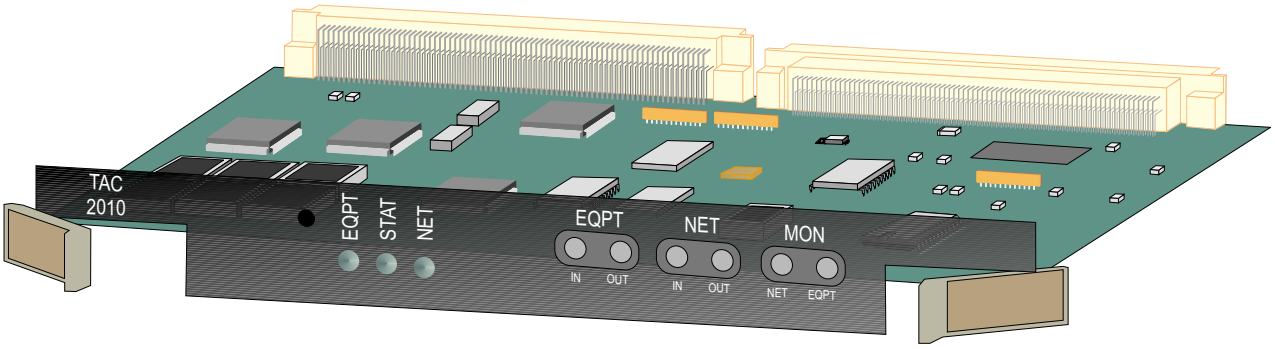
Verilink TAC 2010
User Manual

October 1999

P/N 880-503298-001-A1



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Trademarks

FCC Requirements

This equipment has been tested and found to comply within the limits for a Class A digital device pursuant to Part 15 of the Federal Communications Commission (FCC) rules. These limits are designed to provide protection against harmful interference in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user manual, can cause harmful interference to radio communications.

There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception—which can be determined by turning the equipment off and on—try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with Part 68 of the FCC Rules. On the rear, side or bottom of the unit is a label that contains the FCC registration number and other information. If requested, provide this information to the telephone company.

- All direct connections to the network lines must be made using standard plugs and jacks (compliant with Part 68). The following tables list the applicable registration jack universal order codes (USOCs), facility interface codes (FICs), and service order codes (SOCs). These are required to order service from the telco.

For T1 interfaces:

Port ID	REN / SOC	FIC	USOC
1.544 Mbit/s SF 1.544 Mbit/s SF, B8ZS 1.544 Mbit/s ANSI ESF 1.544 Mbit/s ANSI ESF, B8ZS	6.0N	04DU9 -BN 04DU9 -DN 04DU9 -1KN 04DU9 -1SN	RJ-48C jack

- If the unit appears to be malfunctioning, inform the telco and disconnect it from the network lines until the source of trouble is determined to be your equipment or the telephone line . If your equipment needs repair, it should not be reconnected until it is repaired.
- The unit has been designed to prevent harm to the network. If the telephone company finds that the equipment is exceeding tolerable parameters, it can temporarily disconnect service. In this case, the telephone company will provide you advance notice if possible.
- If the telephone company alters its equipment in a manner that can affect the use of this device, it must give you warning so that you have the opportunity to maintain uninterrupted service. You will be advised of your right to file a complaint with the FCC.

- No customer is authorized to repair this equipment, regardless of warranty status. All repairs must be performed by Verilink or an authorized agent. It is the responsibility of users requiring service to report the need for service to Verilink or to one of our authorized agents.

Lithium Battery

The lithium battery referred to in the following notices is contained inside the clock chip.

English

DANGER!

The battery can explode if incorrectly replaced! Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

DANGER!

To avoid electrical shock in case of failure, the power supply must be installed by a professional installer. The terminal labeled with the ground symbol (⏚) on the power supply must be connected to a permanent earth ground.

CAUTION!

Interconnecting circuits must comply with the requirements of EN60950:1992/A4:1997 Section 6.2 for telecommunications network voltages (TNV) circuits.

Français

ATTENTION!

Une explosion peut se produire si la batterie est remplacée d' une façon incorrecte! Remplacez-la seulement avec le même modêle de batterie ou un modèle équivalent selon les recommendations de manufacture. Disposez de les batteries usées selon les instructions de manufacture.

ATTENTION!

Pour éviter choc électrique en cas de insuccès, la provision de pouvoir doit êtré installé par un installeur professionnel. Le terminal de la provision de pouvoir, marqué du symbol de terre, (⏚) doit connecté à un circuit de terre permanent.

PRUDENT!

Les circuits doivent êtré interconnectés de manière à ce que l' équipement continue a êtré en agrément avec "EN60950:1992/A4:1997, Section 6.2, pour les circuits de voltage de liaisons d' échanges (réseau) par les télécommunications (TNV)," après les connections de circuits.

Española

ATTENCION!

La bateria puede explotar si se reemplaza incorrectamente. Reemplace la bateria con el mismo tipo de bateria ó una equivalente recomendada por el manufacturero. Disponga de las baterias de acuerdo con las instrucciones del manufacturero.

ATTENCION!

Para evitar contacto con circuitos que electrocutan, la fuente de alimentación debe ser instalada por un técnico profesional. La terminal de la fuente de alimentación marcada con el símbolo de tierra (⏚) debe ser conectada a un circuito de vuelta por tierra permanente.

PELIGRO!

Circuitos que se interconectan a la red de telecomunicaciones deben hacerse de tal manera que cumplan con los requisitos estipulados en las especificaciones "EN60950:1992/A4:1997, Sección 6.2, para los voltages de circuitos interconnectados a la Red de Telecomunicaciones (TNV)," despues de terminar las connecciones entre los circuitos.

Deutsch

VORSICHT!

Explosionsgefahr bei unsachgemäßem Ersetzen der Batterie! Batterie gleichen Typs und gleicher Qualität benutzen, wie vom Hersteller empfohlen. Entsorgung der Batterie nach Anweisung des Herstellers!

VORSICHT, GEFAHR!

Um keinen Schlag zu erhalten beim Versagen der electrischen Anlage, muss der Stromanschluss von einem Elektriker vorgenommen werden. Der elektrische Pol, versehen mit dem Erdsymbol (⏚) muss am Stromanschluss permanent geerdet sein.

VORSICHT!

Schaltungen, die in den Geräten zusammengeschaltet sind, müssen weiterhin den Vorschriften EN60950:1992/A4:1997, Absatz 6.2 für Telecommunications Netz Spannung (TNV) Schaltkreize entsprechen.

Canadian Requirements

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques (de la class A) prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

The Industry Canada label indentifies CS-03 certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

Safety Precautions

This equipment is intended to be installed only in a Restricted Access Location that meets the following criteria:

- Access can only be gained by service personnel or users who have been instructed about the reasons for the restrictions applied to the location and about any precautions that must be taken.
- Access can only be gained through the use of a lock and key or other means of security, and is controlled by the authority responsible for the location.

When handling this equipment, follow these basic safety precautions to reduce the risk of electric shock and injury:

- Follow all warnings and instructions marked on the product and in the manual.
- Unplug the hardware from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a cloth slightly dampened with water.
- Do not place this product on an unstable cart, stand, or table. It may fall, causing serious damage to the product.
- Slots and openings in the shelves are provided for ventilation to protect them from overheating. These openings must not be blocked or covered. Never place this product near a radiator or heat register.
- This product should be operated only from the type of power source indicated on the marking label and manual. If you are unsure of the type of power supply you are using, consult your dealer or local power company.
- Do not allow anything to rest on the power cord. Do not locate this product where the cord will interfere with the free movement of people.

- Do not overload wall outlets and extension cords, as this can result in fire or electric shock.
- Never push objects of any kind into the shelves. They may touch dangerous voltage points or short out parts that could result in fire or electric shock. Never spill liquid of any kind on this equipment.
- Unplug the equipment from the wall outlet and refer servicing to qualified service personnel under the following conditions:
    - When the power supply cord or plug is damaged or frayed.
    - If liquid has been spilled into the product.
    - If the product has been exposed to rain or water.
    - If the product has been dropped or if the cabinet has been damaged.

Product Warranty

Verilink's product warranty covers repair or replacement of all equipment under normal use for a five-year period from date of shipment. Replacement products may be new or reconditioned. Any replaced or repaired product or part has a ninety (90) day warranty or the remainder of the initial warranty period, whichever is longer. Our in-house Repair Center services returns within ten working days.

Customer Service

Verilink offers the following services:

- System Engineers at regional sales offices for network design and planning assistance (800) 837-4546
- Technical Assistance Center for free 24x7 telephone support during installation, maintenance, and troubleshooting (800) 285-2755 and support@verilink.com
- To return a product, it must be assigned a Return Materials Authorization (RMA) number before sending it to Verilink for repair (800) 926-0085, ext. 2282
- Maintenance contracts and leasing plans (800) 837-4546
- Technical Training on network concepts and Verilink products (800) 282-2755 and training@verilink.com
- Web site (www.verilink.com)

Publications Staff

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Table of Contents

Chapter 1 Overview

This user manual describes the TAC 2010 module, a component of Verilink's Access System 2000 (AS2000) platform. The TAC 2010 is a T1 Channel Service Unit (CSU) that can optionally be used with up to 24 Verilink Data Service Unit (DSU) modules.

Scope

This manual assumes you are already familiar with the AS2000 product line. Where appropriate, the text refers you to a specific Access System 2000 manual for greater detail.

Installation Information

For information on installing and replacing shelves, modules, and power supplies, see the manual *AS2000, The Basics*.

Related Verilink Documents

Refer to the following related AS2000 manuals:

- *AS2000, The Basics* provides general information about Verilink products.
- The *DIU 2130 User Manual* documents a two port DSU often used with the TAC 2010 CSU.
- *Node Manager for Windows 95 User Manual*, documents the Verilink network management program designed to operate under Windows 95™ or Windows NT™.
- *Access Manager 2000 User Manual*, documents the Verilink network management program designed to operate under Windows™ 3.1 (only).

Management Options

The TAC 2010 CSU module must be managed by one of five Verilink node controller modules; the NCC 2020, NCC 2130, SCC 2020, SCC 2130 or NCM 2000. You can configure the TAC 2010 through an ASCII terminal port (Craft interface) on the associated node controller.

Depending on the controller module used, you can manage the TAC 2010 using either of two Verilink node management programs or an industry standard SNMP manager. Table 1-1 lists the node management programs which can be used with the three types of node controller.

Table 1-1 Node Management Programs

Node Controller Module	Craft Interface	Node Management Programs
NCM 2000	Use port labelled LOCAL.	Verilink Node Manager or any SNMP manager.
NCC 2020 NCC 2130	Use port labelled CRAFT.	Verilink Access Manager 2000 or Verilink Node Manager.
SCC 2020 SCC 2130	Use port labelled CRAFT.	Verilink Node Manager or any SNMP manager.

Types of Node Controllers

In an AS2000 node only one node controller module is required. Additional T1 CSU functions can use TAC 2010 CSU modules. Verilink's family of AS2000 node controllers includes the following modules:

- The NCM 2000 is an SNMP node controller. It does not contain any type of T1 CSU. See the *NCM 2000 User Manual* for full details.
- The NCC 2020 is a TAC 2010 T1 CSU with the addition of a node controller function. See the *NCC 2020 User Manual* for full details.
- The NCC 2130 is a TAC 2130 IDCSU (Integrated T1 CSU/DSU) with the addition of a node controller function. See the *NCC 2130 User Manual* for full details.
- The SCC 2020 is a TAC 2010 T1 CSU with the addition of an SNMP node controller function. See the *SCC 2020 User Manual* for full details.
- The SCC 2130 is a TAC 2130 IDCSU (Integrated T1 CSU/DSU) with the addition of an SNMP node controller function. See the *SCC 2130 User Manual* for full details.

Compatible Modules

The TAC 2010 defaults to CSU-only mode. It can be configured to use a shelf midplane to pass channelized data timeslots to an optional DSU module.

Table 1-2 Compatible DSU Modules

Module	Type	Usage
DIU 2130	DSU	DSU with two synchronous serial interface ports for connection of Data Terminal Equipment (DTE). May be used with TAC 2010 (including the TAC 2010 portion of an NCC 2020).
DIU 2130/DBU	DSU	DSU with a single synchronous serial interface port and modified firmware which uses the second port to switch the DTE data from port 1 to an external Dial Back-Up device—which must be configured to dial on DTR.
DIU 2130 56K/NMS	DSU	DSU with two synchronous serial interface ports and support for routing of individual timeslots, in the “telco cloud”, to remote sites with 56K DDS circuits. Uses a shelf midplane to receive/transmit data to a CSU module.
DIU 2140	Sub-Rate Data Multiplexer, 5 port DSU	DSU with five RS-232 interface ports, each individually selectable for sync or async data, which are multiplexed into a single timeslot (DS0) of the associated T1 CSU. Uses a shelf midplane to receive/transmit data to a CSU module.

Components

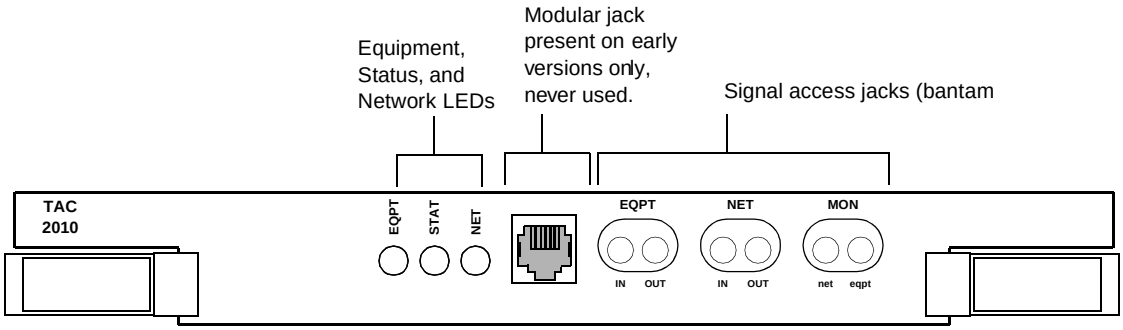
The complete TAC 2010 assembly consists of a front-panel module and a rear panel connector interface module (CIM), together occupying a single shelf-slot position accessible from the front and back of the AS2000 shelf. The CIM is installed from the rear of the shelf into the backplane. The TAC 2010 front module is installed from the front. The CIM is always installed first and removed last. The TAC 2010 module is installed last and removed first, using the dual ejector handles.

TAC 2010 Front Panel

The TAC 2010 front panel provides LED indicators and signal access jacks. It has dual ejector levers to aid installation and removal of the module.

NOTE: *The bantam type signal access jacks provide access to internal signals within the module. If the TAC 2010 is being used with any type of DIU (DSU) module, the signals on the bantam jacks will NOT reflect line signals and this jack field should not be used.*

Figure 1-1 TAC 2010 Front Panel



The TAC 2010 front panel has:

- Three LEDs (status indication)
- Three pairs of bantam jacks (see note above)
- Early versions of the TAC 2010 had an RJ-11 modular connector which is not used.

TAC 2010 CIMs

The TAC 2010 front module must be installed with a rear connector module which provides interface ports. The following table lists the connector modules that can be paired with the TAC 2010 T1 CSU front module.

Table 1-3 TAC 2010 Connector Interface Modules

Front Module	Connector Interface Module	DSX-1 Port Connector	Net Port Connector
TAC 2010 (T1 CSU)	CIM 2010	RJ-48C	RJ-48C
	CIM 2015	DB-15	DB-15

The following illustrations show the connector interface modules used with the TAC 2010.

Figure 1-2 CIM 2010 Back Panel (RJ-48C)

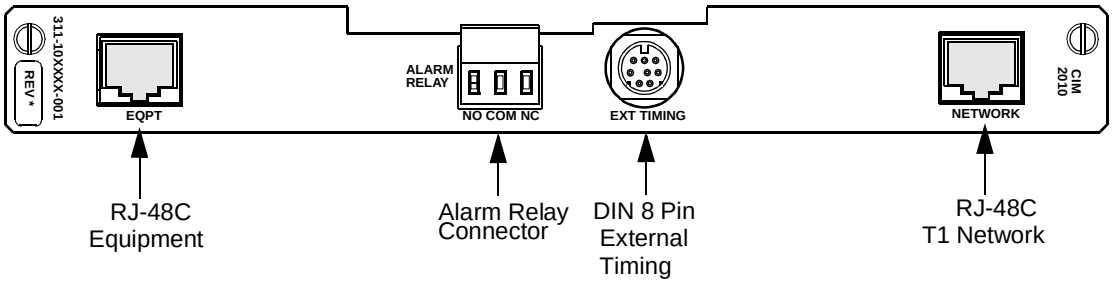
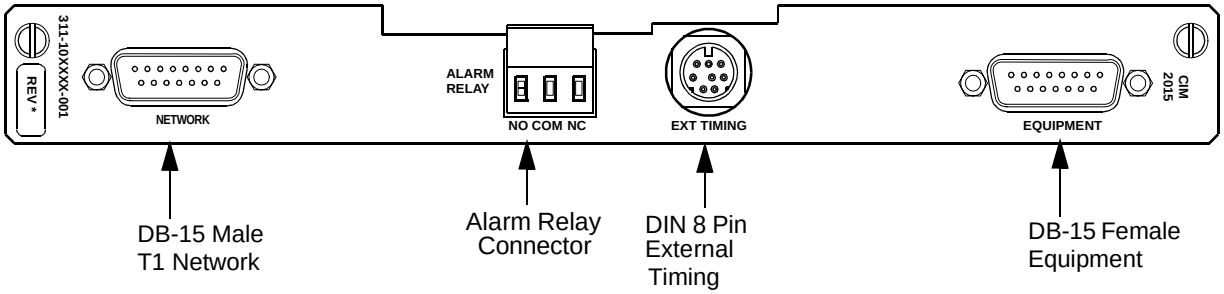


Figure 1-3 CIM 2015 Back Panel (DB-15)



Port Usage

Table 1-4 lists connector details for the front and rear modules.

Table 1-4 TAC 2010 Connector Ports

Port	Located	Usage
Bantam Jacks	Front	Monitor network signals, DSX-1 equipment signals, connect T1 test equipment. *These ports do not reflect line signals unless the module is in CSU mode*. Use only when in CSU mode (DIU bus = none). The MON pair is used to monitor receive or transmit data and is non-intrusive. MON NET allows access to the T1 receive data. MON EQPT allows access to the CSU transmit data. The EQ pair disconnects the DSX-1 equipment and replaces it with the test set. Use of EQ IN or EQ OUT will disrupt any service operating on the entire T1. The NET pair disconnects the rest of the CSU from the T1 circuit and allows the test set to replace the CSU. Use of NET IN or NET OUT will disrupt any service operating on the T1.
Network	Rear	Connect the T1 line to this port.
Equipment	Rear	Connect customer equipment which presents a DSX-1 T1 framed signal—often a PBX. This port is only used if the module is in CSU mode or drop and insert mode.
Ext Timing	Rear	Connect an optional external clock source, using either a TTL (Transistor Transistor Logic) level (0 to +5V) or balanced (RS-422) signal. The clock must be at 1.544 Mbit/s.
Alarm Relay	Rear	Connect an external alarm system which will trigger on either a relay closure (using NO and COM leads) or an open (using NC and COM leads). The relay in the TAC 2010 module supports Form C relay specifications.

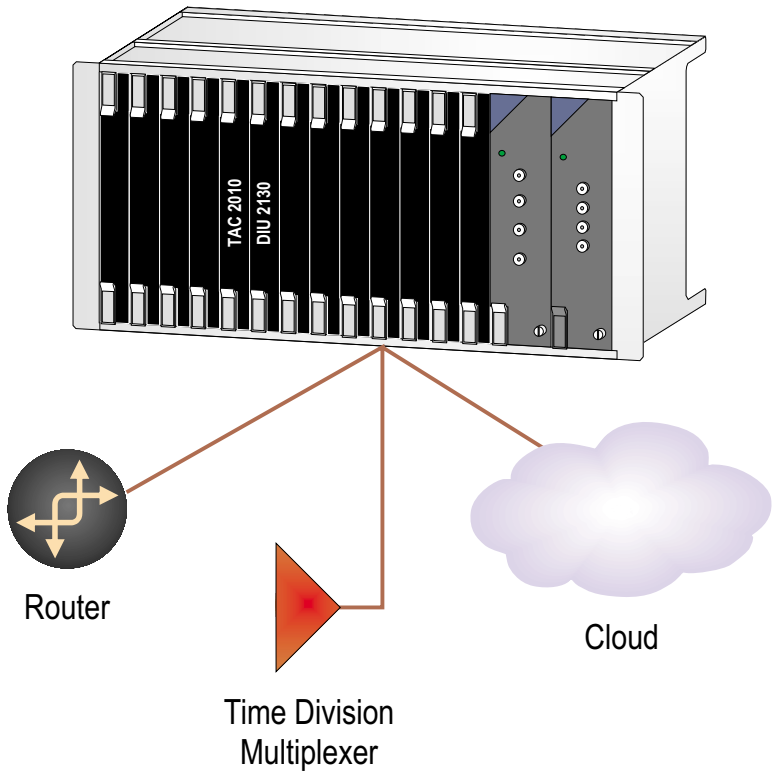
Chapter 2

Quick Set-Up

This section details a quick, step-by-step procedure for configuring the TAC 2010. For this quick configuration guide, the following assumptions are made:

- That you are adding the TAC 2010 and a single DIU 2130 DSU module to an existing installation in a Multi-line shelf.
- That the specific Multi-line shelf used is an MLS 2200, and the new modules are being placed in slots 5 and 6.
- That you are dividing the bandwidth of an ESF/B8ZS T1 evenly between the two data ports of the DIU 2130.
- That one of the data ports is used for a router and the other data port is for a time-division multiplexer.
- That you are using an NCC 2020 controller card in slot 1 of shelf 1.

Figure 2-1 Example Configuration



It is most likely that this procedure will not match your configuration exactly. Use this chapter as a guide to the process of installing your equipment. Chapter 3 provides complete details on configuration covering all selectable options.

Connect to Craft Port

Connect the modular (RJ-11) end of the Craft cable to the port labeled CRAFT or LOCAL on the front panel of the node controller module. The node controller module is usually installed in slot 1 of shelf 1. Connect the other end of the Craft cable to your PC or terminal. If your PC has a DB-9 COM port connector, use a standard PC-AT serial cable to complete the connection.

Set your terminal, or terminal program, to 19.2 kbit/s, 8 data bits, no parity, one stop bit, and *no flow control.*

Login

1. Press ENTER.
2. If the node controller module is an NCC 2020 or NCC 2130, skip to step 5, otherwise proceed to step 3.
3. If the node controller module is an NCM 2000, SCC 2020 or SCC 2130, the prompt **pSH+>** is presented.
4. Type “craft” (use lowercase) and press ENTER.
5. The prompt **YOUR PASSWORD?** is displayed.
6. Initially there is no password. Press ENTER.
7. The **Main Menu** for the controller module is displayed. See Figure 2-2.

NOTE: *The example screens in this chapter are from an NCC 2020 controller module. If you are using an NCM or SCC type of node controller the screens presented will be slightly different.*

Figure 2-2 NCC 2020 Main Menu

```
        -- VERILINK NCC NODE CONTROLLER at[1,1]: FW Rev 4.75 --
SITE NAME:
NODE ID:   0

                                  <- SLOT ->
 SHELF    1    2    3    4    5    6    7    8    9   10   11   12   13
 1 M     [C]   D    C    D    C    D    I    C    D
 2
 3
 4
 KEY: C=CSU, D=DIU, F=DIU/DDS, B=DIU/DBU, R = SRD, I=IDCSU, T=TU, S=SMDS, V=VCU


S) shelf/slot                       D) diagnostics
N) near element                     O) node administration
F) far element                      M) monitor alarms (OFF)
C) configuration                    A) alm to net mgr (OFF)
P) performance                      X) system log off


[1,1] NEAR TAC 2010 >
```

Select the CSU

Select the TAC 2010 CSU in slot 5 by using the Shelf/Slot command.

1. Type “S” and press ENTER.
2. The prompt for the Shelf/Slot command is presented.
3. Type “1,5” and press ENTER.
4. The prompt line is redisplayed with the slot number changed **[1,5]** and the module identified as a TAC 2010 at the bottom of the screen.

CSU Configuration

When installing a TAC 2010 module to be used with any type of DIU 21xx module, always configure the CSU module before configuring anything on the DIU 21xx module. When the DIU 21xx is configured, it is connected logically to a CSU. At that instant the DIU gets information from the CSU as to which data bus in the shelf midplane to use. If the CSU has not been configured yet, the DIU 21xx will not get a correct bus assignment. This is why the CSU should be configured first.

Type “C” and press ENTER. The **Configuration Menu** is presented.

Figure 2-3 TAC 2010 Configuration Menu

```
CSU CONFIGURATION -- FW Rev 1.4  HW Fab 0.8  Type TAC 2010 --

                      |-----------------------|
-------<< eq  <<-------| K) keep alive  AIS    |-------<< net <<-------
 W) framing   SF      | T) alm thld    DEF    | W) framing   ESF
 F) format    AMI     |                       | F) format    AMI
 J) jitt buf  40 BITS |                       | J) jitt buf  40 BITS
 R) eq crc    REGEN   |                       | R) net crc   REGEN
 Y) xcode yel TO NET  |                       | Y) xcode yel OFF
 M) distance  0-133   |                       | L) lbO       0 DB
------->> eq  >>-------| I) idle code   ONES   |------->> net >>-------
                      |-----------------------| Z) density   12%+80z

 X) exit menu                                   C1-C5) canned config
 S) save csu config                             Q) restore csu config

 A) diu bus   NONE                              B) diu clock THRU
 P) prm OFF



[1,5] NEAR TAC 2010 >
```

The factory default values for the TAC 2010 are shown. The unit is in CSU mode (DIU bus = **NONE**) and the network interface (shown at top right) is set for ESF framing and AMI line coding format.

The DSX-1 Equipment interface, shown at top left, is set for SF (D4) framing and AMI line code. For this quick set-up, the equipment interface is not being used, as it would be in CSU mode or drop and insert mode. Because this example will use all 24 timeslots for data on a DIU 2130 module, Mux mode is required.

1. Type "A" and press ENTER. The prompt for bus selection appears: **DSU Bus (1)NONE (2)A (3)B (4)C (5)B,D&I EQ (6)A,D&I NET >**.

2. Select "2" to use Data Bus A. This means that the CSU and the DIU 2130 will use Data Bus A in the shelf to pass data back and forth. The CSU is now in Mux mode. The EQPT LED changes from red to green.

3. Type "F" and press ENTER. The prompt for line format appears: **Line Format(eq,net) 1(AMI,AMI) 2(AMI,B8ZS) 3(B8ZS,AMI) 4(B8ZS,B8ZS) >**. Select "4" for B8ZS (since the Equipment side interface is not used, selection 2 would also work).

4. The default value for the density enforcement selection is not correct for a B8ZS T1. Use the "Z" command and select "1" to change it to **NONE**. B8ZS was developed to eliminate the need for density enforcement.

5. For this example, a Network Service Provider (NSP—the phone company) is providing a timing signal with a Digital Access and Cross-connect System (DACS). This is usually the case where an inter-exchange carrier (long distance company) is involved. When the carrier provides a timing signal, all other devices on the T1 must use that signal to derive their transmit clock. Use the "B" command for the DIU timing options and select "5" for **NET** (recovered NETwork clock).

6. There are no more changes required to the default CSU configuration to configure this example. Use the "X" command to return to the controller **Main Menu**.

Configuring the DIU 2130

For this example, the TAC 2010 is used with a DIU 2130 module in slot 6 of a Multi-line shelf. The TAC 2010 connects directly to the T1 circuit and provides CSU functionality. The DIU 2130 presents two synchronous serial interfaces for connecting the Data Terminal Equipment (DTE) and provides DSU functions.

To configure the DIU 2130, first select it.

The **S) shelf/slot** command is used to navigate from one module to another. Type "S" and press ENTER. The prompt for selecting another module appears. Type "1,6" and press ENTER.

The prompt line returns as: **[1,6] DIU 2130 (UPDATE) >** this indicates that the DIU 2130 in slot 6 has been selected.

NOTE: *Whenever the word UPDATE appears in the command line prompt, it indicates that some information has changed since the screen was last refreshed. To refresh the screen with current information, simply press* ENTER.

Configuration Menu

Type "C" and press ENTER to select the DIU 2130 **Configuration Menu**.

There is a brief delay as the node controller module attempts to communicate with a CSU module in Shelf 0, Slot 0 . This is the default value for CSU assignment in a new DIU 2130 module.

NOTE: *An address of Shelf 0, Slot 0 is not a valid address. Modules are shipped this way so they may be added to a shelf without interfering with any existing applications.*

An error message appears:

No response from csu[0,0].

The error message, in this case, means that the DIU 2130 is new and has not assigned to a CSU module. Ignore this error message.

Then the DIU 2130 **Configuration Menu** is displayed.

Figure 2-4 DIU 2130 Configuration Menu

```
       --- DIU 2130  CONFIGURATION/DIAGNOSTIC MENU ---
S) save config      Q) restore config      X) exit menu

C) CSU              [ 0,0 ]
T) timing source    CSU

   chnl 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Dp)port .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. .. ..

   Lead Toggles     DTR)   DSR)   RTS)   CTS)   DCD)
   Forced Ports     -/-    -/-    -/-    -/-    -/-

                    Port 1     Port 2        Statistics
Mp) mode            56K        56K           FW/HW Rev...1.6/0.8
Sp) scram/hdlc inv  N/N        N/N           Battery.....OK
Kp) clocking        ST         ST            DTE Intf....V.35/V.35
Gp) LOS lead        NONE       NONE          Data bus....NONE

Ep) enable loop     YES        YES           Tp) test and monitor BEC
Np) near loopback   OFF        OFF           Pp) monitor leads and status
Fp) far loopback    OFF        OFF           A)  enable alarm reporting...YES

[1,6] DIU 2130 >
```

NOTE: *For the remainder of this chapter you will not be instructed to press* ENTER *each time. Generally, the* ENTER *key is used after each command or value entry.*

The CSU command is used to assign the DIU 2130 module to the CSU with which it will be used. The TAC 2010 CSU module in slot 5 will be used for the CSU in this example. Type "C". At the prompt **enter shelf >,** type "1". At the prompt **enter slot >**, type "5". This selects the TAC 2010 in slot five of shelf one as the CSU for this DIU 2130 module.

The Timing Source defaults to CSU, meaning that the DIU 2130 will derive its transmit clock from the source selected in the CSU configuration (recovered network clock in this example). This is correct for this example.

In the middle of the display, a line across the screen lists all 24 timeslots. The DS0 (timeslot) selection prompt appears at the beginning of the next line, **Dp**. The lowercase **p** is a variable, instead of typing "p" use a port number (1 or 2). For this example timeslots 1 through 12 are to be used on data port number 1 and timeslots 13 through 24 are to be assigned to data port number 2.

Type "D1", the prompt **enter port 1 channels >** appears.

Type “1-12”. This assigns timeslots one through twelve to data port number one.

Now type “D2”, the prompt **enter port 2 channels >** appears. Type “13-24”.

Press ENTER by itself to refresh the display with the new DS0 assignments.

Figure 2-5 DIU 2130 Configuration Menu

```
       --- DIU 2130  CONFIGURATION/DIAGNOSTIC MENU ---
S) save config      Q) restore config      X) exit menu

C) CSU              [ 1,5 ]
T) timing source    CSU

   chnl 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Dp)port 01 01 01 01 01 01 01 01 01 01 01 01 02 02 02 02 02 02 02 02 02 02 02 02

   Lead Toggles     DTR)   DSR)   RTS)   CTS)   DCD)
   Forced Ports     -/-    -/-    -/-    -/-    -/-

                    Port 1     Port 2        Statistics
Mp) mode            56K        56K           FW/HW Rev...1.6/0.8
Sp) scram/hdlc inv  N/N        N/N           Battery.....OK
Kp) clocking        ST         ST            DTE Intf....V.35/V.35
Gp) LOS lead        NONE       NONE          Data bus....A

Ep) enable loop     YES        YES           Tp) test and monitor BEC
Np) near loopback   OFF        OFF           Pp) monitor leads and status
Fp) far loopback    OFF        OFF           A)  enable alarm reporting...YES

[1,6] DIU 2130 >
```

Lead toggles are used to determine whether the control leads on the synchronous serial interface will function in the normal way or be forced on. When the DTE does not assert control leads they can be forced on by typing the three letter abbreviation of the control lead. For this example the default values are appropriate.

Mode is used to determine the data rate of each of the timeslots assigned to the port. For an AMI T1 circuit the mode must be 56K. For the B8ZS T1 used in this example, 64K gives the user greater throughput. Use the “M1” and “M2” commands to set both data ports to 64K per DS0.

The remaining options are correct for this example. The T1 circuit and DTE should now be connected.

Once the CSU has been connected to the T1 circuit for at least fifteen minutes, meaningful performance statistics will be available under the **Performance Menu**. See Chapter 4 for more details.

Within 15 seconds of connecting the T1 circuit, the NET LED on the front of the TAC 2010 should change from red to green. If it does not, the **Diagnostics Menu** may be used for troubleshooting. See Chapter 5 for more information on diagnostics.

For more information on DIU 2130 modules see the *DIU 2130 User Manual*.

The configuration options for the TAC 2010 are covered in detail in Table 3-4, in Chapter 3 of this manual.

Chapter 3 Configuration

This chapter covers using the Craft interface to configure the TAC 2010 CSU, and use of the front panel thumbwheel switches which are present on NCC and SCC type controller modules.

Using the Craft Interface

To access the Craft interface, connect a terminal or a computer running a terminal program to the port labeled CRAFT or LOCAL on the front panel of the node controller module.

Craft Port Terminal Setup

Set your terminal parameters to:

Data Rate : 19.2 kbit/s

Word Size : 8 bits

Parity : None

Stop Bits : One

Flow Control: None

The Verilink Craft interface does not assert any control leads.

Verilink provides one of two types of "Craft cable". Both versions of the Craft cable have an RJ-11 modular connector at one end. The original cable has a female DB-25 connector at the other end and a more recent version has a DB-9 female connector. Connect the RJ-11 modular connector to the port labeled CRAFT or LOCAL on the front of the node controller module.

The original Craft cable pinout is shown in Table 3-1:

Table 3-1 Verilink Craft Cable p/n 458-501788-008

DB-25 female	RJ-11 modular	Usage
pin 2	pin 3	Transmit Data
pin 3	pin 4	Receive Data
pin 7	pin 5	Signal Ground

An alternative Craft cable, designed for direct connection to a PC COM port, uses DB-9 and RJ-11 connectors. See Table 3-2 for pinouts.

Table 3-2 DB-9 Craft Cable p/n 458-102119-008

DB-9 female	RJ-11 modular	Usage
pin 3	pin 3	Transmit Data
pin 2	pin 4	Receive Data
pin 5	pin 5	Signal Ground

Log In

Log in to the node controller module. If you need details on how to log in, refer to the user manual for your NCC, SCC, or NCM controller module.

The top or **Main Menu** is displayed.

Figure 3-1 Typical Controller Main Menu

```
        -- VERILINK NCC NODE CONTROLLER at[1,1]: FW Rev 4.75 --
SITE NAME:
NODE ID:   0

                                <- SLOT ->
 SHELF    1    2    3    4    5    6    7    8    9   10   11   12   13
 1 M     [C]   D    C    D    C    D    I    C    D
 2
 3
 4
 KEY: C=CSU, D=DIU, F=DIU/DDS, B=DIU/DBU, R = SRD, I=IDCSU, T=TU, S=SMDS, V=VCU


S) shelf/slot                       D) diagnostics
N) near element                     O) node administration
F) far element                      M) monitor alarms (OFF)
C) configuration                    A) alm to net mgr (OFF)
P) performance                      X) system log off


[1,1] NEAR TAC 2010 >
```

Use this menu to navigate from card to card, or choose option menus for the current card.

NOTE: *Menus shown in this manual are from an NCC module. Similar menus are presented by the SCC and NCM type controllers.*

The **Main Menu** commands are detailed in Table 3-3.

Table 3-3 NCC 2020 Main Menu Commands

Menu Option	Description	Instructions
S) shelf/slot	Used to navigate from module to module within a node.	Enter the shelf number and slot number of the desired module, use a comma delimiter (1,2).
N) near element	Selects the local node.	Used to return from a far-end element session.
F) far element	Selects the CSU at the remote end of the T1 circuit connected to the current module, functions only if ESF FDL has continuity.	Once you have navigated to the remote CSU, you may configure or troubleshoot that module only. You will not be able to navigate to other modules in that node unless you are using an SCC type controller module.
C) configuration	Selects the **Configuration Menu**.	See Figure 3-2 and Table 3-4 below.
P) performance	Selects the **Performance Menu**.	See Chapter 4 of this manual.
D) diagnostics	Selects the **Diagnostics Menu**.	See Chapter 5 of this manual.
O) node administration	Selects the **Node Administration Menu**.	See the user manual for your node controller module.
M) monitor alarms	Toggles on/off the monitor alarms function.	If monitor alarms is ON, alarm messages are displayed on the Craft interface as they occur. No alarm messages are displayed if monitor alarms is OFF.
A) alm to net mgr	Enables or disables sending alarms to a network management program. See the user manual for your node controller module and network management program.	Select OFF if there is no path to a network management program. Select ON if you are using either Access Manager 2000 or Node Manager and this NCC module is to send alarms to the network manager PC.
X) log off	Exits the **Main Menu.**	The user is logged off.

Configuration Menu

In the **Main Menu** shown in Figure 3-1, the element [C] is selected. The letter “C” is defined in the menu key as a CSU. For a card in slot 1 of shelf 1, this is an NCC 2020 or SCC 2020.

The T1 CSU portion of an NCC 2020 or SCC 2020 is a TAC 2010 card. Once an NCC or SCC is installed in a node, additional T1 CSU requirements are met by adding TAC 2010 modules.

Each node (group of shelves connected together) must have only one type of controller card. The first such card should be located in slot 1 of shelf 1. If additional CSU cards are needed, use TAC 2010 cards instead of adding more NCC or SCC cards.

Therefore, a “C” located in the slot 1, shelf 1 position represents an NCC 2020 or SCC 2020 while a “C” located at some other position represents a TAC 2010.

Use the command “C”, to display the **Configuration Menu** for the element.

Figure 3-2 CSU Configuration Menu

```
CSU CONFIGURATION -- FW Rev 1.4  HW Fab 0.8  Type TAC 2010 --

                       |-----------------------|
-------<< eq  <<-------| K) keep alive  AIS    |-------<< net <<-------
 W) framing   SF       | T) alm thld    DEF    | W) framing   ESF
 F) format    AMI      |                       | F) format    AMI
 J) jitt buf  40 BITS  |                       | J) jitt buf  40 BITS
 R) eq crc    REGEN    |                       | R) net crc   REGEN
 Y) xcode yel TO NET   |                       | Y) xcode yel OFF
 M) distance  0-133    |                       | L) lbO       0 DB
------->> eq  >>-------| I) idle code   ONES   |------->> net >>-------
                       |-----------------------| Z) density   12%+80z

 X) exit menu                                    C1-C5) canned config
 S) save csu config                              Q) restore csu config

 A) diu bus   NONE                               B) diu clock THRU
 P) prm OFF



[1,1] NEAR TAC 2010 >
```

Configuration Menu Commands

Some of the commands on the CSU **Configuration Menu** are shown on both the left and right sides of the screen. Commands that are used for both DSX-1 equipment and T1 network ports are repeated on both the equipment and the net side of the diagram. Command prompts for these options present pairs of values: the value for the equipment side is followed by the value for the network side.

For example, if connecting a D4 (SF) channel bank to an ESF T1 circuit the **SF,ESF** framing selection is used.

Table 3-4 below describes the TAC 2010 CSU **Configuration Menu** options:

Table 3-4 CSU Configuration Options

Menu Option	Description	Instructions
W) framing	Selects T1 framing mode for both DSX-1 equipment port and T1 network port. Selection for the Equipment side must match the configuration of the DSX-1 equipment. Selection for the T1 network side must match the type of T1 installed by the network service provider.	First value = DSX-1 equipment, second value = T1 circuit. 1(SF,SF)—D4 equipment and a D4 T1. 2(ESF,SF)—ESF equipment and a D4 T1. 3(SF,ESF)—D4 equipment and an ESF T1. 4(ESF,ESF)—ESF equipment and an ESF T1. 5(UF,UF)—unframed equipment on an unframed T1 (never use this option on a T1 circuit provided by a telephone company). 6(SF,ZBT)—D4 equipment on a Zero Bit Time Slot Insertion T1. There are no ZBTSI T1 circuits. Do not use this option. 7(ESF,ZBT)—ESF equipment on a ZBTSI T1. There are no ZBTSI T1 circuits. Do not use this option.
F) format	Selects AMI or B8ZS for the DSX-1 equipment and T1 network line codes, must match T1 and equipment settings. In Mux mode (where no DSX-1 equipment is used), only the second parameter is meaningful.	First value = DSX-1 equipment, second value = T1 circuit. 1(AMI,AMI)—AMI coded DSX-1 equipment on an AMI T1. 2(AMI,B8ZS)—AMI DSX-1 equipment on a B8ZS T1. 3(B8ZS,AMI)—B8ZS DSX-1 equipment on an AMI T1 (this selection is problematic unless the equipment is configured to use only 56K of each DS0 instead of 64K per DS0). 4(B8ZS,B8ZS)—B8ZS DSX-1 equipment on a B8ZS T1.
J) jitt buf	Jitter Buffer selects the size of the jitter buffer, in bits, on the DSX-1 and Network sides of the CSU. Larger buffers are more resistant to a jittery signal; smaller buffers introduce less delay.	1(16,16)—Sets both buffers to 16 bit depth, less resilience to jitter and less delay. 2(40,16)—Sets DSX-1 side to 40 bits and network side to 16 bits. 3(16,40)—Sets the DSX-1 side to 16 bits and the network side to 40 bits. 4(40,40)—Sets the default value of 40-bit jitter buffer on both sides of the CSU.
R) eq crc	Selects whether or not the CSU will regenerate the CRC-6 error checking used in ESF framing on both, one, or no sides.	1(PASS)—same type framing on both sides. 2(NET TO EQ)—ESF equipment on a non-ESF T1. 3(EQ TO NET)—non-ESF equipment on an ESF T1. 4(BOTH)—use in Drop and Insert mode if equipment and T1 are both ESF.
Y) xcode yel	Selects whether yellow alarms will be translated from the D4 bit 2 method to the ESF FDL method.	1(OFF)—use for same type framing on both sides or to have the CSU drop yellow alarms with dissimilar framing. 2(NET TO EQ)—ESF equipment and non-ESF T1. 3(EQ TO NET)—D4 equipment on an ESF T1. 4(BOTH)—not used.

Menu Option	Description	Instructions
M) distance	Cable length option, used to increase DSX-1 signal strength when DSX-1 cable is long.	Choices are: (1)0-133 (2)133-266 (3)266-399 (4)399-533 (5)533-655—Select the value that most nearly equals the length of the cable between the CSU and the local DSX-1 equipment.
L) lbo	Line build out is used to reduce the signal strength being sent to the T1 network. New T1 circuits installed by a telephone company in the USA will have a smart jack—use 0db.	(1) 0 db—use this value if a smart jack (network termination device) has been installed by the telephone carrier, or if the first active device on the T1 is between 2,000 and 3,000 feet away. (2) 7.5 db—use this value only if there is no smart jack and the first repeater is 1,000 to 2,000 feet away. (3) 15 db—use this value only if there is no smart jack and the first repeater is zero to 1,000 feet away.
K) keep alive	Selects the method used to guarantee sufficient pulse density is sent to the T1 when the DSX-1 equipment has failed or is disconnected. The value “none” should not be used on a commercial T1 circuit as it violates T1 standards (AT&T 54016 and ANSI T1.403).	(1)none—no method of keep alive is used in the absence of a valid, framed DSX-1 signal. Do not use this value on a T1 circuit provided by a telephone company. (2)loop—when the DSX-1 signal fails, the CSU loops data received from the T1 back toward the T1 to meet pulse density requirements. (3)ais—the CSU sends a pattern of unframed all ones (Alarm Indication Signal) to the network during a DSX-1 equipment failure, thus alerting the carrier and far-end equipment to trouble on the T1. (4)fais—the CSU sends a framed pattern of all ones. This should not create a T1 level alarm, but voice switching equipment will see all 24 timeslots in a busy state at the far end.
T) alm thld	Selects enabling or disabling thresholds.	(1)disable—Alarm threshold function is shut off. (2)default—Default values for alarm thresholds are enabled.
I) idle code	Selects idle pattern to be sent in 4K FDL, used for ESF circuits only. No effect on SF.	1(flag's)— idle code of 01111110 is sent in Facilities Data Link when no other traffic is present. 2(one's)—idle code of 11111111 is sent in Facilities Data Link when no other traffic is present.
Z) density	Selects density enforcement technique. Density should always be set to NONE on a B8ZS T1, B8ZS allows a full 64K per DS0. Density should never be set to NONE on an AMI T1.	(1)NONE—no density enforcement. Use this value only and always on a B8ZS T1. (2)12—The CSU begins stuffing ones into the user datastream after 12 consecutive zeroes. (3)62411—The CSU enforces AT&T publication 62411 density restrictions (average 12.5% minimum ones density). (4)80 0's—The CSU begins stuffing ones into the user datastream after 80 consecutive zeroes (recommended). (5)15 0's—The CSU begins stuffing ones into the user datastream after 15 consecutive zeroes.

Menu Option	Description	Instructions
C1-C5) canned config	Allows selection of any of five complete configurations which all use CSU mode (no DIU 21xx) and vary according to framing and line coding on EQ and Net sides.	Canned configuration #1, EQPT=SF/AMI NET=ESF/AMI. Canned configuration #2, EQPT=ESF/AMI NET=ESF/AMI. Canned configuration #3, EQPT=SF/AMI NET=ESF/B8ZS. Canned configuration #4, EQPT=SF/B8ZS NET=ESF/B8ZS. Canned configuration #5, EQPT=ESF/B8ZS NET=ESF/B8ZS.
S) save csu config	Stores the current CSU configuration.	Configuration information for other modules in the node can be saved in non-volatile RAM in the NCC type node controllers. This feature is not supported in the SCC series.
Q) restore csu config	Restores stored configuration.	If the configuration for a module has been previously stored in an NCC, a replacement module can be placed in the same slot and sent the stored configuration.
A) diu bus	Selects both the "Mode" in which the CSU will operate (CSU, Mux or Drop and Insert) as well as which midplane data bus, if any, will be used to exchange data with any DIU 21xx modules. In Mux mode, the TAC 2010 EQPT LED is always green.	(1)NONE—no data bus, CSU is in CSU mode. (2)A—Mux mode using data bus A. (3)B—Mux mode using data bus B. (4)C—Mux mode using data bus C. (5)B,D&I EQ—Drop and Insert mode toward equipment (some DSX-1 timeslots routed to *local* DIU. Rarely or never used). (6)A,D&I NET—Drop and Insert toward the Net (some network timeslots routed to DSX-1 port, some others to one or more DIU modules). This is typical drop and insert.
B) diu clock	Selects the source of the Transmit Clock used by the CSU to transmit data toward the T1 network. Note that in CSU mode (DIU Bus = NONE), this option is ignored. The TAC 2010 performs as though THRU timing were selected. In Drop and Insert mode, use of THRU timing is suggested. In Mux mode, if the far end CSU is set for INT clock or if the carrier is using a DACS to provide a clock, then NET (recovered network clock) is required.	(1)THRU—The CSU derives transmit clock from the transmit datastream of the DSX-1 equipment, automatically selected in CSU mode, recommended in Drop and Insert mode, and invalid in Mux mode. (2)INT—The CSU uses an internal oscillator to generate a 1.544 MHz clock. Used only in Mux mode, and then only at one end of a T1 on which the carrier uses no DACS. (3)EXT 422—The CSU uses a balanced clock signal provided by an external source through the DIN connector on the rear connector module. (4)EXT TTL—The CSU uses an unbalanced (0V to +5V) clock signal provided by an external clock source through the DIN connector on the rear connector module. (5)NET—The CSU uses the clock recovered from receive data on the T1 network port for the transmit clock, this is most often the desired option in Mux mode and is required if the network provides a clock (uses a DACS). (6)EQ—The CSU recovers the DSX-1 T1 transmit clock to time the network transmit. (7)TIU—The CSU uses a clock on data bus C produced by an optional TIU 2850 module installed in the same shelf. (8)DIU—The CSU uses a clock provided by DTE connected to a data port on a DIU 213x module. Tail-circuit timing requires this option.

Menu Option	Description	Instructions
P) prm	Performance Response Messages may optionally be sent in the 4K FDL portion of an ESF framed T1.	1(NO)—Performance response messages received from the network are ignored. No messages are sent. 2(USER)—Performance response messages are allowed responses and information stored in the user ESF registers is made available. Used by pro-active carriers.
O) poll far end	If enabled on a point-to-point ESF T1, far-end polling can monitor alarms at a remote CSU.	(1) yes—far-end polling is used. Requires FDL continuity from end to end. A DACS in the T1 usually terminates the FDL making this unusable. Note that ESF is required to use this option. (2) no—far-end polling is not supported.
G) Alarm	Determines whether or not alarm messages are presented.	0(Disable)—Alarm reporting is turned off. 1(Enable)—Alarm reporting is enabled. Messages will appear on the Craft terminal as alarms occur and clear.
X) exit menu	Exit this menu.	Returns to the TAC 2010 **Main Menu**.

Mode

The TAC 2010 CSU, has three distinctly different modes of operation.

- CSU Mode
- Mux Mode
- Drop and Insert Mode

The mode is determined by the selection for **DIU bus** on the **Configuration Menu**.

CSU Mode

In CSU mode, the TAC 2010 does not use any data bus in the shelf to pass data to any other module. All 24 timeslots in the T1 signal are passed, unmodified, to the DSX-1 equipment port. In the transmit direction, the DSX-1 device is the timing source and the CSU behaves as if THRU timing is selected, despite what the menu may indicate. Any DIU 21xx modules present in the shelf are ignored in terms of data flow.

A TAC 2010 is in CSU mode whenever the DIU bus option is set to **NONE**. A typical use of CSU mode would be for voice-only PBX applications.

Mux Mode

In Mux mode, the DSX-1 equipment port is not used. All 24 timeslots of the T1 signal are available for use by some number of DIU 21xx module(s) assigned to the CSU. The CSU is configured to use one of the three data busses in the midplane of the shelf. Any associated DIU 21xx modules use this bus to accept receive data from and present transmit data to the CSU. The CSU multiplexes data from up to 24 ports on up to 24 DIU modules into the T1 transmit datastream.

A TAC 2010 module is in Mux mode when the DIU bus option is set to **A**, **B**, or **C**. A typical use of Mux mode would be for data-only applications.

Drop and Insert Mode

Drop and Insert mode combines the features of CSU mode and Mux mode. The DSX-1 equipment port is used for some of the T1 timeslots and data bus A is used to pass other timeslots to some DIU 21xx module(s). Since the CSU cannot control the transmit data rate of the DSX-1 equipment, the CSU is usually configured to recover transmit clock from the DSX-1 datastream (THRU timing).

Drop and Insert mode is established by selecting **A, D&I NET** for the DIU bus option. When this is done, a new option field appears in the **Configuration Menu**, beneath the PRM field, as shown in Figure 3-3:

Figure 3-3 Select D&I DSOs Field

```
A) diu bus   A,D&I NET
P) prm OFF
D) select D&I DS0s (1,-,24)
_ _ _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _
G) Alarm ENABLE
```

This field is used to select the timeslots for data use. Any timeslots shown in this field are placed on data bus A for use by a DIU 21xx module. The DSX-1 equipment will receive a framed all-ones signal in those timeslots, making them appear busy to a PBX. Timeslots not listed in this field are allowed to pass unmodified to the DSX-1 equipment.

Clearing Configuration

To reset a TAC 2010 to its factory default configuration, interrupt the battery used to protect stored configuration information.

There have been three different versions of the TAC 2010 module. Each requires a different method for interrupting the battery backup of stored options.

Identifying Your Card

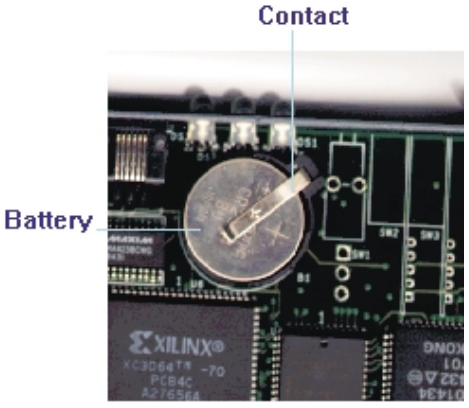
Use this procedure to determine which of the three versions of TAC 2010 module you have.

1. Does the front panel of the TAC 2010 have an RJ-11 modular connector?
   a. Yes—You have an original or intermediate version of the card. Proceed to step 2.
   b. No—You have the latest version of the TAC 2010, use Procedure 3 Current.
2. The battery is located on the component side of the TAC 2010 module, directly behind the three LEDs. Is the battery in a black plastic socket?
   a. Yes—You have an original version TAC 2010, use Procedure 1 Original.
   b. No—You have an intermediate version TAC 2010, use Procedure 2 Intermediate.

Procedure 1 Original

If the battery is surrounded by a black plastic socket, you can interrupt the battery and reset the module to default configuration by inserting a thin piece of cardboard, such as a business card, between the battery and the contact which connects to the positive pole. See Figure 3-4:

Figure 3-4 Original Version

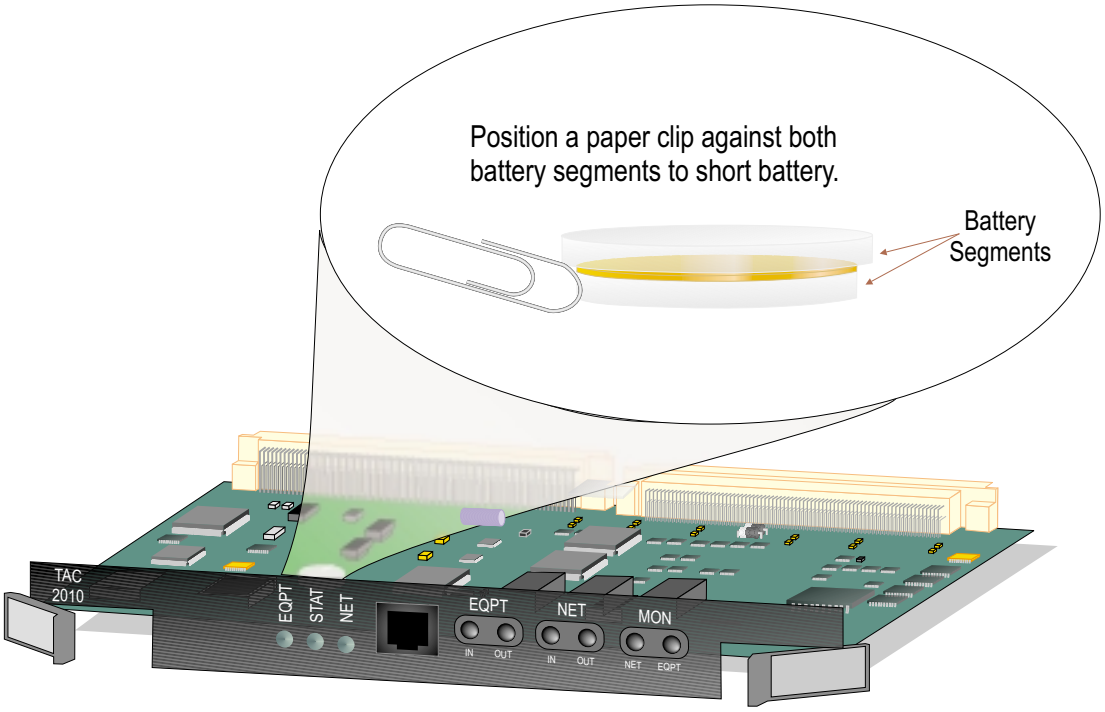


Procedure 2 Intermediate

If the battery is directly behind the three LEDs, but not in a black plastic socket, it is soldered directly to the printed circuit board.

To reset the module to default, momentarily short the positive and negative poles of the battery. The positive pole is the top and the negative pole is the lower portion of the battery. Briefly short them to each other using a short jumper wire, the blade of a pocket screwdriver, or a paper clip. See Figure 3-5:

Figure 3-5 Intermediate Version

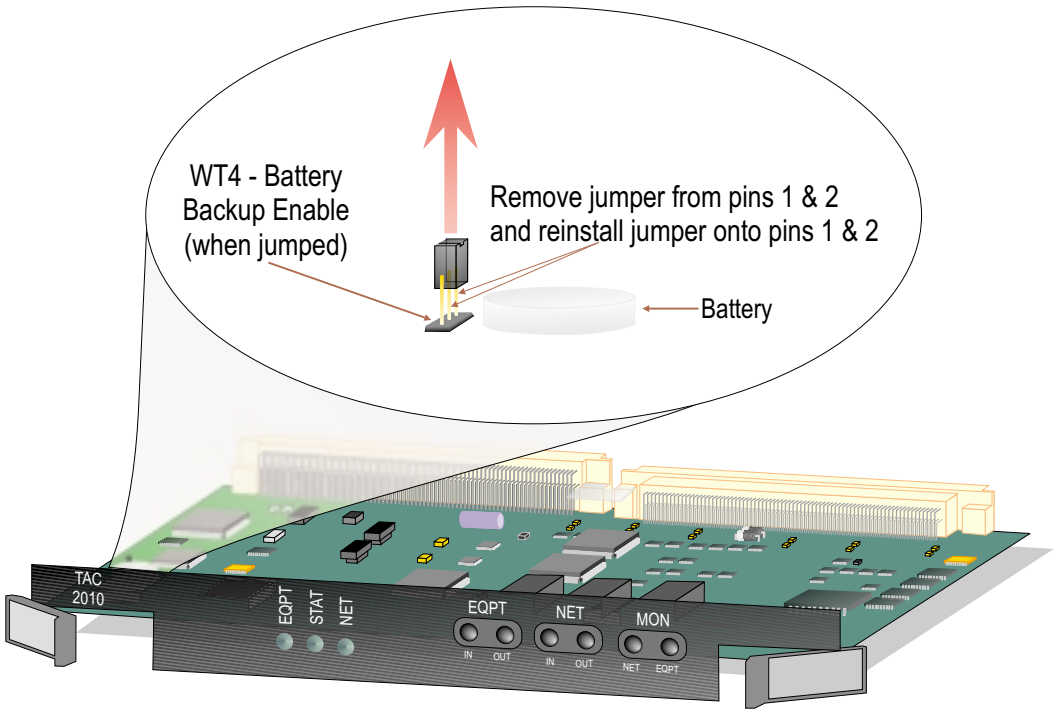


Procedure 3 Current

The current version of the TAC 2010 is easily recognized by the absence of an RJ-11 modular connector on the front panel.

The current TAC 2010 has a berg jumper which completes the battery circuit. By momentarily removing this jumper, then re-inserting it, the module is reset to the default configuration. See Figure 3-6:

Figure 3-6 Current Version



Firmware Upgrade Procedures

Firmware upgrades to a TAC 2010 may be done in two ways:

- Replacing the socketed EEPROM which holds the CSU firmware.
- Using either Access Manager 2000 or Node Manager to download new code to the module.

Replacing the EEPROM

The TAC 2010 CSU firmware resides in a socketed EEPROM.

- In a TAC 2010 module which has an (unused) RJ-11 modular connector on the front panel (older versions), the firmware resides in socket U11.
- In a TAC 2010 module which does not have an RJ-11 connector on the front panel (current version), the firmware resides in socket U12.

Contact Verilink Technical Support if you require a firmware upgrade.

Network Management Programs

Both Access Manager 2000 and Node Manager offer download procedures which may be used to upgrade the TAC 2010 CSU.

For details on using Access Manager 2000 to upgrade a TAC 2010, refer to the *Access Manager 2000 User Manual*.

For details on using Node Manager to upgrade an NCC 2020 or the other modules it controls, refer to the *Node Manager for Windows 95 User Manual*.

Thumbwheel Switches

Thumbwheel switches are present on the front panel of the NCC and SCC type node controller modules. They are provided as a measure of last resort for configuring the application modules.

Whenever possible, use the Craft interface or a network management program instead of the thumbwheels.

Thumbwheel Procedure

A four-step procedure is used for each thumbwheel command:

1. Set the thumbwheel to the number, 01 through 30, equal to the slot number of the module to be configured. If a node consists of multi-line shelves, the first slot in shelf two would be numbered as 14 and the last slot 26. In a node consisting of all dual-line shelves, the first (left-hand) slot of a second shelf is number 03.

2. Rapidly press the EXE pushbutton twice, as if double-clicking a mouse. If the NCC or SCC accepts your double-click, the STAT LED on the selected module will begin to blink green to off. If the STAT LED does not begin to blink, try double clicking again at a slightly faster or slower rate. Do not proceed to step 3 until the STAT LED on the desired module begins to blink. Once the STAT LED does begin to blink, do steps 3 and 4 within 60 seconds or the procedure will time-out.

3. Set the thumbwheel switches to the command value to be used, per Table 3-5 below.

4. Double-click the EXE pushbutton again. If the NCC or SCC module accepts your double-click, the STAT LED on the selected module will stop blinking green to off and will return to some other state. If the STAT LED on the module continues to blink green to off, the NCC or SCC did not accept your double-click. Try double-clicking again, at a faster or slower

rate. If you are not successful within 60 seconds of the time you selected the module in step 2, the module will timeout and return to its normal state. If this happens, start over with step 1 of this procedure.

Thumbwheel Commands

Table 3-5 lists the commands available through the front panel thumbwheels.

Table 3-5 Thumbwheel Switch Commands

Code	Applies to	Description
01 to 30	Any of first 30 modules	Selects a module in the indicated slot, up to slot 30. A node controlled by an NCC module may contain a maximum of 30 modules. A node controlled by an SCC may have up to 52 modules, but only the first 30 modules can be selected with the thumbwheel switches.
31	NCC 2020 NCC 2130 SCC 2020 SCC 2130	Accesses the controller functionality of the NCC or SCC node controller (not the T1 CSU portion). For an NCC or SCC in slot 1 of shelf 1, use address 01 to set CSU options.
32	NCC 2020 NCC 2130 SCC 2020 SCC 2130	Resets the modem interface by sending the configured modem initialization string to the DB-9 modem port.
40	NCC 2020 SCC 2020 TAC 2010	Canned configuration #1, EQPT=SF/AMI NET=ESF/AMI.
41	NCC 2020 SCC 2020 TAC 2010	Canned configuration #2, EQPT=ESF/AMI NET=ESF/AMI.
42	NCC 2020 SCC 2020 TAC 2010	Canned configuration #3, EQPT=SF/AMI NET=ESF/B8ZS.
43	NCC 2020 SCC 2020 TAC 2010	Canned configuration #4, EQPT=SF/B8ZS NET=ESF/B8ZS.
44	NCC 2020 SCC 2020 TAC 2010	Canned configuration #5, EQPT=ESF/B8ZS NET=ESF/B8ZS.
45	NCC 2020 NCC 2130	The configuration of the selected module—having been previously stored— is restored to the module from the NCC. Not supported by SCC modules.
46	NCC 2020 NCC 2130	The configuration of the module selected in steps 1 and 2 of this thumbwheel command sequence is stored in the NCC. If the module is replaced or loses its configuration later, command 45 may be used to restore it. Not supported by SCC modules.

Code	Applies to	Description
47	NCC 2020 NCC 2130 SCC 2020 SCC 2130 TAC2010 TAC 2130	Network LBO = 0 dB; Typical value—use when a T1 installed by a local Bell carrier is terminated in a “smart jack”, (network termination device) or the first repeater is 2000 to 3000 feet away.
48	NCC 2020 NCC 2130 SCC 2020 SCC 2130 TAC2010 TAC 2130	Network LBO = 7.5 dB; Attenuates transmit signal by 7.5db. *USE ONLY IF NO SMART JACK IS PRESENT* . Implies that the first active device (repeater, T3 mux, far CSU) is 1000 to 2000 feet away.
49	NCC 2020 NCC 2130 SCC 2020 SCC 2130 TAC2010 TAC 2130	Network LBO = 15 dB; Attenuates transmit signal by 15db. *USE ONLY IF NO SMART JACK IS PRESENT* . Implies that the first active device (repeater, T3 mux, far CSU) is 0 to 1000 feet away.
50	NCC 2020 SCC 2020 TAC 2010	Selects DSX-1 Equipment cable length of 0-132 ft.
51	NCC 2020 SCC 2020 TAC 2010	Selects DSX-1 Equipment cable length of 133-265 ft.
52	NCC 2020 SCC 2020 TAC 2010	Selects DSX-1 Equipment cable length of 266-398 ft.
53	NCC 2020 SCC 2020 TAC 2010	Selects DSX-1 Equipment cable length of 399-532 ft.
54	NCC 2020 SCC 2020 TAC 2010	Selects DSX-1 Equipment cable length of 533-655 ft.
55	NCC 2020 SCC 2020 TAC 2010 DIU 2140	Sets data bus to NONE (CSU mode) [default].
56	NCC 2020 SCC 2020 TAC 2010 DIU 2140	Sets data bus to A (Mux mode).
57	NCC 2020 SCC 2020 TAC 2010 DIU 2140	Sets data bus to B (Mux mode).

Code	Applies to	Description
58	NCC 2020 SCC 2020 TAC 2010 DIU 2140	Sets data bus to C (Mux mode).
59	NCC 2020 NCC 2130 SCC 2020 SCC 2130 TAC2010 TAC 2130	Sends in-band CSU loop-up code to far-end CSU. This should cause the far end CSU to enter a Line Loopback condition.
60	NCC 2020 NCC 2130 SCC 2020 SCC 2130 TAC2010 TAC 2130	Sends framed QRSS to far end.
61	NCC 2020 NCC 2130 SCC 2020 SCC 2130 TAC2010 TAC 2130	Stops QRSS pattern and sends inband CSU loop-down code to far end.
62	DIU 2140	Uses timeslot 24 on the assigned CSU. Sets all 5 data ports to 9.6 kbit/s.
63	DIU 2140	Selects split timing (RX clock ~ TX clock); typical value.
64	DIU 2140	Selects single source timing (RX clock = TX clock).
65	DIU 2140	Sets DTE timing option for all synchronous data ports to ST.
66	DIU 2140	Sets DTE timing option for all synchronous data ports to $\overline{\text{ST}}$.
67	DIU 2140	Sets DTE timing option for all synchronous data ports to TT.
68	DIU 2140	Sets RTS to normal operation. For synchronous data ports, data is transmitted ONLY if the DTE asserts RTS (ignored in Async) [default].
69	DIU 2140	Sets RTS to forced “on” (requires version 1.1 DIU 2140 firmware), data is sent regardless of actual state of RTS from DTE. This behavior always applies to Async ports.
80	DIU 2130 NCC 2130 SCC 2130 TAC 2130	Sets Data Port 1 to tail-circuit timing. Note that TAC 2130-T and TAC 2130-S modules do not support tail circuit timing, external timing or TIU 2850 timing.
81	DIU 2130 NCC 2130 SCC 2130 TAC 2130	Canned configuration #1—assigns all 24 timeslots to data port #1.

Code	Applies to	Description
82	DIU 2130 NCC 2130 SCC 2130 TAC 2130	Canned configuration #2—assigns timeslots 1-12 to data port #1 and timeslots 13-24 to data port #2 (data port #2 ignored by TAC 2130).
83	DIU 2130 NCC 2130 SCC 2130 TAC 2130	Canned configuration #3—assigns timeslots 1-8 to data port #1 and timeslots 9-16 to data port #2 (data port #2 ignored by TAC 2130).
84	DIU 2130 NCC 2130 SCC 2130 TAC 2130	Canned configuration #4—assigns timeslots 1-6 to data port #1 and timeslots 7-12 to data port #2 (data port #2 ignored by TAC 2130).
85	DIU 2130 NCC 2130 SCC 2130 TAC 2130	Canned configuration #5—assigns timeslots 1-4 to data port #1 and timeslots 5-8 to data port #2 (data port #2 ignored by TAC 2130).
86	DIU 2130 NCC 2130 SCC 2130 TAC 2130	Canned configuration #6—assigns timeslots 1-2 to data port #1 and timeslots 3-4 to data port #2 (data port #2 ignored by TAC 2130).
87	DIU 2130 NCC 2130 SCC 2130 TAC 2130	Canned configuration #7—assigns timeslots 1-23 to data port #1 and timeslot 24 to data port #2 (data port #2 ignored by TAC 2130).
88	DIU 2130 NCC 2130 SCC 2130 TAC 2130 DIU 2131	Sets DTE port(s) clock to TT. The data port samples Transmit Data during the negative going transition of a clock received from the DTE (on the pair Terminal Timing in RS-422, SCTE in V.35 or XTC in RS-232).
89	DIU 2130 NCC 2130 SCC 2130 TAC 2130 DIU 2131	Sets DTE port(s) clock to inverted ST ($\overline{ST}$). The data port samples the Transmit Data lead during the positive going transition of the transmit clock signal.
90	DIU 2130 NCC 2130 SCC 2130 TAC 2130 DIU 2131	Sets DTE ports to $n \times 56$ kbit/s (as required for an AMI T1).
91	DIU 2130 NCC 2130 SCC 2130 TAC 2130 DIU 2131	Unassigns port 1 timeslot(s).
92	DIU 2130 DIU2131	Unassigns port 2 timeslot(s).

Code	Applies to	Description
99	NCC 2020 NCC 2130 SCC 2020 SCC 2130	Resets password for the Craft interface to the default condition (no password).
00	ALL	Clears the address command. Releases currently selected module. Use this command if you change your mind after selecting a module in step two, or if you select the wrong module accidentally, or to practice double-clicking.

Chapter 4

Performance Monitoring

Once the TAC 2010 is installed, the performance monitoring routines allow you to monitor the performance of the T1 circuit.

The TAC 2010 maintains a history of the T1 circuit performance for the previous 24 hours and offers the ability to examine various tables.

Performance statistics can be viewed in a Craft interface session.

As described by the various technical publications which define ESF (Extended SuperFrame), the TAC 2010 maintains performance records in 15-minute intervals. After a TAC 2010 has been operating for 24 hours, there are 96 of these 15-minute intervals stored in the CSU registers.

Performance Monitoring Menu

Most of the information accessible under the **Performance Monitoring Menu** is only available with an ESF T1. CRC-6 error checking, used to detect errored seconds, is only present on an ESF T1.

The **Performance Monitoring Menu** is accessed by typing "P" while at the TAC 2010 **Main Menu**.

The **Performance Monitoring Menu** offers six options to display information and a Reset Registers command to clear all stored information.

Figure 4-1 Performance Monitoring Menu

```
            --- PERFORMANCE MONITORING ---

        N)    1 hour network
        E)    24 hour es
        B)    24 hour bes
        S)    24 hour ses
        U)    24 hour uas
        L)    24 hour lofc
        R)    reset registers
        X)    exit menu

[1,5] NEAR TAC 2010 >
```

Definitions

The acronyms shown on the **Performance Monitoring Menu** are described in Table 4-1 below

Table 4-1 Performance Monitoring Menu Acronyms

Acronym	Meaning
ES	Errored Second—any second during which one or more bit errors have been detected.
BES	Bursty Errored Seconds—a second having between 2 and 319 CRC-6 error events. Bursty errored seconds are not counted when an SES or UAS is counted.
SES	Severely Errored Second—a second with 320 or more CRC-6 error events, or one or more OOF (Out of Frame) events.
UAS	Unavailable Second—any second during which an Unavailable Signal State occurs. An Unavailable Signal State condition is declared after ten consecutive SES and clears only after ten consecutive seconds which are not Severely Errored Seconds.
LOFC	Loss of Frame Count—an accumulated value equal to the number of times that a Loss of Frame has been declared. Loss of frame is declared when either LOS (Loss of Signal) or OOF (Out of Frame) is true for two to three seconds. LOF is cleared only after 10 seconds with LOS and OOF clear.

One Hour Network

The One Hour Network function produces a 24-hour summary for each of the parameters described in Table 4-1 above. Also shown are counts for each of the same alarm conditions for the preceeding hour, in four 15-minute intervals.

Figure 4-2 One Hour Network Report

```
 ONE HOUR PERFORMANCE DATA
6-3-98  12:10:44
Site Name: Tech Pubs TAC 2010
                              ELEMENT ID  1, 1
Valid Intervals  96       Seconds in Current Interval 464

ES      UAS     BES     SES     LOFC
0       0       0       0       0       24 Hour Total
0       0       0       0       0       Current Interval
0       0       0       0       0       Interval 1
0       0       0       0       0       Interval 2
0       0       0       0       0       Interval 3
0       0       0       0       0       Interval 4

[1,5] NEAR TAC 2010 >
```

24-hour Errored Seconds

The 24-hour Errored Seconds selection on the **Performance Monitoring Menu** displays the errored second counts for each of the last 96 fifteen-minute intervals. Errored seconds are the least serious of the error conditions tracked by the CSU. A typical errored seconds display is shown below in Figure 4-3.

Figure 4-3 24-Hour Errored Seconds

```
24 HOUR ES PERFORMANCE DATA  6-3-98  12:25:26
Site Name: Tech Pubs TAC 2010
                              1, 1
Valid Intervals  96       Seconds in Current Interval 627
ES   in 24 Hours  23      ES   in Current Interval     0

 1: 0     17: 0     33: 0     49: 0     65: 0     81: 0
 2: 0     18: 0     34: 0     50: 0     66: 0     82: 0
 3: 0     19: 3     35: 0     51: 0     67: 0     83: 0
 4: 0     20: 0     36: 0     52: 0     68: 0     84: 0
 5: 0     21: 0     37: 0     53: 0     69: 0     85: 0
 6: 0     22: 0     38: 0     54: 0     70: 0     86: 0
 7: 0     23: 0     39: 0     55: 0     71: 0     87: 0
 8: 0     24: 0     40: 0     56: 0     72: 0     88: 0
 9: 0     25: 0     41: 0     57: 0     73: 0     89: 0
10: 0     26: 0     42: 0     58: 0     74: 0     90: 0
11: 0     27: 0     43: 0     59: 0     75: 0     91: 0
12: 0     28: 0     44: 5     60: 0     76: 0     92: 0
13: 0     29: 0     45: 0     61: 0     77: 0     93: 0
14: 0     30: 0     46: 0     62: 0     78: 15    94: 0
15: 0     31: 0     47: 0     63: 0     79: 0     95: 0
16: 0     32: 0     48: 0     64: 0     80: 0     96: 0

[1,5] NEAR TAC 2010 >
```

24-Hour Bursty Errored Seconds

Bursty Errored Seconds are more severe than errored seconds and can cause some applications to lose sessions or suffer excessive retransmissions.

A typical 24-Hour Bursty Errored Seconds display is shown in Figure 4-4.

Figure 4-4 24-Hour Bursty Errored Seconds

```
24 HOUR BES PERFORMANCE DATA  6-3-98  12:43:46
Site Name: Tech Pubs TAC 2010
                              1, 1
Valid Intervals  96       Seconds in Current Interval 829
BES  in 24 Hours  0       BES  in Current Interval     0

 1: 0     17: 0     33: 0     49: 0     65: 0     81: 0
 2: 0     18: 0     34: 0     50: 0     66: 0     82: 0
 3: 0     19: 0     35: 0     51: 0     67: 0     83: 0
 4: 0     20: 0     36: 0     52: 0     68: 0     84: 0
 5: 0     21: 0     37: 0     53: 0     69: 0     85: 0
 6: 0     22: 0     38: 0     54: 0     70: 0     86: 0
 7: 0     23: 0     39: 0     55: 0     71: 0     87: 0
 8: 0     24: 0     40: 0     56: 0     72: 0     88: 0
 9: 0     25: 0     41: 0     57: 0     73: 0     89: 0
10: 0     26: 0     42: 0     58: 0     74: 0     90: 0
11: 0     27: 0     43: 0     59: 0     75: 0     91: 0
12: 0     28: 0     44: 0     60: 0     76: 0     92: 0
13: 0     29: 0     45: 0     61: 0     77: 0     93: 0
14: 0     30: 0     46: 0     62: 0     78: 0     94: 0
15: 0     31: 0     47: 0     63: 0     79: 0     95: 0
16: 0     32: 0     48: 0     64: 0     80: 0     96: 0

[1,5] NEAR TAC 2010 >
```

24-Hour Severely Errored Seconds

Severely Errored Seconds pose a serious threat to the integrity of your data. Since a T1 offers a maximum of 1.536 Mbit/s, an error rate over 320 per second becomes significant. Severely errored seconds can also result from Out of Frame (OOF) conditions. During an OOF event all user data is lost.

A typical 24-Hour Severely Errored Seconds Report is shown in Figure 4-5.

Figure 4-5 24-Hour Severely Errored Seconds

```
24 HOUR SES PERFORMANCE DATA  6-3-98  12:48:46
Site Name: Tech Pubs TAC 2010
                              1, 1
Valid Intervals  96       Seconds in Current Interval 231
SES  in 24 Hours  0       SES  in Current Interval     0

 1: 0     17: 0     33: 0     49: 0     65: 0     81: 0
 2: 0     18: 0     34: 0     50: 0     66: 0     82: 0
 3: 0     19: 0     35: 0     51: 0     67: 0     83: 0
 4: 0     20: 0     36: 0     52: 0     68: 0     84: 0
 5: 0     21: 0     37: 0     53: 0     69: 0     85: 0
 6: 0     22: 0     38: 0     54: 0     70: 0     86: 0
 7: 0     23: 0     39: 0     55: 0     71: 0     87: 0
 8: 0     24: 0     40: 0     56: 0     72: 0     88: 0
 9: 0     25: 0     41: 0     57: 0     73: 0     89: 0
10: 0     26: 0     42: 0     58: 0     74: 0     90: 0
11: 0     27: 0     43: 0     59: 0     75: 0     91: 0
12: 0     28: 0     44: 0     60: 0     76: 0     92: 0
13: 0     29: 0     45: 0     61: 0     77: 0     93: 0
14: 0     30: 0     46: 0     62: 0     78: 0     94: 0
15: 0     31: 0     47: 0     63: 0     79: 0     95: 0
16: 0     32: 0     48: 0     64: 0     80: 0     96: 0

[1,5] NEAR TAC 2010 >
```

24-Hour Unavailable Seconds

After ten Severely Errored Seconds in a row, the CSU begins to count Unavailable Seconds. As the name suggests, the error rate in this condition is considered to be so high that the T1 circuit should be treated as though it were not available.

Once a CSU begins counting Unavailable Seconds it continues to do so until ten consecutive seconds pass, all of which are error free or have a lower error rate than a Severely Errored Second.

A typical 24-Hour Unavailable Seconds display is shown in Figure 4-6.

Figure 4-6 24-Hour Unavailable Seconds

```
24 HOUR UAS PERFORMANCE DATA  6-3-98  13:13:03
Site Name: Tech Pubs TAC 2010
                              1, 1
Valid Intervals  96       Seconds in Current Interval 786
UAS  in 24 Hours  0       UAS  in Current Interval     0

 1: 0     17: 0     33: 0     49: 0     65: 0     81: 0
 2: 0     18: 0     34: 0     50: 0     66: 0     82: 0
 3: 0     19: 0     35: 0     51: 0     67: 0     83: 0
 4: 0     20: 0     36: 0     52: 0     68: 0     84: 0
 5: 0     21: 0     37: 0     53: 0     69: 0     85: 0
 6: 0     22: 0     38: 0     54: 0     70: 0     86: 0
 7: 0     23: 0     39: 0     55: 0     71: 0     87: 0
 8: 0     24: 0     40: 0     56: 0     72: 0     88: 0
 9: 0     25: 0     41: 0     57: 0     73: 0     89: 0
10: 0     26: 0     42: 0     58: 0     74: 0     90: 0
11: 0     27: 0     43: 0     59: 0     75: 0     91: 0
12: 0     28: 0     44: 0     60: 0     76: 0     92: 0
13: 0     29: 0     45: 0     61: 0     77: 0     93: 0
14: 0     30: 0     46: 0     62: 0     78: 0     94: 0
15: 0     31: 0     47: 0     63: 0     79: 0     95: 0
16: 0     32: 0     48: 0     64: 0     80: 0     96: 0

[1,5] NEAR TAC 2010 >
```

24-Hour Loss of Frame Count

A loss of frame synchronization on a T1 circuit causes a loss of *all user data* as long as the Out of Frame (OOF) condition continues.

The 24-Hour Loss of Frame Count indicates how many seconds, per fifteen-minute interval, were during an Out of Frame condition. These are seconds during which no user data passed. Since there are 900 seconds in a fifteen-minute period, the value for any one interval will never exceed 900.

A typical 24-Hour LOFC display is shown below in Figure 4-7:

Figure 4-7 24-Hour Loss of Frame Count

```
24 HOUR LOFC PERFORMANCE DATA  6-3-98  13:28:48
Site Name: Tech Pubs TAC 2010
                              1, 1
Valid Intervals  96       Seconds in Current Interval 830
LOFC in 24 Hours  0       LOFC in Current Interval     0

 1: 0     17: 0     33: 0     49: 0     65: 0     81: 0
 2: 0     18: 0     34: 0     50: 0     66: 0     82: 0
 3: 0     19: 0     35: 0     51: 0     67: 0     83: 0
 4: 0     20: 0     36: 0     52: 0     68: 0     84: 0
 5: 0     21: 0     37: 0     53: 0     69: 0     85: 0
 6: 0     22: 0     38: 0     54: 0     70: 0     86: 0
 7: 0     23: 0     39: 0     55: 0     71: 0     87: 0
 8: 0     24: 0     40: 0     56: 0     72: 0     88: 0
 9: 0     25: 0     41: 0     57: 0     73: 0     89: 0
10: 0     26: 0     42: 0     58: 0     74: 0     90: 0
11: 0     27: 0     43: 0     59: 0     75: 0     91: 0
12: 0     28: 0     44: 0     60: 0     76: 0     92: 0
13: 0     29: 0     45: 0     61: 0     77: 0     93: 0
14: 0     30: 0     46: 0     62: 0     78: 0     94: 0
15: 0     31: 0     47: 0     63: 0     79: 0     95: 0
16: 0     32: 0     48: 0     64: 0     80: 0     96: 0

[1,5] NEAR TAC 2010 >
```

Reset Registers

The Reset Registers command on the **Performance Monitoring Menu** is used to clear out all of the accumulated information being held in the ESF registers. All of the values in the displays available from the **Performance Monitoring Menu** are reset to zero, the number of valid intervals is reset to zero.

A typical use of this option would be after installation. If a T1 facility has been serviced and it is believed that any problems have been corrected, it may be desirable to reset the registers so that any errors reported are known to be new.

Chapter 5 Diagnostics

While installing the TAC 2010, or after it has been placed into service, the diagnostic routines allow you to troubleshoot or verify the T1 circuit and Verilink equipment. The front panel of the TAC 2010 has three LEDs which give a visual indication of alarm conditions.

Display elements on the **Diagnostics Menu** give current information about alarm conditions as well as offering command options which may be used to establish and terminate loopbacks and test patterns.

Using Diagnostics

A typical way of using the **Diagnostics Menu** might involve the following steps:

1. Establish a loopback somewhere in the circuit path.
2. Start transmitting a test pattern.
3. Observe the test error counter to see if the test pattern is received as it was sent.
   a. If no errors are observed, move the point of loopback further away to test more of the circuit path, or
   b. If errors are observed, move the point of loopback closer to determine the source of the problem.
4. Stop the test pattern, drop all loopbacks, then:
   a. Place the T1 circuit back into service if all tests passed, or
   b. Contact the appropriate vendor if a problem is found.

Alarm Status

In addition to offering the ability to put up and take down loopbacks and test patterns, the **Diagnostics Menu** provides information about the current status of the DSX-1 equipment interface and DS-1 network interface.

The top half of the **Diagnostics Menu** includes a drawing made up of ASCII characters representing the operation of the CSU. The equipment interface is shown on the left, and the network interface is shown on the right. To the left and right of the drawing of a framer, status information is represented by words displayed in upper case characters.

Diagnostics Menu

A sample of the **Diagnostics Menu** is shown in Figure 5-1.

In this example, the word **PULSES** appears on both the equipment (left) and network (right) sides of the display. When the word **PULSES** appears alone, that interface has no alarms.

Figure 5-1 Diagnostics Menu

```
CSU DIAGNOSTIC -- FW Rev 1.4  HW Fab 0.8  Type TAC 2010 --

                      |-----------------------|
                      |                       |
-------<< eq  <<------|----------|f|----------|-------<< net <<-------
                      |          |r|          | PULSES
                      |          |a|          |
                      |          |m|          |
 PULSES               |          |e|          |
------->> eq  >>------|----------|r|----------|------->> net >>-------
                      |                       |
                      |-----------------------|

X) exit menu     Y) enable loops   Z) reset alarm    T) test time (15 SEC)

 __eq loops__      __err counter__   __net signals__   __net loops__
 R) repeater       A) show cntr      1) qrss           L) line
 E) equip          B) clear cntr     2) 3 in 24        P) payload
                                     3) 1 in 8         U) inband up
                   N) end tests      4) all 1s         D) inband down

[1,5] NEAR TAC 2010 >
```

Since a T1 circuit operates by sending pulses to represent a logical "one", the indication **PULSES** means that the TAC 2010 does see pulses on both the equipment (left side) and network (right side) interfaces. Therefore, of all the messages which might appear on this menu in upper case characters, **PULSES** is the only message which does not represent an alarm condition. Pulses are the logical opposite of a Loss of Signal (LOS) condition.

Figure 5-2 below shows the result of disconnecting the T1 circuit from a TAC 2010 module. The word **PULSES** no longer appears on the right side where network status is indicated. Instead, alarm conditions are reported including **ALARM**, **FRAME LOSS**, **CRC ERRORS**, and **SIGNAL LOSS**.

NOTE: *Whenever a T1 CSU reports Signal Loss, it will report other alarms as well. The other alarms are caused by the signal loss condition. Ignore the other alarms and find the cause of the Signal Loss to restore the T1 to service.*

Figure 5-2 Diagnostics Menu

```
CSU DIAGNOSTIC -- FW Rev 1.4  HW Fab 0.8  Type TAC 2010 --

                      |----------------------| ALARM
                      |                      | FRAME LOSS
-------<< eq  <<------|----------|f|----------|-------<< net <<-------
                      |          |r|          | SIGNAL LOSS
                      |          |a|          |
                      |          |m|          | CRC ERRORS
 PULSES               |          |e|          |
------->> eq  >>------|----------|r|----------|------->> net >>-------
                      |                      |
                      |----------------------|

X) exit menu     Y) enable loops   Z) reset alarm    T) test time (15 SEC)

 __eq loops__      __err counter__   __net signals__   __net loops__
 R) repeater       A) show cntr      1) qrss           L) line
 E) equip          B) clear cntr     2) 3 in 24        P) payload
                                     3) 1 in 8         U) inband up
                   N) end tests      4) all 1s         D) inband down

[1,5] NEAR TAC 2010 >
```

Status Messages

The status messages which may appear on the **Diagnostics Menu** are listed in Table 5-1 below:

Table 5-1 Diagnostic Menu Status Messages

Message	Meaning
ALARM	Yellow Alarm (RAI)—The CSU is receiving a Remote Alarm Indication Signal on the port. This signal is sent by a device in a red alarm condition, such as AIS, LOS or LOF.
FRAME LOSS	Out Of Frame (OOF)—The CSU does not detect a valid framed signal on the port. If pulses are also present, may indicate receipt of unframed all ones, Alarm Indication Signal (AIS), which is often used as a Keep Alive signal on T1 circuits.
SIGNAL LOSS	Loss Of Signal (LOS)—The CSU does not detect any pulses on the port. This is the worst possible alarm condition on a T1 port. Ignore other alarms and resolve the cause of the LOS first.
CRC ERRORS	Cyclic Redundancy Check errors (CRC-6)—The CSU detects errors using the CRC-6 feature of ESF framing. Applies only to T1 circuits or equipment using ESF framing.
LOW DENSITY	The T1 signal on the port does not meet the required average ones density of 12.5%.
BPV	The CSU is detecting Bipolar Violations on the port. Two or more pulses in a row were of the same polarity, violating the Alternating Mark Inversion requirement.
EXT CLK LOSS	The CSU is configured to use an external clock signal and that signal is not detected.
PULSES	Not an alarm condition. The CSU does see valid pulses on the port. When a CSU is in Mux mode, PULSES should always be displayed on the equipment side of the menu. In Mux mode, only synchronous serial interfaces are used and the CSU does not expect to see any particular framed pattern of pulses.

Diagnostic Commands

There are seventeen command options available on the TAC 2010 diagnostics menu. Table 5-2 lists all of these commands.

Drawings which illustrate the various loopbacks can be found in the manual *AS2000, The Basics*.

Table 5-2 Diagnostic Commands

Menu Option	Description	Instructions
X) exit menu	Exits to menu above.	Returns to the TAC 2010 **Main Menu**.
Y) enable loops	Determines whether CSU will respond to received standard CSU loop-up codes.	Normally this selection should be enabled. In a telephone carrier central office environment this option might be disabled.
Z) reset alarm	Clears alarm history for the current 15 minute interval.	Extinguishes red LED alarm conditions on front panel of the TAC 2010 CSU after installation or after resolving a service problem.
T) test time	Sets the length of time tests and loopbacks will be allowed to run. FOREVER is suggested by Verilink.	ENTER INTERVAL (DEFAULT, x SEC, x MIN, x HR, FOREVER): Type FOREVER or type a numeric value followed by SEC for seconds, MIN for minutes, HR for hours. Example “45MIN”.
R) repeater	Establishes a repeater loopback. Useful for testing local CSU hardware.	The CSU loops data it is about to transmit back to the receive circuitry. Local equipment should see its own signal. This test is functionally equivalent to placing a T1 loopback plug into the network port of the CSU.
E) equip	Establishes an equipment loopback.	The local DSX-1 equipment port is looped back directly to the local equipment. Useful for verifying cable connections.
A) show cntr	Displays test error counter, increments for each error detected.	Used to monitor a test in progress. When the CSU transmits a test pattern, it expects to receive the same test pattern unaltered, either from a loopback or a compatible test signal source.
B) clear cntr	Resets test error counter.	Used to reset the test error counter to zero after a test or before a new test.
N) end tests	Ends tests and *local* loopbacks.	Used to end any running test patterns as well as terminating any loopbacks in the local CSU.
1) qrss	Starts QRSS test.	CSU transmits a Quasi-Random test pattern while monitoring the receive pair for the same signal to be returned. This test is widely supported by telephone carrier test facilities. This test pattern is valid for all T1 circuit types.
2) 3 in 24	Starts 3 in 24 test.	CSU transmits a 3-in-24 test pattern while monitoring the receive pair for the same signal to be returned. 3-in-24 guarantees that of any 24 bits sent, at least 3 will be ones, thus strings of twenty one contiguous zeroes are possible. Because this pattern may have strings of up to 21 zeroes in a row, it may fail on some perfectly good AMI T1 circuits as equipment in the circuit enforces ones density.

Menu Option	Description	Instructions
3) 1 in 8	Starts 1 in 8 test.	CSU transmits a 1-in-8 pattern, which guarantees one bit of every 8 will be a one, while monitoring the receive pair for the same signal to be returned. This test pattern is valid for all T1 circuit types.
4) all 1	Starts all ones pattern. Use of this pattern is suggested whenever any T1 circuit is tested.	The CSU transmits a framed pattern of all ones and monitors receive data for the same pattern. Because it produces maximum current levels, this test is especially good at finding some problems like bad repeater cards or resistive punchdown connections. All ones is a valid test on all T1 circuits.
L) line	Initiates a line loopback.	Line loopback faces the T1 circuit. All data received from the T1 circuit is sent back to the T1 circuit. This is the same loopback which occurs when a CSU receives a loop-up code from the network.
P) payload	Initiates a payload loopback.	Payload loopback faces the T1 circuit like the line loopback. A payload loopback passes through more of the CSU circuitry while the line loopback occurs closer to the network port.
U) inband up	Sends a standard CSU loop-up code toward the far end CSU.	Under normal circumstances, sending the line loop-up code will cause the far end CSU to enter a line loopback state.
D) inband down	Sends a standard CSU loop-down code to the far end CSU.	Under normal circumstances, sending the line loop-down code will terminate a line loopback state in the far end CSU.

Front Panel LEDs

This section describes the function of the TAC 2010 LED indicators.

EQPT LED

The EQPT (equipment) LED is a tri-color indicator with six states, as follows:

Table 5-3 Equipment LED States

State	Meaning
Solid Green	The signal being transmitted by the local DSX-1 equipment is OK or the TAC 2010 card is configured for Mux mode (in Mux mode the EQPT LED is *always* green).
Solid Yellow	The TAC 2010 is in a loop which faces the Equipment port (Repeater Loopback or Equipment Loopback).
Solid Red	A continuous error condition exists (Loss Of Signal, Loss Of Frame, Alarm Indication Signal, Remote Alarm Indication Signal) in the signal (or lack of a signal) being transmitted by the local DSX-1 equipment.
Flashing Red to Off	Bipolar Violations, CRC-6 Errors, or a low density condition have been detected in the local DSX-1 equipment transmit signal.
Flashing Red to Yellow	The CSU is looped toward the equipment (RLB, ELB) and errors are detected in the data stream being transmitted by the equipment.
Not Lit	The CSU has no power or, if other LEDS are lit, the CSU is defective.

NOTE: *"Solid Red" events take priority over "Flashing Red" events, except when a loopback is enabled.*

STAT LED

The STAT (CSU status) LED is a tri-color indicator with six states, as follows:

Table 5-4 Stat LED States

State	Meaning
Solid Green	The CSU has been loaded with the Test Set 2000 test program using AM2000.
Solid Yellow	A test is in progress and no errors are detected (a test signal is currently being transmitted to the circuit by the CSU and the received pattern matches the transmitted pattern).
Solid Red	Some alarm condition has occurred within the last fifteen minutes on either the Network or Equipment interface.
Flashing Red to Off	Power-up self-test has failed. Verify that the rear CIM module is of a correct type (CIM 2010 or CIM 2015).
Flashing Red to Yellow	Errors have been received during a test (a test signal is being transmitted and the pattern received does not match the pattern sent).
Not Lit	No alarms have occurred within the last fifteen minutes. This is the normal state for the Stat LED.

NET LED

The NET (network) LED is a tri-color indicator with six states, as follows:

Table 5-5 Net LED States

State	Meaning
Solid Green	A normal signal is being received from the network (all OK).
Solid Yellow	The CSU is looped toward the network via a line loopback (LLB) or payload loopback (PLB) and no errors are being received from the network.
Solid Red	Continuous errors are being received on the network interface (e.g., LOS, LOF, RAI, AIS).
Flashing Red to Green	Bipolar violations or CRC-6 errors are being received on the network interface.
Flashing Red to Yellow	The CSU is looped toward the network and errors are being received (BPV or CRC-6).
Not Lit	The CSU has no power or, if other LEDS are lit, the CSU is defective.

Test Procedures

Testing can be be divided into two categories:

- Tests which are conducted to verify an installation where no known problems exist.
- Tests which result from an effort to troubleshoot a problem known to exist.

Two procedures are described below.

- In the section "Verifying a T1", a method is described to test a T1 circuit when it is expected that no trouble will be found.
- In the section "Troubleshooting", a suggested method for finding T1 problems is detailed.

Verifying a T1

For this procedure a pattern is sent from a local CSU, through the entire transmit path of the T1 circuit, to a loopback in a far end CSU, then back through the other direction of the T1 circuit.

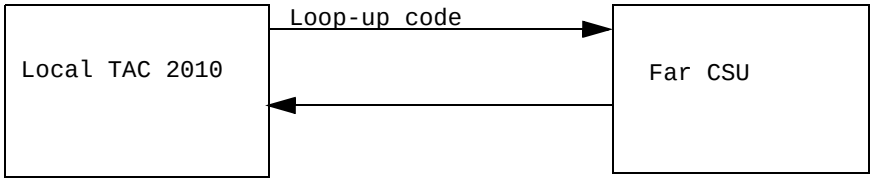
First a loop-up code is sent, then a test pattern is transmitted.

The data received from the T1 circuit will be compared to the data which was transmitted. If the data received is identical to the data which was transmitted, the T1 is good and may be placed into service.

Far End Loop

To begin the verification, use the **Inband Up** command on the **Diagnostics Menu.** This causes the local CSU to transmit a loop-up code towards the far end CSU.

Figure 5-3 Sending Loop-up Code.



If the loop-up code reaches the far CSU and it is optioned to respond to loop-up codes, then the far CSU enters a line loop condition. Now the local CSU receives whatever it is sending.

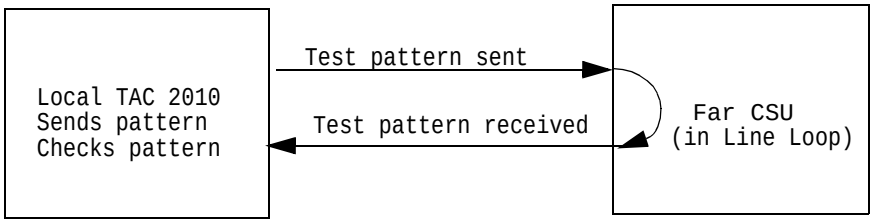
NOTE: *Whenever the* **Inband Up** *command is used to send a loop-up code to a far-end CSU, the* **Inband Down** *command must be used later to send the loop-down code. Otherwise the far-end CSU will be left in a looped condition.*

Sending a Pattern

Begin transmitting a test pattern by using the **qrss** command.

Verify that the pattern received matches the pattern being transmitted by using the **show cntr** command.

Figure 5-4 Sending and Receiving Pattern



If the QRSS pattern is received with no errors, the Test Error Counter does not increment.

If the Test Error Counter does increment, one of the following applies:

- The far-end CSU never went into a loopback and therefore the test pattern being transmitted is not being received at all. This would cause the Test Error Counter to increment at a rapid and steady rate.
- The far-end CSU went into a loopback, but the pattern received at the local TAC 2010 does not match the pattern transmitted. In this case, the Test Error Counter might increment in uneven amounts at virtually any rate.

Results

If the test passes, consider doing the same test with a different pattern. Some patterns will fail on a T1 that passes other test patterns. See Table 5-2 for details on the various patterns.

Test Failures

If the test fails, consider one of these alternatives:

- Use a loopback closer to the local CSU. The telephone carrier may be able to put up loopbacks at various locations along the path of the T1 circuit. Start at the far end and work your way back to the local CSU.
- If it appears that the local CSU is defective, try using a repeater loopback. Send a test pattern while the local CSU is in repeater loopback. The test pattern never leaves the CSU because it is receiving what it is sending. If this test passes, the CSU is probably OK.
- If a problem is identified but not resolved by this procedure, go on to the next section, "Troubleshooting".

Troubleshooting

When it is known that a problem exists in a T1 network application, a different approach is suggested. In the verification procedure above, the initial test passed data through the entire T1 circuit, including both local and far-end CSUs. This was done because no troubles were expected.

With trouble known to exist, begin by establishing what is good. Start with a repeater loopback test in the local CSU.

Repeater Loopback

The repeater loopback test takes the transmit data just as it is about to leave the network port of the CSU and feeds it directly into the receive circuitry of the CSU. If the CSU is transmitting bad data, it will now receive bad data and the problem will be located (the CSU). If the CSU is transmitting good data but the receive circuitry is defective, the signal received will fail and the CSU will declare an alarm.

Use the "R" command on the **Diagnostics Menu** to initiate a repeater loopback. A warning message appears:

Service Affecting, Are you sure ? (Y/N)

Press "y" because you are sure. During a repeater loopback test the NET LED on the CSU should be green and the EQPT LED should be amber. The STAT LED will usually turn red because of a transient bit error condition which occurs at the instant the test begins. Ignore the STAT LED when conducting loopback tests on a CSU.

If the EQPT LED blinks amber to red during a repeater loopback, errors are being detected in the DSX-1 data presented by the local equipment. Verify cabling and option compatability.

If the NET LED is not green during a repeater loopback test, contact Verilink Technical Support for assistance.

Tips

If the repeater loopback test passes, the CSU is not defective.

For troubleshooting tips related to non-CSU problems, see Table 5-6.

Table 5-6 Troubleshooting Tips

Trouble	Suggestion
Signal loss	Verify that a T1 circuit is connected to the network port. Verify that a proper cable is used, T1 circuits use pins 1,2,4 and 5 when presented in an RJ-45 connector. Use a straight through cable (1 to 1, 2 to 2, etc.) on the network side of the CSU. Use a crossover cable on the DSX-1 equipment side. The smart jack (network termination device) may be in a loopback.
Frame loss	In a new installation, T1 circuits are often patched out at a carrier's DACS or switch until completely turned up. In this case a pattern of unframed all ones (AIS) is kept on the T1 as a keep-alive signal. Contact the carrier and request that they "normal up" the circuit. The CSU must be optioned for the same type of framing as the T1 carrier is providing. Framing can not be changed arbitrarily by the user. Contact the carrier and verify the type of framing used on the T1.
CRC errors and BPVs reported on a new installation	When a T1 presents symptoms of CRC errors and BPVs, with no other alarms, it often is traced to problems with wiring inside the customer premise. When the smart jack is a considerable distance from the CSU (over 50 feet), there is the risk that the high level (hot) signals in the transmit pair will induce echo into the lower level (long) signals in the receive pair. This condition is called crosstalk and is a *leading cause of T1 problems.* As telephone carriers move toward a policy of housing all smart jacks in one location within commercial buildings, crosstalk related complaints are becoming more common. To prevent crosstalk related issues the transmit pair and the receive pair must be isolated from each other. The recommended cable for T1 uses individually shielded, twisted pairs; each pair has shielding around it—the cable therefore has two shields inside it, one for each pair. If shielded twisted pair cable is not available, try to route the transmit pair and the receive pair in different cables as they traverse the building. If the transmit and receive pairs must be routed through a multi-pair cable, such as the 25 pair or 50 pair cables found in large office buildings, select pairs which are not near each other in the cable. Many smart jacks offer an option "regeneration". This causes the smart jack to increase the amplitude of the signal received from the network before handing it off to the CSU. Try to get the carrier to turn on this option.
CRC errors	ESF T1 circuits offer CRC-6 error checking as a means of detecting changes in data which occur on the T1 circuit. If CRC errors are reported, the errors are occurring at some point between the two CSUs. Verify in-house wiring as indicated above. Contact the carrier and request they monitor the circuit. Carriers can monitor a T1 circuit for CRC errors without disrupting user data.

Trouble	Suggestion
Alarm	When a Verilink AS2000 CSU reports “ALARM” in the Craft interface, it is receiving a yellow alarm (RAIS) on that port. T1 devices send a yellow alarm to alert the far end device when they are in a red alarm condition such as: Loss Of Signal (LOS), Loss Of Frame (LOF), or Alarm Indication Signal (AIS—received all ones keep-alive). To resolve a problem with received yellow alarms, find the trouble in the transmit path of the CSU which is receiving the yellow alarm.
BPV	A bipolar violation is a sequence of two or more consecutive pulses of the same polarity. If a T1 is designed to support B8ZS, but some portion of the facility is configured for AMI in error, the AMI portion of the T1 may attempt to “fix” the intentional bipolar violations used to represent 8 or more zeroes on a B8ZS T1. This may manifest as BPVs or BPVs with CRC-6 errors. To verify that a T1 which is intended to be B8ZS is actually configured properly, test the facility with a pattern of all zeroes.
CSU reports no errors but DTE reports errors	In some data applications using DSU functions, a condition is reported in which the CSU does not report errors, but the customer Data Terminal Equipment (DTE) does report errors. This usually results from transmit data sampling errors at a DSU interface at the opposite end of the circuit from the DTE reporting the errors. If a CSU/DSU samples a zero when the DTE actually presented a one, the transmitting CSU creates CRC checksum data based on the improperly sampled bit(s). The data does not change on the T1 facility, and the receiving CSU detects no error. These types of errors are caused by a broken phase relationship between the transmit clock provided by the DSU and the transmit data provided by the DTE. If errors of this type are reported, try changing the ST vs INV-ST selection for DSU clocking in the DSU at the *opposite end* of the circuit. For more information on DTE clocking issues, see the *DIU 2130 User Manual*.

Loopback Plug

For a completely reliable test of a CSU, make a T1 loopback plug and plug it in to the network port. The CSU will now receive the signals it is sending.

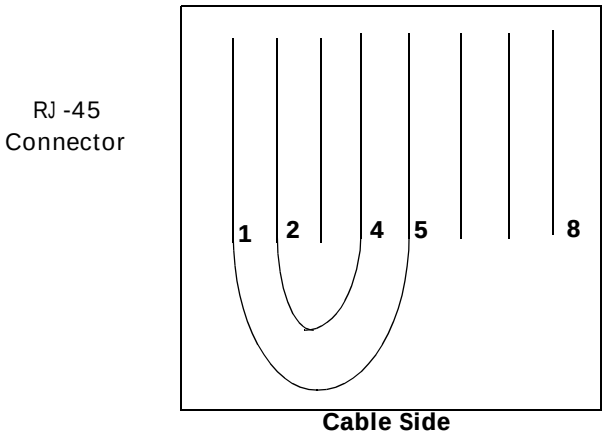
If the CSU is sending a defective signal, it will receive a defective signal and declare an alarm. If the receive circuitry is defective, such that it cannot decode a good signal, it will be unable to decode the signal it is transmitting and will declare an alarm. Thus, if a T1 CSU does not declare any alarms with a loopback plug in lieu of the T1 circuit, the CSU is not defective. This does not rely on any tests built in to the product, thereby producing a higher confidence level in the results of the test.

With a loopback plug in the network port, any customer equipment connected to the TAC 2010 (or a data port of any DIU module assigned to the CSU) should see a loopback condition. If the customer equipment can report errors, it should indicate that no errors are being received.

A T1 loopback plug can be made by taking a male RJ-45 connector and placing two short jumper wires where a cable would normally go. One jumper is placed from pin one to pin five, the other jumper connects pin 2 to pin 4. See Figure 5-5 for a drawing of a T1 loopback plug.

NOTE: *When using a T1 loopback plug, it may be necessary to temporarily change the timing selection in the CSU. If the CSU is set to recover network clock, it will be trying to recover a clock it is trying to recover. The clock frequency will drift. For this test, set the CSU clock source to "Internal". Remember to change it back after the test.*

Figure 5-5 T1 Loopback Plug



RJ-45 plug held with plastic latching tab unseen at bottom

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