H0FL-EthMux.SA1601/SA1602

E1/T1 over Ethernet Converter

User's Manual

Beijing Huahuan Electronics Co., Ltd.

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Version 1.3 (Nov. 2014)

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Product Name: H0FL-EthMux.SA1601/SA1602
E1/T1 over Ethernet Converter

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BEIJING HUAHUAN ELECTRONICS Co., LTD.

Address: No.26, Shangdi 6th Street, Haidian District, Beijing, 100085
P.R. China

Tel: +86-400-810-8580, +86-010-52046188

Fax: +86-010-52046288

Website: www.huahuan.com

E-mail: support@huahuan.com

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1. Overview

1.1 Introduction

Thank you for choosing the H0FL-EthMux.SA1601/SA1602 E1/T1 over Ethernet Converter designed and made by Beijing Huahuan Electronics Co., Ltd. This converter encapsulates data of E1/T1 stream in the data packet, supports SAToP protocol and UDP/IP packet mode; realizing transportation of 1~2 E1/T1 service over 1 FE port. In the same Ethernet segment, routers or layer-3 switch can be used to cross the Ethernet segment to realize interconnection within IP network, so as to build carrier-class E1/T1 channels. In addition, H0FL-EthMux.SA1601/SA1602 device also supports 2 local Ethernet data access; its internal QoS can set the priority of local Ethernet lower than that of E1/T1 data, so as to ensure the E1/T1 signal priority transmission.

H0FL-EthMux.SA1601/SA1602 has many optional parameters which can be modified by users to suit different application requirements. Please read this manual carefully before using the product.

Features of H0FL-EthMux.SA1601/SA1602:

- ✧ H0FL-EthMux.SA1601 provides 1 E1/T1 over 1 Ethernet adaptation, H0FL-EthMux SA1602 provides 2 E1/T1 over 1Ethernet adaptation;
- ✧ Provides 4 100Base-Tx electrical ports (2 for uplink, 2 for local data, 1 local data port can be used as monitoring port) and 1 100Base-Fx Ethernet optical port can be used for uplink or local data;
- ✧ Supports E1 circuit emulation service on Ethernet links, supports SAToP protocol, Ethernet encapsulation supports IP/UDP, supports E1 QoS;
- ✧ E1 clock supports 3 modes: local clock, adaptive and loopback;

- ✧ 2 uplink Ethernet electrical ports support 1+1 hitless protection;
- ✧ Ethernet built-in layer 2 switch, supports VLAN (802.1Q based and QinQ based), QoS (port based, 8021.1P based and TOS based); supports port speed limit, flow control, MAC address automatic learning and MAC address aging time setting;
- ✧ Supports 120Ω_E1/100Ω_T1 interface in the form of RJ-48C, which can be changed into 75Ω unbalanced interface through the dip setting of bottom and proprietary cable, so as to realize the impedance matching;
- ✧ High transmission efficiency, low transmission delay;
- ✧ The clock reconstruction frequency is stable, jitter and wander are low;
- ✧ Resists to packet loss, no frequency jump, supports frame synchronization protection;
- ✧ Supports buffer absorption function to resist packet delay variation (PDV);
- ✧ Web server NM is supported to realize remote monitoring, it's easy to operate and maintain;
- ✧ Supports SNMP network management protocol (V2);
- ✧ Supports local and remote software and hardware online upgrade;
- ✧ Supports SNTP network time setting;
- ✧ Supports software test E1 error.

1.2 Typical Application

H0FL-EthMux.SA1601/SA1602 device can interconnect with CO aggregation E1 over Ethernet interface converter H0FL-EthMux.SA63, making point-to-multipoint application. And can also make point to point connection to realize interconnections within the same Ethernet sub-network, such as used in

the interconnection of wireless bridge, or using routers or layer-3 switch to cross the Ethernet segment to realize interconnection within the IP network. Typical applications are shown in Figure 1.2-1~Figure 1.2-3.

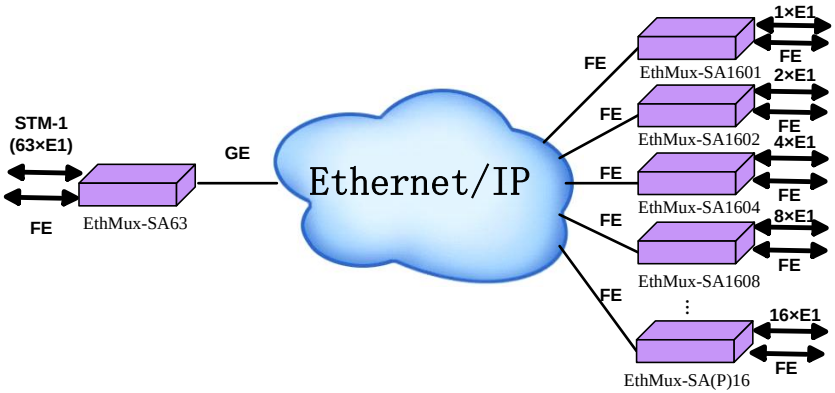


Figure 1.2-1 Typical application of H0FL-EthMux.SA1601/SA1602 interconnected with aggregation device

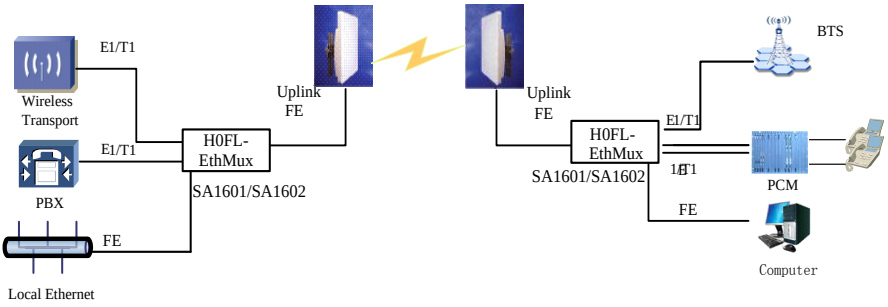


Figure 1.2-2 Typical application of H0FL-EthMux.SA1601/SA1602 in wireless network

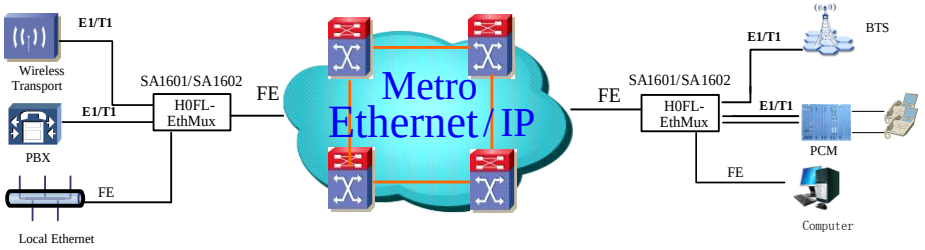


Figure 1.2-3 Typical application of H0FL-EthMux.SA1601/SA1602 in cable network

In wireless network application, H0FL-EthMux.SA1601/SA1602 can cooperate with wireless bridges from most manufacturers. At present, the transmission bandwidth of wireless bridge sold in the market is changing with the Ethernet packets; some bridges will introduce the packet delay jitter. When working with different wireless bridges, E1/T1 signal packet length and jitter absorption buffer size need to be adjusted to get the best transmission effect.

Warning: When this device is working with the wireless bridges, it usually connects with outdoor wireless bridge antenna system through Ethernet cable, thus there is a risk of lightning strike. At this time, Ethernet lightning protection protector must be combined with the uplink network cable; otherwise, the lightning will seriously damage device and pose threat to the field staff!

1.3 Timing Modes

As an E1/T1 signal transparent transmission device, H0FL-EthMux.SA1601/SA1602 does not only transfer E1/T1 data stream correctly to the receiving end, but also recovers the E1/T1 data stream timing information of sending end at the receiving end (E1/T1 output end) accurately. Normally, bi-directional E1/T1 transmission signals are not necessary in the state of

synchronization. In other words, although the signals coming in and going out of the same E1/T1 interface are nominal bit rate, there can be 100ppm frequency difference between them. In this case, the receiving end must reconstruct timing mode according to E1/T1 stream transferred from peer end, this process is Adaptive Timing mode. H0FL-EthMux.SA1601/SA1602 uses timing recovery technique; the output E1/T1 has low jitter and high frequency stability; typical frequency offset is within 5ppm and clock jitter is below 0.1UI, which can meet most applications,

Because IP network transmission data packets have great randomness, although the adaptive timing can restore the clock with high stability and low jitter, the longtime wander is big. The wander does not affect the normal work of the reception device which adopts the slave timing mode, but for some applications, such as switches using the internal clock, may cause the overflow of the frame memory in input port, thus the slip frame will occur.

Therefore, H0FL-EthMux.SA1601/SA1602 provides another timing mode, loopback timing mode. In this mode, H0FL-EthMux.SA1601/SA1602 uses the clock extracted from E1/T1 input port signal to reconstruct E1/T1 output stream, the wander formed in network transmission can be absorbed completely by internal memory of H0FL-EthMux.SA1601/SA1602. Once the input signal loss fault, it will automatically switch to adaptive timing. H0FL-EthMux.SA1601/SA1602 provides two kinds of timing modes.

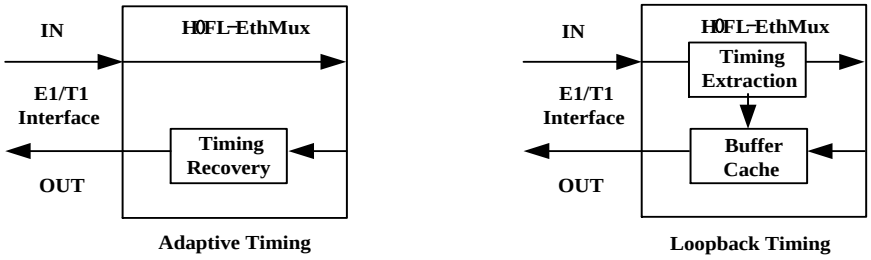


Figure 1.3-1 Timing modes

Choosing proper timing mode is important for ensuring service quality. In most cases, setting both devices to adaptive timing mode is sufficient. But sometimes, setting one device to loop timing mode may work better. For example, setting the H0FL-ETHMUX.SA1601/SA1602 device connected with the master clock (such as switch) to loop back mode, and the other device connected with the slave clock (such as PBX remote module or PCM terminal) to adaptive mode, is probably better than setting both to adaptive modes. It's better to set the both sides H0FL-ETHMUX.SA1601/SA1602 to loop back timing mode when the both sides devices use synchronous master clock, such as the switches with independent clock distribution network interconnect with each other. In another case, set both sides H0FL-ETHMUX.SA1601/SA1602 to adaptive timing mode when the both sides' devices use asynchronous master clock, at this time, slips will occur.

Note that one typical error in applications is to let both communication devices (such as PCM terminal) work at slave clocks. Neither transmission devices nor H0FL-EthMux.SA1601/SA1602 device will support such operation.

Tip: At the beginning of startup, the clock usually takes several minutes to be locked. During that period, errors and slips are normal.

Various timing schemes are listed in Table 1.3-1, which can be selected according to the device interconnection shown in Figure 1.3-2.

Figure 1.3-2 Diagram for device interconnection

Table 1.3-1 Timing mode schemes

A side device clock mode	B side device clock mode	A side EthMux timing mode	B side EthMux timing mode	Remark
Master clock	Master clock	Loopback	Loopback	Device clocks at A and B sides are synchronous
		Adaptive	Adaptive	
Master clock	Master clock	Adaptive	Adaptive	Device clocks at A and B sides are respectively independent
Master clock	Slave clock	Loopback	Adaptive	-
		Adaptive	Adaptive	
Slave clock	Master clock	Adaptive	Loopback	-
		Adaptive	Adaptive	
Slave clock	Slave clock	-	-	Not allowed

2. 📖 System Architecture

2.1 Function Introduction

H0FL-EthMux.SA1601/SA1602 is built on TDM/Packet processing unit. It truncates E1/T1 data stream and encapsulates the data into Ethernet packet; and then sends the packed MAC frame to the Ethernet exchange unit via MII interface; finally, accesses to Ethernet network through uplink Ethernet ports.

The receiving end sends Ethernet data packets carried with E1/T1 data to the TDM/Packet processing unit via MII interface. The processing unit will reassemble the receiving packets to recover the original E1/T1 data stream and outputs it via E1/T1 interface unit. TDM/Packet processing unit needs to process

the reassembled data regularly, so as to recover bit rate, jitter and wander index of E1/T1 stream to meet the requirements of TDM signals.

Users can set various operational parameters of H0FL-EthMux.SA1601/SA1602 through Network Management.

2.2 Front Panel Arrangement

2.2.1 Diagrams of Front Panels

All service interfaces, power ports, indicators and dips are on the front panel of H0FL-EthMux.SA1601/SA1602 device. The equipment type is stuck to the upper cover. Front panels of H0FL-EthMux.SA1601/SA1602 are shown in Figure 2.2-1~Figure 2.2-4 (not in the exact proportion, some interfaces and LEDs are added or removed according to selection of actual devices).

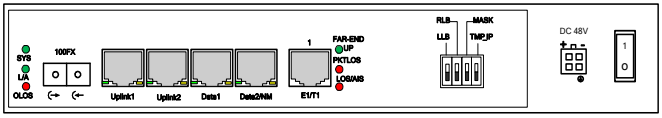


Figure 2.2-1 Front panel of H0FL-EthMux.SA1601 (-48V DC)

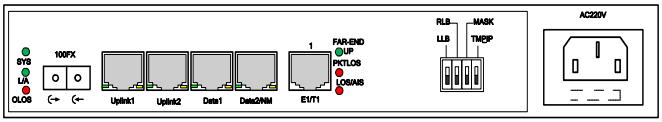


Figure 2.2-2 Front panel of H0FL-EthMux SA1601 (220V AC)

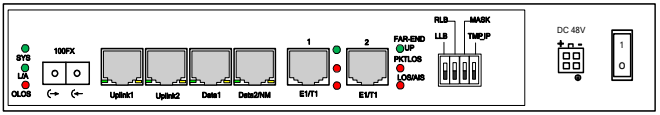


Figure 2.2-3 Front panel of H0FL-EthMux SA1602 (-48V DC)

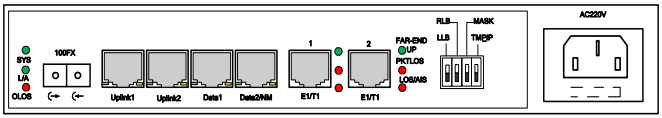


Figure 2.2-4 Front panel of H0FL-EthMux SA1602 (220V AC)

2.2.2 LED Functional Description

LED functional descriptions of H0FL-EthMux.SA1601/SA1602 are shown in Table 2.2-1.

Table 2.2-1 LED functional descriptions

Label	Color	Num	Functional descriptions	Remark
SYS	Green	1	System working state instructions: Blink: running normal On: system is on configuration or running abnormally Off: system does not work or works abnormally	
PWR FAIL	Red	1	The power failure alarm instructions: On: power supply board is not plugged in or the power supply hasn't been accessed Off: normal	
L/A	Green	1	Ethernet optical port connection state instructions: On: connected with remote Ethernet optical port Off: not connected with Ethernet optical port	Ethernet optical port indicators

OLOS	Red	1	Ethernet optical port receiving no light instructions: On: no light receiving Off: receiving normally	
(Ethernet electrical port LINK)	Green	4	Ethernet electrical port state instructions: On: Link normally Blink: data transmitting/receiving Off: Link abnormally	One link indicator on the left of each Ethernet electrical port socket
(Ethernet electrical port FDX)	Yellow	4	Ethernet electrical port rate instructions: On : rate is HULL Off : rate is HALF	One FDX indicator on the right of Ethernet electrical port socket
FAR-END UP 1~2	Green	2	1st~2nd channels of E1/T1 addressing the remote device link state instructions: On: addressing the remote MAC address Off: unaddressing the remote MAC address	
PKT LOS 1~2	Red	2	E1/T1 service lost package instructions in Ethernet link: On: cannot receive the E1/T1 remote package Blink: remote E1/T1 lost package or disorderly sequence Off: remote E1/T1 no lost package or disorderly sequence	

LOS/AIS 1~2	Red	2	E1/T1 port alarm state instructions: On: LOS alarm Regular slow blink: AIS alarm Irregular fast blink: receive E1/T1 signal with wrong HDB3 code Off: no alarm	

2.2.3 DIP Switch

There is a 4-position DIP switch on the front panel of H0FL-EthMux.SA1601/SA1602; the definition is show in Table 2.3-2.

Table 2.3-2 DIP switches definition on the front panel of H0FL-EthMux.SA1601/SA1602 device

DIP	Label	Definition
DIP-1	LLB	E1/T1 port Tx to Rx loop back: ON: set local E1/T1 port Tx to Rx loop back OFF: cancel local E1/T1 port Tx to Rx loop back
DIP-2	RLB	E1/T1 port Rx to Tx loop back: ON: set local E1/T1 port Rx to Tx loop back OFF: cancel local E1/T1 port Rx to Tx loop back
DIP-3	MASK	Alarm mask setting: ON: set local alarm mask Off: cancel local alarm mask
DIP-4	TMP_IP	IP setting: ON: restore default IP address 192.192.192.192 OFF: use the IP address set by user
Note: 1) Dial down TMP_IP dip, 5 minutes later, no matter whether the user dials it up, it will return to the original user Settings IP **2) Dial down all the 4 dips, power failure will recover the default setting of the factory, but keep the current IP address, MAC address**		

There is a 4-position DIP switch on the bottom of device, which can be used to control E1/T1 interface impedance and 75 Ω unbalanced interface shell grounding; definitions are shown in Table 2.2-2.

Table 2.2-2 DIP switches definition on the bottom panel of H0FL-EthMux.SA1601/SA1602

DIP	Definition
1st	ON: the 1st E1/T1 Interface impedance is 75 Ω OFF: the 1st E1/T1 Interface impedance is 120Ω-E1/ 100Ω-T1
2nd	ON: the 1st E1/T1 Interface shell grounding OFF: the 1st E1/T1 Interface shell suspended
3rd (supported by SA1602)	ON: the 2nd E1/T1 Interface impedance is 75 Ω OFF: the 2nd E1/T1 Interface impedance is 120Ω-E1/ 100Ω-T1
4th (supported by SA1602)	ON: the 2nd E1/T1 interface shell grounding OFF: the 2nd E1/T1 interface shell suspended

2.2.4 E1/T1 Interface

H0FL-EthMux.SA1601 provides 1 channel of 120Ω-E1/100Ω-T1 balanced interfaces and uses RJ-48C socket; H0FL-EthMux SA1602 provides 2 channels of 120Ω-E1/100Ω-T1 balanced interfaces and uses dual-E1 socket. Pin orders of RJ48-C and dual-E1 connectors, and socket signals are defined as follows.

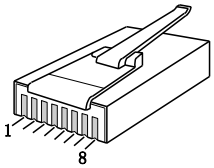


Figure 2.2-5 Pin orders of RJ48-C and dual-E1 connectors

Table 2.2-3 RJ-48C and dual-E1socket signal definition (120Ω-E1/100Ω-T1)

Pin	1	2	3	4	5	6	7	8
Signal	+	-	GND	+	-	GND		
	E1-IN			E1-OUT				

When 75Ω unbalanced interface is used, the device can use BH4.850.122 cable to convert RJ45 interface to 75Ω unbalanced interface. The "+" connects core, "-" connects sheath.

E1/T1 interface provides Rx→Tx, Tx→Rx loop back operation through network which is convenient for opening and maintain test. See loopback definitions in 3.1.2.

2.2.5 Ethernet Port

There are four 100Base-Tx Ethernet electrical ports and one 100Base-Fx optical port provided by H0FL-EthMux.SA1601/SA1602 device. Two Ethernet electrical ports (Uplink) are uplink ports used to connect with transmission network and the other two are local data ports (Data1) used to access local Ethernet, such as switches; and one optical port (100Fx) used as either uplink port or local data port. Ethernet electrical port (marked with Data2/NM) can use Web Server to monitor two devices connected at both ends; or online upgrade software and hardware. When the uplink port is accessed to the upper switch, it also can be used for monitoring.

Ethernet electrical port supports auto-negotiation or forced 10M full /half-duplex and 100M full/half-duplex. Ethernet optical port supports auto-negotiation or forced 100M full-duplex mode.

Ethernet of H0FL-EthMux.SA1601/SA1602 device built-in layer-2 switches function, supporting Ethernet packet size up to 2000 bytes. It supports multiple functions, such as port speed limited, IEEE802.3 x flow control, the MAC address automatic learning and MAC address aging time function set etc.

It supports VLAN division based on 802.1Q and QinQ; and QoS setting based on port, 8021.1P and TOS which can be divided into priorities. These three QoS are enabled by default and configured with the recommended priority to ensure the normal monitoring and E1/T1 signal transmission priority, i.e. monitoring uses the highest priority (7); UPLINK port and optical port use priority (4); layer-2 E1/T1 uses priority (6); layer-3 E1/T1 uses DSCP priority 184 (0xB8); Ethernet service uses the lowest priority (0). If priorities need to be modified, E1/T1 service and monitoring priorities are recommended to be set to 6, 7; common Ethernet service priority is set to 0-5.

Ethernet electrical port uses RJ45 socket. Pin definition of RJ45 Ethernet socket is shown in Table 2.2-4. Ethernet optical port can use dual-fiber SFP optical module and the port labeled (→ is for optical signal output, (← for input. Also Ethernet optical port can use single-fiber optical module which has only one optical interface. The wavelength of single-fiber module is its emission wavelength, which is 1310nm or 1550nm. **Note that single fiber device with the same emission wavelength cannot interwork. So when single-fiber devices are interworked, the devices with matched emission wavelengths should be used.** The user can choose different SFP optical module according to the different transmission distance.

Table 2.2-4 RJ45 Ethernet socket definition

Pin	1	2	3	4	5	6	7	8
Definition	TxD+	TxD-	RxD+			RxD-		

Tip: In auto-negotiation mode, Ethernet electrical port supports HP auto-MDIX function, which can automatically detect the transceiver line order of the network cable connected and make adaptions. So the port can be used whether the Ethernet port is MDI or MDI-X and whether the network cable used is crossover or straight-through.

2.2.6 Power Switch and Power Socket

H0FL-EthMux.SA1601/SA1602 device supports -48V DC and ~220V AC power supplies. The ~220V AC power supply adopts ~220V AC power socket which complies with national standard and is connected by standard three-core power cable. The -48V DC power is connected by 2x2 socket.

When connecting AC power cable, IEC standard power cable sent with device will be used. The middle electrode of AC power socket is protection ground electrode. When connecting DC power cable, DC power cable sent with device will be used. Note that the red line of power cable is high potential, i.e. power ground of -48V power supply, and that the black line is low potential, i.e. -48V. When inserting the power plug, please note the direction of the locking lever. The yellow-green line of DC power cable sent with device is ground line. Make sure that the device has connected to the ground when installing it.

Note: For user's safety, when ~220V AC power supply is used, the AC power socket must have good protection ground connection! When DC power supply is used, the DC power socket must have good protection ground connection too!

3. Installation

3.1 Electrical Installation

3.1.1 Power Connection

When -48V power supply is used, please correctly access positive and negative electrodes of the power supply according to the labels on device power socket; when ~220V AC power supply is used, please connect power cord which complies with national standard to the AC power socket.

Note: For user's safety, both DC and AC power supply must have good protection ground connection!

3.1.2 E1/T1 Interface Connections

H0FL-EthMux.SA1601 provides 1 120Ω-E1/100Ω-T1 balanced interface and uses RJ-48 socket; H0FL-EthMux SA1602 provides 2 120Ω-E1/100Ω-T1 balanced interfaces and uses dual-E1 socket. Besides, both of them support 75Ω non-balanced interface by the Dip switches on the rear panel and external impedance converting cable. For this function, the user should give the interface impedance when making orders. Meanwhile, the user can buy or make connection cables according to actual requirements.

E1/T1 interface provides Rx→Tx, Tx→Rx through NMS, and the loopback of each channel can be set up independently. Rx→Tx, Tx→Rx loop back definition is shown in Figure 3.1-1.

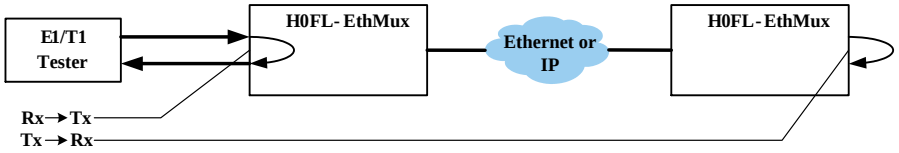


Figure 3.1-1 E1/T1 loop back

Rx→Tx can test E1/T1 connection cable, and Tx→Rx is used to test the whole circuit including H0FL-ETHMUX.SA1601/SA1602 in the two ends and the Ethernet link between them.

3.1.3 Ethernet Cable/Optic Fiber Connections

H0FL-EthMux.SA1601/SA1602 device provides four 100Base-Tx Ethernet electrical interfaces (two ports are uplink port and the other two are

local data ports, Data2 is used as the monitoring port), and one 100Base-Fx Ethernet optical interface used as either uplink port or local data port.

Ethernet optical port uses SFP integrated optical modules, and the port labeled (→ is for optical signal output, (← for input. Also Ethernet optical port can use single-fiber optical module which has only one optical interface. The wavelength of single-fiber module is its emission wavelength, which is 1310nm or 1550nm. Note that single fiber device with the same emission wavelength cannot interwork. So when single-fiber devices are internetworked, the devices with matched emission wavelengths should be used. Optical fiber cable is accessed into optical port by pigtail. When the plug is inserted into fiber transceiver module socket, the locating pin on the plug should be put into the correspondent locating notch on the socket and make sure the pin is in place. The bending radius of pigtail should not be less than 50mm. When plugging or unplugging optical fiber connector, please do not directly pull the optical fiber. The protection plug on the SFP socket should be preserved. When no optical fiber is plugged, the protection plug must be inserted to prevent dust from entering.

Tip: In auto-negotiation mode, Ethernet electrical port of this series device supports HP auto-MDIX function, which can automatically detect the transceiver line order of the network cable connected and make adaptions. So the port can be used whether the Ethernet port is MDI or MDI-X and whether the network cable used is crossover or straight-through.

4. Usage and Maintenance

After powering on H0FL-EthMux.SA1601/SA1602 device, the system should start after 90 seconds to work normally. The system completion startup SYS indicator changes from long on to flashing. You can observe each interface indicator to preliminarily judge working state of each port.

4.1 Troubleshooting

This paragraph describes common faults that may occur during installation and maintenance. Please seek technical support from Beijing Huahuan Electronics Co., Ltd for other problems.

4.1.1 PWR FAIL LED on

PWR FAIL LED is on, indicating the corresponding power supply board is not complete plugged in or not connected with, please check the following subjects: whether the power supply meets the requirements; the power cable is connected well; or the switch is open.

4.1.2 SYS LED Doesn't Blink

After starting up 90 seconds or during working state, the SYS LED doesn't blink, indicating system hasn't powered on or program runs abnormally, you can turn off the power and reboot the device, if the system still does not start up, you need to find provider for technical support.

4.1.3 Ethernet Electrical Port LINK LED off

Ethernet electrical port LINK LED is off, indicating that corresponding Ethernet port does not connect properly. You can check the following subjects: whether cable connection is normal or circuit is broken; cable line order is right,

straight-through cable is used under manual mode (crossover cable should be used); the electrical interface connection does not match the client configuration, and network device connected with is working properly.

4.1.4 Ethernet Optical Port L/A LED off or OLOS LED on

Ethernet optical port L/A LED is off, indicating that the corresponding Ethernet port does not establish connection properly. The OLOS LED is on, indicating no optical signal is received. You can check the following subjects: the corresponding fiber is connected or not; sending and receiving pins are reversed or not; the emission wavelength of single-fiber module and the device connected are the same (optical modules with matched emission wavelengths should be used), and the remote device is working normally or not.

4.1.5 E1/T1 Interface Alarm LED ON

E1/T1 interface LOS/AIS LED is on, indicating loss of E1/T1 signal. Troubleshooting can be conducted as following steps: first, check the E1/T1 terminal connected with the other end of cable, such as whether PCM terminal is powered off; and then check whether the E1/T1 cable connections and connectors are reliable; finally, check whether the E1/T1 cable is broken, this will cause the loss of input signal.

LOS/AIS LED blinks slowly and regularly when E1/T1 interface AIS alarm is detected, i.e. the alarm signal is all 1. Such alarm doesn't indicate fault conditions on the local device, but to detect the alarm information of E1/T1 terminal connected to the local device. The operation state of corresponding device should be checked.

PKT LOS LED is on, indicating the service packet in peer end E1/T1 port cannot be received in Ethernet links; blink indicates the service packet in peer end E1 / T1 port loss or out-of-order in Ethernet links; off indicates there is no service packet in peer end E1/T1 port loss or out-of-order in Ethernet links.

4.1.6 Two Ends of Devices Cannot Connect

Both ends of devices are in the same Ethernet broadcast domain, please check both ends of devices IP address should on dual relationship; check MAC address is unique (including other devices on the same network); use Ping command to check network and check bandwidth is sufficient or not.

If both ends of devices are not in the same Ethernet segment, please check device IP default gateway setting, IP address, IP address mask, and check conflicts of MAC address or IP address; check bandwidth is sufficient. IP address and gateway address can be modified by NMS, MAC address is set by manufacture.

Check whether VLAN settings on both sides of the devices are in accordance with each other.

4.1.7 Both Sides E1/T1Terminals Have Slips

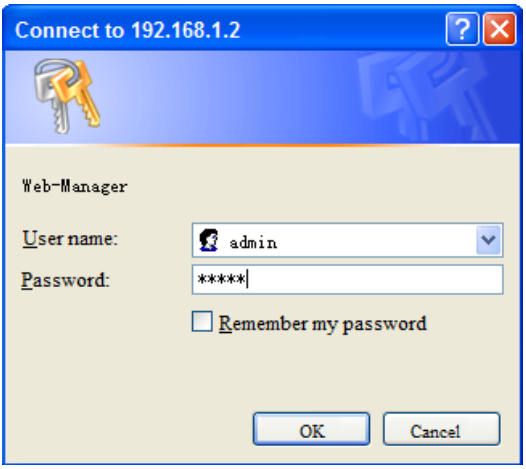
Check E1/T1 terminals connected on both sides of H0FL-EthMux.SA1601/SA1602, whether both of them use slave clock timing, at least one of terminals should be master clock.

Check timing mode setting of H0FL-EthMux.SA1601/SA1602. If both sides of the E1/T1 devices are not in the state of the synchronization, timing mode of H0FL-EthMux.SA1601/SA1602 must be adaptive timing, not loop timing.

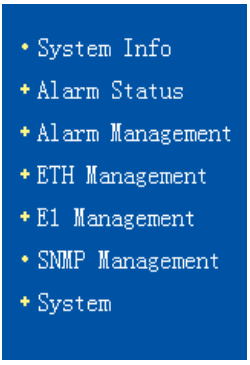
At the beginning of startup, slip is normal.

5. Device Monitoring

H0FL-EthMux.SA1601/SA1602 device supports Web Server to monitor devices. Login Web Server needs Username and Password, the default Username and Password are lowercase “admin”, as shown in the following figure, you can change it at System setting.



All Web Server includes 7 parts: System Info, Alarm State, Alarm Management, ETH Management, E1 Management, SNMP Management, and System.



Web Server NM of H0FL-EthMux SA1602 will be introduced in the following part.

5.1 System Info

After login Web Server, Welcome page will be shown. This page includes Hardware version number, Software version number, Web manager version number, IP address, Subnet Mask, Gateway IP address and MAC address. IP address, Subnet address and Gateway address can be modified by customer, while others are only for querying, as shown in Figure 5.1-1. The default setting IP address is 192.168.1.2.

Figure 5.1-1 System Info

5.2 Alarm State

Alarm state includes E1 Channel, Ethernet Port, Power Supply and Alarm Log test.

5.2.1 E1 Channel State

Click left side of Alarm State–E1 Channel will show E1 channel Service Name, Loopback state, E1 Port LOS, AIS alarm, Packet loss alarm, Packet loss count and far-end connection state. E1 loopback is for testing connection, loopback is defined in 3.1.2. E1 Loopback setting will become effective after

submitting, but not saved, after rebooting the device, E1 in each channel will not be in Loop state. See details in Figure 5.2-1.

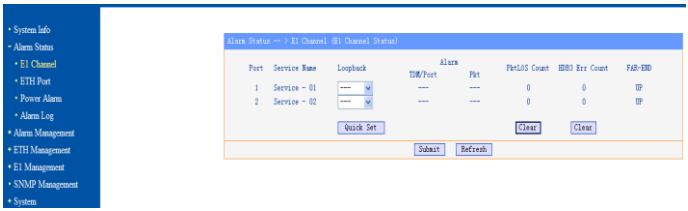


Figure 5.2-1 E1 channel Alarm State

5.2.2 Ethernet Port State

Click left side Alarm State–ETH Port will show 4 Ethernet electrical ports and 1 optical port LINK UP/DOWN state, as shown in Figure 5.2-2.

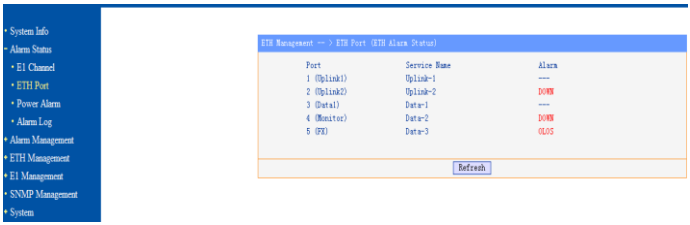


Figure 5.2-2 ETH port Alarm State

5.2.3 Power State

Click left side Alarm State–Power State will show Power Alarm State, including 2 channels power-off alarm state information, as shown in Figure 5.2-3.

Figure 5.2-3 Power State

5.2.4 Alarm Log

Click left side Alarm State–Alarm Log will show Alarm Type, Alarm Item, Port Number, Start Time and End Time, as shown in Figure 5.2-4

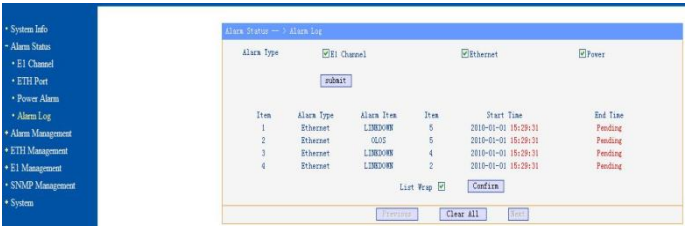


Figure 5.2-4 Alarm Log

5.3 Alarm Management

Alarm Management includes E1 Channel, Ethernet Port and Power Alarm Shielding setting.

5.3.1 Alarm Shielding Management

If alarm mask is set, this alarm will be shielded at alarm log, alarm indicator on the front panel and it will not be displayed no matter what situation is unless the mask is canceled. E1 channel supports not only shielding any alarm of any channel, but also batch shielding. But Ethernet port alarm and power

alarm shielding can only be set one by one. E1 channel alarm shielding management and Ethernet port alarm shielding management are respectively shown in Figure 5.3-1 and Figure 5.3-2.

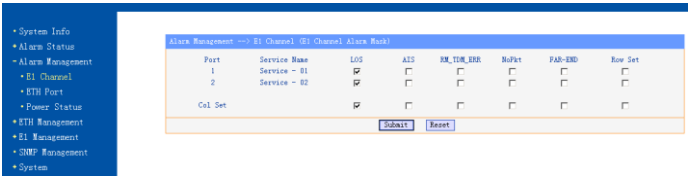


Figure 5.3-1 E1 channel alarm shielding management

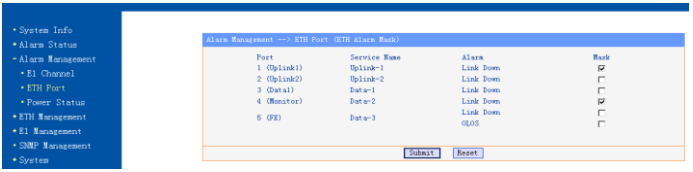


Figure 5.3-2 ETH alarm shielding management

5.4 ETH Management

ETH Management includes Ethernet port management, Ethernet senior management (MAC address aging time, QoS management and port rate control) and VLAN management.

5.4.1 Ethernet Port Management

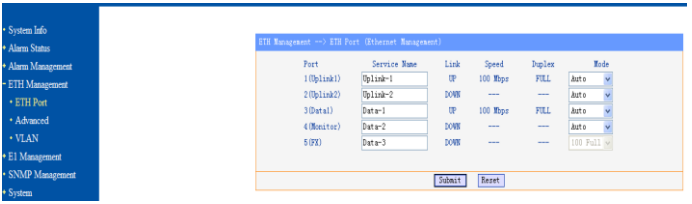


Figure 5.4-1 Ethernet port management

Table 5.4-1 Ethernet port management parameters

Parameters		Options	Instruction
Ethernet Management	Port		Numbers for 5 Ethernet ports
	Service Name		Ethernet service name: support up to 15 capital/small letters, digit and part special character input; support 7 Chinese characters (doesn't support any special characters, such as "/", "\" input)
	Link		Indicate current Ethernet port link state (Up/Down)
	Speed		Indicate current Ethernet port working speed, such as 10/100Mbps
	Duplex		Indicate current Ethernet work mode (FULL/HALF)
	Mode	Auto, 100M full, 100M half, 10M full/ 10M half	5 Ethernet ports work mode configuration: Auto- negotiation (default) 100M full 100M half 10M full 10M half Electrical port work modes have Auto, 100M full, 100M half, 10M full and 10M half Optical port work mode has 100M full

Tip: The sentence with underline is default setting.

5.4.2 Ethernet Senior Management

Ethernet senior management provides MAC address aging time, Ethernet port QoS management and port rate control setting. MAC address aging time range is 0~524287s (default: 300s), as shown in Figure 5.4-2.

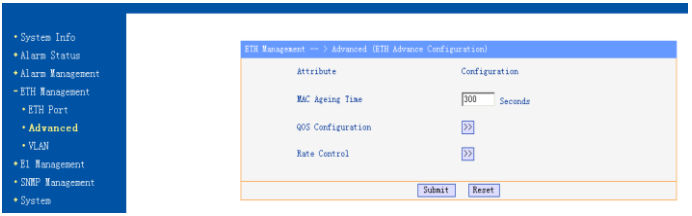


Figure 5.4-2 Ethernet senior management

For Ethernet ports 1~5, we can enable QoS, QoS priority tags based on port, IEEE 802.1p and TOS are supported. QoS is enabled by default.

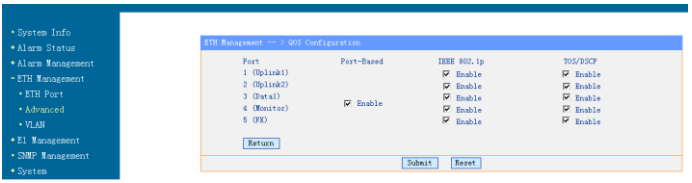


Figure 5.4-3 Ethernet port QoS configuration (enabled by default)

Port rate control of Ethernet senior management includes enable Ethernet port throughput limiting and speed configuration (supporting entry speed limiting) and storm suppression, as shown in Figure 5.4-4. Speed class of Ethernet interface is shown in Table 5.4-2. When we configure the maximum port speed, if the value is not equal to any speed class in Table 5.4-2, it will select the lower speed class proximal to this value. For example, value is set to

70, after clicking Submit, the value will change to 64, means the maximum speed is 64KB. This series device supports suppression function of broadcast, multicast and unknown package, you can set rate limit according to your actual use.

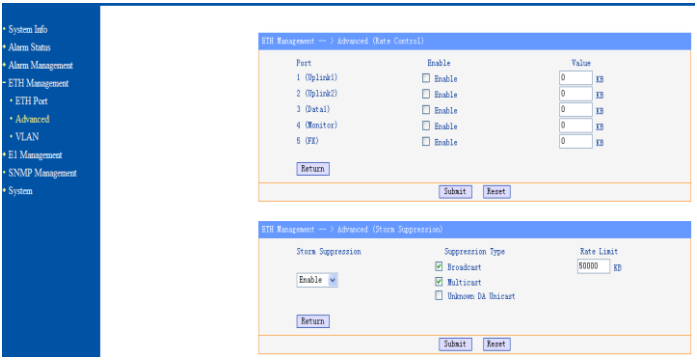


Figure 5.4-4 Ethernet port rate control configuration

Table 5.4-2 Speed class of Ethernet interface

Speed limit range	Speed class interval	Minimum speed	Maximum speed
Lower than 2M	64KB	64KB	1.792MB
Higher than 2M lower than 100M	1MB	2MB	100MB

5.4.3 VLAN Management

Two uplink Ethernet electrical interfaces support 1+1 nondestructive protection. After enabling 1+1 nondestructive protect, device can configure QinQ VLAN automatically and user only needs to configure VID of uplink Ethernet electrical interface and monitoring port, as shown in Figure 5.4-5 and Figure 5.4-6.

Figure 5.4-5 Uplink port 1+1 nondestructive configuration

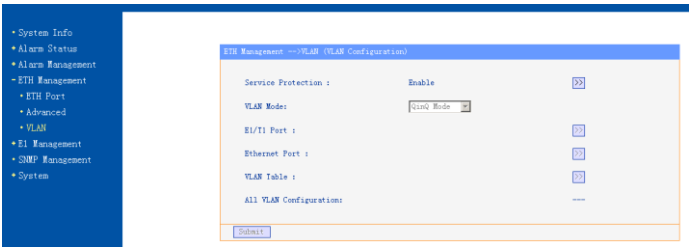


Figure 5.4-6 Configure QinQ VLAN automatically

Uplink 1 + 1 nondestructive protection function is forbidden, Ethernet of H0FL-EthMux.SA16 series device supports 802.1 Q VLAN and QinQ VLAN. 802.1Q VLAN is that adding the VLAN tag in front of Ethernet frame type. QinQ VLAN is that nesting the VLAN (S-Tag) of operators in 802.1Q outer layer to enable the VLAN stacking. VLAN management parameters are shown in Table 5.4-3.

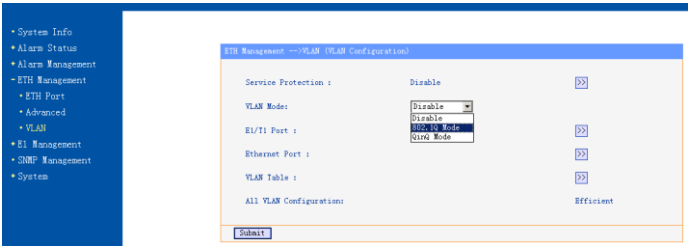


Figure 5.4-7 VLAN management 1-VALN configuration

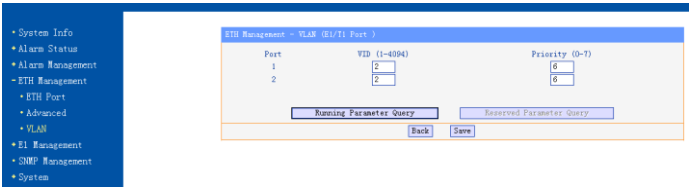


Figure 5.4-8 VLAN management 2-E1 port configuration

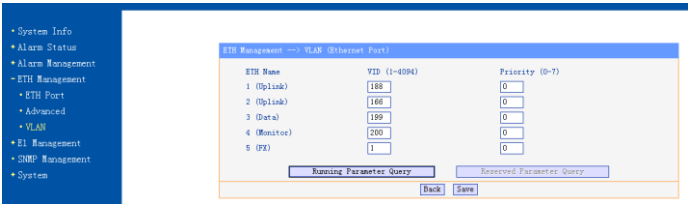


Figure 5.4-9 VLAN management 3-Ethernet port VLAN configuration

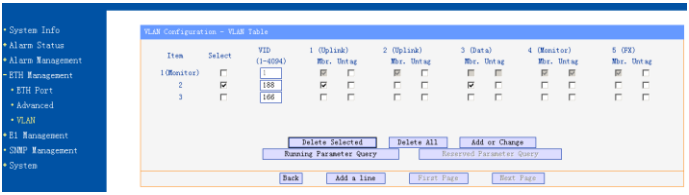


Figure 5.4-10 VLAN management 4-VLAN Table

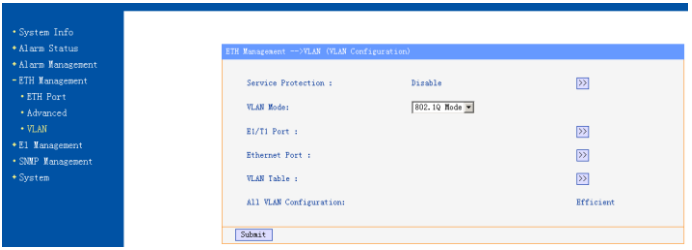


Figure 5.4-11 VLAN management 5-VLAN configuration confirmation

Table 5.4-3 VLAN management parameters

Parameters	Options	Instruction
VLAN Mode	Disable	During VLAN division, untagged VLAN is disabled, it is applicable to the network which doesn't support VLAN priority; When 802.1Q VLAN is enabled, add the VLAN tag in front of Ethernet frame type; when QinQ VLAN is enabled, nest the VLAN (S-Tag) of operators in 802.1Q outer layer to enable the dual-layer VLAN tag
	802.1Q	
	Q in Q	
Service Protection	Protection Control	Disable: not supply slave transmission channel Enable: both master and slave transmission channels transport service and no data loss during protection switching
	Attribute	Attribute of 1~5 Ethernet port, including uplink port and data/monitoring port
	Ethernet Port	Ethernet port number 1~5
	VID	VLAN ID, support 4094 VLAN ID, range (1-4094)
E1 Channel VLAN Configuration	Port	E1 port number 1~2
	VID	VLAN ID, support 4094 VLAN ID, range (1-4094)
	Priority	Define customer priority, including 8 PRI degrees (0-7). The higher the value is, the greater the priority will be
Ethernet Port	Eth Name	Ethernet port number 1~5

Parameters	Options	Instruction
VLAN Configuration	VID	VVLAN ID, support 4094 VLAN ID, range (1-4094)
	Priority	Define customer priority, including 8 PRI degrees (0-7). The higher the value is, the greater the priority will be
VLAN Table	VLAN table configurations, inquiry, adding and deleting	
	Select	When adding VLAN groups or VLAN members, property are changed, this option must be tick off
	VID	VLAN group ID, support 1-4094
	Mbr.	VLAN group member, it will be a VLAN member when ticking off
	Untag	Tagged/untagged, ticking off means (untag)

Tip: According to the PVID value of Data2/NM port, the device can automatically generate a default monitoring VLAN entry and it cannot be changed. If the monitoring VID value needs to be modified, the PVID of monitoring port needs to be modified first.

5.5 E1 Management

E1 management includes E1 service management, E1 senior management, and bit error test. Every section has many parameter settings as shown in Table 5.5-1.

5.5.1 E1 Service Management

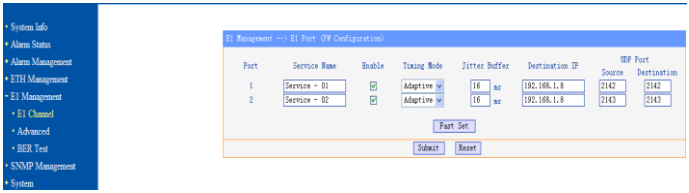


Figure 5.5-1 E1 channel Management

5.5.2 E1 Senior Management

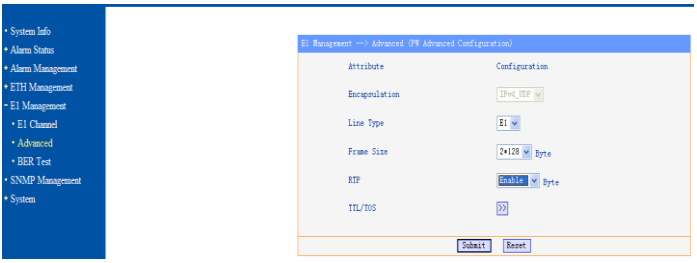


Figure 5.5-2 E1 channel senior Management

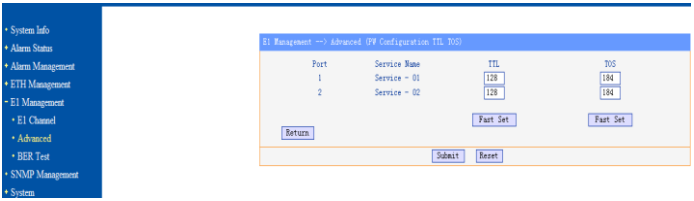


Figure 5.5-3 TTL/TOS configuration of E1 channel Management

E1 Management parameter settings are shown in Table 5.5-1.

Table 5.5-1 E1 Management parameters

Parameters		Options	Instruction
E1 Channel	Service Name		E1 service name: support up to 15 capital/small letters, digit and part special character input; support 7 Chinese characters (not support any special characters, such as "/", "\" input)
	Enable		Enable this E1 channel. Default: disable
	Timing Mode	Adaptive	Adaptive timing mode: E1 timing comes from remote E1 stream
		Loopback	Loopback timing mode: E1 timing comes from local E1 stream
		Local	Local clock mode: E1 timing comes from local device crystal oscillator
	Jitter Buffer	2~255ms	Jitter absorption buffer: worked with the link with bigger jitter, used to buffer the receiving packets; buffer coming packets to eliminate jitter. Range: 2~255ms Default: 16ms
	Destination IP		Remote site IP address connected with each E1 can be set separately; Default 192.168.1.3
	UDP Port	Source	UDP source port number, effective port number range: 1024~65535

Parameters		Options	Instruction
		Destination	UDP destination port number, effective port number range: 1024~65535
Advanced	Encapsulation	IPv4_UDP	IP encapsulation
	Line Type	E1/T1	E1/T1 service can be selected Default: E1
	Frame Size	1×128 byte	Every Ethernet packet encapsulation length can select 1×128 byte /2×128byte/4×128 bytes. The longer the packet is, the more E1 data encapsulated in the packet is, the lower expense ratio is, the higher bandwidth efficiency is and the bigger time delay is. Vice versa. Default: 2
		2×128 byte	
		4×128 byte	
	RTP	Enable	Real-time Transport Protocol, used to define E1 time stamp Default: Enable
		Disable	
	TTL/TOS		TTL: Time To Live, Default: 128 TOS: Type Of Service, Default: 184

Supplementary items:

1. Whether E1 bandwidth is adaptive depends on whether enabling this E1. Suggestion: If this E1 is not used, it is better to let this E1 channel disabled.

2. Each end of Ethernet devices has a unique and fixed with 12 a hexadecimal MAC address, such as 80-80-80-80-80-80, can make the communication with other device. H0FL-EthMux.SA63 device Ethernet MAC address has formed, you don't need to set. H0FL-EthMux.SA1601/SA1602 supports ARP protocol addressing; the opposite device or default gateway device's

MAC address can automatically get through Negotiation, you don't need to set the opposite end MAC address, but need to set up its IP address.

Note: In Ethernet broadcast domain, all of the device's MAC address must be unique, otherwise it will cause address conflict!

3. In order to improve the transmission service quality of E1 data, according to provide transmission Ethernet whether support IEEE 802.1 Q, 802.1 AD and 802.1 p standard, H0FL-EthMux.SA1601/SA1602 can set the standard is packed to join contain priority VLAN label (V-Tag) or QinQ label (S-Tag). According to 802.1Q/QinQ/802.1p standard packing, the encapsulation spending is slightly bigger, but can be transmitted by higher priority. But for the network that doesn't support 802.1p standard; there is no practical significance, but increases unnecessary transmission bandwidth costs, therefore, VLAN should be set to Disable.

5.5.3 Error Test

Click BER Test will display error test, including error test enables, the selection of test channels, the selection of test start and stop, port state (frame synchronization or out-of-frame), error count (Bit), error-rate and Test duration, as shown in Figure 5.5-4. If need to test error for channel, at first elected "enable" and "start", and second click "submit" button to begin testing. Stop testing can choose the channel "stop", and click "submit" button, at this time, test results will be displayed. Clicking on the "Refresh" button during test can inquire test error by the current time.

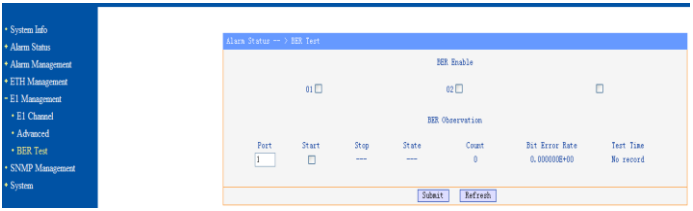


Figure 5.5-4 Error test

5.6 SNMP Management

SMMP management is shown in Figure 5.6-1, SNMP management parameters are in Table 5.6-1.

Figure 5.6-1 SNMP management

Table 5.6-1 SNMP management parameters

Parameters		Option	Instruction
SNMP Configuration Information	SNMP Read Community		Read commands of device nodes (Read-only) Default: public
	SNMP Write Community		Configure commands of device nodes Default: private

Parameters		Option	Instruction
	SNMP Trap Community		Receive commands of Trap Default: public
	SNMP Port Number		The communication ports connecting the devices with SNMP, SNMP protocol, Default: port: 161
SNMP Trap Address and Port	SNMP Trap Address		Address used to receive Trap information: the most addresses and ports can be set is up to 5. That means the managed device can sent Trap information to 5 network management devices at the same time. SNMP Trap Address needs to be configured at the first time (initial value: 0), but it can be saved and recovered
	SNMP Trap Port		Ports used to receive Trap information: it needs to be configured at the first time (initial value: 0), but it can be saved and recovered

5.7 System Configuration

This section includes time configuration, password modification, default parameter recovery, upgrade online and reboot system.

5.7.1 System Time Management

System time can be modified in three ways: manually enter the time, use Local PC time or SNTP network time. System time setting divides into time setting and device SNTP management, as shown in Figure 5.7-1.

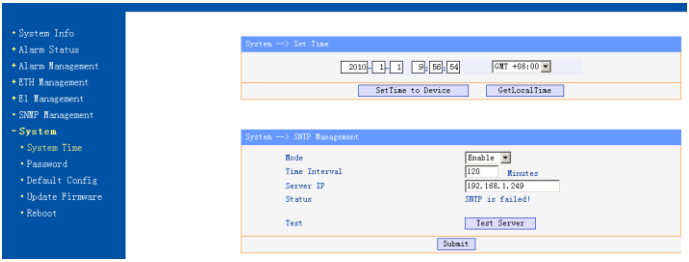


Figure 5.7-1 System time management

SNTP management includes SNTP server option (stop/start/test), time setting interval (10~60000 minutes), SNTP server IP address and SNTP server state display (disable/enable, connect successfully/fail).

Note: It needs to get the current time again when the power is off!

5.7.2 Password Management

Password Management is shown in Figure 5.7-2, the change will be valid after confirming the submitting.

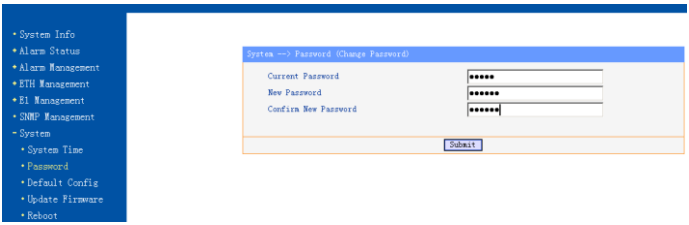


Figure 5.7-2 Password Management

5.7.3 Default Parameter Recovery

Default parameter recovery can make all the parameters recover to factory default except the IP address of devices and the devices will reboot automatically. If you don't select to remain current IP, IP address will also recover to factory default (192.168.1.2). At the same time, due to the change of IP, it will show Access failed. Then we need to restart Web Server.

Figure 5.7-3 Default parameters recovery

H0FL-EthMux.SA1601/SA1602 supports changing E1/T1 port number. For example, change E1/T1 port number of H0FL-EthMux.SA1602 to 1. Steps are shown as follows:

Step 1: Generate the configuration code by verification code. Type in the MAC address of H0FL-EthMux.SA1602 and set E1 number as 1, and then click Generate, finally, the configuration code is generated.

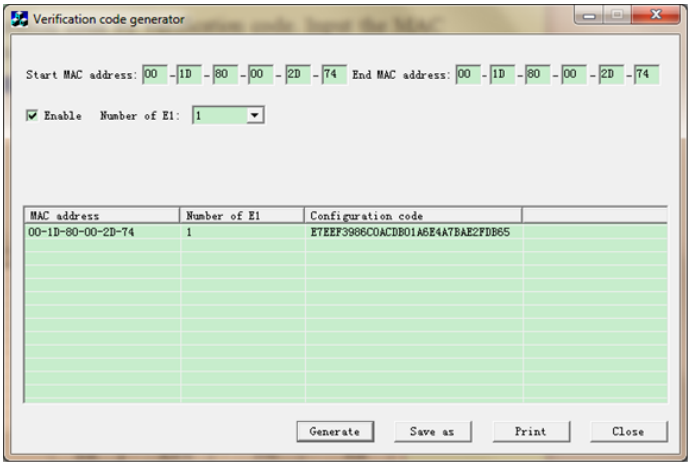


Figure 5.7-4 Generate configuration code

Step 2: Type in the configuration code and click Submit, E1/T1 port number will be changed.

Figure 5.7-5 Change E1/T1 port number

Step 3: Check E1/T1 port number in Configuration State to confirm whether the change is successful.

Figure 5.7-6 Change E1/T1 port number successfully

5.7.4 Upgrade Online

Both hardware and software programs of H0FL-EthMux.SA1601/SA1602 can be upgraded through ftp. We will take software program as an example to introduce online upgrade method.

Step 1: Use any FTP tool or type in ftp://root:root@192.168.1.2/home/ftp directly in My Computer address bar to access the ftp server. And then copy the upgrade program to the server. Note that software program file name is S_patch.r, and the hardware program file name is H_patch.r. The file name cannot be changed.

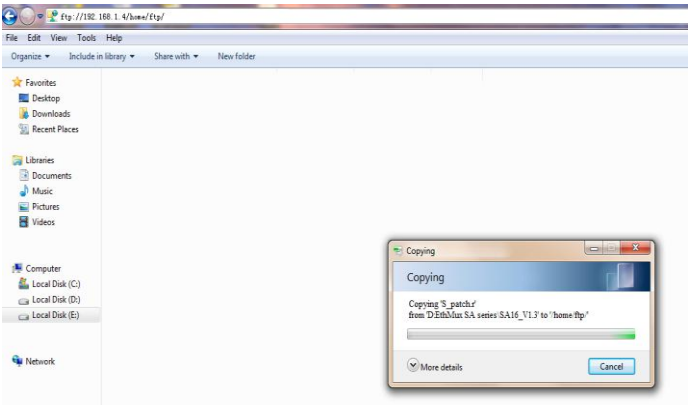


Figure 5.7-7 Upgrade online 1—upload upgrade program

Step 2: Select an upgrade mode; it is available to select software and hardware at the same time. Note that the upgrade files must be uploaded at the first step, and then click “Upgrade” and confirm it, finally, it starts to upgrade.

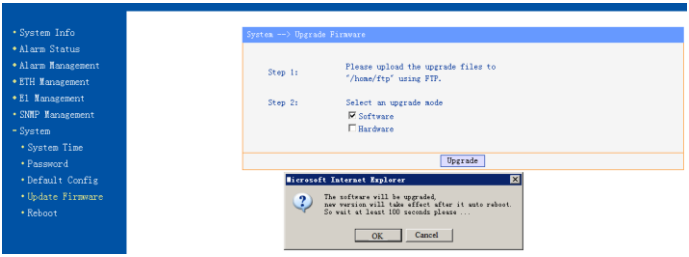


Figure 5.7-8 Upgrade online 2—upgrade program

It may take several minutes to complete the upgrade (depends on what program you upgraded). During the upgrade, we can refresh to check upgrade progress.

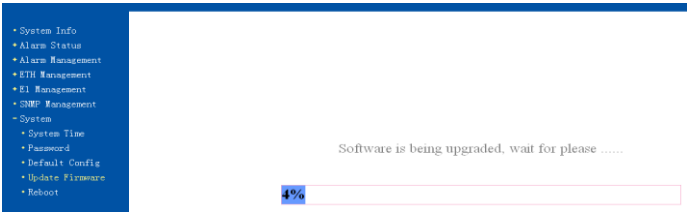


Figure 5.7-9 Upgrade online 3—during the upgrade

When the upgrade is done, click Confirm to reboot the device. Login Web management again to check the version number and confirm the upgrade is successful.

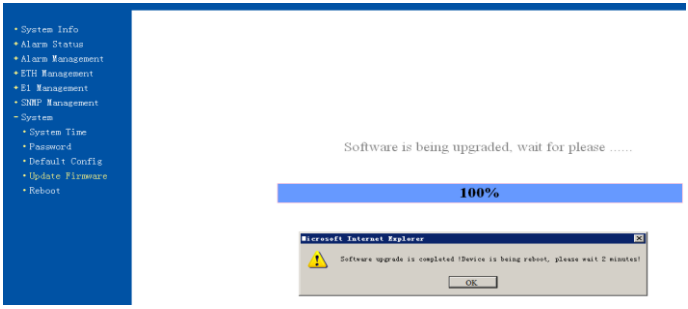


Figure 5.7-10 Upgrade online 4—upgrade is completed

Note: If the power is off during upgrade, it may make equipment not start and need to program procedures with download line.

5.7.5 Reboot Device

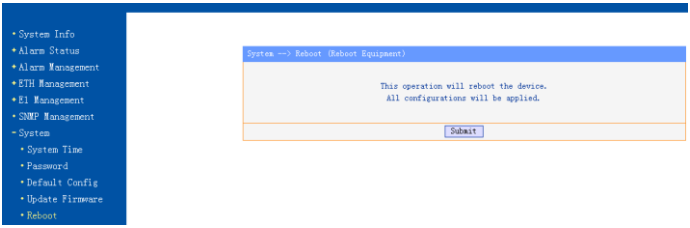


Figure 5.7-11 Reboot device

6. Technical Specifications

6.1 System Parameters

H0FL-EthMux.SA1601: 1 E1/T1 interface
4 100Base-Tx Ethernet electrical ports
1 100Base-Fx Ethernet optical port

H0FL-EthMux SA1602: 2 E1/T1 interfaces
4 100Base-Tx Ethernet electrical ports
1 100Base-Fx Ethernet optical port

6.2 E1/T1 Interface Features

E1/T1 interface: Complies with ITU-T G.703 recommendation

Point-to-point single way additional processing delay (minimum delay setting): ≤10ms

Output frequency stability (adaptive timing, stable): ≤5ppm

Output jitter (adaptive timing): ≤0.1UI

Interface impedance: Default configuration: E1-120Ω/T1-100Ω; 75Ω conversion can be achieved

Connector: RJ-48C or dual-E1

Interface number: H0FL-EthMux.SA1601: 1 E1/T1 interface
H0FL-EthMux SA1602: 2 E1/T1 interfaces

6.3 Ethernet Port

Complies with IEEE 802.3, 802.1Q, 802.1ad, 802.1P recommendations

Operating mode: Electrical ports: auto-negotiation, manual 10M/100M, half-duplex/ full-duplex

	Optical ports: manual 100M full-duplex
Maximum packet length:	2000bytes
Connector:	100M electrical port: RJ45
	100M optical port: LC
Port number:	100M electrical port: 4
	100M optical port: 1

6.4 Power Supply

AC	100V~260V/50~60Hz (fuse: 1A）
DC	-36V~ -72V
Power consumption	≤4.5W

6.5 Operating Environment

Temperature	(0~45)℃
Humidity	≤90% RH (non-condensing)

6.6 Dimensions

W×H×D (mm)	195× 35 × 140

6.7 Weight

Weight	≤ 0.8kg

Appendix Acronyms and Abbreviation

Word	Definition
TDM	Time Division Multiplex
SAToP	Structure-Agnostic TDM over Packet
DSCP	Differentiated Services Code Point
UDP	User Datagram Protocol
QoS	Quality of Service
TOS	Terms Of Service
TTL	Time To Live
VLAN	Virtual Local Area Network
RTP	Real-time Transport Protocol
SNTP	Simple Network Time Protocol