WT-1550-EM10
1550nm External Modulated Optical Transmitter
Operating Manual

Hangzhou Prevail Optoelectronic Equipment Co., Ltd.

2015.8 (Version 1)

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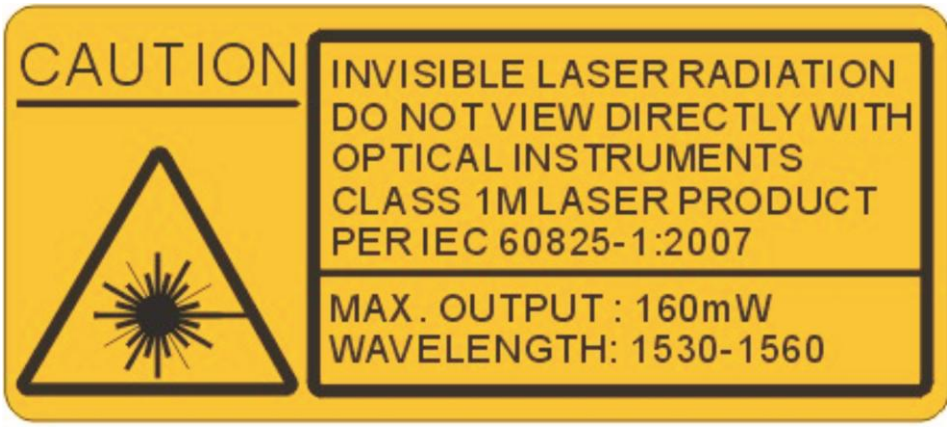
Safety Instruction



1. Overview

1.1 About This Manual

This instruction manual is a complete guide to install and operate the (1RU) WT-1550-EM10 series 1550nm external modulated optical transmitter. Please read the entire manual before beginning installation.

This manual applies to WT-1550-EM10 series external modulated optical transmitter.

• Chapter 1 gives general information about the WT-1550-EM10 series 1550nm external modulated optical transmitter.
• Chapter 2 describes the complete technical specifications of WT-1550-EM10.
• Chapter 3 describes the front/rear panel interfaces and menu system.
• Chapter 4 tells you how to install WT-1550-EM10 series external modulated optical transmitter.
• Chapter 5 tells you the communication setting of WT-1550-EM10.
• Chapter 6 describes maintenance and what to do in the event of problems.

1.2 Product Description

WT-1550-EM10 series optical transmitter is 1550nm external modulated single output optical transmitter. It is specially developed for the CATV signal that satisfies HFC network, and the medium/short distance transmission of cable phone and cable data.

Working principle

WT-1550-EM10 series transmitter has 7 function modules: RF control, DFB laser, optical modulator, SBS control, CSO control, communication/display control and power supply.

Automatic gain control circuit (AGC) or manual gain control circuit (MGC) amplifies the RF signal. AGC or MGC control makes the optical modulator maintain a suitable input level. Use the detected RF root-meansquare(RMS)-total power to calculate the optical modulation index(OMI).

In general we recommend using the AGC function, and special users can use the MGC function to adjust the CNR/CSO/CTB performance indexes.

The core of transmitter is the optical modulator. The 1550nm signal input the optical modulator, make the laser intensity changed follow the external RF signal voltage, and then generate the AM optical signal.

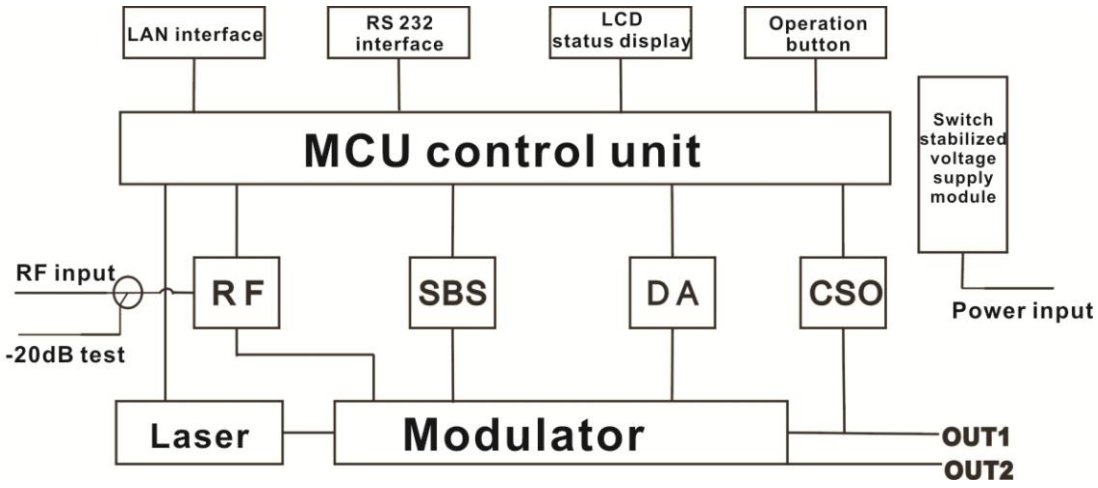
Stimulated Brillouin Scattering (SBS) occurs, when the optical input power is greater than a certain threshold value. SBS generate the lower frequency backscattered light which will attenuate the transmission light and return to the laser while destroying its performance. Causing optical power fluctuation, generates large noise, and seriously deteriorates the system carrier to noise ratio (CNR). EM10 series optical transmitter adopts SBS control technology which is independent researched and developed by ourselves to improve the system CNR.

The optical modulator has a two-way optical signal output. Parts of that signal are routed to an InGaAs photodiode. This detection of the optical signal has two functions:

1) Detect whether the laser is normal working. Once the output optical power is 2dB lower than standard power, alarm will be set off.

2) Detect CSO distortion to optimize the bias point of the optical modulator. For working normal the detector circuit needs at least two carrier signal inputs with an interval of 24MHz. There is a CSO initialization program in the boot process. If the CSO install failed, the RF indicator will flash red, see details in **6.2 Troubleshooting.**

Block Diagram



1.3 Product Applications

- High-power distribution network
- Redundancy loop architecture
- FTTx network
- RFOG application
- DWDM network

2. Technique Parameters

2.1 Optical Parameters

Item	Unit	Value
Optical Wavelength	nm	1545～1560 (or specified by the user)
Side-mode Suppression ratio	dB	>30
Relative Intensity Noise	dB/Hz	<-155
Optical Power	dBm	1*3, 1*5,1*6
SBS Threshold Value	dBm	+13～+16.5 (Continuously adjustable)
Laser Linewidth	MHz	0.65

2.2 Model Test Indicators

Test Model	D59	D84
Channel Plan	PAL D59	PAL D84
Channel Number TV/FM/QAM64	59/0/0	84/0/0
Bandwidth Noise	5	5
CNR Tx/Rx	52.5	51.0
CNR Link 1	52	50.5
CNR Link 2	51	49..5
CSO Tx/Rx and Link 1	65	65
CSO Link 2	65	65
CTB	65	64

2.3 Test Condition

	First stage EDFA	First paragraph fiber length	Second stage EDFA	Second paragraph fiber length	RX	SBS (dBm)
Tx/Rx	No	No	No	no	0dBm	13.5
Link 1	No	35km	no	no	0dBm	13.5
Link 2	16dBm	65km	no	no	0dBm	16
Link 3	13dBm	50km	13dBm	50km	0dBm	13.5

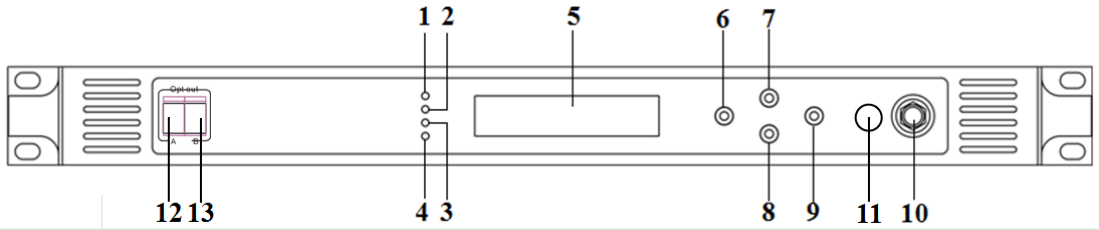
Rx with 8 pA/ÖHz input noise current density; EDFA with 5dB noise figure; RF input level at 80 dBμV / TV channel;

2.4 Technical Data Sheet

Item	Unit	Technical Parameters
RF range	MHz	47～1003
RF flatness	dB	+/-0.75
RF return loss	dB	>16
RF input impedance	Ω	75
RF input connector type		F type
Rated input level	dBμV	80
Input level range	dBμV	78~96 (AGC mode, modulating signal)
AGC control range	dB	+3～-3
MGC adjustable range	dB	0~15
Optical connector		SC/APC, FC/APC
Operating temperature	℃	-5～50
Storage temperature	℃	-30～+70
Power Source Specification	V	90～265VAC
		36～72VDC
Consumption	W	≤60
Dimension	mm	483(L) ×455(W) ×44(H)
Total Weight	kg	5.5

3. Panel Interface and Menu System Description

3.1 Front Panel

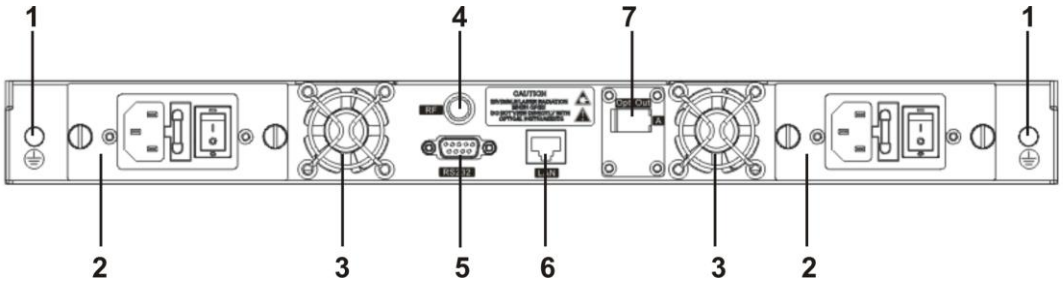


1	Power indicator	**2**	AGC indicator	**3**	RF modulation degree indicator
4	Laser indicator	**5**	LCD	**6**	ESC key
7	UP key	**8**	DOWN key	**9**	Enter key
10	-20dB RF input test port	**11**	RF input port (or on the rear panel, optional)	**12**	Optical output interface A (or on the rear panel, optional)
13	Optical output interface B (or on the rear panel, optional)				

3.1.1 Indicator Description

Power indicator	One power supply	LED yellow
	Two power supplies	LED green
AGC indicator	AGC mode	LED green
	MGC mode	LED off
RF modulation degree indicator	Normal	LED green
	Abnormal	LED flash red
Laser indicator	Bias current, cooling current and output power are all normal	LED green
	At least one of bias current, cooling current and output power is abnormal	LED flash red

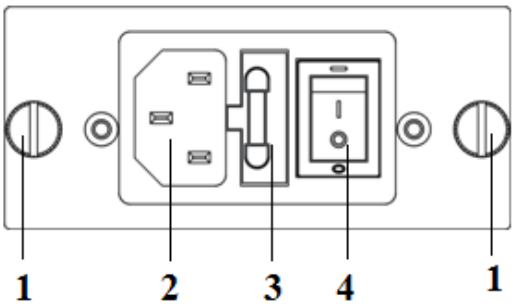
3.2 Rear Panel



1	Ground stud	**2**	Power module	**3**	Fan
4	RF input port (or on the front panel, optional)	**5**	RS232 interface	**6**	LAN interface
7	Optical output interface (or on the front panel, optional)				

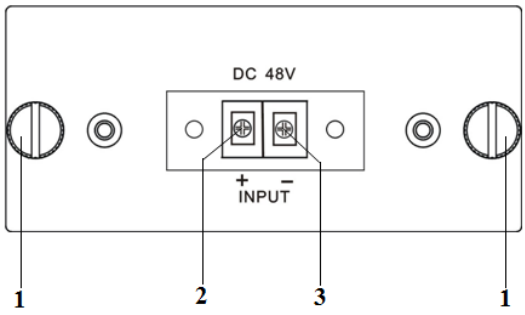
3.3 Power Module

3.3.1 220V Power Module



1	Mounting screws	**2**	220V power outlet	**3**	Fuse
4	Power switch				

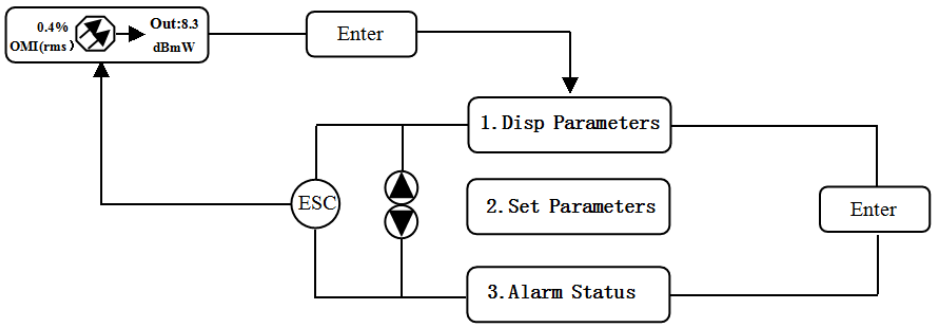
3.3.2 48V Power Module



1	Mounting screws	**2**	+ Positive terminal block	**3**	- Negative terminal block

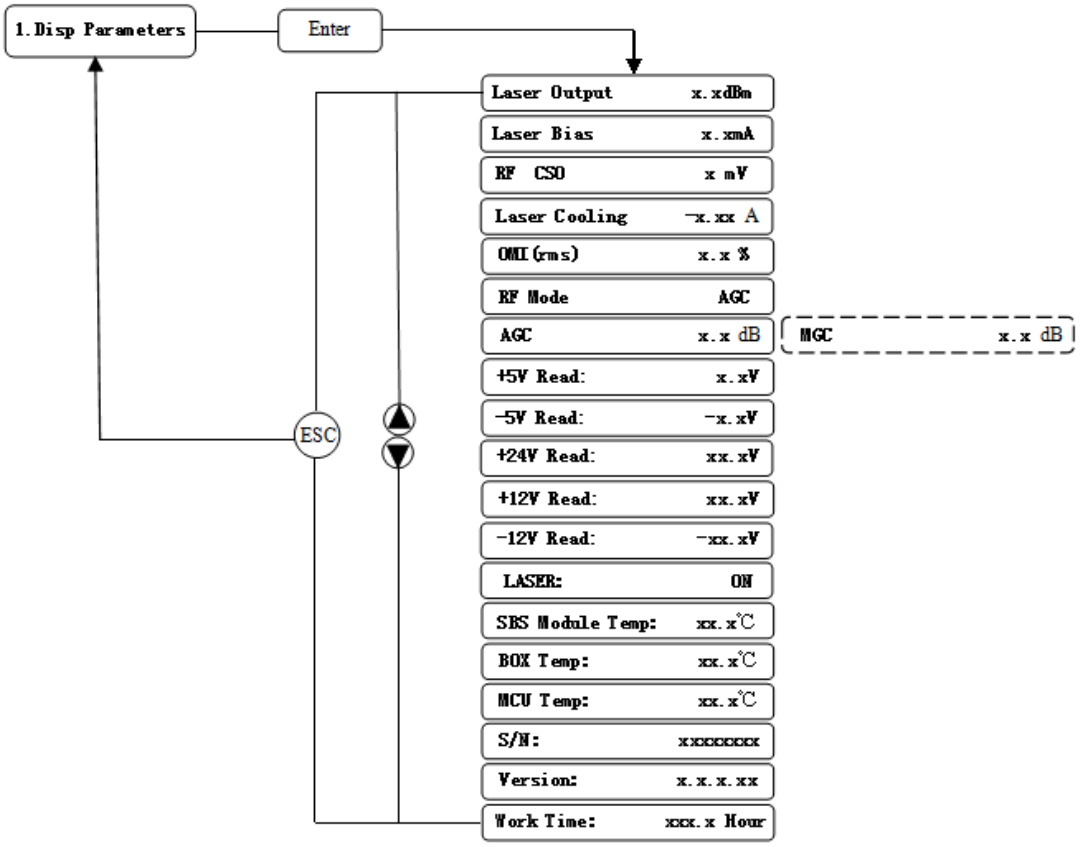
3.4 Menu Operation

3.4.1 Main Menu



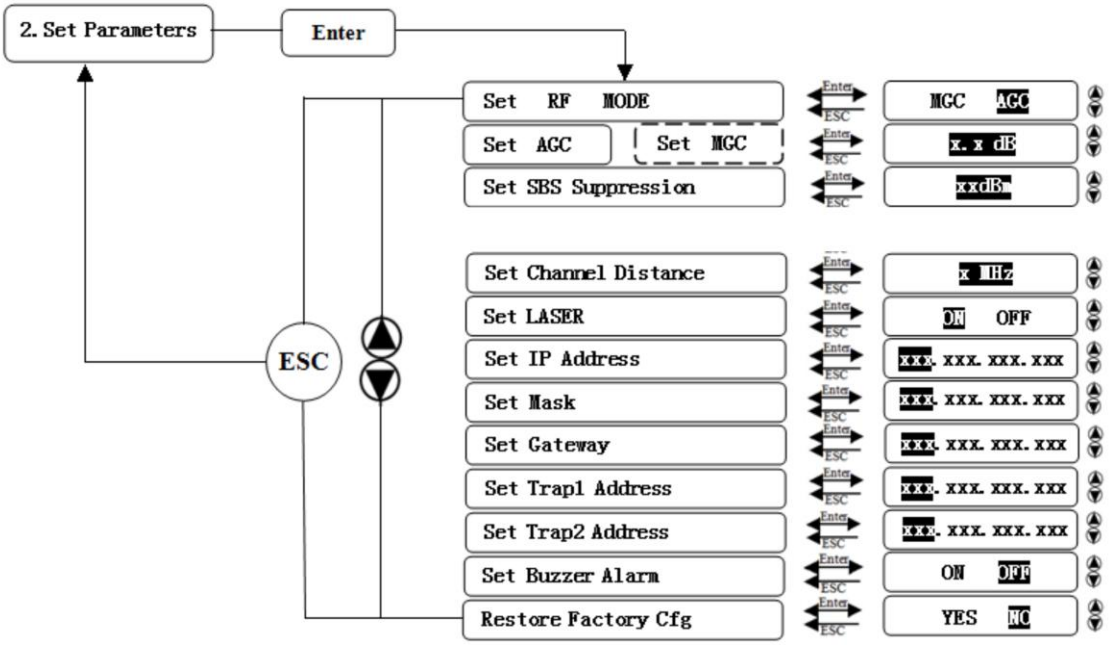
Displayed parameters	Comments
	Boot display
1.Disp Parameters	Menu one: Display parameters
2.Set Parameters	Menu two: Set parameters
3.Alarm Status	Menu three: Alarm status

3.4.2 Display Menu



Displayed parameters	Comments	Displayed parameters	Comments
Laser Output	Output optical power	**+24V Read:**	+24V monitor voltage
Laser Bias	Laser current	**+12V Read:**	+12V monitor voltage
RF CSO	CSO monitor voltage	**-12V Read:**	-12V monitor voltage
Laser Cooling	Cooling current	**LASER:**	Laser status
OMI(rms)	Total modulation degree	**SBS Module Temp:**	SBS module temperature
RF Mode	RF control mode	**BOX Temp:**	Overall temperature
AGC	Adjusted value with AGC mode	**MCU Temp:**	MCU temperature
MGC	Adjusted value with MGC mode	**S/N:**	Serial number
+5V Read:	+5V monitor voltage	**Version:**	Version number
-5V Read:	-5V monitor voltage	**Work Time:**	Work time

3.4.3 Set Menu



Displayed parameters		Comments	Remarks
Set RF MODE		Set RF control mode	MGC and AGC two modes selectable
Set AGC	**Set MGC**	Set RF adjusted value	Adjustable range 0~15dB with MGC mode Adjustable range -3~+3dB with AGC mode
Set SBS Suppression		Set SBS value	Range 13~16.5dBm, 0.5dB stepping
Set Channel Distance		Set channel distance	6MHz, 7MHz, 8MHz
Set LASER		Set laser status	ON/OFF
Set IP Address		Set IP address	
Set Mask		Set subnet mask	
Set Gateway		Set gateway	
Set Trap1 Address		Set trap1 address	
Set Trap2 Address		Set trap2 address	
Set Buzzer Alarm		Set buzzer alarm	ON/OFF
Restore Factory Cfg		Restore factory settings	

3.4.4 Alarm Menu

The displayed alarm content		Comment
RF IN Status	HIGH（LOW）	The RF input signal is high (low)
Laser Bais	HIGH（LOW）	The laser bias current is high (low)
Laser TEC	HIGH	The laser cooling current is high
OutPutPower Status	HIGH（LOW）	The output optical power is high (low)
-5V Status	HIGH（LOW）	The -5V voltage is high (low)
+5V Status	HIGH（LOW）	The +5V voltage is high (low)
+12V Status	HIGH（LOW）	The +12V voltage is high (low)
-12V Status	HIGH（LOW）	The -12V voltage is high (low)
+24V Status	HIGH（LOW）	The +24V voltage is high (low)
Laser	OFF	The laser is off
CSO Initialization failed		The CSO initialization is failed
Power invalid	LEFT（RIGHT ）	The left (right) power is invalid

3.4.5 AGC Mode

This mode is the recommended mode and also the standard operation.
The optical transmitter will automatically adjust to the optimal gain while the input level is in the working range (see the technical data sheet). And the specified OMI (rms) modulation index will be automatic gain control.

3.4.6 MGC Mode

Special users, who need to adjust system CNR/CSO/CTB performance indexes to satisfy the specified requirements, can use this mode. The amplification gain attenuation range 0-15dB.
(Not recommend).

3.4.7 SBS Suppression Adjustment

SBS value is very important in 1550nm long-distance transmission system. Stable continuous coherent light source, add +6 dBm optical power in the standard single mode fiber may occur SBS phenomenon. Ultrahigh SBS threshold will reduce CNR and CSO low-frequency indicators.
High SBS threshold will also influence self phase modulation (SPM) and reduce high-frequency CSO indicator.
When meet the conditions, as far as possible to use a low threshold SBS.

4. Installing the WT-1550-EM10 Optical Transmitter

4.1 Receiving and Inspecting

As you unpack your unit, inspect the shipping container and equipment for damage. Save the shipping material for future use. If the container or the equipment is damaged, notify both the freight carrier and us.

CAUTION: To protect yourself from potential injury and to protect the equipment from further damage, do not perform any operational tests if the equipment appears to be damaged.

4.2 Precautions

Heed the following precautions when working with the **WT-1550-EM10**.

 Warning	Read the installation instructions before connecting the system to the power source.
Attention	Avant de brancher le système sur la source d'alimentation,consulter les directives d'installation.
Warnung	Vor dem Anschließen des Systems an die Stromquelle die Installationsanweisungen lesen.

 Warning	The plug-socket combination must be accessible at all times, because it serves as the main disconnecting device.
Attention	La combinaison de prise de courant doit être accessible à tout moment parce qu'elle fait office de système principal de déconnexion.
Warnung	Mit Wechselstrom betriebenes Modell: Der Netzstecker muss jederzeit leicht zugänglich sein.

4.3 Mounting WT-1550-EM10

4.3.1 Mounting the EM10 in the Rack

Mounting the EM10 in the standard 19 inch equipment rack:
1. Place the equipment in the rack.
2. Use four screws fixed the mounting lug on the WT-1550-EM10 front panel to the rack.
3. Reliably ground the equipment. The ground terminal is on the rear panel.
4. Visually inspect each key (button) on the front panel to ensure that it is not trapped under the edge of its hole. If a key is trapped, tap the key to enable it to move freely.

4.3.2 Connecting the RF Cables

Verify the RF input F connector type according to the ordering information, then screw on the matched RF cable.

4.3.3 Connecting the Optical Fiber Cables

WT-1550-EM10 has two output optical connectors.

> **DANGER:** The fiber carries invisible laser radiation. **AVOID DIRECT EXPOSURE TO BEAM**. Never operate the unit with a broken fiber or with a fiber connector disconnected.

1. Verify the matched WT-1550-EM10 fiber cable connector type according to the ordering information.
2. Verify that the fiber cable connector has been cleaned properly. If the fiber cable connector needs to be cleaned, follow the cleaning procedure outlined in “Cleaning Patch Cord or Pigtail Fiber Optical Connectors”.
3. Verify that the WT-1550-EM10 optical connector has not been exposed to any contamination.

> **NOTE:** Any contamination of optical connector can significantly degrade optical link performance. This degradation will most likely manifest itself as poor signal-to-noise (SNR) performance.

4. Note to butt the nick of the connectors and align them accordingly.

4.3.4 Connecting the Ethernet Cable

You can connect the WT-1550-EM10 to your TCP/IP network in order to monitor and control the transmitter remotely. After you complete the installation procedures described in this chapter, you can use a network management system (NMS) to monitor and control the WT-1550-EM10.
To connect the WT-1550-EM10, you must use a shielded and grounded Category 5 Ethernet cable.
To connect the Ethernet cable:
1. Connect an Ethernet cable to the transmitter's RJ-45 Ethernet port and to your TCP/IP network. The Ethernet port is on the built-in transponder of the transmitter.
2. Verify that the green Link LED is illuminated, indicating that there is a connection. The Link LED is above the Ethernet port on the rear panel.

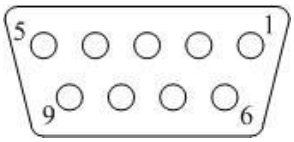
4.3.5 Connecting Power

The WT-1550-EM10 is available in an AC power model or DC power model. After mounting the WT-1550-EM10 in a rack, follow the power connection procedure below for the model that you are installing.
The AC-powered WT-1550-EM10 has two optional power supplies 110V and 220V:
110V power supply has two 110 VAC (50/60 Hz) input connector that requires input voltage from 90 to 130 VAC, at 50 to 60 Hz single phase. The AC power plug is located on the rear panel.
220V power supply has two 220 VAC (50/60 Hz) input connector that requires input voltage from 150 to 265 VAC, at 50 to 60 Hz single phase. The AC power plug is located on the rear panel.
The DC-powered WT-1550-EM10 has two -48 VDC input connectors that require input voltage from -36 to -72 VDC. The DC input connectors are located on the rear panel.
Turn on the power source. It takes about 60 seconds for all systems to operate. When connect one power supply, the power indicator is yellow; when connect two power supplies, the power indicator is green.

5. Communication Setup

5.1 RS232 Communication Interface Description

Adopt DB9 standard connector, the pin definitions as follow:



1: No Connect
2: TX
3: RX
4: No Connect
5: GND
6: No Connect
7: No Connect
8: No Connect
9: No Connect

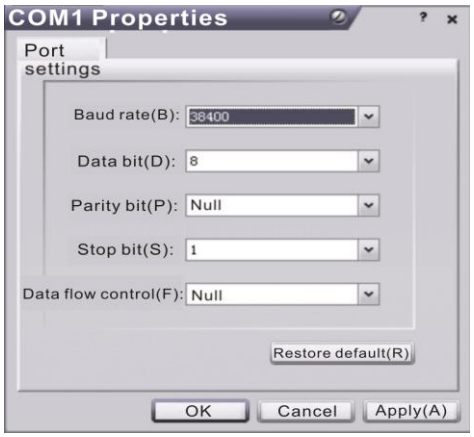
The serial communication uses the standard NRZ form, 1 starts bit, 8 data bits, 1 stop bit and the baud rate is 38400.

5.2 Set up the Hyper Terminal

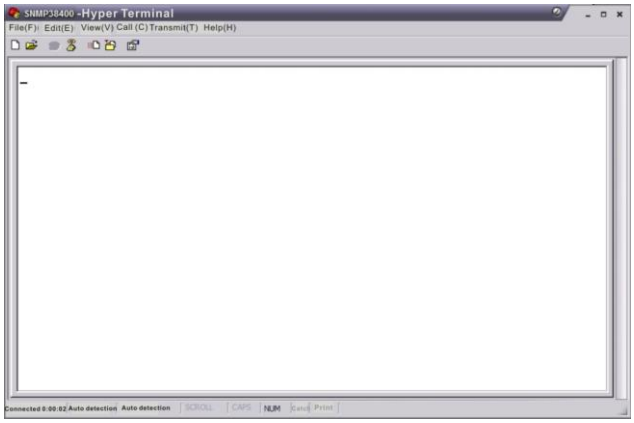
If you have not setup the Hyper Terminal in your Windows system, follow the steps:
Click “start menu →program→ accessory→communication→Hyper Terminal”:
This results in the following screen:

Then you input your connection name, such as “SNMP38400”，and choose the serial port to connect with your equipment. As follows:

Press the “OK” button shows the configuration page of serial port. As follows:



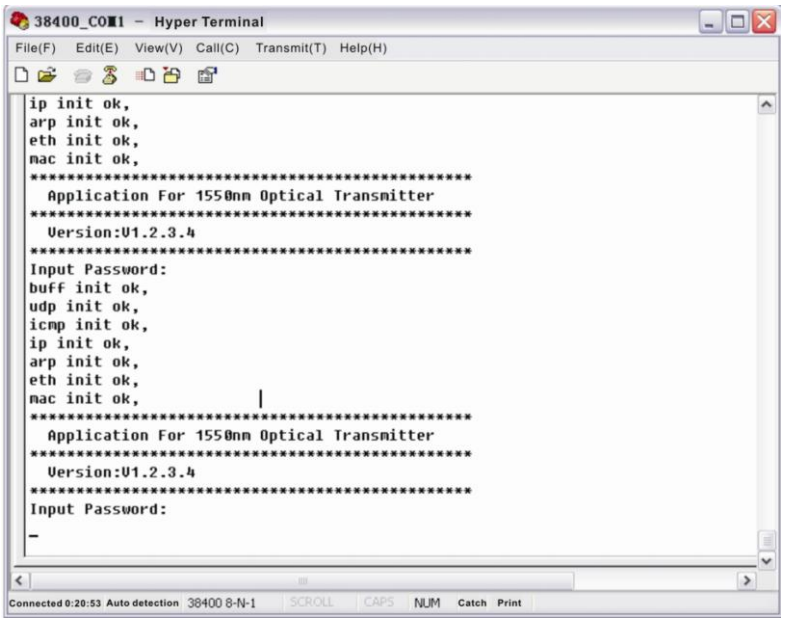
Change the serial port configuration to 38400-baud rate, 8 data bits, no parity bit, 1 stop bit, no data flow control, press the “OK” button, you have set up the Windows serial port Hyper Terminal.



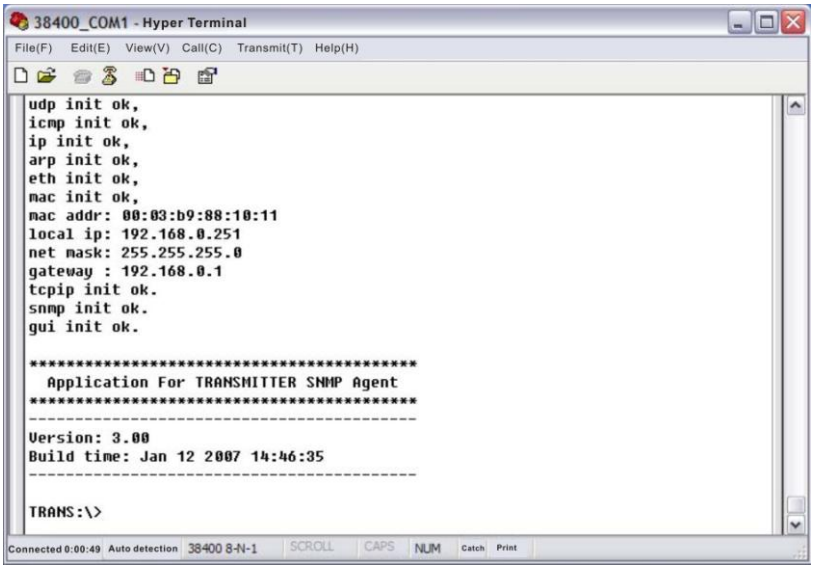
You can click “file→save” menu to save this configuration of Hyper Terminal for later using.

5.3 Operating Parameters Configuration

Under the condition of power off, use the serial port lines to connect the RS232 port with the computer port. Open the Windows Hyper Terminal which you have set up. Then turn on the power, you will see the page as follows. Enter the password to enter the configuration interface.



Enter the password, display the following screen:



You can input your command in this page, and then configure the operating parameter of the application program.

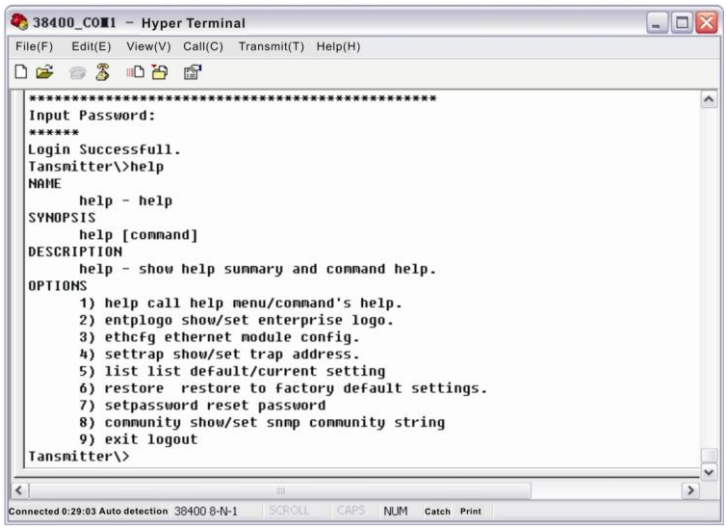
System supports the following commands:

help	**List internal commands of the system;**
ethcfg	**Configure the Ethernet operating parameters;**
settrap	**Configure the aim host IP address of the SNMP Trap;**
community	**Configure the SNMP group name;**
List	**List system default parameters or user updated parameters;**
Restore	**Restore the factory default values;**

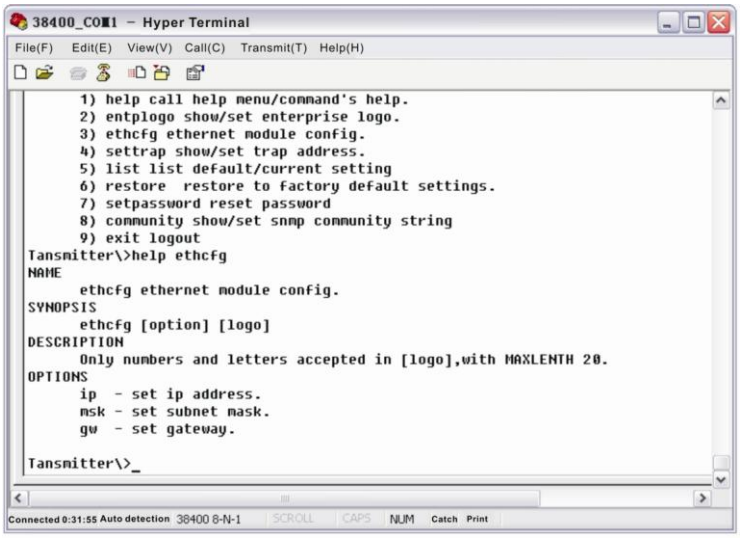
Specific using as follows:

help

This command shows current application program version, program name and the internal commands list of the system as follows:



You can also use the "help" command to show help information of other commands, such as "help ethcfg" , ethcfg's help information appears as follows:



ethcfg

This command configures the Ethernet parameters, including IP address, subnet mask

and gateway. You can refer to the help information for its using.

settrap

This command shows or modifies the aim host IP address list of the SNMP Trap, IP address of 0.0.0.0 and 255.255.255.255 don't exist. SNMP Trap does not send to these two addresses.

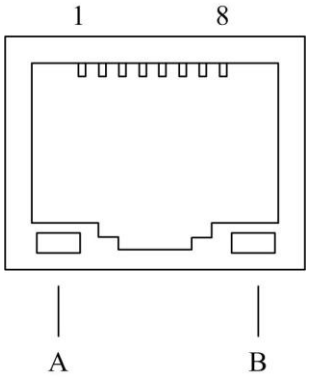
community

This command configures the read-only group name and read-write group name. "Group name" is the concept of SNMP agreement like the password. Use the command "community ro" to configure the read-only, and "community rw" for the read-write. For example, input "community rw public", "public" is the read-write group name. The group name for read-only and read-write are both "public" as the equipment default setting from factory.

5.4 Remote Monitoring: SNMP

LAN communication interface

Adopt RJ45 standard connector, the pin definitions as follow:



1: TX+
2: TX-
3: RX+
4: No Connect
5: No Connect
6: RX-
7: No Connect
8: No Connect
A: Green indicator flashing means that the LAN port is sending data.
B: Yellow indicator means that the network connection is normal.

SNMP basic background

Simple Network Management Protocol (SNMP) is an application layer protocol. It makes the management information between network devices exchange easier. It is part of the TCP / IP protocol group. SNMP enables the end-users to manage network performance, find and solve network problems, and arrange for future network upgrades.

Management Information Base (MIB) is the organized hierarchical information set. Use SNMP to visit these MIB. They are composed of manageable information, and identified by the object identifier.

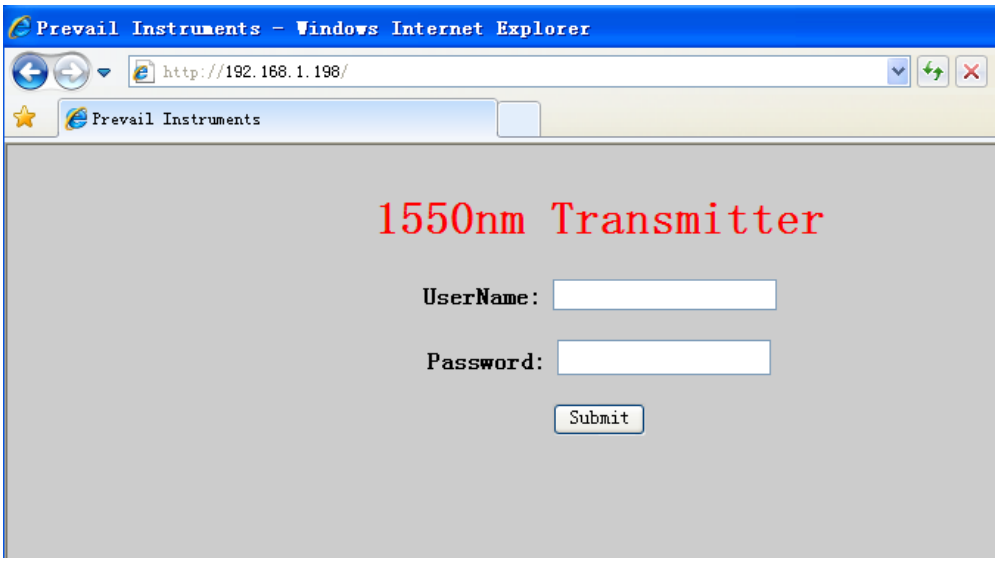
SNMP

Transmitter configuration of network communication

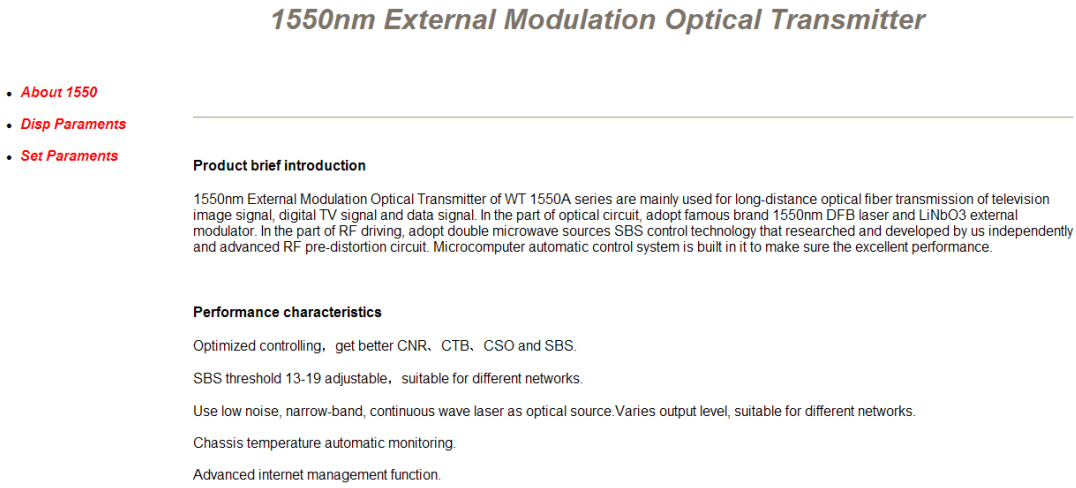
When the transmitter initial work, the IP address and gateway are in the default state, you need to configure them. The configuration of initial state can be achieved through the RS-232 interface or the front panel keys. Other configurations see our **5.5 WEB Network Management** section.

5.5 WEB Network Management

Open the IE browser, type the IP address and enter the interface as follows:



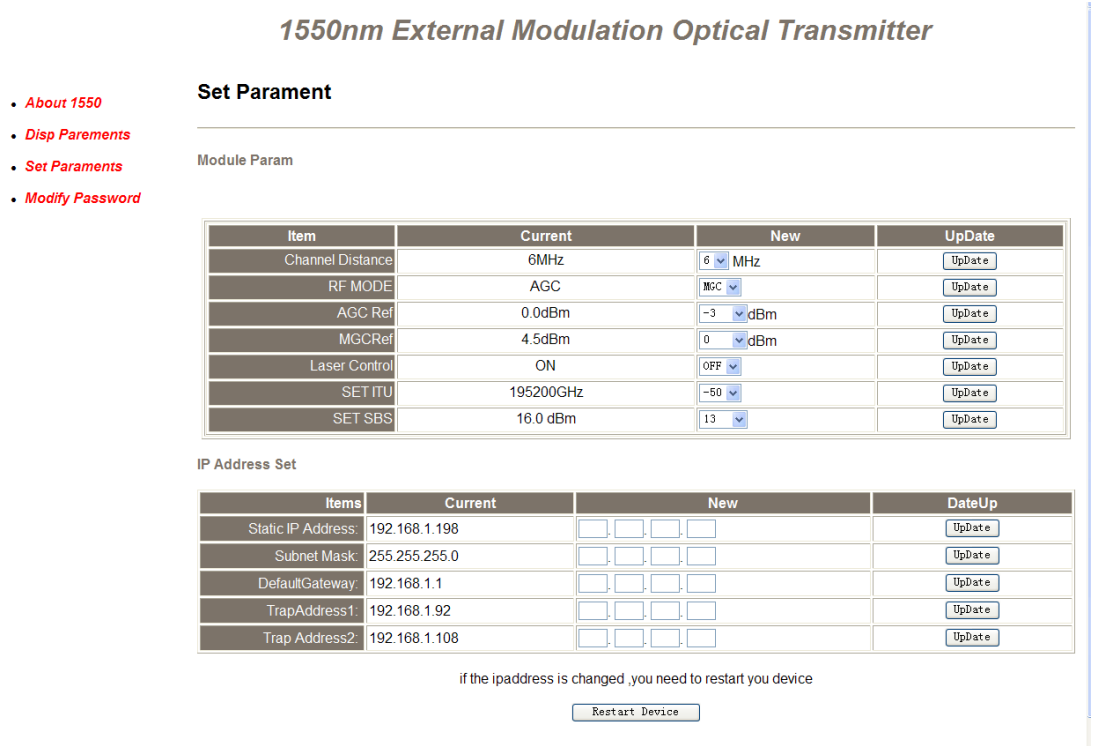
Type the user name **admin** and the password **123456** (factory default), enter the following interface:



There are 3 sub-interfaces:

1. About1550 interface: Mainly described the basic information of the equipment.
2. Disp Paraments interface: Mainly described the display menu of the equipment.
3. Set Paraments interface: Change the device parameters in this interface.

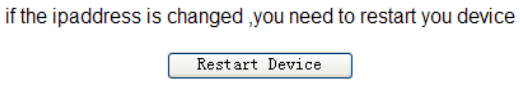
Click Set Paraments to enter Set Paraments interface as follows:



The Item and Items columns list the parameters that can be changed, the Current column lists the present parameter values, the New column can select or type the new parameter values, and the Update column can update the parameters.

The steps to change the parameters: find the item in the Item column, select the new parameter values in the New column, and click the corresponding Update button to update the parameters.

The change steps in the Items are the same, but finally need to click the Restart Device button to take effect.



The Restart Device button is the device reboot button, click it the device will auto reboot.

The • *Modify Password* is the change interface of WEB network management login password, click it and enter the interface to change as follows:

6. Maintenance and Troubleshooting

6.1 Cleaning Fiber Optic Connectors

DANGER: The fiber optic connector carries invisible laser radiation while working, so should avoid charged operation.

Dirty optical connectors are the leading source of poor performance in a broadband optical fiber network. Dirty optical connectors lead to optical signal loss and reflections, which in turn can seriously degrade signal-to-noise (SNR) performance and, in some cases, distortion performance. We recommend that you clean all mating fiber connectors before connecting them to an optical transmitter.

In addition, if you suspect that the optical connector of WT-1550-EM10 may have been exposed to contamination (by a dirty fiber cable connector, for example), you should properly clean the WT-1550-EM10 optical connector before connecting the optical fiber.

CAUTION: Improper cleaning of an optical connector can do more harm than good. Never spray a clean-air product onto the surface of an optical connector. Spraying air onto an optical connector can cause condensation on the connector surface, leaving water spots and trapping dust. Failing to wipe a connector on dry lens paper immediately after wiping on paper wet with isopropyl alcohol can also lead to condensation on the connector. Using low-grade cleaning paper or other cloth to wipe an optical connector can leave microscopic fibers on the optical connector Surface.

6.1.1 Cleaning Patch Cord or Pigtail Fiber Optical Connectors

To clean optical connectors, we recommend using a fiber optic connector cleaning cartridge (such as NTT Cletop). If a cleaning cartridge is not available, follow these steps.

To clean the optical connector of a patch cord or pigtail:

1. Fold a piece of unused dry lens cleaning paper twice, for a four-ply thickness.
2. Use a drop of high-grade isopropyl alcohol to wet part of the paper.
3. Lay the connector on the lens cleaning paper with the tip touching the paper.
4. In one continuous motion, pull the connector from the wet part of the paper to the dry part.

6.2 Troubleshooting

Should a problem occur, see if the symptoms are listed in Table 6-1.

Table **6-1: Troubleshooting Solutions**

Indicator status	Alarm menu content	Fault phenomenon	Solution
Power indicator is yellow	Power Invalid LEFT (RIGHT)	The left (right) power is break down or the power cord is not plugged in	Plug in the left (right) power cord. If that does not correct the problem, contact Customer Service. Replace the power supply.
Power indicator is flash yellow	-5V Status HIGH (LOW) +5V Status HIGH (LOW) +12V Status HIGH (LOW) -12V Status HIGH (LOW) +24V Status HIGH (LOW)	Power alarm menu shows one of the contents The laser is off	Contact Customer Service.
RF indicator is flash red	RF IN Status LOW (HIGH)	RF input is low (high)	Verify the optical transmitter is operating within the proper input level threshold range (78-96dBμV). If that does not solve the problem, contact Customer Service.
	CSO Initialization failed	CSO nonlinearity indexes are poor	Disconnect the RF connection, wait 10 seconds before reconnecting the RF signal.
Laser indicator is flash red	Laser Bias HIGH	The laser is off	Contact Customer Service.
	Laser TEC HIGH	The laser is off	Verify that the unit is operating within the proper temperature range (-5～+45℃). Verify that nothing is obstructing airflow through the openings in the front and back of the unit. Recall factory settings by pressing the key on the front panel (see Section 3). If that does not correct the problem, contact Customer Service.

	OutPutPower Status HIGH (LOW)	The laser is off	Reboot the equipment. If that does not correct the problem, contact Customer Service.
None	None	The optical output power is lower than the nominal value	Check the fiber connector. Follow the connector cleaning procedure (see Section 6.1). If that does not correct the problem, contact Customer Service.

6.3 After-sales Service Description

1. If the equipment fault is resulted from the users' improperly operation or unavoidable environment reasons, we will responsible maintenance but ask suitable material cost.
2. When the equipment breaks down, immediately contact local distributor or directly call our technical support hotline 86-0571-82576002, 18967160936.
3. The site maintenance of the fault equipment must be operated by professional technicians to avoid worse damage.
   Special notice: If the equipment has been maintained by users, we will not responsible free maintenance. We will ask suitable maintenance cost and material cost.

6.4 Disclaimer

We reserve the right to change any products described herein at any time, and without prior notice. We assume no responsibility or liability arising from the use of the products described herein, except as expressly agreed to in writing by us. The use and purchase of this product does not convey a license under any patent rights, copyrights, trademark rights, or any intellectual property rights of us. Nothing hereunder constitutes a representation or warranty that using any products in the manner described herein will not infringe any patents of third parties.