NETWORKING EQUIPMENT & TOOL KITS

WT-1550-EM30
1550nm Externally Modulated Optical
Transmitter Operating Manual

Table of Contents

1. Overview

1.1 About This Manual

This instruction manual is a complete guide to install and operate the (1RU) WT-1550-EM30 series 1550nm externally modulated optical transmitter. Please read the entire manual before beginning installation.

This manual applies to WT-1550-EM30 series externally modulated optical transmitter.

• Chapter 1 gives general information about the WT-1550-EM30 series 1550nm externally modulated optical transmitter.

• Chapter 2 describes the complete technical specifications of WT-1550-EM30.

• Chapter 3 describes the front/rear panel interfaces and menu system.

• Chapter 4 tells you how to install WT-1550-EM30 series externally modulated optical transmitter.

• Chapter 5 tells you the communication setting of WT-1550-EM30.

• Chapter 6 describes maintenance and what to do in the event of problems.

1.2 Product Description

WT-1550-EM30 series optical transmitter is a 1550nm DFB laser externally modulated transmitter. It is specially developed for the CATV signal that satisfies HFC network, and the long-distance transmission of cable phone and cable data.

Working principle

WT-1550-EM30 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). To improve the SBS threshold, WT-1550-EM30 series optical transmitter adopts SBS control technology which is independent researched and developed by ourselves. The threshold value can be set up to 19dBm.

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
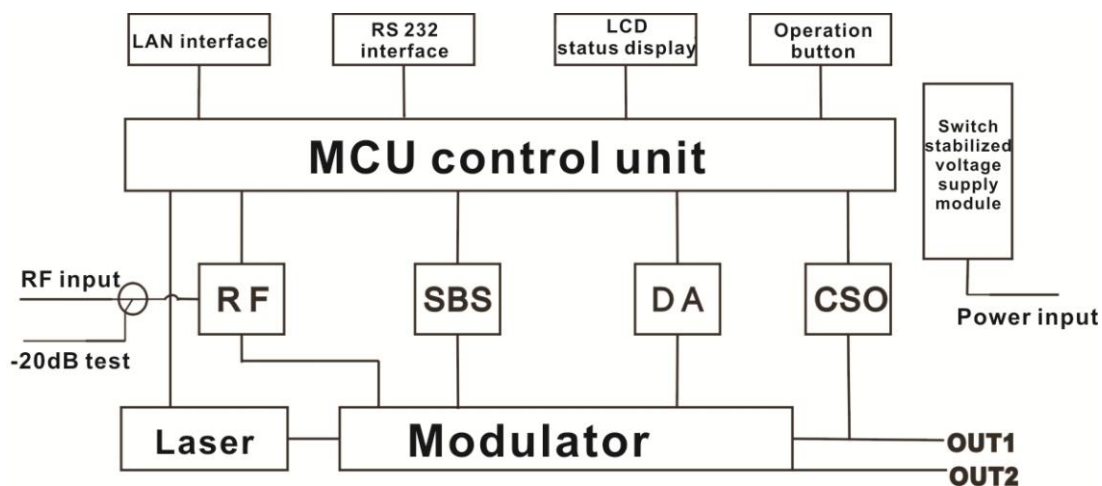
1.3 Product Applications

- High‑performance long-distance transmission
- 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	<-160
Wavelength Adjustment Range	GHz	+/-50GHz
Optical Power	dBm	2*7, 2*8, 2*9, 2*10
SBS Threshold Value	dBm	+13～+19 (Continuously adjustable)
Laser Linewidth	MHz	0.3

2.2 Model Test Indicators

Test Model	C42	D59	D84	D84
Channel Plan	CENELEC42	PAL D59	PAL D84	**PAL D**
Channel Number TV/FM/QAM64	42/0/0	59/0/0	84/0/0	30/0/48
Bandwidth Noise	5	5	5	5
CNR Tx/Rx	55.5	54.0	52.5	54.5
CNR Link 1	55.0	53.5	52.0	54.0
CNR Link 2	53.0	52.5	50.5	52.5
CNR Link 3	50.5	50.5	49.0	51.0
CSO Tx/Rx and Link 1	64	65	65	70
CSO Link 2	63	65	65	70
CSO Link 3	62	64	63	65
CTB	65	65	65	68

2.3 Test Condition

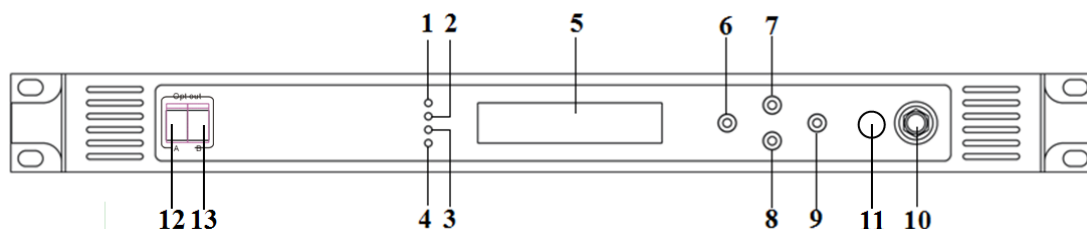|	First stage EDFA	First paragraph fiber length	Second stage EDFA	Second paragraph fiber length	RX	SBS (dBm)
Tx/Rx	No	No	No	no	0dBm	13.5
Link 1	No	35km	no	no	0dBm	13.5
Link 2	16dBm	65km	no	no	0dBm	16
Link 3	13dBm	50km	13dBm	50km	0dBm	13.5

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	°C	-5～45
Storage temperature	°C	-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
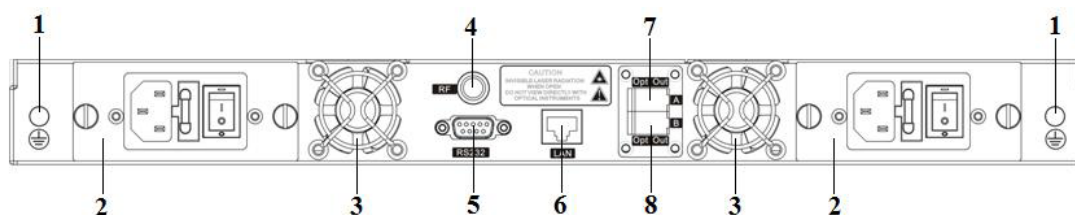
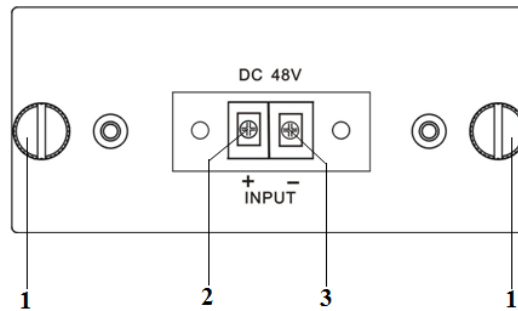| 1	Ground stud	2	Power module	3	Fan
4	RF input port (or on the front panel, optional)	5	RS232 interface	6	LAN interface
7	Optical output interface A (or on the front panel, optional)	8	Optical output interface B (or on the front panel, optional)		

3.3 Power Module

3.3.1 220V Power Module
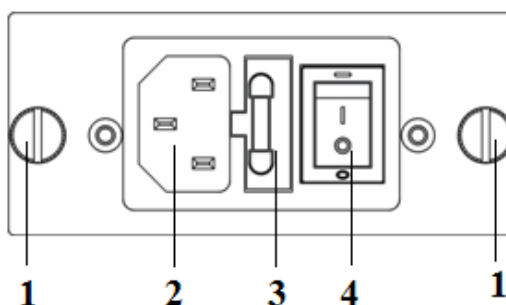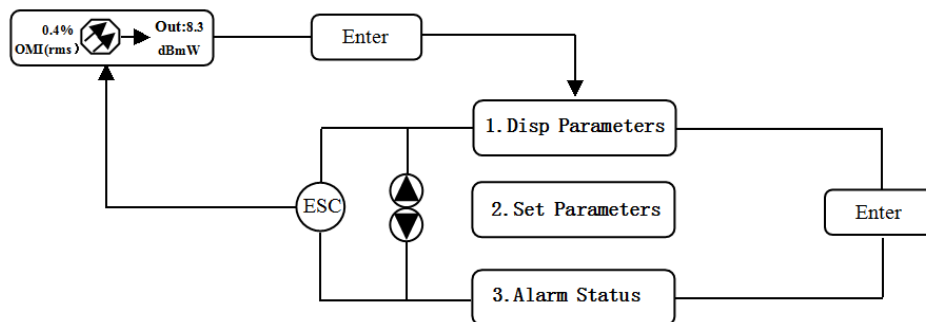

1	Mounting screws	2	220V power outlet	3	Fuse
4	Power switch				

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
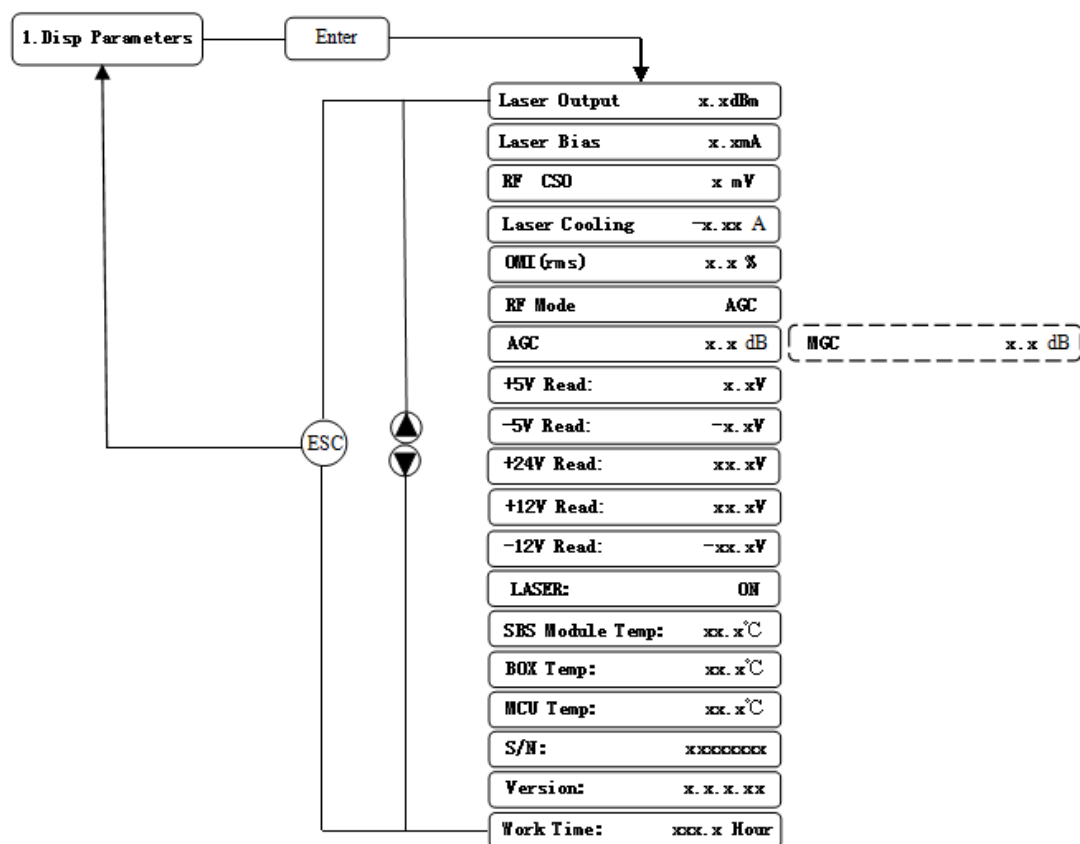
Displayed parameters	Comments	Displayed parameters	Comments
Laser Output	Output optical power	**+24V Read:**	+24V monitor voltage
Laser Bias	Laser current	**+12V Read:**	+12V monitor voltage
RF CSO	CSO monitor voltage	**-12V Read:**	-12V monitor voltage
Laser Cooling	Cooling current	**LASER：**	Laser 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
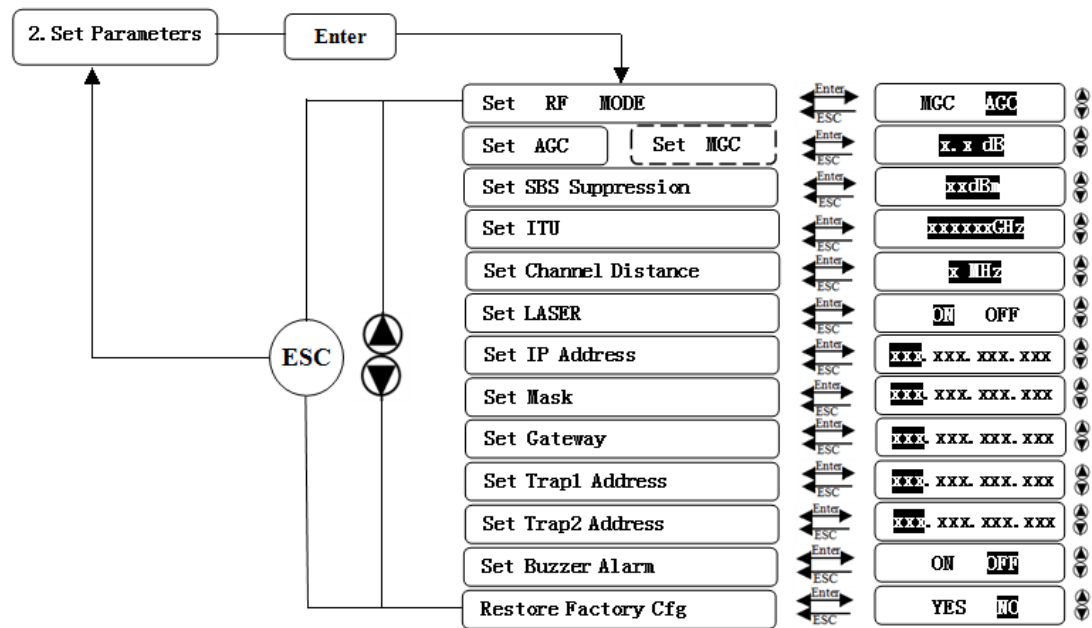
Displayed parameters	Comments	Remarks
Set RF MODE	Set RF control mode	MGC and AGC two modes selectable
Set AGC	Set MGC	Set RF adjusted value	Adjustable range 0~15dB with MGC mode Adjustable range -3~+3dB with AGC mode
Set SBS Suppression	Set SBS value	Range 13~19dBm, 0.5dB stepping
Set ITU	Set optical wavelength	Range ±50GHz
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 Frequency Adjust ITU in DWDM

To help DWDM applications, WT-1550-EM30 can adjust optical wavelength. The adjustable range is ±100GHz, 50GHz stepping. The button on the front panel or the Ethernet interface will complete the adjustment.

λ=c/f, c is the speed of light. It is the constant value.

c=299792458m/s, f is the frequency, its unit is Hz; eg frequency 193400GHZ, the corresponding wavelength is 1550.12nm.

In the 1545-1560nm band, the frequency distance and the wavelength distance is very similar to linear relationship.

50GHz frequency distance reflects to wavelength is very approximate to 0.4nm width; As the same, 100GHz frequency distance reflects to wavelength is very approximate to 0.8nm width.

3.4.8 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-EM30 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-EM30**.

⚠ 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-EM30

4.3.1 Mounting the EM30 in the Rack

Mounting the EM30 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-EM30 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-EM30 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-EM30 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-EM30 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-EM30 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-EM30.

To connect the WT-1550-EM30, 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 RJ45 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-EM30 is available in an AC power model or DC power model. After mounting the WT-1550-EM30 in a rack, follow the power connection procedure below for the model that you are installing.

The AC-powered WT-1550-EM30 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-EM30 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:
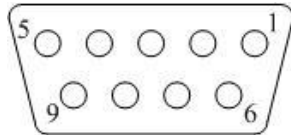
1: No Connect
2: TX
3: RX
4: No Connect
5: GND
6: No Connect
7: No Connect
8: No Connect
9: No Connect

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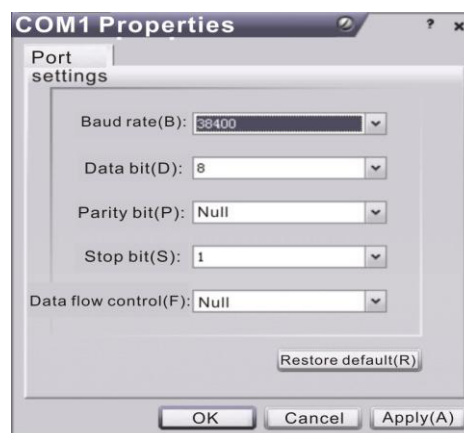
5.2 Set up the Hyper Terminal

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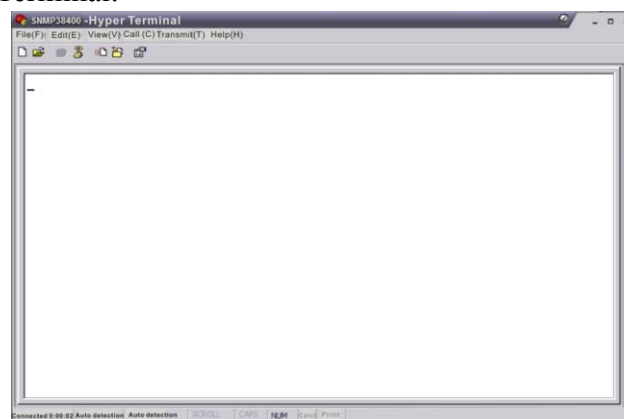
You can click "file save" menu to save this configuration of Hyper Terminal for later using.

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.
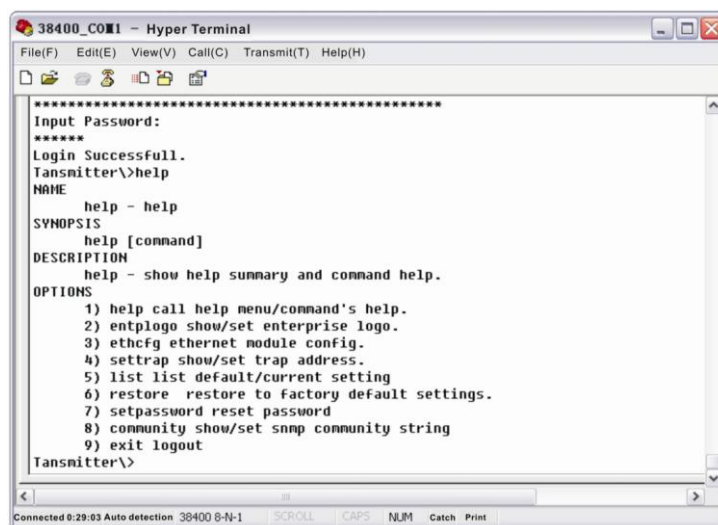
System supports the following commands:

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:
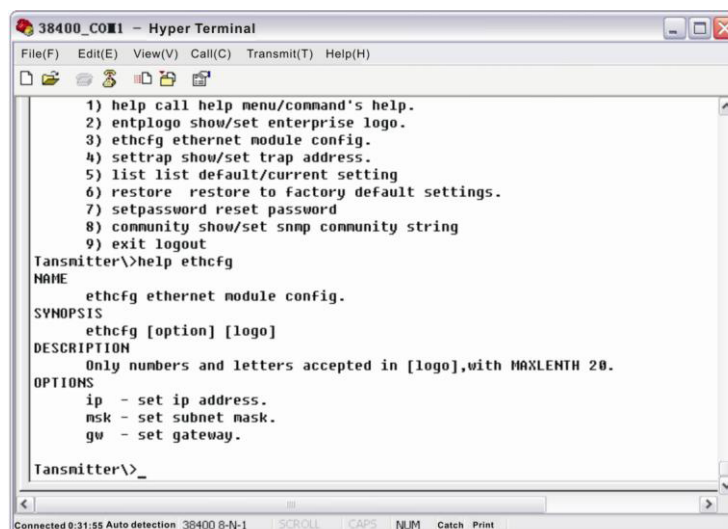
You can also use the "help" command to show help information of other commands,

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:
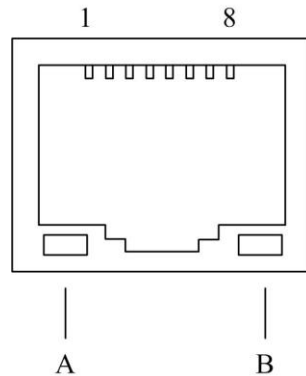
1: TX+

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.