



551V MLS AND 551V M-2
MULTILINE CHANNEL SERVICE UNITS
USERS MANUAL

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FCC WARNING STATEMENT

Federal Communications Commission (FCC) Rules require that you be notified of the following:

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with this instruction Manual, may cause interference to radio communications.

It has been tested and found to comply with the limits for Class A computing devices pursuant to Subpart J of Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct interference.

Per FCC Part 68 requirements, the customer is required to notify the Telephone Company prior to disconnecting this Channel Service Unit from the Network Interface. Registration: GIC472-16545-DE-N (with 4019-1 plug-ins), GIC472-16731-DE-N (with 4019 plug-ins).

SAFETY SUMMARY

This manual contains information and warnings which must be followed by the user to ensure safe operation and retain the equipment in a safe condition.

DANGER

The **DANGER** sign denotes a hazard to the operator. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a **DANGER** sign until the indicated conditions are fully understood and met.

CAUTION

The **CAUTION** sign denotes the possibility of service interruption and calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in interruption of service.

WARNING

The **WARNING** sign denotes the possibility of equipment damage and calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to the equipment.

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Information in this document is subject to change without prior notice and does not represent a commitment on the part of Verilink Corporation.

Revision D: The new 551V M-2 shelf (manufactured after May 1989) has new wire wrap connectors and no longer accomodates the use of the Fault Locating Filter. A revised Warranty Information section and a new Local Power Connections section have been included.

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APPENDIX I: PREREQUISITES TO CSU-NETWORK CONNECTION**APPENDIX II: FCC PART 68 COMPLIANCE STATEMENT**

INTRODUCTION

This manual provides information necessary for installing, operating, and testing Verilink Corporation's 551V Multiline Channel Service Unit System. The level of this manual is intended for users who have a general understanding of data communications.

How to use This Manual

This manual is divided into the following sections:

Basic Information - This section provides key information on the 551V Multiline Channel Service Unit's Functions, Features, Options, Installation, Operation and Testing, Specifications and Interface.

Product Descriptions - This section describes the general physical characteristics, function and operation of the Multiline System and its associated components, the 4019 CSU Module (E/W Internal Repeater), optional Alarm Module and Fault Location Filter. Descriptions of its LEDs, jacks, switches and optional units are also included.

Installation and Removal Procedures - This section provides step-by-step instructions on how to option and install the 4019 CSU and the optional Alarm/Fault Location Filter. Also included are steps for removing the plug-in modules from the shelf.

Testing Procedures - This section describes testing and trouble isolation procedures for the Channel Service Unit.

Maintenance - This section explains how to obtain service for your Channel Service Unit.

Warranty - This section explains Verilink's warranty and exchange and repair services program.

BASIC INFORMATION

The Verilink Multiline CSU System is designed to provide proper terminating equipment for leased 1.544 MBS digital transmission facilities located on the user's premises. It provides the user with access to the transmit and receive signal pairs using the US telecommunications industry standard DS-1 bipolar signal format. It also protects the Carrier's Network from harm resulting from improper connection or use of customer provided equipment.

Two versions of the Verilink Multiline System (MLS) are available. The Model 551V M-2 Multiple Line CSU System is used for customer premise termination of one or two leased digital DS1 transmission circuits. The second version, the Model 551V MLS, is designed for applications requiring terminations for up to ten leased DS1 circuits.

Functions

The Multiline System has three primary functions:

- Terminating leased DS1 facilities at the user's premises.
- Ensuring that the signals entering the Public Network from Data Terminal Equipment (DTE) comply with the requirements of the T1 transmission system as defined in FCC Part 68 Requirements.
- Providing maintenance, diagnostic and testing capabilities.

Features

Verilink Multiline CSU Systems include the following features:

- Provides a properly balanced 4-wire, 100 ohm interface between the customer Data Terminal Equipment (DTE) and the 1.544 Mb/s digital line.
- Monitors the incoming DTE data and adds pulses (1's) to the outgoing Network data stream as necessary to prevent long strings of zeros (all ones keep-alive).
- Removes bipolar violations (BPV's) from incoming DTE signals during normal operation. However, Network BPV's are not eliminated in the loopback mode.
- The 4019-1 CSU is compatible with B8ZS coding for clear channel applications.
- Properly terminates the DS1 circuit/T1 repeatered line

and regenerates the Network receive data stream.

- The 4019 CSU meets the original FCC Part 68 requirements and is "grandfathered".
- Shelf will accept redundant (A & B) power feeds.
- DTE may be positioned up to 655 cable feet from CSU.
- Jack access to aid in maintenance testing.
- Remotely controlled signal loopback, which operates upon detecting the in-band loopback code from the Serving Central Office or Hub Office.
- Front panel indications for all zeros and low pulse density.
- Two shelf types, 551V M-2 for terminating one or two DS1 circuits, and 551V MLS to terminate up to ten DS1 circuits.

Options

The following options are available on the Multiline System:

- May be equipped with standard 4019 CSU or economical 4019-1 CSU. The 4019-1 is similar to the 4019 CSU except that it does not monitor for bipolar violations, does not support remote fault locating, and does not provide an input for remote loopback using dc signaling.
- Local or line powering (Local powering may be strapped for dry loop operation or sealing current).
- 0 dB, 7.5 dB or 15 dB artificial line for T1 end-section line build-out.
- CSU options for DTE cable lengths of up to 655 feet.
- The 4019 model may be independently optioned to detect incoming Network BPVs and issue local alarms, based on selectable error rates of 10^{-3} through 10^{-9} .
- Optional common alarm card provides independent summed visual and audible dry contact alarm closures for DTE and/or Network faults.
- Optional common fault locating filter to aid in testing the CSU from the Serving Central Office.

551V MULTILINE CSU SPECIFICATIONS**Network Input and Output Signals****Input:**

Line Rate: 1.544 Mbps +/-75 bps
 Line Code: Bipolar, AMI
 Impedance: 100 Ohms +/-5%
 Signal Level: DSX-1 level to -22.5 db (ALBO)

Output:

Line Rate: 1.544 Mbps +/-75 bps
 Line Code: Bipolar, AMI
 Output Level: DSX-1 level into 100 Ohms
 Line Build Out: 0, 7.5, or 15 db artificial line sections
 Pulse Density: 1 in 8 minimum average
 Keep-Alive Signal: Unframed ALL ONES (4019 and 4019-1 CSUs)
 or Network loopback (4019 CSU only)

Network Loopback:**In Band Loopback**

Set Code: (10000) repeating binary pattern
 (4.5 sec +/-10%)
 Reset Code: (100) repeating binary pattern
 (4.5 sec +/-10%)

DTE Input and Output Signals**Input:**

Line Rate: 1.544 Mbps +/-75 bps
 Line Code: Bipolar, AMI
 Impedance: 100 Ohms +/-5%
 Signal Level: DSX-1 level to 655'

Output:

Line Rate: 1.544 Mbps +/-75 Hz

Line Code: Bipolar, AMI
Output Level: DSX-1 level into 100 Ohms

Power Requirements

Line Powered: 60 mA to 160 mA simplex loop current
Local Powered: -48 Vdc @ 0.10 A per CSU or Alarm module.

Environmental Limitations

Temperature: 0 to 60 degrees C
Humidity: 95% (with no condensation)

Physical Characteristics

551V MLS

Height: 7"
Depth: 15"
Width: 19"
Weight: 21 lbs

Approximately 25 pounds shipping weight

551V M-2

Height: 1.75"
Depth: 15"
Width: 19"
Mounting: Wall, 19" or 23" rack
Weight: 11 lbs 2 oz

Approximately 15 pounds shipping weight

PRODUCT DESCRIPTIONS**551V MULTILINE SYSTEMS (MLS and M-2)****Physical Description**

Each Multiline system basically consists of a shelf designed for mounting in a 19" equipment rack and one or more plug-in Channel Service Units. There are two shelf models available. Refer to Figure 1 illustrating the shelf configurations.

The 551V M-2 shelf has slots for three modules, two CSU positions and one position for an optional alarm module. Either the 4019 CSU or the 4019-1 CSU may be equipped in the CSU slots. The 4019 AU-2 Alarm Unit, when used, plugs into the third slot reserved for the alarm module.

For remote systems, the 551V MLS shelf has the capacity to mount up to ten CSU modules of either model and an optional alarm module. The 4019 AFU-10 Alarm Unit is used in this shelf.

For remote testing from the Serving Central Office, the 4019 CSU modules have an auxiliary interrogation output. To utilize this output for testing purposes, an optional plug-in or externally mounted fault location filter (FLF) (not available on 551V M-2 manufactured after June 1989) is required.

The 4019 AFU-10 module, used with the 551V MLS shelf mounts the optional plug-in fault location filter right on the AFU-10 unit. The rear of each Multiline System shelf contains the following connections and terminals (see Figure 2):

- Two or ten DTE interface connectors (female DA15 type) that connect to the DTE via customer provided connectorized cable.
- Two or ten 15 pin Network interface connectors (male DA15 type that connect to the Network via customer provided connectorized cable.
- Two or ten wire wrap connectors for CSU factory interconnect wiring (J1 through J2/J10)
- One wire wrap connector for office audible and visual alarm outputs and also provides access to the Fault Location Filter (if equipped).
- A 3-position terminal strip (TB-1) for local power.

Functional Description

Figure 3 is a block diagram of both models of the 4019 CSU. The bipolar signal from the DTE enters the EQ OUT, SM IN jacks. After going through the signal processing circuitry to the regenerator and optional artificial line, the signal then passes on to the Network T1 line.

The signal received from the Network T1 line enters the regenerator where it is reshaped, amplified and then coupled to the DTE through the SM OUT and EQ IN jacks.

The remote test loopback is used to loop the signal back towards the Network to permit maintenance technicians at the Serving Central Office or Hub Office to evaluate the performance of the DS1 circuit and for troubleshooting purposes. The signal loopback is operated when the CSU detects the industry standard loopback code generated by a Verilink 4019NYP BER Test Set.

On the standard 4019 CSU, the loopback may also be energized by applying a dc control signal to the loopback control leads available at the NET subminiature-D connector or the wire wrap connector. The 4019-1 CSU does not include this feature.

The 4019 CSU includes an error detector circuit monitoring the signal from the Network for bipolar violations. When the error rate exceeds a preset threshold, an alarm output is issued to an alarm bus. This alarm signal can be processed by an alarm card. Alarms from individual CSUs may be isolated from the Alarm Module via the separate from panel LOCAL ACO switch. The 4019-1 CSU does not include this feature.

The 4019-1 CSU includes an "ALL ONES" alarm LED to indicate the failure of the far-end DTE or a network failure.

4019 & 4019-1 CSU MODULES**Physical Description**

The 4019 and 5019-1 CSU units are approximately 7" high, 1.5" wide, and 12" deep. The 4019 CSU unit has 6 front panel LEDs, an ACO switch, and six bantam T/R/S jacks to access both the line and equipment signal paths. The 4019-1 has a similar front panel with 5 LEDs, six bantam jacks, but no ACO switch. Either CSU plugs into any of the 1 or 10 CSU slots of the Multiline Shelves.

The 4019 CSU front panel controls and indicators are described below (see Figure 4a).

On the Data Terminal Equipment (DTE) side:

A red EQPT SIG ZEROS LED illuminates whenever the field selectable zeros string threshold has been exceeded (16 or 50 zeros count).

A red EQPT SIG AVG DENS LED illuminates whenever the average ones' density falls below the factory set threshold (1 in 8 or 12.5%).

On the line (Serving Office) side:

A green LINE SIG PULSE LED lights to indicate the presence of incoming Network pulses (LED "Off" signifies an alarm condition).

A red LINE SIG BPV LED illuminates (for at least 5 seconds) whenever the field selectable BPV threshold has been exceeded (10^{-3} through 10^{-9}) if an AFU-10 or AU-2 is equipped. Whenever the local ACO switch is activated (or an AFU-10 or AU-2 is not equipped), the BPV LED will illuminate in the presence of any incoming Network BPV.

Control Status

A yellow CONT LOOPED LED indicates that the loopback function has been activated.

A second yellow CONT LINE PWR LED indicates a "power up" condition.

Local ACO Switch

Placing the individual CSU LOCAL ACO switch in the ON position will prevent CSU originated alarms from reaching the common alarm module.

Signal (Jack) Access

SM IN - lifting jack access to the Network XMT line (through the CSU).

SM OUT - lifting jack access to the Network RCV line (thru the CSU).
 SM MON - monitors the Network receive signal (thru the CSU).
 EQ IN - lifting jack access to the DTE receive input.
 EQ OUT - lifting jack access to the DTE transmit output.
 EQ MON - monitors the DTE transmit output.

The 4019-1 CSU front panel controls and indicators are described below (see Figure 4b):

On the Data Terminal Equipment (DTE) side:

A red EQPT SIG AVG DEN/ZEROS LED illuminates whenever the pulse density or consecutive zeros constraints of FCC Part 68 are not met.

On the line (Serving Office) side:

A green LINE SIG PULSE LED lights to indicate the presence of incoming Network pulses (LED off signifies an alarm condition).

A yellow LINE SIG ALL ONES LED illuminates whenever the signal received from the Network contains all ones (pulses). This is an indication of an upstream failure of the DS1 circuit or failure of the far-end DTE.

Control Status

A yellow CONT LOOPED LED indicates that the loopback function has been activated from the Serving Office or far end.

A yellow CONT LINE POWER LED indicates the CSU is receiving dc power from either the line or a local supply. (Should always be on.)

Signal (Jack) Access

SM IN - lifting jack access to the Network XMT line (thru the CSU).
 SM OUT - lifting jack access to the Network RCV line (thru the CSU).
 SM MON - monitors the Network receive signal (thru the CSU).
 EQ IN - lifting jack access to the DTE receive input.
 EQ OUT - lifting jack access to the DTE transmit output.
 EQ MON - monitors the DTE transmit output.

Functional Description (4019 & 4019-1 CSUs)

The CSU receives the signal from the DTE, monitors the signal for consecutive zeros and average density consistent with T1 repeatered line requirements, and provides visual indications of excessive

zeros or low average density. It also receives the data stream from the Network, monitors for presence of pulses, loopback control codes, and obtains line power from the Network, when optioned for it. In addition, the 4019 unit monitors incoming DS1 for bipolar violations (BPV) indicating line errors.

The EQ IN, EQ OUT and EQ MON jacks access the DTE transmit input and receive output signals.

The SM IN, SM OUT and SM MON jacks access the Network transmit input and receive output signals (see Figures 3 and 4).

The fuse alarm for both models (and BER alarm for the 4019 CSU) is passed to the alarm module over an alarm bus. The 4019 CSU has a front panel LOCAL ACO switch which can be used to turn off the individual CSU alarm output (no ACO switch on the 4019-1).

Both CSU modules provide a remote signal loopback towards the Network that is activated when the industry standard loopback code is received. The loopback connects together the XMT NET and RCV NET signal paths and terminates the XMT DTE signal. It does, however, pass the RCV NET signal on to the DTE RCV.

The CSUs can operate with Network span lengths of up to 3000 feet by using a signal regenerator (repeater) which rebuilds the receive signal and a selection of fixed attenuation line buildout pads that can be switched in or out as needed. DTE cable lengths from 0 to 655 feet are supported.

Transmit Signal Path

In the transmit direction (DTE to Network) the signal transmitted by the DTE is coupled through the EQ OUT and SM IN jacks to the transmit side signal processing circuitry. This circuitry monitors for an adequate signal level and an acceptable pulse density. If the proper signal is missing, it generates a signal with an all ones content for keep-alive. The signal is then buffered and attenuated by the artificial line.

The artificial line allows the transmit level to be attenuated 0, 7.5, or 15 dB to meet the typical 15 to 22.5 dB section loss. Slide switches are used to insert none, one, or two 7.5 dB artificial line sections into the signal path.

At settings of 7.5 and 15 dB, the pads introduce frequency roll-off simulating cable lengths of 1000 and 2000 feet, respectively, to present the nearest span line repeater a signal level and pulse shape consistent with a distance of 2000 to 3000 feet from the CSU. With a pad setting of 0.0 dB, the CSU will drive cable lengths of 2000 to 3000 feet, and, subsequently, present similar signal levels and pulse shapes to the first line repeater.

The bipolar signal from the DTE is coupled through the network protection circuitry to an isolation transformer. The surge protection network protects the DTE from potentially harmful

voltages, such as power line crosses or lightning hits. The secondary of the transformer derives the simplex current for powering the regenerator and couples the signal to the T1 span line.

A slide switch selects either local powering or line powering for the internal regenerator. In the line power position, the powering for the CSU is derived from the voltage applied to the Network line at the Serving Central Office. In the local position, an external source of -48 VDC must be provided.

Line powering is generally utilized. However, if the line is too long to power completely from the Serving Office or if the DS1 circuit is provided by means other than a T1 line, such as fiber optic or microwave radio, local powering may be required.

Receive Signal Path

In the receive direction (Network to DTE), the signal is attenuated by a 7.5 dB pad and isolated by a surge protection device. Network protection circuitry is used on the receive side in the same manner as described for the transmit side. The signal is transformer coupled and the secondary is used to complete the line powering path using the receive signal pair to complete the power loop back to the Serving CO.

The regenerator is a separate plug-in module mounted in the regenerator slot on either CSU module. It provides up to 28 db gain for the Network receive signal, sufficient gain and cable equalization to terminate a span line of between 0 and 3000 feet (i.e. cable losses of between 0 to 22.5 dB from the last line repeater to the CSU).

The input Automatic Line Build Out (ALBO) circuitry compensates for receive signal levels ranging from -7.5 to -30.0 db below DSX-1 levels. The overall operating range is altered by introducing a 7.5 db fixed attenuator into the receive path which shifts the dynamic operating range 7.5 db (0 to -22.5 db). Code detection circuits across the receive signal path after regeneration continuously monitor the incoming signal for the loopback code. The loopback detection time is approximately 5 seconds after which the loopback is operated (and a front panel LED is turned on). The loopback is reset when the reset code is received from the Network. (The 4019-1 CSU also monitors the incoming signal for an All Ones [AIS] and turns on a front panel LED if it is detected.)

ALARM MODULES (AU-2 & AFU-10)**General**

These Alarm Modules are generally used only when the MLS shelves are equipped with 4019 CSU units and are rarely used with 4019-1 CSU units as the 4019-1 CSU does not detect bipolar violations on the receive signal line.

Both the 4019 AFU-10 (10-line Alarm & Fault Locating Unit) and the 4019 AU-2 (two line Alarm Unit) provide separate summed DTE and Network alarm contact closures for local office alarm indications. Both visual and audible contacts are provided which may be strapped for "normally open" or "normally closed" operation. The alarm relay may be released during an alarm condition via the front panel Alarm Cut Off (ACO) switch on each 4019 CSU.

The AFU-1 differs from the AU-2 in that the AU-2 is strictly an alarm unit whereas the AFU-10 has space on the module to mount an optional fault locating filter (to be discussed later).

Physical Description

The 4019 AFU-10 Alarm Module is approximately 7" high, 1.5" wide, and 12" deep, and the 4019 AU-2 is approximately 1.25" high, 2.5" wide and 12". Both have 4 LEDs and an Alarm Cut Off Switch (ACO). Refer to Figures 5a and 5b illustrating the front panels.

A red FUSE ALARM LED lights to indicate that a CSU or the Alarm Card fuse has blown.

A red NETWORK ALARM LED lights to indicate the presence of a Network Alarm condition.

A red DTE ALARM LED lights to indicate the presence of a DTE alarm condition.

A yellow ACO LED indicates the alarm cut-off switch is operated.

Functional Description

Refer to Figure 6 which illustrates a simplified alarm diagram using the 4019 AFU-10 or 4019 AU-2 Alarm Modules. The Alarm Module monitors DTE and Network alarm status information originating within the CSU Modules. Switch S1 on either the 4019 AFU-10 or 4019 AU-2 permits selection of Network and DTE alarm reporting with either an immediate or 10 second delay. Upon receipt of an alarm input to the AU-2 or AFU-10:

- The relative DTE or NET ALARM LED will illuminate.
- The alarm relay will energize, producing visual and audible contact closures.

- The ACO switch may then be manually activated to silence the local audible alarm.
- If another alarm of a different type occurs after the ACO switch has been manually activated, the ACO will be cleared and a new alarm will be reported.

FAULT LOCATION FILTER (FLF)

General

The Fault Locating Filter is used only when the MLS shelves are equipped with 4019 CSU units and are not used with 4019-1 CSU units as the 4019-1 CSU does not support remote interrogation.

The 4019 FLF-2 Fault Location Filter (FLF) is an optional plug-in on the 4019 AFU-10 alarm Module when using the 551V MLS shelf. An externally located 1114VCC FLF was used on 551V M-2 shelves manufactured prior to June 1989.

Physical Description

The 4019 FLF-2 fault locating filter is 1.1" high, 2.6" wide, and 5.2" deep. It plugs into a receptacle on the AFU-10 Alarm Module.

Functional Description

The Fault Location Filter allows the local telephone company to verify CSU regenerator operation from the Serving Central Office using specialized test equipment. All Verilink FLFs are supplied with the M filter code which is commonly used for the far circuit end on most T1 lines.

INSTALLATION AND REMOVAL PROCEDURES

This section contains step-by-step instructions for the installation of the 551V Multiline Shelf, the 4019 CSU Modules and the Alarm Module, together with option settings for these two plug-in units. Instructions are also included for the installation of the optional Fault Location Filter.

Preparing the Equipment for Installation

1. Unpack the equipment and carefully inspect it for any physical damage. Inspect the Shelf assembly as well as both plug-in units (and the Fault Location Filter, if included).
2. Report any damage to both the carrier and your Verilink Support Representative.

551V MLS Shelf Preparation

The 551V Multiline Shelf may come equipped from the factory with the FLF bypass strap in place. This strap must be removed if a fault location filter is installed. The strap is located on J11 (MLS shelf) between pin K and the chassis ground. (See Figure 2.)

4019 & 4019-1 CSU Preparation

The 4019 and 4019-1 CSUs contain strapping options to select several signal processing operating modes. These modes are described below. Review this list and make any necessary changes before installing CSUs in the shelf.

Even though the actual options for each CSU type are similar, the locations of these options are not. The locations of these options are shown in Figures 7a & 7b. At the end of this section is a list of the normal factory installed straps for the two types of CSUs.

4019 CSU Signal Processing Options

- ONES causes the unit to transmit an ALL ONES "keep-alive" signal toward the central office when DTE transmit signal drops below the required minimum average density.
- ESS causes the unit to loop back its receive line to its transmit line (instead of generating ALL ONES) when the DTE transmit signal fails. The looped back framing pattern will prevent alarms at CO's with ESS or DACS equipment.
- ZEROS selects either sixteen (16) or fifty (50) consecutive zeros as criteria for activating the excessive ZEROS LED. Most channel bank applications require the sixteen zero selection. Some encryption devices will process up to 50 zeros before transmitting a one.

These options are selected on the 4019 CSU by WT-1 jumper straps as indicated in Table A. The options are not selectable on the 4019-1 CSU.

OPTIONS	(WT-1 JUMPER)
ONES	1 - 2
ESS	3 - 4
16 ZEROS	5 - 6
50 ZEROS	7 - 8

Table A. 4019 CSU Signal Processing Options

DTE Extended Range Capability

Normally the distance from the CSU to the DTE is short. If this distance exceeds 85', the CSU must be optioned to condition the DTE line. Both transmit and receive DTE pairs may be conditioned independantly from each other. Some DTE provide conditioning in the transmit direction. If this is the case, do not add CSU conditioning in the DTE receive direction. See Table B for optioning for extended DTE cable length.

OPTION	4019 JUMPER	4019-1 JUMPER
DTE XMT, 0 - 85'	WT-3 pins 1-2	WT-1 pins 1-2
86' - 375'	WT-3 pins 3-4	WT-1 pins 3-4
375' - 655'	WT-3 pins 5-6	WT-3 pins 5-6
DTE RCV, 0 - 85'	WT-2 pins 1-2	WT-2 pins 1-2
86' - 375'	WT-2 pins 3-4	WT-2 pins 3-4
375' - 655'	WT-2 pins 5-6	WT-2 pins 5-6

Table B. 4019 & 4019-1 DTE Extended Range Options.

BPV Threshold Selection (4019 only)

Each 4019 CSU module may be independently optioned to detect incoming Network BPV rates from 1×10^{-3} thru 1×10^{-9} . Normally, the option selected is determined by the type of service to which the user has subscribed. The 4019-1 CSU does not include the option for detecting bipolar violations so there is no option selection for BPV Threshold.

The MLS or M2 shelf must be equipped with the optional 4019 AFU-10 or 4019 AU-2 Alarm Module for this BPV detection feature to be operative. If the Shelf is not equipped with the Alarm Module, or the 4019 CSU ACO switch is placed in the ON position, the BPV LED will flash upon receipt of ANY BPV but no alarm will be given.

Table C details the settings for the WT-4 BPV options.

BPV THRESHOLD	4019 CSU WT-4 JUMPERS
10^{-3}	1 - 2
10^{-4}	3 - 4
10^{-5}	5 - 6
10^{-6}	7 - 8
10^{-7}	9 - 10
10^{-8}	11 - 12
10^{-9}	13 - 14

Table C. 4019 CSU BPV Options

Artificial Line Option

The output of the regenerator toward the line in either the 4019 or 4019-1 CSU is a nominal 6v pip signal. This output level can be attenuated via two 7.5 db artificial lines which are switch-selectable providing output attenuation of 0.0, 7.5, or 15.0 db, as required.

At settings of 7.5 and 15.0 db, the artificial lines introduce frequency roll-off, simulating cable runs of 1000' and 2000' respectively, to present a signal to the nearest span-line repeater with a level and pulse shape consistent with a distance of 2000' to 3000' from the CSU.

With a pad setting of 0.0 db, the CSU will drive cable lengths of 2000' to 3000' and, subsequently, present similar signal levels and pulse shapes to the first line repeater. The required setting of the transmit pad is generally specified by the serving Telco.

Table D contains settings for the artificial line options.

<u>ARTIFICIAL LINE OPTION</u>	<u>4019 CSU</u>	<u>4019-1 CSU</u>
0 db	S1 Out, S2 Out	S1 = 0 db
7.5 db	S1 In, S2 Out	S2 = 7.5 db
15.0 db	S1 In, S1 In	S3 = 15 db

Table D. 4019 & 4019-1 Artificial Line Options

Power Source Selection

Span, or "Line," power is furnished by the local telephone company. When span power is not offered, the CSU must be powered from a separate 48 volt power supply co-located with the CSU.

The CSUs may be independently powered from Telco provided span power or from a local -48 Vdc power source capable of .10 A per equipped CSU module. The 4019 and 4019-1 CSU power sources may be mixed within any individual shelf depending on user needs. In all configurations, the AU-2 & AFU-10 Alarm modules are powered from the local -48 Vdc source. Verilink recommends the PSU-48v100 L-2 redundant 110 Vac/ -48 Vdc 1 A power supply in applications where local power is required.

Local Power Connections

See Figure 2 or SD-100656 and SD-100677 for Network Interface information and connections of locally furnished power.

WARNING: To avoid damaging the shelves, make these connections with the power supply turned off and do not turn the power on until all installation is complete!

Using the wire sizes specified below, make the following chassis and signal ground connections:

Connect the chassis ground lead from the equipment rack (i.e., vertical ground or if not available the building ground) to J11 pin 11 (early model 551V MLS) or J12 pin 1 (current 551V MLS) or J3 pin 11 (early model 551V M-2) or P4 pin 1 (current 551V M-2).

Do not connect "circuit ground" of the shelves if an AFU-10 or AU-2 alarm unit is installed. If there is no alarm unit you may connect circuit ground to horizontal ground at the top of the rack or if not available to building ground. Circuit ground is J11 pin 10 (early model 551V MLS), J12 pin 7 (current 551V MLS), J3 pin 10 (early model 551V M-2) or P4 pin 4 (current 551V M-2).

Connect the minus (-) side of the A & B local power supplies connect to TB1 terminal 1 and 3, respectively, and the positive (+) side to TB1 terminal 2.

The following minimum gauges of stranded insulated copper wire are required for power and ground runs:

Distance	Gauge
50 - or less	#14
80 - 125 ft.	#12
125 - 200 ft.	#10

4019 Power Source Options

Table E shows the setting for the 4019 and 4019-1 option switches and the regenerator L/T switch. The 4019 and regenerator must be optioned together. However, on the 4019-1, there is only one switch, S1, to select.

Note: To move the 4019 regenerator switch, grasp the "slot switch" with long nosed pliers, then gently pull up. The switch may now be rotated to the desired position and resealed by gently pushing down.

<u>OPTIONS</u>	<u>4019 CSU</u>	<u>REGENERATOR</u>	<u>4019-1 CSU</u>
SPAN POWER	S3 = LINE	T	S1 = SP
LOCAL POWER (DRY LOOP)	S3 = LOCAL	L	S1 = DL
LOCAL POWER (WET LOOP)	S3 = LOCAL	L	S1 = WL

Table E. Power Option Selections

Regenerator Fault Locate Options (551V MLS with 4019 only)

The Fault Locate Filter strap on J11 of the 551V MLS: pin K to chassis GND on the rear of the shelf must be removed when the Fault Location Filter is installed. Refer to the shelf wiring diagrams at the rear of this manual for location of this strap for the two shelf types.

The regenerator itself should always have its option switch set to the STD position. Other positions of this switch are not used with Verilink CSUs.

The 551V M-2 and 4019-1 CSU do not provide for a fault locate feature.

551V MLS & M-2 Alarm Module Option

The SIM/AFU jumpers, which are located on the backplanes of the 551V MLS and M-2 shelves, should be in the AFU position (The SIM alarm module is not normally used with either the 4019 or 4019-1.) Both jumpers should be horizontal in the case of the 551V M-2, and vertical in the case of the MLS.

Factory Installed Options

The options on each 4019 and 4019-1 CSU are preset in the factory according to the arrangement given in Table F below:

OPTION	4019	4019-1
KEEP-ALIVE	ALL ONES	n.a.
ZEROS alarm indication	16 zeros	n.a.
DTE RCV distance	0 - 85'	0 - 85'
DTE XMT distance	0 - 85'	0 - 85'
Network BPV Threshold	10 ⁻⁶	n.a.
Artificial Line	7.5 dB	7.5 dB
Line/Local Power Option	LOCAL, DRY LOOP	LOCAL, DRY LOOP
<u>Regenerator</u>		
PWR OPT "L" (Dry Loop Operation)		
FL OPT "STD" All Verilink Applications		

Table F. 4019 & 4019-1 CSU Factory Select Options.

4019 AFU-10 Preparation

Table G below shows the settings for the WT-1 alarm operations. Refer to Figure 8a for the option locations on the module.

OPTIONS	WT-1	JUMPER
Not used	Do not install jumper	AA
DTE Visual	ACO Disable	BB & OO
DTE Visual	ACO Enable	CC & DD
DTE Visual	Normally closed	EE
DTE Visual	Normally open	FF
NET Visual	Normally closed	JJ
NET Visual	Normally open	KK
NET Visual	ACO Disable	LL & PP
NET Visual	ACO Enable	MM & HH
NET Visual	ACO Enable	HH
Not used	Do not install jumper	NN
Not Used	For jumper storage	OO
Not Used	For jumper storage	PP

CAUTION: Possible equipment damage may occur if option jumpers WT-1 AA or NN and WT-2 AA or BB are installed and the AFU-10 is plugged into the shelf with -48VDC connected.

Table G. AFU-10 Alarm Options

Table H below shows the settings for the AFU-10 S1 alarm delay switch.

ALARM DELAY OPTIONS	SWITCH S1
Network 10 Second Delay Enable	S1-1 Open
Network 10 Second Delay Disable	S1-1 Closed
DTE 10 Second Delay Enable	S1-2 Open
DTE 10 Second Delay Disable	S1-2 Closed
Not Used	S1-3
Not Used	S1-4

Table H. AFU-10 Alarm Delay Options

AFU-10 Factory Strapping

The options on the AFU-10 modules are factory preset according to the following arrangement indicated in Table I:

WT-1	CC & DD FF	DTE Visual ACO enable DTE Visual normally open
	HH & MM KK	Network Visual ACO enable Network Visual normally open
WT-2	Not used - DO NOT INSTALL JUMPERS	
WT-3	(Storage for spare jumpers)	
S1	S1-1	Open (Network 10 sec. delay enabled)
	S1-2	Open (DTE 10 sec. delay enabled)
	S1-3	Not used
	S1-4	Not used
TP 1 thru 11	For factory use only	

Table I. AFU-10 Factory Strap Selections.

4019 AU-2 Preparation

Table J below shows the settings for the AU-2 alarm options. Refer to Figure 8b for the option locations on the module.

OPTIONS		JUMPER WT-1 - WT-6
DTE Visual	ACO Disable	WT-6 AB & WT-5 AB
DTE Visual	ACO Enable	WT-6 BC & WT-5 BC
DTE Visual	Normally closed	WT-4 AB
DTE Visual	Normally open	WT-4 BC
NET Visual	Normally closed	WT-1 AB
NET Visual	Normally open	WT-1 BC
NET Visual	ACO Disable	WT-3 BC & WT-2 BC
NET Visual	ACO Enable	WT-3 AB & WT-2 AB

Note: DTE and NET audible alarms are always ACO controlled.

Table J. AU-2 Alarm Options

Table K below shows the settings for the AU-2 alarm delay switch.

ALARM DELAY OPTIONS	SWITCH S2
DTE 10 Second Delay Enable	S2-1 Open
DTE 10 Second Delay Disable	S2-1 Closed
Network 10 Second Delay Enable	S2-2 Open
Network 10 Second Delay Disable	S2-2 Closed
Not Used	S2-3 & S2-4

Table K. AU-2 Alarm Delay Options

AU-2 Factory Strapping

The options on the AU-2 modules are factory preset according to the following arrangement in Table L.

WT-1	BC	Network Visual normally open
WT-2	AB	Network Visual ACO enable
WT-3	AB	Network Visual ACO enable
WT-4	BC	DTE Visual normally open
WT-5	BC	DTE Visual ACO enable
WT-6	BC	DTE Visual ACO enable
S2	S2-1	Open (DTE 10 sec. delay enabled)
	S2-2	Open (Network 10 sec. delay enabled)

Table L AU-2 Factory Select Options

Shelf Installation

The 551V Multiline System is designed to mount, with four screws supplied with the mounting brackets for mounting in either a 19" or 23" relay rack, or in a KS type data cabinet. Figure 9 illustrates how mounting brackets A and B can be reconfigured to suit various alternative 19" or 23" EIA rack mounting arrangements. However, if WECCO 23" brackets are required (1" hole spacing), they can be supplied by the factory on request.

The 551V Multiline chassis accepts one or two (551V M-2) or from one to ten (551V MLS) 4019 (or 4019-1) CSU modules with one extra space reserved for an optional Alarm Unit. Before installation, the 4019 (or 4019-1) CSU module(s) should be optioned appropriately, according to the option settings given in the Installation and Removal Procedures sections of this manual.

Cable Termination

The CSU connections to the Network and data terminal equipment are made via the 15 pin subminiature "D" DTE and NET connectors (see Figure 2) on the back of the unit, or, alternately, may be accomplished via wire wrap connections J1 through J10 on the MLS shelf or P1 and P2 on the M-2 shelf, also located on the back of the unit. If used, the subminiature "D" connectors should be equipped with a right-angle hood and slide lock assembly that will mate with the DTE and NET connectors on the shelf.

The typical cable distance between the customer DTE and the CSU is less than 85'. The 4019 CSU may be configured to support DTE cable distances up to 655'. The local -48 Vdc power and ground (if used) is made by screw connection to TB1. (See Table M.)

Table M. Multiline Interface

NET D Sub. Connections	TO PIN:
Transmit data toward the Network (tip)	1
Transmit data toward the Network (ring)	9
Receive data from the Network (tip)	3
Receive data from the Network (ring)	11
Out-of-band DC current loopback (tip)	7
Out-of-band DC current loopback (ring)	8
Note: Pins 2 and 4 are reserved for Telco use; Pins 10,12,13,14 and 15 are not connected.	
DTE D Sub. Connections	TO PIN:
Receive data from the DTE (tip)	1
Receive data from the DTE (ring)	9
Transmit data toward the DTE (tip)	3
Transmit data toward the DTE (ring)	11
CSU WIRE WRAP J1 - J10 (MLS Shelf)	TO PIN:
Transmit data toward the Network (tip)	D
Transmit data toward the Network (ring)	4
Receive data from the Network (tip)	E
Receive data from the Network (ring)	5
Out-of-band DC current loopback (tip)	F
Out-of-band DC current loopback (ring)	6
Receive data from the DTE (tip)	A
Receive data from the DTE (ring)	1
Transmit data toward the DTE (tip)	C
Transmit data toward the DTE (ring)	3
Fault Bus	K
Chassis Ground	11, B, 2
Note: Pins G & I do not exist	
CSU WIRE WRAP P1 - P2 (M-2 Shelf)	TO PIN:
Transmit data toward the Network (tip)	7
Transmit data toward the Network (ring)	8
Receive data from the Network (tip)	9
Receive data from the Network (ring)	10
Out-of-band DC current loopback (tip)	
Out-of-band DC current loopback (ring)	
Receive data from the DTE (tip)	1
Receive data from the DTE (ring)	2
Transmit data toward the DTE (tip)	5
Transmit data toward the DTE (ring)	6
Chassis Ground	3, 4
Note: Fault Bus is not available	

Table M (cont). Multiline Interface

ALARM WIRE WRAP J11 (MLS Shelf)		TO PIN:
DTE visual	NO or NC	A
DTE visual	Com	B
DTE audible	NO	D
DTE audible	Com	C
DTE audible	NC	E
NET visual	NO or NC	1
NET visual	Com	2
NET audible	NC	4
NET audible	Com	3
NET audible	NO	5
Fault pair	Tip	F
Fault pair	Ring	6
ALARM WIRE WRAP P3 (M-2 Shelf)		TO PIN:
DTE visual	NO or NC	1
DTE visual	Com	3
DTE audible	NO	9
DTE audible	Com	5
DTE audible	NC	7
NET visual	NO or NC	2
NET visual	Com	4
NET audible	NC	10
NET audible	Com	6
NET audible	NO	8
LOCAL POWER		TO TERMINAL STRIP:
-48 Vdc	A	TB1-1
COM		TB1-2
-48 Vdc	B	TB1-3

DANGER: Potentials as high as 260 Volts may be present between the transmit and receive pairs of the T1 span line. Exercise care when making connections to the 551V CSU.

CAUTION: When connecting the Network Interface, care must be taken to insure that T1, R1 leads and T, R leads are not transposed. Use the locking screws provided with the connecting cable to insure a secure connection to shelf.

- NOTES:**
1. Confirm that -48 Vdc +/- 1 Vdc is present at TB1 A and B (if used). If required, adjust the relevant power supply to achieve -48 Vdc.
 2. Redundant power supplies are not mandatory. If a single power supply is used, it may be connected to either the -48 Vdc A or B inputs. (TB1-1 or TB1-3 respectively.)
 3. If span power is used, local power is required only if the 4019 AFU-10 or 4019 AU-2 alarm modules are used.

Installing the CSU Plug-in Modules

Insert the CSU Modules in the applicable position in the MLS Shelf assembly, ensuring that they seat securely. Model 4019 and 4019-1 CSUs may be intermixed within a shelf if desired. If installing the 4016R, see the Installation Manual (PN 880-500782-001).

Installing the Fault Location Filter (Optional)

Insert the Fault Location Filter in the Alarm Module of the 551V MLS assembly, ensuring that it seats securely. On the rear of the shelf, cut open the brown-white strap from J11 pin K to ground. Connect the Network fault locating pair to J11 pin F (tip) to J11 pin 6 (ring) on the CSU shelf.

CABLING	FLF MODULE	MLS SHELF
CSU shelf interconnect, fault bus	TB1-4	J3-K
" " , GND	TB1-3	J3-11
Network Fault Locate pair, tip	TB1-2	-
" " , ring	TB1-1	-

Installing the Alarm Module (Optional)

Insert the Alarm Module in the furthest left-hand slot on the 551V MLS, ensuring that it seats securely.

Removing and Replacing the Equipment

NOTE: Prior to insertion, replacement plug-in units should be optioned identically to plug-ins they replace.

Both the CSU and Alarm Modules may be removed by using their ejector/retainers. The CSU and the Alarm units should be replaced with identical units. The Fault Location Filter (FLF) may be removed by pulling out on its handle. Replacement of the FLF should be with a filter of the same frequency. In effecting equipment replacement, follow these steps:

1. To remove the equipment, withdraw the plug-in unit using ejector/retainers or handle.
2. To replace the equipment, follow the instructions described above in the "Installing the Plug-in Modules" section.

TEST PROCEDURES

General

Performance testing of the DS1 circuit may be performed by the local telephone company or end user if specialized test equipment is available. A DS1 Bit Error Rate (BER) Test Set is required to properly test a T1 facility. It contains built-in pattern generators, detectors and displays designed expressly for this purpose.

Acceptance Test

This test assumes that the Data Terminal Equipment (DTE) and the T1 line are both connected to the 551V ML Multiline System as described previously in the Installation and Removal Procedures section, that the CSUs at both ends are optioned properly, and that both the DTEs and the T1 line are transmitting normal DS1 signals.

- 1. Observe the front panel indicators on the CSUs. They should all indicate only the following (all other lamps off):

LINE PWR or POWER ON
 PULSES ON

- 2. If the optional Alarm unit is equipped, observe that all front panel indicators are off.
- 3. Insert a dummy plug or patchcord into the CSU SM IN jack located on the CSU module at the near end.

Requirement:

Near-end CSU: AVG DENS and ZEROS will be indicated. This verifies that the CSU will detect the absence of a signal from the Data Termination Equipment.

Alarm Module (if equipped): The Red DTE ALARM LED will light and the office alarm relay will energize, activating the DTE dry contact closures.

Far-end CSU: If a 4019-1 CSU is equipped, an "ALL ONES" indication will be present. This "All Ones" indication will be present only if the near-end CSU is a 4019-1 CSU or a 4019 CSU optioned for "All Ones" keep-alive and verifies that the CSU keep-alive generator is functional.

- 4. If an Alarm Module and 4019 CSU are not used, skip to Step 15 and remove the dummy plug or patch cord inserted in Step 3.
- 5. Turn ON the LOCAL ACO switch on the 4019 CSU module.

Requirement:

The DTE ALARM on the Alarm Module should clear and the alarm relays

should be deactivated.

6. Turn OFF the LOCAL ACO switch on the 4019 CSU module.

Requirement:

The red DTE ALARM LED will light and the office alarm-relays will energize, activating the DTE dry contact closures. Verify that the proper DTE visual alarm options (N/O or N/C and 0 or 10 second delay) and DTE audible alarm connections (N/O or N/C) were selected and activated.

7. Activate the Alarm Module ACO switch.

Requirement:

The DTE audible alarm relay should be deactivated and the yellow ACO LED illuminated. If DTE visual ACO enable was optioned, that relay output should also be deactivated.

8. Remove the dummy plug(s) or patch cord(s).

Requirement:

All alarms and LEDs should clear except for the LINE PWR or POWER and PULSES LEDs, which should all be on.

9. Generate a Network side alarm by opening the receive to the CSU from the Network Interface or by using a BPV error generator to exceed the set error rate.

Requirement:

The PULSE LED should extinguish or the BPV LED should illuminate depending on the particular method employed. The red NETWORK ALARM LED will light and the office alarm relay will energize, activating the NET dry contact closures.

10. Turn ON the LOCAL ACO switch on the 4019 CSU Module.

Requirement:

The NETWORK ALARM on the Alarm Module should clear and the alarm relays should be deactivated.

11. Turn OFF the LOCAL ACO switch on the 4019 CSU module.

Requirement:

The red NETWORK ALARM LED will light and the office alarm relays will energize, activating the NET dry alarm contacts. Verify that the proper NET visual alarm options (N/O or N/C and 0 or 10 second delay) and NET audible alarm connections (N/O or N/C) were selected and activated.

12. Activate the Alarm Module ACO switch.

Requirement:

The NET audible alarm relay should be deactivated. If NET visual ACO enable was optioned, that relay output should also be deactivated.

13. Generate a DTE alarm by inserting a dummy plug or patch cord in this CSU as described in Step 3.

Requirement:

The ACO LED on the Alarm Module should be turned off and the alarm relays should be activated.

14. Remove the dummy plug(s), patch cord(s), or error generator inserted in Steps 9 and 13.

Requirements:

All alarms and LEDs should clear except for the LINE PWR or POWER and PULSES LEDs, which all should be on.

15. Repeat Steps 1 to 14 at the other end.
16. Repeat Steps 1 through 6, 8 through 11, and 14 for all other CSUs equipped at both ends.

Loopback BER Test

A loopback bit error rate (BER) test should be performed on each DS1 circuit at either end by company communications maintenance personnel. This will confirm that the DS1 circuit operates with an acceptable bit error rate for the subscribed service and that the CSU loopback feature operates properly.

Note: The loopback BER test requires a Verilink 4019NYP Bit Error Rate (BER) Test Set or equivalent. Refer to the Verilink 4019NYP BER Test Set System Practices (103-493-101 thru 104) for instructions for performing loopback testing and other details.

End-to-End BER Test

If time permits, perform a long-term end-to-end BER test. End-to-end testing is described in detail in the 4019NYP Bit Error Rate Test Set System Practices (103-493-101 thru 104).

Fault Locating Test

If the optional fault locating filter is installed, it should be tested at this time. This must be performed from the Serving Central Office by telco personnel. They must be informed that the

Transmission Problems

If user DTE is in alarm, the trouble can often be isolated by looping the DTE on itself. If the DTE appears to be operating properly check the PULSE(S) indication on the CSU associated with the DTE in alarm. The pulses indicator must be on. If an ALL ONES indication is also present, there is an upstream transmission fault which must be reported to the Serving Central Office.

If the LOOPED indicator is on, the company maintenance or telephone company repair personnel may be testing the line and transmission will be out of service until they are finished.

A simple DTE loopback test can be performed by manually patching the EQ OUT jack to the EQ IN JACK at the near end CSU and observing the operation of the near-end DTE.

WARRANTY INFORMATION

Verilink warrants that the products to be delivered hereunder, under normal use and service, will conform to Verilink published specifications and will be free from defects in material and workmanship for a period of 24 months from the date of shipment. Full details of the warranty terms and conditions are covered in the "W-24 Warranty" form.

The following paragraphs list Verilink customer assistance, repair and exchange, and training information.

A. Customer Assistance

24-Hour Hotline

This service is provided for technical assistance for service-affecting equipment failures. The 24-hour Hotline number is 800/543-1008.

The Hotline is answered directly by our field service engineers from 7:30 a.m. to 6:00 p.m. Pacific Time, Monday through Friday except holidays. At all other times, an engineer will be reached to return a phone call within four hours.

The normal hours for Verilink field service engineers are:

- o San Jose, CA: 7:30 a.m. to 6:00 p.m. Pacific Time,
408/945-1736
- o Englewood, NJ: 8:00 a.m. to 5:00 p.m. Eastern Time,
201/871-7303

If you call for assistance and our engineers are unavailable, you will be asked for your name, telephone number, and nature of your request. Your call will be returned by the first available

engineer.

B. Repairs and Exchanges

Prior to returning any unit to Verilink for repair, evaluation, or revision update, please call our technical staff to review the problem and to obtain a Return Material Authorization (RMA) number. This number is used to reference and track returned equipment. Before calling, please have the following information:

- o Type and quantity of affected equipment
- o Equipment serial number(s)
- o Failure mode
- o Purchase order number (if required)
- o Ship to and bill to addresses.

To obtain a technical evaluation and an RMA number, call 800/543-1008. RMA numbers remain active for 90 days, after which they are eliminated from our records. If the equipment has not been cleared by that time, please call for another number. Any equipment shipped to Verilink for repair or exchange without an RMA number will be returned to the sender.

In-Warranty Repair

In-Warranty repairs will be performed free of charge throughout the warranty period. Repairs are performed at the San Jose facility. Standard turnaround is thirty days from the date of receipt at the factory to return shipment.

Damages not covered under warranty will be billed at the current list price.

In-Warranty Advance Exchange

Within the constraints of available spares inventory, Verilink will exchange a unit that has failed during the warranty period with a refurbished unit from our current inventory. The replacement unit will be the current revision, and will normally be shipped within 24 hours from the time of request.

Verilink requires a purchase order to cover the full purchase price of the exchange equipment. The actual charge for this service can be obtained from a Verilink sales office.

Failed units must be returned to the factory within 14 days or the full retail value of the exchanged unit will be billed to the customer's account. Damages not covered under warranty will be billed at the current list price.

All equipment repaired and replaced by Verilink will have a 90-day "return to factory" warranty against defects in material and workmanship. Repaired and replaced equipment will be covered for the original new-product warranty or the 90-day warranty, whichever is longer.

Out-of-Warranty Repair and Exchange

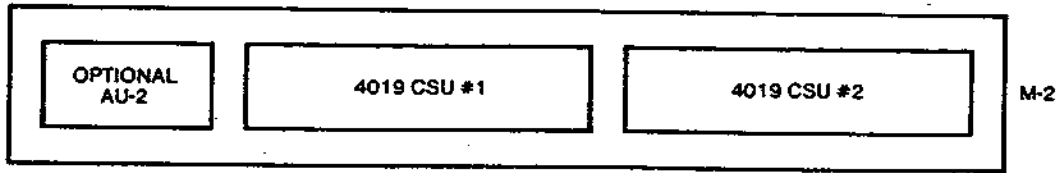
Out-of-Warranty repair and exchange is available for all Verilink products. Pricing for repairs or exchanges can be obtained from the Verilink Sales Office. Written authorization for this charge is required before shipment. A 90-day warranty applies to all replacement units.

Freight Charges

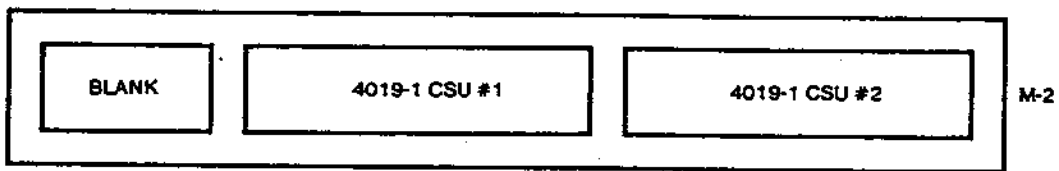
Verilink offers repair of all Verilink-manufactured products at our San Jose facility, and pays the freight charges both ways for warranty repairs. The customer is responsible for all freight charges for out-of-warranty repairs. All shipping will be via UPS Brown Label unless the customer requests and pays for some other method.

C. Customer Training

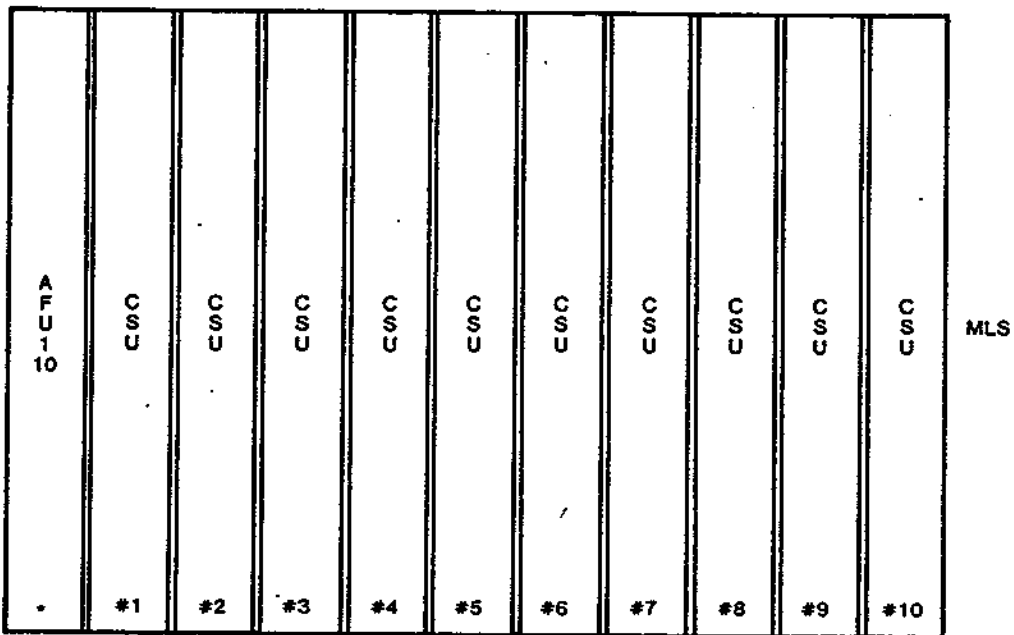
Verilink offers various training courses for the user. Please call 408/945-1199 and ask for the Verilink Training Coordinator for training information or to schedule training classes.



a. Model 551V M-2 Shelf e/w 4019 CSUs.



b. Model 551V M-2 Shelf e/w 4019-1 CSUs.



*Generally not used with 4019-1 CSUs.

c. Model 551V MLS Shelf e/w 4019 CSUs.

Figure 1. 551V Shelf Configurations (Front Views)

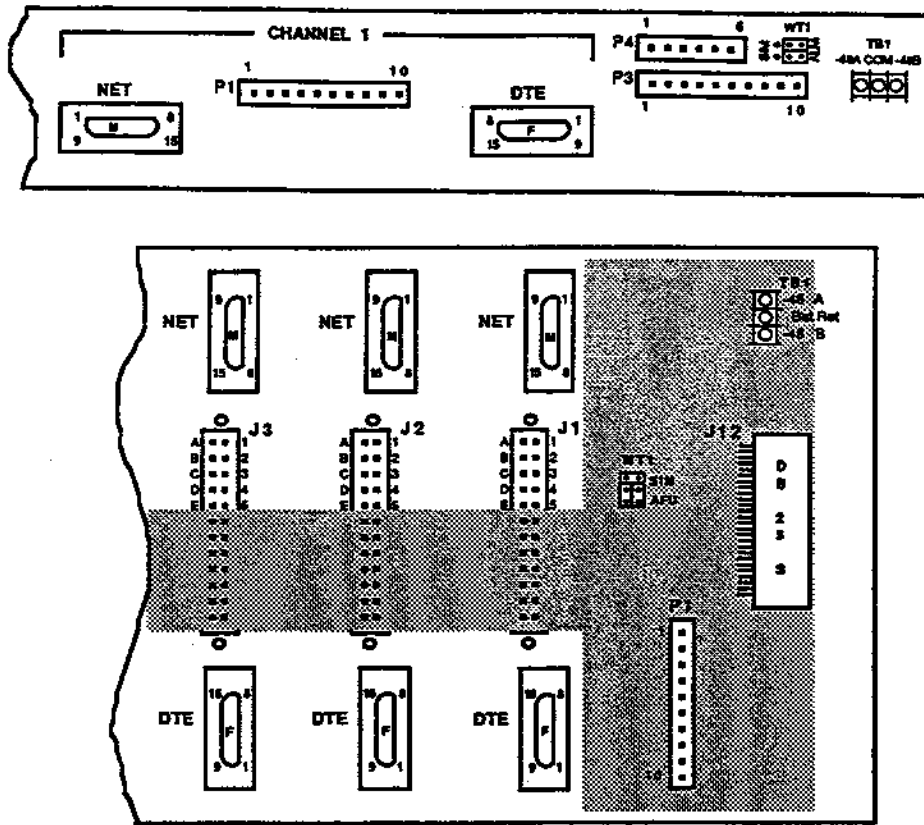


Figure 2. 551V Shelves (Rear View)

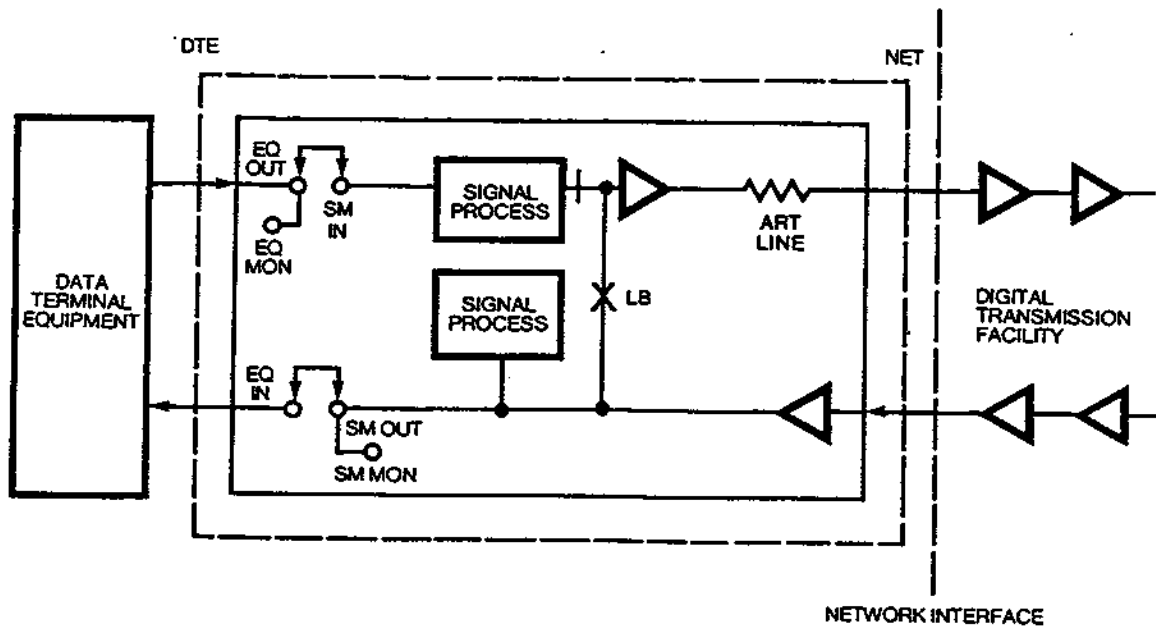
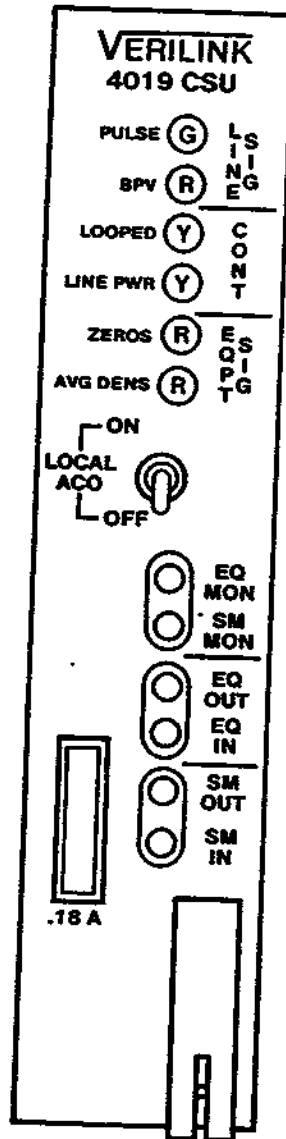


Figure 3. Block Diagram of the 4019 Channel Service Unit



NOTE: R=Red LED
 Y=Yellow LED
 G=Green LED

Figure 4a. 4019 CSU Front Panel

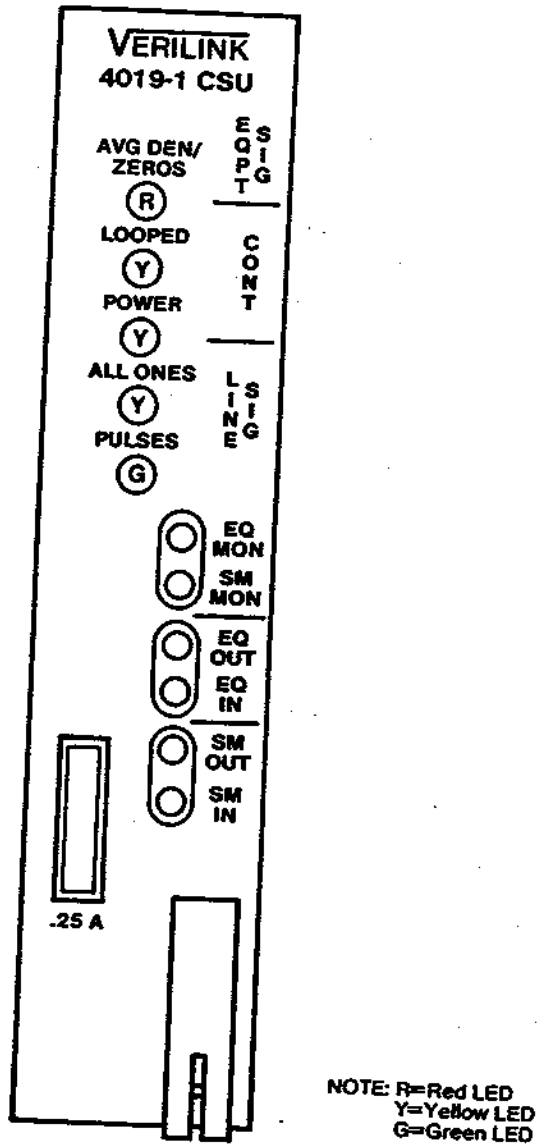
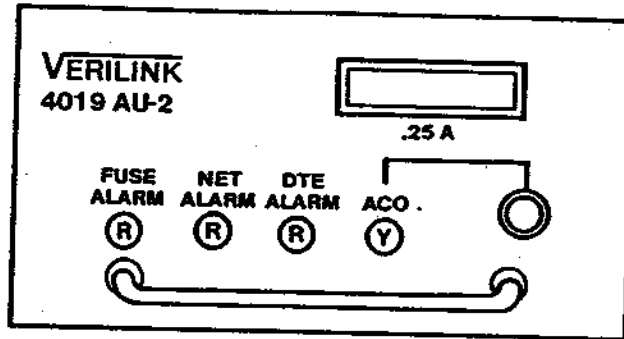


Figure 4b. 4019-1 CSU Front Panel



NOTE: R=Red LED
Y=Yellow LED
G=Green LED

Figure 5a. AU-2 Front Panel

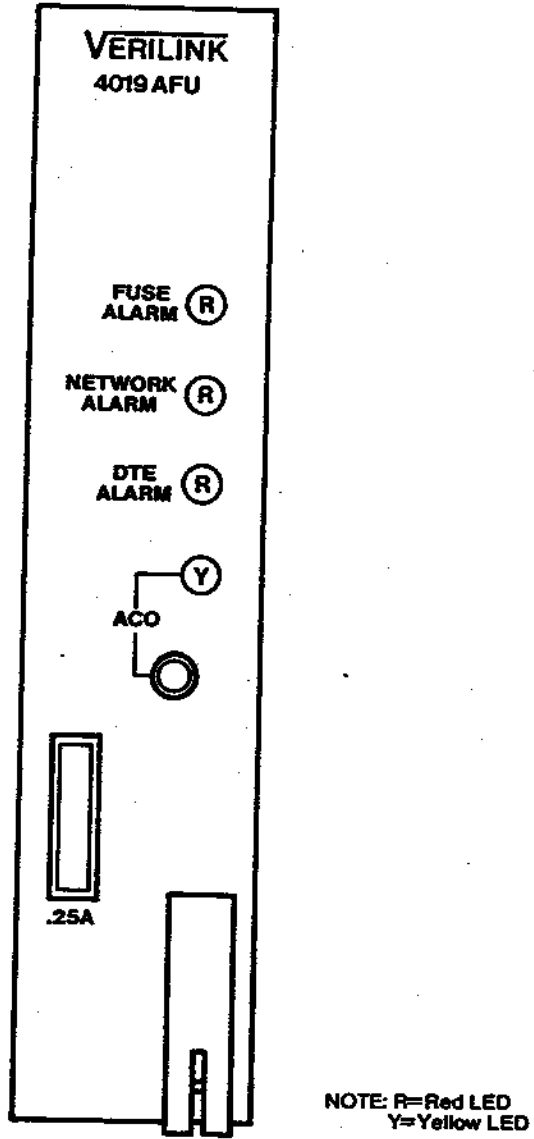


Figure 5b. AFU-10 Front Panel

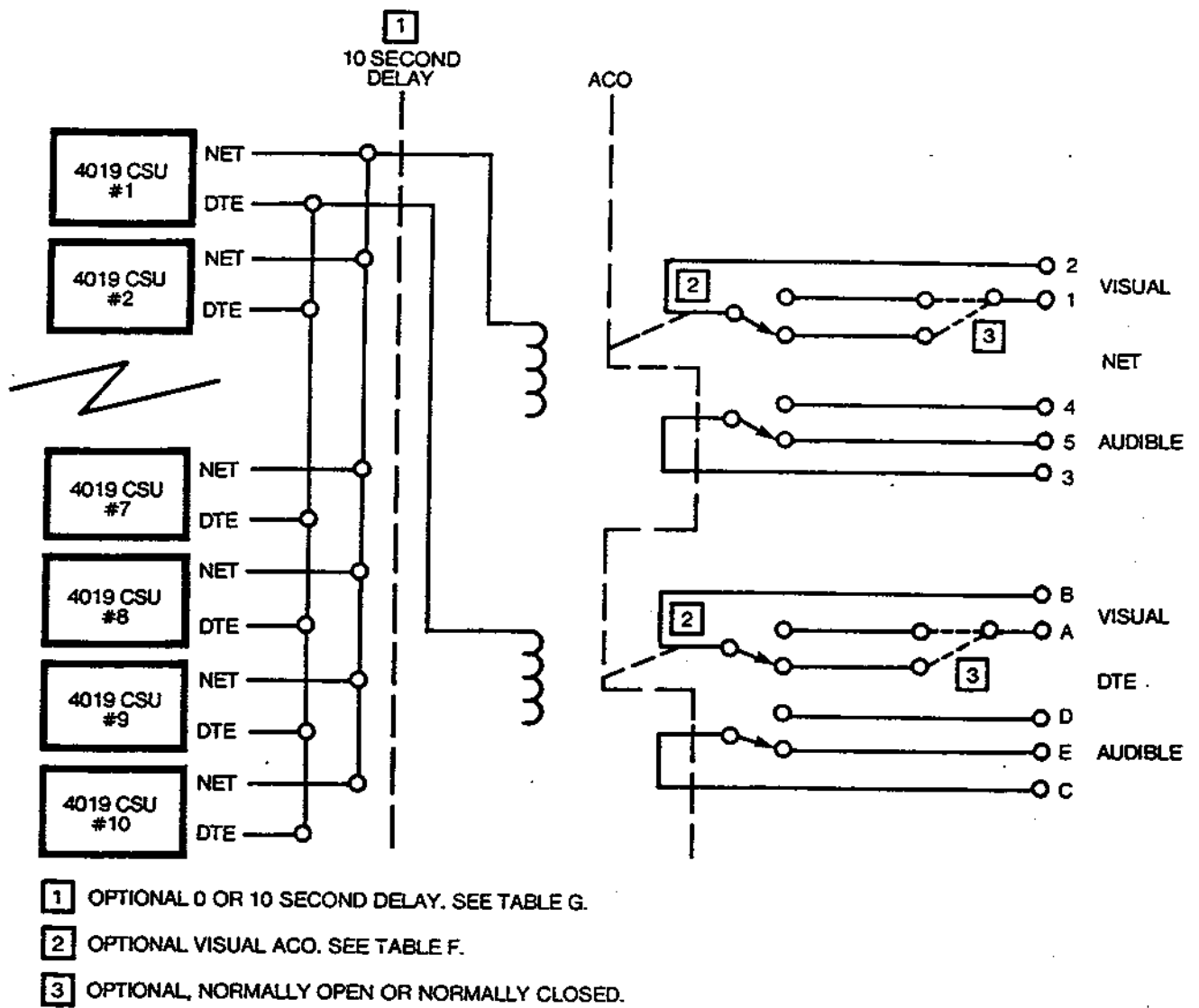
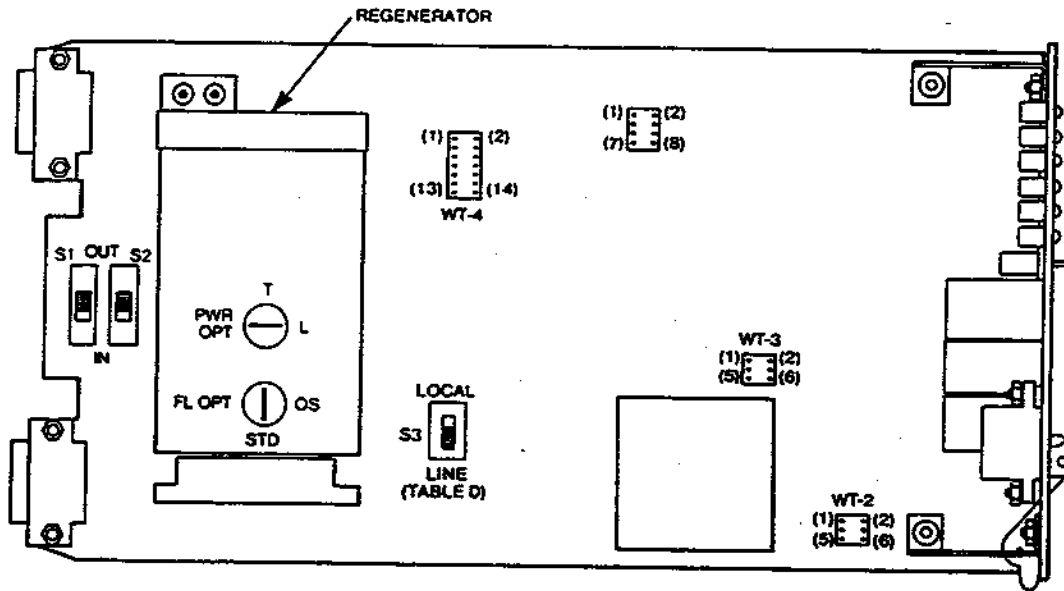
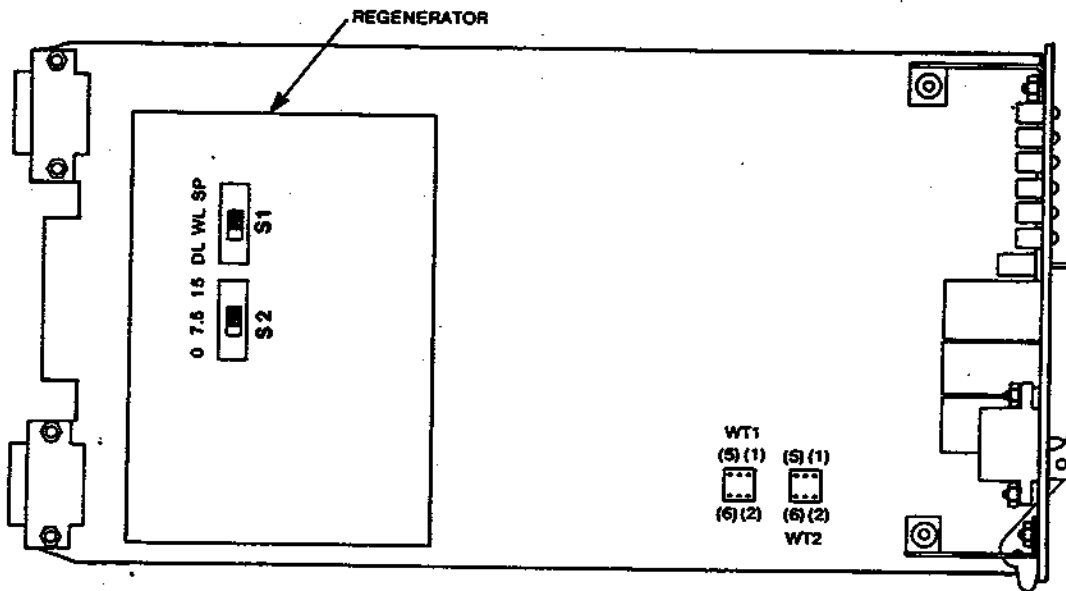


Figure 6. Simplified Alarm Option



a. 4019 CSU



b. 4019-1 CSU

Figure 7. CSU or Locations

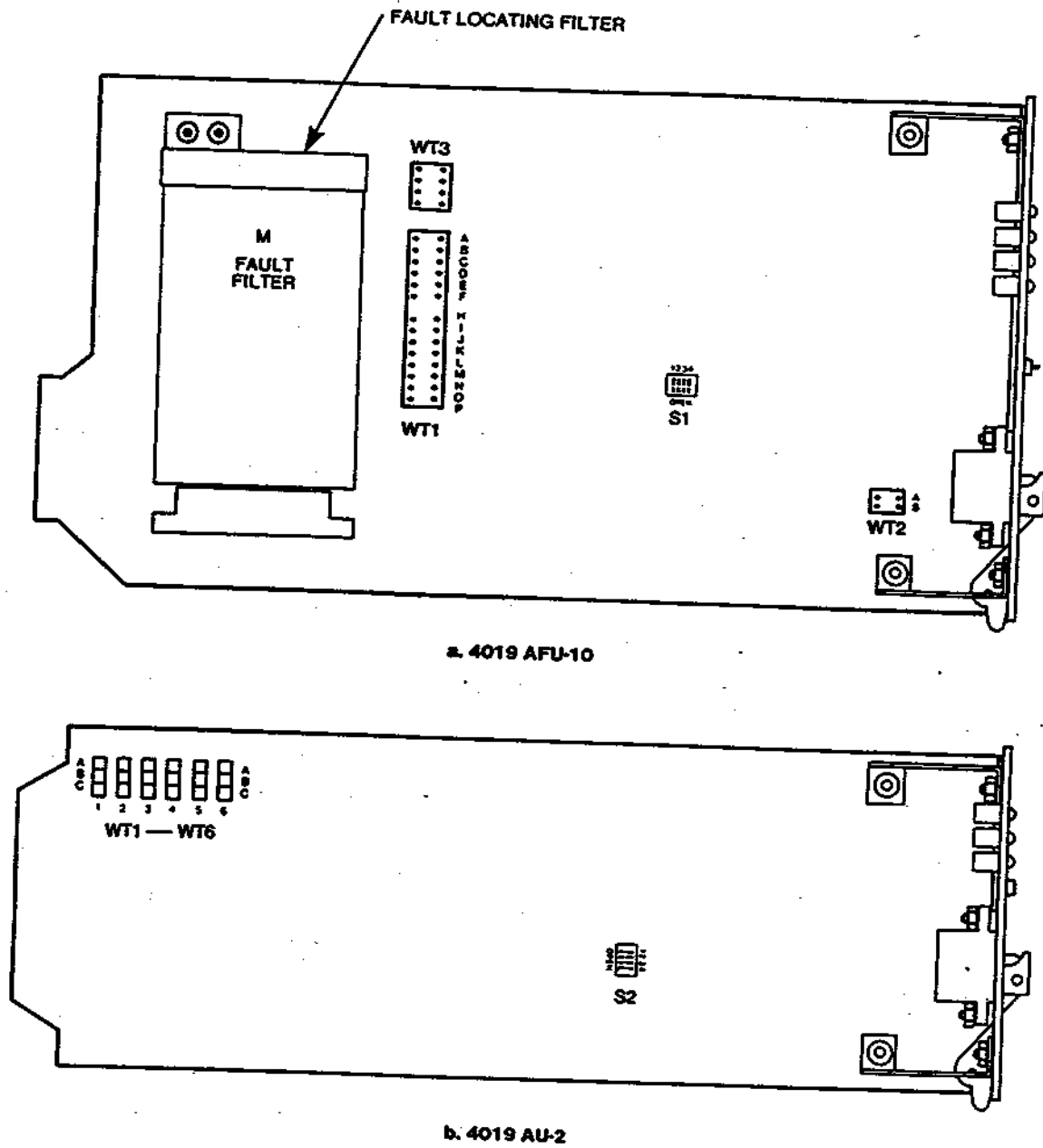


Figure 8. Alarm Unit Option Locations

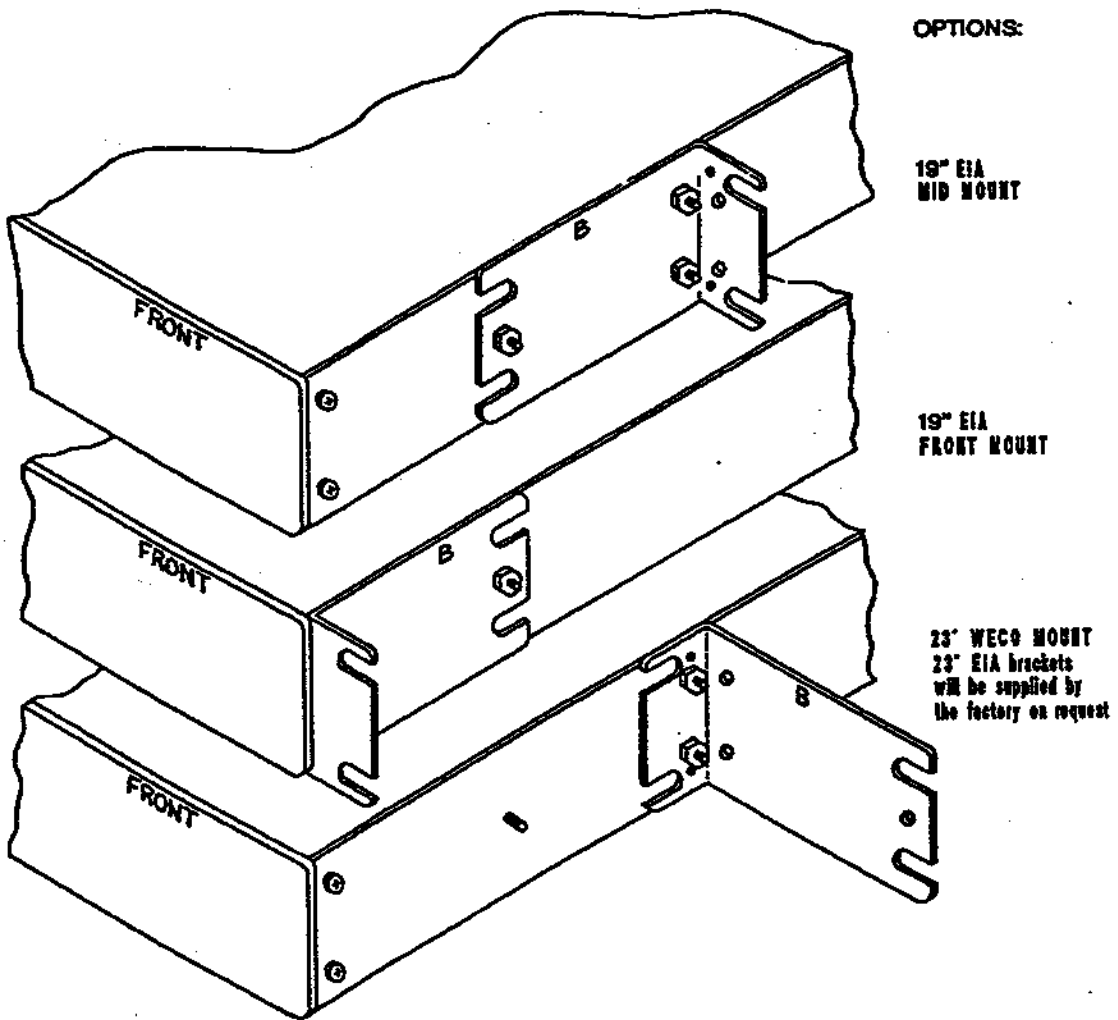


Figure 9. Rack Mounting Arrangements

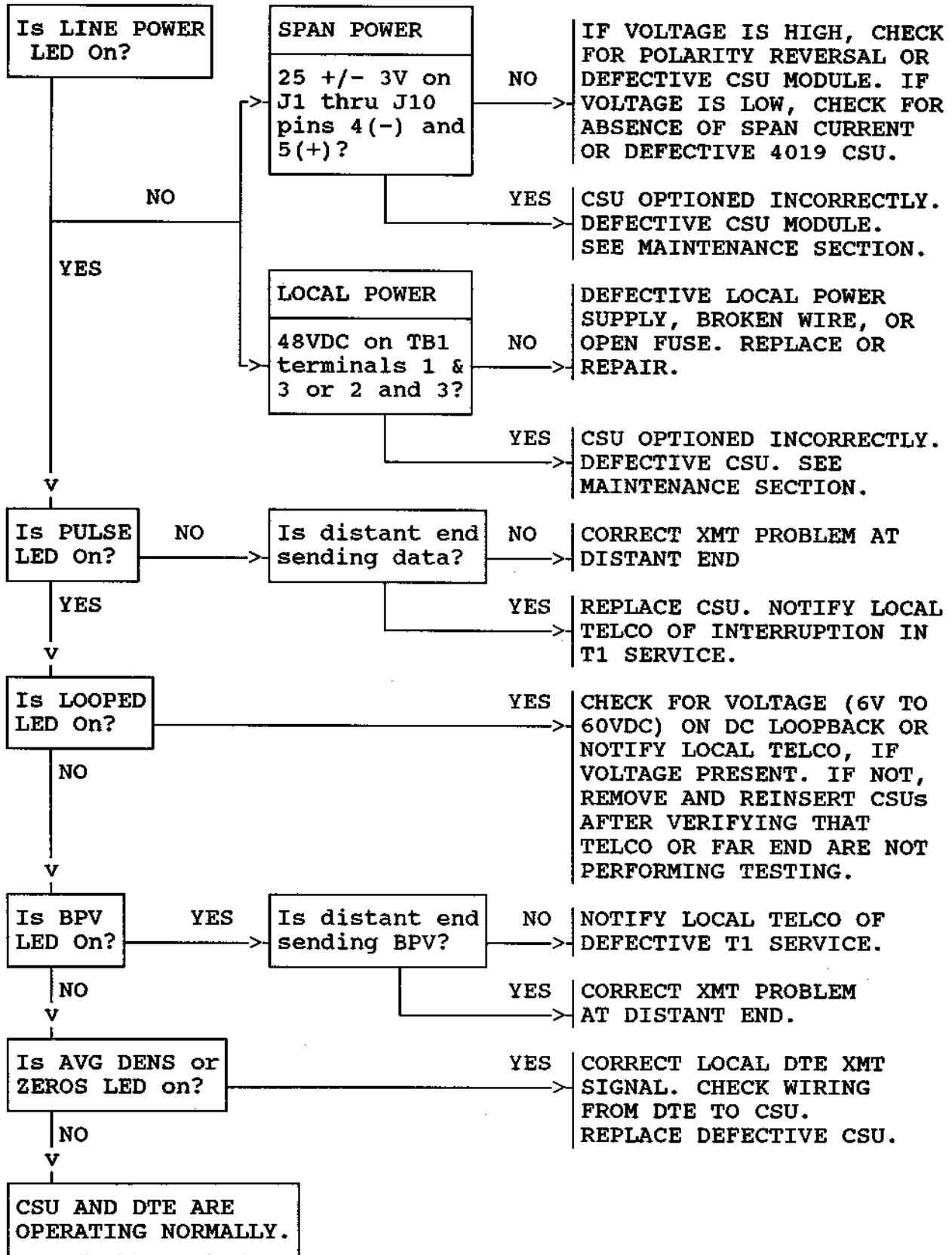
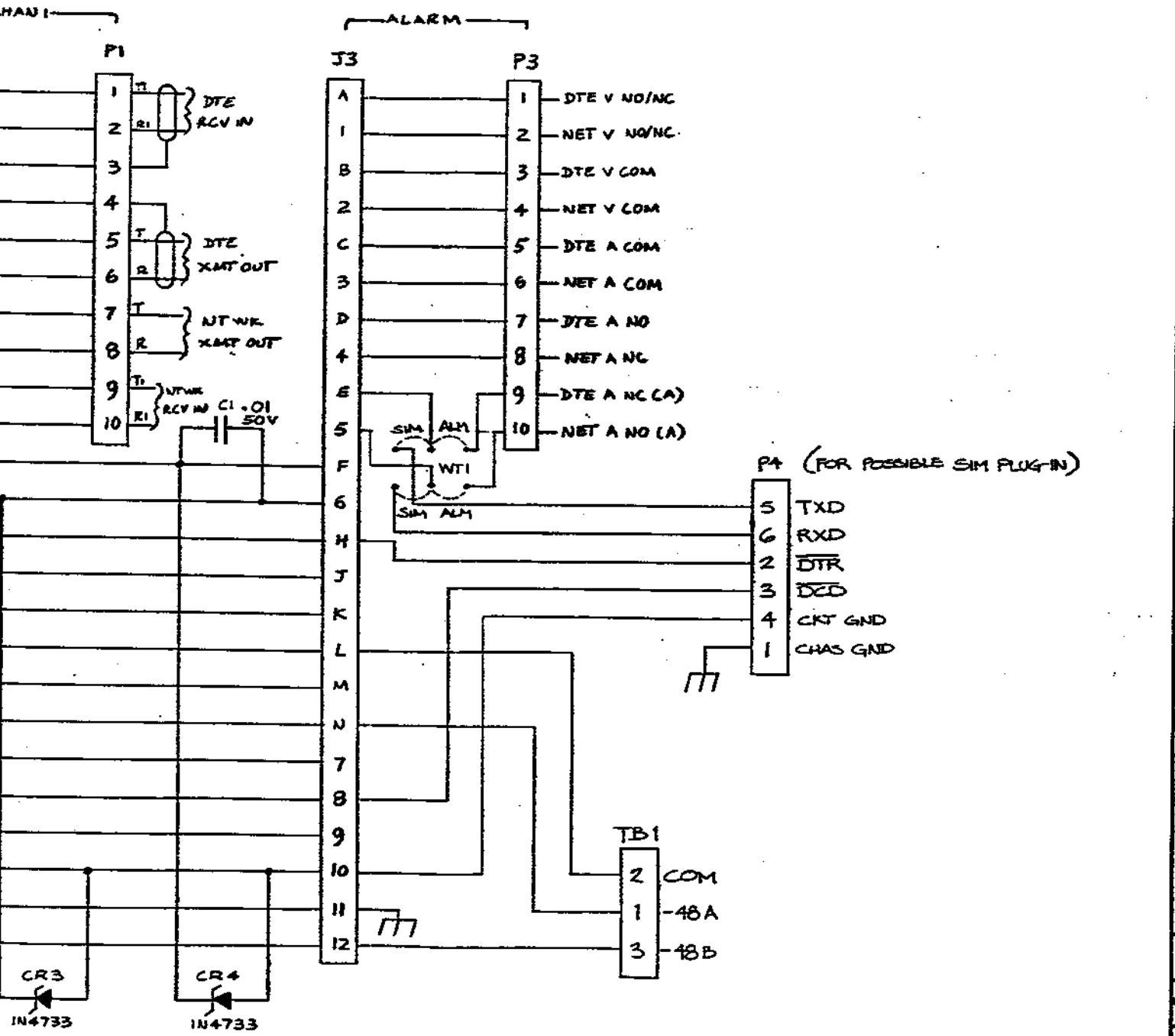


Figure 10. Troubleshooting Flowchart (4019 CSU)

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<u>INDICATORS</u>	<u>PROBLEM</u>	<u>CORRECTION</u>
POWER and PULSE on, all other lamps off	None, normal operation	If DTE in alarm, have Telco check circuit BER.
POWER off, line powering option selected	CSU not powered	Check for voltage between CSU pins D & E at the rear. If no voltage, call Telco. Voltage greater than 10 V, replace CSU.
POWER off, local powering option selected	CSU not powered	Check for -48 Vdc at output of ext. pwr. supply and at TB1-2 for broken wire. Replace CSU.
AVE DENS/ZEROS on	No XMT output from DTE	Loop DTE to check operation. Check for DTE-CSU open wire.
LOOPED on	CSU loopback energized	Telco or far-end testing the circuit. Wait for testing to end.
ALL ONES on	Network AIS alarm signal received.	Notify Telco than an upstream network problem is occurring after verifying that far-end CSU and DTE are functioning properly.
PULSES off	No signal is being received from the network.	Notify Telco than an upstream network problem is occurring after verifying that far-end CSU and DTE are functioning properly.
DTE in alarm, POWER on, all other lamps off	DTE problem, RCV wiring from CSU to DTE, or far-end DTE problem	Loop DTE at eqpt. If OK, patch SM OUT to SM IN and check for wiring problem at far-end.

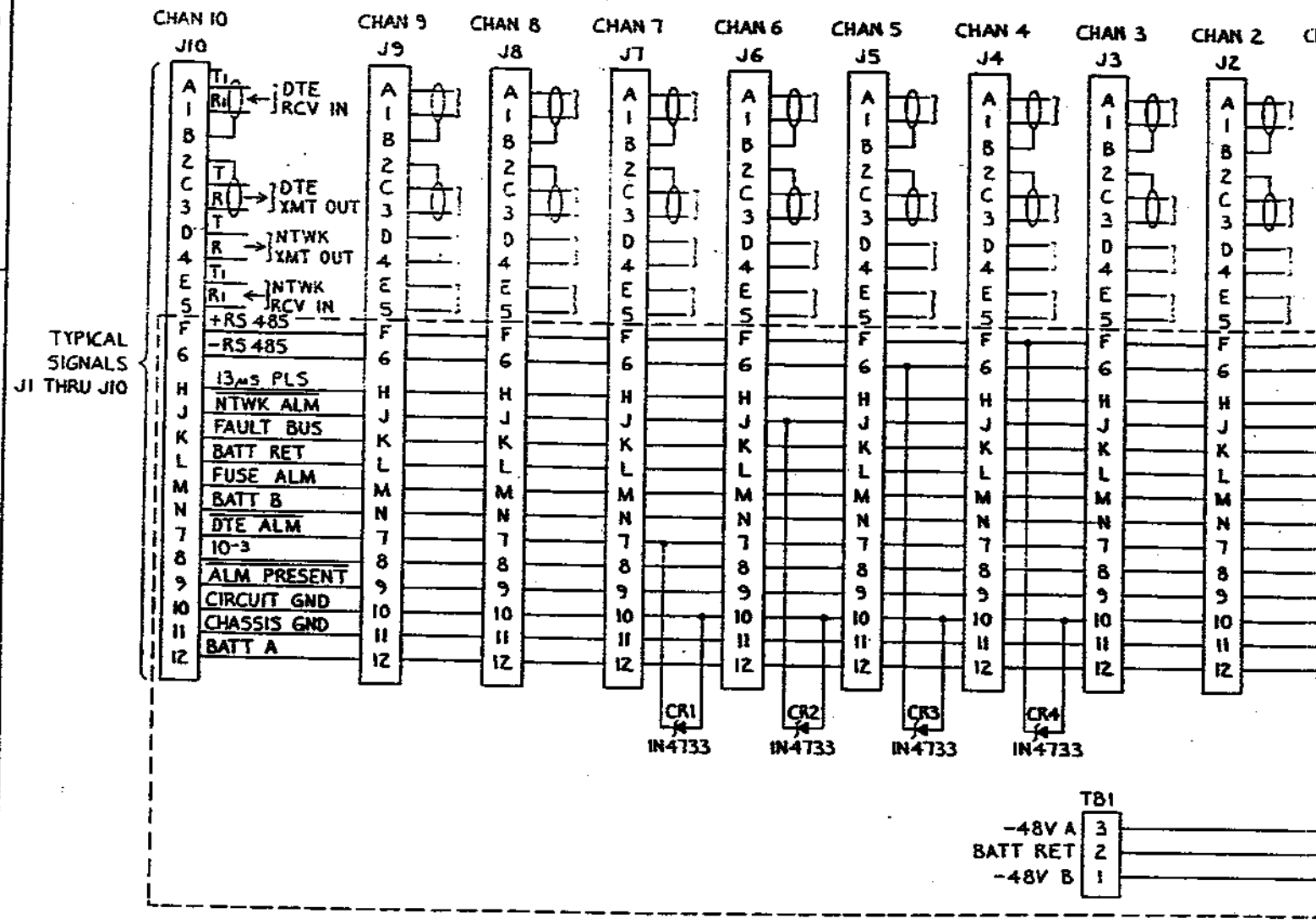
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
2	RELEASED TO PRODUCTION	1-18-62	JR



DIV. NO. SD-100677
 SHEET 1
 REV. B

THIS DOCUMENT CONTAINS INFORMATION CONSIDERED PROPRIETARY, AND SHALL NOT BE REPRODUCED WHOLLY OR IN PART, NOR DISCLOSED TO OTHERS WITHOUT THE SPECIFIC WRITTEN PERMISSION OF VERILINK CORP.		VERILINK	
MATERIAL: <input checked="" type="checkbox"/> ALL DIMS AND SHARP CORNERS		SCHEMATIC DIAGRAM - BACKPLANE 551V M-2	
1 3.0-Y477-01 1 551V M-2 CSU		CODE IDENT. NO. C	DRAWING NO. SD-100677
1 3.0-Y477-01 1 551V M-2 CSU		SIZE	REV. B
1 3.0-Y477-01 1 551V M-2 CSU		SCALE	SHEET 1 OF 1

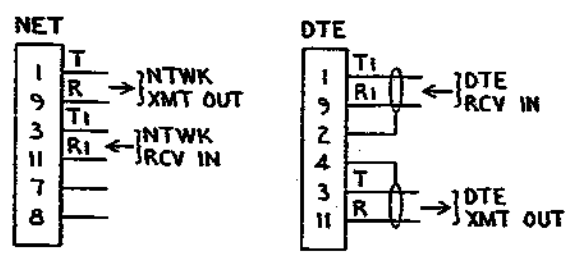
D



C

B

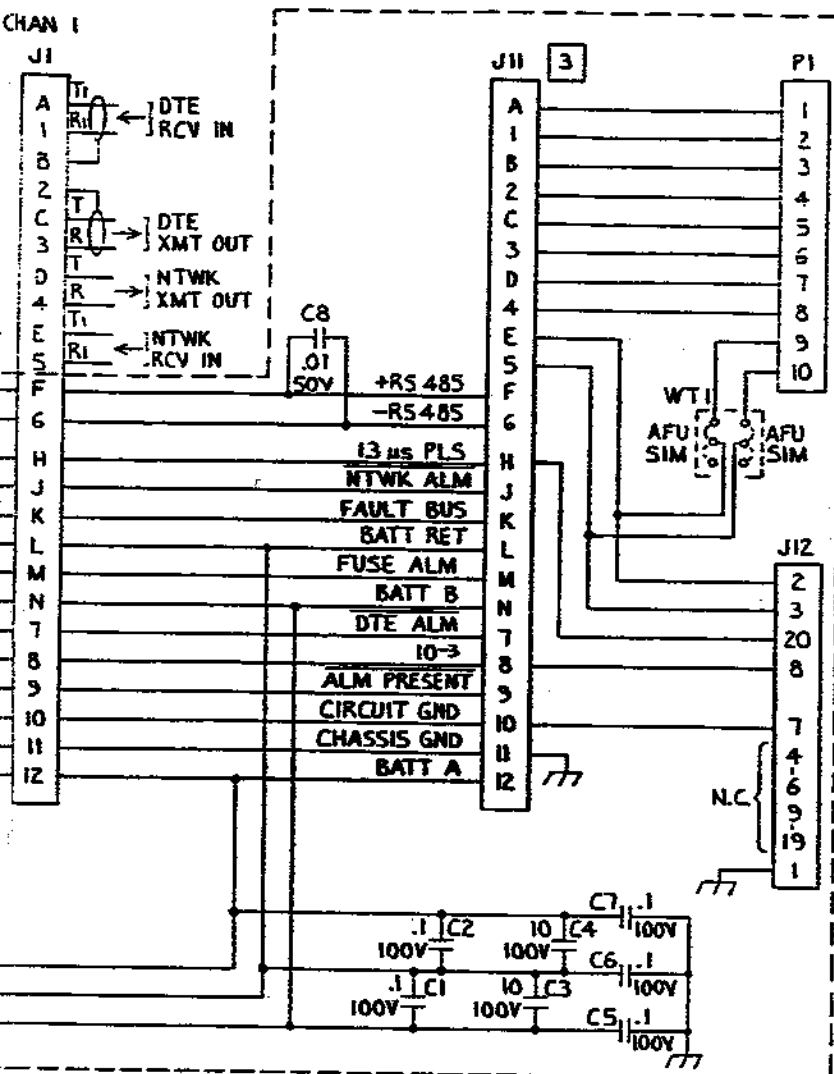
TYPICAL SIGNALS ON EACH CSU PLUG-IN



A

- 3 ALARM MODULE AND ALARM OUTPUTS NOT USED WITH 4019-1 MODULES.
 - 2. CAPACITORS - VALUE IN μ F.
 - 1. ALL VOLTAGES ARE DC.
- NOTES: (UNLESS OTHERWISE SPECIFIED)

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	RELEASED TO PRODUCTION	8-12-88	[Signature]



SIM ALARM CONNECTIONS		AFU ALARM CONNECTIONS	
1	DTE V NO/NC	1	DTE V NO/NC
2	NET V NO/NC	2	NET V NO/NC
3	DTE V COM	3	DTE V COM
4	NET V COM	4	NET V COM
5	DTE A COM	5	DTE A COM
6	NET A NO/NC	6	NET A COM
7	DTE A NO/NC	7	DTE A NO
8	NET A COM	8	NET A NC
9		9	DTE A NC(A)
10		10	NET A NO(A)

SIM SIGNALS (RS-232)		J12 NOT USED WITH AFU	
2	TXD		
3	RXD		
20	DTR		
8	DCD		
7	CKTGND		
4, 6, 9, 19	CHAS GND		

INTERCONNECT PCB

VERILINK PART NO.	ITEM NO.	QUANTITY	UOM	DESCRIPTION
LIST OF MATERIALS				
VERILINK				
SCHEMATIC DIAGRAM - INTERCONNECT REAR PANEL SSIV MLS				
DRAWN: J. MOORE 8-9-88		DESIGN: [Signature]		
CHECKED: EFS [Signature] 8-10-88		DATE: 8-12-88		
APPROVED: [Signature] 8-12-88		DATE: 8-12-88		
UNLESS OTHERWISE SPECIFIED		CODE IDENT NO	SIZE	DRAWING NO.
DECIMALS			D	SD-100656
NEXT ASSY		QTY PER UNIT		MODEL NO.
1		1		SSIV MLS

SD-100656

APPENDIX I: PREREQUISITES TO CSU-NETWORK CONNECTION

GENERAL: Because this initial connection will require cooperation between the end user and the Telco engineering staff, be sure to notify the serving telephone company (TELCO) before connecting (or disconnecting) your Channel Service Unit (CSU) to (or from) the T1 line at the Network Interface. The agent who originally negotiated your service will inform you whom to contact at the Telco. FCC Part 68 regulations require that the end user notify the Telco before disconnecting the CSU from the T1 line.

Filling out the customer information portion of the attached form and then submitting it to the Telco will help facilitate interactive T Carrier engineering. The end user should request that the Telco complete the "TELCO DATA" portion of this form before returning it for implementation.

The TELCO response will itemize all the required information and usually make power and LBO recommendations since it is in their own basic interest. A call to Verilink Field Service will also help you make proper pad selections and powering arrangements.

CSU powering and Line Build Out (LBO) settings are discussed below.

CSU POWER OPTION

DANGER: Potentials as high as 260V DC may be present across the transmit and receive pairs.

The CSU may be powered using either TELCO span line power or a local -48VDC power source (Some CSUs require local power). Figure 1 illustrates three different methods of CSU powering: (a) Span Power, (b) Local Power--Wet Loop and (c) Local Power--Dry Loop.

Span line power, which is typically available if the transmission medium is copper pairs, may be detected by measuring the voltage difference between the transmit and receive pairs with the CSU disconnected. The voltage measured will typically be 48, 130, 178 or 260V DC. If span line power is provided and the TELCO concurs, option the CSU for Span Power, as in Figure 1a.

If the transmission medium is copper pairs and span line power is not provided, then the CSU should be optioned for Local Power--Wet Loop (sealing current), as in Figure 1b.

WARNING: Connecting a CSU provisioned for Local Power--Wet Loop with span line power present may result in damage to the CSU. The end user should always consult the TELCO before connecting the CSU.

If the transmission medium is digital microwave, digital multiplexers or fiber optics, then span line power will not be provided. This application requires that the CSU be optioned for Local Power--Dry Loop, as in Figure 1c.

WARNING: Connecting a CSU provisioned for Local Power--Wet Loop to digital microwave, digital multiplexers or fiber optics may damage the equipment. In all situations the TELCO should be notified prior to connecting the CSU.

LINE BUILD OUT (LBO) OPERATION:

Correct setting of the LBO Switch will insure proper operation of both the terminal equipment and the network. Incorrect setting will result in unreliable operation, interference between user services, and non-compliance with FCC Part 68 rules.

Multiple users of 1.544 Mbps service share the same multipair cable shield. In order to minimize harmful crosstalk at T Carrier frequencies it is important that equal signal levels be maintained for all users within the same cable shield. When properly set, the LBO attenuator will assure that the signal delivered to the first line repeater will include the loss expected from a 2000 to 3000 ft. cable section loss.

The output of the CSU is nominal 3V bP (base-to-peak), which can be attenuated via a switch-selectable artificial line (LBO Switch) providing attenuation of 0.0, 7.5, or 15.0 dB, as required. At settings of 7.5 and 15.0 dB, the pads introduce frequency roll-off simulating cable runs of 1000 and 2000 feet, respectively, to present the nearest span-line repeater a signal level and pulse shape consistent with a distance of 2000 to 3000 feet from the 4019 CSU. With a pad setting of 0.0 dB, the CSU will drive cable lengths of 2000 to 3000 feet, and, subsequently, present similar signal levels and pulse shapes to the first line repeater. Figure 2 illustrates 3 possible network configurations.

REQUEST FOR 1.544 MBPS END SECTION CHARACTERISTICS

This form, which addresses important electrical setup issues pertaining to the installation of 1.544 Mbps T Carrier service, is designed to initiate communications between the end user and the serving Telco. The end user communications manager should complete all information within the "Customer Data" block and submit the form to the serving Telco with a request to complete the "Telco Data" portion. The serving Telco can then return the completed form to the end user for implementation.

CUSTOMER DATA

CUSTOMER NAME _____
LOCATION _____
SERVICE ORDER # _____
CIRCUIT IDENTITY _____
FAULT LOCATE FILTER (M TYPE) SUPPLIED? YES () NO ()
DISTANCE (FEET) FROM NETWORK INTERFACE TO CSU _____
COMMUNICATIONS MANAGER _____
TELEPHONE NUMBER _____
DATE _____

TELCO DATA

SERVING CENTRAL OFFICE _____
SERVING METHOD:
A--COPPER-POWERING CUSTOMER CSU (SPAN POWER)
B--COPPER-WET LOOP (CSU LOCAL POWER WITH SEALING CURRENT TO
LAST REPEATER)
C--FIBER, MULTIPLEXER, ETC. (DRY LOOP)
SERVING METHOD PROVIDED (A, B OR C?) _____
SUPPLY VOLTAGE FOR "A" (-48, -130, -178, -260, ASPR) _____
SUPPLY CURRENT FOR "A" (60 OR 140 MAMP) _____
LOCATION OF CABLE ENTRY _____
LOCATION OF NETWORK INTERFACE _____
A--0 1000 FEET (15 dB)
B--1000 2000 FEET (7.5 dB)
C--2000 3000 FEET (0.0 dB)
DISTANCE FROM 1ST LINE REPEATER TO CSU (A, B OR C?) _____
(Include Network Interface to CSU distance
indicated above in "Customer Data" section.)
SUGGESTED CSU TRANSMIT LINE BUILD OUT PAD (0, 7.5 or 15db) _____ dB
TELCO ENGINEER _____
TELEPHONE # _____
DATE _____

APPENDIX II: FCC PART 68 COMPLIANCE STATEMENT

This Verilink equipment complies with Part 68 of FCC Rules. Please note the following:

- 1.) When you order service, the telephone company needs to know:
 - a.) The Facility Interface Code 04DU9-B (1.544 Mb D4 framing format) or 04DU9-C (1.544 Mb Extended Framing Format).
 - b.) Service Order Code: 6.0N. A signal power affidavit will be required to guarantee encoded analog content and billing protection unless this unit is used in combination with an XD-type device, or no encoded analog signals and billing information are transmitted. A sample affidavit is attached.
 - c.) The USOC jack required is an RJ48C, M, or X.

In addition, if requested, please inform the telephone company of the make, model number, and FCC Registration Number, all of which are on the label affixed to the unit.

- 2.) Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance in order to give you an opportunity to maintain uninterrupted telephone service.
- 3.) If your telephone equipment causes harm to the telephone network, the telephone company may discontinue your service temporarily. If possible, they will notify you in advance, but if advance notice is not practical, you will be notified as soon as possible. You will be informed of your right to file a Complaint with the FCC.
- 4.) You are required to notify the telephone company prior to disconnecting this unit from the network.

AFFIDAVIT FOR THE CONNECTION OF
CUSTOMER PREMISES EQUIPMENT TO 1.544 MBPS AND
SUBRATE DIGITAL SERVICES

For work to be performed in the certified territory of _____
State of _____ (Telco's name)
County of _____

I, _____ , _____ , _____
(Name) (Business Address) (Telephone Number)

representing _____ , a customer located at _____,
(Name of Customer)

_____ being duly sworn, state:

I have responsibility for the operation and maintenance of the terminal equipment to be connected to 1.544 Mbps subrate digital services. (Check below where applicable.)

I attest:

_____ That all operations associated with the establishment, maintenance and adjustment of the digital CPE with respect to encoded analog content and encoded billing information continuously complies with Part 68 of the FCC's Rules and Regulations.

or

_____ The digital CPE does not transmit digital signals containing encoded analog content or billing information which is intended to be decoded within the telecommunications network.

or

_____ The encoded analog and billing protection is factory set and is not under control of the end user.

If appropriate, I attest that the operator(s)/ maintainer(s) of the digital DTE responsible for the establishment, maintenance and adjustment of the encoded analog content and billing information has (have) been trained to perform these functions by successfully completing one of the following: (Check where appropriate.)

- _____ a. A training course provided by the manufacturer of the equipment used to encode analog signals; or

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- _____ b. A training course provided by the customer or authorized representative, using training materials and instruction provided by the manufacturer of the equipment used to encode analog signals; or
- _____ c. An independent training course (e.g., trade school or technical institution) recognized by the manufacturer of the equipment used to encode analog signals; or
- _____ d. In lieu of the preceding training requirements, the operator(s)/maintainer(s) is (are) under the control of a supervisor trained in accordance with _____ above. (circle one)

I agree to provide _____ with proper documentation to
 (Telco's name)
 demonstrate compliance with the information provided in the preceding paragraph, if so requested.

(Signature)

(Title)

(Date)

Subscribed and Sworn to before me
 this _____ day of _____, 19____

 NOTARY PUBLIC

My commission expires: