



Optelecom 9000 Series Installation and Operation Manual

Model 9525A

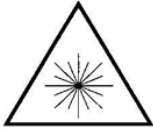
Dual Optics RS232, RS422, or RS485
Drop and Insert Modem

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Safety Instructions

The safety information contained in this section, and on other pages of this manual, must be observed whenever this unit is operated, serviced, or repaired. Failure to comply with any precaution, warning, or instruction noted in the manual is in violation of the standards of design, manufacture, and intended use of the unit. TKH Security Solutions USA assumes no liability for the customer's failure to comply with any of these safety requirements.



LASER RADIATION
DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS (MAGNIFIERS)
CLASS 1M LASER PRODUCT
WARNING: Viewing the laser output with certain optical instruments (for example: eye loupes, magnifiers and microscopes) within a distance of 100 mm may pose an eye hazard.

CAUTION:
DISCONNECTED OPTICAL CONNECTORS MAY EMIT OPTICAL ENERGY.
DO NOT VIEW BEAM WITH OPTICAL INSTRUMENTS

This product contains Class 1M lasers or LEDs.

- Class 1M laser product according to IEC60825-1:1993+A1+A2
- **CAUTION: Use of controls or adjustments or procedures other than those specified herein may result in hazardous radiation exposure.**
- Precautions should be taken to prevent exposure to optical radiation when the unit is removed from its enclosure or when fiber is disconnected from the unit.
- Laser radiation may be present on a fiber connection to this unit even when the power has been removed from the unit.
- This unit is intended for installation in locations where only trained service personnel have access to the fiber connections.
- The locations of all optical connections are listed in the Connection Locations and Function section of this manual.
- Optical outputs and wavelengths are listed in the Specifications section of this manual.

The optical devices used in this equipment are Hazard Level 1M. As required by IEC60825-1, the installer is responsible for insuring that the label depicted below is present in the restricted locations where this equipment is installed.



The border shall be black and the background shall be yellow



This assembly contains parts sensitive to damage by electrostatic discharge (ESD). Use ESD precautionary procedures when touching, removing, or inserting parts or assemblies.



The DC power input connector serves as a service disconnect for this module. This module is intended for installation in locations that provide suitable access to the DC power input connector.

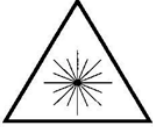


The chassis into which this unit is installed must be housed in a properly rated NEMA enclosure.



When this unit is operated in extremely elevated temperature conditions, it is possible for internal and external metal surfaces to become extremely hot. Care should be taken to insure this unit is installed in a restricted area where only properly trained service personnel have access to the unit.

Debe observarse la información de seguridad contenida en esta sección, y en otras páginas de este manual siempre que se opere, dé servicio o repare esta unidad. Si no se cumple con alguna precaución, advertencia o instrucción indicada en este manual se infringen los estándares de diseño, fabricación y el uso destinado a la unidad. TKH Security Solutions USA no asume ninguna responsabilidad si el cliente no cumple con alguno de estos requisitos de seguridad.



RADIACIÓN LÁSER
NO VER DIRECTAMENTE CON INSTRUMENTOS ÓPTICOS (DE AUMENTO)
PRODUCTO LÁSER CLASE 1M
¡PRECAUCIÓN! Mirar la salida del laser con ciertos instrumentos ópticos (ej., lentes, anteojos, lupas de aumento, microscopios, etc.) dentro de una distancia de 100 mm podría ocasionar lesiones permanentes en los ojos.

PRECAUCIÓN:
LOS CONECTORES ÓPTICOS DESCONECTADOS PUEDEN AMITIR ENERGÍA ÓPTICA
NO VER EL HAZ CON INSTRUMENTOS ÓPTICOS (DE AUMENTO)

Este producto contiene rayos láser o diodos emisores de luz Clase 1M.

- Producto láser Clase 1M conforme a la norma IEC60825-1: 1993+A1+A2
- **PRECAUCIÓN:** El uso de los controles, ajustes o procedimientos, aparte de los aquí especificados, pueden ocasionar exposición peligrosa a la radiación.
- Deben tomarse precauciones para evitar la exposición a la radiación óptica cuando se saque la unidad de su alojamiento, o cuando se desconecte la fibra de la unidad
- Puede haber radiación laser en una conexión de fibra a esta unidad aun cuando se haya eliminado la corriente de la unidad.
- Este equipo está destinado a instalarse en lugares donde sólo el personal de servicio debidamente entrenado tenga acceso a las conexiones de fibra.
- La ubicación de todas las conexiones ópticas se enumeran en la sección Ubicación de los conectores y funciones de este manual.
- Las salidas ópticas y longitudes de onda aparecen en la sección Especificaciones de este manual.

Los dispositivos ópticos usados en este equipo son de Nivel de Riesgo 1M. Según lo exige la norma IEC60825-1, el instalador es responsable de asegurar que la etiqueta descrita a continuación esté presente en las áreas restringidas donde se instale este equipo.

Nivel de Riesgo 1M

El borde debe ser negro y el fondo debe ser amarillo



Este ensamblaje contiene piezas sensibles al daño por descargas electrostáticas (ESD, por sus siglas en inglés). Use procedimientos para prevenir las descargas electrostáticas al tocar, desmontar o insertar piezas o ensamblajes.



El conector de entrada de energía de CC sirve como desconector de servicio para este módulo. Este modulo está destinado a instalarse en ubicaciones que ofrecen acceso adecuado al conector de entrada de energía de CC.

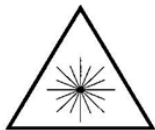


El chasis en el cual está instalada esta unidad debe estar dentro de un alojamiento debidamente calificado por NEMA.



Quando se opera esta unidad en condiciones de temperatura sumamente elevada, es posible que las superficies internas y externas de metal se pongan extremadamente calientes. Debe tenerse cuidado para asegurar que esta unidad se instale en un área restringida donde sólo tenga acceso a la unidad el personal de servicio debidamente capacitado.

Die in diesem abschnitt und auf anderen seiten dieses Handbuchs enthaltenen Sicherheitsinformationen müssen befolgt werden, wenn diese einheit betrieben, gewartet oder repariert wird. Falls Vorsichtsmassnahmen, Warnungen oder Anweisungen in diesem Handbuch nicht befolgt werden, verstösst dies gegen die Konstruktions, und Herstellungsstandards und erfolgt im gegensatz zum vorgesehenen Verwendungszweck dieser einheit. TKH Security Solutions USA übernimmt keine Haftung für das Verabsäumen des Kunden, diese Sicherheitsanforderungen einzuhalten.



LASER-STRAHLUNG
NICHT DIREKT MIT OPTISCHEN INSTRUMENTEN (LUPEN) ANSEHEN
LASER-PRODUKT DER KLASSE 1M

WARNUNG: Betrachtung des Laserlichtausgangs mit bestimmten optischen Instrumenten(zumBeispiel, Augenlupe-Vergrößerungsgläser und Mikroskope) innerhalb einer Entfernung von 100 mm kann eine Augengefahr darstellen.

VORSICHT:
ABGEKLEMMTE OPTISCHE STECKVERBINDER KÖNNEN OPTISCHE ENERGIE FREI SETZEN
NICHT MIT OPTISCHEN INSTRUMENTEN (LUPEN) IN DEN STRAHL BLICKEN.

Dieses Produkt enthält Laser oder LEDs der Klasse 1M.

- Laserprodukt der Klasse 1M gemäß IEC60825-1:1993+a1+A2
- **VORSICHT: Wenn die Bedienungselemente anders als hier beschrieben bzw. andere Einstellungen verwendet werden, kann es zu schädlicher Strahlenaussetzung kommen.**
- Es müssen Vorsichtsmaßnahmen getroffen werden, um Aussetzung an optischer Strahlung zu vermeiden, wenn die Einheit aus dem Gehäuse genommen oder die Faseroptik von der Einheit getrennt wird.
- In einer Faseroptik-Verbindung dieser Einheit kan auch dann Laserstrahlung vorhanden sein, wenn die Stromversorgung zur Einheit abgeschaltet wurde.
- Diese Einheit ist zum Einbau an Orten vorgesehen, an denen nur geschultes Personal Zugang zu den Faseroptik-Verbindungen hat.
- Die Lage aller optischen Verbindungen ist im Abschnitt über die Lage von Anschlüssen und Funktionsweise dieses Handbuchs zu finden.
- Optische Ausgänge und Wellenlängen sind im Abschnitt mit den technischen Daten dieses Handbuchs zu finden.

Die optischen Vorrichtungen in diesem Gerät haben Gefahrenstufe 1M. Wie vorgeschrieben durch IEC60825-1 ist der Installateur dafür verantwortlich, sicherzustellen, dass die unten abgebildeten Schilder an den Orten mit eingeschränktem Zugang, an denen dieses Gerät aufgestellt ist, vorhanden sind.

Gefahrenstufe 1M

Schwarzer Rand und gelber Hintergrund



Diese Baugruppe enthält Teile, die durch elektrostatische Entladungen (ESD) beschädigt werden können. Vorsichtsmaßnahmen zum Schutz vor elektrostatischer Entladung treffen, wenn Teile oder Baugruppen berührt, ausgebaut oder eingefügt werden.



Der Gleichstrom-Eingangssteckverbinder dient als Unterbrechung der Stromversorgung für dieses Modul. Dieses Modul ist für den Einbau an Orten vorgesehen, an denen geeigneter Zugang zu einem Gleichstrom-Steckverbinder vorhanden ist.

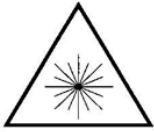


Das Gestell, in dem diese Einheit eingebaut ist, muss in einem entsprechend klassifizierten NEMA-Schutzgehäuse untergebracht sein.



Wenn diese Einheit bei besonders hohen Temperaturen betrieben wird, können interne und externe Metallflächen extrem heiß werden. Es muss darauf geachtet werden, dass diese Einheit in einem Bereich mit eingeschränktem Zugang aufgestellt wird, damit nur geschultes Wartungspersonal Zugang zur Einheit hat.

Les consignes de sécurité contenues dans cette section et dans le reste de ce manuel doivent être respectées à chaque fois que cet appareil est utilisé ou fait l'objet d'une maintenance ou d'une réparation. Le non-respect d'une précaution, d'un avertissement ou d'une instruction figurant dans ce manuel est une violation des normes de conception, fabrication et indication d'usage de l'appareil. TKH Security Solutions USA n'est pas responsable du non-respect de ces consignes de sécurité par le client.



RAYONNEMENT LASER
NE PAS REGARDER DIRECTEMENT AVEC DES INSTRUMENTS OPTIQUES (LOUPES)
PRODUIT LASER DE CLASSE 1M

ATTENTION: Observer la sortie Laser avec certains instruments optiques (par exemple: une loupe, un agrandisseur, ou un microscope), d'une distance inférieure à 100 mm peut causer des dommages oculaires.

ATTENTION:
LES CONNECTEURS OPTIQUES DEBRANCHES PEUVENT EMETTRE UNE ENERGIE OPTIQUE.
NE PAS REGARDER LE FAISCEAU AVEC DES INSTRUMENTS OPTIQUES (LOUPES)

Ce produit contient des lasers ou diodes électroluminescentes de classe 1M.

- Produit laser de classe 1M conformément à IEC60825-1:1993+A1+A2
- **ATTENTION: L' utilisation de commandes ou réglages, ou de procédures différentes de celles indiquées ici risque de provoquer une exposition dangereuse au rayonnement.**
- Prendre des précautions pour empêcher une exposition au rayonnement optique lorsque l' appareil est retiré de son boîtier ou lorsque le câble optique fibre est débranché de l' appareil.
- Un rayonnement laser pourra être présent dans un câble optique branché sur cet appareil, même une fois l'alimentation coupée.
- Cet appareil est prévu pour une installation à des endroits où seul un personnel de maintenance formé accès aux câbles optiques.
- Les points de branchement de tous les câbles optiques sont indiqués à la section Points de branchement et fonction de ce manuel.
- Les sorties et longueurs d' onde optiques figurant à la section Caractéristiques techniques de ce manuel.

Les appareils optiques utilisés dans cet équipement correspondent à un niveau de danger 1M. Comme exigé par la norme IEC60825-1, il incombe à l'installateur de s'assurer que l'étiquette ci-dessous est présente aux endroits d'accès limité où cet équipement est installé.

Niveau de danger 1M

La bordure doit être noire et le fond jaune



Cet ensemble contient des pièces sensibles aux décharges électrostatiques (ESD). Prendre les précautions relatives aux ESD avant de toucher, retirer ou insérer des pièces ou des ensembles.



Le connecteur d'entrée d'alimentation c.c. sert de sectionneur de maintenance pour ce module. Ce module est prévu pour une installation à des endroits donnant raisonnablement accès au connecteur d'entrée d'alimentation c.c.



Le châssis dans lequel est installé cet appareil doit être placé dans une enceinte NEMA conforme aux spécifications nominales.



Lorsque cet appareil fonctionne à une température ambiante extrêmement élevée, il est possible que les surfaces métalliques internes et externes deviennent extrêmement chaudes. S'assurer que cet appareil est installé dans une zone dont l'accès est limité à un personnel de maintenance correctement formé.

Fiber Information

This unit was manufactured with attention to fiber cleanliness by TKH Security Solutions USA. Beyond the optical safety information contained in this manual, the following guidelines should be observed when working with optical fibers.

The biggest problem is **dirt!**

It takes very little contamination to cause problems with optical fiber connections; cleanliness is extremely important to proper operation of optical equipment.

1. Protect optical connectors by leaving the connector covers in place on unused fiber connections and on the fiber tips themselves.
2. Personnel who remove and replace fibers should be equipped with a fiber cleaning kit. These are inexpensive and can be obtained from any fiber equipment supply house. If you choose to, you can use propanol and lint-free tissue to clean fibers.
 - a. Do not use isopropanol alcohol (typically called rubbing alcohol) mixed with water. This can cause additional spots. (**Caution: *Pure isopropanol is very flammable!***)
 - b. Use lintless tissues to clean fibers.
 - c. Clean the fiber with a folded tissue moistened with the propanol, pulling the connector tip across the tissue, then turn the connector 90 degrees and repeat in a different spot on the tissue.
 - d. Don't pull the fiber across and then push it back. This will put the dirt that was cleaned off back on again.
 - e. Repeat the process on a dry, folded tissue.
3. When removing fibers, ***always*** clean them when replacing them no matter how long you had them off.
4. When connecting fibers, pay attention to the bend radius of the fibers. A general rule is to have a 3-inch (8 cm) bend radius. A bend radius less than 3 inches is an attenuator and can cause optical signal loss.
5. Installers of fiber equipment should be equipped with the equipment manuals and an optical power meter to measure the optical inputs and outputs in a system. An optical power meter is an inexpensive tool that can save much time and effort in getting optical communications links up and running. Properly equipped and trained installers can quickly determine the source of any problems that occur.

External Wiring Information

Cable assemblies with lengths external to the unit not exceeding 3.05 meters, coiled or uncoiled, may be constructed of jacketed appliance wiring material suitable for the maximum voltage current and temperature, rated VW-1 or FT-1 or better. Cable assemblies with lengths external to the unit not exceeding 3.05 meters, coiled or uncoiled, and supplied by a limited power source or NEC Class 2 source of supply as defined in the National Electric Code, ANSI/NFPA 70, may be constructed of materials rated VW-1 or FT-1 or better with no additional requirements.

1 - INTRODUCTION

1.1 General description

The TKH Security USA Model 9525A is an RS232, RS422, and RS485 compatible stand alone fiber optic modem with dual optics for drop and insert applications which can be configured in a wide range of poll/response network architectures. The unit operates using two optical fibers to transmit and receive in the upstream direction. A second pair of fibers is used in the downstream direction. This results in the formation of a two-fiber daisy chain or ring.

The units may be operated in either daisy chain or fault tolerant redundant ring architectures. In addition, in certain modes, an RS232 expansion port on the modem may be connected to a second modem with single or dual optics to branch the network in one or two additional directions. With this capability a daisy chain network may be set up with unlimited branches off the main trunk(s). Additionally, unlimited daisy chain connections may be made branching off of a main fault tolerant dual fiber ring. All signals received via an optical port and retransmitted via fiber or via the expansion port are re-timed to .01% pulse width accuracy by a crystal controlled time-base, eliminating pulse width distortion and allowing virtually unlimited repeating.

The units have four switch selectable modes of operation: Daisy Chain Master mode, Daisy Chain Local mode, Fault Tolerant Master mode, and Fault Tolerant Local mode. See Section 2, Installation, for a complete description of these modes of operation.

The units may be operated in either daisy chain or fault tolerant redundant ring architectures. In addition, in daisy chain mode an RS232 expansion port on the modem may be connected to another modem with single or dual optics to branch the network in one or two additional directions. With this capability a daisy chain network may be set up with unlimited branches off the main trunk(s).

The units have anti-streaming (sometimes referred to as anti-babbling) circuitry for both the optical fiber and electrical (RS232) sides. On the RS232 side, when enabled, the anti-streaming limits the amount of time a terminal is allowed to transmit data onto the network for each Request to Send. This is to prevent a faulty terminal unit from monopolizing the network. On the fiber side the anti-streaming disables an optical receiver in the event that the receiver output stays high longer than the maximum allowable time. This will prevent the whole fiber network from being disabled by a continuous "on" failure by receiver or optical emitter. This feature is not available when in RS422 or RS485 mode because the RTS line is not supported.

The units have nine front panel LED indicators. A POWER indicator is on solid when operating under primary power and blinks if operating on an external gel cell battery in the case of the loss of the primary power source. If operating in local mode, a FAULT indicator illuminates in the event of an RS232 anti-streaming timeout. If operating in Master fault tolerant mode, the FAULT indicator illuminates if one of the two redundant rings is broken. A relay with N.O. and N.C. contacts activates in conjunction with an illuminated FAULT LED. A BERT indicator operates when properly receiving the BERT signal. The other six indicators serve dual functions as selected by the indicator mode switch. In one position the LEDs indicate electrical side signal activity. In the other position the LEDs indicate fiber port activity as well as the active fiber input port as chosen by the priority select circuitry.

A ten-position MODES dipswitch allows the user to select the operating mode, Tx1 and Tx2 BERT Signal Enable, and the data interface. In addition, an eight-position TIMEOUT dipswitch allows the user to select timeouts for (or disable) the electrical side anti-streaming, the fiber activity CTS inhibit (RS232 mode), echo cancel timeouts, and priority select timeouts.

The unit operates from a 9 to 15 VDC supply. The unit contains a built in battery charger compatible with a 6-volt lead-acid gel cell battery (1.2 Amp-hour to 7 Amp-hour capacity). This battery allows from 6 to 35 hours of emergency battery backup operation. A screw terminal connector allows the unit to connect the battery to the unit.

The package is an anodized aluminum extrusion with painted aluminum front and rear panels. An optional mounting kit is available for mounting in a System 9000 chassis (Model 9000KIT-5).

Table 1 - Models Available

MODELS	OPTIC PORT	FIBER	WAVELENGTH	OPTICAL BUDGET
9525A-S-ST	ST	62.5/125 μm	850 nm	22 dB
9525A-L-ST	ST	62.5/125 μm	1310 nm	21 dB
9525A-LD-ST	ST	09/125 μm	1310 nm	23 dB
9525A-LD-FC	FC	09/125 μm	1310 nm	23 dB
9525A-LD3-ST	ST	09/125 μm	1550 nm	23 dB

1.2 Physical Specification

DIMENSIONS	Height	Width	Length
INCHES	1.5	3.17	5.0
WEIGHT	0.875 lb.	0.4 kg	
INDICATORS	POWER, TD/TX1, RD/RX1, RTS/TX2, CTS/RX2, TDEXP/RX1 PRIORITY, RDEXP/RX2 PRIORITY, BERT, and FAULT.		

1.3 Environmental Specification

TEMPERATURE	Fahrenheit	Celsius
Operating	-40 to 165° F	-40 to 74° C
Storage	-40 to 185° F	-40 to 85° C
HUMIDITY	0 to 95% RH noncondensing	

1.4 Functional Specifications

1.4.1 OPTICAL

Version	S	L	LD	LD3
Wavelength, nm	830	1310	1310	1550
Output power, dBm, with BERT				
Signal enabled, dBm				
62.5 um fiber	-19	-20	N/A	N/A
09/125 um fiber	N/A	N/A	-18	-18
Input power, dBm, min. for 10 ⁹ BER, measured with transmitting unit				
BERT Signal enabled	-41	-41	-41	-41

1.4.2 ELECTRICAL (Tx and Rx)

Data Interfaces	RS232, RS422, or RS485 (2- or 4-wire), switch selectable
Connectors	
Primary Port	DB25S
Expansion Port	RJ12
Data rates	150, 300, 600, 1.2 k, 2.4 k, 3.6 k, 4.8 k, 7.2 k, 9.6k, 14.4k, 19.2k, 28.8k, 38.4k, 57.6k, and 115.2k baud (auto baud)
BER	10 ⁹ or better at the minimum receiver power level
Re-timing accuracy	0.01% of pulse width for repeated signals
Electrical anti-streaming timeout selections	DISABLED 1, 2, 3, 4, 8, 16, 32, and 64 sec.
Propagation Delay as a repeater	Approx. 6.5 microseconds

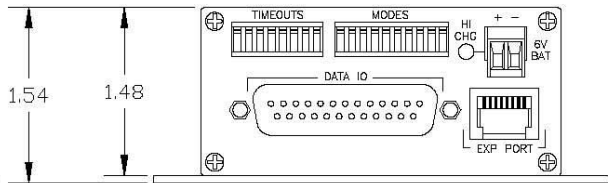
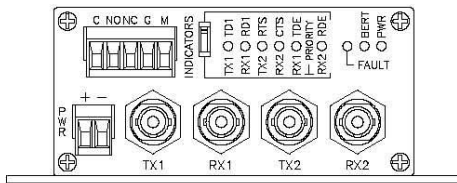
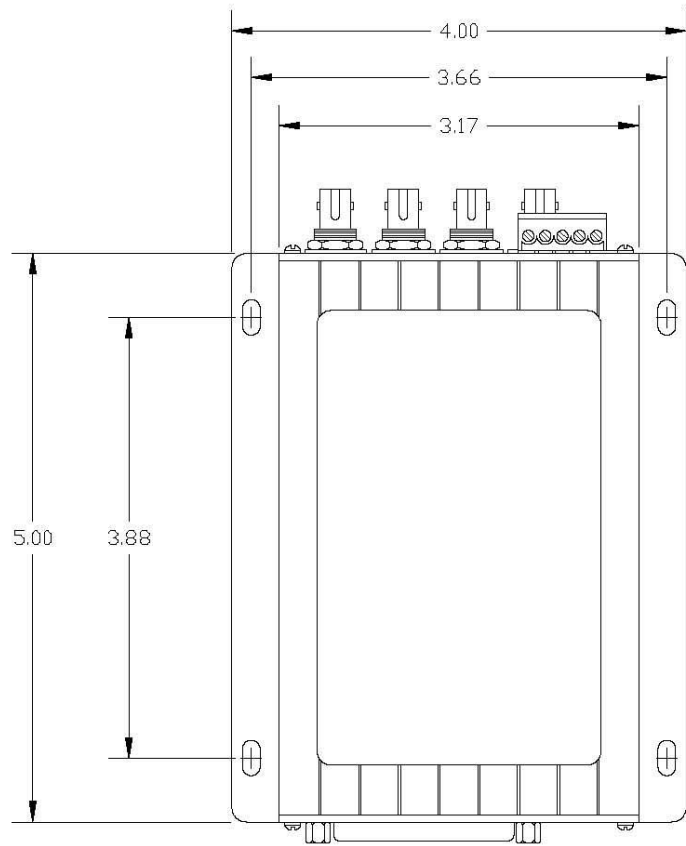
1.4.3 ALARM

Contact Rating	28 VDC @ 100 mA
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1.4.4 POWER

Operate	8 to 15 VDC @ 180 mA
Recommended Power Supplies	
9014PS (for operating temperature ranges 0° C to +40° C)	
PSR 12 DC (for operating temperature ranges -10° C to +70° C)	
Recommended External Battery	
6 VDC, 4 Amp hour, PowerSonic Model PS640WL or equal (provides up to 20 hours backup @ 20° C). Battery temperature range is -20° C to +50° C.	

FIGURE 1 — MODEL 9525A ENGINEERING VIEWS AND DIMENSIONS



FRONT VIEW

REAR VIEW

2 - INSTALLATION

2.1 System Architecture

The Model 9525A can be configured into three basic network architectures. To configure the network, the modems may be set to operate in one of four modes, characterized mainly by the internal signal routing within the modem among the data port, the RS232 expansion port, and the two optical transmitter/receiver ports.

In addition to the routing of the data signals within the modem that characterizes its mode of operation, there are several other operational features that are important to know. Some of these features are inherent, some are optional, and others are absent depending on the mode of operation.

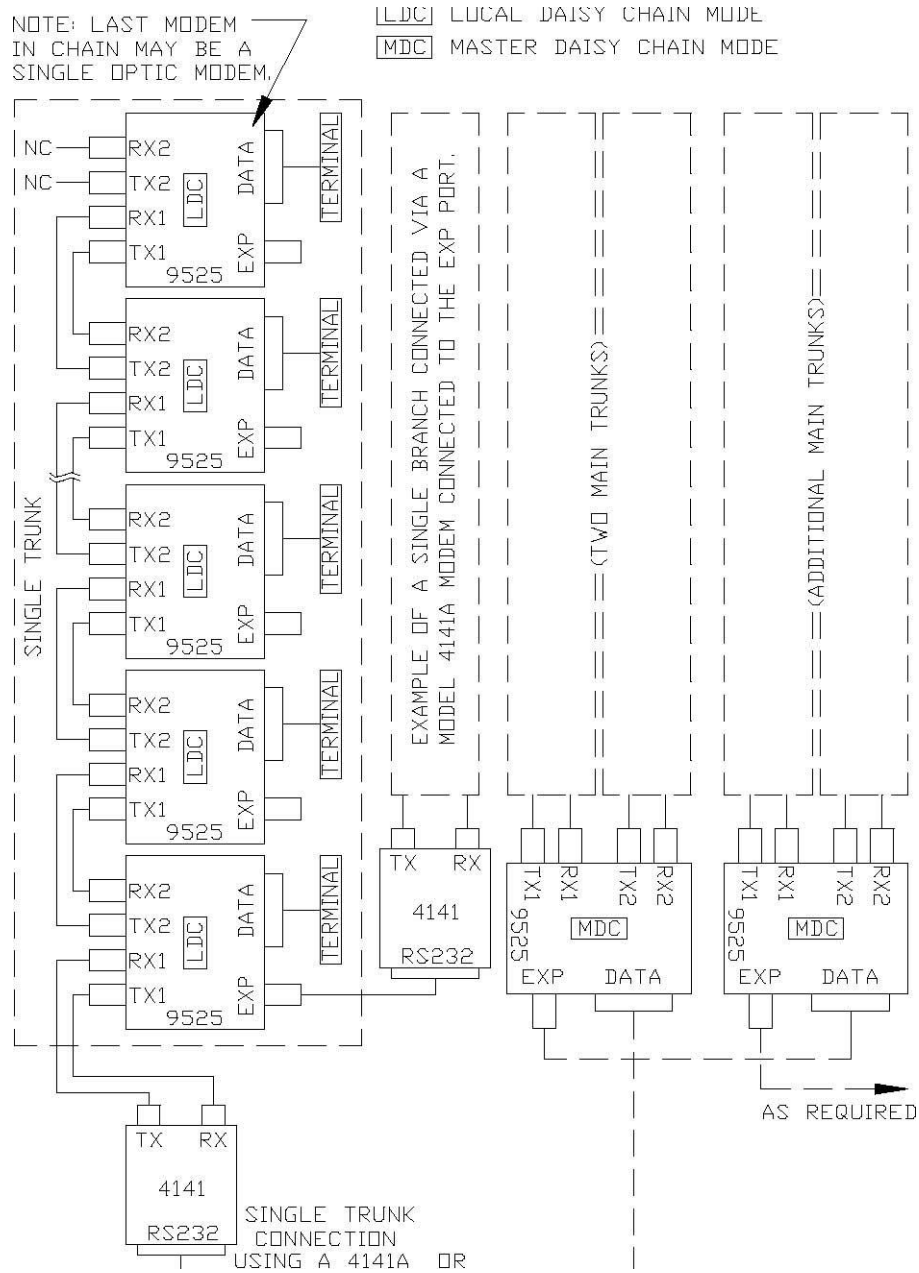
The Model 9525A can be configured into various basic architectures. They include:

- a) Simple Daisy Chain
- b) Daisy Chain with branches
- c) Fault Tolerant Redundant Ring

2.1.1 Simple Daisy Chain(s) With this architecture, the master controller lies at the end of one or two daisy chains. See Figure 2. Note that the TX1 and RX1 ports always connect toward the master modem.

2.1.2 Daisy Chain(s) with Branches When operating in RS232 mode, the RS232 expansion port may be used to establish additional daisy chains or branches from any of the modems in the system. To do this, connect a Model 9525A in RS232 mode to the RJ45 expansion port of another Model 9525A, set the unit for Master Daisy Chain operation and connect other daisy chains to it in the same way they are connected to the primary master.

FIGURE 2 – SIMPLE DAISY CHAIN TRUNKS FROM THE MAIN MASTER, WITH EXAMPLES OF BRANCHING USING THE EXPANSION



2.1.3 Fault Tolerant Redundant Ring With the architecture shown in Figure 3, all modems are arranged along a dual fiber ring starting with the master controller modem (operating in Master Fault Tolerant mode), looping through a number of local terminal modems (operating in Local Fault Tolerant mode), and terminating back into the second set of optical ports of the master controller modem, completing the ring.

In this architecture the master modem transmits data in both directions around the ring and receives its own signal. The ring is terminated at the master modem. In other words, the data is not repeated by the master modem, but instead it ends there.

Each local modem in the ring transmits its input data in both directions, receives from both directions, and retransmits in both directions the data received by the optical receivers. Each local modem, receiving data from the master from both directions around the ring, will select the data that arrives first and output that signal to the data port. If the transmission is interrupted in that direction, the modem will automatically select the data from the other direction. The master modem also receives data from both directions from each of the local modems, and selects the first arriving data in the same manner.

In this mode, the master will normally receive an echo of its own signal. To disable the echo, select the ECHO OFF on the Mode switch bank. Enabling the "ECHO OFF" is imperative for RS485 2-wire operation.

2.2 Modes of Operation

To set up a modem into one of its four operating modes, the user selects one of four combinations for switch sections 1 and 2 of the MODES dipswitch.

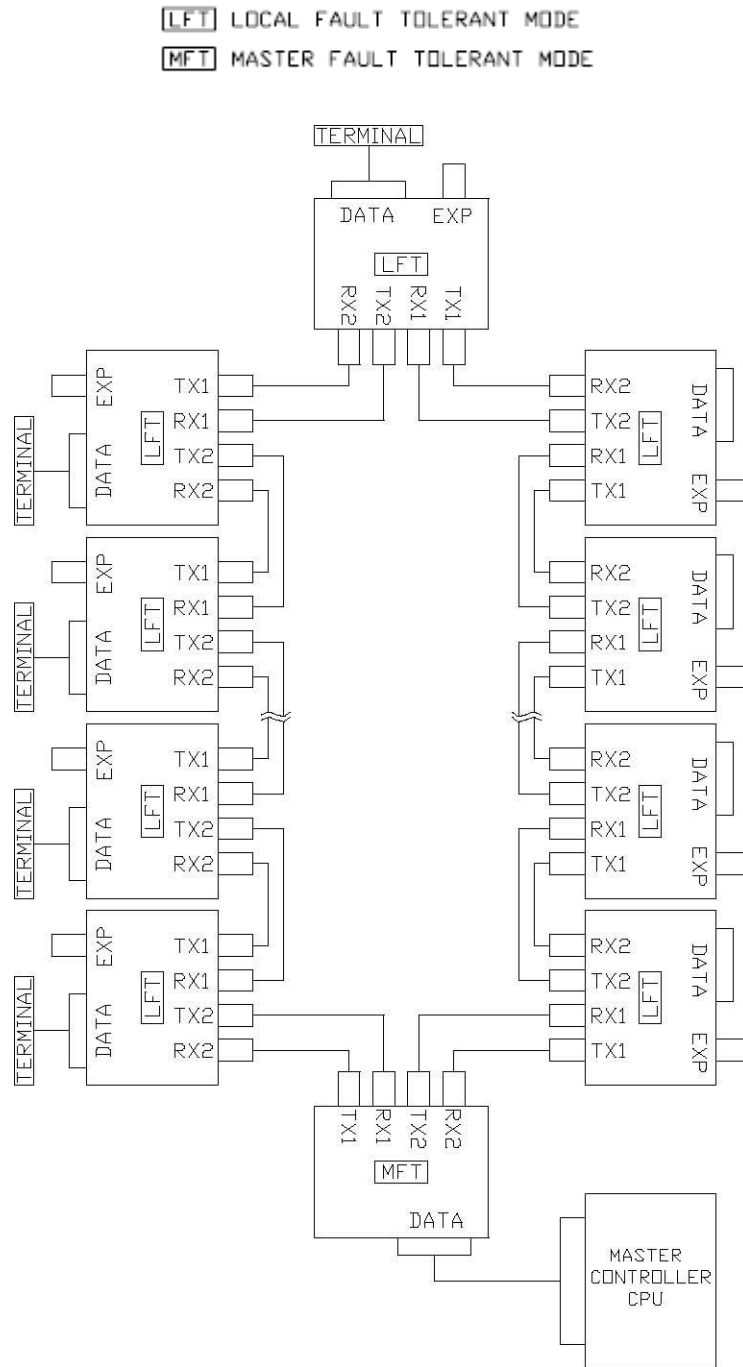
These four modes are characterized by the specific signal routing within the modem, shown in Figure 4. The following sections include a detailed description of each mode described in Figure 4.

2.2.1 Master Daisy Chain Mode

In this mode a TD input to the data port is transmitted out via the TX1 and TX2 optical ports and out the expansion port as RDE in RS232 format. With the INDICATORS mode switch in the up position, a TD input will cause the TX1, TX2 and RDE indicators to illuminate.

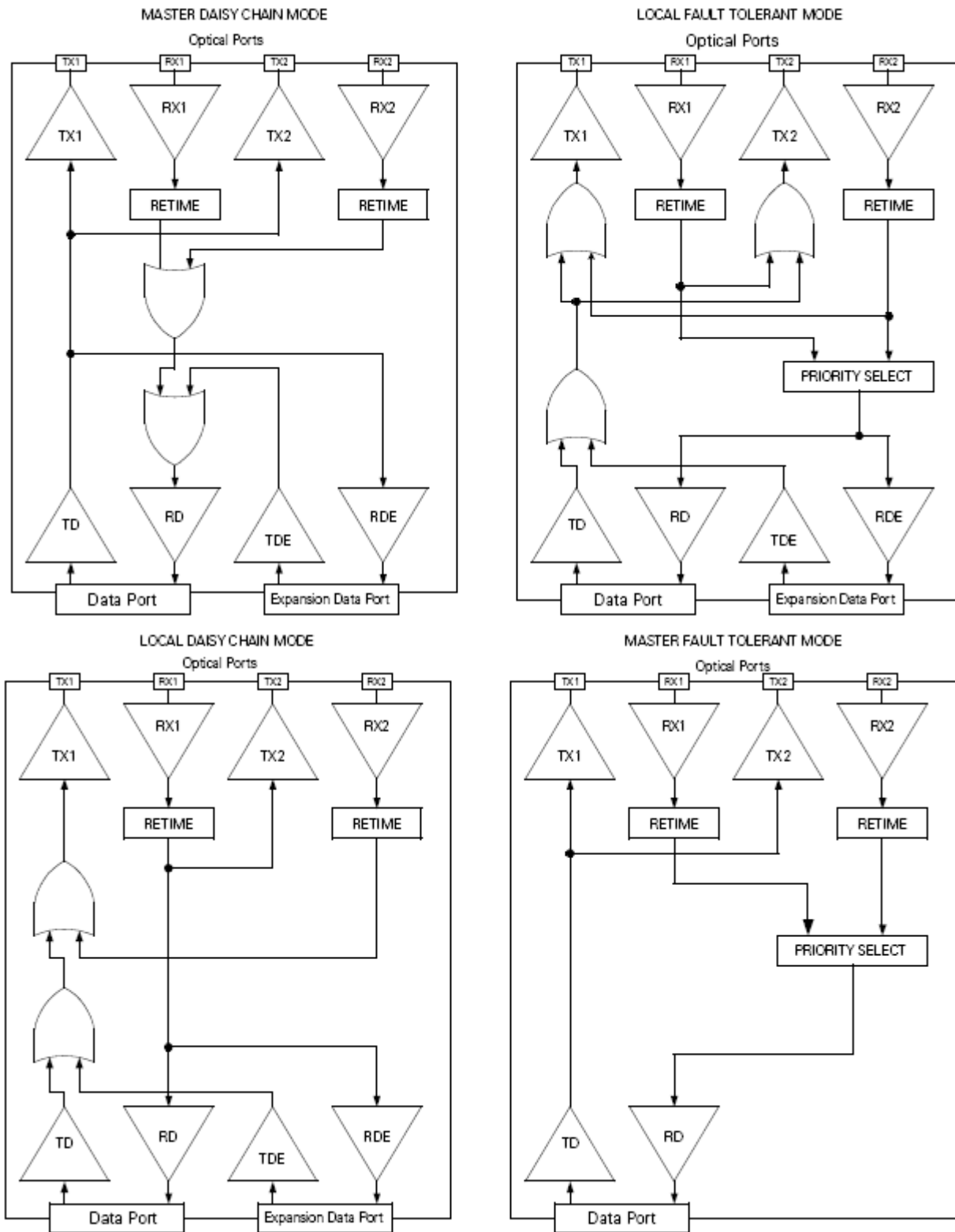
Conversely, an optical input via the RX1 or RX2 optical port or an RS232 input via the expansion port will be output via the DB25 port as RD.

FIGURE 3 – FAULT TOLERANT RING ARCHITECTURE



In this mode, priority select is not used. This mode is normally used in a network with numerous modems in local daisy chain mode, where the master can act at the head of two separate daisy chains (or more, if the expansion port is used).

FIGURE 4 – INTERNAL SIGNAL ROUTING FOR EACH OPERATING MODE



2.2.2 Local Daisy Chain Mode

In this mode, there is a specific "upstream" and "downstream" data direction. Specifically, the TX1 and RX1 ports communicate upstream with the master controller and the TX2 and RX2 ports communicate downstream with the next modem on the daisy chain. The local daisy chain mode is not fault tolerant. Optical data received from the master via RX1 is re-timed, retransmitted downstream via the TX2 port and output as RD on the data port. Anti-streaming on the RX1 port is disabled because it would serve no purpose. Optical data received from the next modem downstream via the RX2 port is re-timed and retransmitted upstream to the master controller via the TX1 port. Data received via the expansion port input TDE from a modem feeding a branch, and from the TD input of the data port are ORed with the data from the RX2 port to be transmitted back to the master via the TX1 port.

Antistreaming is an option on the RX2 port in this mode when operating in RS232 data mode.

2.2.3 Master Fault Tolerant Mode

This mode is virtually the same as the master daisy chain mode explained in Section 2.2 with these exceptions: Because this is a fault tolerant mode, data will normally be received via both optical ports, skewed slightly in time of arrival. Therefore, in this mode the priority select circuitry is employed to choose only the data that arrives first. Secondly, the expansion port is not available in this mode.

2.2.4 Local Fault Tolerant Mode

This mode is used for all the local modems serving the many terminals around a fault tolerant dual fiber counter-rotating ring. In this mode optical data received via both optical ports is selected based on the earliest arrival (see Priority Select, Section 2.1.4), and routed to the RD output of the data port and the RD output of the expansion port.

Optical data received via RX1 is retransmitted via TX2. Optical data received via RX2 is retransmitted via TX1. These functions serve to regenerate and repeat data traveling both directions on the dual optical ring. Data input via either TD on the RS232 port or TDE on the expansion port is ORed and transmitted in both directions on the dual fiber ring.

2.3 Operational Features and Considerations

In addition to the signal routing that characterize each mode of operation (Section 2.2) the following features of operation are incorporated as either basic indispensable functions or as performance enhancements.

2.3.1 Electrical Side (Data Input) Anti-Streaming (RS232 mode only)

The electrical side anti-streaming feature, when enabled, limits the time that a terminal unit may transmit data with a single request-to-send (RTS) enable. This feature is designed to prevent a terminal unit from monopolizing the network if a terminal unit fails in a mode causing continuous transmission. When the RTS input is set high (TRUE), the RS232 side anti-streaming counter is armed. When data transmission begins, the timer begins, allowing the terminal to transmit data for a period of time up to the time-out limit. When the terminal unit stops transmitting it must immediately set the RTS low, (FALSE), resetting the timer. If the terminal continues to transmit data to the modem past the timeout period, transmission from the modem will cease, the CTS will go Low, the FAULT indicator will illuminate, and the alarm dry contact relay will activate.

To use this feature an active RTS signal is required. If the RTS input cannot be actively controlled, the electrical side anti-streaming feature must be disabled. MODES switch numbers 1, 2, and 3 allow the user to select one of seven timeout periods, or disable the feature. To select a timeout, calculate the longest transmission burst expected by the terminal and pick the next highest timeout period. If this is not practical in your system, just disable it.

2.3.2 Optical Side Anti-Streaming

The optical side anti-streaming feature, when enabled, disconnects an optical receiver from the circuit in the event that the receiver's output goes high for a period longer than would be expected in normal data flow. This may occur due to a receiver failure, a transmitter or terminal equipment failure, or if the receiver input is left open to strong ambient light (850 nm versions only). The anti-streaming feature will prevent such an error from "locking up" the network.

The circuit works as follows: As long as the data is high (optical power present at the receiver) the timeout proceeds. Whenever the data goes low, as it does for all normal zeros, the timeout resets. As long as the data does not contain a long string of continuous ones that exceeds the timeout period, the anti-streaming will not be triggered. If there are too many ones in a row or if there is a failure that leaves the receiver output constantly high, the receiver output will be disconnected from the circuit and the FAULT indicator will illuminate. Mode switch numbers 4 and 5 allow the user to select among 3 timeouts or to disable the feature. The longest timeout selection is sufficient to not trigger an optical side anti-streaming timeout for continuous 8 bit ASCII characters ("quick brown fox") at only 150 baud. Faster data rates allow the use of a shorter timeout.

2.3.3 Clear to Send Inhibited by Optical Side Activity

Another optional feature, enabled or disabled by MODES switch number 6, causes the disabling of the Clear-to-Send (CTS) control line output in the presence of fiber side data activity. Normally the system software will preclude such an occurrence, but as a safeguard, this feature will prevent a terminal from interfering with data already traveling on the optical trunk or ring either from the master or from another terminal. The circuit uses the "Priority Select" timers to determine the CTS disable period. Whatever Priority Select timeout is selected applies. The selected rates should be sufficient to keep CTS disabled for a period of one byte. For ASCII character transmission at rates below 600 baud, this feature should not be used.

2.3.4 Priority Select

Priority Select is enabled automatically in both Master and Local Fault Tolerant modes (see Sections 2.2.3 and 2.2.4). The priority select circuitry automatically selects the data that arrives first via optical port RX1 or RX2. In normal operation, since the master transmits both directions on the ring, each terminal on the ring will receive data from both directions. The optical signal that arrives first will be selected by the priority select circuitry and output via the RS232 ports as RD and RDE. If the data transmission in the first direction fails it will automatically select the data coming from the other direction the next time it is transmitted.

2.3.5 Echo Cancel

There is a circuit that prevents data transmitted around a ring by a unit operating in Master Fault Tolerant mode from being output as received data (RD). This data would normally be termed an ECHO. Some software is intolerant of echoed data.

Echo cancel is mandatory when operating in RS485, 2-wire mode to prevent data corruption, optional in other interface modes.

In addition, when operating in RS485 2-wire mode it is possible to have the electrical data corrupted due to the fact that the transmit data input and the echoed data output occurs on the same pair of wires.

2.3.6 Redundant Ring Break Detector

When a unit is operated in Master Fault Tolerant mode, a circuit is automatically engaged that will detect if either or both of the signals transmitted in opposite directions around the dual fiber ring fails to arrive back at the master unit, indicating a re-transmission failure or fiber break in one or both of the rings. If this occurs, the FAULT LED will illuminate and the dry contact relay will activate.

Examining the RX1

and RX2 indicators, or running the simple BERT test (see 2.3.7), should reveal which ring has the problem.

2.3.7 BERT

The unit has a built-in rudimentary BERT signal generator and detector. This feature may be used off-line such as in system installation or in a troubleshooting session to quickly indicate the integrity of a transmission path in the network. If properly received, the green BERT indicator will illuminate steadily. Any one unit in the network at any one time may be chosen to initiate the BERT signal. If initiated by the master unit in a fault tolerant ring, removing the fiber from one, then the other, output port will allow for the separate testing of each ring. The blinking of the BERT indicator during normal data transmission is meaningless and should be ignored. The indication of this LED is only valid while a BERT generator is enabled. The

BERT test signal may be transmitted via either or both optical ports as enabled by switches 3 and 4 of the MODES dipswitch.

2.3.8 Remote Master Mode Selection

The unit may be selected to change from Local to Master mode by attaching an external switch closure between the G and M terminals of the 5-position terminal block shared with the alarm relay contact outputs. Alternately, an active LOW TTL logic level may be input to the G terminal. With this feature, different units in a network may serve as the master at different times. To use this feature, the Master/Local switch, position 1 on the MODES dip-switch, must be in the UP, or OFF position (Local Mode selected).

2.4 Set-Up Procedures

The Model 9525A has two dipswitches, marked TIMEOUTS and MODES, accessible via the rear panel. Program each of these switches upon installation to satisfy your chosen network operational requirements. Refer to the following paragraphs.

2.4.1 Modes of Operation

To select among the four operational modes as described in Section 2.2, set switch numbers 1 and 2 of the MODES dipswitch per Table 2.

Table 2 – Mode of Operation Select via the Modes Dipswitches

Switch #		Mode of Operation
1	2	
D	D	Master Fault Tolerant Mode
D	U	Master Daisy Chain Mode
U	D	Local Fault Tolerant Mode
U	U	Local Daisy Chain Mode

D (DOWN) = ON; U (UP) = OFF

TO USE THE REMOTE MASTER MODE SELECT INPUT, select the Local mode via the MODES dipswitch (switch #1 UP). Introduction of a low logic level to the "M" input of the 5-position terminal block will switch the unit to Master mode. A low logic level input may be accomplished either by connecting it to the "G" (ground) terminal via a switch or by connecting a TTL output to the "M" input.

2.4.2 BERT Test Signal Enable

To enable the Bert Test Signal (See Section 3.3) for the TX1 output port, set the MODES dipswitch position #3 in the DOWN position. To enable the Bert Test Signal (see Section 3.3) for the TX2 output port, set the MODES dipswitch position #4 in the DOWN position. For normal operation, both switches must be in the UP, or OFF position.

2.4.3 Data Interface and Echo Cancel

Configure the unit for RS232, RS422, RS485 four-wire or RS485 two-wire operation by setting switch numbers 5 through 10 of the MODES dipswitch per Table 3.

Table 3 – Data Interface Selection via the MODES Dipswitch

Switch Number						Data Interface
5	6	7	8	9	10	
U	U	OPT	U	U	U	RS232
D	U	OPT	U	U	D	RS422
D	D	OPT	U	U	OPT	RS485 4-Wire
D	D	D	D	D	OPT	RS485 2-Wire

U (UP) = OFF; D (DOWN) = ON; OPT (OPTIONAL)

Optional Switches

ECHO CANCEL, SWITCH #7: In RS232, RS422, or RS485 4-wire modes, when operating as a master in a fault tolerant ring, the data ECHO may be disabled by setting MODES switch #7 in the DOWN position.

RS485 LINE TERMINATION, SWITCH #10: If the modem is connected to an RS485 bus, terminate the input by setting switch #10 in the DOWN position only if it is the terminating unit on the bus.

2.4.4 RS232 Anti-stream Enable/Timeout Selection

To set switch numbers 1 and 2 of the TIMEOUTS dipswitch to disable or select an RS232 anti-streaming timeout as explained in section 2.3.1, refer to Table 4.

Table 4 – RS232 Antistream Timeout Selection via the Timeouts Dipswitch

Time (seconds)	S2		
	1	2	3
Disabled	Dn	Dn	Dn
64	Up	Dn	Dn
32	Dn	Up	Dn
16	Up	Up	Dn
8	Dn	Dn	Up
4	Up	Dn	Up
2	Dn	Up	Up
1	Up	Up	Up

D (DOWN) = ON; U (UP) = OFF

2.4.5 Optical Side Anti-streaming Enable

The optical side anti-streaming feature (see section 2.3.2) can be enabled or disabled via switch position #4 of the MODES dipswitch. It is disabled when the switch is set in the DOWN position and enabled when the switch is set in the UP position.

2.4.6 Priority Select Timeout Selection

To select the Priority Select timeout as explained in Section 2.3.3, set TIMEOUTS switch number 5 DOWN for 2.22 ms and UP for 8.88 ms.

To help in the selection consider the following:

- 1) The Priority Select function is not used when operating in Daisy Chain Mode.
- 2) The purpose of the Priority Select timeout is to keep the modem output from switching from one receiver to the other within a data message, between bits, rather than only at the beginning of a message. To prevent this, select a timeout equal to one whole byte, say 10 bits, at the operating data rate. For example, at 9600 bps, one bit equals 104 microseconds. Ten times 104 microseconds equals 1040 microseconds, or about 1millisecond. Select the 2.22 ms timeout.

- 3) **Warning:** If one of the rings in a fault tolerant ring is broken, a modem on the ring may only be able to receive an important signal from one direction. In this case, unless a time period greater than the priority select timeout elapses before the next transmission occurs, the priority select circuit will not be able to react in time and the first portion of the message could be lost. Therefore, the priority select timeout limits the speed at which a terminal may respond to a poll and limits the polling rate. Select the timeout accordingly.

2.4.7 Clear to Send Inhibited by Optical Side Activity

To enable this feature, as explained in Section 2.3.2, set TIMEOUTS switch #6 in the UP position. To disable it, set switch #6 in the DOWN position. To enable it, set switch #6 in the UP position.

2.4.8 Ring Propagation Timeout As It Pertains to the ECHO CANCEL Feature and RS485 2-Wire Operation

The Ring Propagation Timeout plays a role in the ECHO CANCEL function as explained in Section 2.3.4. This timeout is not important unless the unit is operated in Master Fault Tolerant Mode and MODES switch #7 is set to the DOWN position. This timeout should exceed the time it takes for a signal to travel from the master unit around the ring and return to the master unit. To calculate the time, figure (2 microseconds) plus (6.5 microseconds times the number of local modems around the ring) plus (1.5 nanoseconds per foot of fiber in the ring). For example, for a ring with a total length of 3000 feet with 15 local modems, the propagation time would be 2 microsecond + 97.5 microseconds + 4500 ns = 104 microseconds. For this ring, the shortest timeout of 1 millisecond should be chosen. Refer to Table 5.

Table 5 – Ring Propagation Timeout Selection via the TIMEOUTS Dipswitch

Switch #		Ring Propagation Timeout
7	8	
U	U	1 millisecond
D	U	4 milliseconds
D	D	12 milliseconds

D (DOWN) = ON; U (UP) = OFF

2.5 Mounting

2.5.1 The model 9525A can be mounted directly to a flat surface using the attached mounting plate. The mounting plate attaches to the bottom of the unit using four screws. Use the oval holes in the plate to mount the unit to the flat surface. Although not required, it is best to mount the unit to a heat conductive surface to maximize heat transfer away from the units.

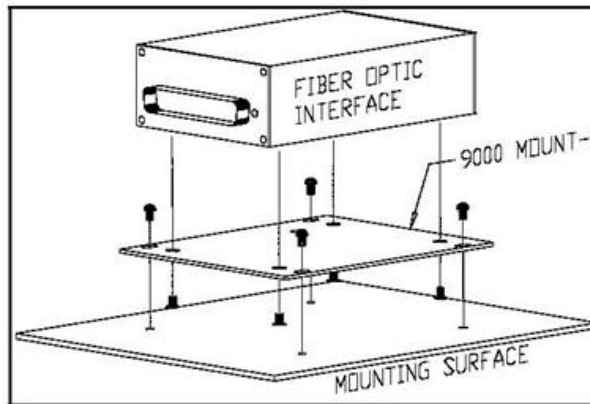


FIGURE 5 – STAND ALONE MOUNTING

2.5.2 The 9525A can alternately be mounted in a Model 9001 chassis. Nine units will fit in one 9001-0 chassis, eight will fit in a 9001-1 chassis and seven will fit in a 9001-2 chassis. Remove and save the 4 screws holding the surface mounting plate to extrusion. Attach the 9000KIT-5 to the unit using the four corner screws that hold the rear panel on the Model 9525A (D shell connector end). Then attach the units to the chassis using the captive screws in the plate supplied with the kit.

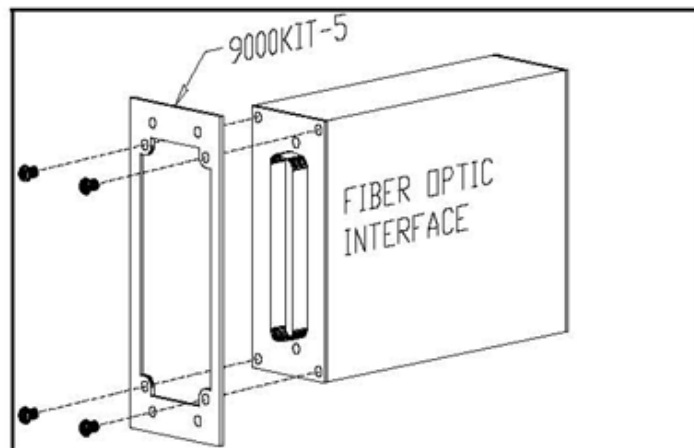


FIGURE 6 – SYSTEM 9000 CHASSIS MOUNT

2.6 Optical Cabling

2.6.1 GENERAL

The Model 9525A communicates over four fibers: two fibers to transmit and receive in one direction and a second fiber to transmit and receive in the other direction.

Most cable manufacturers identify the individual fibers in the cable. Check the fiber and mark it to ensure that the fiber connected to the TX1 and RX1 ports of the modem at one end are the same fibers that are connected to the RX2 and TX2 ports, respectively, of the modem at the other end.

Before connecting the optical cable, first remove and save the plastic dust caps from the optical ports and fiber connectors.

Remove and store the dust caps from the fiber connections. Clean the connectors with Isopropyl alcohol on lint free tissue.

2.6.2 SPECIFIC OPTICAL CABLING

Refer to the architecture diagrams, Figures 2, 3 and 4, for help in defining the optical cabling hookup. Note that in Local Daisy Chain mode the TX1 and RX1 ports always connect to the fibers going toward the master controller. The TX2 and RX2 ports are always connected to the fiber going toward the trunk and branch ends. If the unit is in master mode or either fault tolerant mode the TX1 and RX1 ports and TX2 and RX2 ports are equals.

2.7 Electrical Cabling

2.7.1 RS232 Connections Connect both the master controller CPU and each local terminal's RS232 com port via the DB25S RS232 port on the Model 9525A modem. The only required connections between the terminal equipment and the modem are pins 2 (Data Input), 3 (Data Output), and 7 (Signal Return/Common). On the modem end, however, if the Electrical Anti-streaming feature is enabled, pin 4 (RTS) must be in a high (TRUE) state in order to be able to transmit the data (input on pin 2) via the fiber.

Table 6 – RS232 Pinouts on DB25S Connector

Pin #	Identification	Input/Output to modem and auxiliary information.
2	Transmit Data (TD)	Input to model 9525A
3	Receive Data (RD)	Output from model 9525A
4	Request to Send (RTS)	Input to model 9525A
5	Clear to Send (CTS)	Output from model 9525A
6	Data Set Ready (DSR)	Fixed Pull-up to +5 VDC Output from Model 9525A
7	Signal/Chassis Ground	
8	Carrier Detect (CD)	Fixed Pull-up to +5 VDC Output from Model 9525A

2.7.2 RS422 and RS485 Connections

When operation with RS422 or RS485, refer to table 5 for the pinouts. In RS422 or RS485 model there are no RTS or CTS control lines. Rather the RTS and CTS signals are internally enabled. The RTS and CTS indicator will always be illuminated when the unit is operated with RS422/RS485 data. Refer to section 2.3.4, Priority Select, for an additional consideration when operating in RS485 2wire mode.

Table 7 – RS422/RS485 Pinouts on DB25S Connector

Identification	Pin Numbers
RS422/RS485 4 wire TD(+) input	11
RS422/RS485 4 wire TD(-) input	10
RS422/RS485 4 wire RD(+) output	13
RS422/RS485 4 wire RD(-) output	12
RS485 2-wire Data (+) input/output	11
RS485 2-wire Data (-) input/output	10
Ground	7

2.7.3 Expansion Port

When using the expansion port to branch the network, wire the EXP port to the DB25 port on a second Model 9525A. See the figure below for cable wiring diagram. NOTE: The extended 9525A must be in RS232 mode and the electrical side anti-streaming must be disabled.

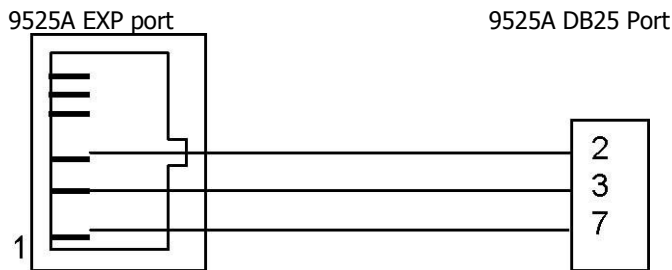


Table 8 – RJ12 Expansion Port Pinouts

1	Signal Ground	
2	Transmit Data (TD)	Input
3	Receive Data (RD)	Output
4	N/C	
5	Primary power voltage output under primary power, battery voltage if operating under battery back-up.	Output
6	N/C	

2.8 POWER WIRING

2.8.1 DC POWER SOURCE CONNECTION

Connect the DC power source as required per the Specification, Section 1.4, to the two PWR screw terminals on the front panel. Refer to the markings on the chassis top above the terminals. An optional 110 VAC to 9 VDC power adapter, Model 9014PS, may be used when 110 VAC power is available.

2.8.2 BACKUP BATTERY CONNECTION

If it is decided to equip the unit with a 6V gel cell type emergency backup battery, connect it to the two-position BAT screw terminal connection. See the Specification section 1.4 for a recommended battery type. **OBSERVE THE POLARITY!**

3 - OPERATION

3.1 Turn on Procedure

Supply primary power to the unit.

3.2 Indicator Light Interpretation

Table 9 – Indicator Light Interpretation

Indicator ID	Color	INDCTR Switch	Function
POWER	AMBER	N/A	This indicator is steadily ON in the presence of primary DC or AC power. If your unit has an optional battery, this indicator will blink while being powered by the battery (discharge mode).
TD	GREEN	DN	Indicates data input to the DATA I/O Port.
RD	GREEN	DN	Indicates data output from the DATA I/O Port.
RTS	GREEN	DN	Indicates a true RTS input to Pin 4 of the RS232 connector when on.
CTS	GREEN	DN	Indicates a true CTS output from Pin 5 of the RS232 connector, when on.
TDE	GREEN	DN	Indicates data input to Pin 2 of the Expansion Port.
RDE	GREEN	DN	Indicates data output from Pin 3 of the Expansion Port
TX1	GREEN	UP	Indicates data being transmitted via the TX1 optical port.
RX1	GREEN	UP	Indicates data being received by the RX1 optical port
TX2	GREEN	UP	Indicates data being transmitted via the TX2 optical port.
RX2	GREEN	UP	Indicate data being received by the RX2 optical port.
RX1 Priority	GREEN	UP	When on, indicates that the RX1 optical input port is currently selected by the Priority Select circuitry.
RX2 Priority	GREEN	UP	When on, indicates that the RX2 optical input port is currently selected by the Priority Select circuitry.
FAULT	RED	N/A	Indicates an electrical anti-streaming timeout, except when the unit is in Master Fault Tolerant mode. In MFT mode, it indicates a break in one of the rings.
HI CHG	AMBER	N/A	When this light is on, the battery charger is operating at or near its 150 mA max. current. This will occur when a battery is being freshly charged after a power outage when the battery is nearly totally discharged.
BERT	GREEN	N/A	Indicates that it is properly receiving a "BERT" signal transmitted by another unit (usually the master).

3.3 BERT Test

The unit has a rudimentary BERT test feature that may be implemented off-line. See section 2.3.6 for additional information. While the test is being run, no other signals may be introduced to a modem in the network. To run the test, set either switch #3 (for TX1 source), or switch #4 (for TX2 source) of the MODES dipswitch DOWN. The BERT indicator will illuminate on all modems properly receiving the signal for presentation at the RD output. It will not illuminate if the data is only being repeated but not dropped off (via RD) by the modem. If initiated from the master in a fault tolerant ring and the BERT LED on the master illuminates, it is receiving data that has traveled around the ring. To test each ring separately, selectively enable the TX11 or TX2 BERT signal outputs and confirm that the BERT LED illuminates in both cases.

3.4 Ring Integrity Test (Master Fault Tolerant Mode)

When in Master Fault Tolerant Mode, the Fault LED will illuminate and the ALARM relay will activate if a transmitted burst is not being transmitted around both rings and received by BOTH optical input ports. If it is not received by one of the inputs, it indicates a break in that ring possibly caused by a broken fiber or a failure of one of the modems on the ring. If this happens, disconnect the good fiber input and enable the BERT test. Go around the ring to see which modems have the BERT LED illuminated.

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