



Optelecom 9000 Series Installation and Operation Manual

Model 9522A

Two Fiber, Dual Port
Intelligent Drop/Insert Data Modem

9522A modules transport a single RS232/RS422/RS485 data signal in a daisy chain or redundant loop configuration, making it available on two separate electrical I/O ports on each unit.

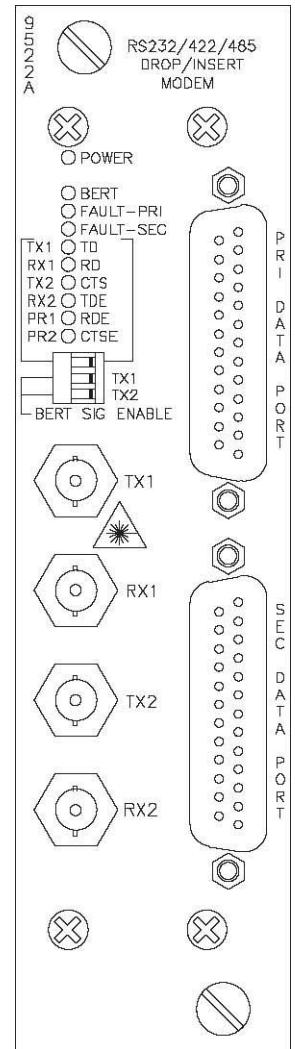


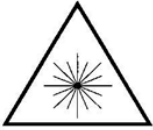
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Safety Instructions

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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

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

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.

Hazard Level 1M

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.

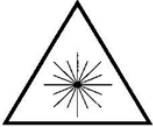


The chassis into which this unit is installed must be housed in a properly rated NEMA enclosure.



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:
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.



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

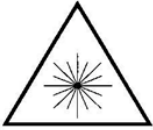


Cuando se opera esta unidad en condiciones de temperatura sumamente elevada, es posible que las superficies internas y externas de metal se pongan extremadamente calientes. Debe tenerse cuidado para asegurar que esta unidad se instale en un área restringida donde sólo tenga acceso a la unidad el personal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

Sicherheitsanleitungen

RM-1

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

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.



Schwarzer Rand und
gelber Hintergrund

N.



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



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

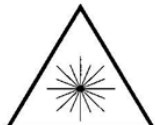


Wenn diese Einheit bei besonders hohen Temperaturen betrieben wird, können interne und externe Metallflächen extrem heiß werden. Es muss darauf geachtet werden, dass diese Einheit in einem Bereich mit eingeschränktem Zugang aufgestellt wird, damit nur geschultes Wartungspersonal Zugang zur Einheit hat.

Consignes de Sécurité

RM-1

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:
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 la 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 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.

Functional Description

The TKH Security USA Model 9522A is an RS232, RS422, and RS485 compatible fiber optic standalone modem with dual electrical I/O ports and dual optics for drop and insert applications that can be configured in a wide range of poll/response network architectures. The unit operates using only one fiber for transmit and receive in the upstream direction and a second fiber in the downstream direction. This results in the formation of a single fiber daisy chain or loop.

The units have four switch-selectable modes of operation: Master Fault Tolerant mode (MFT), Local Fault Tolerant mode (LFT), Master Daisy Chain mode (MDC), and Local Daisy Chain mode (LDC). See the Installation section for a complete description of these modes of operation.

Each modem has two full function data I/O ports (Primary and Secondary), allowing it to serve two terminal units at a single location without the need for a second modem. Each of these ports can also interface with another modem to establish branches off the main trunks or even off other branches. The modem has a unique feature in that it is able to tag data originating from it when operating in local mode and separately tag the data from master and local modems. The result of this feature, which identifies the data source, is that the master only receives data from the locals and the local only receive the data from the master.

The units have ten LED indicators. Power and various fault and status indicators provide information on the electrical status of the I/O ports, fiber status, redundant ring status, and other possible conditions. A built-in, offline Bit Error Rate Test (BERT) with indicator LED can help troubleshoot the system. Six of the indicators serve dual functions as selected by the SELECT switch. In one position the LEDs indicate electrical side signal activity and CTS status. 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.

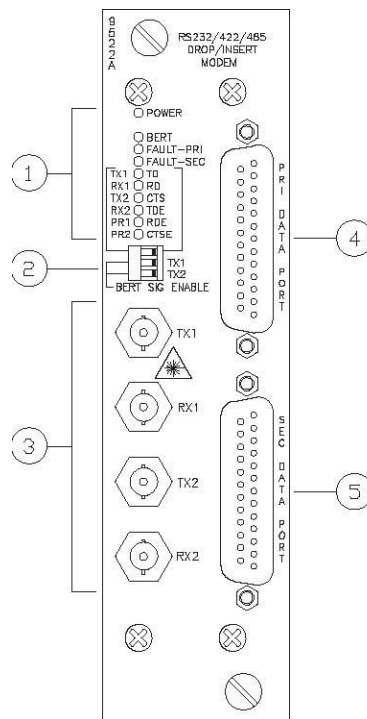
Dipswitches allow the user to select one of the four operating modes (BERT test enable, the communications interface for each data I/O port, and the timeouts for the optical and electrical side anti-streaming), the fiber activity CTS inhibit (RS232 mode), the Priority Select Timeout, the electrical Ring Propagation delay, Echo Cancel, and the "Data Tagging" selective routing feature. These are explained in the Installation section.

The unit operates on 6VDC supplied from the chassis backplane and is compatible with the Network Management System software for monitoring and troubleshooting TKH Security USA fiber optic transport systems.

The 9522A modem is optically compatible with the Models 9526A and 9525A standalone drop/insert modems.

9522A Front Panel Indicator, Connector, and Switch Locations and Functions

FIGURE 1



1. INDICATORS

- **Power Indicator:** This **green** LED illuminates when 8 to 15 VDC power is applied to the modem via the Power Connector on the back of the enclosure.
- **BERT Indicator:** This **green** LED illuminates when the unit is properly receiving a BERT signal from another unit, usually the Master unit. **NOTE:** The rare blinking of this indicator during normal operation is meaningless and may be ignored.
- **FAULT — PRI Indicator:**
 - When operating in Master Fault Tolerant Mode, this **red** LED will illuminate to indicate a break in the redundant loop.
 - When operating in one of the two Local Modes, this **red** LED will illuminate to indicate that the Primary Data port has exceeded the electrical anti-streaming timeout period and has been disabled. In Master Daisy Chain Mode, there are no fault indications.
- **FAULT — SEC Indicator:** This **red** LED illuminates to indicate that the Secondary Data port has exceeded the optical or electrical anti-streaming timeout period and has been disabled.
- **TX1/TD Dual Function Indicator:**
 - *TX1:* When the Indicator Selection Switch is in the left position this **green** LED will flash when data is being transmitted via the TX1 *Optical* Port.
 - *TD:* When the Indicator Selection Switch is in the right position this **green** LED will flash when data is detected on the input (Pin 2) of the Primary Data Port.
- **RX1/RD Dual Function Indicator:**
 - *RX1:* When the Indicator Selection Switch is in the left position this **green** LED will flash when data is being received via the RX1 *Optical* Port.
 - *RD:* When the Indicator Selection Switch is in the right position this **green** LED will flash when data is output (on Pin 3) from the Primary Data Port.

- **TX2/CTS Dual Function Indicator:**
 - *TX2:* When the Indicator Selection Switch is in the left position this **green** LED will flash when data is being transmitted via the TX2 *Optical* Port.
 - *CTS:* When the Indicator Selection Switch is in the right position this **green** LED indicates a true CTS output from Pin 5 of the Primary Data Port.
- **RX2/TDE Dual Function Indicator:**
 - *RX2:* When the Indicator Selection Switch is in the left position this **green** LED will flash when data is being received via the RX2 *Optical* Port.
 - *TDE:* When the Indicator Selection Switch is in the right position this **green** LED will flash when data is detected on the input (Pin 2) of the Secondary Data Port.
- **PR1/RDE Dual Function Indicator:**
 - *PR1:* When the Indicator Selection Switch is in the left position this **green** LED will illuminate when the RX1 *Optical* Port is selected by the priority selection circuitry.
 - *RDE:* When the Indicator Selection Switch is in the right position this **green** LED will flash when data is output (on Pin 3) from the Secondary Data Port.
- **PR2/CTSE Dual Function Indicator:**
 - *PR2:* When the Indicator Selection Switch is in the left position this **green** LED will illuminate when the RX2 *Optical* Port is selected by the priority selection circuitry.
 - *RDE:* When the Indicator Selection Switch is in the right position this **green** LED will flash when data is output (on Pin 3) from the Secondary Data Port.

2. FRONT PANEL DIPSWITCH

- **Indicator Selection Switch (Position 1):**
 - When in the left position, the Dual Function Indicators are relevant to the signals listed on the left side of the indicators.
 - When in the right position, the Dual Function Indicators are relevant to the signals listed on the right side of the indicators.
- **BERT Test Enable Switch, Optical Port TX1 (Position 2):** This switch enables the built-in rudimentary BERT test signal generator and detector for the TX1 Optical Port. To run a BERT test, the normal electrical input to all the modems in the system must be disconnected or disabled.
- **BERT Test Enable Switch, Optical Port TX2 (Position 3):** This switch enables the built-in rudimentary BERT test signal generator and detector for the TX2 Optical Port. To run a BERT test, the normal electrical input to all the modems in the system must be disconnected or disabled.

For details on the built-in BERT test, refer to the Operations section of this manual.

3. OPTICAL INPUT/OUTPUT PORTS

The TX1 and RX1 pair are the output and input ports for the optical link to/from the next upstream modem. The TX2 and RX2 pair are the output and input ports for the optical link to/from the next downstream modem.

4. PRIMARY DATA PORT CONNECTOR

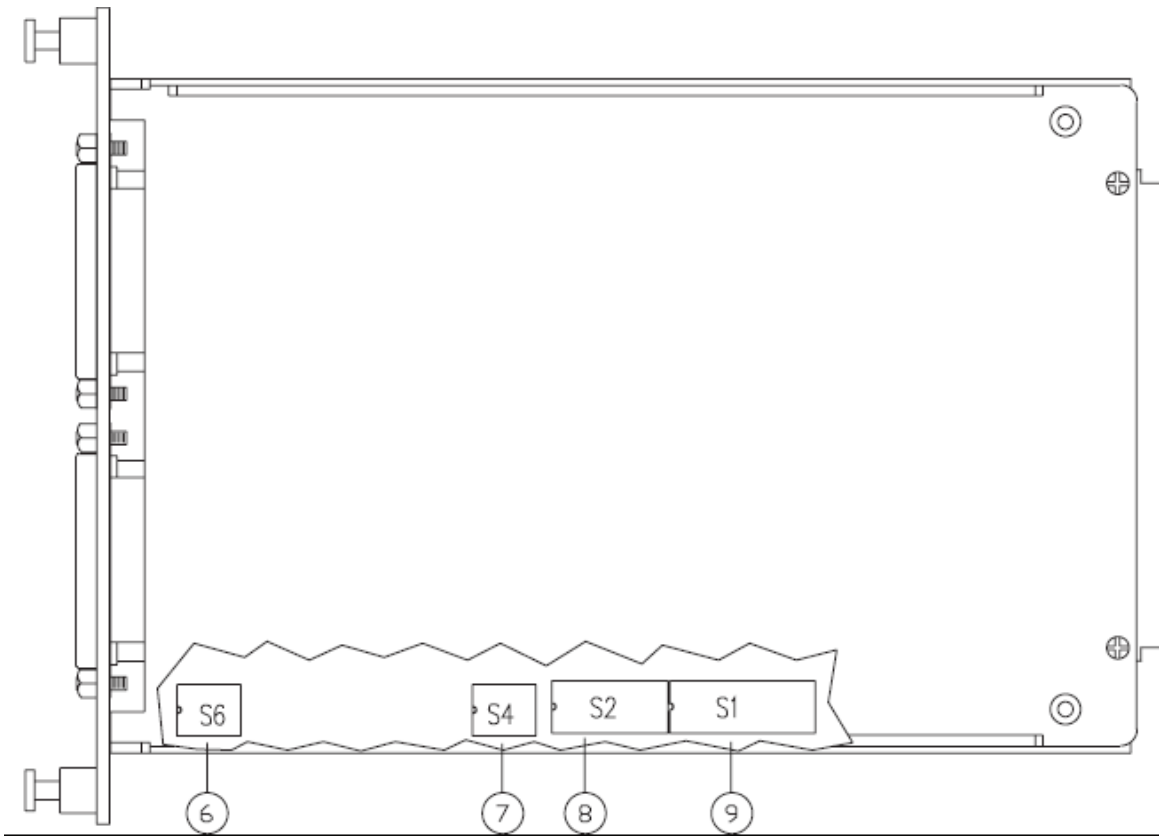
This DB25P connector provides the input/output connections for the RS232, RS422, and RS485 Connections to the Primary Data Port. Refer to the Set Up section of this manual for more details on using these outputs and inputs.

5. SECONDARY DATA PORT CONNECTOR

This DB25P connector provides the input/output connections for the RS232, RS422, and RS485 Connections to the Secondary Data Port. Refer to the Set Up section of this manual for more details on using these outputs and inputs.

9522A Internal Switch Locations and Functions

FIGURE 2



6. DIPSWITCH S6

This dipswitch, along with S1, is used to set the Primary Data Port Electrical mode to RS232, RS422, or RS485. Refer to the Quick Set Up Guide and the Set Up sections of this manual for more details on setting this switch.

7. DIPSWITCH S4

This dipswitch, along with S1, is used to set the Secondary Data Port Electrical mode to RS232, RS422, or RS485. Refer to the Quick Set Up Guide and the Set Up sections of this manual for more details on setting this switch.

8. DIPSWITCH S2

This dipswitch is used to set various Timeout, Anti-Stream, Priority Select and Ring Propagation Delay Parameters. Refer to the Quick Set Up Guide and the Set Up sections of this manual for more details on setting this switch.

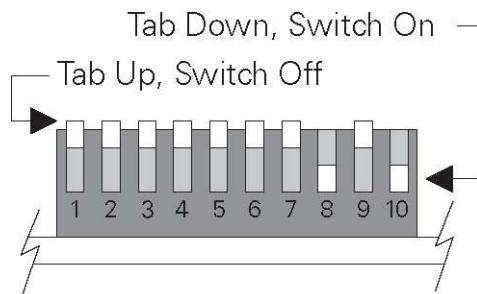
9. DIPSWITCH S1

This dipswitch is used to set the Mode of operation, and is used in conjunction with S4 and S6 to set the data types for each of the data ports. Refer to the Quick Set Up Guide and the Set Up sections of this manual for more details on setting this switch.

Quick Set Up Guide

This section provides all the dipswitch information in one location. For details on each function, refer to the Set Up section of the manual.

FIGURE 3 — DIPSWITCH GUIDE



Switch 1 — Mode/Data Port Settings/Echo/Data Tagging										
1	2	3	4	5	6	7	8	9	10	Mode Selection
Down	Down									Master Fault Tolerant (MFT)
Down	Up									Master Daisy Chain (MDC)
Up	Down									Local Fault Tolerant (LFT)
Up	Up									Local Daisy Chain (LDC)
										Switch 6 - Primary Data Port Settings
										1 2 3 4
		Up		Up	Up					U U N/A N/A RS232
		Up		Down	Up					U U D D RS422
		Up		Down	Down					U U T* T* RS485 4-wire
		Down		Down	Down					D D T* T* RS485 2-wire
										Switch 4 - Secondary Data Port Settings
										1 2 3 4
			Up				Up	Up		U U N/A N/A RS232
			Up				Down	Up		U U D D RS422
			Up				Down	Down		U U T* T* RS485 4-wire
			Down				Down	Down		D D T* T* RS485 2-wire
										Primary Port Master Echo Cancel Settings
						Down				Echo Cancelled (MFT mode only)
						Up				Echo Enabled (MFT mode only)
										Data Tagging Settings
									Down	Data Tagging Enabled
									Up	Data Tagging Disabled

* T = Termination, normally on for RS422, optional on RS485; Down = Termination ON; Up = Termination OFF

Switch S3 — BERT Test (on Front Panel, Positions 2 and 3)

Position	Function	
2	Down = BERT Test On (TX1/RX1)	Up = BERT Test Off (TX1/RX1)
3	Down = BERT Test On (TX2/RX2)	Up = BERT Test Off (TX2/RX2)

Switch S2 — Timeout/Streaming/Priority Select/CTS/Ring Propagations Set Up

1	2	3	4	5	6	7	8	Function
Down	Down	Down						RS232 Anti-Stream Disabled
Up	Down	Down						RS232 Anti-Stream Enabled – 64 Seconds
Down	Up	Down						RS232 Anti-Stream Enabled – 32 Seconds
Up	Up	Down						RS232 Anti-Stream Enabled – 16 Seconds
Down	Down	Up						RS232 Anti-Stream Enabled – 8 Seconds
Up	Down	Up						RS232 Anti-Stream Enabled – 4 Seconds
Down	Up	Up						RS232 Anti-Stream Enabled – 2 Seconds
Up	Up	Up						RS232 Anti-Stream Enabled – 1 Second
			Down					Optical Anti-Stream Disabled (RS232 Only)
			Up					Optical Anti-Stream Enabled (RS422, RS485 Only)
				Down				Priority Select Timeout 2.22 ms.
				Up				Priority Select Timeout 8.88 ms.
					Up			CTS Low upon Optical Activity — Enabled
					Down			CTS Low upon Optical Activity — Disabled
						Up	Up	Ring Propagation Timeout 1 ms.
						Down	Up	Ring Propagation Timeout 4 ms.
						Down	Down	Ring Propagation Timeout 12 ms.

System Architecture

The Model 9522A can be configured into three basic network architectures with almost unlimited variations. Variations include unlimited branches from the main trunks. Typically the rack-mountable Model 9522A or 9522AY are used at a central hub. Standalone Models 9526AY and 9526A are used at the remote (local) locations. However either modem can be used in either installation if so desired.

NETWORK ARCHITECTURE

The three basic network architectures are:

- Daisy Chain with One Master Controller
- Daisy Chain with Two Master Controllers
- Fault Tolerant Counter Rotating Ring

The following sections describe the Operating Modes and are they are used to build the different network types.

OPERATING MODES

The modems must be configured into one of four operating modes depending on the network type being utilized. The different modes and the networks they support are characterized by the internal signal routing within the modem among the primary and secondary data I/O ports and the two optical transmitter/ receiver ports.

To set up a modem into one of the four operating modes, the user selects one of four UP/DOWN combinations for switches 1 and 2 of S1. These four modes are characterized by the specific signal routing within the modem and the availability of the various operational features such as the expansion port, anti-streaming, fiber activity CTS inhibit, and ring break detection. Figure 4 shows the signal routing within the modem. The following sections include a detailed description of each mode.

Master Daisy Chain (MDC) Mode

In this mode the Primary data port is configured as a Master port and the Secondary port is configured as a Local port. Data input to the Primary data port (TD) is transmitted out via the optical ports and output from the Secondary data port (RD). Data input to the Secondary data port (TDE) will be output from the Primary port (RD), but will not enter the optical network. Conversely, optical data input via the TX2/RX2 optical port or data input via the Secondary port (TDE) will be output via the Primary port (RD). 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 is located at the head of a daisy chain trunk. In this mode neither Optical nor Electrical side anti-streaming may be employed.

Local Daisy Chain (LDC) Mode

In this mode, there is a specific "upstream" and "downstream" data direction, because data is only transmitted to or from the master rather than in both directions as on a ring. Specifically, the TX1/RX1 port communicates upstream with the master controller and the TX2/RX2 port communicates downstream with the next modem on the daisy chain. The local daisy chain mode is not fault tolerant. A break in the chain will cut off the modems farther downstream from the break. Optical data received from the master via TX1/RX1 is retimed, retransmitted downstream via the TX2/RX2 port, and output from the Primary data port (RD) and from the Secondary data port (TDE). Optical anti-streaming on the TX1/RX1 port is disabled because it would serve no purpose. Optical data received from the next modem downstream via the TX2/RX2 port is retimed and retransmitted upstream to the master controller via the TX1/RX1 port. Data input to the Primary data port (TD) and data input from the Secondary data port (TDE) are ORed with the data from the TX2/RX2 port to be transmitted back to the master via the TX1/RX1 port. Anti-streaming is an option on the TX2/RX2 port in this mode.

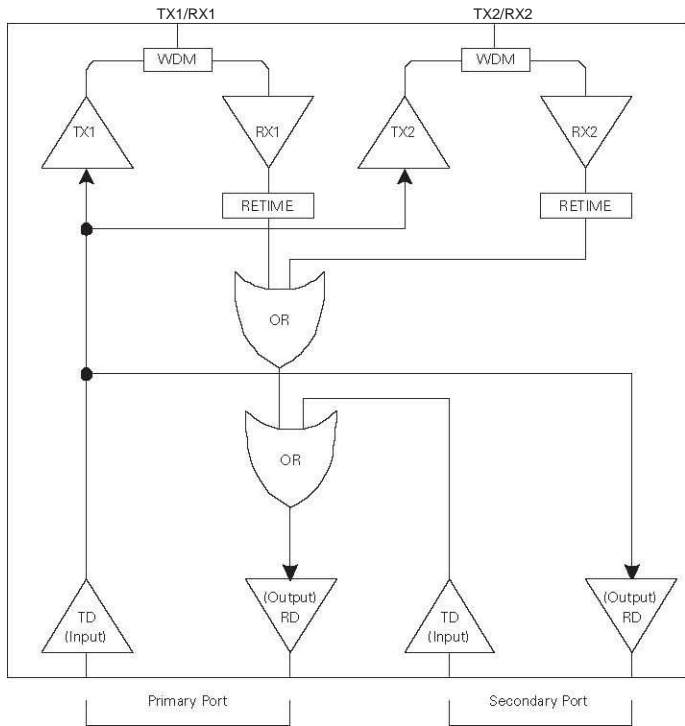
Master Fault Tolerant (MFT) Mode

In this mode the Primary data port is configured as a Master port and the Secondary port is configured as a Local port. Data input to the Primary data port (TD) is transmitted out via the optical ports and output from the Secondary data port (RD). Data input to the Secondary data port (TDE) will be output from the Primary port (RD), but will not enter the optical network. Conversely, an optical input via the TX2/RX2 optical port or data input via the Secondary port (TDE) will be output via the Primary port (RD). In this mode, since optical signals will normally arrive via both optical ports skewed slightly by time of arrival, the Priority Select circuitry is employed to choose only the first arriving data. In this mode neither Optical nor Electrical side anti-streaming may be employed. Also, the automatic ring break detection circuit is enabled when operating in this mode.

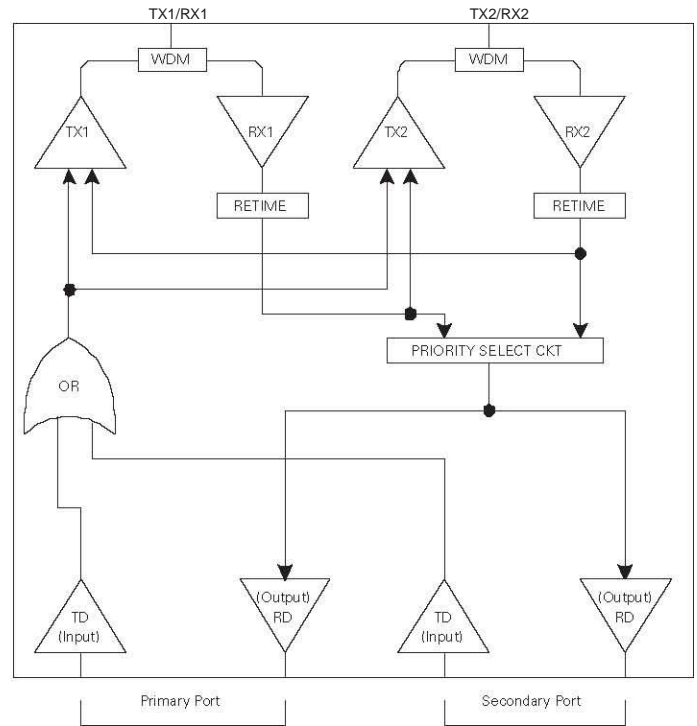
Local Fault Tolerant (LFT) Mode

This mode is used for all the local modems serving the many terminals around a fault tolerant dual fiber counter-rotating ring and for modems in the trunks between dual masters. In this mode optical data received via both optical ports is selected based on the earliest arrival (see Priority Select section), and routed to the RD output of the Primary data port and the RDE output of the Secondary data port. Optical data received via TX1/RX1 is retimed and retransmitted via TX2/RX2. Optical data received via TX2/RX2 is retimed and retransmitted via TX1/RX1. Data input via either the Primary data port (TD) or the Secondary data port (TDE) is ORed and transmitted via both the TX1/RX1 and TX2/RX2 optical ports.

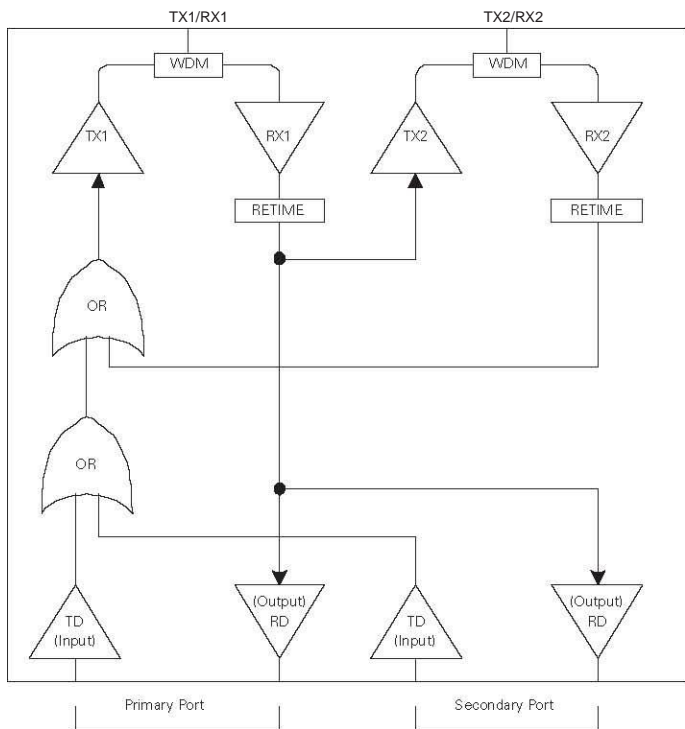
FIGURE 4 — OPERATING MODES SIGNAL ROUTING



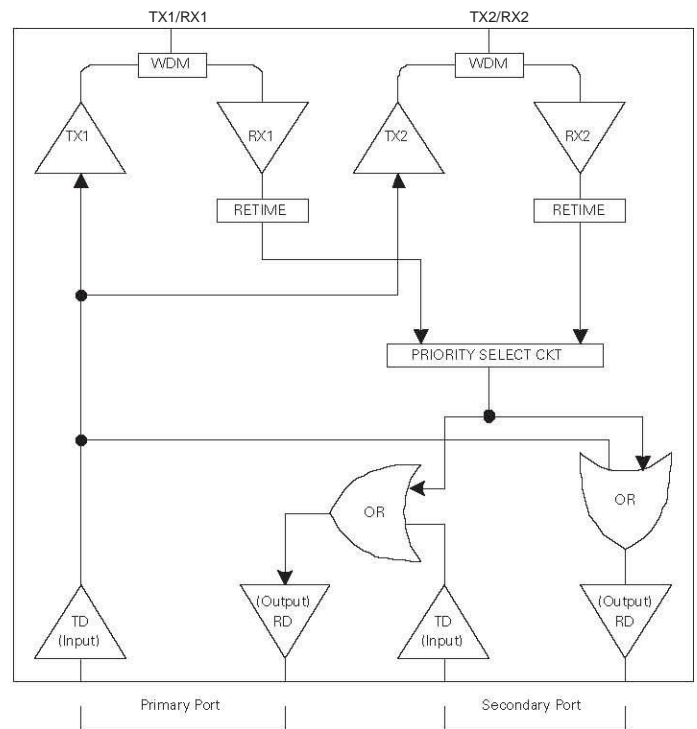
Master Daisy Chain Mode



Local Fault Tolerant Mode



Local Daisy Chain Mode

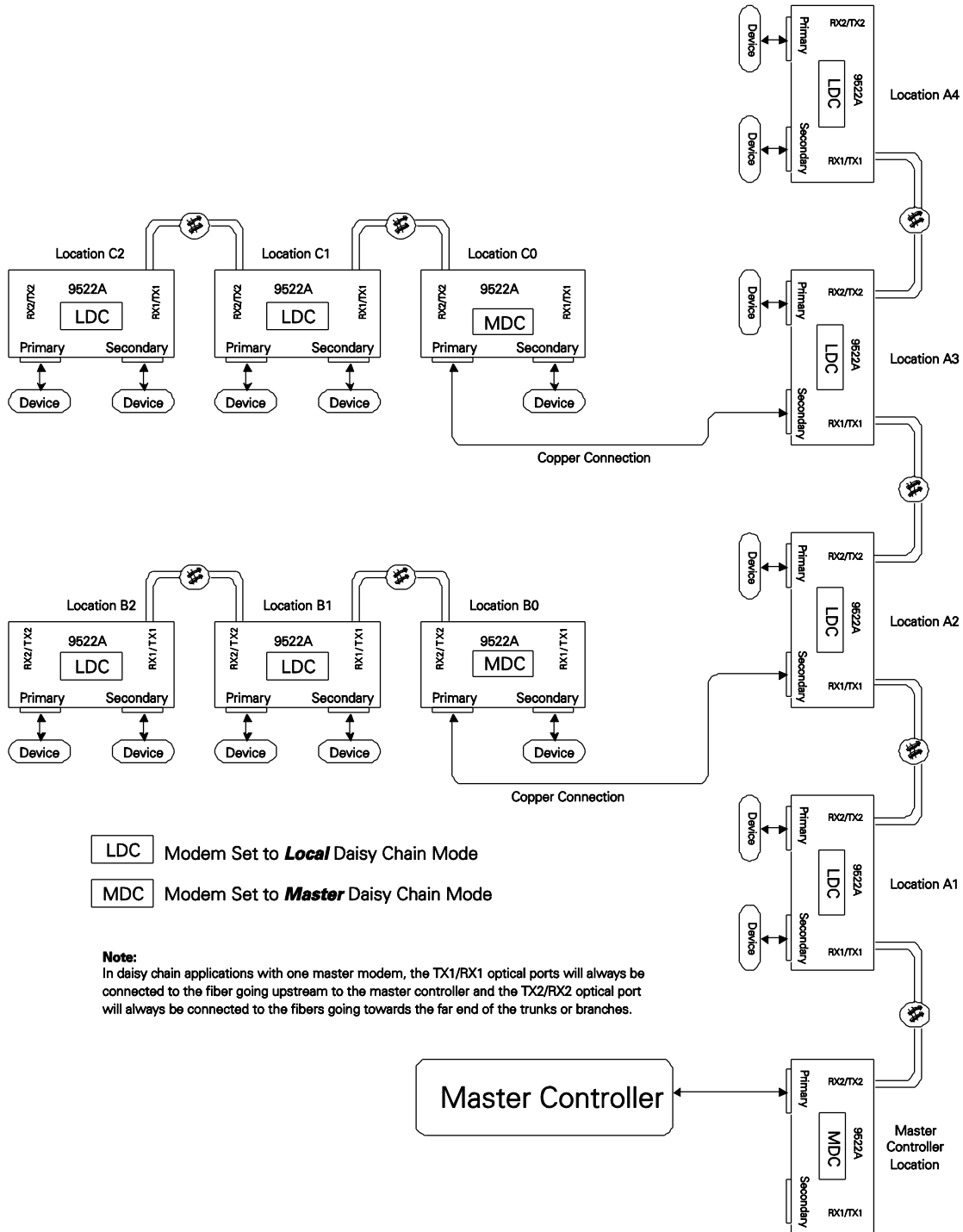


Master Fault Tolerant Mode

DAISY CHAIN MODE WITH ONE MASTER CONTROLLER (Refer to Figure 5)

With this architecture, one master controller lies at the end of one or more main trunks. In all cases, a Model 9522A set in Master Daisy Chain Mode will be used as the master modem. A branch can be configured off the main trunk by connecting another modem to an unused data port of a modem on the trunk and building a daisy chain from that modem. Other branches can be then built off that branch and so forth. There is no limit to the number of branches that can be established.

FIGURE 5 — MULTIPLE DAISY CHAIN TRUNK WITH ONE MASTER CONTROLLER



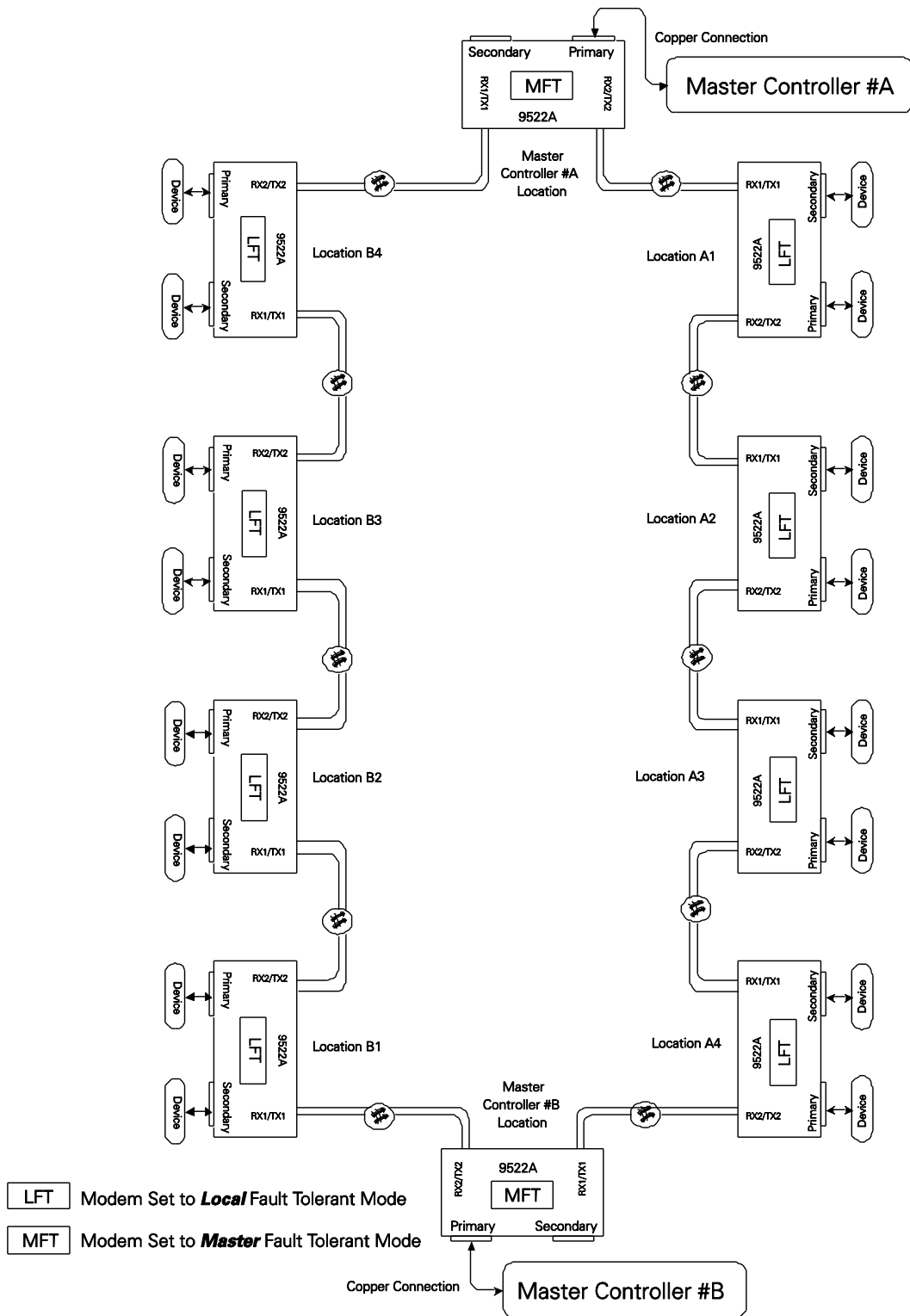
DAISY CHAIN(S) WITH TWO MASTER CONTROLLERS *(Refer to Figure 6)*

With this architecture, master controllers lie at both ends of one or two main daisy chain trunks. In this application, the local modems in the "daisy chain" trunk operate in Local Fault Tolerant mode because the modems in the daisy chain have to be able to communicate with masters in both directions. In this architecture, one master transmits down one or two trunk fibers using one or both optical ports through all modems in each daisy chain. Each modem can receive data from either master and transmits to both masters at the ends of the trunk(s). If communication is lost to one master the modem can communicate with the second master.

Unlimited daisy chain branches may be connected to either trunk; however, the branches will not be fault tolerant if a fault occurs in the branch rather than in one of the main trunks. Use of the Data Tagging feature will prevent one master from receiving data from the other master.

NOTE: When operating with two masters, the secondary ports on the master modems may not be used because a terminal unit connected to it will not receive data via the fiber from the second master.

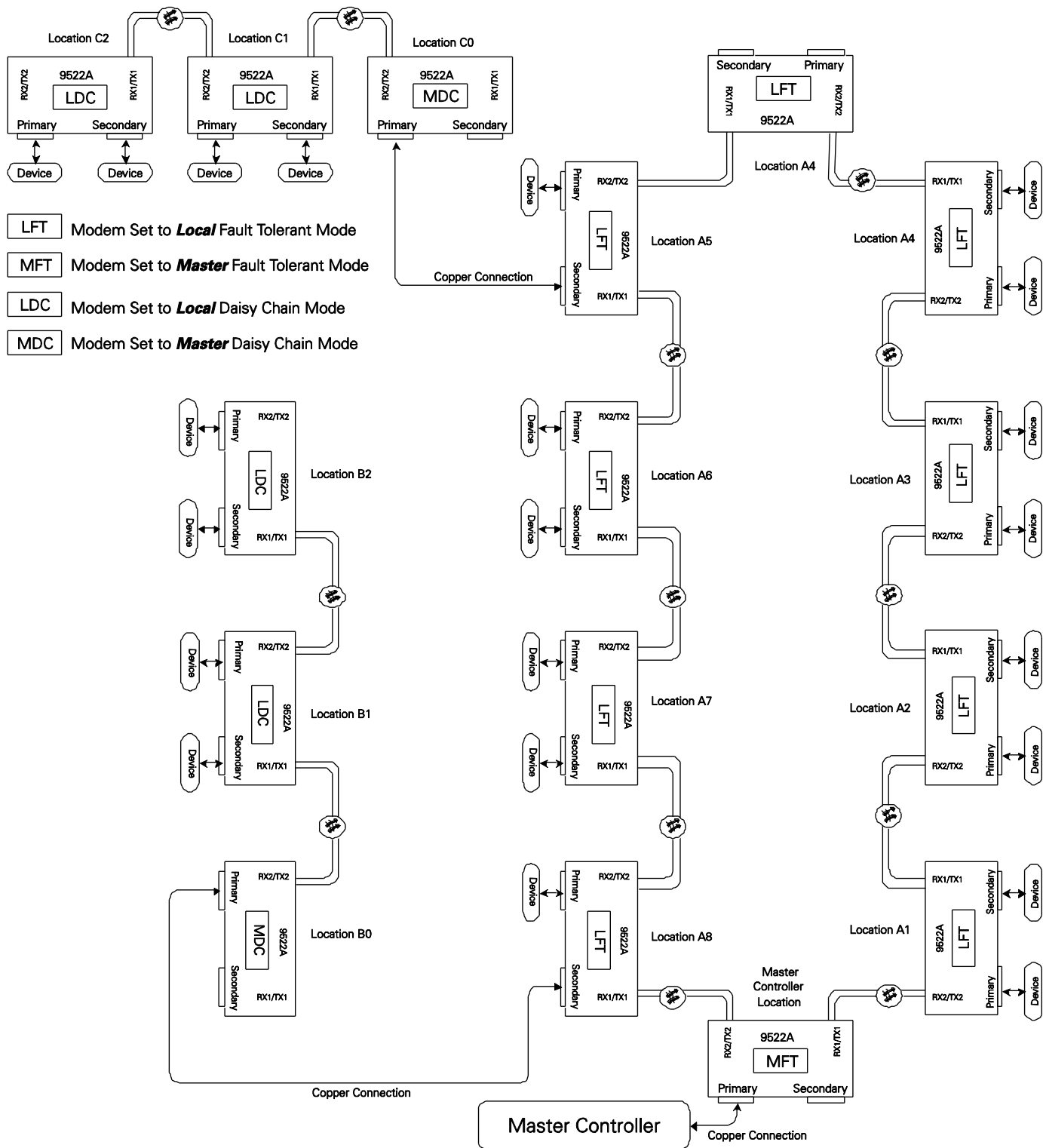
FIGURE 6 — DAISY CHAIN TRUNK WITH REDUNDANT MASTER CONTROLLERS



FAULT TOLERANT REDUNDANT RING *(Refer to Figure 7)*

With the architecture of Figure 7, all modems are arranged around a dual counter rotating fiber ring (via one fiber), starting with one optical port of the master modem (operating in Master Fault Tolerant mode), looping through an indeterminate number of local terminal modems (operating in Local Fault Tolerant mode), and terminating back into the second optical port of the master controller modem completing the ring. In this architecture, the master modem transmits data in both directions around the ring and both signals arrive back at the master (ECHO). The ring is terminated at the master modem. In other words, the data is not repeated by the master modem, but instead it is terminated (ends) there. Each local modem in the ring transmits its input data in both directions, receives from both directions, and retimes and retransmits the data received by the optical receivers in both directions. 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 from both data ports. 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. As described in the Daisy Chain Mode above, a fault tolerant ring can be branched out using any port on the ring to a non-fault tolerant daisy chain. Unlimited daisy chain branches may be connected to the fault tolerant ring.

FIGURE 7 — FAULT TOLERANT RING WITH DAISY CHAIN BRANCHES



ADDITIONAL FEATURES

In addition to the features already described the following features of operation are incorporated as either basic indispensable functions or as performance enhancements or options.

Data Input Anti-Streaming

The electrical side anti-streaming feature, when enabled, limits the time that a terminal unit may accept and transmit RS232 input data with a single request-to-send (RTS) enable. This feature acts independently on both the Primary and Secondary ports and 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 (or RTSE) input to a port 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 (or RTSE) input low (FALSE), resetting the timer. If the terminal continues to transmit data to the modem past the timeout period, the transmission from the modem will cease, the CTS (or CTSE) output will go low, the specific FAULT indicator will illuminate, and the dry contact relay ALARM will activate. To use this feature, an active RTS (or RTSE) input signal is required. If the RTS input cannot be actively controlled, the RS232 side anti-streaming feature must be disabled. S2 switch numbers 1, 2, and 3 allow the user to select the timeout period or disable the feature. If the feature is disabled, RTS (and RTSE) inputs will be internally enabled, eliminating the need for the user to connect to the RTS (or RTSE) input pins. 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. NOTE: Enabling this feature sets the modem to ONLY transmit on the fiber data presented to the I/O ports when RTS is active. This means that the source of the RTS signal must be actively controlled and not just held active. It must go inactive when not transmitting data to reset the timer. For this reason, it cannot be used in connecting one modem to another in a branch off of a daisy chain, as there is no way to control the RTS input.

Optical 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, transmitter, or terminal equipment failure. A failure of this type could disable one modem, part of the network, or the whole network, depending on the network architecture, if it were not for the optical anti-streaming circuitry. 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. The optical anti-streaming timeout is approximately 70 milliseconds, sufficient for ASCII character transmission down to about 150 baud.

Clear to Send Inhibited by Optical Side Activity

Another optional feature, enabled or disabled by S2 switch number 6, causes the disabling of the Clear-to-Send (CTS or CTSE) control line output and the output data (RD or RDE) 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. The selected Priority Select timeout 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.

Priority Select

Priority Select is enabled automatically in both Master and Local Fault Tolerant modes (Refer to the section of the manual on Operational Modes). The priority select circuitry automatically selects the data that arrives first via either the TX1/RX1 or TX2/RX2 optical ports. 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 data ports. 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.

Echo Cancel

This feature prevents data transmitted around a ring by a unit operating in Master Fault Tolerant mode from being output as received data. This data would normally be termed an Echo. Some software is intolerant of echoed data. This feature is applicable only in RS232, RS422 4-wire, and RS485 4-wire modes. The Echo is automatically canceled in RS485 2-wire mode so this switch has no effect.

NOTE: If the Data Tagging feature is enabled, Echo will be canceled in any case because a master cannot "hear" another master (or itself, since it is also a master).

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 retransmission failure or fiber break in one or both of the rings. If this occurs, the FAULT-PRI indicator will illuminate and the dry contact relay will activate. Examining the RX1 and RX2 indicators may reveal which ring has the problem. Or better yet, run a BERT test in each direction around the ring as explained in the Section on BERT (Bit Error Rate Test).

BERT (Bit Error Rate Test)

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 the transmitted BERT signal is received undistorted, the green BERT indicator will illuminate steadily.

NOTE: *The BERT indicator is only functional if the signal received is presented to the output port.* An example of when it would correctly not illuminate is if in a daisy chain installation the emitting unit is a local unit towards the end of a branch. Since the local units in a daisy chain do not output signals received from other locals, the BERT indicator would not illuminate. Any one unit in the network at any one time may be chosen to initiate the BERT signal. A BERT signal may be emitted by one optical output at a time in order to help isolate a problem such as the detection of a break in the ring as in the Redundant Ring Break Detector Section. The BERT enable switches are S1 switch numbers 3 and 4. 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.

External Master/Local Mode Control

The unit may be externally changed to/from Local to Master mode by attaching an external switch closure between the G and M terminals of the five-position terminal block shared with the alarm relay contact outputs. Alternately, an active LOW TTL logic level may be input to the M terminal. With this feature, different units in a network may serve as the master at different times. **NOTE:** *To use this feature the internal Master/Local dipswitch, S1-2, must be in the UP (OFF) or LOCAL position.* When this input is left open, or not shorted, the unit will remain in Local Mode. When shorted, the unit will change to Master mode.

Data Retiming

All data received via an optical port is retimed prior to being sent on to its destinations within the modem. This is to say that the pulse width distortion is reduced to virtually zero. This feature allows virtually unlimited repeating, avoiding the accumulation of pulse width distortion caused by the optical transmission and reception. The circuit outputs pulses, which are integer multiples of 8.6805556 usec in length, accurately retiming all data streams operating at bit rates of:

$$\frac{10^6}{N (8.6805556)}$$

For 9.6 kbaud, N = 12. For 115.2 kbaud, N = 1. If your system operates at a non-standard bit rate, contact the factory. A change in crystal frequency is all that may be required.

Data Tagging for Selective Data Routing

The modem has a unique feature in that it is able to tag data originating from it when operating in local mode and separately tag data originating from it when operating in master. This allows other units to identify the data source as being from either a local or a master unit. With this ability, a local modem can block data received from another local modem and a master modem can block data originating from another master modem. The tags are removed from the data stream after reception via the fiber and prior to being output via the data I/O ports. The result is that master units will only receive data from local modems and vice versa. This can simplify the poll-response software design or allow the user to convert to an optical poll-response network without changing the software designed for use with copper wire modems. **NOTE:** *When operating in Master Fault Tolerant Mode this serves as an Echo Cancel function independent of the normal echo cancel feature.*

When using this feature, ***all*** modems in the network must have the feature enabled, otherwise corruption of the first or first few data bits in a packet will occur. When using this feature, all modems in the network must be Models 9522Y, 9526Y, 9522A, 9521AY, or 9522A. If this feature is disabled, other models such as the 9525Y and 9521Y may also be used in the network.

Set Up of the 9522A

Preparation of the modem for operation consists of setting the dipswitches for the particular application, making the fiber, data, and power connections.

SETTING THE DIPSWITCHES

- **Set the Operational Mode** using S1 switches 1 and 2. Refer to Table 1 and to the System Architecture section for more details on selecting the Operational Mode.

Table 1 — Switch 1, Mode/Data Port Settings/Echo/Data Tagging										
1	2	3	4	5	6	7	8	9	10	Mode Selection
Down	Down									Master Fault Tolerant
Down	Up									Master Daisy Chain
Up	Down									Local Fault Tolerant
Up	Up									Local Daisy Chain

Note that the Operational mode must be set to one of the LOCAL Modes (S1-1 UP) to allow the Remote Master mode Select Input to operate correctly. Refer to the Set Up section on Remote Master Mode Select Set Up.

- **Set the data type for the Primary Data Port.**
This is done on S1-3 thru 6 and S6-1 thru 4. Note that S1-7 is used for the Master Echo Cancel Enable/Disable function, and must be disabled in RS485 2-wire. Insure that you have set the RS485 and RS422 termination switches (S6-3 and S6-4) correctly. In general, the last unit on an RS485 and RS422 bus should have the terminators enabled by setting the switches down. Refer to Table 2 and the System Architecture section for details on this function.
- **Set the ECHO Cancel for the Primary Data Port** with switch S1-7. The Echo Cancel function is affected by Ring Timeout Settings on S-2. If the Data Tagging Feature is enabled (switch S1-10), the Echo will be cancelled no matter how S1-7 is set. Refer to Table 2 and the System Architecture section for details on this function.

- **Set the Data Tagging for the Primary Data Port** with switch S1-10. If the Data Tagging Feature is enabled, ALL modems in the network must have this feature enabled. If there are modems in the network that do not support this feature, it MUST be disabled. Refer to Table 2 and the System Architecture section for details on this function.

Table 2 — Switch 1 and Switch 6, Primary Port Data Settings, Master Echo, Data Tagging										
1	2	3	4	5	6	7	8	9	10	Switch 1 - Primary Data Port Settings
										Switch 6 - Primary Data Port Settings
										1 2 3 4
		Up		Up	Up					U U N/A N/A RS232
		Up		Down	Up					U U D D RS422
		Up		Down	Down					U U T* T* RS485 4-wire
		Down		Down	Down					D D T* T* RS485 2-wire
										Primary Port Master Echo Cancel Settings
						Down				Echo Cancelled (MFT mode only)
						Up				Echo Enabled (MFT mode only)
										Data Tagging Settings
									Down	Data Tagging Enabled
									Up	Data Tagging Disabled

* T = Termination, normally on for RS422, optional on RS485; Down = Termination ON; Up = Termination OFF

- **If required, set the data type for the Secondary Data Port.** This is done on S1-8 and 9 and S6-1 thru 4. Insure that you have set the RS485 and RS422 termination switches (S4-3 and S4-4) correctly. In general, the last unit on an RS485 and RS422 bus should have the terminators enabled by setting the switches down. Insure that you have set the RS485 and RS422 termination switches (S6-3 and S6-4) correctly. In general, the last unit on an RS485 and RS422 bus should have the terminators enabled by setting the switches down. Refer to Table 3 for details on this function.

Table 3 — Switch 1 and Switch 4, Secondary Port Data Settings										
1	2	3	4	5	6	7	8	9	10	Switch 1 - Secondary Data Port Settings
										Switch 4 - Secondary Data Port Settings
										1 2 3 4
			Up				Up	Up		U U N/A N/A RS232
			Up				Down	Up		U U D D RS422
			Up				Down	Down		U U T* T* RS485 4-wire
			Down				Down	Down		D D T* T* RS485 2-wire

- **Set the RS232 Anti-Stream Enable/Timeout.** Set S2-1, S2-2, and S2-3 to either disable or select the RS232 anti-streaming timeout. Refer to the Anti-stream Timeout section in System Architecture and to Table 4.

Table 4 — Switch S2, Timeout/Streaming Set Up								
1	2	3	4	5	6	7	8	Function
Down	Down	Down						RS232 Anti-Stream Disabled
Up	Down	Down						RS232 Anti-Stream Enabled – 64 Seconds
Down	Up	Down						RS232 Anti-Stream Enabled – 32 Seconds
Up	Up	Down						RS232 Anti-Stream Enabled – 16 Seconds
Down	Down	Up						RS232 Anti-Stream Enabled – 8 Seconds
Up	Down	Up						RS232 Anti-Stream Enabled – 4 Seconds
Down	Up	Up						RS232 Anti-Stream Enabled – 2 Seconds
Up	Up	Up						RS232 Anti-Stream Enabled – 1 Second

- **Set the Optical Anti-Streaming Option.** This function is set by S2-4. Refer to the Optical Anti-Streaming section of System Architecture and Table 5.

Table 5 — Switch S2, Streaming Set Up								
1	2	3	4	5	6	7	8	Function
			Down					Optical Anti-Stream Disabled (RS232 Only)
			Up					Optical Anti-Stream Enabled (RS422, RS485 Only)

- **Set the Priority Timeout Value** as explained in Priority Timeout Section of System Architecture, set S1-5. Refer to Table 6. 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 4800 bps one bit equals 208 microseconds. Ten times 208 microseconds equals 2080 microseconds or about 2.1 milliseconds. Select the 2.22 ms timeout. For data rates above this, also select the 2.22 ms. timeout. For slower data rates, select the 8.88 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.

Table 6 — Switch S2, Priority Select Set Up								
1	2	3	4	5	6	7	8	Function
				Down				Priority Select Timeout 2.22 ms.
				Up				Priority Select Timeout 8.88 ms.

- **Set the Clear to Send Inhibited by Optical Side Activity** as explained in the Clear to Send Inhibited by Optical Side Activity section of System Architecture by setting S2-6. Refer to Table 7.

Table 7 — Switch S2, CTS Optical Activity Set								
1	2	3	4	5	6	7	8	Function
					Up			CTS Low upon Optical Activity — Enabled
					Down			CTS Low upon Optical Activity — Disabled

- **Set the Ring Propagation Timeout** as described in the Ring Propagation Timeout section of System Architecture on S2-7 and S2-8. Note that the Ring Propagation Timeout plays a role in the ECHO CANCEL Feature and RS485 2-Wire Operation as explained in System Architecture. This timeout is not important unless the unit is operated in Master Fault Tolerant Mode and the ECHO Cancel is enabled (S1 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 (100 nsecs plus 6.5 msecs) times (the number of local modems around the ring) plus (1.5 nsecs 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 0.1 msecs + 97.5 msecs + 4.5 msecs = 102.1 msecs. For this ring, the shortest timeout of 1 msec can be chosen. Refer to Table 8.

Table 8 — Switch S2, Timeout/Streaming/Priority Select/CTS/Ring Propagation Set Up								
1	2	3	4	5	6	7	8	Function
						Up	Up	Ring Propagation Timeout 1 ms.
						Down	Up	Ring Propagation Timeout 4 ms.
						Down	Down	Ring Propagation Timeout 12 ms.

- **Make the Data Port Connections**

RS232 Connections

Data port connections for the two DB25S connectors on the front panels are as shown in Table 9 and Figures 9 and 10 below. The RS232 connector is wired internally as a DCE (Data Communications Equipment) device. Note that the connections for both the Primary and Data port are identical.

Connect both the master controller CPU and each local terminal's communications port via the Primary or Secondary Data Port (DB25S) on the Model 9522Y 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). If the RS232 anti-streaming feature is used it will also be necessary to connect pin 4, the RTS input. If the terminal equipment requires a high (True) CTS input in order to transmit data, connect pin 5 of the terminal equipment to pin 8 (CD) of the modem. The CD output is always high.

Table 9 — RS232 Primary and Secondary Data Port Connections

Pin #	Identification	Signal Direction, Comments
2	Transmit Data (DT)	Input to modem
3	Receive Data (RD)	Output From Modem
4	Ready to Send (RTS)	Input To Modem
5	Clear To Send (CTS)	Output from Modem
6	Data Set Ready (DSR)	Output (this output is always tied High)
7	Signal and Chassis Ground	
8	Carrier Detect (CD)	Output (this output is always tied High)

FIGURE 8 — TYPICAL RS232 WIRING, 9526AY TO PC DB9 CONNECTOR

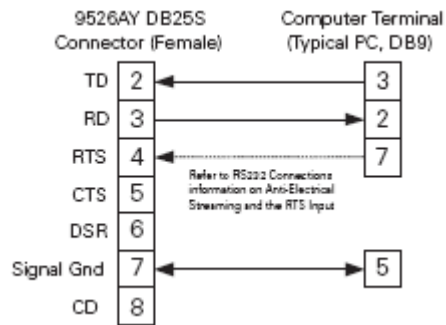
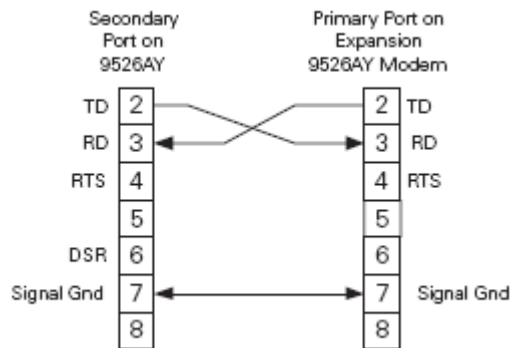


FIGURE 9 — CONNECTING A LOCAL 9526AY MODEM IN A RING OR DAISY CHAIN CONFIGURATION TO ANOTHER DAISY CHAIN



RS422 and RS485 Connections

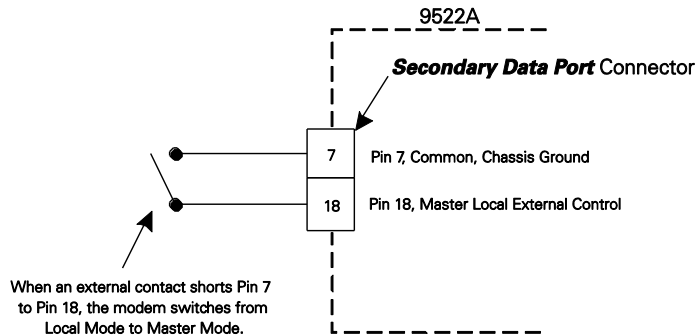
When operation with RS422 or RS485 is required, make the connections as listed in Table 10. In RS422 or RS485 model there are no RTS or CTS control lines. Rather the RTS and CTS signals are internally enabled. The RTS and CTS indicator will always be illuminated when the unit is operated with RS422/RS485 data. Refer to the Priority Select section in System Architecture, for additional considerations when operating in RS485 2-wire mode.

Table 10 — RS422/RS485 Pinouts, Primary and Secondary Data Ports	
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

- External Master/Local Control Connection.** The Local/Master mode may be externally controlled by attaching an external contact closure between Pin 18 and Pin 7 of the Secondary Data Port. Alternately, an active LOW TTL logic level may be input to Pin 18. With this feature, different units in a network may serve as the master at different times. NOTE: *To use this feature the internal Master/Local dipswitch, S12, must be in the UP (OFF) or LOCAL position.* When this input is left open, the unit will remain in LOCAL mode. When shorted, or Pin 18 is pulled to ground, the unit will switch to MASTER mode. Care must be taken to insure that any user logic or controls used to drive this input allow only one master unit in a redundant ring at a time.

FIGURE 10

Master/Local External Control Connection via **Secondary Data Port**



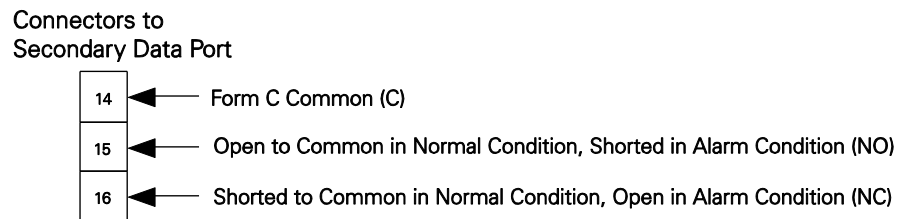
- **Alarm Connections.** A Form C relay output is available via Pins 14, 15, and 16 of the Secondary Data Port connector. Refer to Figure 11.

There are three alarm conditions that will activate the external alarm contacts.

1. In the Master Fault Tolerant Mode, if the master unit does not sense the return of a transmitted data burst on both of its optical inputs indicating a break in the optical ring.
2. RS232 Anti-Streaming Timeout is active, and the selected timeout has been exceeded, shutting down the RS232 port.
3. Optical Anti-Streaming is enabled, and has sensed optical streaming exceeding the limits.

Note that the alarm contacts will operate on alarms from both I/O ports.

FIGURE 11



- **Connect the Fiber.** Refer to the manual section on fiber cleanliness. This is important for reliable uninterrupted modem operation.

Operation of the 9522A

After the proper set up procedures have been accomplished, the modem should communicate correctly with the controller and the other modems in the network. In the event of problems, make use of the extensive array of indicators available on the 9522A for troubleshooting. Table 11 below provides additional information about the Indicators.

Table 11			
Indicator	Color	Indicator Switch Position	Function
POWER	Green	N/A	On when the unit is powered by DC input voltage. Blinks when operating from the Gel Cell Battery.
BERT	Green	N/A	Indicates that it is properly receiving a "BERT" signal transmitted by another unit (only valid during a BERT Test).
FAULT-PRI	Red	N/A	Indicates one of three conditions on the Primary Port: 1. RS232 Electrical Anti-Streaming timeout 2. If the unit is in Master Fault Tolerant mode and a break has been sensed in the ring. 3. RX1 or RX2 Optical Anti-Stream Condition
FAULT-SEC	Red	N/A	Indicates one of two conditions on the SECONDARY Port: 1. RS232 Electrical Anti-Streaming timeout 2. RX1 or RX2 Optical Anti-Stream Condition
TD	Green	Right	Indicates data input to Pin 2 of the Primary Data I/O Port.
RD	Green	Right	Indicates data output from Pin 3 of the Primary Data I/O Port.
CTS	Green	Right	Indicates a true CTS output from Pin 5 of the Primary Data I/O connector in RS232 Mode
TDE	Green	Right	Indicates data input to Pin 2 of the Secondary Data I/O Port.
RDE	Green	Right	Indicates data output from Pin 3 of the Secondary Data I/O Port
CTSE	Green	Right	Indicates a true CTS output from Pin 5 of the Secondary Data I/O connector in RS232 Mode
TX1	Green	Left	Indicates data being transmitted via the TX1 optical port
RX1	Green	Left	Indicates data being received by the RX1 optical port
TX2	Green	Left	Indicates data being transmitted via the TX2 optical port
RX2	Green	Left	Indicates data being received by the RX2 optical port.
PR1	Green	Left	When illuminated, indicates that the RX1 optical input port is currently selected by the Priority Select circuitry.
PR2	Green	Left	When illuminated, indicates that the RX2 optical input port is currently selected by the Priority Select circuitry.

USING THE BUILT-IN BERT FUNCTION

The 9522A has a rudimentary BERT test feature that may be implemented off-line. While the test is being run, no other signals may be introduced to a modem in the network. To run the test, set the Front Panel dipswitch position 2 (center switch), for the TX1/RX1 optical ports or position 3 (bottom switch), for the TX2/RX2 port DOWN, depending on which data path you wish to test. The BERT indicator will illuminate on all modems properly receiving the signal for presentation at the RD (or RDE) output. It will not illuminate if the data is only being repeated but not dropped off (via RD or RDE) by the modem. If initiated from the master in a fault tolerant ring, and the BERT indicator on the master illuminates, it is receiving data that has traveled around the ring. If the BERT indicator does not illuminate, inspect the BERT indicators on each modem in the ring to determine where the ring is broken. Test both directions independently to obtain the most information.

Operation of the 9522A with the Network Management System (NMS) Software

Operation of the cards with the NMS Network Management System software provides the following information:

Parameter	Type/Comment	Value Range	Default Status	Default Limits
Card Location (Slot)	Calculated by the NMS software	N/A	N/A	N/A
Card Name	Text – Factory Programmed into NV ram on card	N/A	N/A	N/A
Serial Number	Text – Factory Programmed into NV ram on card	N/A	N/A	N/A
Revision Number	Text – Factory Programmed into NV ram on card	N/A	N/A	N/A
Chronometer	Numeric – Calculated – stored in NV ram on card	N/A	N/A	N/A
Reset Cycles	Numeric – Calculated – stored in NV ram on card, Represents the cumulative number of power cycles	N/A	N/A	N/A
Firmware Revision	Text – Factory Programmed into NV ram on card	N/A	N/A	N/A
Master/Local Mode	Status – Represents current Set Up of Primary Data Port	Master / Local	Info	*
Fault Tolerant Daisy Chain Mode	Status – Represents current Mode of Primary Data Port	Fault Tolerant/ Daisy Chain	Info	*
Primary Data Port Alarm Status	Status – Represents current Alarm Status of Primary Data Port	True (In Alarm) False (Normal)	Info	*
Secondary Data Port Alarm Status	Status – Represents current Alarm Status of Secondary Data Port	True (In Alarm) False (Normal)	Info	*
Data Tagging Status	Status – Represents current Data Tagging Feature Status	Tagging Enabled/ Disabled	Info	*
Primary Data Port Echo Cancel Status	Status – Represents current Echo Cancel Feature Status	Echo Cancel Enabled/ Disabled	Info	*
BERT Test Status	Status – Represents current BERT TEST status	BERT TEST Enabled/ Disabled	Minor	*
BERT TEST Result Status	Status – Represents current BERT TEST results	BERT Signal Detected/ Not Detected	Minor	*
Primary Port Setup Control	Control – Provides NMS control over Set Up status	Master Local	N/A	N/A
TX1- BERT Test Enable	Control – Provides NMS control for BERT Test on TX1	Enabled/Disabled	N/A	N/A
TX2- BERT Test Enable	Control – Provides NMS control for BERT Test on TX2	Enabled/Disabled	N/A	N/A
Temperature	Analog – Detected on card	Deg C	Info	*

*NMS users should set the Status and Limits for each parameter as required for the specific application when the NMS software is operated for the first time, or a new card is added into the system.

When the 9522A card is installed into an existing system already utilizing NMS system software, an upgrade of the software will be necessary to add the 9522A card to the software database in the NMS software. Consult the factory for guidance on how to download the latest version of the software from the TKH Security USA FTP download site.

Specifications for the 9522A

OPTICAL

Optical specifications are measured with the BERT test enabled.

Model Type	S	L	LD
Fiber Size	62.5/125	62.5/125	09/125
Tx Output Power (dBm)	-19	-20	-18
Tx Optical Wavelength (nm)	850	1310	1310
Rx Receiver Sensitivity (dBm)	-38	-38	-38
Optical Budget (dB)	19	18	20
Estimated Distance (km) ¹	5.3	15	48

¹Distance estimations based on losses of 3.0 dB/km @ 850nm or 1.0 dB/km @ 1310 nm on 62.5/125 fiber and 0.35 dB/km @ 1310 nm or 0.25 dB/km at 1550 nm on 09/125 fiber and include a 3db safety factor.

ELECTRICAL

Primary and Secondary Data I/O Ports

Interfaces (Dipswitch Selectable)	RS232, RS422 4-wire, RS485 2- or 4-wire
Connectors	DB25S (25-pin) configured as DCE
Performance	
Baud Rate	150 Baud to 115.2 Kbps (Auto Baud, no settings required)
BER	10 ⁹ or better at the minimum optical receiver power level
Retiming Accuracy	0.01% of pulse width for repeated signals
Electrical Anti-Streaming	
Timeout Selections	1, 2, 4, 8, 16, 32, and 64 seconds

Alarm Contacts

Rating	28 VDC @ 100 mA
Type	Form C (Normally Open, Normally Closed, Common)
Connector	Three terminals on five-pin removable screw terminal connector

Power Requirements

Current Voltage	400 mA @ 6 VDC
Source	Chassis backplane

PHYSICAL

Dimensions

6.2 H x 1.6 W x 8.6 D in.
157.5 H x 40.6 W x 218.4 mm

Weight

2.8 lb.
952 gm

ENVIRONMENTAL

Operating Temperature

-40° C to +74° C

Storage Temperature

-55° C to +85° C

Relative Humidity

0 to 95% noncondensing

In line with TKH Security USA's policy of continuous product improvement, we reserve the right to vary product specifications and descriptions without notice.

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