USER MANUAL

SHDTU03

NTU/E1

CTC union CTC Union Technologies Co.,Ltd.

ISO 9001

SHDTU03-NTU/E1 SHDSL Modem

Installation and Operation Manual

Version 1.1

Revision Marks

Revision	Date	Notes
V 1.0	**N/A**	**Software: Version: 1.5X7001r-XAT0**
V 1.1	**2003.10**	**Auto-configuration added** **Software: Version 1.19 FW: 2.2**

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I. Features

The SHDSL NTU offers two different ways to connect customers to high-speed TDM services with two G.703 E1 interfaces (balance 120 Ohm RJ45 jack or unbalance 75 Ohm dual BNCs). The G.703 interface will carry data at N*64kbps rates (where n=1~32).

The SHDSL NTU can be configured and managed via EOC, or menu-driven VT100 compatible Asynchronous Terminal Interface, either locally or remotely.

The SHDSL NTU is equipped with an auto rate capability that identifies the maximum line rate supported by the copper loop. This powerful automatic configuration capability makes installation and service provisioning simple and painless. Further flexibility is provided in the ability to manually set the maximum NTU speed at different levels for different customer-tailored service offerings.

- Standard G.shdsl (ITU G.991.2) supports improved reach/speed and greater interoperability
- Fast and cost-effective provisioning of traditional frame relay (FR or T-HDLC) or TDM leased line services
- Uses existing copper loop infrastructures
- Can operate in back to back connection
- Efficient single wire pair usage
- Up to 2.312Mbps symmetric service bit rate
- Auto rate installation maximizes data rate based on loop conditions
- Local management interface with LCD display
- Remote line loopback
- SHDSL Line performance monitoring
- Raw and per time interval statistics
- Bandwidth guaranteed transmission equipment

II. Specification

Network Interface
- Line Rate: SHDSL per ITU G.991.2
- Coding: trellis coded pulse amplitude modulation
- Support: ANSI (Annex A) and ETSI (Annex B)
- Payload rates: 64kbps to 2.304Mbps (N x 64kbps N=1 to 36)
- Connection: RJ-45 jack (2-wire)

G.703 Interface
- Connection: RJ-45 for balanced 120 Ohm E1 cable
- Connection: BNC for unbalanced 75 Ohm E1 cable

Framing
- G.703/G.704
- CRC 4 enable/disable
- CCS/CAS
- Framed / Unframed

DSL Timing
- Network / Internal / DTE

Performance Monitoring
- ES, SES, UAS, Alarms, Errors for E1, SHDSL

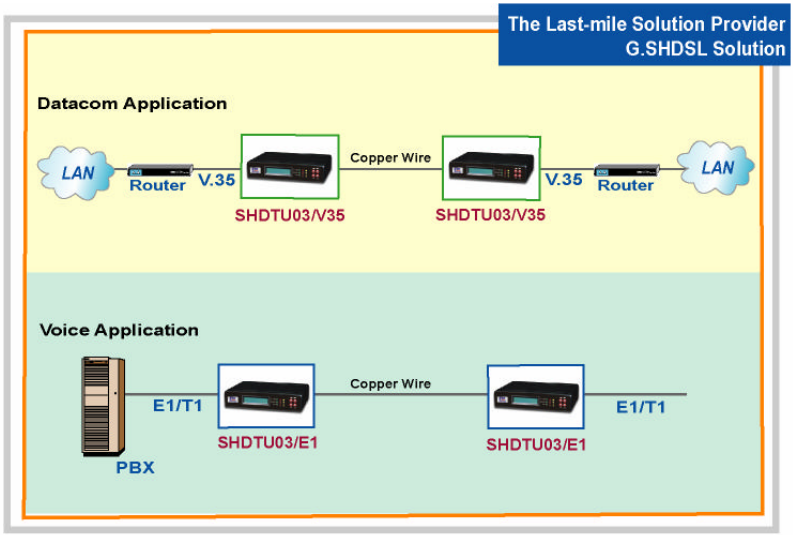
Loopback Tests
- Local / Digital / Remote Loopback

Management
- Configuration with keypad and LCD display
- Console port
- Supports firmware upgrade

Physical/Electrical
- Dimensions: 19.5 x 4.8 x 16.8 cm
- Input: 90~240VAC with 50~60Hz
- Power Consumption: 10W Max
- Operation: 0 to 50°C ; Humidity: Up to 95% (non-condensing)


Warning! High voltage. Do not open

III. Application



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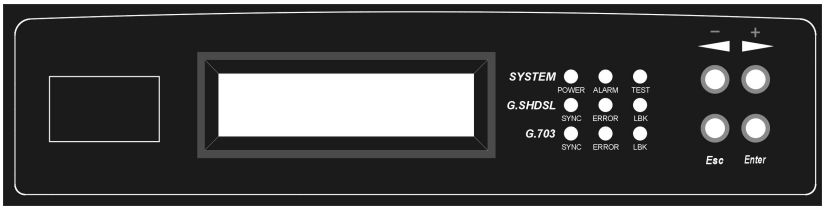
Chapter 2. Hardware Installation

This chapter shows the front panel and how to install the hardware.

I. Front Panel

The front panel contains LED status



The LCD can show the status and configuration of the product. The local management interface will be done by push button keys and LCD display. For more detail, refer to Chapter 4: Configuration.

The purpose of key pad is to configure the SHDSL NTU. Review Chapeter 4 for detail configuration.

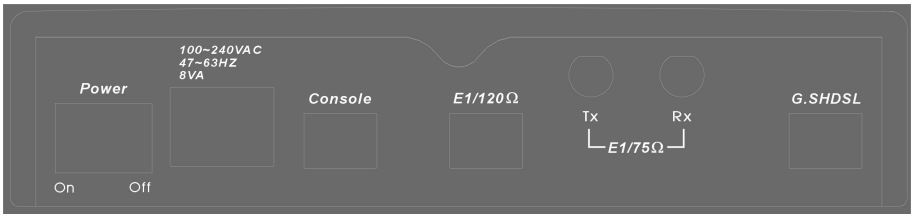
Key Pad		Description
Exit/-	●	Return to previous configuration menu.
Enter/+	■	Skip to next configuration menu or configure the items.
L	◄	Select other parameter in the same level menu.
R	►	Select other parameter in the same level menu.

The following table describes the LEDs' function of the SHDTU03.

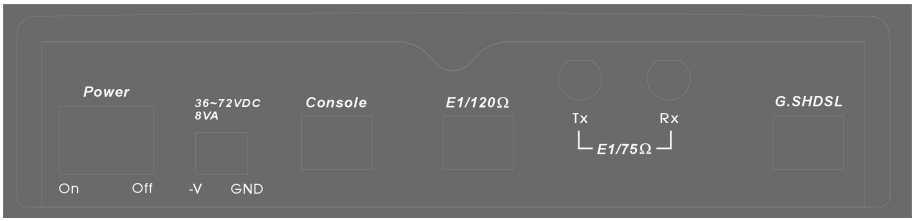
LED		Color	Action	Description
System	PWR	Green	On	Power is on.
			Off	Power is off.
	ALM	Red	On	Major alarm occurs.
			Off	System is working normally.
	TST	Yellow	On	System is testing for connection.
			Off	System is working normally.
SHDSL	SYN	Green	On	SHDSL line is connected.
			Blink	Data transmit in SHDSL line.
			Off	SHDSL line has dropped.
	ERR	Red	Blink	There are error seconds.
			Off	There are not any error seconds.
	LBK	Yellow	On	Loopback is on.
			Off	Loopback is off.
G.703	SYN	Green	On	E1 line is connected.
			Off	E1 line has dropped sync.
	ERR	Red	Blink	There are error seconds.
			Off	There are not any error seconds.
	LBK	Yellow	On	Loopback is on.
			Off	Loopback is off.

II. Rear Panel

From left to right, the rear panel of SHDSL NTU includes the power switch, power socket, RJ-45 console, RJ-45 G.703, BNC jacks for transmitting and receiving and the RJ-45 for SHDSL.



Rear Panel with the AC Type



Rear Panel with the DC Type

Connector Description

Power	Power switch. Press 1 to turn on and press 0 for off.
100~240V AC	Power socket. It has power adapting function from 90~240VAC.
36~72VDC	Power socket . It has power adapting function from 36~72VDC.
Console	RJ-45 for system configuration and maintenance.
E1/120O	RJ-45 for 120 Ohm E1 connection with PABX (Private Automatic Branch Exchange) or Router
TX	BNC for 75 Ohm E1 transmitting
RX	BNC for 75 Ohm E1 receiving
G.SHDSL	RJ-45 for G.SHDSL connection

III. Hardware Installation

Note: To avoid possible damage to the SHDTU03, do not turn on the product before hardware installation.

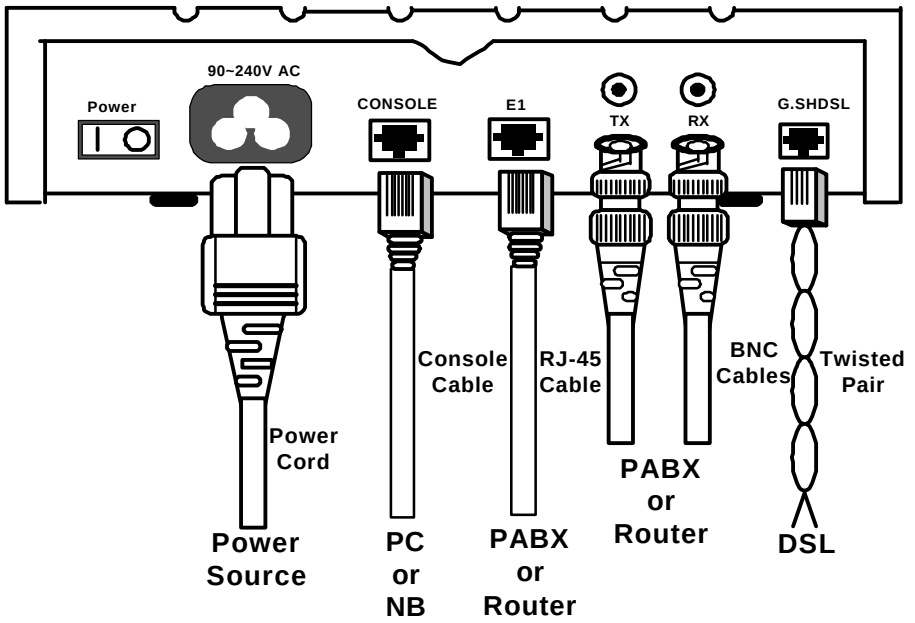
1. Plug the power cord in the power socket.

2. Plug the console port in console if you want to configure the NTU with VT100 program of NB or PC.

3. Plug in the E1 cable (Either 75 Ohm BNC cables or 120 Ohm twisted pair cable)

4. Plug in the SHDSL cable

5. Power on



Warning! High voltage. Do not open

Chapter 3. What is Auto Configuration

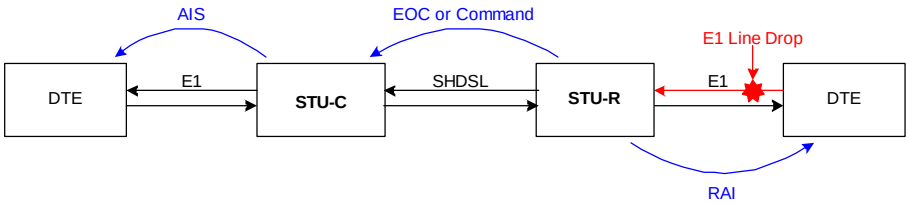
Some of the embedded functions do not have a separate command to setup but some of them are auto sense with some configurations and change itself configuration. Some of them are always enable function.

I. Wetting Current

Wetting current, also known as loop sealing current, is a low-level DC current applied to a loop for the specific purpose of maintaining cable splice integrity by preventing the build-up of oxidation. The “enable” applies a relative –42 ± 2 V DC voltage to the cables and allows 2~3 mA of current to flow at all times. As with all STU-C type devices, they have the ability to source wetting current. The SHDTU03 will automatically enable wetting current as STU-C type. As STU-R type, it always terminates the wetting current.

II. AIS (Alarm Indication Signal)

Alarm Indication Signal (RAI) is an always enabled signal transmitted automatically to the connected device when the remote E1 line drops or the SHDSL line drops. For example: When STU-R E1 RX line is dropped, STU-R will send the status to STU-C via EOC or command. STU-C will send AIS (Alarm Indication Signal) to DTE.



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I. Purpose

This chapter provides information about configuration your SHDSL NTU via the front panel LCD display and keypads.

Note: After you have completed all necessary settings for your SHDSL NTU, make sure to write the new configuration to NVRAM by “write” command and reboot the system for the of new configuration to take effect.

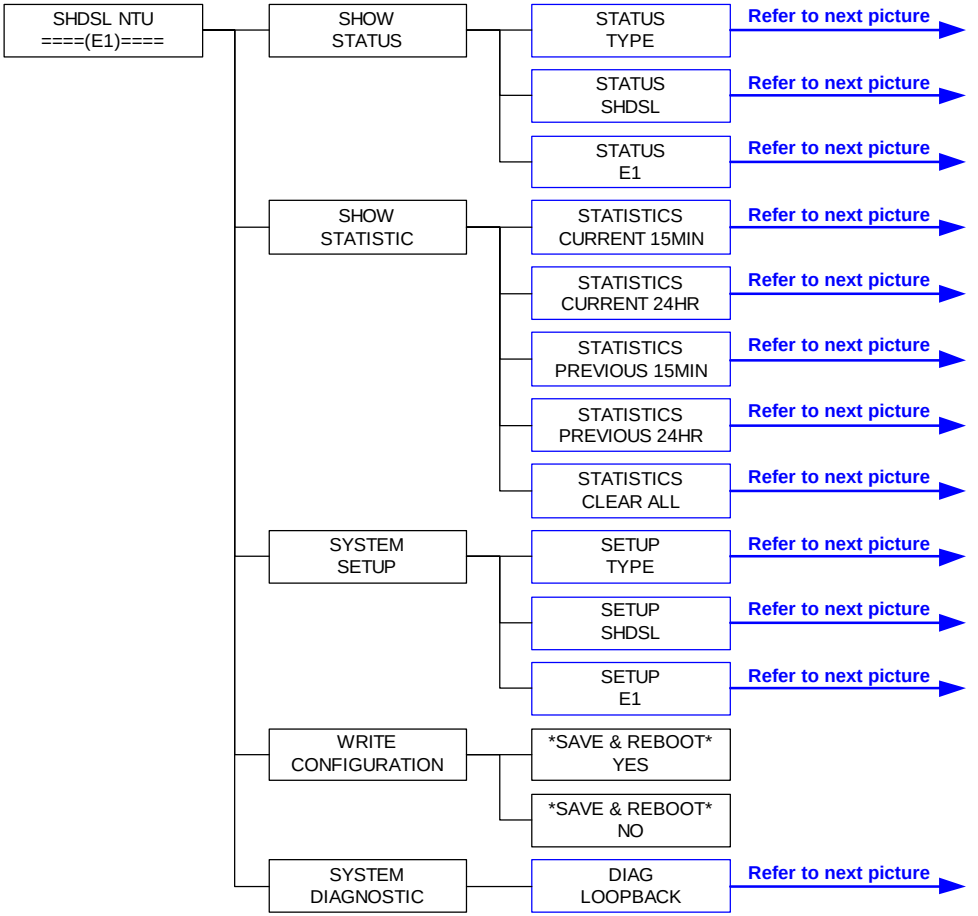
II. How to use key pads

The SHDTU03 is designed for user-friendly configuration with keypads and LCD display without using PC or NB with VT100 terminal.

Key Pad		Description
Exit/-		Return to previous configuration menu.
Enter/+		Skip to next configuration menu or configure the item.
L		Select other parameter in the same level menu.
R		Select other parameter in the same level menu.

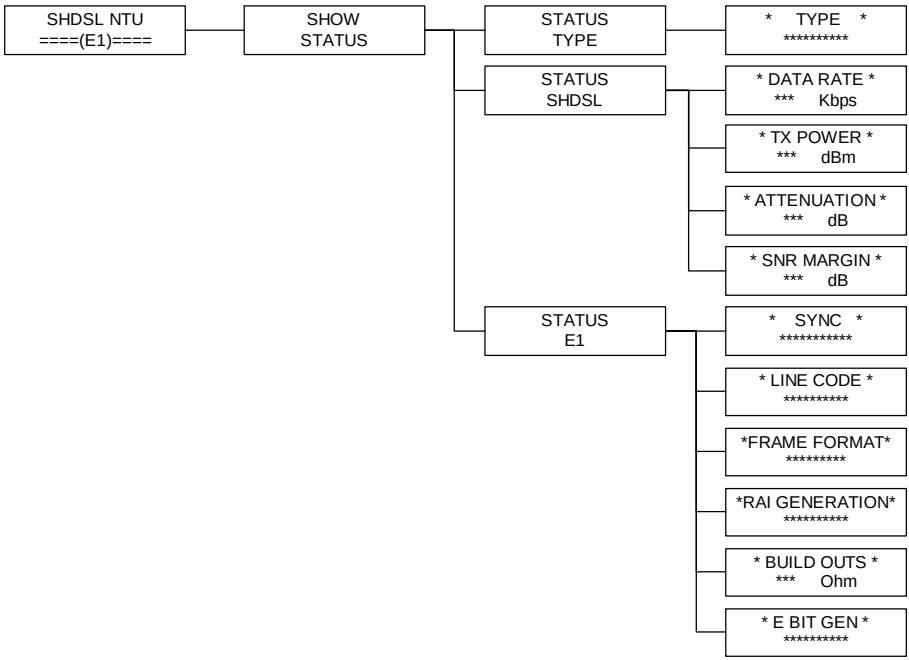
III. Menu Tree

After turning on the SHDTU03, the LCD will prompt **SHDSL NTU (E1).** Press ***Enter*** to enter. There are five main commands, show status, show statistics, system setup, write configuration and system diagnostic. For more detail, refer to each title.



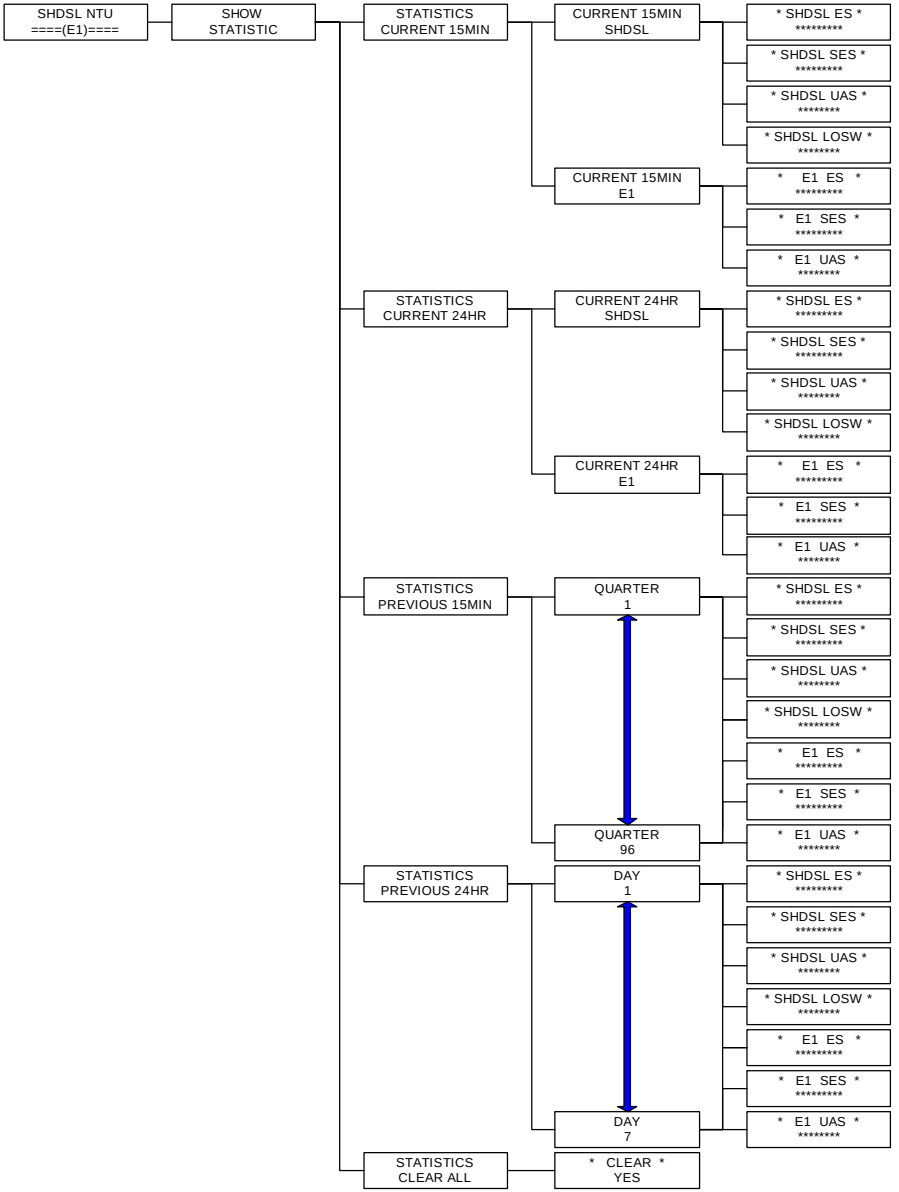
Menu tree for SHOW STATUS

You can check three kinds of status via LCD display: Type, SHDSL status and E1 status. The SHOW STATUS menu tree is as follows.



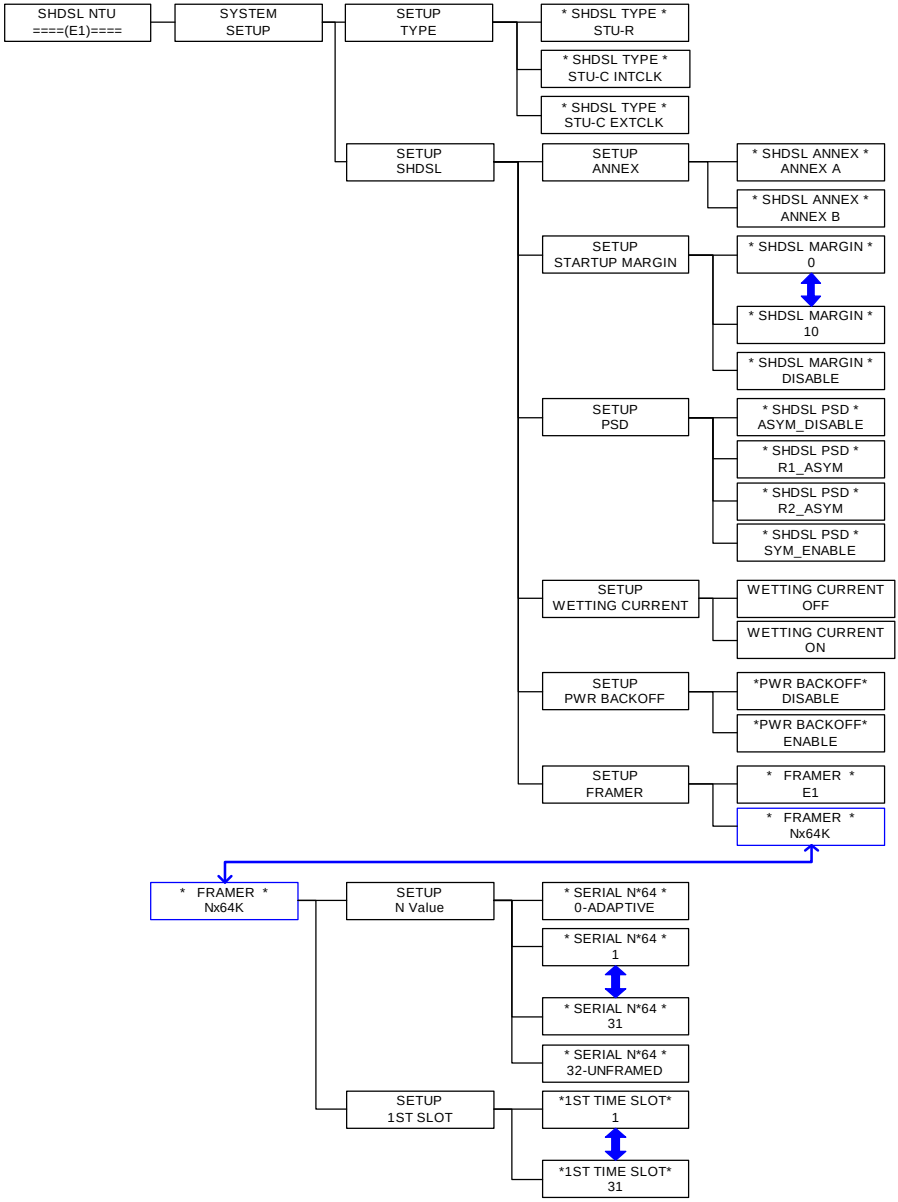
Menu tree for SHOW STATISTIC

The SHDTU03 can display for current 15 minutes and current 24 hours. The menu tree is as follows.



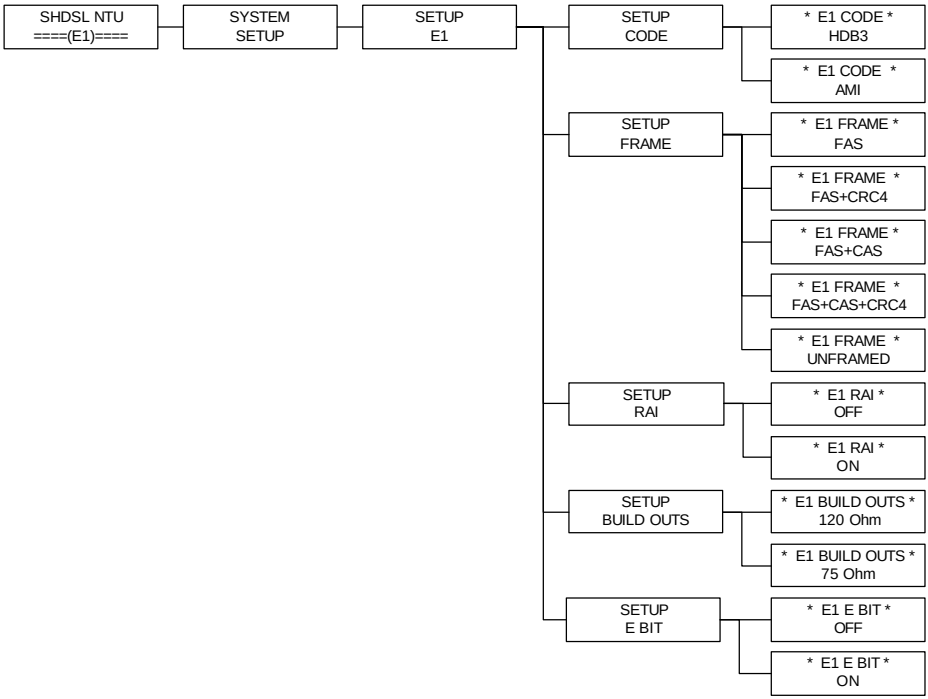
Menu tree for SETUP TYPE

The menu tree is as follows.



Menu tree for SETUP E1

The route of setup E1 is SHDSL NTU ✍ SYSTEM SETUP ✍ SETUP E1.



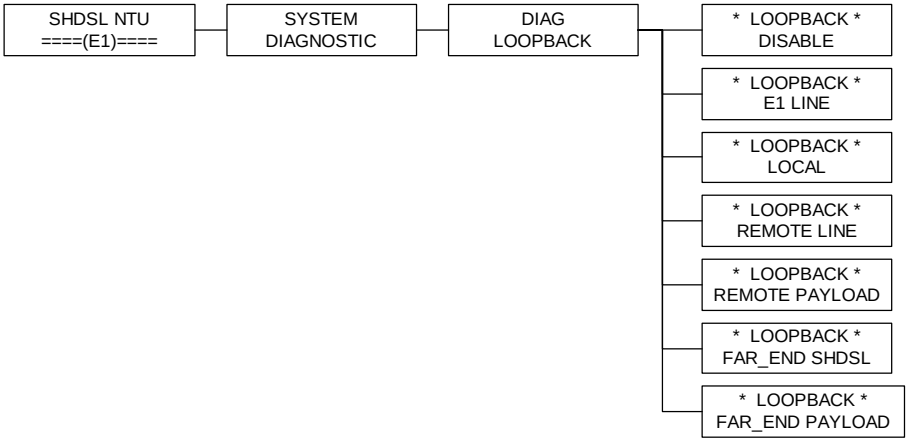
Menu tree for SAVE CONFIGURATION

After configuration, the new parameters have to be saved in NVRAM by following these steps. Choose WRITE CONFIGURATION by using ***L*** or ***R*** key and press ***Enter.*** Choose SAVE & REBOOT YES and then press ***Enter.***

Congratulation! You are done. The configuration is complete.

Menu tree for DIAGNOSTIC

The route for diagnostic is SHDSL NTU ✍ SYSTEM DIAGNOSTIC ✍ DIAG LOOPBACK.



Chapter 5. Configure via Console Port

This chapter provides information about configuring the SHDTU03 via the console port with VT100 terminal.

Note: After you have completed all necessary settings for your SHDSL NTU, make sure to write the new configuration to NVRAM by “write” command and reboot the system for the of new configuration take effect.

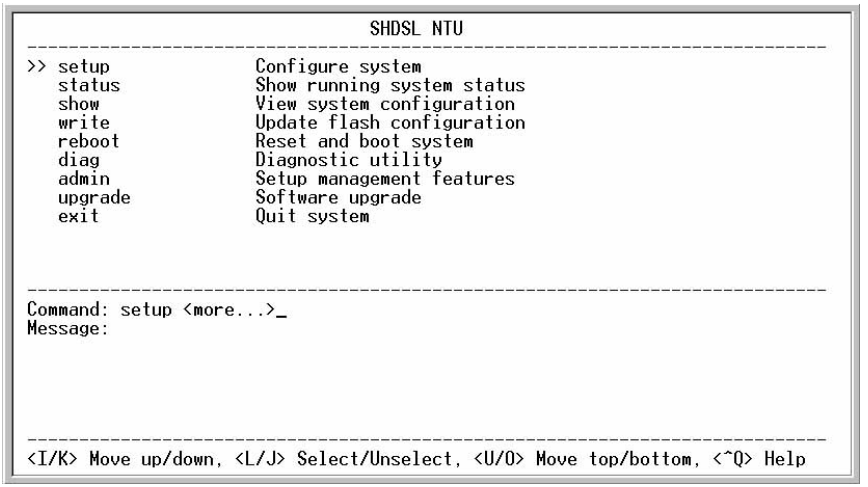
I. Login Procedure

Check the connectivity of the RS-232 cable from your computer to the console port of SHDTU03. Start your terminal access program with VT100 terminal emulation. Configure the serial link with baudrate of 9600, 8 data bits, no parity check, 1 stop bit, and no flow-control, and press the SPACE key until the login screen appears. When you see the login screen, you can logon to the SHDTU03.

```
User : admin
Password: *****
```

Note: If you have not set any user profile for the SHDSL NTU, enter the factory default user “admin”. When the system prompts you for a password, type “admin” to enter SHDSL NTU.

After you type the password, the SMT displays the main menu.



II. Window Structure

From top to bottom, the window will be divided into four parts:

1. Product name
2. Menu field: Menu tree is prompted on this field. "**>>**" symbol indicates the cursor place.
3. Configuring field: You will configure the parameters in this field. **< parameters >** indicates the parameters you can choose and **< more…>** indicates that there have submenu in the title.
4. Operation command for help

III. System Management Terminal (SMT)

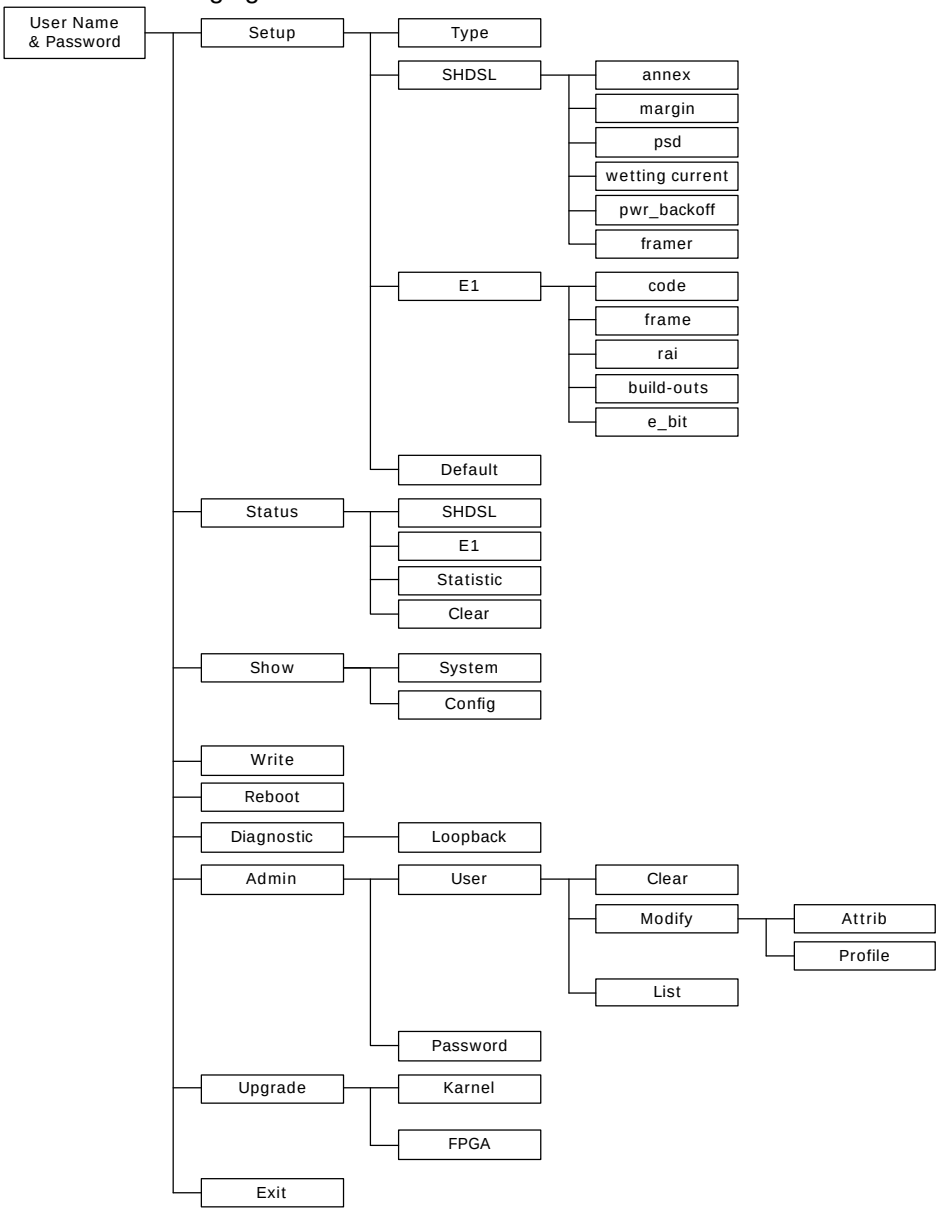
Menu Commands

Before changing the configuration, familiarize yourself with the operations list in the following table. The operation list will be shown on the window.

Keystroke	Description
[UP] or I	Move to above field in the same level menu.
[DOWN] or K	Move to below field in the same lever menu.
[LEFT] or J	Move back to previous menu.
[RIGHT] or L	Move forward to submenu.
[ENTER]	Move forward to submenu.
[TAB]	To choose another parameters.
Ctrl + C	To quit the configuring item.
Ctrl + Q	For help

Navigating the SMT interface

Use the SMT (System Management Terminal) interface to configure the NTU. The following figure is an overview of the menu tree.



IV. Main Menu Summary

The main menu is prompt as follows.

Menu Title	Function
Setup	Use this menu to setup SHDSL type, SHDSL parameters and E1 parameters or restore factory default setting.
Status	Use this menu to show SHDSL status, E1 status and statistics or clear the statistics
Show	Use this menu to show general information, all configurations and all configurations in command script.
Write	Use this menu to save your configuration.
Reboot	Use this menu to reset and reboot the system
Diag	Use this menu to setup diagnostic utility
Admin	Use this menu to manage user profile and change user password
Upgrade	Use this menu to upgrade kernel and FPGA.
Exit	Use this menu to exit STM

V. Changing the password and user profile

The SHDSL NTU comes pre-configured with user profile 1 already established, that is, user “admin” and password “admin” with menu driven interface. The maximum number of user profile is limited to 5 users. You can add, delete and modify the users in Admin menu.

For system security, suggest to change the default user name and password by performing the following steps.

Step 1: Move the cursor to **admin** and press [ENTER] or [RIGHT].

```
------------------------------------------------------------
    setup       Configure system
    status      Show running system status
    show        View system configuration
    write       Update flash configuration
    reboot      Reset and boot the system
    diag        Diagnostic utility
>>  admin       Setup management features
    upgrade     Software upgrade
    exit        Quick system
------------------------------------------------------------
```

Step 2: Choose **user** and press [ENTER] or [RIGHT].

```
-------------------------------------------------
>>  user        Manage user profile
    passwd      Change supervisor password
-------------------------------------------------
```

Step 3: Move to **modify** and press [ENTER] or [RIGHT].

```
-------------------------------------------------
    clear       Clear user profile
>>  modify      Modify user profile
    list        List user profile
-------------------------------------------------
```

Step 4: The default user name and password is pre-configured in user profile 1. For changing the default setting, type **1** to modify.

```
-------------------------------------------------
Command: admin user modify <1~5> <more…>
Message: Please input the following information.

Legal access user profile number <1~5> :1

-------------------------------------------------
```

Step 5: Move the cursor to **profile** and press [ENTER] or [RIGHT]

```
-------------------------------------------------
    attrib      UI mode
>>  profile     User name and password


-------------------------------------------------
```

Step 6: Type the new user name, old password (admin), new password and retype the new password to confirm. The passwords are prompted as star symbols.

Note: After setting the user name and password, strongly suggest you to save them. In the next time when you login, you have to use the new user name and password.

```
-------------------------------------------------
Command: admin user modify 1 profile <name> <pass conf>
Message: Please input the following information.

Legal user name (Enter for default) <admin>:test
Input the old Access password:*****
Input the new Access password:*****
Re-type Access password: *****
-------------------------------------------------
```

There are two UI modes, command mode and menu mode, used for setting the product. User can determine one kind for configuration the product in the **attrib** command.

```
-------------------------------------------------
>>  attrib      UI mode
    profile     User name and password
-------------------------------------------------
Command: admin user modify 1 attrib <Command|Menu>
Message: Please input the following information.

User interface (Tab select) <Menu> :Menu

-------------------------------------------------
```

VI. Configure the SHDSL NTU

This section provides information about configuring the SHDSL NTU. Follow the procedures:

In main menu, select **setup** and press [ENTER] or [RIGHT].

```
-------------------------------------------------
>>  setup       Configure system
    status      Show running system status
    show        View system configuration
    write       Update flash configuration
    reboot      Reset and boot the system
    diag        Diagnostic utility
    admin       Setup management features
    upgrade     Software upgrade
    exit        Quick system


-------------------------------------------------
```

The screen will prompt as follows

```
------------------=-----------------------
>>  type        Configure shdsl type
    shdsl       Configure shdsl parameters
    e1          Setup e1 parameters
    default     Restore factory default setting


-----------------------------------------
```

Configure SHDSL type

This section will introduce the configuring of SHDSL type: STU-R, STU-C-INTCLK, STU-C-EXTCLK. The default operation type is STU-R. Select **type** and press [ENTER] or [RIGHT] to setup SHDSL type. Press [TAB] to select the operating type and press enter to finish setting.

```
-------------------------------------------------
>> type          Configure shdsl type
   shdsl         Configure shdsl parameters
   serial        Setup serial parameters
   default       Restore factory default setting


-------------------------------------------------
Command: setup type <STU-R, STU-C-INTCLK, STU-C-EXTCLK>
Message: Please input the following information.

SHDSL operation type (TAB Select) <STU-R>: STU-C-INTCLK

-------------------------------------------------------
```

INTCLK: The device will generate the appropriate clock speed defined by the speed setting of the interface.

EXTCLK: The device will accept the clock from the interface and will use that clock to receive and transmit data across the interface.

Most applications use Internal Clock. If the DTE provides a clock with TX data, the clock can set to be External Clock.

Configure SHDSL parameters

This section provide the setup for SHDSL parameters: Annex type, margin, psd, wetting current, power backoff and framer.
Select SHDSL and press [ENTER] or [RIGHT].

```
-------------------------------------------------
    type        Configure shdsl type
>>  shdsl       Configure shdsl parameters
    e1          Setup e1 parameters
    default     Restore factory default setting
```

For setting the SHDSL Annex type, move the cursor to **annex** and press [ENTER]. Select the annex type by using [TAB] key.

```
-------------------------------------------------
>>  annex               Configure shdsl annex
    margin              Configure shdsl margin
    psd                 Configure shdsl psd
    pwr_backoff         Configure power backoff
    framer              Configure shdsl framer

Command: setup shdsl annex <Annex_A|Annex_B>
Message: Please input the following information.

Annex Type (TAB Select) <Annex_A>:Annex_B
-------------------------------------------------
```

For setting SHDSL Margin, move the cursor to **margin** and press [ENTER]. Select the startup margin via [TAB] key and key in the Next margin.

```
-------------------------------------------------
    annex               Configure shdsl annex
>>  margin              Configure shdsl margin
    psd                 Configure shdsl psd
    pwr_backoff         Configure power backoff
    framer              Configure shdsl framer
```

```
------------------------------------------------
Command: setup shdsl margin <0~10|Disable>
Message: Please input the following information.

Set Startup Margin (TAB Select)<0~10>: Disable
------------------------------------------------------
      --
```

SNR margin is an index of line connection. You can see the actual SNR margin in STATUS SHDSL. The larger SNR margin, the better line connection. If you set SNR margin in the field as 2, the SHDSL connection will drop and reconnect when the SNR margin is lower than 2.
For configuring SHDSL PSD, move the cursor to **psd** and press [ENTER]. Select the parameter via [TAB] key.

```
-------------------------------------------------------------------
    annex               Configure shdsl annex
    margin              Configure shdsl margin
>>  psd                 Configure shdsl psd
    pwr_backoff         Configure power backoff
    framer              Configure shdsl framer
```

```
-------------------------------------------------

      -
Command: setup shdsl psd
     <r1_asym|r2_asym|sym_enable|asym_disable>
Message: Please input the following information.

SHDSL PSD (TAB Select) <r1_asym>:r2_asym
-------------------------------------------------------
--
```

The SHDSL PSD will enable the transceiver to use an asymmetric power spectral density, as specified in the G.991.2 standard.

Possible values for PSD are:
r1_asym: 786kbps for Annex A, 2312kbps for Annex B
r2_asym: 1552kbps for Annex A, 2056kbps for Annex B
sym_enable: Symmetric and Asymmetric enable.
asym_disable: Symmetric enable but asymmetric disable.

For configuring power backoff, move the cursor to **pwr_backoff** and press [ENTER]. Select enable or disable via [TAB] key.

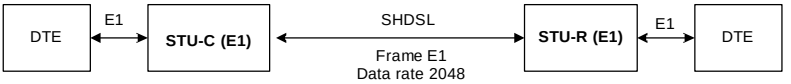
```
-------------------------------------------------
--
   annex            Configure shdsl annex
   margin           Configure shdsl margin
   psd              Configure shdsl psd
>> pwr_backoff      Configure power backoff
   framer           Configure shdsl framer

-------------------------------------------------------
     -
Command: setup shdsl pwr_backoff <enable|disable>
Message: Please input the following information.

SHDSL Power Backoff (TAB Select) <disable>:enable
-------------------------------------------------
```

The power backoff of SHDSL is a transmit power negotiation mechanism applied between STU-C and STU-R to limit the power transmitted on the SHDSL line to the minimum necessary for a clear signal to be received at the STU-C.

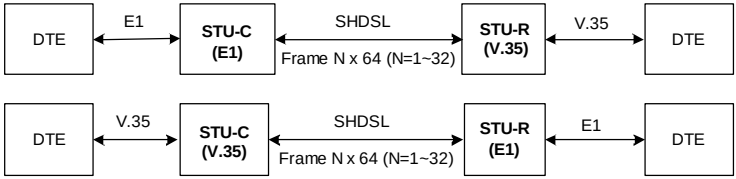
For configuring framer, move the cursor to **framer** and press [ENTER]. Select the parameters via [TAB] key.

```
-------------------------------------------------------
   annex             Configure shdsl annex
   margin            Configure shdsl margin
   psd               Configure shdsl psd
   pwr_backoff       Configure power backoff
>> framer            Configure shdsl framer

-------------------------------------------------------
      --
Command: setup shdsl framer <e1|Nx64k> <1~32> <1~31>
Message: Please input the following information.

SHDSL Framer (TAB Select) <E1>:Nx64k
Set Time Slot Number (Enter for default) <0>:8
Set First Time Slot (Enter for default) <1>:1
-------------------------------------------------------
      --
```

Though ITU 991.2 (SHDSL) supports data rate of 2304kbps, G.703 (E1) only supports data rate of 2048kbps so the maximum data rate of SHDSL line, connected with E1 DCEs, depends on data rate of E1, 2048kbps. There are two types of frames on SHDSL line, E1 and N x 64k. E1 frame only use for connection with E1 DCEs.



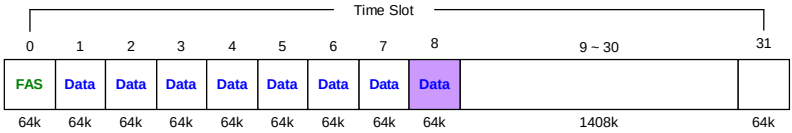
If the connection is E1 vs V.35 or V.35 vs E1, the frame has to be used N x 64k. In this case, the data rate depends on value of N. Same as above case, SHDSL and V35 can support 2304kbps data rate (36 x 64k) but E1 supports maximum data rate of 2048kbps (32 x 64k).



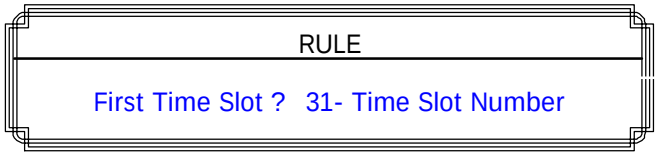
Time slot, N value, is place of data in the frame. Time Slot Number 1~31 (N=1~31) is Fractional E1 and Time Slot Number 32 (N=32) is unframed.

Fractional E1

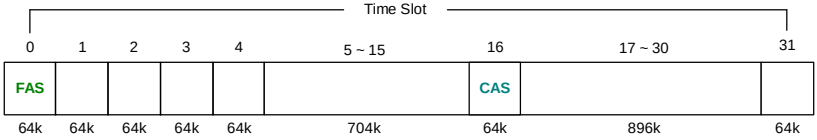
For fractional E1, FE1, the data rate is from 64k, N=1, to 1984k, N=31, according to the E1 frame. If the E1 frame is FAS or FAS+CRC4, there are 1~31 available time slot for use data. If the data rate of SHDSL line set to be 512k, the time slot number is 8 and first time slot number is 1. The frame is shown as below.



The First Time Slot setting of FAS and FAS+ CRC4 have to follow the rule:

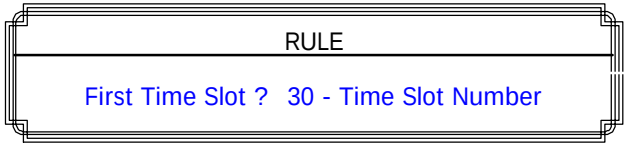


Using E1 frame of FAS+CAS or FAS+CAS+CRC4, the FAS will occupy Time Slot 0 and CAS Time Slot 16. There are only 30 Time Slot left for data. On the other hand, the data rate is 1920kbps.

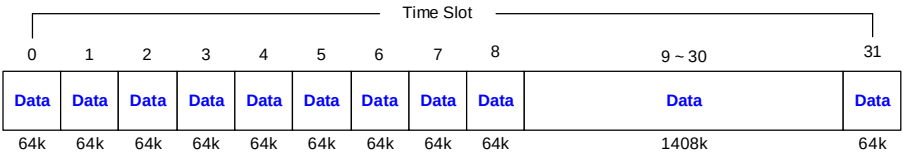


The First Time Slot setting of FAS+CAS and FAS+CAS+CRC4 have to

follow the rule:



Unframed E1



Configure EI parameters

This section introduce the setting of E1 code, frame, rai, built out and e_bit. Select E1 and press [ENTER] or [RIGHT].

```
------------------------------------------------------------
    type        Configure shdsl type
    shdsl       Configure shdsl parameters
>>  e1          Setup e1 parameters
    default     Restore factory default setting

------------------------------------------------------------
```

```
>> code                 Configure e1 code
   frame                Configure e1 frame
   rai                  Configure e1 rai
   build_outs           Configure e1 build outs
   e_bit                Configure e1 e_bit
```

For configuring code, move the cursor to **code** and press [ENTER]. Select the parameter via [TAB] key.

```
------------------------------------------------------------
```

```
>>  code                Configure e1 code
    frame               Configure e1 frame
    rai                 Configure e1 rai
    build_outs          Configure e1 build outs
    e_bit               Configure e1 e_bit
```

```
-----------------------------------------------------
Command: setup e1 code <AMI|HDB3>
Message: Please input the following information.

SHDSL E1 code (TAB Select) <HDB3>:HDB3
-----------------------------------------------------
```

HDB3	In this line coding, the transmitter substitutes a deliberate bipolar violation when excessive zeros in the data stream are detected. The receiver recognizes these special violations and decodes them as zeros. This method enables the network to minimum pulse density requirements. Unless AMI is required for your application, HDB3 should be used whenever possible.
AMI	Alternate Mark Inversion defines a pulses as a " mark," a binary one, as opposed to a zero. In an E1 network connection, signals are transmitted as a sequence of one and zero. One is sent as pulse, and zero is sent as spaces, i.e. no pulse. Every other pulse is inverted from the previous pulse in polarity, so that the signal can be effectively transmitted. This means, however, that a long sequence of zero in data stream will cause problems, since the NTU receiving the signal relies on the signal to recover the 2048kbps clock.

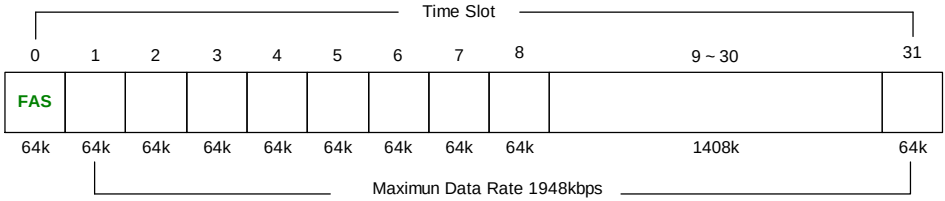
For configuring frame, move the cursor to **frame** and press [ENTER]. Select the parameter via [TAB] key.

```
-------------------------------------------------------
    code                Configure e1 code
>>  frame               Configure e1 frame
    rai                 Configure e1 rai
    build_outs          Configure e1 build outs
    e_bit               Configure e1 e_bit
```

```
-------------------------------------------------------------
Command: setup e1 frame
      <FAS|FAS+CRC4|FAS+CAS|FAS+CRC4+CAS|UNFRAMED>
Message: Please input the following information.

SHDSL E1 frame (TAB Select) <fas+crc4+cas>:unframed
-------------------------------------------------------------
```

FAS

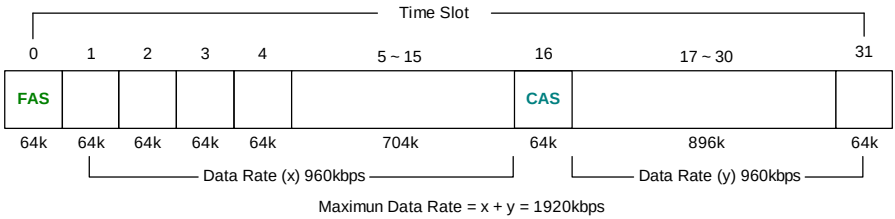
Frame Alignment Signal use 7-bit patterns to establish and maintain frame synchronization. The FAS word is located in timeslot 0 of frame. In FAS mode there are 1~31 timeslot available for use data.



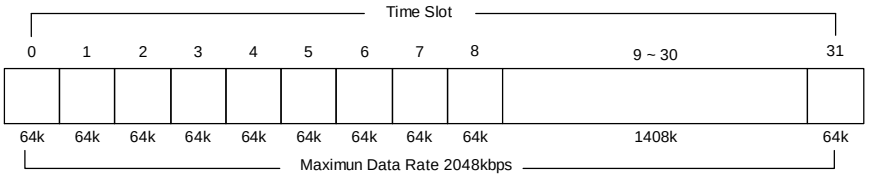
CAS

Also known as time slot 16 multiframing. It requires a multiframe alignment signal to be present for frame sync. The Multiframe Alignment Signal (MFAS) is inserted into the 16th timeslot of frame 0 of the 16-frame multiframe.

In CAS mode, there are 30 channels available for user data. If timeslot 16 is included in the unit's mapping, it will be disregarded.



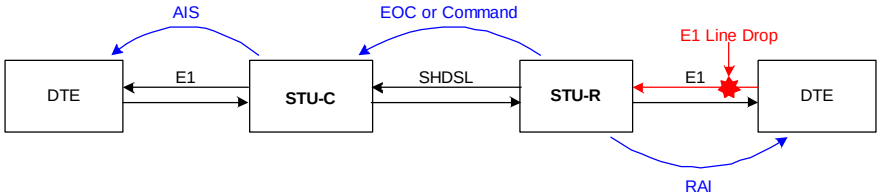
CRC4	The CRC-4 checksum bits are transmitted in the outgoing E1 data stream. Also the received signal is checked for errors. CRC-4 checksum cannot be sent in unframed mode.
Unframed	In this mode, user data is inserted into all 32 channels (64k x 32 = 2048k) of the E1 stream. The object of running without framing is to utilize the full bandwidth of the E1 line.



For configuring RAI, move the cursor to **rai** and press [ENTER]. Select the parameter via [TAB] key.

```
------------------------------------------------------------
    code                Configure e1 code
    frame               Configure e1 frame
>>  rai                 Configure e1 rai
    build_outs          Configure e1 build outs
    e_bit               Configure e1 e_bit

------------------------------------------------------------
Command: setup e1 rai <enable|disable>
        Message: Please input the following information.

SHDSL E1 rai (TAB Select) <disable>:enable
------------------------------------------------------------
```

Remote Alarm Indication (RAI) is a signal which transmits automatically when E1 line drop. For example: When STU-R E1 RX line is dropped, STU-R will send the status to STU-C via EOC or command. At the same time it will send RAI to DTE. STU-C will send AIS (Alarm Indication Signal) to DTE if AIS function is enabled.



For configuring build outs, move the cursor to **built_outs** and press [ENTER]. Select the parameter via [TAB] key.

```
------------------------------------------------------------
    code                Configure e1 code
    frame               Configure e1 frame
    rai                 Configure e1 rai
>>  build_outs          Configure e1 build outs
    e_bit               Configure e1 e_bit


------------------------------------------------------------
Command: setup e1 built_outs <120_Ohm|75_Ohm>
Message: Please input the following information.

SHDSL E1 built_outs (TAB Select) <120_Ohm>:75_Ohm
------------------------------------------------------------
```

For configuring e_bit, move the cursor to **e_bit** and press [ENTER]. Select the parameter via [TAB] key.

```
------------------------------------------------------------
    code                Configure e1 code
    frame               Configure e1 frame
    rai                 Configure e1 rai
    build_outs          Configure e1 build outs
>>  e_bit               Configure e1 e_bit


-------------------------------------------------------------
Command: setup e1 e_bit <enable|disable>
Message: Please input the following information.

SHDSL E1 e_bit (TAB Select) <disable>:enable
------------------------------------------------------------
```

Restore factory default

If you want to restore factory default setting in setup, select **default** and press [ENTER] or [RIGHT].

```
 ------------------------------------------------------------
    type        Configure shdsl type
    shdsl       Configure shdsl parameters
    e1          Setup e1 parameters
 >> default     Restore factory default setting

------------------------------------------------------------
Command: setup default
Message: Please input the following information.

Are you sure? (y/n):y
------------------------------------------------------------
```

If you enter “y” the setup field will be automatically configured to factory default setting.

VII. Write the Setup Parameter

After configuration, write the new configured parameters into NVRAM and reboot the SHDSL NTU to work with new parameters. Follow the procedure;

Step 1: In main menu, move the cursor to **write** and press [ENTER].

```
------------------------------------------------------------
    setup       Configure system
    status      Show running system status
    show        View system configuration
>>  write       Update flash configuration
    reboot      Reset and boot the system
    diag        Diagnostic utility
    admin       Setup management features
    upgrade     Software upgrade
    exit        Quick system

------------------------------------------------------------
```

Step 2: Type “y” to write the new parameters

```
------------------------------------------------------------
Command: write <CR>
Message: Please input the following information.

Are you sure? (y/n): y
------------------------------------------------------------
```

VIII. Reboot the SHDSL NTU

For the SHDSL NTU to work with new parameters, you must reboot it after writing the parameters into NVRAM. Follow the procedure;

Step 1: In main menu, move the cursor to **reboot** and press [ENTER].

```
-------------------------------------------------------------
    setup       Configure system
    status      Show running system status
    show        View system configuration
    write       Update flash configuration
>>  reboot      Reset and boot the system
    diag        Diagnostic utility
    admin       Setup management features
    upgrade     Software upgrade
    exit        Quick system

-------------------------------------------------------------
```

Step 2: Type “y” to reboot the SHDSL NTU.

```
-------------------------------------------------------------
Command: reboot <CR>
Message: Please input the following information.

Do you want to reboot? (y/n):y
-------------------------------------------------------------
```

IX. View the System Status

You can use the status command to view the status of SHDSL, E1 as well as statistic and clear the statistic log. Select **status** and press [ENTER].

```
------------------------------------------------------------
    setup       Configure system
>>  status      Show running system status
    show        View system configuration
    write       Update flash configuration
    reboot      Reset and boot the system
    diag        Diagnostic utility
    admin       Setup management features
    upgrade     Software upgrade
    exit        Quick system

------------------------------------------------------------
```

Select **SHDSL** command to show the status of SHDSL.

```
------------------------------------------------------------
>>  shdsl       Show shdsl status
    e1          Show e1 status
    statistic   Show statistic
    clear       Clear statistic

------------------------------------------------------------
```

Select **e1** command to show the status of E1.

```
------------------------------------------------------------
    shdsl       Show shdsl status
>>  e1          Show e1 status
    statistic   Show statistic
    clear       Clear statistic

------------------------------------------------------------
```

Select **statistic** command to show the statistic information in 15 minutes or 24 hour via [TAB] to choose.

```
------------------------------------------------------------
    shdsl       Show shdsl status
    e1          Show e1 status
>>  statistic   Show statistic
    clear       Clear statistic
```

```
------------------------------------------------------------
Command: status statistic <15m|24h>
Message: Please input the following information.

SHDSL Statistic (TAB Select):15m
------------------------------------------------------------
```

To clear the statistic log file, select **clear** and press [ENTER].

```
------------------------------------------------------------
    shdsl       Show shdsl status
    e1          Show e1 status
    statistic   Show statistic
>>  clear       Clear statistic

---------------------------------------------------
```

X. View the System Configuration

You can use the status command to view the system configuration. Select **show** and press [ENTER] or [RIGHT].

```
------------------------------------------------------------
    setup       Configure system
    status      Show running system status
>>  show        View system configuration
    write       Update flash configuration
    reboot      Reset and boot the system
    diag        Diagnostic utility
    admin       Setup management features
    upgrade     Software upgrade
    exit        Quick system

------------------------------------------------------------
```

To show system information, select **system** and press [ENTER] or [RIGHT]. The screen will prompt the system information.

```
-------------------------------------------------—---------
>>  system      Show general information
    script      Show all configuration in command script

------------------------------------------------------------
```

To show the system configuration, select **script** and press [ENTER] or [RIGHT]. The screen will prompt the configuration in script type.

```
------------------------------------------------------------
    system      Show general information
>>  script      Show all configuration in command script

------------------------------------------------------------
```

XI. Upgrade the SHDSL NTU

This section will introduce how to upgrade the kernel and FPGA of the SHDSL NTU. Select **upgrade** in main menu and press [ENTER] or [RIGHT].

```
------------------------------------------------------------
    setup       Configure system
    status      Show running system status
    show        View system configuration
    write       Update flash configuration
    reboot      Reset and boot the system
    diag        Diagnostic utility
    admin       Setup management features
>>  upgrade     Software upgrade
    exit        Quick system

------------------------------------------------------------
```

Before upgrading the NTU you must have the main software or FPGA code in your computer.

If you want to upgrade the kernel:

1. Select **kernel** and press [ENTER] or [RIGHT].

```
------------------------------------------------------------
>>     kernel   Upgrade main software
       FPGA     Upgrade FPGA code

------------------------------------------------------------
```

2. Confirm the process via pressing "**y**"

```
------------------------------------------------------------
Command: upgrade kernel <CR>
Message: Please input the following information.

Are you sure (y/n)?: (Note: this will erase flash)y
------------------------------------------------------------
```

3. After entering "**y**", the SMT will show

```
------------------------------------------------------------
Utility running window...
Starting XModem download...CCC

------------------------------------------------------------
```

4. Click Send file in terminal access program, hyper terminal, to send the file.
5. Select the source file in window and press OK.
6. After upgrading the product, press "**y**" to write in flash.

If you want to upgrade the FPGA code:

1. Select **FPGA** and press [ENTER] or [RIGHT].

```
------------------------------------------------------------
        kernel       Upgrade main software
>>      FPGA         Upgrade FPGA code

------------------------------------------------------------
Command: upgrade FPGA <CR>
Message: Please input the following information.

Are you sure (y/n)?: (Note: this will erase flash)y
------------------------------------------------------------
```

2. After entering "**y**", the SMT will show

```
------------------------------------------------------------
Utility running window...
Starting XModem download...CCC

------------------------------------------------------------
```

3. Click Send file in terminal access program, hyper terminal, to send the file.
4. Select the source file in window and press OK.
5. After upgrading the product, press “y” to write in flash.

XII. Diagnostic

The diagnostic facility allows you to test the different aspects of your SHDSL NTU to determine if it is working properly. Select **diag** and press [ENTER] or [RIGHT].

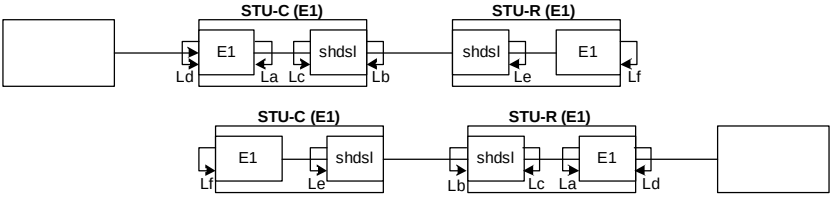
```
------------------------------------------------------------
    setup       Configure system
    status      Show running system status
    show        View system configuration
    write       Update flash configuration
    reboot      Reset and boot the system
>>  diag        Diagnostic utility
    admin       Setup management features
    upgrade     Software upgrade
    exit        Quick system

-------------------------------------------------------------
```

Loopback can test whether the NTU is properly working with the connected device.

Press [ENTER] or [RIGNT] to setup the loopback.

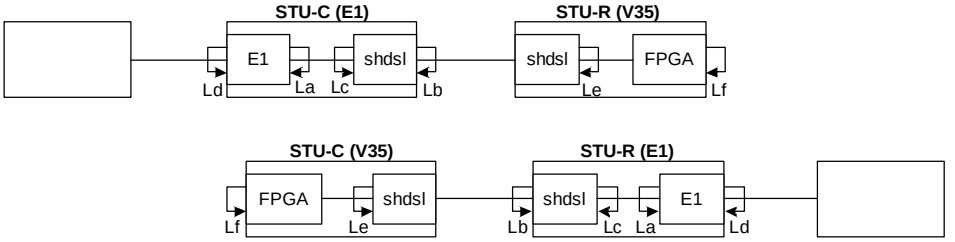
```
 ------------------------------------------------------------
 >>  loopback    Loopback
     ber_test    Ber_test
-------------------------------------------------------------
Command: loopback
      <...local|remote_line|remote_payload|Farend_line|Farend_pa
      yload>
Message: Please input the following information.

SHDSL Loopback Type (TAB Select) <disable>:
      e1_line
 ------------------------------------------------------------
```

Loopback Define E1 vs E1



E1_Line	La
Local	Lb
Remote Line	Lc
Remote Payload	Ld
Far End Line	Le
Far End Payload	Lf

Loopback Define Fractional E1 vs V35



E1_Line	La
Local	Lb
Remote Line	Lc
Remote Payload	Ld
Far End Line	Le
Far End Payload	Lf

The SHDTU03 supports Bit Error Rate Testing (BERT). To configure the BERT, move the cursor to ber_test and press enter.

```
-----------------------------------------------------------
    loopback          Loopback
    ber_test          Ber_test


-------------------------------------------------------------

Command: diag ber_test <disable|2047|resync>

Message: Please input the following information.


SHDSL Ber_test Type (TAB Select) <disable>:2047

-------------------------------------------------------------
```

XIII. Exit SMT

For exiting SMT without saving any configuration, you can use the **exit** command to exit the SMT. Select **exit** and press [ENTER] or [RIGHT].

```
------------------------------------------------------------
    setup       Configure system
    status      Show running system status
    show        View system configuration
    write       Update flash configuration
    reboot      Reset and boot the system
    diag        Diagnostic utility
    admin       Setup management features
    upgrade     Software upgrade
>>  exit        Quick system

------------------------------------------------------------


------------------------------------------------------------
Command: exit <CR>
Message: Please input the following information.

Do you want to disconnect? (y/n) :y
------------------------------------------------------------
```

After press [ENTER], the SMT will be disconnected.

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Appendix I

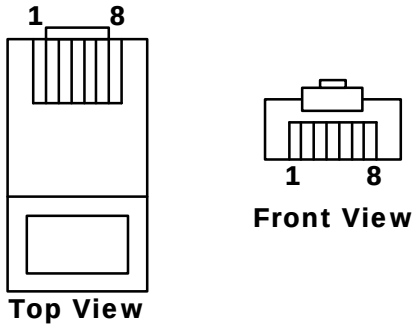
AMI	Alternate mark inversion
B8ZS	Bipolar 8 zero substitution
CAS	Also known as timeslot 16 multiframing, requires a multiframe alignment signal to represent for frame sync.
CRC4	Cyclic redundancy check 4 bit
E BIT GEN	Remote End Block Error Bit generation
EOC	Embedded operations channel
ES	Number of Error second (Errors/Second)
ESF	Extended super frame
FAS	Frame alignment signal
LINE BUILD OUTS	Cable used between NTU and Router or PABX
LOSW	Loss of synchronization word
PSD	Power spectral density
RAI	Remote alarm indication
R1 ASYM	Symmetric speed, 784kbps for Annex A or 2312kbps for Annex B
R2 ASYM	Symmetric speed, 1552kbps for Annex A or 2056kbps for Annex B
SES(Severe Error Second)	Number of SES (more than 832 CRC errors / second. Approximately equivalent to a bit error rate of 1×10^{-3}.
SF	Super Frame
SNR MARGIN	Signal to noise ration margin
SYNC	Synchronization
TX POWER	Transmission power
UAS	Number of Unavailable second (more than10 seconds.)

Appendix II

Connector Architecture

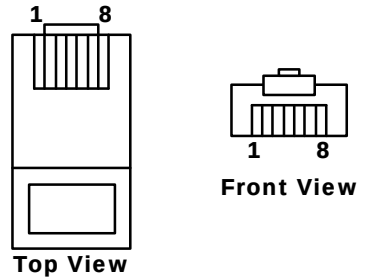
Console Connector (RJ-45)

The Console Port interface is a 8 position Modular Jack.
The table below displays the pin out assignments.

Pin Number	Description	Figure
1	No connection	
2	No connection	
3	No connection	
4	GND	
5	RC	
6	TD	
7	No connection	
8	No connection	

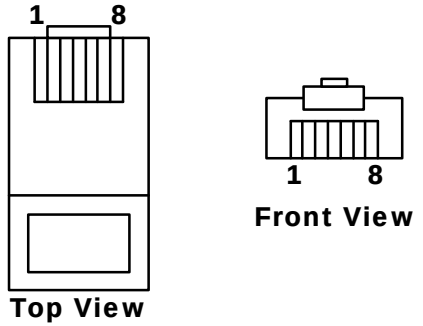
G.703 120O Connector (RJ-45)

The 120O E1 Port interface is a 8 position modular jack, the following table displays the pin our assignments.

Pin Number	Description	Figure
1	E1 interface receive pair-ring	
2	E1 interface receive pair-tip	
3	No connection	
4	E1 interface transmit pair-ring	
5	E1 interface transmit pair-tip	
6	No connection	
7	No connection	
8	No connection	

SHDSL Interface Pin Assignments (RJ-45)

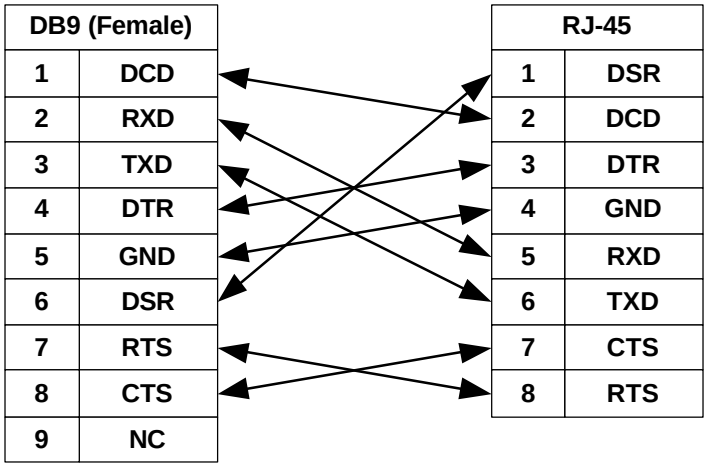
The SHDSL interface is standard eight-pin modular jack.
The table below displays the pin out assignments.

Pin Number	Description	Figure
1	No connection	
2	No connection	
3	No connection	
4	ANALOG Input/Output	
5	ANALOG Input/Output	
6	No connection	
7	No connection	
8	No connection	

Appendix III

Cable Connection

DB9 vs. RJ45 Cable (Console)



Transmission Units

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