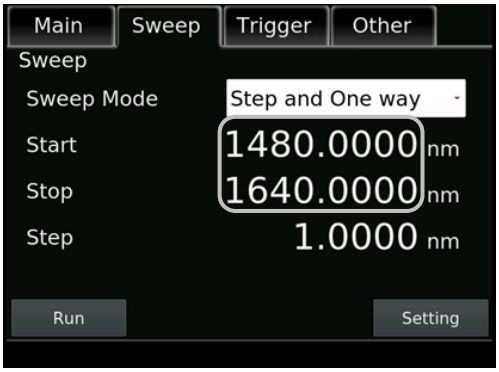
1. Touch the “Sweep” tab.



2. After the screen switches to the Sweep setting screen, set Sweep Mode. The Step sweep has one-way operation "Step and One way" and two-way operation "Step and Two way".

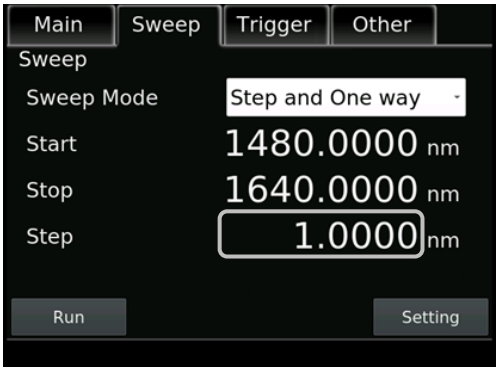


3. Input the sweep start wavelength and sweep stop wavelength according to "5-4. Setting the Wavelength".



4. Set the Step interval.

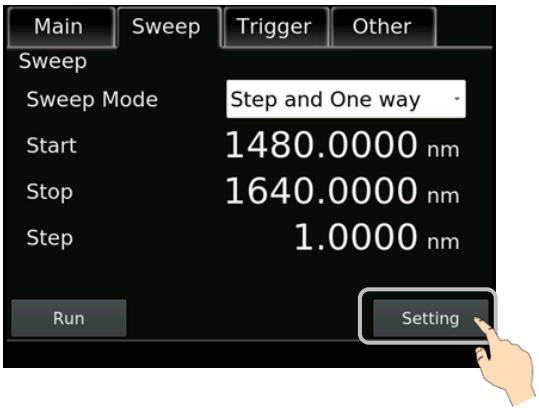
   Minimum step: 0.0001 nm



5.6.4. Trigger setting for step sweep

Set the trigger setting for step sweep.

1. Touch the “Setting” button.

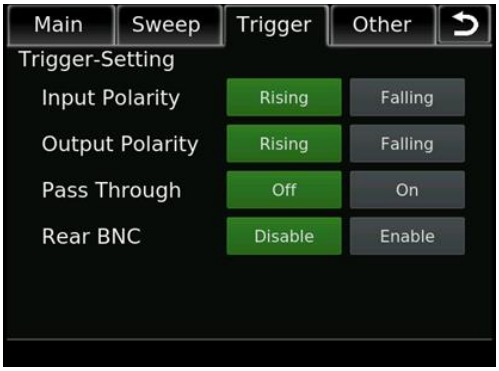


2. Set each parameter at the Sweep setting screen.

Parameter	Unit	Description
Cycles	times	Sweep repetition times
Dwell	sec	Wait time between consequent steps in step sweep mode. When setting the Cycles to “0” (Zero), the sweep times is infinite.

5.6.5. Detailed trigger settings

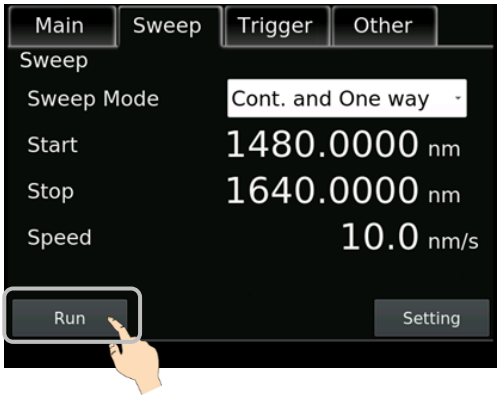
Describe the detailed trigger output setting.



Setting Parameter	Description
Input Polarity/ Output Polarity	Set the Input/ Output trigger polarity. Factory settings is “Rising”. Select the polarity to change to “Falling” (Low).
Pass Through	Set this parameter when using the trigger signal in synchronization with other products. When using a trigger from the device, such as in Sweep mode, set it to “Off”.
Rear BNC	This product operates using the input voltage to the Trigger Input terminal on the rear panel as a trigger signal. When setting to “Disable”, LCD operation or soft trigger of communication command is recognized as a trigger.

5.7. Executing the Wavelength Sweep

1. Touch RUN on the Sweep setting screen.



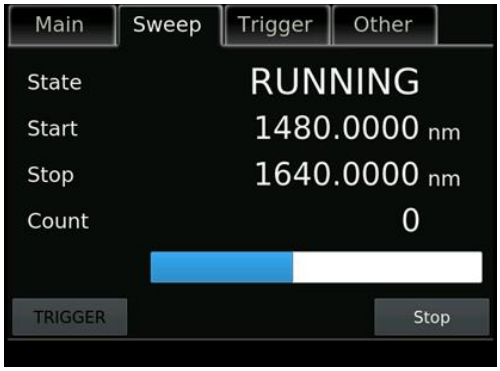
2. The sweep operation screen is displayed.

The operation status is shown on the first line during the sweep operation.

- RUNNING Sweeping
- PREPARE Stand-by

An indicator at the lower shows the progress of the sweep operation.

When setting the Cycles to “0” (Zero), the sweep times is infinite.



3. Stop Sweep

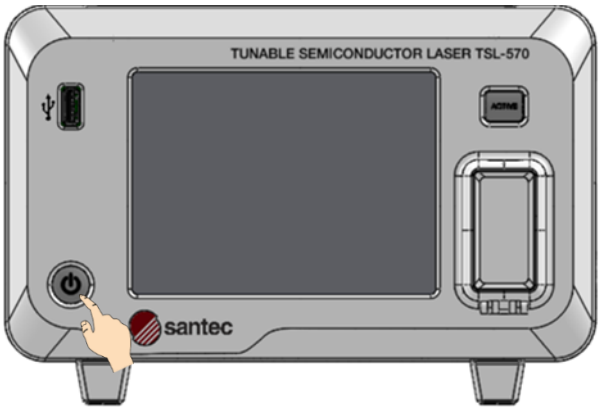
Touch STOP to stop a sweep in progress. Sweep is stopped immediately

NOTE

When stopping sweep operation in the middle, follow "5-6-6 Stop Sweep". The number of sweeps displayed returns to 0 when the number exceeds 1000. If the mode is set to Two way, one round trip counts as two.

5.8. Turning off the Unit

1. Press the power ON/OFF key.
2. “Shutting Down ...” is displayed on the main screen and LED of ON/OFF key blinks during power shut down operation.
   The unit is shut down after several seconds, and LED is turn off.



CAUTION

Do not unplug power cord from rear panel before power shut down is complete (LED of power ON/OFF key is turn off). Damage of the device may be caused by vibration under transportation if power supply is not shut down properly. Make sure power supply is shut down properly before transportation. If power supply is shut down under abnormal conditions or due to events such as power failures while Laser is illuminated, turn power back on (once) after power distribution is restored, and then turn off power using the normal procedure.

NOTE

Unplug power cord from rear panel to completely shut down power supply.

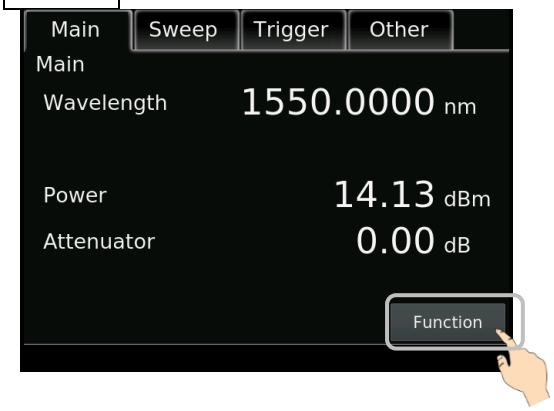
6. Detailed Operation

6.1. Fine-tuning

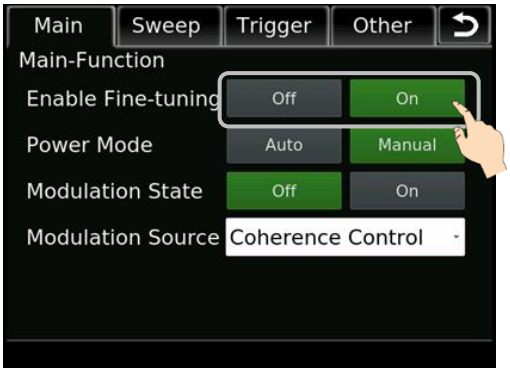
Fine-tuning adjusts output wavelength with a resolution under 1MHz. The adjustable wavelength range is about 10 GHz (about 80 pm around 1550 nm). Fine-tuning can be also performed with an external analog signal. Refer to “6-3. External Modulation” for details.

■ How to set on the front panel

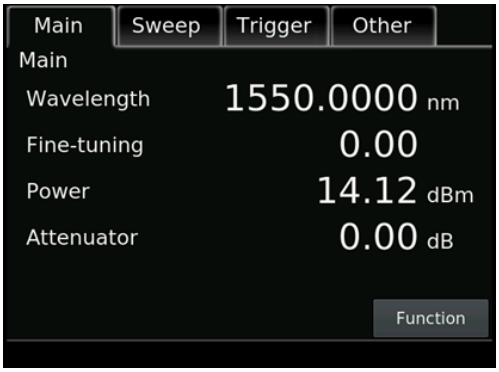
1. Set the wavelength according to the wavelength setting procedure.
2. Touch Main -> Function to move the setting screen.



3. Touch On at the Enable Fine-Tuning.



4. The input area of the FT value is displayed on the main screen. Input a value with the numeric keypad. (Refer to “5-4 Setting the Wavelength”.) Wavelength is shifted to shorter wavelength as FT value is increased.
   Range: -100.00 to +100.00
   Step: 0.01



5. Tune the wavelength to the desired wavelength while monitoring the output wavelength with an instrument such as a wavelength meter.

■ How to cancel on the front panel

When touching Off on the right side of Enable Fine-Tuning, the fine tuning mode is canceled.

NOTE

Closed-loop wavelength control is stopped when Fine-tuning function is active. To restart Closed-loop wavelength control, cancel Fine-tuning mode or set the wavelength.

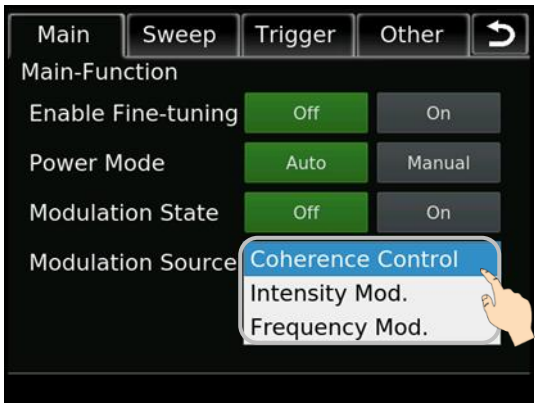
6.2. Coherence Control

Coherence Control increases spectral linewidth of output light. Coherency of output light is reduced by this function, and fluctuation of optical power by interference can be suppressed. If fluctuation of optical power becomes a problem due to influence from reflecting point in a system using the device, use the function.

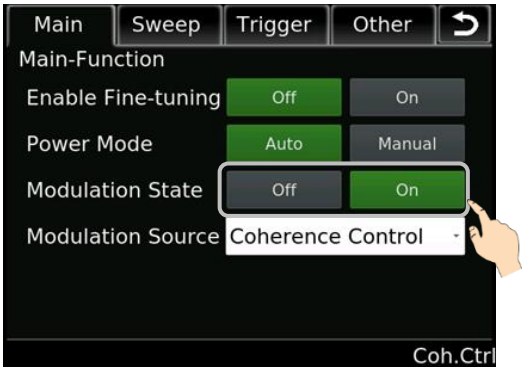
■ How to set

1. Touch Function to move to the modulation setting screen.

2. Select “Coherence Control” in Modulation Source pull-down menu.



3. The operation starts when Modulation State is turned ON. During operation, the “Coh.Ctrl” status is displayed on the status screen.



■ How to stop

1. Select the Off at the Modulation State.
2. Coherence control function turns OFF, and the “Coh.Ctrl” status turns off on the screen.

6.3. External Modulation

6-3.1. Intensity Modulation

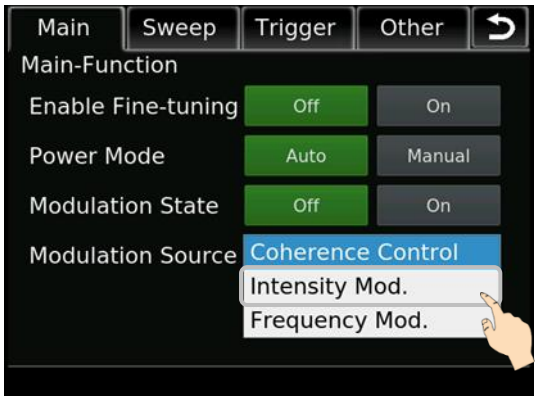
Modulating the intensity of optical power is performed at relatively low frequency.

Specifications

Parameter	Unit	Description
Input voltage	V	-2 ~ 0
Modulation depth	%	100 (Maximum)
Bandwidth	kHz	0 ~ 400 (typical value)
Input impedance	Ω	100
Input terminal	-	ANALOG INPUT

■ How to set

1. Touch Function to move to the modulation setting screen.
2. Select “Intensity Mod.” in Modulation Source pull-down menu.

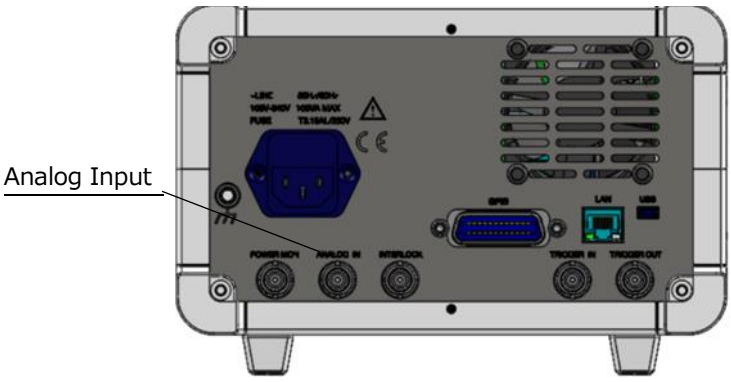


3. Select On at the Modulation State. During operation, the “Intensity Mod.” status is displayed at the status area.

NOTE

While the "Intensity Mod." Status is displayed, the wavelength and power closed-loop control is stopped. Therefore, the wavelength and power may fluctuate due to changes in the environment.

4. Input the voltage signal into the BNC connector labeled “ANALOG INPUT” at the rear panel.



CAUTION

Never apply voltage out of the input level range. Doing so may damage the device.

■ How to cancel

1. Select the Off at the Modulation State.
2. Intensity Modulation control function turns OFF, and the “Intensity Mod.” Status turns of on the screen.

6-3.2. Frequency Modulation

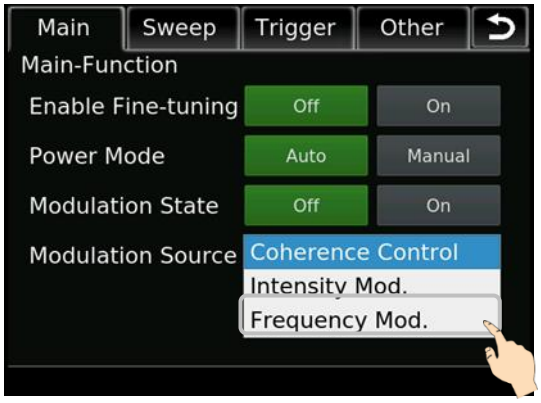
The function fine tunes wavelength with external signal.

Specifications

Parameter	Unit	Description
Input voltage	V	-1.2 ~ 1.2
Modulation depth	GHz/V	5 (typical value)
Bandwidth	Hz	100 (typical value)
Input impedance	kΩ	4.7
Input terminal	-	ANALOG INPUT

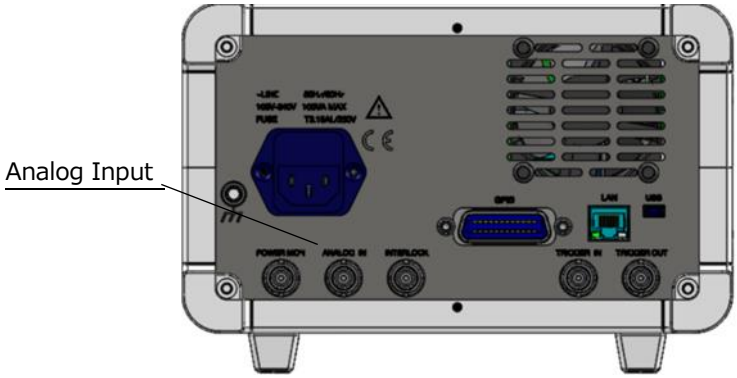
■ How to use

1. Touch Main -> Setting to move to the modulation setting screen.
2. Select “Frequency Mod.” in Modulation Source pull-down menu.



3. Select On at the Modulation State. During operation, the “Frequency Mod.” status is displayed at the status area.

4. Input the voltage signal into the BNC connector labeled “ANALOG INPUT” at the rear panel.



CAUTION

Never apply voltage out of the input level range. Doing so may damage the device.

■ How to cancel

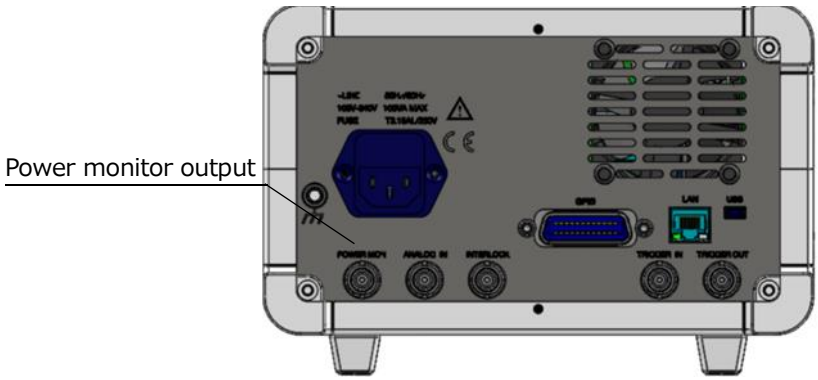
1. Select the Off at the Modulation State.
2. Frequency Modulation control function turns OFF, and the “Frequency Mod.” Status turns of on the screen.

NOTE

While the “Frequency Mod." Status is displayed, the wavelength closed-loop control is stopped. Therefore, the wavelength may fluctuate due to changes in the environment.

6.4. Power Monitor Signal Output

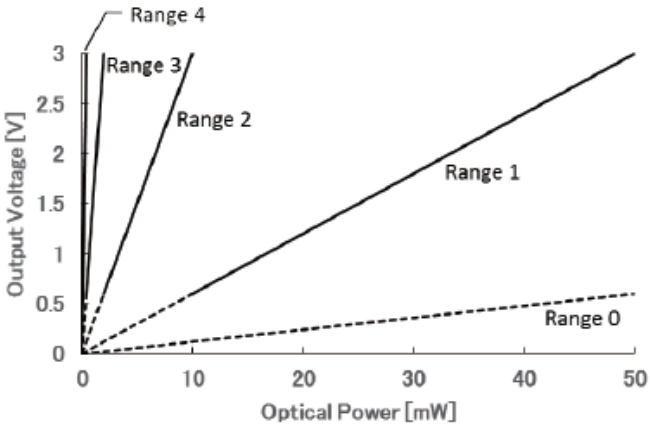
The function outputs voltage signal according to integrated power monitor. It can be used to compensate optical output power fluctuation in real time. (For example, this feature is best recommended to be used with Santec’s Swept Test System as WDL/PDL measurement solution.)



Signal is output from BNC connector leveled “POWER MONITOR” on rear panel.

The relation between output voltage and optical power depends on measurement range of power monitor, as shown below. Measurement range is adjusted automatically. Output voltage value against optical output power is not calibrated.
Typical voltage over output power correlation for each measurement range is shown below.

Range0: 0.03 V/mW (> 20 mW)
Range1: 0.15 V/mW (4 to 20 mW)
Range2: 0.75 V/mW (0.8 to 4 mW)
Range3: 3.75 V/mW (0.16 to 0.8 mW)
Range4: 18.75 V/mW (< 0.16 mW)



6.5. Trigger Setting

Trigger signals can be used for synchronizing with external instruments.
Specifications of output trigger signal

Signal Voltage:	3.3V (High), 0V (Low)
Signal width:	25 μs
Repetition rate:	20 kHz (Maximum)
Minimum trigger step:	Dependence on sweep speed. See table below as reference.

Sweep speed [nm/s]	Minimum trigger step [pm]	
	Time constant mode	Wavelength constant mode

1	≥0.1	≥0.2
2	≥0.1	≥0.2
5	≥0.3	≥0.5
10	≥0.5	≥1
20	≥1	≥1
50	≥2.5	≥2.5
100	≥5	≥5
200	≥10	≥10

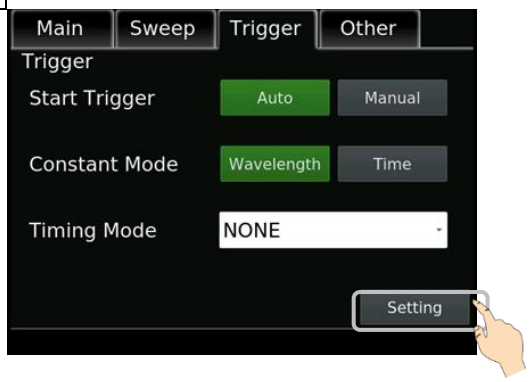
NOTE

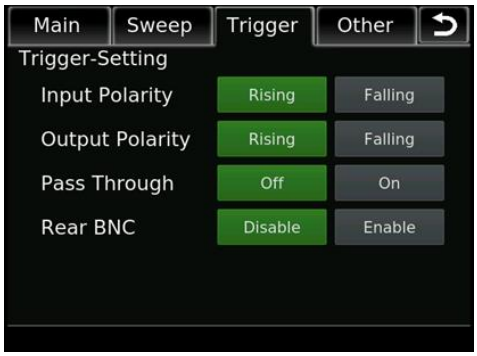
If settings other than those in the above table are set, the sweep speed will be prioritized.
e.g.

When the sweep speed is set to 200 nm/s, the minimum trigger interval is set to 1pm, the minimum trigger interval is automatically set to 10pm.

If necessary high resolution trigger output at a slow sweep speed, the time constant mode is effective. In this case, please read the wavelength logging data using the ":READout:DATa?" command.

1. Touch the Setting on the Trigger tab to move to trigger setting screen.





Input Polarity		Sets input trigger polarity.
	Rising	Triggers on a rising edge.
	Falling	Triggers on a falling edge.
Output Polarity		Sets output trigger polarity.
	Rising	Select when use an instrument that identifies rising edge.
	Falling	Select when use an instrument that identifies falling edge.
Pass Through		Replicates the input trigger on the output trigger with identical timing.
	ON	A trigger is output with the same timing as the input trigger, but reshaped according to the Output Polarity setting.
	OFF	No trigger is output even if there is an input trigger.

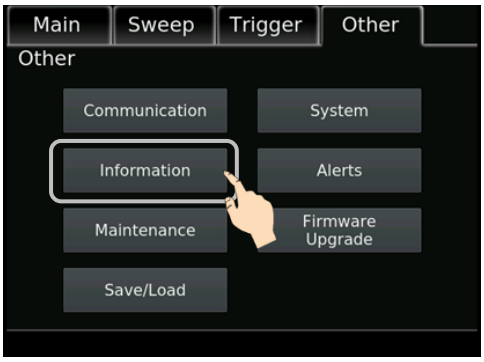
6.6. Displaying the Product Information

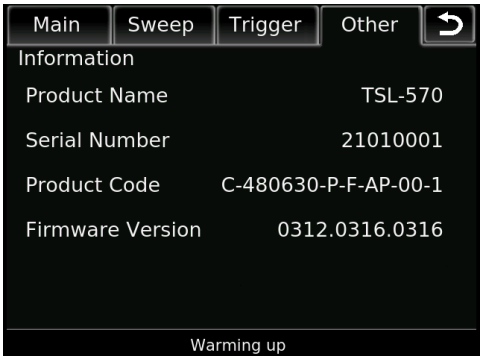
Display the various product information.

1. Touch Information on the Other tab to move to the screen for various settings.

The following information is displayed.

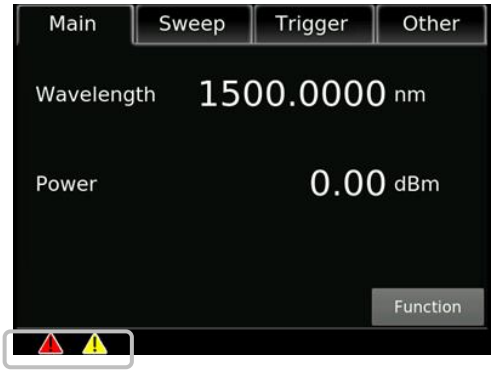
- Product name
- Serial Number
- Product Code
- Firmware Version



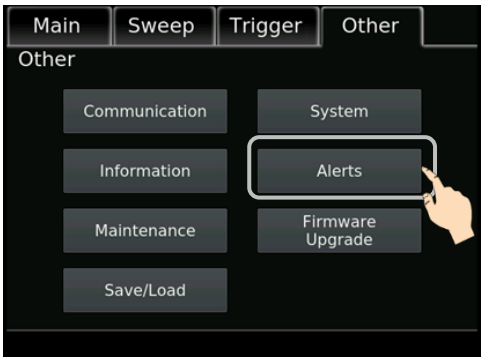


6.7. System Alert

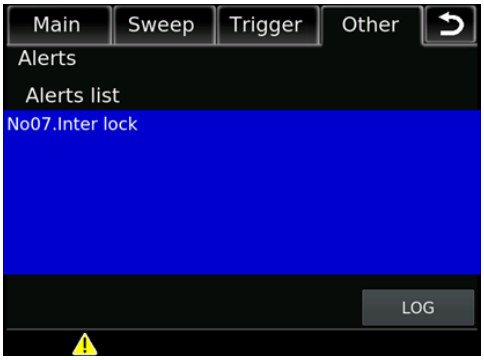
If an error occurs in the product, marks are displayed in the lower left corner of the screen. Follow the following steps to check the details of the error.



1. Touch Alerts on the Other tab to move to the Alerts screen.



2. The error code is displayed in the alarm list field. The detailed information is as below.



3. Refer to the following for the error contents and the copying method for the error number.

Error number	Detail	How to deal with errors
No 00 to 03	There is something issue with power supply.	Please stop using the product and contact santec.
No 04	Power setting Error	Reset the power in the configurable power range
No 05	Wavelength Error.	Press the Power ON/OFF key to turn off the product and restart the product. If the error still occurs, please stop using the product and contact santec.
No 06	There is something issue with the attenuator.	Press the Power ON/OFF key to turn off the product and restart the product. If the error still occurs, please stop using the product and contact santec.
No 07	There is something issue with the interlock.	Check the Interlock connection. Refer to “4-3 Interlock”.
No 20 to 22	There is something issue with the Temperature control.	Press the Power ON/OFF key to turn off the product and restart the product. If the error still occurs, please stop using the product and contact santec.
No 23	Ongoing Warm up.	Please wait until the warm up display disappears.
No 24	There is something issue with the sensor.	Press the Power ON/OFF key to turn off the product and restart the product. If the error still occurs, please stop using the product and contact santec.
No 25	There is something issue with the shutter function.	Please stop using the product and contact santec.
No 26	There is something issue with the sensor.	Press the Power ON/OFF key to turn off the product and restart the product. If the error still occurs, please stop using the product and contact santec.
No 27	There is something issue with the connection.	Please stop using the product and contact santec.
No 30	There is something issue with the exhaust fan.	Press the Power ON/OFF key to turn off the product and restart the product. If the error still occurs,

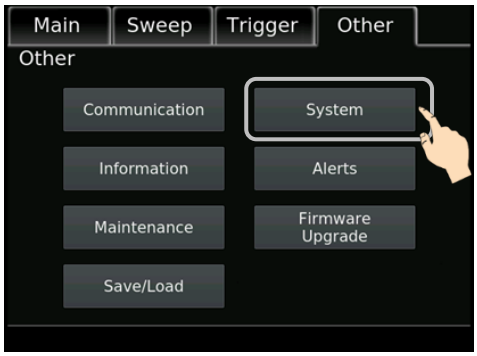
		please stop using the product and contact santec.

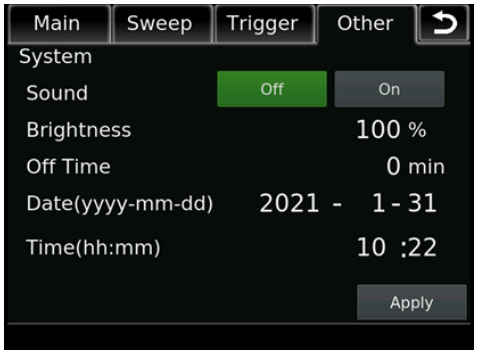
*Contact information can be found on the last page of this document.

6.8. System Settings

This function allows various settings related to System.

1. Touch System on the Other tab. The “System” screen will be displayed.



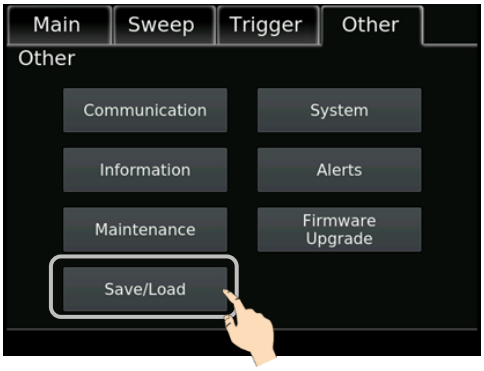


Sound	Set the presence or absence of a beep sound during touch operation.
Brightness	Sets the screen brightness in the range 10 to 100%.
Off Time	The screen brightness is reduced to 10% when the touch screen, numeric keypad have not been used for the specified period of time. Set the time in minutes (up to 99 minutes). When setting to “0“ minutes, the timer is disabled and the brightness will not decrease.
Date	Set the date of the built-in clock.
Time	Set the time of the built-in clock.

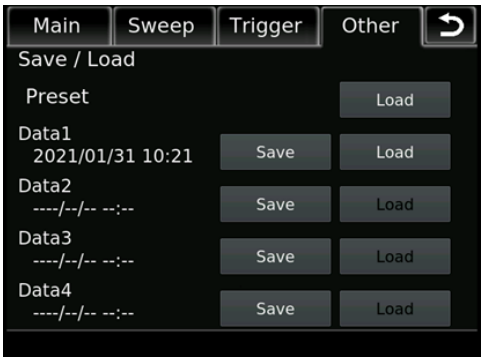
6.9. Save/ Load Setting parameters

This product can save up to 4 set parameters.

1. Touch the Save/Load on the Other tab to move to the Save/Load screen.



2. Select the Save/Load destination file. When touching the Load on the Present, the setting returns to the factory setting.



7. Operation by Communication

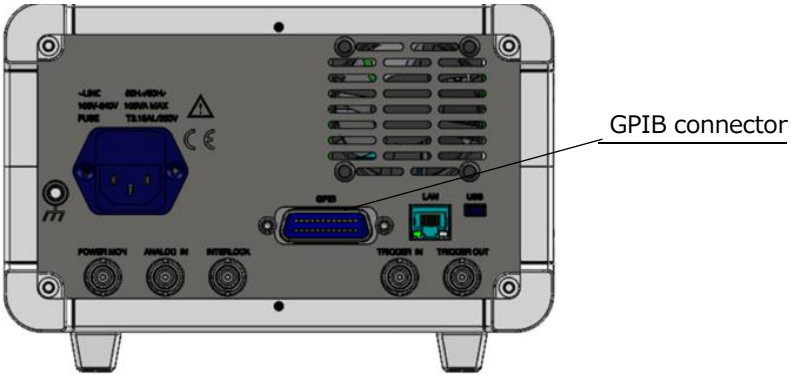
This device supports GP-IB, LAN and USB as means of communication. The setting method, characteristics, and differences of each method are described below.

7.1. GPIB

A communication function based on standards specified in IEEE-488.

7.1.1. Connection

Connect the 24-pin GPIB cable to the GPIB connector on the rear panel.
The total extension of the connected cable shall be 20 m or less. The cable length between each device must be 2 m or less. At most, 15 devices can be connected.



CAUTION

Do not disconnect or connect a cable from and to devices connected with GPIB cable, do not short-circuit connector, and do not turn ON/OFF the devices. Otherwise, action may be stopped, error may occur, causing a failure. In the event of trouble owing to these causes, reset all the connected devices, and then activate the system once again. When configuring a system, remove the unused device or unnecessary cable and return to the original setup.

7.1.2. GPIB Function

GP-IB has 10 kinds of interface functions, each of which has its grade that is called its subset. A "0" after the symbol of each function shows that support is not made,

and each numeric value represents grade.

Symbol	Function	TSL-570 Subset
SH	Source handshake	SH1: All functions
AH	Acceptor handshake	AH1: All functions
T	Talker	T8: Basic talker, talker release by MLA
L	Listener	L4: Basic listener, listener release by MTA
SR	Service request	SR1: All functions
RL	Remote/Local	RL2: Remote/local function, no local lockout function
PP	Parallel poll	PP0: none
DT	Device trigger	DT0: none
DC	Device clear	DC1: All functions
C	Controller	C0: none

1. GPIB address

GP-IB address of this product can be changed to refer to “7-1-3 Setting the address, delimiter, and command set”. The changed address will be available after setting. The changed address is saved in internal memory.

2. LOCAL

LOCAL is a state that this product is controlled by a key operation. This state is valid for all key operations.

3. REMOTE

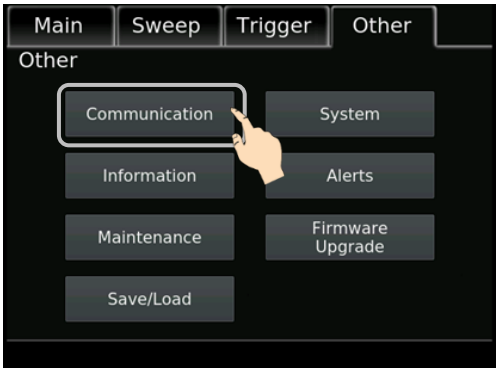
REMOTE is a state that this product is controlled from other controllers through GPIB bus. In this state, all the key operations are disable except for LOCAL key and LD key.

4. Device Clear (DCL)

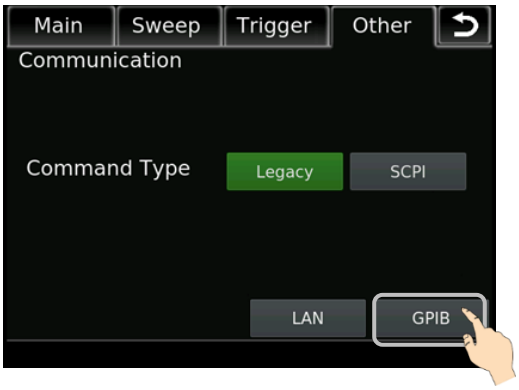
When this product receives the universal command “DCL” in REMOTE state, the transmit and receive buffers are cleared.

7.1.3. Setting the Address, Delimiter and Command set

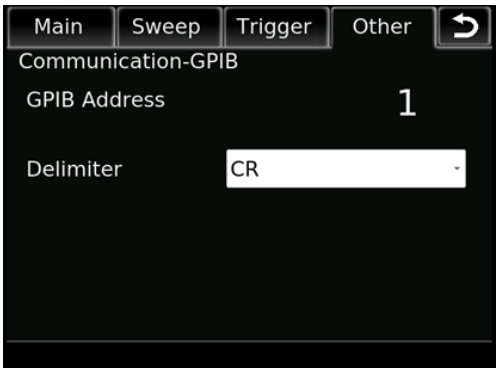
1. Touch Communication on the Other tab. The GPIB setting screen will be displayed.
   Set GPIB address and delimiter.



2. Touch GPIB on the Communication.



3. Set GPIB Address and Delimiter.

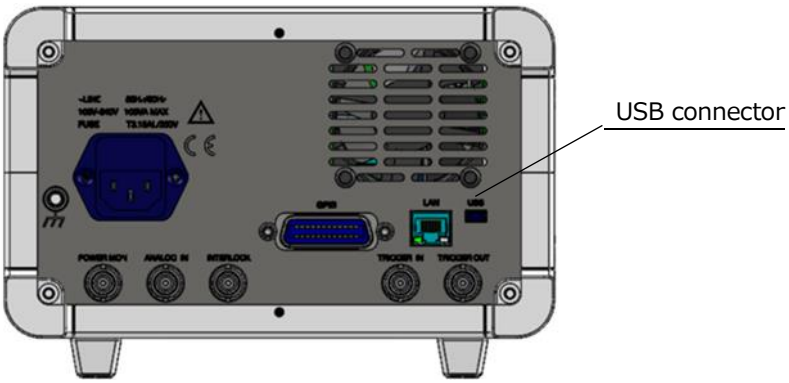


Address	Set an address from 1 to 30. The default value is 1.
Delimiter	Select a delimiter from ”CR”, ”LF”, ”CR+LF”, and ”EOI “. Set the end character of the command string. When “CR”, ”LF” or ”CR+LF” is selected, the command is accepted and analysis begins when the specified delimiter is received. When a command is sent, the delimiter is added to the end of the command and an EOI signal is asserted. When “EOI” is selected, the command is accepted and analysis begins when the EOI is received. When a command is sent, an EOI is asserted when the last character is sent.

7.2. USB

7.2.1. Connection

Connect USB B type cable to the connector leveled “USB DEVICE” on rear panel. “USB HOST” connector is not used for communication.



7.2.2. Communication Conditions and System Requirements

Transfer speed	1 MBps (with D2XX driver)

Setting the Delimiter: The delimiter of the command is “CR”. At receiving time, the reception of commands is completed and analysis begins after the delimiter is recognized. At sending time, the delimiter is added to the end of the response string and then sent.

7.2.3. Installing a USB Driver Software

To enable USB communication, USB driver software must be installed.
Even though some pop-up messages will be displayed when USB cable is connected the device and PC, please click cancel or close message.

1. Open “Device Manager” (Figure 7-2-3-1) and open “TSL-570” under “Other devices.” Right-click on “TSL-570” and click on “Update Driver Software...”.

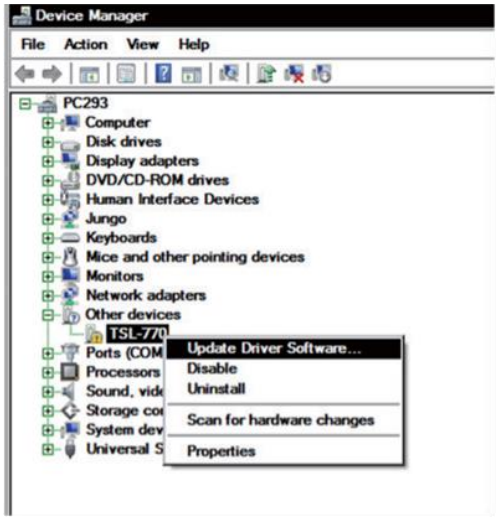


Figure 7-2-3-1. Device message

2. Click on “Browse my computer for driver software” when message window (Figure 7-2-3-2) appears.

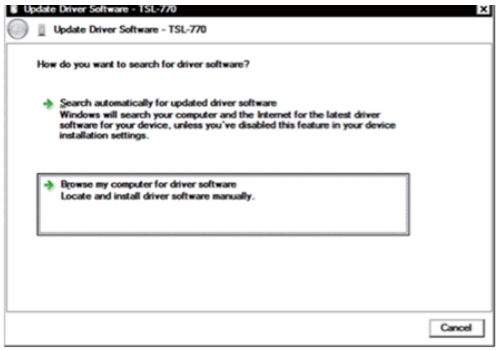


Figure 7-2-3-2. Update driver software

3. On message window (Figure 7-2-3-3), click on “Browse” button to select the driver software location under Removable disk included in package. (e.g., D:¥Common¥USB Driver on Figure 7-2-3-3)

Figure 7-2-3-3. Search for driver software location

4. Installation will automatically start. Message window Figure 7-2-3-4 will

appear.

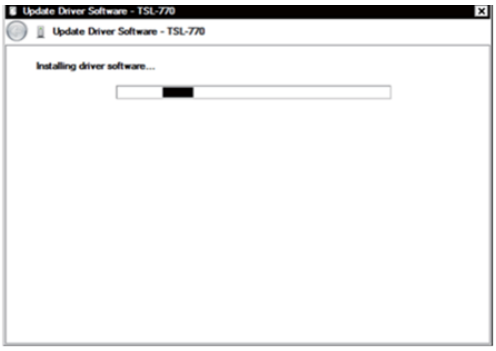


Figure 7-2-3-4. Installation in progress

5. If a Windows Security message in Figure 7-2-3-5 appears, please click on "Install this driver software anyway" to proceed.

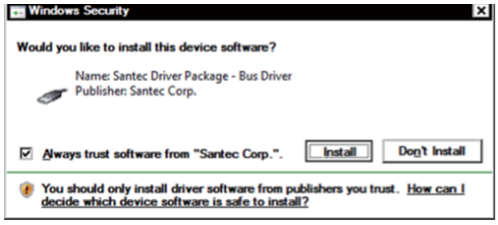


Figure 7-2-3-5. Windows security message

6. Installation is completed successfully when Figure 7-2-3-6 appears. Click on "Close" to exit the installation.

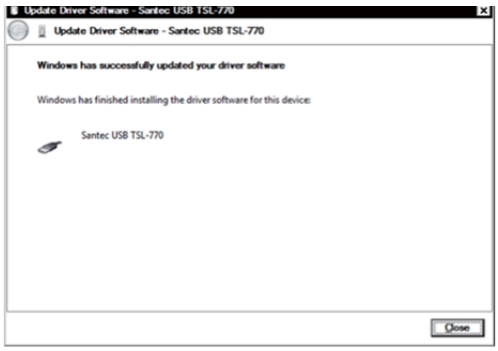
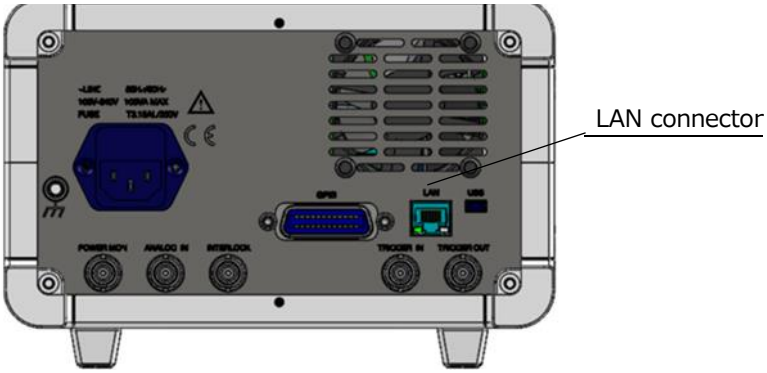


Figure 7-2-3-6. Installation complete

7.3. LAN

7.3.1. Connection

Connect the LAN cable to the RJ-45 connector on the rear panel.



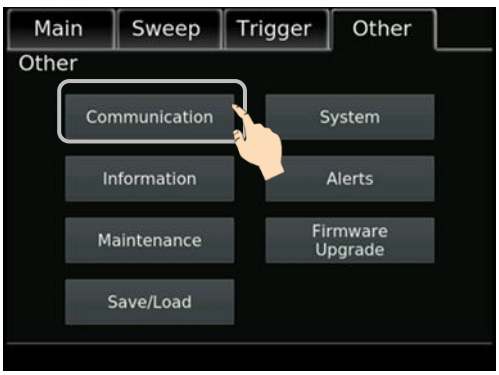
7.3.2. Communication Conditions and System Requirements

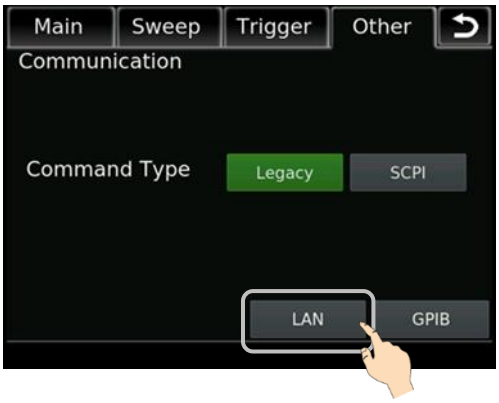
Electrical Specifications	IEEE802.3 Standard
Transfer Method	Ethernet（100BASE-TX）
Transfer speed	30Mbps
Communication Protocol	TCP/IP
Connector Type	RJ-45
IP Address	*.*.*.* (* = integer from 0 ~ 255)
Subnet mask	*.*.*.* (* = integer from 0 ~ 255)
Default Gateway	*.*.*.* (* = integer from 0 ~ 255)
Port No.	Integer from 0 ~ 65535

The delimiter of the command is “CR”.
The command is accepted and analysis begins when the delimiter is received.
At sending time, the delimiter is added to the end of the response string and sent.

7.3.3. Settings

1. Touch the Communication on the Other tab to move to the Communication setting screen. Then, touch the LAN to move to the Ethernet setting screen.

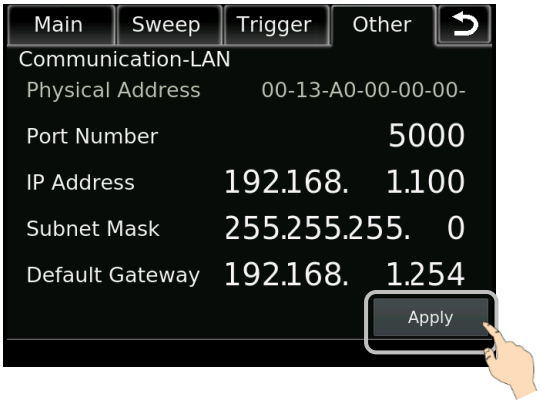




2. Set the following items.

Physical Address	The number is unique and cannot be changed.
Port Number	Set integer number from 0 to 65535 using numeric keypad.
IP Address	Input numbers using numeric keypad.
Subnet Mask	Input numbers using numeric keypad.
Default Gateway	Input numbers using numeric keypad.

3. Touch the Apply to complete settings.



7.4. Command Reference

7.4.1. Common Command List

Available for IEEE-488.2 common commands in the following list.

Command	Description
*IDN?	Identification Query Returns strings that identify the device.
*RST	Reset (Aborts the standby command.)
*TST?	Initiates an instrument self-test and returns the results.

;*OPC?	Queries the completion of operation.
*CLS	Status Clear (Clears STBR and SESR.)
*ESE	Sets Standard Event Enable Register. (The result of SESR and SEER is set to ESB.)
*ESE?	Reads out the value of the Standard Event Enable Register.
*ESR?	Reads out the value of the Standard Event Status Register.
*SRE	Sets Service Request Enable. (Selects enable or disable SRQ.)
*SRE?	Reads out the value of the Service Request Enable Register.
*STB?	Reads out the value of the Status Byte Register.

7.4.2. TSL-570 Status system

When Command set 1 is selected, the following status systems with four registers are provided.

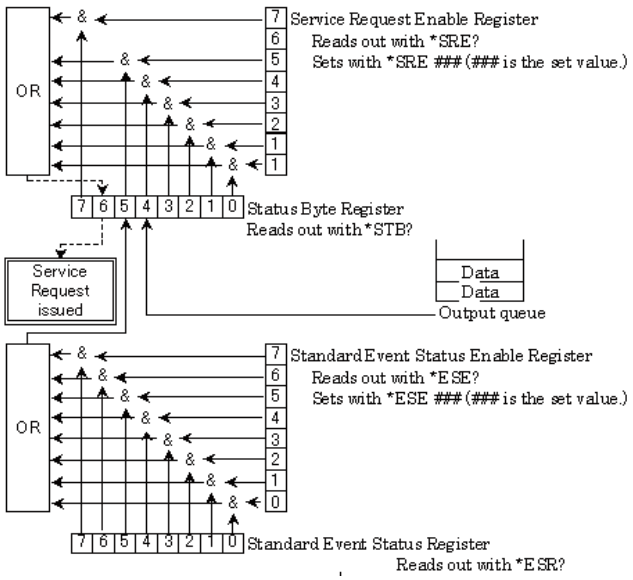
(1) Status Byte Register (STBR)

(2) Service Request Enable Register (SRER)

(3) Standard Event Status Register (SESR)

(4) Standard Event Enable Register (SEER)

1. Status System Structure Overview



* Output queue is cleared when a new command is input into the input queue.

2. Status Byte Register (STBR)

The status is read out by serial poll, or *STB? command.

7	6	5	4	3	2	1	0
Not used	RQS	ESB	MAV	Not used	Not used	Not used	Not used

RQS (Request Service Bit):

RQS is set when a Service Request is issued.

ESB (Event Status Bit):

ESB is set when any of the bits of the Standard Event Status Register (SESR) is set.

MAV (Message Available Bit):

MAV is set when output data is prepared.

3. Service Request Enable Register (SRER)

An 8-bit register to set Enable/Disable of each bit of the Status Byte Register. If a bit of the SRER is set to 1, the corresponding bit of the STBR is set to Enable.

4. Standard Event Status Register (SESR)

An 8-bit register to indicate the standard status of the device.

7	6	5	4	3	2	1	0
PON	Not used	CME	EXE	DDE	QYE	Not used	OPC

PON (Power ON):

Bit is set when power is turned on.

CME (Command Error):

CME is set when a command has a syntax error or is misspelled.

EXE (Execution Error):

EXE is set when a command is not available for the device, or a command cannot be executed in the current device condition.

DDE (Device Definition Error):

Not used

QYE (Query Error):

QYE is set when an attempt is made to read data from the output queue while the output queue is empty.

OPC (Operation Completion):

OPC is set when all pending operations are completed.

5. Standard Event Enable Register (SEER)

SEER is an 8-bit register to set Enable/Disable of each bit of the SESR. If a

bit of the SEER is set to 1, the corresponding bit of the SESR is set to Enable.

7.4.3. IEEE-488.2 common commands - Detailed description

Command		*IDN?
Description		Identification Query A query to identify the device; places strings of device information such as the manufacturer name, model number, serial number, firmware version in the output queue.
Syntax		*IDN?
Parameter		None
Response		The information of this device information is as follows. SANTEC,TSL-570,########,****.****.**** # field = serial number of the device in 8 digits. * field = firmware version as 4 digits + .(period) + 4 digits + .(period) + 4 digits.
Example		The information of this device information is as follows. Manufacturer: SANTEC, Model: TSL-570, Serial: 21020001, Firmware: 0001.0000.00001
	Transmission	*IDN?
	Response	→SANTEC,TSL-570,21020001,0001.0000.0001

Command		*RST
Description		Device Reset Aborts standby operation. Clears the following items. ・Command input queue ・Error queue
Syntax		*RST
Parameter		None
Response		None
Example		The device is in the idle state waiting a command.
	Transmission	*RST
	Response	None

Command	*TST?
Description	Self-test Query Initiates an instrument self-test and places the results in the output queue.
Syntax	*TST?

Parameter		None
Response		This should return “0” for success, non-zero return values for error conditions 0: No error Non zero: Error
Example		This should return “0” for success, non-zero return values for error conditions.
	Transmission	*TST?
	Response	→0

Command		*OPC?
Description		Operation Complete Query Places 1 in the output queue when all operation processing has completed.
Syntax		*OPC?
Parameter		None
Response		0: (In operation) 1: (Operation completed)
Example		All operation processing has completed.
	Transmission	*OPC?
	Response	→1

Command		*CLS
Description		Clear Status Clears all event registers and queues and reflects the summary in the Status Byte Register. Clears the following items. ・Status Byte Register ・Standard Event Status Register ・Error Queue
Syntax		*CLS
Parameter		None
Response		None
Example		Clears all event registers and queues.
	Transmission	*CLS
	Response	None

Command	*ESE
Description	Standard Event Enable Register Setting Sets the Standard Event Enable Register (SEER).
Syntax	*ESE<wsp><value>

Parameter		Setting value from 0 to 255
Response		None
Example		Set SEER to 255.
	Transmission	*ESE 255
	Response	None

Command		*ESE?
Description		Standard Event Enable Register Query Places the value of the Standard Event Enable Register (SEER) in the output queue.
Syntax		*ESE?
Parameter		None
Response		Integer from 0 to 255
Example		SEER setting is 255.
	Transmission	*ESE?
	Response	→255

Command		*ESR?
Description		Standard Event Status Register Query Places the value of the Standard Event Status Register (SESR) in the output queue. Register is cleared after being read.
Syntax		*ESR?
Parameter		None
Response		Integer from 0 to 255
Example		ESR setting is 255.
	Transmission	*ESR?
	Response	→255

Command		*SRE
Description		Service Request Enable Register Setting Sets the Service Request Enable Register (SRER).
Syntax		*SRE<wsp><value>
Parameter		Setting value from 0 to 255
Response		None
Example		Set SRE to 255.
	Transmission	*SRE 255
	Response	None

Command	*SRE?

Description		Service Request Enable Register Query Places the value of the Service Request Enable Register (SRER) in the output queue.
Syntax		*SRE?
Parameter		None
Response		Integer from 0 to 63, or 128 to 191. (Values are missing since Bit 6 is always 0.)
Example		SRER setting is 63.
	Transmission	*SRE?
	Response	→63

Command		*STB?
Description		Status Byte Register Query Places the value of the Status Byte Register (STBR) in the output queue.
Syntax		*SRE?
Parameter		None
Response		Integer from 0 to 255 When read out by a serial poll, the value returned is the sum of 64 and the value of the Status Byte Register (since Bit 6 is set in the serial poll).
Example		STB setting is 0.
	Transmission	*STB?
	Response	→0

7.4.4. TSL-570 Specific command overview

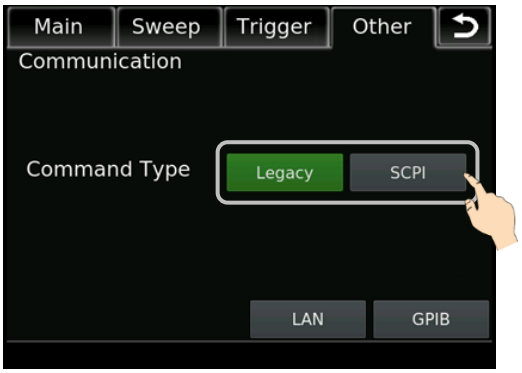
Two kinds of command sets are provided for the TSL-570. Select one of them in advance and use the commands in that category. Commands in one command set cannot be used with commands in the other command set simultaneously. “TSL-570 SCPI” is using commands complying with the standards specified by the SCPI consortium. This command set has high compatibility with other companies’ instruments.

“Legacy” is using commands based on santec’s conventional SCPI commands. This command set has compatibility with santec conventional model TSL-550, TSL-710, and TSL-510.

■ How to switch the command set

1. Touch Communication on the Other tab to move to command set ting screen.

2. Select ”Legacy” or ” SCPI”.



Command set	Description
Legacy	This command is compatible with our previous products.
SCPI	This command complies with the standards specified by the SCPI consortium.

Command set can also be selected by “:SYSTem:COMMunicate:CODe” command.

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1. Optical output related commands

Command		:WAVelength
Description		Sets the output wavelength.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength<wsp><value>
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength<wsp><value> [PM|NM|UM|MM|M]
Parameter		Range: Specified wavelength range Step: 0.1 pm
	Legacy	<value> should be decimal notation in “nm”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, m（meter）is used as the default.
Response		None
Example		Set the wavelength to 1550nm.

	Legacy	:WAV 1550
	SCPI1	:WAV 1550nm
	SCPI2	:WAV 1550E-9

Command		:WAVelength?
Description		Reads out the wavelength value.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength [:MINimum|:MAXimum]?
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength?<wsp> [PM|NM|UM|MM|M][MINimum|MAXimum]
Parameter		None: Reads out the current set wavelength. MINimum: Reads out the minimum acceptable wavelength. MAXimum: Reads out the maximum acceptable wavelength.
Response		Range: Specified wavelength range Step: 0.1pm
	Legacy	Response is decimal notation in “nm”.
9	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, m (meter) is used as the default.
Example		The setting wavelength is 1550nm.
Transmission		:WAV?
Response	Legacy	→1550.0000
	SCPI	→+1.55000000E-006

Command		:WAVelength:UNIT
Description		Sets units of displayed wavelength.
Syntax		[:SOURce]: WAVelength:UNIT<wsp><value>
Parameter		0: nm 1: THz
Response		None
Example		Sets units of wavelength to THz.
	Transmission	:WAV:UNIT 1

Command	:WAVelength:UNIT?
Description	Reads out units of displayed wavelength.
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength:UNIT?
Parameter	None
Response	0: nm 1: THz
Example	The setting unit of wavelength is THz.
Transmission	:WAV:UNIT?

Response	Legacy	→1
	SCPI	→+1

Command		:WAVelength:FINe
Description		Sets Fine-Tuning value.
Syntax		[:SOURce[n]][:CHANnel[m]]:WAVelength:FINe<wsp><value>
Parameter		Range: -100.00 to +100.00 Step: 0.01
Response		None
Example		Sets Fine-Tuning value to 50.
	Transmission	:WAV:FIN 50.00

Command		:WAVelength:FINe?
Description		Reads out Fine-Tuning value.
Syntax		[:SOURce[n]][:CHANnel[m]]:WAVelength:FINe?
Parameter		None
Response		Range: -100.00 to +100.00 Step: 0.01
Example		The setting Fine-Tuning value is 100.
Transmission		:WAV:FIN?
Response	Legacy	→100.00
	SCPI	→+1.00000000E+002

Command		:WAVelength:FINetuning:DISable
Description		Terminates Fine-Tuning operation.
Syntax		[:SOURce[n]]:WAVelength:FINetuning:DISable
Parameter		Note
Response		None
Example		Terminates Fine-Tuning operation.
	Transmission	:WAV:FIN:DIS

Command		[:WAVelength]:FREQuency
Description		Sets the output wavelength in optical frequency.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:[:WAVelength]: FREQuency<wsp><value>
	SCPI	[:SOURce[n]][:CHANnel[m]][:WAVelength]: FREQuency<wsp><value>[Hz|kHz|MHz|GHz|THz]
Parameter		Range: Specified wavelength range Step: 10MHz

	Legacy	<value> should be decimal notation in “THz (terahertz)”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, Hz is used as the default.
Response		None
Example		Sets the frequency to 200THz.
	Legacy	:FREQ 200
	SCPI1	:FREQ 200THZ
	SCPI2	:FREQ 200E+12

Command		[:WAVelength]:FREQuency?
Description		Reads out output wavelength in optical frequency.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]][:WAVelength]:FREQuency? [:MINimum|:MAXimum]
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength?<wsp> [Hz|kHz|MHz|GHz|THz][MINimum|MAXimum]
Parameter		None: Reads out the currently setting frequency. MINimum: Reads out the minimum acceptable frequency. MAXimum: Reads out the maximum acceptable frequency.
Response		Range: Specified frequency range Step: 10MHz
	Legacy	Response is decimal notation in “THz”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, Hz is used as the default.
Example		The setting frequency is 200THz.
Transmission		: FREQ?
Response	Legacy	→200
	SCPI	→+2.00000000E+014

Command		:COHCtrl
Description		Sets Coherence control status.
Syntax		[:SOURce[n]][:CHANnel[m]]:COHCtrl<wsp><value>
Parameter		0: Coherence control OFF 1: Coherence control ON
Response		None
Example		Sets Coherence control status to ON.
	Transmission	:COHC 1

Command		:COHCtrl?
Description		Reads out Coherence control status.
Syntax		[:SOURce[n]][:CHANnel[m]]:COHCtrl?
Parameter		None
Response		0: Coherence control OFF 1: Coherence control ON
Example		Coherence control status is ON.
Transmission		:COHC?
Response	Legacy	→1
	SCPI	→+1

Command		:POWer:STATe
Description		Sets optical output status.
Syntax		[:SOURce[n]][:CHANnel[m]]:POWer:STATe<wsp><value>
Parameter		0: optical output OFF 1: optical output ON
Response		None
Example		Sets optical output status to ON.
	Transmission	:POW:STAT 1

Command		:POWer:STATe?
Description		Reads out optical output status.
Syntax		[:SOURce[n]][:CHANnel[m]]:POWer:STATe?
Parameter		None
Response		0: optical output OFF 1: optical output ON
Example		Optical output is active.
Transmission		:POW:STAT?
Response	Legacy	→1
	SCPI	→+1

Command		:POWer:ATTenuation
Description		Sets the attenuator value.
Syntax		[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation <wsp><value>
Parameter		Range: 0 ～30 (dB) Step: 0.01 (dB)
Response		None
Example		Sets the attenuator value to 10 dB.
	Legacy	:POW:ATT 10

	SCPI	:POW:ATT +1.00000000E+001

Command		:POWer:ATTenuation?
Description		Reads out the attenuator value.
Syntax		[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation?
Parameter		None
Response		Range: 0 ～30 (dB) Step: 0.01 (dB)
Example		The attenuator value is 10 dB.
Transmission		:POW:ATT?
Response	Legacy	→10.00
	SCPI	→+1.00000000E+001

Command		:POWer:ATTenuation:AUTo
Description		Sets the power control mode.
Syntax		[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation:AUTo <wsp><value>
Parameter		0: Manual mode 1: Auto mode
Response		None
Example		:POW:ATT:AUT 1
	Transmission	:POW:STAT 1

Command		:POWer:ATTenuation:AUTo?
Description		Reads out the setting of the power control.
Syntax		[:SOURce[n]][:CHANnel[m]]:POWer:ATTenuation:AUTo?
Parameter		None
Response		0: Manual mode 1: Auto mode
Example		The power control mode is Auto mode.
Transmission		:POW:ATT:AUT?
Response	Legacy	→1
	SCPI	→+1

Command		:POWer[:LEVel]
Description		Sets optical output power level.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel]<wsp><value>
	SCPI	[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel]<wsp><value>[PW|NW|UW|MW|Watt|DBM]
Parameter		Range: -15dBm to +13dBm

		Step: 0.01dB (0.01mW)
@	Legacy	<value> should be decimal notation in “dBm” or “mW”. Units are defined by the command “:POWer:UNIT”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, the default units are used. The default units are defined by
Response		None
Example		Set the power level to 10dBm.
	Legacy	:POW 10
	SCPI1	:POW 10dBm
	SCPI2	:POW +1.00000000E+001

Command		:POWer[:LEVel]?
Description		Reads out optical output power level setting.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel] [:MINimum|MAXimum]?
	SCPI	[:SOURce[n]][:CHANnel[m]]:POWer[:LEVel]? <wsp>[dBm|mW][MINimum|MAXimum]
Parameter		None: Reads out the current set output power. MINimum: Reads out the minimum configurable ouput power. MAXimum: Reads out the maximum configurable output power.
Response		Range: -15dBm to +13dBm Step: 0.01dB (0.01mW) Units are defined by the command “:POWer:UNIT”.
Example		Setting power level is 10dBm or 10mW. Units are defined by the command “:POWer:UNIT”.
Transmission		:POW?
Response	Legacy	→10.00
	SCPI	→+1.00000000E+001

Command	:POWer:ACTual[:LEVel]?
Description	Reads out monitored optical power. The value is measured by the built in power monitor.
Syntax	[:SOURce[n]][:CHANnel[m]]:POWer:ACTual[:LEVel]?
Parameter	None
Response	Range: -15dBm to peak power Step: 0.01dB (0.01mW)

		Units are defined by the command ":POWer:UNIT".
Example		Monitored power level is 9.6dBm or 9.6mW. Units are defined by the command ":POWer:UNIT".
Transmission		:POW:ACT?
Response	Legacy	→9.60
	SCPI	→+9.60000000E+000

Command		:POWer:SHUTter
Description		Sets Open/Close status of the internal shutter. The function is same as the Laser ON/OFF command ":POWer:STATe" (Note, the relationship between parameter and state is reversed).
Syntax		[:SOURce[n]][:CHANnel[m]]:POWer:SHUTter<wsp><value>
Parameter		0: Shutter Open 1: Shutter Close
Response		None
Example		Closes the internal shutter.
	Transmission	:POW:SHUT 1

Command		:POWer:SHUTter?
Description		Reads out the status of the internal shutter.
Syntax		[:SOURce]:POWer:SHUTter?
Parameter		None
Response		0: Shutter Open 1: Shutter Close
Example		The internal shutter is closed.
Transmission		:POW:SHUT?
Response	Legacy	→1
	SCPI	→+1

Command		:POWer:UNIT
Description		Changes the unit of the power setting and display.
Syntax		[:SOURce[n]][:CHANnel[m]]:POWer:UNIT<wsp><value>
Parameter		0: dBm 1: mW
Response		None
Example		Sets the power setting and display unit to "mW".
	Transmission	:POW:UNIT 1

Command	:POWer:UNIT?
Description	Reads out the unit of the power setting and display.

Syntax		[:SOURce[n]][:CHANnel[m]]:POWer:UNIT?
Parameter		None
Response		0: dBm 1: mW
Example		The setting unit of power is mW.
Transmission		:POW:UNIT?
Response	Legacy	→1
	SCPI	→+1

Command		:WAVelength:SWEep:STARt
Description		Sets the sweep start wavelength.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STARt <wsp><value>
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: STARt<wsp><value>[PM|NM|UM|MM|M]
Parameter		Range: Specified wavelength range Step: 0.1 pm
	Legacy	<value> should be decimal notation in “nm”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, m（meter）is used as the default.
Response		None
Example		Sets sweep start wavelength to 1480 nm.
	Legacy	:WAV:SWE:STARt 1480
	SCPI1	:WAV:SWE:STARt 1480nm
	SCPI2	:WAV:SWE:STARt 1480E-9

Command		:WAVelength:SWEep:STARt?
Description		Reads out the sweep start wavelength.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STARt?
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STARt? <wsp>[PM|NM|UM|MM|M]
Parameter		None
Response		Range: Specified wavelength range Step: 0.1pm
	Legacy	Response is decimal notation in “nm”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, m（meter）is used as the default.

Example		Setting sweep start wavelength is 1480 nm.
Transmission		:WAV:SWE:STARt?
Response	Legacy	→1480.0000
	SCPI	→+1.48000000E-006

Command		[:WAVelength]:FREQuency:SWEep:STARt
Description		Sets the sweep start wavelength in optical frequency.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]][:WAVelength]:FREQuency: SWEep:STARt<wsp><value>
	SCPI	[:SOURce[n]][:CHANnel[m]][:WAVelength]:FREQuency: SWEep:STARt<wsp><value>[Hz|kHz|MHz|GHz|THz]
Parameter		Range: Specified wavelength range Step: 10MHz
	Legacy	<value> should be decimal notation in “THz”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, Hz（Hertz）is used as the default.
Response		None
Example		Sets the sweep start wavelength to 185.057 THz.
	Legacy	:FREQ:SWE:STAR 185.0570
	SCPI1	:FREQ:SWE:STAR 185.057THZ
	SCPI2	:FREQ:SWE:STAR 185.057E+12

Command		[:WAVelength]:FREQuency:SWEep:STARt?
Description		Reads out the sweep start wavelength in optical frequency.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STARt?
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STARt? <wsp>[Hz|kHz|MHz|GHz|THz]
Parameter		None
Response		Range: Specified wavelength range Step: 10MHz
	Legacy	Response is decimal notation in “THz”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, Hz is used as the default.
Example		Setting sweep start frequency is 185.0570THz.
Transmission		:FREQ:SWE:STAR?
Response	Legacy	→185.057
	SCPI	→+1.8505700E+014

Command		:WAVelength:SWEep:STOP
Description		Sets the sweep stop wavelength.
Syntax	Legacy	:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STOP <wsp><value>
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STOP <wsp><value>[PM|NM|UM|MM|M]
Parameter		Range: Specified wavelength range Step: 0.1 pm
	Legacy	<value> should be decimal notation in “nm”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, m（meter）is used as the default.
Response		None
Example		Sets sweep stop wavelength to 1640 nm.
	Legacy	:WAV:SWE:STOP 1640
	SCPI1	:WAV:SWE:STOP 1640nm
	SCPI2	:WAV:SWE:STOP 1640E-9

Command		:WAVelength:SWEep:STOP?
Description		Reads out the sweep stop wavelength.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STOP?
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:STOP? STOP?<wsp>[PM|NM|UM|MM|M]
Parameter		None
Response		Range: Specified wavelength range Step: 0.1pm
	Legacy	Response is decimal notation in “nm”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, m（meter）is used as the default.
Example		Setting sweep stop wavelength is 1640 nm.
Transmission		:WAV:SWE:STOP?
Response	Legacy	→1640.0000
	SCPI	→+1.64000000E-006

Command	:WAVelength:SWEep:RANGe:MINimum?
Description	Reads out the minimum wavelength in the configurable sweep range

Syntax	Legacy	[:SOURce]:WAVelength:SWEep:RANGe:MINimum?
	SCPI	[:SOURce]:WAVelength:SWEep:RANGe:MINimum? [PM|NM|UM|MM|M]
Parameter		None
Response		Range: The minimum wavelength in the configurable sweep range at the current sweep speed Step: 0.1pm
	Legacy	Response is decimal notation in “nm”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, m （meter） is used as the default.
Example		The minimum wavelength in the configurable sweep range is 1482 nm.
Transmission		:WAV:SWE:RANG:MIN?
Response	Legacy	→1482.0000
	SCPI	→+1.48200000E-006

Command		:WAVelength:SWEep:RANGe:MAXimum?
Description		Reads out the maximum wavelength in the configurable sweep range
Syntax	Legacy	[:SOURce]:WAVelength:SWEep:RANGe:MAXimum?
	SCPI	[:SOURce]:WAVelength:SWEep:RANGe:MAXimum? [PM|NM|UM|MM|M]
Parameter		None
Response		Range: The maximum wavelength in the configurable sweep range at the current sweep speed Step: 0.1pm
	Legacy	Response is decimal notation in “nm”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, m （meter） is used as the default.
Example		The maximum wavelength in the configurable sweep range is 1638 nm.
Transmission		:WAV:SWE:RANG:MAX?
Response	Legacy	→1638.0000
	SCPI	→+1.63800000E-006

Command		[:WAVelength]:FREQuency:SWEep:STOP
Description		Sets the sweep stop wavelength in optical frequency.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]][:WAVelength]:FREQuency: SWEep:STOP<wsp><value>

	SCPI	[:SOURce[n]][:CHANnel[m]][:WAVelength]:FREQuency: SWEep:STOP<wsp><value>[Hz|kHz|MHz|GHz|THz]
Parameter		Range: Specified wavelength range Step: 10MHz
	Legacy	<value> should be decimal notation in “THz”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, Hz（Hertz）is used as the default.
Response		None
Example		Sets the sweep stop wavelength to 185.057 THz.
	Legacy	:FREQ:SWE:STOP 185.05700
	SCPI1	:FREQ:SWE:STOP 185.05700THZ
	SCPI2	:FREQ:SWE:STOP 185.05700E+12

Command		[:WAVelength]:FREQuency:SWEep:STOP?
Description		Reads out the sweep stop wavelength in optical frequency.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]][:WAVelength]:FREQuency: SWEep:STOP?
	SCPI	[:SOURce[n]][:CHANnel[m]][:WAVelength]:FREQuency: SWEep:STOP?<wsp>[Hz|kHz|MHz|GHz|THz]
Parameter		None
Response		Range: Specified wavelength range Step: 10MHz
	Legacy	Response is decimal notation in “THz”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, Hz（Hertz）is used as the default.
Example		Setting sweep stop frequency is 185.0570THz.
Transmission		:FREQ:SWE:STOP?
Response	Legacy	→185.05700
	SCPI	→+1.8505700E+014

Command		:FREQuency:SWEep:RANGe:MINimum?
Description		Reads out the minimum frequency in the configurable sweep range
Syntax	Legacy	[:SOURce][:WAVelength]:FREQuency:SWEep:RANGe :MINimum?
	SCPI	[:SOURce][:WAVelength]:FREQuency:SWEep:RANGe :MINimum? [HZ|KHZ|MHZ|GHZ|THZ]

Parameter		None
Response		Range: The minimum frequency in the configurable sweep range at the current sweep speed Step: 10MHz
	Legacy	<value> should be decimal notation in “THz”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, Hz（Hertz）is used as the default.
Example		The minimum frequency in the configurable sweep range is 182.80028THz.
Transmission		:FREQ:SWE:RANG:MIN?
Response	Legacy	→182.80028
	SCPI	→1.82800280E+014

Command		80:FREQuency:SWEep:RANGe:MAXimum?
Description		Reads out the maximum frequency in the configurable sweep range
Syntax	Legacy	[:SOURce][:WAVelength]:FREQuency:SWEep:RANGe :MAXimum?
	SCPI	[:SOURce][:WAVelength]:FREQuency:SWEep:RANGe :MAXimum? [HZ|KHZ|MHZ|GHZ|THZ]
Parameter		None
Response		Range: The maximum frequency in the configurable sweep range at the current sweep speed Step: 10MHz
	Legacy	<value> should be decimal notation in “THz”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, Hz（Hertz）is used as the default.
Example		The maximum frequecy in the configurable sweep range is 202.56247THz.
Transmission		:FREQ:SWE:RANG:MAX?
Response	Legacy	→202.56247
	SCPI	→+2.02562470E+014

Command	:WAVelength:SWEep:MODe
Description	Sets the sweep mode.

Syntax		[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: MODe<wsp><value>
Parameter		0: Step sweep mode and One way 1: Continuous sweep mode and One way 2: Step sweep mode and Two way 3: Continuous sweep mode and Two way
Response		None
Example		Sets the sweep mode to continuous and One way.
	Transmission	:WAV:SWE:MOD 1

Command		:WAVelength:SWEep:MODe?
Description		Reads out the sweep mode.
Syntax		[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:MODe?
Parameter		None
Response		0: Step sweep mode and One way 1: Continuous sweep mode and One way 2: Step sweep mode and Two way 3: Continuous sweep mode and Two way
Example		Setting sweep mode is continuous and One way.
Transmission		:WAV:SWE:MOD?
Response	Legacy	→1
	SCPI	→+1

Command		:WAVelength:SWEep:SPEed
Description		Sets the sweep speed.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: SPEed<wsp><value>
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: SPEed<wsp><value>
Parameter		Range: 1 to 200 nm/s Selection: 1,2,5,10,20,50,100,200 (nm/s)
	Legacy	<value> should be decimal notation in “nm/s”. Character strings representing a unit cannot be accepted.
	SCPI	<value> should be decimal notation in “nm/s”. Character strings representing a unit cannot be accepted.
Response		None
Example		Sets the sweep speed to 200 nm/s.
	Legacy	:WAV:SWE:SPE 200
	SCPI	:WAV:SWE:SPE 200

Command	:WAVelength:SWEep:SPEed?

Description		Reads out sweep speed.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:SPEed?
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:SPEed?
Parameter		None
Response		Range: 1 to 200 nm/s Selection: 1,2,5,10,20,50,100,200 (nm/s)
	Legacy	Character strings representing a unit cannot be accepted.
	SCPI	Character strings representing a unit cannot be accepted.
Example		Setting sweep speed is 200nm/s.
Transmission		:WAV:SWE:SPE?
Response	Legacy	→200.0
	SCPI	→+200.0

Command		:WAVelength:SWEep:STEP[:WIDTh]
Description		Sets the step for Step sweep mode.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: STEP[:WIDTh]<wsp><value>
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: STEP[:WIDTh]<wsp><value>[PM|NM|UM|MM|M]
Parameter		Range: 0.1pm to specified wavelength span. Step: 0.1 pm
	Legacy	<value> should be decimal notation in “nm”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, meters are used as the default units.
Response		None
Example		Sets the step to 0.01 nm.
	Legacy	:WAV:SWE:STEP 0.01
	SCPI1	:WAV:SWE:STEP 10pm
	SCPI2	:WAV:SWE:STEP 1.0E-11

Command		:WAVelength:SWEep:STEP[:WIDTh]?
Description		Reads out the step for Step sweep mode.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: STEP[:WIDTh]?
	SCPI	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: STEP[:WIDTh]?<wsp>[PM|NM|UM|MM|M]
Parameter		None
Response		Range: 0.1pm to specified wavelength span.

		Step: 0.1 pm
	Legacy	Response is decimal notation in “nm”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, meters are used as the default units.
Example		Setting step is 0.1 nm.
Transmission		:WAV:SWE:STEP?
Response	Legacy	→0.100
	SCPI	→+1.00000000E-010

Command		[:WAVelength]:FREQuency:SWEep:STEP[:WIDTh]
Description		Sets the step for Step sweep mode in optical frequency.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]][:WAVelength]: FREQuency:SWEep:STEP[:WIDTh]<wsp><value>
	SCPI	[:SOURce[n]][:CHANnel[m]][:WAVelength] :FREQuency:SWEep:STEP[:WIDTh]<wsp><value> [Hz|kHz|MHz|GHz|THz]
Parameter		Range: 20MHz to specified wavelength span. Step: 10 MHz
	Legacy	<value> should be decimal notation in “THz”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, “Hz” are used as the default units.
Response		None
Example		Sets the step to 10 GHz.
	Legacy	:FREQ:SWE:STEP 0.010
	SCPI1	:FREQ:SWE:STEP 10GHZ
	SCPI2	:FREQ:SWE:STEP 1.0E+10

Command		[:WAVelength]:FREQuency:SWEep:STEP[:WIDTh]?
Description		Reads out the step for Step Sweep mode in optical frequency.
Syntax	Legacy	[:SOURce[n]][:CHANnel[m]][:WAVelength]: FREQuency:SWEep:STEP[:WIDTh]?
	SCPI	[:SOURce[n]][:CHANnel[m]][:WAVelength]: FREQuency:SWEep:STEP[:WIDTh]?<wsp> [Hz|kHz|MHz|GHz|THz]
Parameter		None
Response		Range: 20MHz to specified wavelength span. Step: 10 MHz

	Legacy	Response is decimal notation in “THz”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, “Hz” are used as the default units.
Example		Setting step is 0.01 THz.
Transmission		:WAV:SWE:STEP?
Response	Legacy	→0.01
	SCPI	→+1.0000000E+010

Command	:WAVelength:SWEep:DWELl
Description	Sets wait time between consequent steps in step sweep mode. This wait time does not include time for wavelength tuning.
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: DWELl<wsp><value>
Parameter	Range: 0 to 999.9 sec Step: 0.1 sec
Response	None
Example	Sets the dwell time to 1 second.
Transmission	:WAV:SWE:DWEL 1

Command		:WAVelength:SWEep:DWELl?
Description		Reads out wait time between consequent steps in step sweep mode.
Syntax		[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:DWELl?
Parameter		None
Response		Range: 0 to 999.9 sec Step: 0.1 sec
Example		Setting dwell time to 3 seconds.
Transmission		:WAV:SWE:DWEL?
Response	Legacy	→3.0
	SCPI	→+3.00000000E+000

Command	:WAVelength:SWEep:CYCLes
Description	Sets the sweep repetition times.
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: CYCLes<wsp><value>
Parameter	Range: 0 to 999 Step: 1
Response	None
Example	Sets the sweep repetition times to 100.
Transmission	:WAV:SWE:CYCL 100

Command		:WAVelength:SWEep:CYCLes?
Description		Reads out the setting sweep repetition times.
Syntax		[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:CYCLes?
Parameter		None
Response		Range: 0 to 999
Example		The setting repetition times is 100.
Transmission		:WAV:SWE:CYCL?
Response	Legacy	→100
	SCPI	→+100

Command		:WAVelength:SWEep:COUNt?
Description		Reads out the current number of completed sweeps.
Syntax		[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep:COUNt?
Parameter		None
Response		Range: 0 to 999
Example		100 sweeps have completed.
Transmission		:WAV:SWE:COUN?
Response	Legacy	→100
	SCPI	→+100

Command	:WAVelength:SWEep:DELay
Description	Sets the wait time between consequent scans.
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: DELay<wsp><value>
Parameter	Range: 0 to 999.9 sec Step: 0.1 sec
Response	None
Example	Sets the wait time to 1 second.
Transmission	:WAV:SWE:DEL 1

Command		:WAVelength:SWEep:DELay?
Description		Reads out the setting wait time between consequent scans.
Syntax		[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep: DELay?
Parameter		None
Response		Range: 0 to 999.9 sec Step: 0.1 sec
Example		Setting wait time is 1 second.
Transmission		:WAV:SWE:DEL?
Response	Legacy	→1.0

	SCPI	→+1.00000000E+000

Command	:WAVelength:SWEep[:STATe]
Description	Sets sweep status.
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep [:STATe]<wsp><value>
Parameter	0: Stop. 1: Start. This command executes single scan. Use ":WAVelength:SWEep[:STATe]:REPeat" for repeat scan.
Response	None
Example Transmission	Starts a sweep. :WAV:SWE 1

Command		:WAVelength:SWEep[:STATe]?
Description		Reads out the current sweep status.
Syntax		[:SOURce[n]][:CHANnel[m]]:WAVelength:SWEep[:STATe]?
Parameter		None
Response		0: Stopped 1: Running 3: Standing by trigger 4: Preparation for sweep start
Example		Sweep is running.
Transmission		:WAV:SWE?
Response	Legacy	→1
	SCPI	→+1

Command	:WAVelength:SWEep[:STATe]:REPeat
Description	Starts repeat scan.
Syntax	[:SOURce[n]][:CHANnel[m]]:WAVelength: SWEep[:STATe]:REPeat
Parameter	None
Response	None
Example Transmission	Starts repeat scan. :WAV:SWE:REP

Command	:READout:POINts?
Description	Reads out the number of logging data.
Syntax	[:SOURce[n]][:CHANnel[m]]:READout:POINts?
Parameter	None

Response		0 to 500,000
Example		Recorded data number is 10,000.
Transmission		:READ:POIN?
Response	Legacy	→10000
	SCPI	→+10000

Command		:READout:DATa?
Description		Reads out walength logging data.
Syntax		[:SOURce[n]][:CHANnel[m]]:READout:DATa?
Parameter		None
Response		Please refer to the following.
	Legacy	The data is comprised of a header (ASCII characters) and wavelength data array (4-byte binary). Example: #42000 □□□□□□□□ ..... The “4” after the “#” indicates the number of digits following “4”. The following four digits, “2000”, indicate the amount of recorded data in byte units. In this example, there are 2000 bytes of data (500 points). The data is saved in integer format in 0.1 pm units. Binary data is transmitted in Intel byte order.
	SCPI	The data is comprised of a header (ASCII characters) and wavelength data array (8-byte binary). Example: #44000 □□□□□□□□ The “4” after the “#” indicates the number of digits following “4”. The following four digits, “4000” indicate the amount of recorded data in byte units. n this example, there are 4000 bytes of data (500 points). The data is saved in the 64 bit IEEE Standard format and data is transmitted in Intel byte order.

Command	:READout:DATa:POWer?
Description	Reads out power logging data.
Syntax	[:SOURce[n]][:CHANnel[m]]:READout:DATa:POWer?
Parameter	None
Response	The data is comprised of a header (ASCII characters) and wavelength data array (4- byte binary). Example: #42000 □□□□□□□□ ..... The “4” after the “#” indicates the number of digits following is 4. The following four digits, “2000”, indicate the amount of recorded data in byte units. In this example, there are 2000 bytes of data (500 points).

	The data is saved in the 32 bit IEEE Standard format and data is transmitted in Intel byte order. The data is saved in dBm.

Command	:AM:STATe
Description	Enables and disables modulation function of the laser output.
Syntax	[:SOURce[n]][:CHANnel[m]]:AM:STATe<wsp><value>
Parameter	0: Disable 1: Enable
Response	None
Example	Enables the modulation function of the laser output.
Transmission	:AM:STAT 1

Command		:AM:STATe?
Description		Reads out status of modulation function of the laser output.
Syntax		[:SOURce[n]][:CHANnel[m]]:AM:STATe?
Parameter		None
Response		0: Disable 1: Enable
Example		The modulation function is enabled.
Transmission		:AM:STAT?
Response	Legacy	→1
	SCPI	→+1

Command	:AM:SOURce
Description	Sets modulation source.
Syntax	[:SOURce[n]][:CHANnel[m]]:AM:SOURce<wsp><value>
Parameter	0: Coherence control (same operation as ":COHCtrl") 1: Intensity modulation 3: Frequency modulation
Response	None
Example	Selects Coherence control.
Transmission	:AM:SOUR 0

Command	:AM:SOURce?
Description	Reads out modulation source.
Syntax	[:SOURce[n]][:CHANnel[m]]:AM:SOURce?
Parameter	None
Response	0: Coherence control (same operation as ":COHCtrl") 1: Intensity modulation 3: Frequency modulation

Example		The intensity modulation is set.
Transmission		:AM:SOUR?
Response	Legacy	→1
	SCPI	→+1

Command		[:SOURce]:WAVelength:OFFSet
Description		Add the constant offset to the output wavelength.
Syntax	Legacy	:WAVelength:OFFSet<wsp><value>
	SCPI	:WAVelength:OFFSet<wsp><value>
Parameter		Range: -0.1000 ~ 0.1000 (nm) Step: 0.0001（nm）
	Legacy	<value> should be decimal notation in “nm”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, m（meter） is used as the default.
Response		None
Example		Adds the constant offset by 0.01nm to the output wavelength.
	Legacy	:WAV:OFFS 0.010
	SCPI1	:WAV:OFFS 10pm
	SCPI2	:WAV:OFFS 1.0E-13

Command		[:SOURce]:WAVelength:OFFSet?
Description		Reads out the constant offset to the output wavelength.
Syntax	Legacy	[:SOURce]:WAVelength:OFFSet?
	SCPI	[:SOURce]:WAVelength:OFFSet?<wsp>[PM|NM|UM|MM|M]
Parameter		None
Response		Range: -0.1000 ~ 0.1000 (nm) Step: 0.0001（nm）
	Legacy	Response is decimal notation in “nm”.
	SCPI	These numbers are followed by character strings representing a unit. When a unit character string is not specified, m (meter) is used as the default.
Example		The constant offset to the output wavelength is 0.01nm.
Transmission		:WAV:OFFS?
Response	Legacy	→0.01
	SCPI	→+1.00000000E-013

2. Input/ Output related command

Command	:TRIGger:INPut:EXTernal
Description	Enables / Disables external trigger input.
Syntax	:TRIGger:INPut:EXTernal<wsp><value>
Parameter	0: Disable 1: Enable
Response	None
Example	Enables external trigger input.
Transmission	:TRIG:INP:EXT 1

Command		:TRIGger:INPut:EXTernal?
Description		Reads out the setting of external trigger input.
Syntax		:TRIGger:INPut:EXTernal?
Parameter		None
Response		0: Disable 1: Enable
Example		External trigger input is enabled.
Transmission		:TRIG:INP:EXT?
Response	Legacy	→1
	SCPI	→+1

Command	:TRIGger:INPut[:EXTernal]:ACTive
Description	Sets input trigger polarity.
Syntax	:TRIGger:INPut[:EXTernal]:ACTive<wsp><value>
Parameter	0: High Active / Triggers at rising edge 1: Low Active / Triggers at falling edge
Response	None
Example	Sets the input trigger polarity to Low Active.
Transmission	:TRIG:INP:ACT 1

Command		:TRIGger:INPut[:EXTernal]:ACTive?
Description		Reads out input trigger polarity.
Syntax		:TRIGger:INPut[:EXTernal]:ACTive?
Parameter		None
Response		0: High Active / Triggers at rising edge 1: Low Active / Triggers at falling edge
Example		The input trigger polarity is set to Low Active.
Transmission		:TRIG:INP:ACT?
Response	Legacy	→1

	SCPI	→+1

Command	:TRIGger:INPut:STANdby
Description	Sets the device in trigger signal input standby mode.
Syntax	:TRIGger:INPut:STANdby<wsp><value>
Parameter	0: Normal operation mode 1: Trigger standby mode
Response	None
Example	Sets the device in trigger standby mode.
Transmission	:TRIG:INP:STAN 1

Command		:TRIGger:INPut:STANdby?
Description		Reads out the trigger signal input standby mode.
Syntax		:TRIGger:INPut:STANdby?
Parameter		None
Response		0: Normal operation mode 1: Trigger standby mode
Example		The device is in trigger standby mode.
Transmission		:TRIG:INP:STAN?
Response	Legacy	→1
	SCPI	→+1

Command	:TRIGger:INPut:SOFTtrigger
Description	Issues a soft trigger. Executes sweep from trigger standby mode.
Syntax	:TRIGger:INPut:SOFTtrigger
Parameter	None
Response	None
Example	Issues a soft trigger.
Transmission	:TRIG:INP:SOFT

Command	:TRIGger:OUTPut
Description	Sets the timing of the trigger signal output.
Syntax	:TRIGger:OUTPut<wsp><value>
Parameter	0: None 1: Stop 2: Start 3: Step
Response	None

Example	Sets the timing of the trigger signal output to be at sweep completion.
Transmission	:TRIG:OUTP 1

Command		:TRIGger:OUTPut?
Description		Reads out the timing setting of the trigger signal output.
Syntax		:TRIGger:OUTPut?
Parameter		None
Response		0: None 1: Stop 2: Start 3: Step
Example		The timing of the trigger signal output is at sweep start.
Transmission		:TRIG:OUTP?
Response	Legacy	→2
	SCPI	→+2

Command		:TRIGger:OUTPut:ACTive
Description		Sets output trigger polarity.
Syntax		:TRIGger:OUTPut:ACTive<wsp><value>
Parameter		0: High Active / Triggers at rising edge 1: Low Active / Triggers at falling edge
Response		None
Example		Sets the output trigger polarity to High Active.
Transmission		:TRIG:OUTP:ACT 0

Command		:TRIGger:OUTPut:ACTive?
Description		Reads out output trigger polarity.
Syntax		:TRIGger:OUTPut?
Parameter		None
Response		0: High Active / Triggers at rising edge 1: Low Active / Triggers at falling edge
Example		The output trigger polarity is set to High Active.
Transmission		:TRIG:OUTP:ACT?
Response	Legacy	→0
	SCPI	→+0

Command		:TRIGger:OUTPut:STEP[:WIDTh]
Description		Sets the interval of the trigger signal output.
Syntax	Legacy	:TRIGger:OUTPut:STEP[:WIDTh]<wsp><value>

	SCPI	:TRIGger:OUTPut:STEP[:WIDTh]<wsp><value>[PM|NM|UM|MM|M]
Parameter		Range : 0.0001 ～ Maximum specified wavelength range (nm) Step : 0.0001（nm） The minimum set trigger step depends on the setting sweep speed. Refer to “6-5. Trigger Setting” for details.
	Legacy	<value> should be decimal notation in “nm”. Character strings representing a unit cannot be accepted.
	SCPI	<value> is accepted in decimal notation and exponential notation. These numbers are followed by character strings representing a unit. When a unit character string is not specified, m（meter）is used as the default.
Response		None
Example		Sets the interval of the trigger signal output to 1nm.
	Legacy	:TRIG:OUTP:STEP 1
	SCPI1	:TRIG:OUTP:STEP 1nm
	SCPI2	:TRIG:OUTP:STEP 1E-9

Command		:TRIGger:OUTPut:STEP[:WIDTh]?
Description		Reads out the interval of the trigger signal output.
Syntax		:TRIGger:OUTPut:STEP[:WIDTh]?
Parameter		None
Response		Range: 0.0001 ～ Maximum specified wavelength range (nm) Step: 0.0001（nm）
	Leagacy	Response is decimal notation in “nm”.
	SCPI	Response is exponential notation in meters.
Example		the trigger signal output interval is 0.1 nm.
Transmission		:TRIG:OUTP: STEP?
Response	Legacy	→0.100
	SCPI	→+1.00000000E-010

Command	:TRIGger:OUTPut:SETTing
Description	Sets the output trigger period mode.
Syntax	:TRIGger:OUTPut:SETTing<wsp><value>
Parameter	0: Sets the output trigger to be periodic in wavelength. 1: Sets the output trigger to be periodic in time.
Response	None
Example	Sets the output trigger to be periodic in wavelength.
Transmission	:TRIG:OUTP:SETT 0

Command	:TRIGger:OUTPut:SETTing?

Description		Reads out the output trigger period mode.
Syntax		:TRIGger:OUTPut:SETTing?
Parameter		None
Response		0: Output trigger is periodic in wavelength. 1: Output trigger is periodic in time.
Example		The output trigger is periodic in wavelength.
Transmission		:TRIG:OUTP:SETT?
Response	Legacy	→0
	SCPI	→+0

Command	:TRIGger:THRough
Description	Sets the trigger through mode. When On is selected, input trigger signal is put through to the output trigger port. Trigger signal is re-shaped according to polarity setting.
Syntax	:TRIGger:THRough<wsp><value>
Parameter	0: OFF 1: ON
Response	None
Example	Sets the trigger through mode to ON.
Transmission	:TRIG:THR 1

Command		:TRIGger:THRough?
Description		Reads out the trigger through mode.
Syntax		:TRIGger:THRough?
Parameter		None
Response		0: OFF 1: ON
Example		The trigger through mode is set to ON.
Transmission		:TRIG:THR?
Response	Legacy	→1
	SCPI	→+1

3. System related commands

Command	:SYSTem:ERRor?
Description	Reads out the error issued.
Syntax	:SYSTem:ERRor?
Parameter	None
Response	Error Number (Refer to “7-4 5. Command Error”)
Example	Error numbers and error messages are returned.

Transmission	:SYST:ERR?

Command	:SYSTem:COMMunicate:GPIB:ADDRess
Description	Sets the GPIB address.
Syntax	:SYSTem:COMMunicate:GPIB:ADDRess<wsp><value>
Parameter	Integer from 1 to 30
Response	None
Example	Sets the GPIB address to “10”.
Transmission	:SYST:COMM:GPIB:ADDR 10

Command		:SYSTem:COMMunicate:GPIB:ADDRess?
Description		Reads out the GPIB address.
Syntax		:SYSTem:COMMunicate:GPIB:ADDRess?
Parameter		None
Response		Integer from 1 to 30
Example		The GPIB address is “10”.
Transmission		:SYST:COMM:GPIB:ADDR?
Response	Legacy	→10
	SCPI	→+10

Command	:SYSTem:COMMunicate:GPIB:DELimiter
Description	Sets the command delimiter for GPIB communication. EOI is always sent.
Syntax	:SYSTem:COMMunicate:GPIB:DELimiter<wsp><value>
Parameter	0: CR 1: LF 2: CR+LF 3: None
Response	None
Example	Sets the GPIB command delimiter to “LF”.
Transmission	:SYST:COMM:GPIB:DEL 1

Command	:SYSTem:COMMunicate:GPIB:DELimiter?
Description	Reads out the command delimiter for GPIB communication.
Syntax	:SYSTem:COMMunicate:GPIB:ADDRess?
Parameter	None
Response	0: CR 1: LF 2: CR+LF 3: None

Example		The GPIB delimiter is ”LF”.
Transmission		:SYST:COMM:GPIB:DEL?
Response	Legacy	→1
	SCPI	→+1

Command	:SYSTem:COMMunicate:ETHernet:MACaddress?
Description	Reads out the MAC address.
Syntax	:SYSTem:COMMunicate:GPIB:ADDRess?
Parameter	None
Response	12 digits hexadecimal
Example	The read MAC address is 00-13-A0-00-00-00.
Transmission	:SYST:COMM:ETH:MAC?
Response	→0013A0000000

Command	:SYSTem:COMMunicate:ETHernet:IPADdress
Description	Sets the IP address.
Syntax	:SYSTem:COMMunicate:ETHernet:IPADdress<wsp><value>
Parameter	***.***.***.*** (*** is integer from 0 to 255)
Response	None
Example	Sets the IP address to “192.168.0.1”.
Transmission	:SYST:COMM:ETH:IPAD 192.168.0.1

Command	:SYSTem:COMMunicate:ETHernet:IPADdress?
Description	Reads out the IP address.
Syntax	:SYSTem:COMMunicate:ETHernet:IPADdress?
Parameter	None
Response	***.***.***.*** (*** is integer from 0 to 255)
Example	The IP address is ”192.168.0.1”.
Transmission	:SYST:COMM:ETH:IPAD?
Response	→192.168.0.1

Command	:SYSTem:COMMunicate:ETHernet:SMASk
Description	Sets the subnet mask.
Syntax	:SYSTem:COMMunicate:ETHernet:SMASk<wsp><value>
Parameter	***.***.***.*** (*** is integer from 0 to 255)
Response	None
Example	Sets the subnet mask to “255.255.255.0”.
Transmission	:SYST:COMM:ETH:SMAS 255.255.255.0

Command	:SYSTem:COMMunicate:ETHernet:SMASk?

Description	Reads out the subnet mask.
Syntax	:SYSTem:COMMunicate:ETHernet:SMASk?
Parameter	None
Response	***.***.***.*** (*** is integer from 0 to 255)
Example	The subnet mask is “255.255.255.0”.
Transmission	:SYST:COMM:ETH:SMAS?
Response	→255.255.255.0

Command	:SYSTem:COMMunicate:ETHernet:DGATeway
Description	Sets the default gateway.
Syntax	:SYSTem:COMMunicate:ETHernet:DGATeway <wsp><value>
Parameter	***.***.***.*** (*** is integer from 0 to 255)
Response	None
Example	Sets the default gateway to “192.168.0.254”.
Transmission	:SYST:COMM:ETH:DGAT 192.168.0.254

Command	:SYSTem:COMMunicate:ETHernet:DGATeway?
Description	Reads out the default gateway.
Syntax	:SYSTem:COMMunicate:ETHernet:DGATeway?
Parameter	None
Response	***.***.***.*** (*** is integer from 0 to 255)
Example	The default gateway is “192.168.0.254”.
Transmission	:SYST:COMM:ETH:DGAT?
Response	→192.168.0.254

Command	:SYSTem:COMMunicate:ETHernet:PORT
Description	Sets the port number.
Syntax	:SYSTem:COMMunicate:ETHernet:PORT<wsp><value>
Parameter	Integer from 0 to 65535
Response	None
Example	Sets the port number to “64000”.
Transmission	:SYST:COMM:ETH:PORT 64000

Command	:SYSTem:COMMunicate:ETHernet:PORT?
Description	Reads out the port number.
Syntax	:SYSTem:COMMunicate:ETHernet:PORT?
Parameter	None
Response	Integer from 0 to 65535
Example	The port number is “64000”.

Transmission		:SYST:COMM:ETH:PORT?
Response	Legacy	→64000
	SCPI	→+64000

Command	:SYSTem:COMMunicate:CODe
Description	Sets the command set.
Syntax	:SYSTem:COMMunicate:CODe<wsp><value>
Parameter	0: Legacy 1: SCPI
Response	None
Example	Sets the command set to “SCPI”.
Transmission	:SYST:COMM:COD 1

Command	:SYSTem:COMMunicate:CODe?	
Description	Reads out the current set.	
Syntax	:SYSTem:COMMunicate:CODe?	
Parameter	None	
Response	0: Legacy 1: SCPI	
Example	The command set is “SCPI”.	
Transmission	:SYST:COMM:COD?	
Response	Legacy	→1
	SCPI	→+1

Command	:SYSTem:LOCK?	
Description	Reads out the status of external interlock.	
Syntax	:SYSTem:LOCK?	
Parameter	None	
Response	0: Unlocked 1: External inter locked	
Example	The external interlock is locked.	
Transmission	:SYST:LOCK?	
Response	Legacy	→1
	SCPI	→+1

Command	:DISPlay:BRIGhtness
Description	Sets brightness of the display.
Syntax	:DISPlay:BRIGhtness<wsp><value>
Parameter	0 to 100 Unit: %

Response	None
Example	Sets brightness of the display to 50%.
Transmission	:DISP:BRIG 50

Command		:DISPlay:BRIGhtness?
Description		Reads out brightness of the display.
Syntax		:DISPlay:BRIGhtness?
Parameter		None
Response		0 to 100 Unit: %
Example		Brightness of the display is 50%.
Transmission		:DISP:BRIG?
Response	Legacy	→50
	SCPI	→+50

Command	:SPECial:SHUTdown
Description	Shuts down the device.
Syntax	:SPECial:SHUTdown
Parameter	None
Response	None
Example	Shuts down the device.
Transmission	:SPEC:SHUT

Command	:SPECial:REBoot
Description	Restarts the device.
Syntax	:SPECial:REBoot
Parameter	None
Response	None
Example	Restarts the device.
Transmission	:SPECial:REBoot

Command	:SYSTem:ALERt?
Description	Reads out the current alert information.
Syntax	:SYSTem:ALERt?
Parameter	None
Response	Error Number (Refer to “7-4 6. System Alert”)
Example	Error numbers and error messages are returned.
Transmission	:SYST:ALER?

Command	:SYSTem:VERSion?

Description	Reads out the frimware version
Syntax	:SYSTem:VERSion?
Parameter	None
Response	****.****.**** 4 digits + .(period) + 4 digits + .(period) + 4 digits.
Example	The firmware version is 0012.0010.0005.
Transmission	:SYSTem:VERSion?
Response	'→0012.0010.0005

Command	:SYSTem:CODe?
Description	Reads out the product code
Syntax	:SYSTem:CODe?
Parameter	None
Response	*-******-*-*-**-**-* 1 digit + "-" + 6 digits (integer) + "-" + 1 digit + "-" + 1 digit + "-" + 2 digits (integer) + "-" + 1 digit (integer)
Example	The product code is C-480640-P-F-AP-00-1.
Transmission	:SYSTem:CODe?
Response	→C-480640-P-F-AP-00-1

7.4.5. Command error

Errors issued are stored as error messages in the error queue and can be read out with the ":SYSTem:ERRor?" command. The list is as shown below.

Command error list

Code	Error message
0	No error
-102	Syntax error
-103	Invalid separator
-108	Parameter not allowed
-109	Missing parameter
-113	Undefined header
-148	Character data not allowed
-200	Execution error
-222	Data out of range
-410	Query INTERRUPTED

7.4.6. System alert

Alert issued are stored as alert messages in the alert queue and can be read out

with the ” :SYSTem:ALERt?” command. The list is as shown below.

System alert list

Code	Alert condition
No00.	Power supply Error1
No02.	Power supply Error2
No03.	Power supply Error3
No04	Power setting error (Unconfigurable power)
No05.	Wavelength Error
No06.	Attenuator Error
No07.	Inter lock detection
No20.	Temperature control Error1
No21.	Temperature control Error2
No22.	Temperature control Error3
No23.	Temperature control Error4
No24.	Sensor Error1
No25.	Shutter Error
No26.	Sensor Error2
No27.	Connection Error
No30.	Exhaust Fan Error

8. Specifications

8.1. Specifications

Table 1: Model number 260360, 355485, 500630 and 560680 specifications

Category	Parameter		Unit	Performance	
				Type A	Type C
Wavelength Characteristics	Wavelength Tuning Range		nm	1260 - 1360 / 1355 - 1485 / 1500 - 1630 / 1560 -1680	
	Wavelength Setting Resolution		pm	0.1	
	Wavelength Stability (typ.) *1		pm	≤±5	≤±1
	Absolute Wavelength Accuracy *2	Step Mode	pm	±15	±3
	Absolute Wavelength Accuracy (Operating temp.)		pm	±20	±5
	Wavelength Repeatability (typ.)		pm	±5	±1
	Absolute Wavelength Accuracy (typ.) *2	Continuous sweep mode @100 nm/s	pm	±15	±5
	Wavelength Repeatability (typ.)		pm	±8	±1.5
	Sweep Speed		nm/s	1 to 200	
	Fine Tuning Scan Range		GHz	≥10	
Optical Power Characteristics	Output Power *7	Peak (typ.)	dBm	≥13	
		@1260 - 1360 / 1380 - 1485 / 1500 - 1630 / 1560 - 1680 nm	dBm	≥10	
		@1355 - 1485 nm	dBm	≥7	
	Power Stability *1, *3		dB	±0.01	
	Power Repeatability *3	Step mode	dB	±0.01	
	Power Flatness vs. Wavelength *3, 7		dB	±0.2	
	Dynamic power repeatability (typ.) *3	Continuous sweep mode @100 nm/s	dB	±0.01	
	Dynamic relative power flatness (typ.) *3		dB	±0.02	
	Relative intensity noise (RIN) (typ.) *4		dB/Hz	-145 (1 MHz to 3 GHz)	
Spectrum	Linewidth (typ.)	Coherence Ctrl. Off	kHz	200	
		Coherence Ctrl. On	MHz	40	
	SMSR (typ.)		dB	≥45	
	Signal to Total Source Spontaneous Emission Ratio *5		dB	≥70	
	Signal to Source Spontaneous Emission Ratio *6		dB/nm	≥80 (≥90 dB/0.1 nm)	

Table 2: Model number 240380, 355505 and 480640 specifications

Category	Parameter		Unit	Performance		
				Type A	Type C	Type P
Wavelength Characteristics	Wavelength Tuning Range *8		nm	1240 - 1380 / 1355 - 1505 / 1480 - 1640		
	Wavelength Setting Resolution		pm	0.1		
	Wavelength Stability (typ.) *1		pm	≤±5	≤±1	≤±1
	Absolute Wavelength Accuracy *2	Step Mode	pm	±15	±3	±1 (typ.)
	Absolute Wavelength Accuracy (Operating temp.)		pm	±20	±5	±2
	Wavelength Repeatability (typ.)		pm	±5	±1	±0.5
	Absolute Wavelength Accuracy (typ.) *2	Continuous sweep mode @100 nm/s	pm	±15	±5	±1.5
	Wavelength Repeatability (typ.)		pm	±8	±1	±0.8
	Sweep Speed		nm/s	1 to 200		
	Fine Tuning Scan Range		GHz	≥10		
Optical Power Characteristics	Output Power *7	Peak (typ.)	dBm	≥13		
		@1260 - 1360 / 1380 - 1485 / 1500 - 1630 nm	dBm	≥10		
		Full Tuning Range	dBm	≥7		
	Power Stability *1, *3		dB	±0.01		
	Power Repeatability *3	Step mode	dB	±0.01		
	Power Flatness vs. Wavelength *3, *7		dB	±0.2		
	Dynamic power repeatability (typ.) *3	Continuous sweep mode @100 nm/s	dB	±0.01		
	Dynamic relative power flatness (typ.) *3		dB	±0.2		
	Relative intensity noise (RIN) (typ.) *4		dB/Hz	-145 (1 MHz to 3 GHz)		
Spectrum	Linewidth (typ.)	Coherence Ctrl. Off	kHz	200		100
		Coherence Ctrl. On	MHz	40		
	SMSR (typ.)		dB	≥45		
	Signal to Total Source Spontaneous Emission Ratio *5		dB	≥70		
	Signal to Source Spontaneous Emission Ratio *6		dB/nm	≥80 (≥90 dB/0.1 nm)		

* All specifications are quoted after 1 hour warm-up period. Specifications apply for wavelengths not equal to any water absorption line.
*1: For period of 1 hour. Within ± 0.5 ºC. *2: At 25±1 ºC. *3: At "Auto" power mode and > 0 dBm. *4: At maximum output power.
*5: Ratio of signal power to total spontaneous emission power within ±15 nm of the signal wavelength (typical value).
*6: Ratio of signal power to maximum spontaneous emission power in a 1 nm band within a ±3 nm band around the signal wavelength (typical value).
*7: The specification range is up to 1630 nm.
*8: Full wavelength tuning range reduced by 2 nm on both ends for sweep speeds ≥ 100 nm/s and < 150 nm/s.
Full wavelength tuning range reduced by 3 nm on both ends for sweep speeds ≥ 150 nm/s.

Table 3: General specifications

Category	Parameter		Unit	Performance
Interface	Optical Output Connector		-	FC or SC, SPC or APC
	Optical Fiber		-	PMF *1
	Communication		-	GP-IB (IEEE 488.2), USB, Ethernet
	Power Monitor		V	0 to 3
Modulation	Intensity Modulation		kHz	DC to 400 (Input level -2 to 0 V, Modulation depth > 50 %/V (typ.))
Environmental Conditions and others	Operating	Temperature	°C	15 to 35
		Humidity	%	< 80 (non-condensing)
	Power Supply		-	AC100 to 120 / 200 to 240 V ±10 %, 50/60 Hz
	Power Consumption		VA	100
	Dimensions (W) x (D) x (H) *2		mm	220 x 385 x 130
	Weight		kg	7

*1: In case of PMF, polarization axis in alignment with connector key. Polarization extinction ratio is 17 dB (typical value).
*2: Except for the protrusion.

8.2. Regulations conformity

This product conforms the following standards.

- EMC:

  EN 61326-1:2013

  EN55011:2009 + A1:2010 (Class A, Group 1)

  EN61000-4-2:2009

  EN61000-4-3:2006 + A1:2008 + A2:2010

  EN61000-4-4:2012

  EN61000-4-5:2014 + A1:2017

  EN61000-4-6:2014

  EN61000-4-8:2010

  EN61000-4-11:2004 + A1:2017

  FCC 47 CFR Part15 Subpart B Class A (ANSI C63.4:2014)

  ICES-003 Issue 7(October 2020) Class A

  ICES-003 Issue 6 Class A (ANZI C63.4:2014)

- Safety:

  IEC 61010-1: 2010 +

  AMD1:2016 IEC 60825-1: 2014(3rd Edition)

- RoHS:

  EN IEC 63000:2018

9. Maintenance

9.1 Daily Maintenance

Turn off the power and pull out the power cord before cleaning, and use a soft dry cloth to gently dust the instrument. Do not use chemicals (acetone, alcohol, cleaning fluid, etc.), as they may cause damage to the coating. Do not vigorously rub the display, as damage may result.

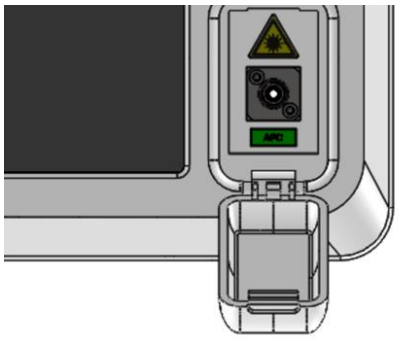
9.2 Cleaning the Optical Power Sensor

Connection of the optical fiber with dust and dirt on the end of the optical connector of the TSL-570 cause loss of optical output, therefore, clean the connector periodically.

■ Procedure

1. Loosen the 2 screws of the optical adapter and pull out the optical adapter straight toward you.

2. Clean the end of the optical connector with alcohol immersed in cotton pad.
3. After cleaning, reinsert the optical adapter and tighten the screws again.



NOTE

If the optical adapter is not attached correctly, optical output power loss will result.

9.3 Replacing Fuses

Fuses are in the fuse box above the power inlet on the rear panel. Use two surge resistant type fuses. T3.15AL/250V (100 – 120V/ 200- 240V). Pull out the fuse box, and replace with new fuses. Replace both of them with new ones.

9.4 Inspection and Calibration

The TSL-570 is warranted for a period of two year. Inspection and calibration on a regular basis (once every 24 months) are recommended. Please contact our Sales Department concerning requests for instrument inspection/calibration or consultation on other matters.

9.5. Self-Inspection

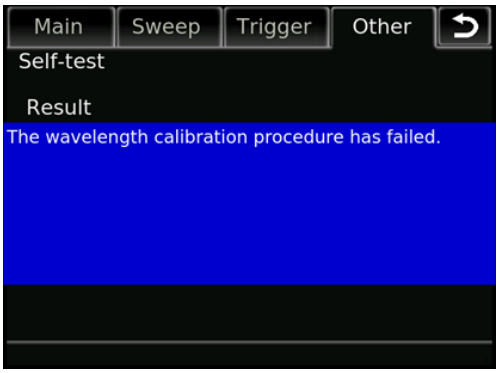
This is a simple inspection function that is executed by the device itself. The self-inspection function checks each functional characteristic of the device.

It has a function to add an offset amount to the device. If there is a difference between the set and measured wavelengths by another instruments (a wavelength meter, optical spectrum analyzer, etc.), the output wavelength can be calibrated.

■ Procedure

1. Touch Other to move to the Maintenance screen.
2. Select Execute at the Self-Test.

3. Press START in the confirmation screen.
4. The Self-Inspection will be completed in about 1 minute and the result will be displayed.



If there is any abnormality, please contact Santec. Contact information is provided on the last page of this document.

Message	Details and how to deal with faults
No faults have been detected.	Instrument is operating normally.
A wavelength lock error has been detected.	There may be a problem with the wavelength monitor and the accuracy of the wavelength may have deteriorated. Restart the product. If the error still occurs, please stop using the product and contact santec.
A decrease in output power was detected.	There may be a problem with the laser source and the output power may be low. Restart the product. If the error still occurs, please stop using the product and contact santec.
A fault has been detected with the attenuation control.	There may be a problem with the internal attenuator. Restart the product. If the error still occurs, please stop using the product and contact santec.
A fault has been detected with the fine tuning control.	There may be a problem with the fine-tuning function and the wavelength accuracy may have deteriorated. Restart the product. If the error still occurs, please stop using the product and contact santec.
A fault has been detected with the light source.	There may be a problem with the optical system. Please stop using the product and contact santec.
A fault has been detected with the wavelength monitor.	There may be a problem with the wavelength monitor. Please stop using the product and contact santec.
A fault has been detected with the power monitor.	There may be a problem with the power monitor. Please stop using the product and contact santec.
TSL-570 encountered an error while setting wavelength. Please restart TSL-570.	There may be a problem with tunable mechanism for wavelength. Restart the product. If the error still occurs, please stop using the product and contact santec.
The self-test procedure has failed.	There may be a problem with internal memory data. Restart the product. If the error still occurs, please stop using the product and contact santec.

9.6. Firmware update

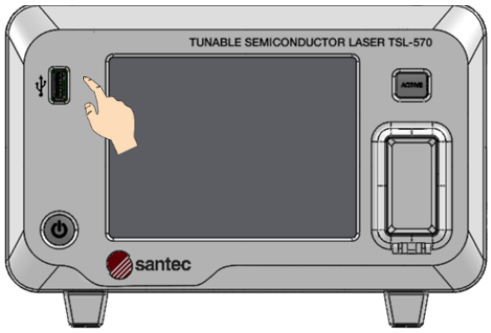
The firmware can be updated using the USB (Host) port on the front of the instrument. Please contact Santec to obtain the latest firmware update.

CAUTION

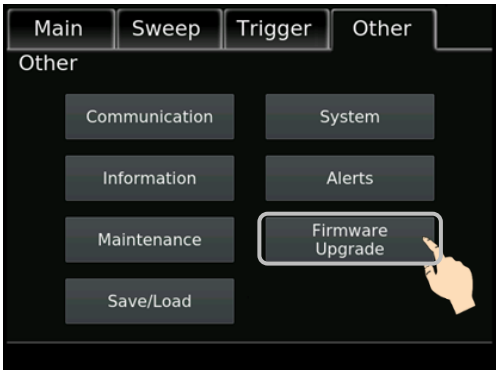
The power must not be interrupted during firmware update. Please ensure a stable power supply. If the power is interrupted during the firmware update procedure it may not be possible to restart the instrument.

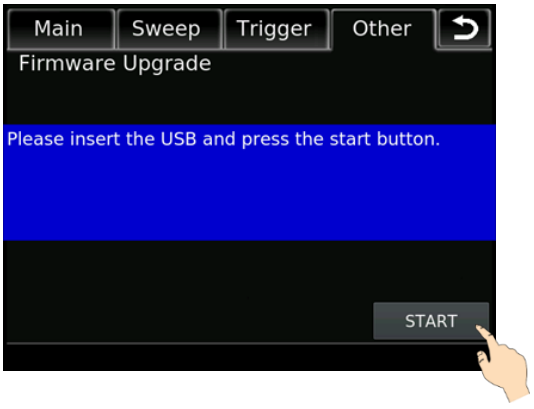
■ Procedure

1. Copy the firmware data files to a USB flash drive. (Firmup.txt, COMupdate.tar.g2, SBC.tar.g2)
2. Insert the USB flash drive into the USB (HOST) port on the front panel.

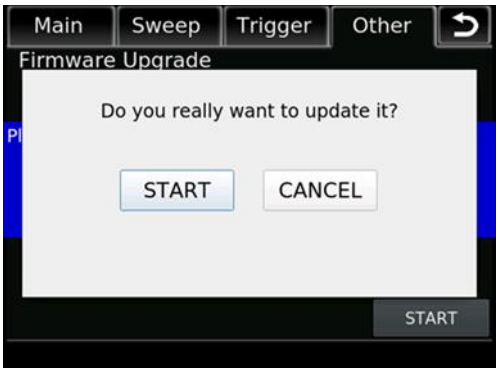


3. Touch Other -> Firmware upgrade, the firmware update screen will be displayed. Read the caution notice and press START.

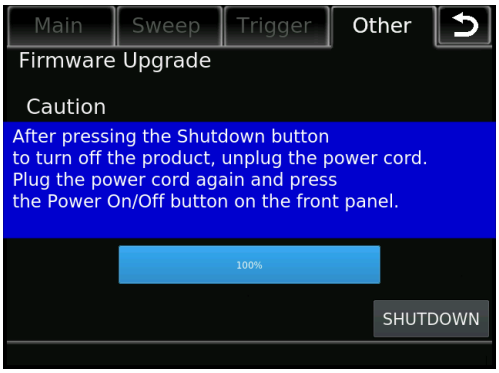




4. Since the confirmation screen appears, press START in order to update the firmware.



5. The update will be completed in about 1 minute, and it will restart automatically. Or, if the following message appears, follow the instructions on the screen to manually turn off the power, unplug the power cord, and then restart it.



CAUTION

Do not turn off the power while updating the firmware. Please ensure the power cable is firmly inserted into its socket before starting the update procedure and be careful not to disconnect the cable during the update. If the power is interrupted during the update the instrument may not restart.

9.7. Long-term Storage

■ Procedure

1. Make sure the power is shut down completely. (Refer to 5-7 Turning off the unit)
2. Wipe off dust, fingerprints, dirt, stains, etc., from the instrument.
3. Avoid storing the instrument in the following types of places.

- Locations that receive direct sunlight
- Locations subject to high temperature or high humidity
- Locations where there's a large amount of dirt, dust, salt content, or corrosive gas
- Locations subject to vibration
- Locations where the instrument can be affected by noise from an electric or magnetic field,

Damage of the device may be caused by the vibration under transportation if the power supply is not shut down properly. Make sure the power is shut down completely. (Refer to 5-8)
Since this instrument is precision measuring equipment, please avoid vibration as much as possible, and maintain the storage conditions previously specified.

10. Re-packing and shipping

Special attention for re-packing and shipping is required when you ship the instrument for repair or to a remote location.

10.1. Re-packing

Please make sure that the original shipping box is used during the shipment, according to the following instructions. If the original shipping box is misplaced or damaged, please contact our customer service department. We can arrange for the shipping box to be sent to you.
Alternately, when the original shipping box is not available, send the instrument with a sturdy, robust shipping box and at least 10cm packing material between the instrument and the shipping box. The entire 10cm space on every side of the instrument should be filled with a cushioning material.

The packing materials we used are designed to protect the instrument from the shock or vibration during the shipment. If the instrument is shipped without packing materials or improperly packed, the instrument might be damaged. Any instrument damage that occurred when the instrument shipped without the original shipping box or without proper packing will not be applicable for warranty repair, even during the guaranteed term.

Damage of the device may be caused by the vibration under transportation if the power supply is not shut down properly. Make sure the power is shut down completely. (Refer to 5-7)

10.2. Packing Instruction

1. Set the cushions to the product as Figure 1. There are two types of cushions. One is printed as “FRONT” and the other is printed as “REAR”.

Figure 1

2. Put the product with two cushions in the shipping box.

3. Secure the box by shipping tape or band after closing the box.

10.3. Shipping

Treat the box carefully, and avoid shock or vibration as much as possible. Maintain the box in an upright position and label “THIS SIDE UP” as much as possible.

11. Troubleshooting

Fault condition	Cause	Action
No power	Cord is unconnected.	Connect power cord properly.
	No fuse or fuse is blown out	Open the fuse box lid and replace fuse.(Refer to “9-3 Replacing Fuses”)
	Power cord is broken or not correct.	Use proper power cord. (Refer to “4-2 Power Supply”)
The unit is not turn off.	Some electrical faults occur.	Press power ON/OFF key for at least 10 seconds. If it did not turn off, unplug the power cord.
No light output	Optical output is not active.	Press ACTIVE key and make sure LED is lit.
	External interlock circuit is open.	Close the circuit or put short circuit cap on the interlock connecter.
	The end of the optical output connector is dirty.	Clean the end face of the optical connector. (Refer to "9-2. Cleaning the Optical Power Sensor")
	Optical connector is lost.	Put the connector properly.
	Connected optical cable is broken.	Replace to an adequate cable.
”SysAlert” and “TempErr” is displayed.	The ambient temperature may have exceeded the operating temperature range.	To ensure exhaust heat inside the product, leave space near the vent so as not to block the flow of air. Also note the environmental temperature during operation.

If after checking the above list, and the device is still not operating correctly, please contact us.

In the event of any trouble with this product, turn the unit off in accordance with the procedures to shut off the power described in this operation manual, disconnect the power source cord, record the product name and serial number described on the name plate of the product, and then contact our dealer at your place or directly contact us at Santec Photonics Laboratories. Our telephone number and facsimile number are shown below. However, we are not responsible for any trouble arising from your own repair or modification on this product. In addition, if the Void sticker on the main body is peeled off and there is evidence that the product has been opened, not only is the product warranty not applicable, it may not be covered by maintenance support.

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