



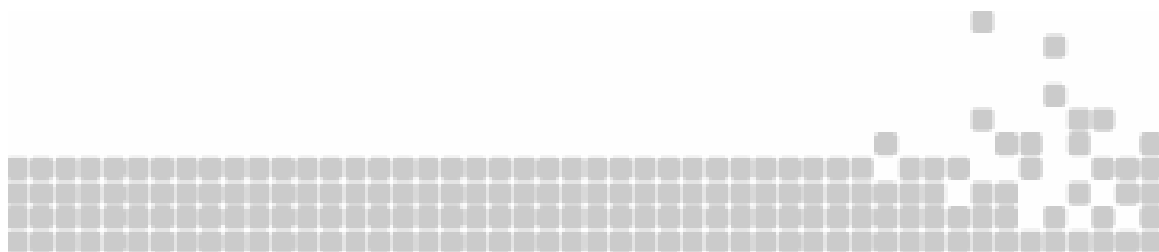
S100 Scrambler
User Manual
V1.0

Beijing Communicate Technology Inc

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Preface

Beijing Communicate Technology Inc is one of the leading domestic high-tech companies in China. It has the advanced end-to-end technology of DVB.

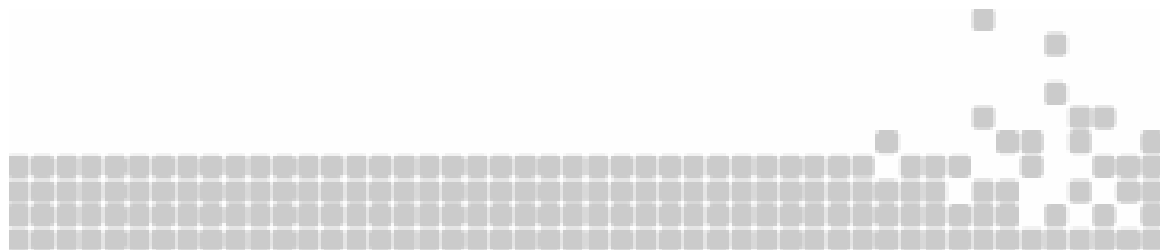
In the digital television head-end, we first developed and manufactured devices compatible with the standard of DVB such as coder, multiplexer, DVB video server, the IP/ DVB net gateway, DVB condition access system and IP condition access system approved by broadcasting bureau in China. “The delivering and receiving system of the digital video broadcast” won the honor of national science and technology award in 2000; this is also highest award a DVB enterprise ever received.

In the digital television receiving-end, our data broadcasting receiving card did very well under the test compared with the similar products and adopted by operator “gehua online”.

CTI also provides the professional services in the digital television field. We can provide the consulting service in the digital television and interactive-television, integrating service, middleware and conditional access.

CTI is looking forward to cooperate with you to succeed together in the digital television industry in China.

S100 scrambler is one of the latest products. This manual describes the basic principle, the system structure, functionality and specifications of the S100 scrambler in detail.



Chapter 1 Overview

S100 scrambler is the TS(Transport stream) scrambler compatible with the DVB-SimulCrypt standard. It can scramble the input real-time video stream using the DVB common scramble algorithm. The scrambler could be remotely managed using the explorer in the computer.

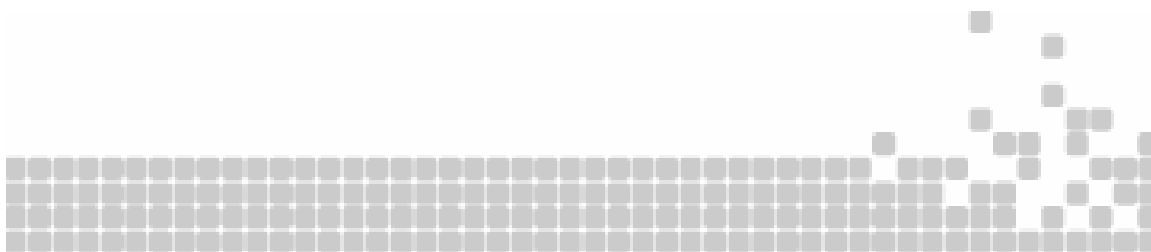
The multiplexing of the base-band signal and the additional data is compatible with ISO/IEC-13818 standard. The transport output port is the DVB-standard ASI port. The scrambler uses TCP/IP protocol and RJ45 Ethernet port to connect with the network management.

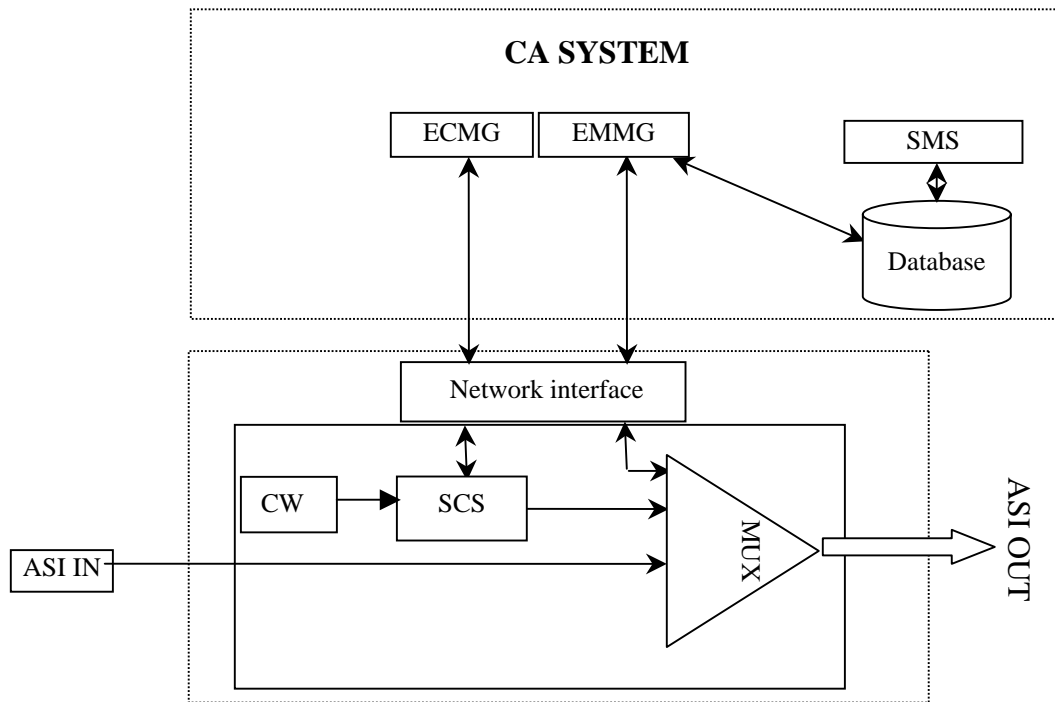
1.1 Product features

- Low delay. The delay is less than 100 ms for the MPEG 2 video program
- Proving PCR adjust
- Support web-based remote control (LAN and WAN)
- Support DVB common scramble algorithm, and support scramble based on service and component
- Monitor the real-time input status
- Generating scrambler word
- Support ECM and EMM information insert
- ASI input and output
- To deal with the CA-related SI information
- Embedded design

1.2 Basic principle

The basic principle schematic of the scramble part of the S100 scrambler is as follows:





1. Scrambler receives the program transport stream
2. Using STC to adjust the PCR(Program Clock Referenc)
3. The scrambler module uses DVB common scramble algorithm and uses CW (control word) to scramble the program information. The ECM, EMMs imported from the Ethernet port is multiplexed and outputted by ASI port

CW:

The encryption or scramble algorithm needs a key. The key used in the CAS (conditional access system) is called CW (control word). It is generated in the scrambler. For there are many CAS available, the S100 scrambler is design compatible with many CAS. The S100 scrambler can operate with many CAS.

For compatibility, the communication protocol used in the scrambler and CAS is defined in the TS103 197 standard.

ECM and EMM:

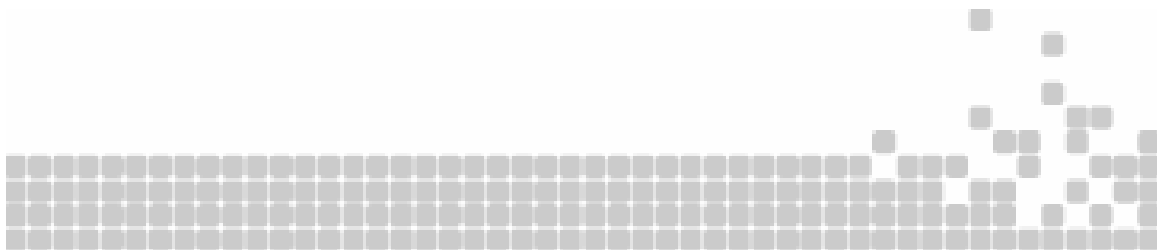
CW cannot be transmitted to the receiving end in the plaintext. It needs to be scrambled. The scrambled CW is sent to the receiving end in the ECM.

An ECM can correspond to one or more services (components).

The authentication is required before the de-scrambling the signal in the receiving end; this is the function of the EMMG and SMS. EMMG connects to the scrambler via TCP/IP or UDP protocol and then the scrambler inserts the EMM into the TS.

1.3Application environment

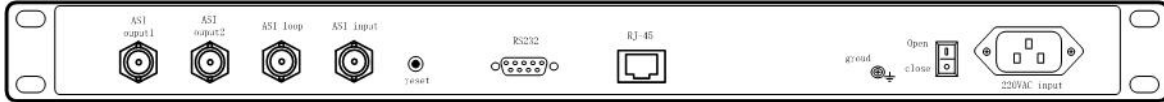
It is used in the head-end, cooperating with CAS, to scramble the digital television program.



Chapter 2 Product description

The scrambler is consisted of two parts: the scrambler module and network management software. The scrambler is used to scramble the DVB information and can receive the CA information. The network management software is based on the web explorer and used to remotely control the system and monitor the status.

description of the back panel



port description is as follows:

ASI input: ASI signal input; used in receiving the single-program TS or multi-program TS. The packet format is 188 bytes or 204 bytes.

ASI loop:ASI signal circular out

ASI output1: ASI signal output; used in sending the single-program TS or multi-program TS. The packet format is 188 bytes or 204 bytes.

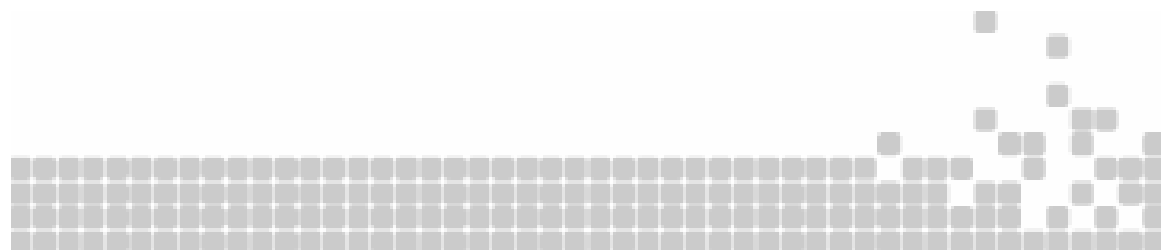
ASI output2: ASI signal output; used in sending the single-program TS or multi-program TS. The packet format is 188 bytes or 204 bytes.

RS232 port: used to upgrade and test the software locally

RJ —45 : is used in the web-based network management. The user can connect to the scrambler from any computer on the LAN or WAN

Ground: protected ground port

reset: to reset the network address to 200.121.2.169。



Chapter 3 operation guide

3.1 Overview

CTI S100 scrambler provides a web-based remote management program. The user can use it from any computer running on Window98 or Windows 2000 to remote control the scrambler.

3.1.1 To install the device safely

- a. The scrambler must be fixed on the cabinet. Notice: please leave at least 1U space to cool the machine
- b. To install the protected ground for the machine
- c. To connect the input signal to ASI input port, ASI output 1(or 2) to the output cable and connect the network cable to RJ-45 port.
- d. To power up, the system will be loaded in 50 seconds. The description for the lights on the front panel is as follows:

Power 1 The light is on after the power is on
Power 2 The light is on after the power is on when the device has two power devices

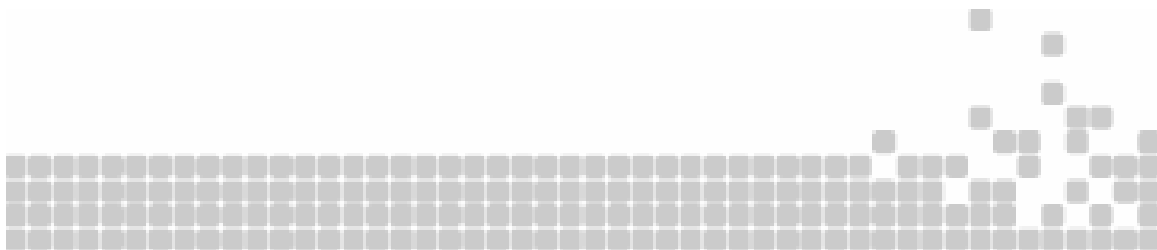
Running The light is on after system is loaded, the light is off when loading. The light is flashing when the system visits the inner FLASH memory, please don't cut off the power at this time

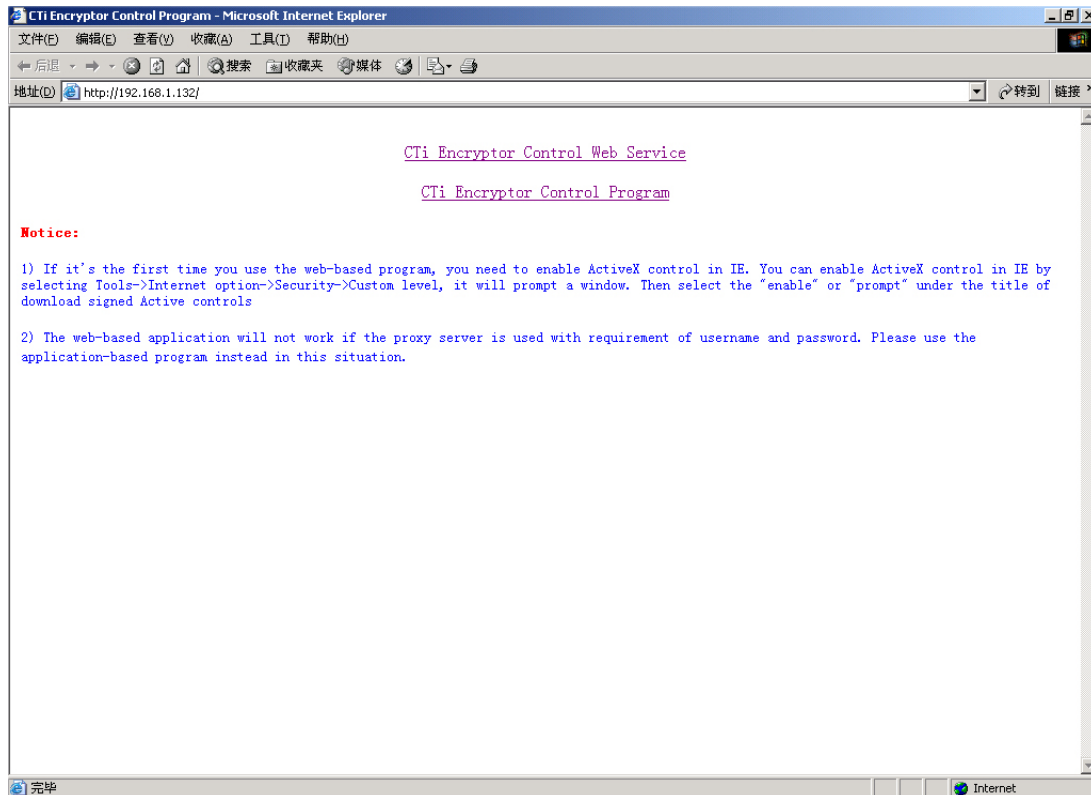
Input signal This light is double-color light
 The green flashing: the system is locking the input signal
 The green light on: the signal is locked
 Red light on: no ASI signal input
 Yellow: the input signal is normal but there is an overflow

- e. The web-control computer's initial web address is: 200.121.2.169. After connecting to the scrambler, please change the address according to user's requirement and then cut off the power.
- f. To power up again after the power light is off on the front panel. The user can configure the scrambler in the remote web-control computer.

3.1.2 To operate on the connected devices via net:

Open IE and type the scrambler's IP address in the address bar, the system will display:

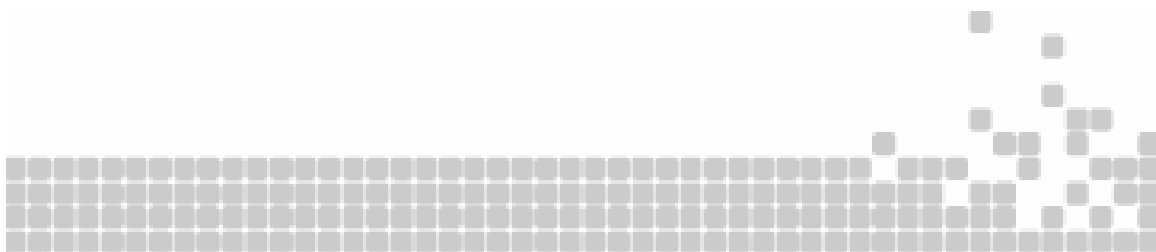




There are two forms of control programs provided now: 1) web-based; 2) Application-based. We recommend the user use the application-based on the Windows 2000.

Startup interface

The following interface will be displayed after the startup:

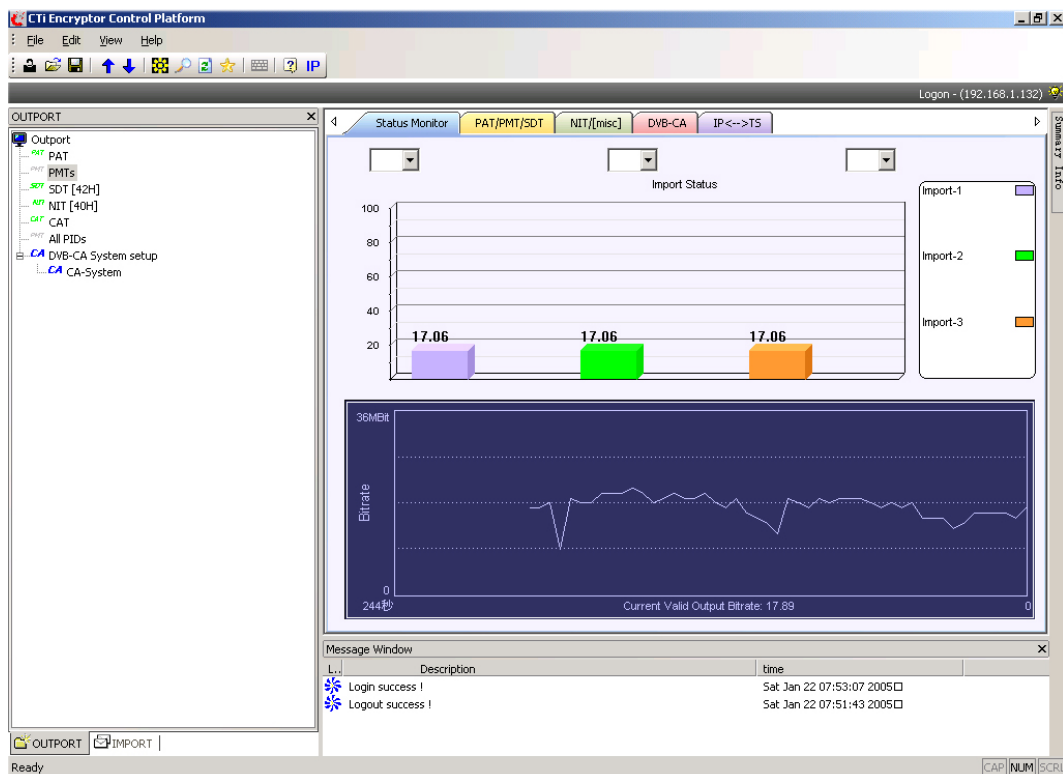


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the interface is divided into four parts:

- (1) The top part is the toolbar. It includes the shortcut to the command “change password”, “save/load file”, “connect scrambler” etc.
- (2) The left part is the output port and the tree-view of the DVB-SI information of 8 input ports. It can be used to configure the resending and canceling of the program.
- (3) The right-upper part of the interface is the main working area. It includes the status view of scrambler’s input and output, the setup interface of the input port and output port, the setup interface of the CA configuration and output program and the setup of the IP-network input data.
- (4) The right-lower part of the interface is the event information window. It is a read-only window and used to display the information in the communication.


3.2Toolbar

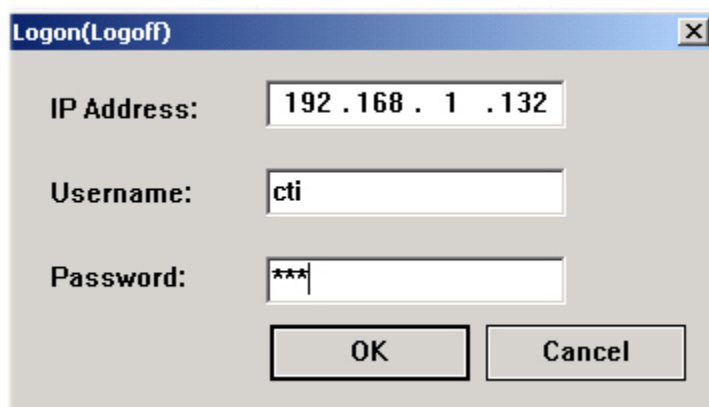
The toolbar is located on top of the program.




- (1) “” is used to change the password
- (2) “” is used to save the setup information
- (3) “” is used to adjust the program order in the PAT table
- (4) “” is used to disconnect with the multiplexer
- (5) “” is used to read DVB-SI info of all input and output
- (6) “” is used to reset the output port’s configuration
- (6) “” is used to send the configured DVB-SI to output
- (7) “” is used to lock the keyboard
- (8) “**IP**” is used to change the scrambler’s IP address

3.3 Log in

After application started, the first thing to do is to connect with the scrambler. Press  it will show the following dialog:

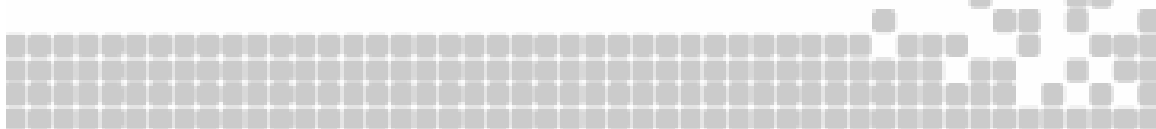


The dialog box titled "Logon(Logoff)" contains three input fields: "IP Address:" with the value "192 . 168 . 1 . 132", "Username:" with the value "cti", and "Password:" with three asterisks "***". At the bottom are "OK" and "Cancel" buttons.

Then type scrambler IP address and username and password.  Login CTI-Multiplexer success ! will be displayed if login successes.

3.4 Read input output DVB-SI information

Press  button to read **input output DVB-SI information after connecting to the scrambler. (Notice: there will be 15-25 seconds delay). The information will be**



displayed in the tree-view.

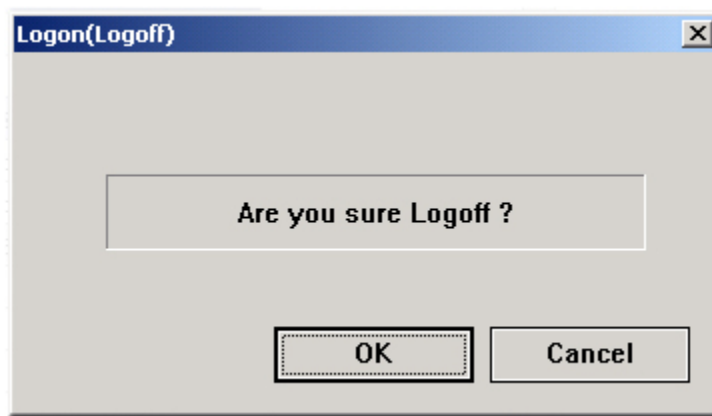
Note: the user can choose the “reset” button after chosen this one to set the output to the default. That is: the output port will resend all the program and PID except PAT, PMT and CAT tables.

3.5 Output the user configured DVB-SI information

Press  to output the configured DVB-SI information to remote scrambler after input all the information.

3.6 Logout

Press  to logout

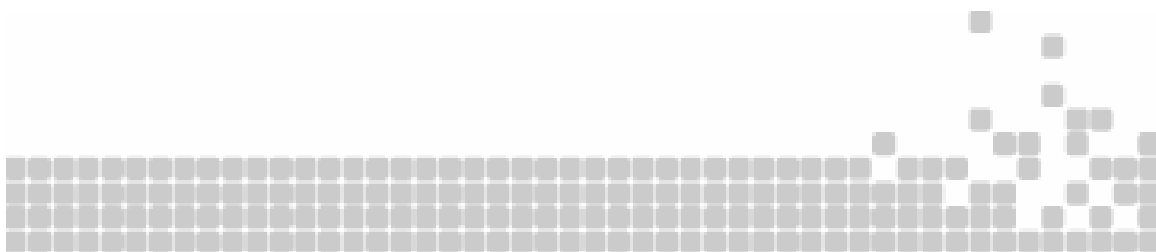


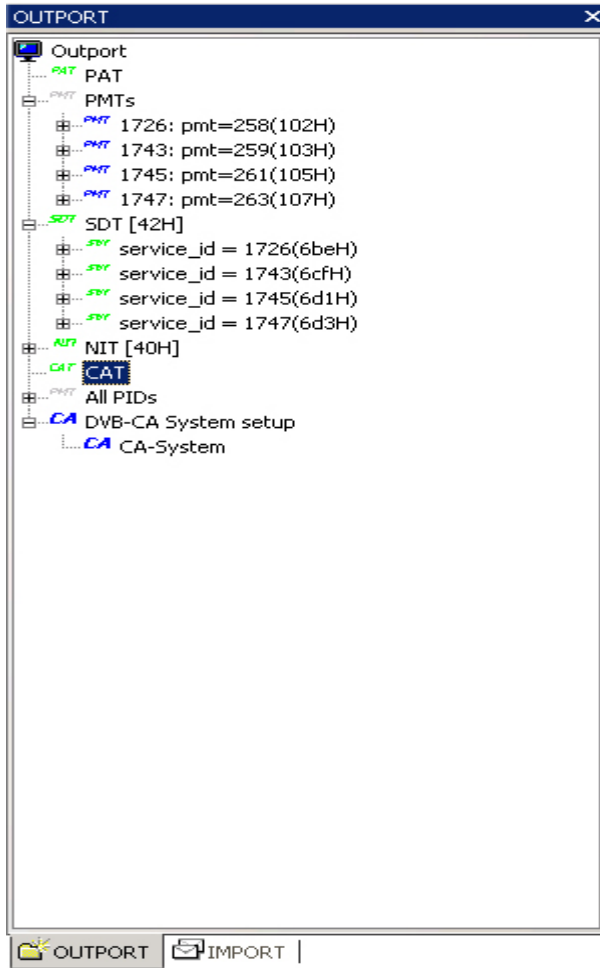
Press “OK” button to disconnect with scrambler.

The scrambler will continue working on the changed setup after the logout. The setup information will not be lost after turning off the machine. Next time the scrambler starts; it will be configured by the latest saved setup.

3.7input and output DVB-SI information window

input and output DVB-SI information window. It locates in the left window:

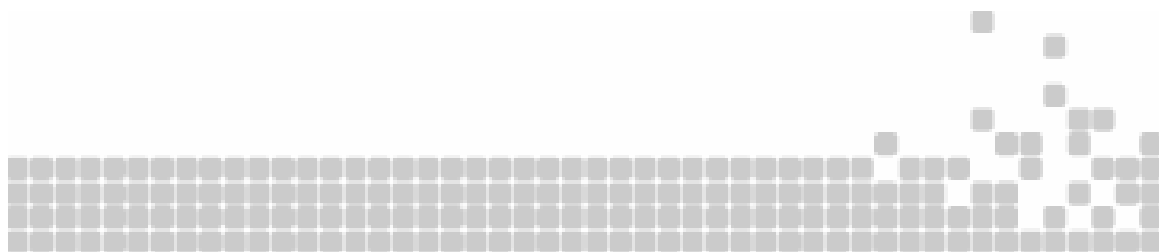


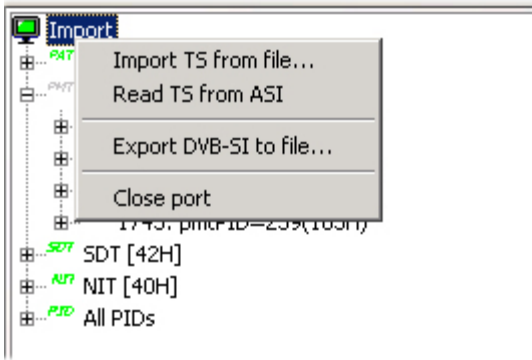


It consists of “input” and “output” windows to represent the DVB—SI information tree of the input and output ports respectively.

3.7.1input port DVB-SI information tree

After success remote login, the input port “green light” means current input port is locked and enabled. “grey light” means current input port is unable.





import port: right-click the mouse the menu will display

Import TS from file: Load TS stream from the file when there is no input signal currently. It can configure the multiplexer using the stored TS stream file.

Read TS from ASI: After the signal is locked, the system can update the PSI information from the input port any time.

Export dvb-SI to file: Save PSI information of the current port to local hard disk to be used by case 1

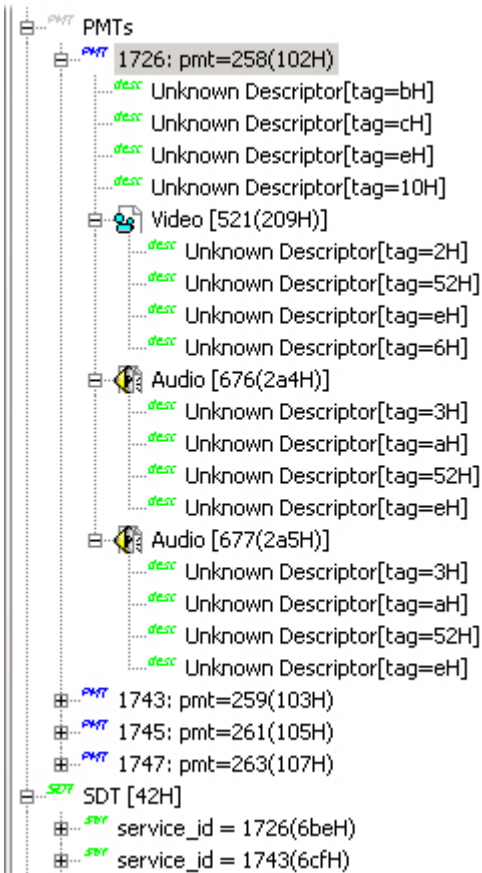
Close port: to close the port. The resend of the program information will continue after close, but the real PID will not be resent.

3.7.2PAT

display current ports information included in PAT

3.7.3 PMTs

displays all the PMT table of the current input table



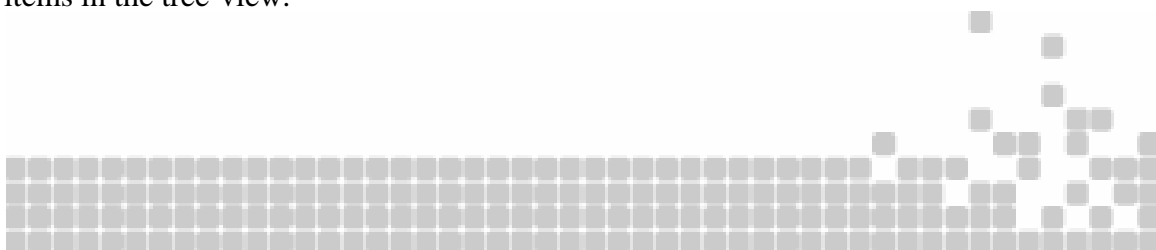
As shown above, “blue” means the program is resent; “green” means the program is not resent; “yellow” means the current program doesn’t exist; “black” means the current program is encrypted.

1100 represents program number, 257(101H) represents PMT_PID. User can switch the resent status by right-click of the mouse. The correspondent parameters will be shown on the right window when clicking the items in the tree-view.

3.7.4SDT table

to display the current SDT table information of the current input port.

The correspondent parameters will be shown on the right window when clicking the items in the tree-view.



3.7.5 NIT table

to display the current NIT table information of the current input port.

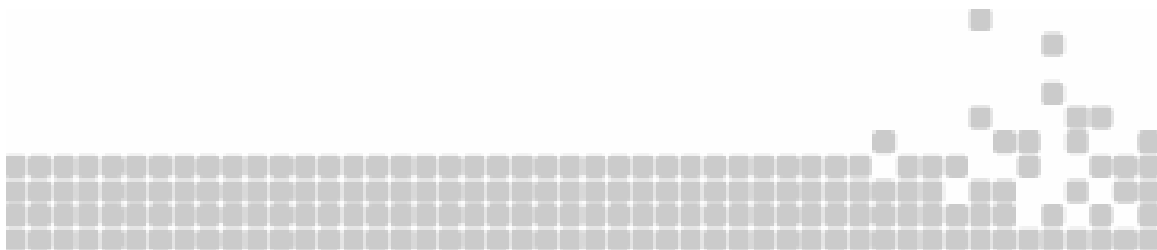
The correspondent parameters will be shown on the right window when clicking the items in the tree-view.

3.7.6 CAT table

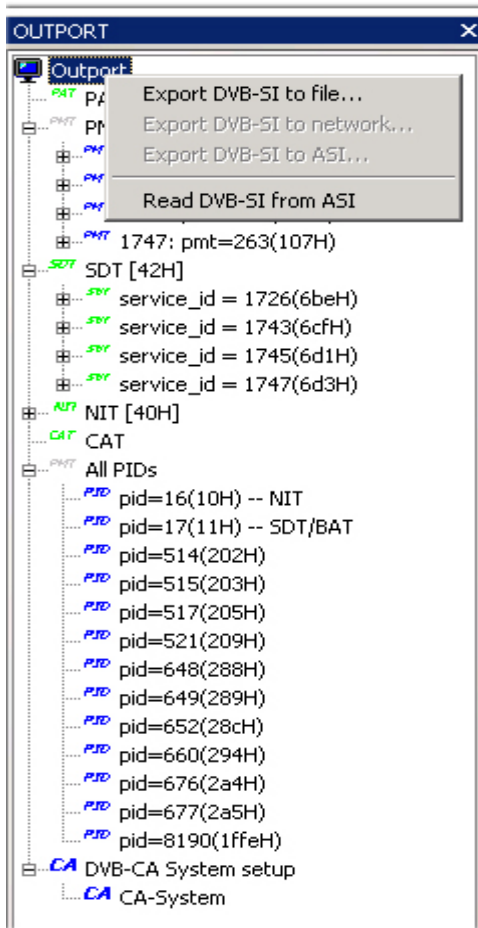
to display the current CAT table information of the current input port. Right-click the CA descriptor can select to resend the correspondent EMM stream

3.7.7 All PID

to display the current PID information of the current input port. Right-click the PID can select to resend the correspondent PID stream



3.8 Output DVB-SI information tree



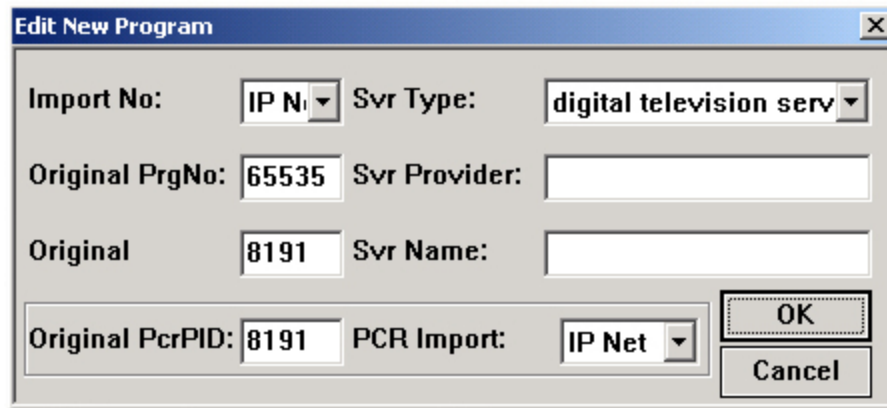
output port: right-click the mouse the menu will display

Export DVB-SI to file: Save TS stream to the file. It will be used as the input of the next-level multiplexer.

Read TS stream from ASI port:

PAT: display current ports information included in PAT

PMTs: displays all the PMT table of the current input table



Edit New Program

Import No: Svr Type:

Original PrgNo: Svr Provider:

Original Svr Name:

Original PcrPID: PCR Import:

OK Cancel

This function is mainly used when there is no current signal or read TS data from IP network.

input port: 1-8 or network choices

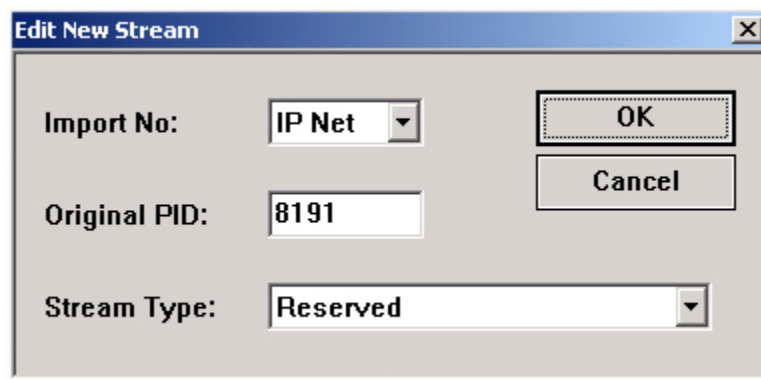
original program no. : program no. of original input

original **PMT_PID** : **PMT_PID** of original input

original **PCR_PID** : **PCR_PID** of original input

PCR_PID input port : port of **PCR_PID** input

Service type, provider , service name: SDT table required information.To add TS to the program using right-click of the mouse



Edit New Stream

Import No:

Original PID:

Stream Type:

OK Cancel

SDT talbe: to display SDT table information

using left-click to change the corresponding paramters

NIT table: to display NIT table information

using left-click to change the corresponding paramters

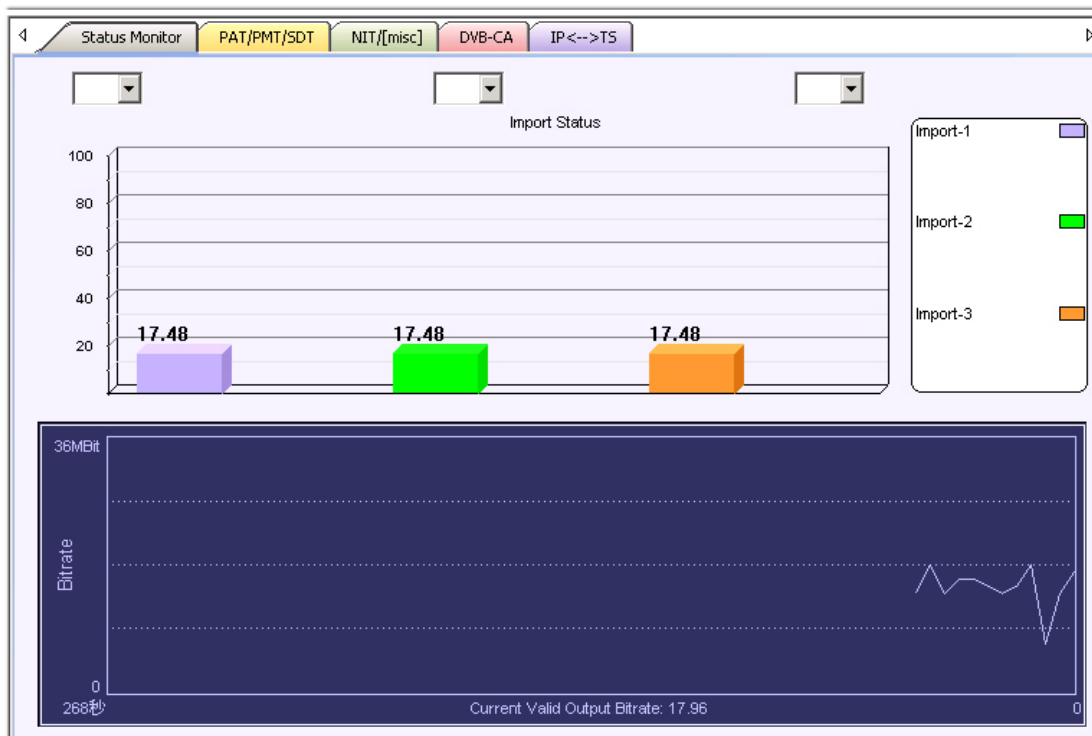
CAT table:to display CAT table information

other PIDs: to add(delete) single PID

DVB-CA system setup: by left clicking the mouse, the user can add DVB-CA system (up to 4). For the detailed setup, please see the DVB-CA setup window part.

3.9Scrambler status figure

Scrambler status figure is as follows:



After successful login, the monitor program will inquire the code rate of the input and output and display it in the figure every 4 seconds

3.9.1status figure of the input port

The horizontal axis represents there monitoring code stream of the input port. The vertical axis is the real-time input code rate.

After selecting the corresponding PID value via lists in the column figure, the user can monitor the real-time code rate, the total code rate and PID code rate of each input

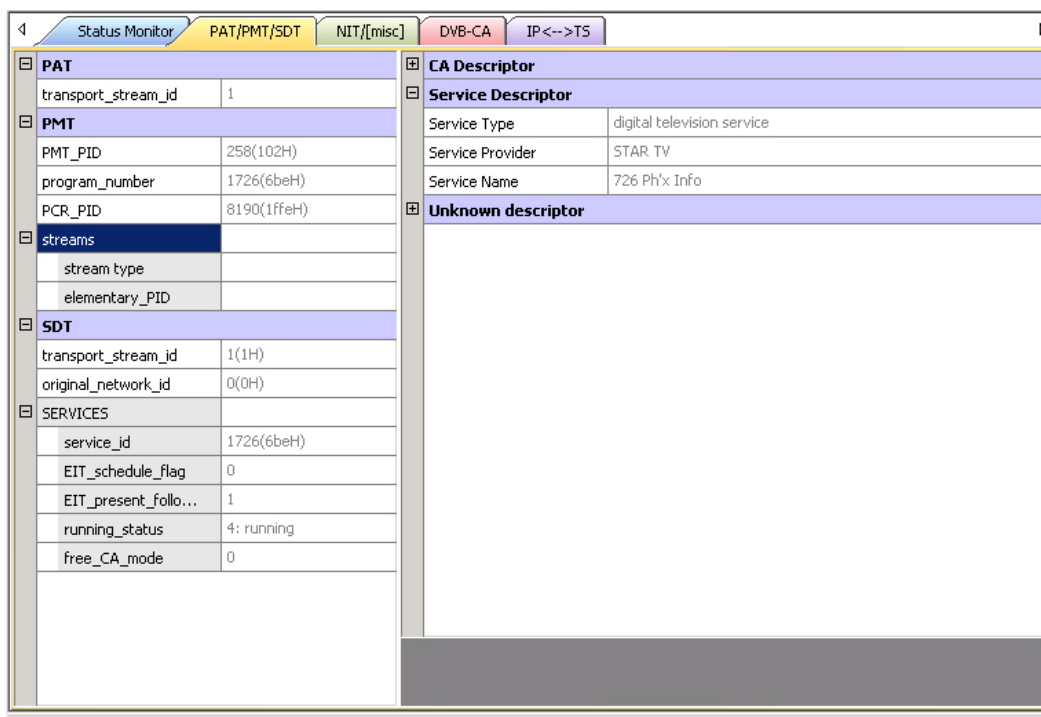
port.

3.9.2 status figure of the output port

The horizontal axis represents time(s). The vertical axis is the output code rate every 4 second in previous 200 seconds.

3.10 PAT/PMT/SDT setup window

PAT/PMT/SDT windows locates on the right window:



PAT	
transport_stream_id	1
PMT	
PMT_PID	258(102H)
program_number	1726(6beH)
PCR_PID	8190(1ffeH)
streams	
stream type	
elementary_PID	
SDT	
transport_stream_id	1(1H)
original_network_id	0(0H)
SERVICES	
service_id	1726(6beH)
EIT_schedule_flag	0
EIT_present_follo...	1
running_status	4: running
free_CA_mode	0

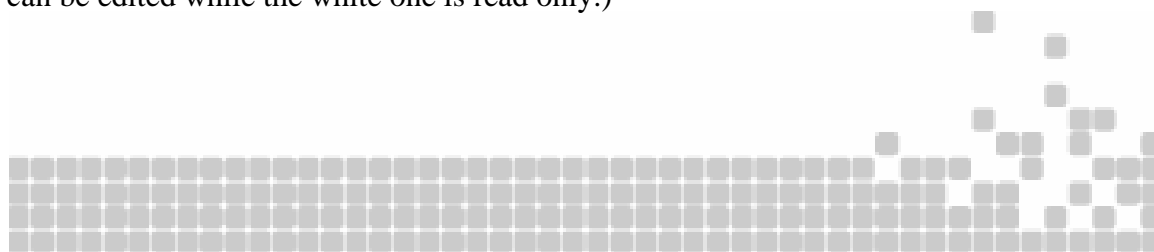
CA Descriptor	
Service Descriptor	
Service Type	digital television service
Service Provider	STAR TV
Service Name	726 Ph'x Info
Unknown descriptor	

You can setup the PAT/PMT/SDT corresponding information in PAT/PMT/SDT windows

(Note: There is the detailed information under the icon, the user can click it to see and edit that information.

program_map_PID	1: Pid = 256(100H)
-----------------	--------------------

 The yellow item means it can be edited while the white one is read only.)



3.10.1PAT table

PAT:to display PAT table information

transport_stream_id to display ID value of the input(output) TS

3.10.2PMT table

PMT: to display PMT table information

PMT_PID:display PMT_PID value of the selected program

program_number: selected program number

PCR_PID: PCR_PID of the selected program

streams:(type、 elementary_PID): the type of the stream and PID of the selected program

3.10.3SDT table

SDT: to display SDT table information

transport_stream_id: the ID of output(input) port transport_stream

original_network_id:the ID of original output(input) port transport_stream

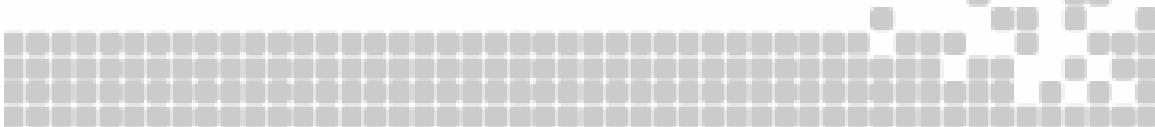
SERVICES: service ID of the selected program

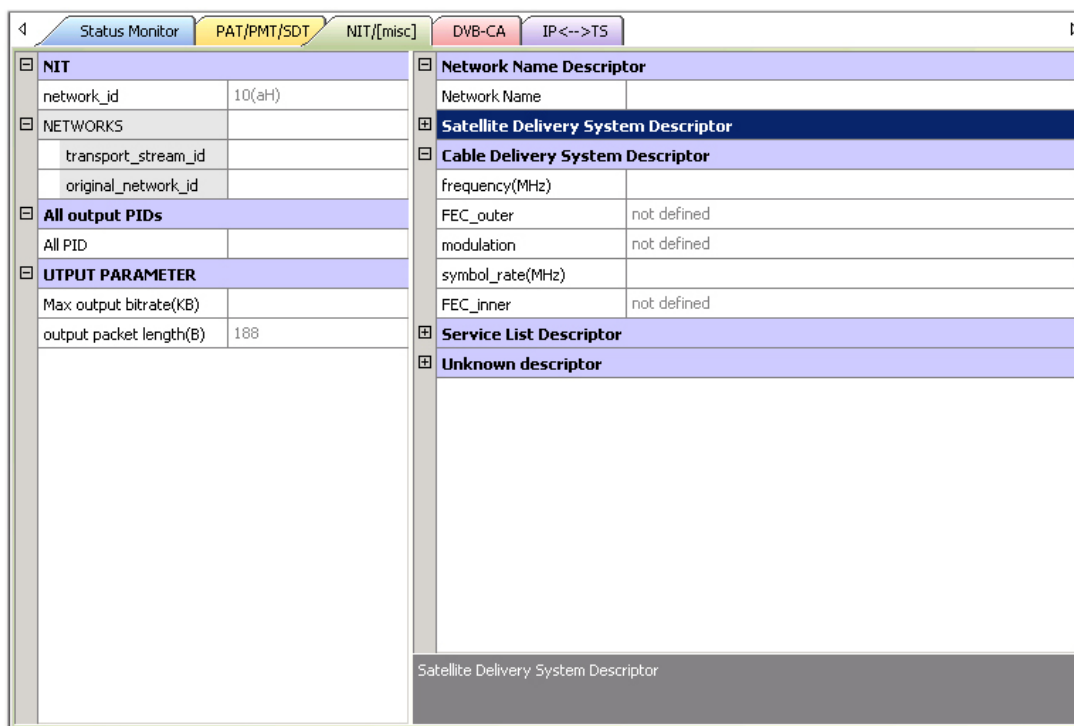
3.10.4DVB descriptors

The multiplexer currently supports the CA_Descriptor and Service_Descriptor of the PAT、 PMT、 SDT tables. All other descriptors belong to Unknown_Descriptor.

3.11NIT setup window

NIT setup window is located in the right part of the interface. The user can set the NIT table in this window. The window is as follows:





NIT	
network_id	10(aH)
NETWORKS	
transport_stream_id	
original_network_id	
All output PIDs	
All PID	
OUTPUT PARAMETER	
Max output bitrate(KB)	
output packet length(B)	188

Network Name Descriptor	
Network Name	
Satellite Delivery System Descriptor	
Cable Delivery System Descriptor	
frequency(MHz)	
FEC_outer	not defined
modulation	not defined
symbol_rate(MHz)	
FEC_inner	not defined
Service List Descriptor	
Unknown descriptor	

3.11.1NIT table

NIT displays the NIT table information of the current input(output) ports

- (1) network_id: the network id of the current input(output) port
- (2) transport_stream_id: the transport_stream id of the current input(output) port
- (3) original_network_id: the original_network id of the current input(output) port

3.11.2output other PIDs

When editing other PID in the right output port, this item is used to input the changed PID value.

3.11.3 Output parameter

(1) setup the output code rate: up to 155MB with unscrambled program and up to 40MB with scrambled program

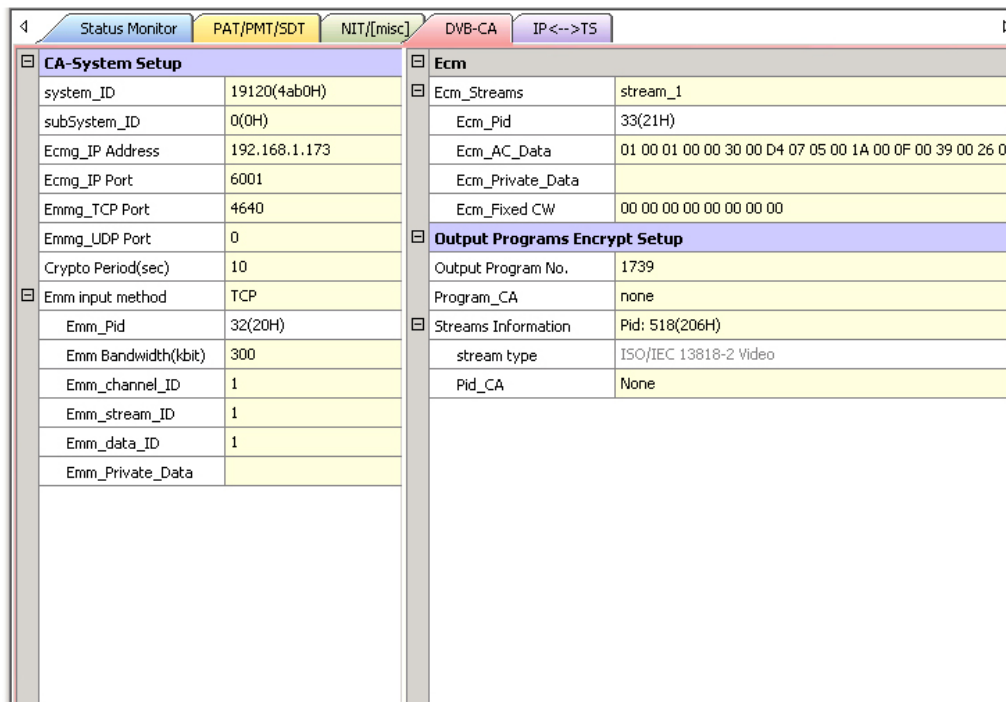
(2) setup the output package length: 188 or 204

3.11.4 Various DVB descriptors

The scrambler currently supports Network_Name_Descriptor、Satellite_Delivery_System_Descriptor、Cable_Delivery_System_Descriptor、of NIT table and all other descriptors belonging to Unknown_Descriptor.

3.12 DVB-CA system configuration

DVB-CA system configuration setup window is located in the right of the program interface. It is as follows:



CA-System Setup	
system_ID	19120(4ab0H)
subSystem_ID	0(0H)
Ecmg_IP Address	192.168.1.173
Ecmg_IP Port	6001
Emmg_TCP Port	4640
Emmg_UDP Port	0
Crypto Period(sec)	10
Emm input method	TCP
Emm_Pid	32(20H)
Emm Bandwidth(kbit)	300
Emm_channel_ID	1
Emm_stream_ID	1
Emm_data_ID	1
Emm_Private_Data	

Ecm	
Ecm_Streams	stream_1
Ecm_Pid	33(21H)
Ecm_AC_Data	01 00 01 00 00 30 00 D4 07 05 00 1A 00 0F 00 39 00 26 0C
Ecm_Private_Data	
Ecm_Fixed CW	00 00 00 00 00 00 00 00
Output Programs Encrypt Setup	
Output Program No.	1739
Program_CA	none
Streams Information	
Pid: 518(206H)	
stream type	ISO/IEC 13818-2 Video
Pid_CA	None

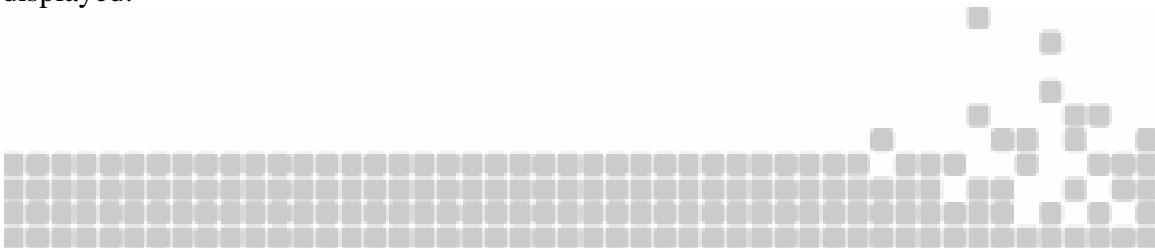
if the user want to scramble the program after setting up the resending program information of the output port, he/she can add a CA system in the output part of the DVB_CA system, which is located in the right part of the program interface. To click any

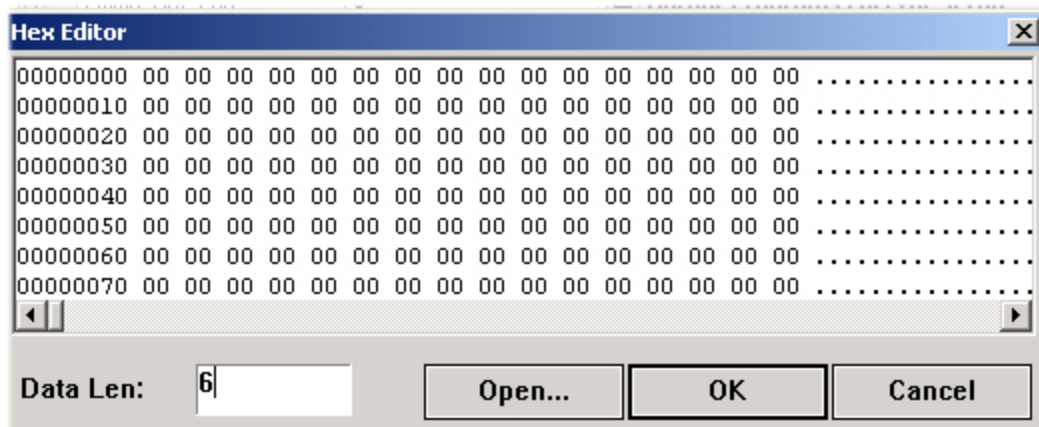
CA-system, the program will enter the DVB-CA system setup window automatically.

3.12.1 CA-System setup

CASystem setup mainly provides the necessary parameter setup for the connection of the CAS with the scrambler.

- (1) system_ID: The current CA system's system_ID
- (2) subsystem_ID: The current CA system's subsystem_ID
- (3) EcmgIP Address: the current CA System's EcmgIP Address
- (4) EcmgIP Port: The current CA system's EcmgIP Port (notice: 8888 is assigned to the scrambler)
- (5) Emmg_TCP Port: The current CA system's Emmg_TCP Port (notice: 8888 is assigned to the scrambler)
- (6) Emmg_UCP Port: The current CA system's Emmg_UCP Port (notice: 8888 is assigned to the scrambler)
- (7) The scrambling period of the current CAS
- (8) EMM insert method: the current CAS EMM insert method: TCP or TCP+UDP
- (9) Emm_Pid: current CAS EMM's pid value, it is the minimum Pid value assigned by the scrambler automatically
- (10) EMM transport bandwidth(kbit): the current CAS' maximum EMM transport bandwidth
- (11) Emm_channel_ID: current CAS EMM stream's Channel ID。
- (12) Emm_stream_ID: current CAS EMM stream's Stream ID
- (13) Emm_data_ID: current CAS EMM stram's Data ID。
- (14) Emm_Private_Data: current CAS EMM stream's private data. (Notice: EMM bandwidth must be assigned first). To click the choice, the following figure will be displayed:

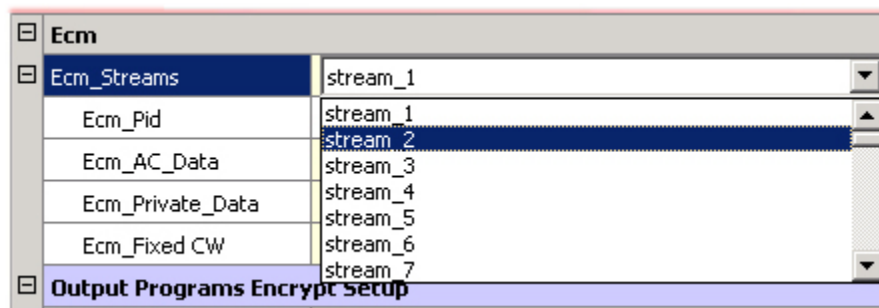




User can input the hex number directly or read it from file. (Notice: the data length must be assigned first, and the data length is up to 128)

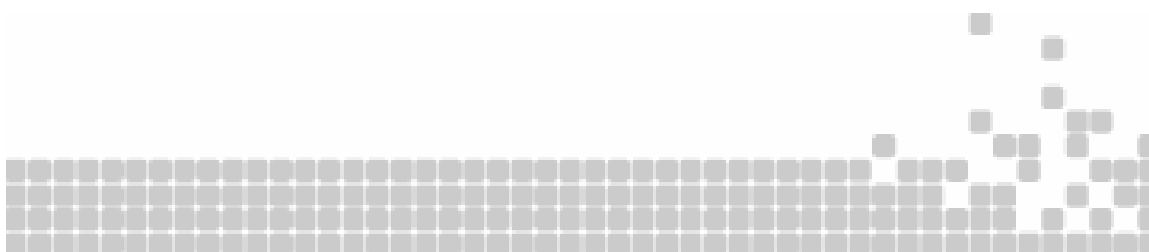
3.12.2Ecm

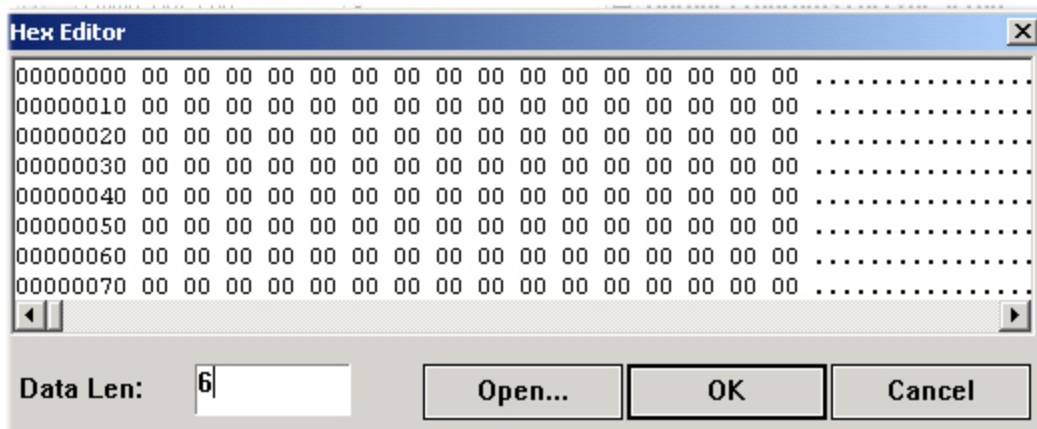
(1) Ecm_Streams: currently the scrambler support 50 ECM stream for each CAS. This item is used to configure the current CAS scrambled ECM stream. It is as follows:



(2) Ecm_Pid: current CAS ECM stream's Pid value, it is the minimum Pid value assigned by the scrambler automatically

(3) Ecm_AC_Data: Used to assign current CAS ECM stream's AC data as follows:





User can input the hex number directly or read it from file. (Notice: the data length must be assigned first, and the data length is up to 128)

(4) **Ecm_Private_Data**: used to assign current CAS ECM stream's private data. The setup method is the same as above.

(5) Using fixed CW: the current CAS uses the fixed CW to scramble the data. The CW is assigned in the **Ecm_Stream**

3.12.3 Output program encryption setup

(1) **Output program number**: the user can select the program that needs to be scrambled from the down-list box.

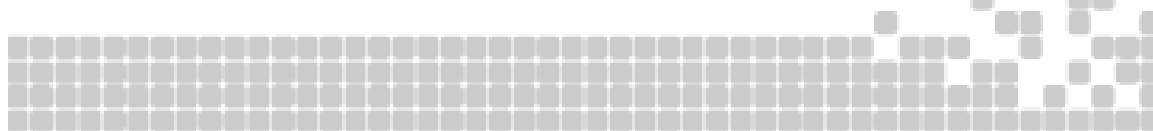
(2) **Program_CA**: if the current program that needs to be scrambled is assigned to the scrambling by program mode, the user can select an ECM stream from the down-list box to scramble the current program

(3) **Program stream details**

Program stream details: to display the detailed information of the all the Elementary Streams of the current program that needs to be scrambled. The user can select the current Elementary Streams from the down-list box.

(3-2) **stream_type**: to display the stream_type of the current Elementary Streams

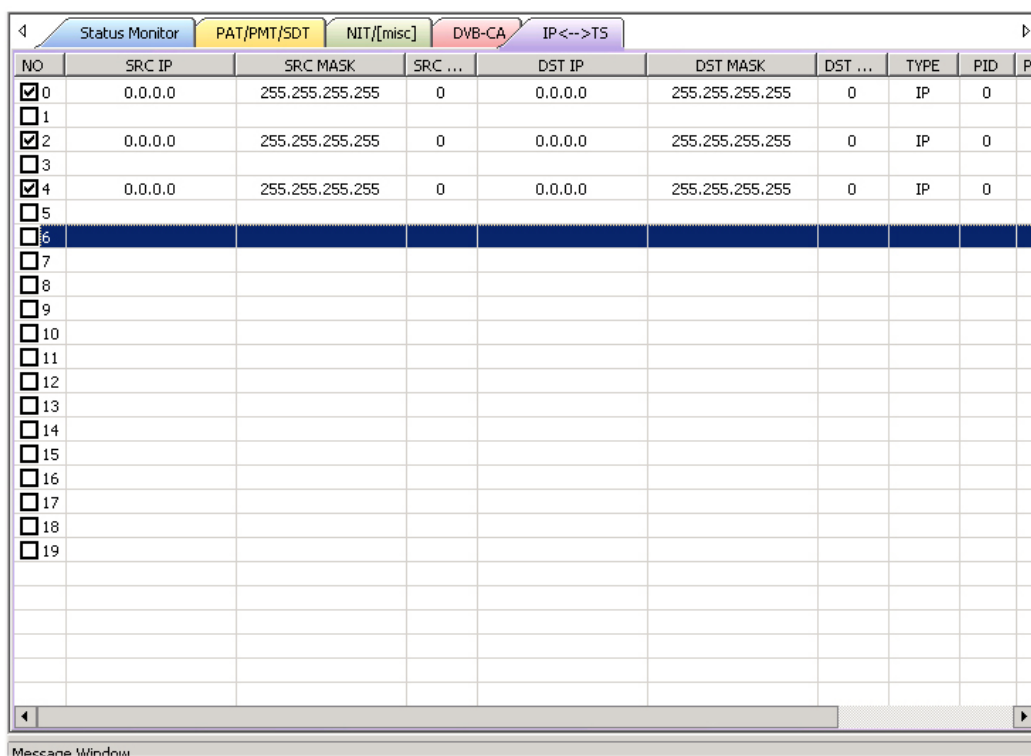
(3-3) **Pid_CA**: if the current program that needs to be scrambled is assigned to the scrambling by Pid mode, the user can select an ECM stream from the down-list box to scramble the current program



3.13 IP-TS setup window

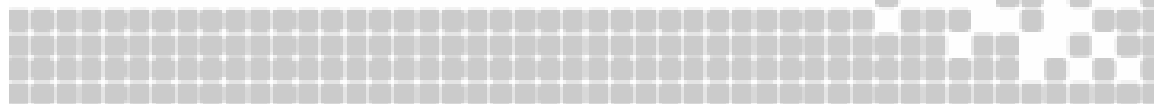
IP-TS is a special feature of our scrambler. It can insert the data into the scrambler via IP network.

There are two types of inserted data: one is to enclose 1-7 TS packet into a UDP packet and then insert the UDP packet into the scrambler via IP network. Another is IP over DVB. It currently supports up to 20 channels.

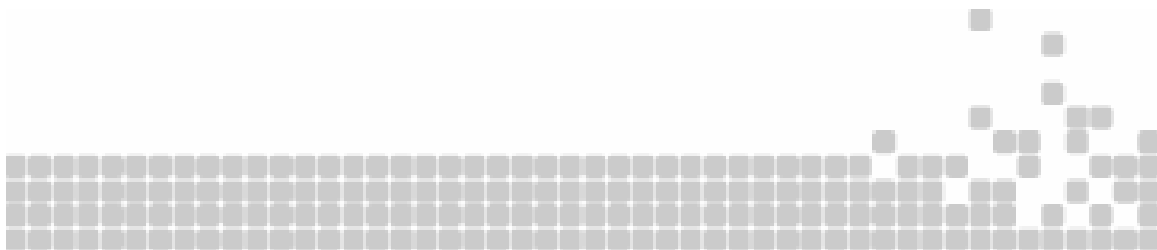


NO	SRC IP	SRC MASK	SRC ...	DST IP	DST MASK	DST ...	TYPE	PID	Pr
<input checked="" type="checkbox"/> 0	0.0.0.0	255.255.255.255	0	0.0.0.0	255.255.255.255	0	IP	0	
<input type="checkbox"/> 1									
<input checked="" type="checkbox"/> 2	0.0.0.0	255.255.255.255	0	0.0.0.0	255.255.255.255	0	IP	0	
<input type="checkbox"/> 3									
<input checked="" type="checkbox"/> 4	0.0.0.0	255.255.255.255	0	0.0.0.0	255.255.255.255	0	IP	0	
<input type="checkbox"/> 5									
<input type="checkbox"/> 6									
<input type="checkbox"/> 7									
<input type="checkbox"/> 8									
<input type="checkbox"/> 9									
<input type="checkbox"/> 10									
<input type="checkbox"/> 11									
<input type="checkbox"/> 12									
<input type="checkbox"/> 13									
<input type="checkbox"/> 14									
<input type="checkbox"/> 15									
<input type="checkbox"/> 16									
<input type="checkbox"/> 17									
<input type="checkbox"/> 18									
<input type="checkbox"/> 19									

- (1) Channel: to check this item means the channel data is valid
- (2) Source address: the IP address of the computer that sends out the IP data. If all the data is 0, it means that it doesn't filter the source address.
- (3) Source mask code: the IP mask code of the source address
- (4) Source port: the port of the computer that sends out IP data. If all the data is 0, it means that it doesn't filter the source address.
- (5) Destination address: the destination address that receives the IP data



- (6) Destination mask code: the IP mask code of the destination address
- (7) Destination port: the port number of the computer that receives the IP data. If all the data is 0, it means that it doesn't filter the destination address.
- (8) Type: IP data sending mode: IP, TCP or UDP
- (9) PID: the PID value when the IP data is enclosed into TS packet. Notice: this program doesn't check the PID conflict. The user must ensure the PID validity by himself
- (10) Format: Raw means the input is TS-over-IP (Notice: to enclose 1-7 TS packet into a UDP packet). Multi-protocol means the input IP data must be encapsulated by multi-protocol.
- (11) Count: the number of the IP packet that the scrambler sent out correctly
- (12) The number of the lost packets: the number of the lost packets that the scrambler cannot send out; the scrambler is overflowed in this situation. The user should increase the output code rate.



Chapter 4 Specifications

4.1 Technical parameters

1) clock precision

PCR precision < 100 ns

2) input

port: standard ASI port, BNC

Impedance 75Ω

code rate: up to 150 Mbps every channel

max PID number: 72

packet length: 188 or 204 bytes

3) output

port: 2 DVB-standard ASI multiplexed output ports, BNC

code rate: up to 40 Mbps every channel (with CA)

Impedance 75Ω

packet length: 188 or 204 bytes

4) weight and size

size : 1U

weight : 4kg

Volume (W*H*D):45cm*4.5cm*45cm

5) power

Double power supply:220VAC±10%, 50Hz, 15W

6) Environment requirement

temp. : 5-35 degree

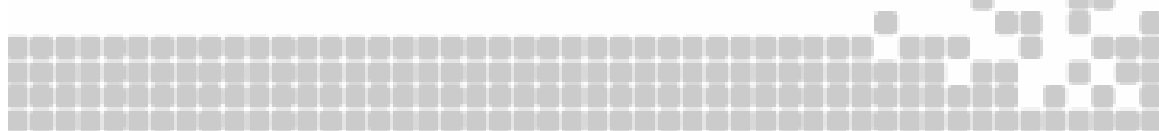
Moisture : 20%~80%

Power supply: 220V(10%) 47-63 HZ

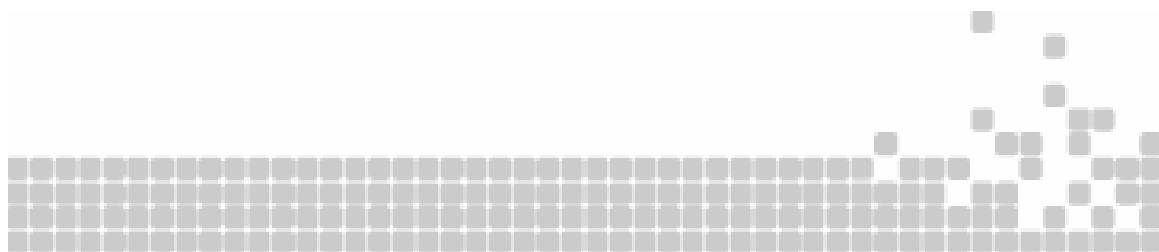
Power consumption 25W

4.2 References

1. ITU-T Rec. H.222.0 / ISO/IEC 13818-1 (1996-04), Information Technology ---
Generic Coding of Moving Pictures and Associated Audio Information: Systems

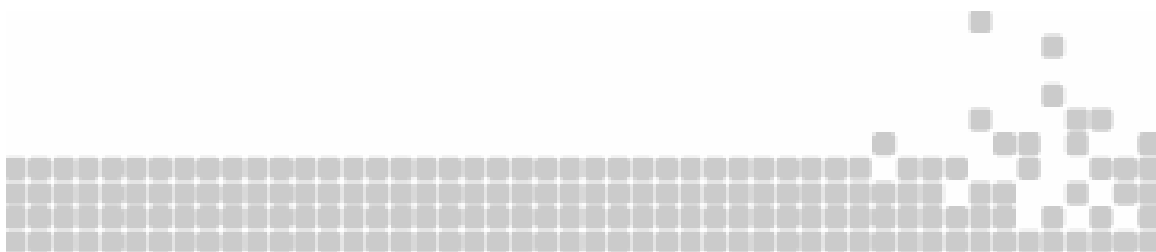


2. ETSI EN300 468(1998), Specification for Service Information (SI) in DVB systems
3. SMPTE 312M --- SMPTE STANDARD for Television --- Splice Points for MPEG-2 Transport Streams



Chapter5 Definition and abbreviations

SPTS:	Single Program Transport Stream
MPTS:	Multiple Programs Transport Stream
PSI:	Program Specific Information
SI:	Service Information
PAT:	Program Association Table
PMT:	Program Map Table
CAT:	Condition Access Table
SDT:	Service Description Table
NIT:	Net work Information Table
BAT:	Bouquet Association Table
EIT:	Event Information Table
TDT:	Time and Date Table
PCR:	Program Clock Reference
PID:	Packet Identifier



Chapter6 Maintenance and services

6.1before-sales services

1. To provide the customized system integration plan for the customer after the full understanding of customer's requirement.
2. To answer customer's questions in detail
3. To introduce our products to our customers and provide documents to our customers for references
4. To configure the hardware according to the customer's requirement

6.2after-sales services

1. To provide one year free service and 24-hour maintenance response normally
2. To provide the system training to the system maintenance personals until the trainees can maintain the system in good performance.
3. 12 months free service after sales if there is the normal malfuction
4. Paid services after 12 month

