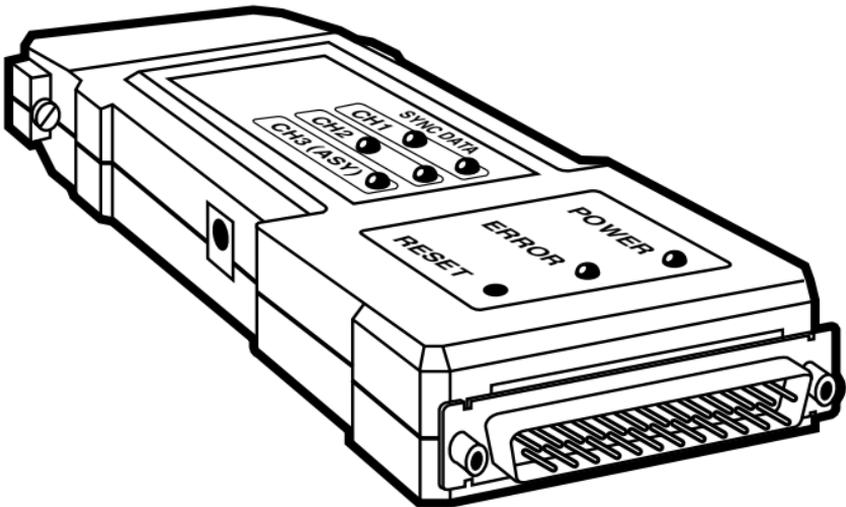




APRIL 2004
MT723A
MT723AE
MT724A
MT724AE
MT725A
MT725AE

Fradswitch-2A/S



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AND
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RADIO FREQUENCY INTERFERENCE STATEMENTS**

This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

NORMAS OFICIALES MEXICANAS (NOM) ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energia.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos liquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

WARNING: SAFETY INSTRUCTIONS

The Fradswitch is powered by an external power supply. To reduce the risk of electric shock, fire, and injury, use only with a UL® listed and CSA certified Class 2 power supply rated 5 VDC, 700 mA.

WARNING: TUV CERTIFICATION REQUIREMENTS

1. To reduce the risk of electric shock and fire, use only with a power supply that is approved for the latest version of EN 60950.
2. For continuous protection against risk of fire, do not operate the equipment with the enclosure completely or partially removed.

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1. Specifications

Synchronous Links

Number of Links: 2

Speed: Up to 64 kbps, determined by external clock

Throughput: 300 packets per second for X.25

Protocol: Compatibility: X.25, Frame Relay, HDLC, STM, asynchronous, selectable by software for each channel

X.25: Complies with 1988 CCITT X.25, LAP-B;

STM: Compatible with STM-4, STM-8, and STM-24 statistical multiplexors

Frame Relay: Supports CLLM, LMI, and ANSI PVC management protocols; complies with ANSI T1.606, T1.617 Annex D, T1.618, and ITU Q.922 Annex A

Interface: MT723A, MT724A: RS-232/RS-530;
MT725A: RS-232/V.24

Connectors: MT723A: (1) DB25 female, (1) DB25 male;
MT724A: (1) DB25 female, (1) DB25 male (V.35);
MT725A: (1) DB25 female, (1) DB25 male (also contains async channel)

X.25 Configuration

Link Level Procedure: Parameters selectable for: Frame Window (K), Packet Window (W); Acknowledge Timer (T1); Link Level: LAP-B can act as DTE or DCE, Modulo 8, or 128-packet sequencing; frame window range: 1–127

Packet Size: Up to 4096 bytes

RAM Size: Buffer: 512 KB; EEPROM: 2 KB

Network Procedure: Modulo 8, 128-packet sequencing, packet window range: 1–127

Services Supported: SVC, PVC

Asynchronous Channel

Speed: 75 bps to 38.4 kbps

Flow Control: X-ON/X-OFF, CTS/RTS

Command Modes: X.28, extended, X.29

Terminal Handling: Enhanced asynchronous terminal, handling beyond X.3 requirements

Interface: V.24/RS-232

Connector: 25-pin male, available via a channel-doubler cable connected to link 2

General

Indicators: (8) LEDs: Power, Error, Reset, Sync Channel 1, Sync Channel 2, Data Channel 1, Data Channel 2, Data Channel 3 (Async)

Channel Doubler: Cable, used to provide async access to one link connector in addition to the sync link, 1 m (3.3 ft.) long with (1) 25-pin female connector at one end and (2) 25-pin male connectors at the other end

Power: Powered by an external power supply: 5 VDC, 700 mA regulated (+10%, -2% VDC)

Size: 4.3"H x 5.3"W x 2.2"D (10.9 x 13.5 x 5.6 cm)

Weight: 3.2 oz. (90.7 g)

2. Introduction

2.1 What the Fradswitch Does

The Fradswitch-2 A/S is a high-performance X.25/Frame Relay switch for routing between an X.25/Frame Relay switch or access units. It can switch up to two synchronous links. An asynchronous channel is also available.

The Fradswitch-2 A/S can perform switching of the following: X.25 to X.25, X.25 to Frame Relay, and Frame Relay to Frame Relay. It can also encapsulate various protocols, like HDLC, over Frame Relay and X.25.

The dual-input cable that comes with the Fradswitch-2 A/S functions as a channel doubler. One input is used as an asynchronous channel (which can be used as a configuration channel); the second input is a synchronous link.

When operating as a PAD, the Fradswitch-2 A/S assembles data from the asynchronous channels into X.25 packets. The concentrated packetized data stream is transferred to the routing module, which then forwards the packets to the appropriate X.25 link.

When operating as a FRAD, the Fradswitch-2 A/S provides FRAD capabilities either directly from async to Frame Relay or from async to X.25 encapsulated over Frame Relay.

The Fradswitch-2 A/S links can be programmed to operate asynchronously, allowing connection of asynchronous devices to a link. When programmed to operate in async mode, the links, including the additional async channel via the channel doubler, work like a PAD async channel with all the X.28 standard facilities.

With a Fradswitch-2 A/S, you can easily expand a network by connecting a remote STM (Statistical Multiplexor) to one or more of its synchronous links. When an STM is connected to a Fradswitch-2 A/S link, the asynchronous ports of the STM have all the functionality of PAD ports.

The Fradswitch-2 A/S is compatible with ITU Rec. X.2, X.3, X.25, X.28, X.29, and X.121 (Blue Book, 1988). It supports both switched and permanent virtual circuits. The channel has multiple-session capabilities. The Fradswitch-2 A/S provides a variety of call-setup options, including automatic and mnemonic dialing.

2.2 Available Models

Six models are available: MT723A, MT723AE, MT724A, MT724AE, MT725A, and MT725AE. Although all three models have DB25 connectors on both sides, on the MT723A these are both V.35 ports, pinned proprietarily on DB25. On the MT724A, the V.35 (network) connector is similarly pinned on DB25. (These ports carry V.35 electrical levels, so they should not be directly connected to RS-232 or RS-530 equipment.)

The MT723A and MT724A come with Adapter Cables that patch the DB25 network connector to a standard M/34 connector for attachment to V.35 devices. (Because the Adapter Cable has a DB25 male connector at the Fradswitch end and the MT723A, unlike the other models, uses a DB25 male network connector, the MT723A comes with a DB25 F-F gender changer for this connection.)

The MT723A also comes with a special channel-doubler cable that has an M/34 connector for its Port 2 (line/device port). For the pinouts of all of the connectors on the MT723A, MT724A, and associated cables, see Tables A-1 through A-3 in the **Appendix**.

Also, whereas the data rate of the MT725A tops out at 64 kbps on Ports 1 and 2 and at 38.4 kbps on Port 3 (the async channel), the MT723A and MT724A have maximum aggregate data rates of 2 Mbps (that is, the total of both or all three ports' data rates can be as high as 2 Mbps). This means that, while the RS-232 async channels still can go no faster than 38.4 kbps, and the RS-232 Port 2 (line/device port) on the MT724A is limited to 64 kbps, the V.35 sync channels can all transmit and receive at 2 Mbps minus the data rates of the other ports.

For example, on the MT724A, if Port 2 is running 64 kbps and Port 3 is running 38.4 kbps, Port 1 can operate at a top speed of $2 \text{ Mbps} - 64 \text{ kbps} - 38.4 \text{ kbps} = 1.8978 \text{ Mbps}$.

2.3 Applications

The Fradswitch-2 A/S can support a wide range of applications:

- Connection of devices supporting HDLC protocol over the X.25 or Frame Relay network. (See Figure 2-1.)

- Public network access.
- Running asynchronous data in X.25 encapsulated packets over Frame Relay.
- Running asynchronous data directly over Frame Relay/X.25.
- Routing between two Frame Relay devices or networks (Frame Relay to Frame Relay switching). (See Figure 2-2.)



Figure 2-1. Fradswitch-2 A/S connecting bridge/routers over X.25/Frame Relay.

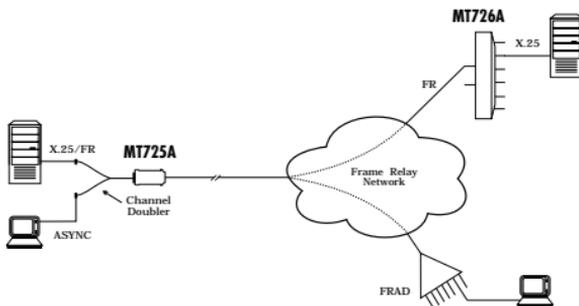


Figure 2-2. Fradswitch-2 A/S using channel doubler cable for local configuration or additional async access channel. (FR=Frame Relay.)

2.4 Features: X.25 Links

When the Fradswitch-2 A/S link is configured to X.25, it operates synchronously at data rates up to 64 kbps. The link 1 interface is DTE and the link 2 interface is DCE in layer 1. The data rate is determined by the external or internal clock.

The Fradswitch-2 A/S link interface types are RS-232/V.24.

The composite-port packet size supported by the Fradswitch-2 A/S is configurable (up to 4096 bytes), and the frame window range is selectable in the range of 1 through 7 (for Modulo-8 operation), or 1 through 127 (for Modulo-128, or extended operation).

The Fradswitch-2 A/S link fully supports switched virtual circuits (SVC) and permanent virtual circuits (PVC). The composite-port connection is LAPB per ITU Rec. X.25, and the Fradswitch-2 A/S can act as either DTE or DCE with respect to the layer 2 and layer 3 protocols.

2.5 Features: Frame-Relay Links

When the link is configured for Frame Relay, packets are processed as follows: If the Fradswitch-2 A/S is located at the user side (acting as an end device), the received Frame Relay packets are converted into async or X.25 format and are routed to the appropriate port. If the Fradswitch-2 A/S is located at the network side, the received Frame Relay packets are routed to another Frame Relay link.

Acting as a FRAD (Frame Relay Assembler/Dis-assembler), the Fradswitch-2 A/S can either convert the asynchronous data into X.25 packets and concentrate the packetized data stream over the Frame Relay link, or directly run asynchronous data over Frame Relay.

The Fradswitch-2 A/S employs a unique funneling method for controlling network congestion and moderating feeder throughput speed.

CLLM and LMI management protocols are supported, and operation is in compliance with ANSI T1.606, T1.618, T1.617 Annex D, and ITU Rec. Q.922, Annex A.

2.6 Features: HDLC Links

The Fradswitch-2 A/S link can be programmed to operate with transparent HDLC allowing computers, bridges and HDLC communication devices to be connected over X.25 or Frame Relay networks. The HDLC protocol is encapsulated over the X.25 protocol, providing end-to-end transparent operation.

2.7 Features: Async Links

The Fradswitch-2 A/S link can be programmed to operate asynchronously, allowing connection of asynchronous devices to the links. When programmed to operate as async, the links operate like PAD async channels with all the standard facilities.

2.8 Characteristics of the Asynchronous Channel Interface

Channel data rate is selectable from 75 bps to 38.4 kbps. Channel operation is asynchronous, through the use of a channel-doubler cable (but note that the use of a channel-doubler cable in an application does not permit simultaneous use of an ASCII terminal).

The asynchronous word format is user-configurable, by means of proprietary extensions to the ITU X.28 basic set of commands. For flexibility in applications, flow control can be performed either by software handshaking (X-ON/X-OFF), or by hardware handshaking.

The Fradswitch-2 A/S channel doubler has an RS-232/V.24 DCE interface.

2.9 Channel PAD Characteristics

The Fradswitch-2 A/S includes a PAD, which supports multiple sessions with independent, user-selected session profiles. This means that any user connected to the Fradswitch-2 A/S channel can simultaneously conduct several independent packet-switched calls by establishing several virtual circuits carried by different logical channels. The maximum number of sessions on the channel is four.

The Fradswitch-2 A/S supports four call-initiation methods, independently selectable for each channel:

- *Manual (regular) call initiation*, whereby the user provides all the information required to set up the call by entering an X.28 command.
- *Mnemonic call initiation*, whereby the user need only enter a mnemonic (“call ID”). The PAD then retrieves the call setup information from the Fradswitch-2 A/S memory, thereby significantly reducing the amount of information that has to be manually entered.

- *Automatic call initiation (“autocall”)*: The call is automatically initiated as soon as the user equipment is turned on, in accordance with predefined call setup information stored in the Fradswitch-2 A/S memory. To completely automate the call setup, a user-defined sequence of X.28 commands (an “alias”) can automatically be sent after the call is set up. The sophisticated Fradswitch-2 A/S autocall mode includes two measures that allow for the reliable setup of the desired call:
 - Automatic call setup retry: the user can specify the number of retries, and the interval between consecutive retries.
 - An alternative address for call setup, which is automatically used when it is not possible to set up a call to the first address.
- *Use of permanent virtual circuit (PVC)*: The call is automatically set up by the X.25 network switch (in accordance with predefined call-destination data requested when you subscribed to the X.25 service).

2.10 ITU Facilities

These are the ITU Rec. X.2 facilities supported by the Fradswitch-2 A/S:

- Closed user groups.
- Fast select.
- Reverse charging.
- Throughput class negotiation.
- Packet and window size negotiation.
- Charging information.
- Network user identification (NUI).

2.11 Features of the Command Facility

The Fradswitch-2 A/S channel PAD operates under the control of a central command facility, which can be used to perform the following activities:

- Set up the individual channel PAD configuration parameters.

- Determine common Fradswitch-2 A/S configuration parameters.
- Perform statistics and performance monitoring on the Fradswitch-2 A/S and its channels.
- Perform diagnostic activities.

The command facility supports the configuration of both the local- and the remote-channel PADs. It includes a help function, which provides information on the available PAD commands, and on the purpose and format of each command.

The command facility can be accessed from any channel, and from any place in the X.25 network. Simultaneous access from several channels is possible, but a warning is given if a user connects to the facility when someone else is already connected to the command facility.

Password protection is used to prevent unauthorized persons from using the command facility. There are two password levels:

- Super user password, which allows performance of all the activities (this password is usually known only to the system administrator).
- Regular user password, which provides access to functions that do not change the system status (that is, a regular user cannot perform system-wide configuration and diagnostics activities).

Using the command facility, each Fradswitch-2 A/S channel can be independently configured for different profiles, including profiles dedicated to specific sessions. The command facility can also be used to prepare a local library of call setup sequences, network user identification data, and predetermined command sequences that can be accessed by all the Fradswitch-2 A/S users, and that can be assigned to specific channels for use in automatic call setup.

The number of information items that can be prepared and stored is limited mainly by the available non-volatile storage capacity.

The required storage is provided by an Electrically Erasable Programmable Read Only Memory (EEPROM). The standard capacity of this EEPROM is 8 KB.

2.12 Configuration Features

The configuration functions provided by the Fradswitch-2 A/S command facility allow the preparation of the following data:

- Individual channel configuration.
- Preparation of profiles.
- Preparation of mnemonic call setup sequences (call IDs).
- Preparation of predefined X.28 command sequences (aliases).
- Preparation of network user identifications (NUI).
- Definition of PVCs.
- Definition of X.25 link configuration parameters.
- Definition of system management parameters.

- Definition of data routes.

For activities that involve repetitive preparation of the same set of parameters (for example, channel configuration, profiles, or call IDs), the Fradswitch-2 A/S provides a time-saving duplicate function that allows copying an already-prepared data set as a basis for the preparation of a new set. Another valuable convenience is the display of reports that summarize the existing data for each type of configurable data item.

In addition, on-line help is available in the preparation of configuration data. The help information includes concise definitions of parameters and specifies the available range of values.

2.13 Link-Configuration Capabilities

The Fradswitch-2 A/S link-configuration functions provide the following capabilities for each of the links:

- Definition of the local X.25 address.
- Selection of layer 2 and layer 3 modes (DCE or DTE).

- Selection of the various LAPB timers and parameters.
- Selection of default window and packet sizes.
- Definition of logical channels allocation (permanent, incoming, two-way, and outgoing).

2.14 System-Parameter Configuration Capabilities

The Fradswitch-2 A/S system parameters CONTROL functions provide the following capabilities:

- Definition of a device identification for the local Fradswitch-2 A/S.
- Selection of default PAD prompt.
- Selection of default software flow control characters (X-ON, X-OFF).
- Changing of user and super-user passwords.
- Definition of herald and bulletin messages.
- Definition of event reporting addresses, and the associated reporting masks.

- Definition of event reporting intervals.

2.15 System-Control Capabilities

The Fradswitch-2 A/S system-configuration functions provide the following capabilities:

- Logical connection/disconnection of the X.25 link.
- Clearing of selected sessions.
- Setting of the date and time of the internal Fradswitch-2 A/S real-time clock.
- Resetting of statistics counters.
- Compression of data stored in the Fradswitch-2 A/S non-volatile memory, to allow maximum utilization of the available storage capacity. The compression is performed by rearranging the data stored in the memory, to close gaps between data blocks that appear naturally when the stored information is modified.

- Fradswitch-2 A/S resetting and reloading of default configuration. This function allows a remote supervisor to perform these activities, that would otherwise require the dispatching of service personnel.

2.16 Remote System Monitoring

The Fradswitch-2 A/S includes an automatic event reporting facility that allows the transmission of statistics and status data to selected X.25 destinations.

The automatically reported information can include:

- Periodic system status information.
- Event reports according to masks definitions. The different events are:
 - SYNC status has changed.
 - RTS status has changed.
 - Power on (Reset).

A report is sent each time an event occurs.

The Fradswitch-2 A/S system-management configuration facility allows the definition of two destinations. The information transmitted to each destination is also selectable by means of event-reporting masks. The masks are defined using the Fradswitch-2 A/S system-management configuration facility. It is therefore possible to program the Fradswitch-2 A/S to transmit the same reports to both destinations and thus to ensure that the reports will reach a management station, or to send different types of information to different locations.

2.17 Status and Statistics Collection and Reporting Capabilities

The Fradswitch-2 A/S has an advanced statistics-collection and status-reporting facility. This facility permits the system administrator to display on demand detailed information on the operation and performance of the X.25 links, and take snapshots that show the status of the Fradswitch-2 A/S, the utilization of the X.25 links, and the status of the individual channels. The information obtained by means of the statistics function allows the system manager to monitor system performance, detect bottlenecks and transmission problems, verify the suitability of the installed

Fradswitch-2 A/S EEPROM and RAM capacity, and troubleshoot on-line user channels.

The information displayed by means of the statistics function includes:

- Fradswitch-2 A/S system data:
 - Fradswitch-2 A/S identification (its “device ID”).
 - The programmed X.25 mode (DTE or DCE).
 - Fradswitch-2 A/S RAM size.
 - EEPROM size and current percentage of utilization.
- Fradswitch-2 A/S system status:
 - The current size (number of characters per buffers) of the Fradswitch-2 A/S data buffers.
 - The current total number of data buffers, and the number of free buffers.

- System history data, collected since the last resetting of the statistics counters:
 - Total number of frames transmitted and received by layer 1 (the physical layer).
 - Total number of information frames transmitted and received by layer 2 (the link control layer).
 - Total number of information frames transmitted and received by layer 3 (the X.25 layer).
 - Current X.25 synchronization status, and the total number of X.25 synchronization losses.
 - The average number of data buffers in the Fradswitch-2 A/S “pool,” and the recorded minimum number of buffers in this pool.
- Asynchronous channels status. The following information is available for each channel:
 - The subaddresses of each channel.
 - The current channel operating mode (data transfer/command mode).

- The current status (free/engaged) and the software flow control state.
- The logical channel numbers used by each channel, and the address reached through each logical channel.
- The number of active logical channels and active sessions.
- The number of buffers currently allocated to the transmit (to network) and receive (to user) directions.
- Autocall ID (mnemonic) configured to the channel.
- The number of the profile currently used by the channel, and the current values of the individual PAD parameters.
- The state of the channel RTS line (when relevant).

- X.25 links status. The following information is available for each channel:
 - Protocol, synchronization state, and transmission mode (DCE or DTE).
 - Current allocation of logical channels (per type) within the logical group in use, the number of active channels, and the total number of layer 3 information frames transmitted through each type of logical channel.
- Logical channel status and the current values of the main protocol variables.
- Physical layer (layer 1) driver statistics:
 - Total number of frames transmitted and received by layer 1 (the physical layer).
 - The number of R frames waiting in the buffers.
 - The physical layer state, and the state of the CD and CTS interface lines.

- LAPB (layer 2) statistics:
 - Total number of I, RR, RNR, REJ, and FRMR frames transmitted and received by layer 2.
 - Number of transmission and reception errors.
 - LAPB state.
 - Current frame size.
- X.25 (layer 3) statistics:
 - Total number of I, clear, reset, and restart packets transmitted and received by layer 3.
 - Number of logical group in use.
 - Current packet size.

2.18 Diagnostic Features

Upon power-up or after reset, the Fradswitch-2 A/S performs a self-test, during which all its circuits are checked. In case of malfunction, the ERR indicator on the Fradswitch-2 A/S lights. The Fradswitch-2 A/S also has a front-panel indicator test.

2.19 General Features

The Fradswitch-2 A/S is supplied in a compact casing which is easily installed. The Fradswitch-2 A/S operates with a standalone 115-VAC or 230-VAC regulated power supply, which supplies 5 VDC. It is a desktop unit that can be placed on desktops or shelves.

3. Installation

This chapter provides mechanical and electrical installation procedures and basic operating procedures.

The Fradswitch-2 A/S is a miniature unit delivered completely assembled. After installing the unit, refer to the Packet-Switching Guide, **Chapter 2**, for system configuration information and procedures.

If you have any problems, refer to the Packet-Switching Guide, **Chapter 5**, for test and diagnostics instructions.

3.1 Unpacking

A preliminary inspection of the equipment container should be made before unpacking. Evidence of damage should be noted and reported immediately. Unpack the equipment as follows:

1. Place the container on a clean flat surface, cut all straps, and open or remove the top.
2. Take out the Fradswitch-2 A/S carefully and place it securely on a clean surface.
3. Inspect the Fradswitch for damage. Report immediately any damage found.

3.2 Site Requirements

3.2.1 POWER

The Fradswitch's external power supply should be installed within 5 feet (1.5 m) of an easily accessible grounded AC outlet capable of furnishing 115- or 230-VAC. The power supply should provide 5 VDC, 700 mA regulated (+10%, -2%).

3.2.2 DATA-CHANNEL CONNECTIONS

The Fradswitch-2 A/S has async/sync connectors (sync only without doubler cable).

3.2.3 MAIN LINKS CONNECTIONS

The Fradswitch-2 A/S has two main links connectors: one male and one female RS-232/V24 25-pin D-type connector.

3.2.4 AMBIENT REQUIREMENTS

The ambient operating temperature of the Fradswitch-2 A/S should be 32 to 122°F (0 to 50°C), at a relative humidity of up to 90%, noncondensing.

3.3 Cable Connections

The Fradswitch-2 A/S has a V.24/RS-232 connector located on the rear that serves the X.25 link, and a V.24/RS-232 connector located on the front for the asynchronous/synchronous data channels.

3.3.1 ASYNCHRONOUS DATA CHANNEL CONNECTIONS

When using the channel-doubler cable, the Fradswitch-2 A/S channel interfaces are configured as data communication equipment (DCE) interfaces, thereby allowing direct connection, via RS-232 port cables, to data terminal equipment (DTE). When modems are used to extend the range (tail circuits), crossover cables are required. Channel interfaces are asynchronous, so clock signals are not supported or required.

The channel-doubler cable is connected to the male DB25 connectors (labeled CH2 and CH3) of the Fradswitch-2 A/S, and the two opposite connectors labeled SYNC and ASYNC to the sync and async sources respectively. (Some cables are labeled “SUB 1234” for the sync port and “SUB 5678” for the async port.)

3.3.2 X.25 LINK CONNECTION

The link 1 interface is configured as a DTE interface, intended for connection to synchronous modems that are capable of providing the clock signals that determine the link 1 data rate. The link 1 connector is an RS-232/V.24, 25-pin D-type female connector.

NOTE

The user data cables and the link cables should be shielded, in order to comply with FCC rules. The Fradswitch-2 A/S and its data interfaces will work well even if the cables are not shielded, but some radio interference may occur.

3.3.3 POWER CONNECTION

AC power should be supplied to the Fradswitch's power supply through the power cable connected to the power supply. Connect the 5-VDC connector of the power supply to the power socket of the Fradswitch-2 A/S.

4. Operation

4.1 Controls, Indicators, and Connectors

Table 4-1 lists the functions of the front-panel indicators and connectors. The numbers under the heading “Item” refer to the identification numbers in Figure 4-1.

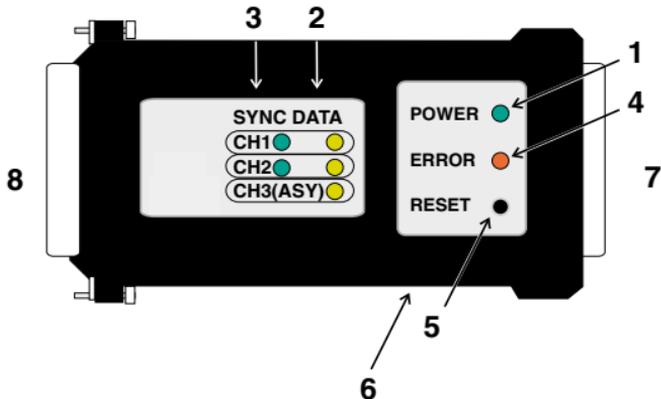


Figure 4-1. Fradswitch-2 A/S indicators and connectors.

Table 4-1. Fradswitch-2 A/S controls, indicators, and connectors.

Item	Control, Indicator, or Connector	Function								
1	POWER Indicator	Lights when the Fradswitch-2 A/S is powered.								
2	DATA Activity Indicators	Indicators, one for each channel, light when the corresponding channel is active (receives or transmits frames).								
3	SYNC Indicators	<p>Indicators, one for each main link, indicate Fradswitch-2 A/S synchronization status.</p> <table border="0"> <tr> <td data-bbox="572 573 656 593"><u>Condition</u></td> <td data-bbox="733 573 819 593"><u>Indication</u></td> </tr> <tr> <td data-bbox="572 600 598 619">Off</td> <td data-bbox="733 600 886 646">Fradswitch-2 A/S not powered</td> </tr> <tr> <td data-bbox="572 652 598 672">On</td> <td data-bbox="733 652 891 804">Fradswitch-2 A/S powered and synchronized with the corresponding X.25 DTE or DCE peer</td> </tr> <tr> <td data-bbox="572 810 648 830">Flashing</td> <td data-bbox="733 810 891 961">Fradswitch-2 A/S powered, but not synchronized with the corresponding X.25 DTE or DCE peer</td> </tr> </table>	<u>Condition</u>	<u>Indication</u>	Off	Fradswitch-2 A/S not powered	On	Fradswitch-2 A/S powered and synchronized with the corresponding X.25 DTE or DCE peer	Flashing	Fradswitch-2 A/S powered, but not synchronized with the corresponding X.25 DTE or DCE peer
<u>Condition</u>	<u>Indication</u>									
Off	Fradswitch-2 A/S not powered									
On	Fradswitch-2 A/S powered and synchronized with the corresponding X.25 DTE or DCE peer									
Flashing	Fradswitch-2 A/S powered, but not synchronized with the corresponding X.25 DTE or DCE peer									
4	ERROR Indicator	Lights when a hardware malfunction was detected during the self-test automatically performed upon power-up, or after pressing the RESET button.								

Table 4-1 (continued). Fradswitch-2 A/S controls, indicators, and connectors.

Item	Control, Indicator, or Connector	Function
5	RESET	Resets the Fradswitch-2 A/S.
6	Power Connector	Socket for 5-VDC regulated power supply.
7	Channel Connector	Connection to Fradswitch-2 A/S channel doubler.
8	Link Connector	Connector to X.25/Frame Relay link.

4.2 Operating Instructions

After being installed, the Fradswitch-2 A/S normally operates unattended. Operator intervention is required only when the Fradswitch-2 A/S is set up for the first time or must be adapted to new operational requirements.

NOTE

Fradswitch-2 A/S configuration is stored in a non-volatile memory and is not affected when power is turned off.

4.2.1 POWERING ON THE FRADSWITCH

Connect the power cable to the Fradswitch-2 A/S power socket; the POWER indicator will light.

If none of the links to the X.25 DTE/DCE peers are operational yet, the SYNC indicators of the Fradswitch-2 A/S will flash. Wait until one of the links becomes operational, and check that the corresponding SYNC indicator stops flashing and lights continuously.

Check that after a short interval (during which Fradswitch-2 A/S performs self-test), the ERR indicator goes out.

Channel activity indicators flash according to the traffic load and are extinguished when the channel is idle.

4.2.2 POWERING OFF

To turn the Fradswitch-2 A/S off, disconnect the power cable from the outlet.

5. Troubleshooting

5.1 Preliminary Checks

If a problem occurs, the following actions will help you return the Fradswitch-2 A/S to normal operation.

- Check that the Fradswitch-2 A/S is powered (the POWER indicator should light).
- Check that all cables are properly connected.
- Check that the equipment connected to the Fradswitch-2 A/S is powered and operates normally.
- Check the LED indicators.
- Check that the configuration of the Fradswitch-2 A/S and that of the remote PAD or switch correspond to the requirements of the equipment connected to their channels.

5.2 Detailed Troubleshooting

If the preliminary checks do not correct the problem, press RESET or turn the Fradswitch-2 A/S off, then turn it on again. If the problem repeats, refer to **Chapter 5** in the *Packet-Switching Guide* for more suggestions.

6. Connecting to the Network

This chapter provides concise operating instructions for the Fradswitch-2 A/S. Remember that the information appearing in this chapter is intended to help you start using the Fradswitch-2 A/S; it is not a replacement for the detailed operating instructions contained in the Packet-Switching Guide.

The instructions assume that the Fradswitch-2 A/S is configured in accordance with the factory defaults. The factory defaults are suitable for most applications, so in many applications it is necessary to change only the parameters that are related to the subscription terms—for example, the X.25 address, the packet and window size, and the X.25 transmission mode. If you want to send packets out from the Fradswitch-2 A/S, you must also change your routing table, because the default Fradswitch-2 A/S routing table directs all packets into the Fradswitch-2 A/S.

Before trying anything described in this chapter, keep in mind that your X.25 data services provider, or your system administrator, may not allow you to do some things. Passwords may have been used to restrict the access to certain functions.

To find what you are allowed to do, and what services are available to your terminal, refer to the terms of your X.25 subscription, and read any network-specific instructions that may have been provided to you.

6.1 Connecting to the Fradswitch's Facility

- If the Fradswitch-2 A/S is not operating, use the following procedure:
 - Turn your DTE on and configure it for the appropriate communication parameters. The default values are 9600 bps, 1 start bit, 8 data bits, no parity, 1 stop bit, flow control disabled.
 - Connect the DTE to the Fradswitch-2 A/S async channel through the channel doubler.
 - Turn the Fradswitch-2 A/S on. After a short interval, you will see the Fradswitch-2 A/S herald message: "Fradswitch-2 A/S CHANNEL NUMBER 1," followed by the PAD prompt, "*."

- If the Fradswitch-2 A/S is already operating and the channel you are connected to is engaged in a call, type **CTRL P** to exit the data-transfer mode and obtain the PAD prompt “*.” After you see the PAD prompt, disconnect the call by typing the command **CLR <CR>**. When the call is cleared, you will see “CLR DTE,” and the following line shows the PAD prompt.
- Type the connection command: **CON 00 <CR>**. You can also use the abbreviated form, **C 0 <CR>**. The Fradswitch-2 A/S displays the opening screen (Figure 6-1) of the command facility.

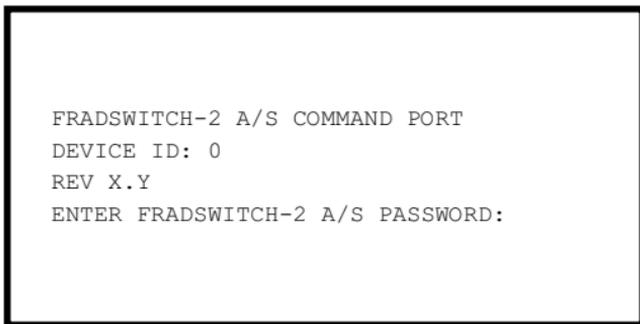


Figure 6-1. Fradswitch-2 A/S opening screen.

- Enter the password. The factory-default password is a carriage return.

- The Fradswitch-2 A/S sends the main menu of the command facility (Figure 6-2).

```

MAIN MENU

1) CONFIGURE
2) SYSTEM CONTROL
3) DIAGNOSTICS
4) STATUS and STATISTICS
5) LOGOUT

SELECT:

```

Figure 6-2. Main menu.

6.2 Basic Configuration Procedures for HDLC Over X.25

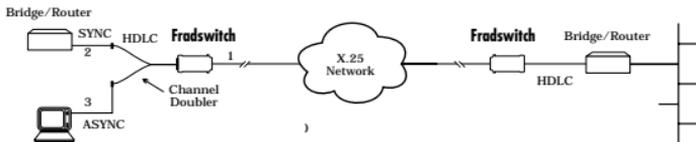


Figure 6-3. Basic Fradswitch-2 A/S HDLC over an X.25 public network.

6.2.1 CONFIGURING X.25 LINK 1

The link configuration may require X.25 address (calling address) setting. Verification of the packet size, window size, and transmission mode (DCE or DTE) is important to match the nearest X.25 peer data. Link 1 is DTE level 1; link 2 is DCE level 2.

- Enter the Fradswitch-2 A/S command facility.
- On the main menu, select 1 (CONFIGURE), and then select 3 (LINK).
- On the link configuration menu, select 3 (UPDATE LINK PARAMETERS), and then enter 1 at the “Enter link number to update:” prompt.
- On the link 1 configuration screen, select 1 (ADDRESS) and then enter your subscribed (calling address) address.
- Verify that your packet size and window sizes (parameters K and W) are correct, and change them if required according to your X.25 subscription data. On the link 1 configuration screen, enter 2 for the DTE/DCE parameter, and then enter 0 for DTE.

- On the link 1 configuration screen, select S (SAVE) and then press <CR> (EXIT). Wait for 3 seconds.

6.2.2 HDLC LINK 2 CONFIGURATION

- Set link 2 type to HDLC.
- Enter 3 to update link parameters.
- Enter 2 at the “Enter link number to update” prompt.
- Enter 11 at “HDLC Link 2 configuration” to choose the protocol encapsulation type.
- Enter 1 to choose encapsulation over X.25.
- If you are connected to DTE equipment, enter 14 for selection of the internal clock rate (maximum baud rate 64 kbps).
- At the X.25 parameters enter 1 for destination address and enter the X.25 address. Assume that the X.25 destination address is 1234567890.
- At the “Destination subaddr” enter the destination HDLC subaddress (assumes the destination subaddress is 22).

- At the “Local subaddress 1” enter the local HDLC subaddress. Assume the local HDLC subaddress is 11.
- Return to configuration menu, select 9 for routing table.
- Select 1 for “Add routing table entry.”
- Enter the routing table entry number (assume 1).
- Select 4, ADDRESS, and enter the destination X.121 address (1234567890).
- Save configuration.
- Select 1 for link, and enter the destination X.25 link number (in this case 1).
- Select “S (save)” and then press <CR> (exit).
- Return to the main menu, and select 2 (SYSTEM CONTROL).
- On the Fradswitch-2 A/S SYSTEM CONTROL menu, select 9 (Reset), and enter “y” at the “Are you sure (y/n):” prompt.

NOTE

On the other side of the network, you must configure the SPS according to the above instructions paying attention to “Destination address” and “subaddress.”

6.3 Configuration Procedures for HDLC Over Frame Relay**6.3.1 FRAME RELAY LINK 1 CONFIGURATION**

- Enter the Fradswitch-2 A/S command facility.
- On the main menu, select 1 (CONFIGURE), and then select 3 (LINK).
- On the link configuration menu, select 1 (SET LINK TYPE). Enter 1 at the “Enter link number to SET:” prompt, and then enter 2 (FRAME RELAY) at the protocol list screen.
- On the link configuration menu, select 3 (UPDATE LINK PARAMETERS), then enter 1 at the “Enter link number to UPDATE:” prompt.
- On the FRAME RELAY link configuration menu, select 3 (UPDATE PORT PARAMETERS). Parameter 2 (MAINTENANCE PROTOCOL MODE) should be 0 (USER), and parameters 3 to 6 should be as given by the Frame Relay public network.

- Save the configuration.
- On the FRAME RELAY link configuration menu, select 1 (ADD DLCI), then enter the DLCI number at the “Enter DLCI number:” prompt. Now enter 1 (UPDATE DLCI CONFIGURATION).
- On the DLCI configuration menu, parameter 1 (DESTINATION PROTOCOL) should be 3 (HDLC ENCAPSULATION), and the CIR parameters should be as given by the Frame Relay public network.
- Save the configuration.

6.3.2 HDLC LINK 2 CONFIGURATION

- On the Fradswitch-2 A/S link configuration menu, select 1 (SET LINK TYPE), then enter 2 at the “Enter link number to SET:” prompt, and then enter 3 (HDLC) at the protocol list screen.
- On the Fradswitch-2 A/S link configuration menu, select 3 (UPDATE LINK PARAMETERS), then enter 2 at the “Enter link number to UPDATE:” prompt.

- On the HDLC link configuration parameter 10 (DESTINATION PORT) should be 1, parameter 9 (DESTINATION DLCI) should be the number of the DLCI added with HDLC destination protocol, parameter 11 (PROTOCOL) 2 (ENCAPSULATION OVER FRAME RELAY).

If you were connected to DTE equipment, enter 14 for selection of the internal clock rate (maximum 64 kbps).

6.4 Configuration Procedures for X.25 Over Frame Relay



Figure 6-3. Typical application.

6.4.1 FRAME RELAY LINK 1 CONFIGURATION

- Enter the Fradswitch-2 A/S command facility.
- On the main menu, select 1 (CONFIGURE), and then select 3 (LINK).

- On the link configuration menu, select 1 (SET LINK TYPE). Enter 1 at the “Enter link number to SET:” prompt, and then enter 2 (FRAME RELAY) at the protocol list screen.
- On the link configuration menu, select 3 (UPDATE LINK PARAMETERS), then enter 1 at the “Enter link number to UPDATE:” prompt.
- On the FRAME RELAY link configuration menu, select 3 (UPDATE PORT PARAMETERS). Parameter 2 (MAINTENANCE PROTOCOL MODE) should be 0 (USER) and parameters 3 to 6 should be as given by the Frame Relay public network.
- On the FRAME RELAY link configuration menu, select 1 (ADD DLCI), then enter the DLCI number at the “Enter DLCI number:” prompt. Now enter 1 (UPDATE DLCI CONFIGURATION).
- On the DLCI configuration menu, parameter 1 (DESTINATION PROTOCOL) should be 1 (X.25 ENCAPSULATION), and the CIR parameters should be as given by the Frame Relay public network.

6.4.2 ROUTING TABLE CONFIGURATION

- Return to configuration menu, select 9 for ROUTING TABLE.
- Select 1 for “Add Routing Table Entry.”
- Enter the routing table entry number (assume 1).
- Select 4 (ADDRESS). Enter the destination X.121 address 1234567890.
- Save configuration.
- Select 1 for LINK, enter the destination DLCI number (port:DLCI), in this case (1:DLCI).
- Save configuration.

6.5 Management Procedures (Must Use Channel Doubler, Channel 3)

All the management procedures described below are started by entering a command when the channel is in the command mode.

Recalling the PAD. If the channel is in the command mode, you can see the PAD prompt on the monitor of your data equipment. If not, recall the PAD by typing CTRL+P.

Invoking the Help Function. Type H and then press the <CR> key.

Loading a Profile. To load a new profile, type PROF, the number of the new profile (1 through 200), and then press the <CR> key.

Checking PAD Parameter Values. Type PAR?nn, and then press the <CR> key. The digits nn are parameter numbers. To see the values of all the parameters, do not enter numbers after the “?”.

Setting PAD Parameter Values. Type SETnn:vv,
. . . , nn:vv, and then press the <<CR>> key. nn is a parameter number, and vv is the value of parameter nn.

If you want to see the new parameter values, type a “?” after SET.

6.6 Calling Procedures (Must Use Channel Doubler, Channel 3)

In order to make a manual call to any destination, the Fradswitch-2 A/S channel must be in command mode. If the channel is in the command mode, you can see the PAD prompt (*) on the monitor of your data equipment. If not, recall the PAD by typing CTRL+P.

Manual call to another X.25 destination. To call a remote X.25 destination, type C and the desired X.25 address, and then press the <CR> key. If the remote X.25 destination includes a subaddress, type C, the desired X.25 address, and the subaddress, and then press the <CR> key.

To request a specific facility you are allowed to use, type the facility after the C, and type a hyphen (-) at the end of the block, before the X.25 address. If you want to request several facilities, insert commas between each pair of codes.

Mnemonic Call. If the same destination is often used, it can be called by a mnemonic call, provided the call-initiation information has been defined by means of the Call ID function.

To use the mnemonic call-initiation command, type `C` and the mnemonic, and then press the `<CR>` key.

Multiple Sessions. To change the current session, or to start a new session, use the following procedure:

- If an active call is handled by the current session, type `CTRL+P` to obtain the PAD prompt.
- When the PAD is free, type `SES`, the number of the desired session (1 through 4), and then press the `<CR>` key.
- The PAD prompt reappears. If the new session number is not 1, the session number (2, 3, or 4) appears to the left of the PAD prompt (separated by one space).

Appendix: Connector Pinouts

Table A-1. Pinouts of MT725A port 1 and its V.35 adapter cable.

Port 1 DB25 Pin	Cable M/34 Pin	Signal Abbr.	Signal Name
1	A	FGND	Frame Ground
2	P	SD A	Send Data A
3	R	RD A	Receive Data A
4	C	RTS	Request to Send
5	D	CTS	Clear to Send
6	E	DSR	Data Set Ready
7	B	SGND	Signal Ground
8	F	RLSD (DCD)	Received Line Signal Detector (a. k. a. Data Carrier Detect)
9	X	SCR B	Serial Clock Receive B
10, 13	[N/C]		[No Connection]
11	W	SCTE B	Serial Clock Transmit External B
12	AA	SCT B	Serial Clock Transmit B
14	S	TD B	Send Data B
15	Y	SCT A	Serial Clock Transmit A
16	T	RD B	Receive Data B
17	V	SCR A	Serial Clock Receive A
18	JJ	LL	Local Loopback
20	H	DTR	Data Terminal Ready
21	HH	RL	Remote Loopback
22, 23	[N/C]		[No Connection]
24	U	SCTE A	Serial Clock Transmit External A
25	KK	TM	Test Mode
[N/C]	G, J-N, Z, etc.		[No Connection]

Table A-2. Pinouts of MT723A port 2/3 and its channel doubler cable.

Unit Port 2/3 DB25 Pin	Cable Port 2 M/34 Pin	Cable Port 3 DB25 Pin	Signal Abbr.	Signal Name
1	A	1	FGND	Frame Ground
2	P	[N/C]	SD A	Send Data A (Port 2)
3	R	[N/C]	RD A	Receive Data A (Port 2)
4	C	[N/C]	RTS/2	Port 2 Request to Send
5	D	[N/C]	CTS/2	Port 2 Clear to Send
6	E	[N/C]	DSR/2	Port 2 Data Set Ready
7	B	7	SGND	Signal Ground
8	F	[N/C]	RLSD/2 (DCD/2)	Port 2 Received Line Signal Detector (a. k. a. Data Carrier Detect)
9	X	[N/C]	SCR B	Serial Clock Receive B (Port 2)
10	[N/C]	20	DTR/3	Port 3 Data Term. Ready
11	[N/C]	15	TSETC	Transmitter Signal Elem. Tim. (DCE Src.) (Port 3) ¹
12	AA	[N/C]	SCT B	Serial Clock Transmit B (Port 2)
13	[N/C]	24	TSETT	Transmitter Signal Elem. Tim. (DTE Src.) (Port 3) ²
14	S	[N/C]	TD B	Send Data B (Port 2)

- 1 The switch does not actually transmit this sync timing signal to Port 3. It can only communicate with Port 3 asynchronously.
- 2 The switch ignores this signal; it can not accept external clock.

Table A-2 (continued). Pinouts of MT723A port 2/3 and its channel doubler cable.

Unit Port 2/3 DB25 Pin	Cable Port 2 M/34 Pin	Cable Port 3 DB25 Pin	Signal Abbr.	Signal Name
1	A	1	FGND	Frame Ground
15	Y	[N/C]	SCT A	Serial Clock Transmit A (Port 3)
16	T	[N/C]	RD B	Receive Data B (Port 2)
17	V	[N/C]	SCR A	Serial Clock Receive A (Port 2)
18	[N/C]	2	TD	Transmit Data (Port 3)
19	[N/C]	3	RD	Receive Data (Port 3)
20	H	[N/C]	DTR/2	Port 2 Data Term. Ready
21	[N/C]	4	RTS/3	Port 3 Request to Send
22	[N/C]	8	RLSD/3 (DCD/3)	Port 3 Received Line Signal Detector (a. k. a. Data Carrier Detect)
23	[N/C]	6	DSR/3	Port 3 Data Set Ready
24	[N/C]	17	RSETC	Receiver Signal Element Tim. (DCE Src.) (Port 3) ¹
25	[N/C]	5	CTS/3	Port 3 Clear to Send
[N/C]	G, J-N, Z, etc.	[N/C]		[No Connection]
[N/C]	[N/C]	9-14, etc.		[No Connection]

¹The switch does not actually transmit this sync timing signal to Port 3. It can only communicate with Port 3 asynchronously.

Table A-3. Pinouts of MT724A port 2/3 and its channel doubler cable.

Unit Port 2/3 DB25 Pin	Cable Port 2 DB25 Pin	Cable Port 3 DB25 Pin	Signal Abbr.	Signal Name
1	1	1	FGND	Frame Ground
2	2	[N/C]	TD/2	Port 2 Transmit Data
3	3	[N/C]	RD/2	Port 2 Receive Data
4	4	[N/C]	RTS/2	Port 2 Request to Send
5	5	[N/C]	CTS/2	Port 2 Clear to Send
6	6	[N/C]	DSR/2	Port 2 Data Set Ready
7	7	7	SGND	Signal Ground
8	8	[N/C]	RLSD/2 (DCD/2)	Port 2 Received Line Signal Detector (a. k. a. Data Carrier Detect)
9–11	[N/C]	[N/C]		[No Connection]
12	[N/C]	8	RLSD/3 (DCD/3)	Port 3 Received Line Signal Detector (a. k. a. Data Carrier Detect)
13	[N/C]	5	CTS/3	Port 3 Clear to Send
14	[N/C]	2	TD/3	Port 3 Transmit Data
15	15	[N/C]	TSETC/2	Port 2 Transmitter Signal Element Timing (DCE Source)
16	[N/C]	3	RD/3	Port 3 Receive Data
17	17	[N/C]	RSETC/2	Port 2 Receiver Signal Element Timing (DCE Source)
18	[N/C]	[N/C]		[No Connection]
19	[N/C]	4	RTS/3	Port 3 Request to Send
20	20	[N/C]	DTR/2	Port 2 Data Term. Ready
21	[N/C]	6	DSR/3	Port 3 Data Set Ready
22	[N/C]	[N/C]		[No Connection]

Table A-3 (continued). Pinouts of MT724A port 2/3 and its channel doubler cable.

Unit Port 2/3 DB25 Pin	Cable Port 2 DB25 Pin	Cable Port 3 DB25 Pin	Signal Abbr.	Signal Name
23	[N/C]	24	TSETT/3	Port 3 Transmitter Signal Element Timing (DTE Source)1, 2
24	24	[N/C]	TSETT/2	Port 2 Transmitter Signal Element Timing (DTE Source)1
25	[N/C]	20	DTR/3	Port 3 Data Term. Ready
[N/C]	9-14, etc.	[N/C]		[No Connection]
[N/C]	[N/C]	9-14, etc.		[No Connection]

1 Even if they are present, the switch ignores these signals; it can never accept external clock.

2 Though this is a sync signal, do not attach any sync device to Port 3. The switch can only communicate asynchronously with Port 3.



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