

# APS-8, APS-16, APS-24

Multiprotocol X.25/Frame Relay  
PAD/FRAD and Packet Switches

Version 4

Installation and Operation Manual

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# **Warranty**

This RAD product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, RAD will, at its option, either repair or replace products which prove to be defective. For warranty service or repair, this product must be returned to a service facility designated by RAD. Buyer shall prepay shipping charges to RAD and RAD shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties and taxes for products returned to RAD from another country.

## **Limitation of Warranty**

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# Safety Warnings



The exclamation point within a triangle is intended to warn the operator or service personnel of operation and maintenance factors relating to the product and its operating environment which could pose a safety hazard.

Always observe standard safety precautions during installation, operation and maintenance of this product. Only qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this instrument. No adjustment, maintenance or repairs should be performed by either the operator or the user.

## Telecommunication Safety

The safety status of each of the ports on the APS-8, APS-16, APS-24 is declared according to EN 41003 and is detailed in the table below:

<b>Safety Status</b>	<b>Ports</b>
SELV	530, V.24, V.35, V.36, X.21, LAN
TNV-1	ISDN, 4W, DDS

SELV = Safety Extra-Low Voltage

TNV-1 = Telecommunications Network Voltage within SELV limits and subject to overvoltages

# Regulatory Information

## FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## Warning per EN 55022

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

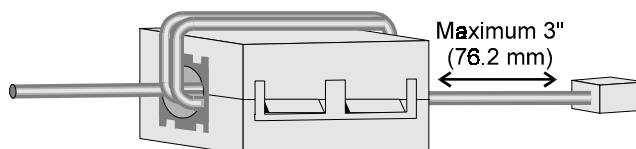
## APS-M/IBE, APS-M/BNC Ferrite Installation Instructions for Compliance with Emission Requirements

To comply with electromagnetic emission requirements, FERRITES (such as FAIR-RITE Catalog number 0443164151 or equivalent) should be installed on any unshielded data cable connected to a port via a RJ-45 connector.

This limits the electromagnetic energy emitted from the unshielded cables. Alternatively, replace unshielded data cable with shielded data cable.

### ***To install the FERRITE***

- Run the cable through the open FERRITE as shown in the figure below.
- If cable thickness allows, wrap it around the FERRITE once or twice. Allow no more than 3 inches (76.2 mm) between the wrap and the connector to the unit.
- The FERRITE should now be snapped shut



# Declaration of Conformity

**Manufacturer's Name:** RAD Data Communications Ltd.

**Manufacturer's Address:** 12 Hanechoshet St.  
Tel Aviv 69710  
Israel

**declares that the product:**

**Product Name:** **APS-8, APS-16, APS-24**

Conforms to the following standard(s) or other normative document(s):

<b>EMC:</b>	EN 55022 (1994)	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
	EN 50082-1 (1992)	Electromagnetic compatibility - Generic immunity standards for residential, commercial and light industry.
<b>Safety:</b>	EN 60950 (1992/93)	Safety of information technology equipment, including electrical business equipment.

## Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC. The product was tested in a typical configuration.

Tel Aviv, October 6th 1996



Haim Karshen  
VP Quality

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# Chapter 1

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## Introduction

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### 1.1 Overview

The APS-8, APS-16 and APS-24, Multiprotocol FRAD/Switches provide easy, cost-effective access to a packet switching network. They also provide packet switching capability for both X.25 and Frame Relay.

The APS-8/16/24 has three synchronous ports which supports aggregate data rates up to 2 Mbps. Each port can be configured to any of the following protocols: X.25, Frame Relay, HDLC, STM, Async, SDLC or SLIP. Switching between ports is provided for X.25, Frame Relay, SDLC and encapsulated protocols.

The APS-8/16/24 can connect up to eight, sixteen or twenty four asynchronous channels, respectively. The asynchronous channels can be configured as X.28 or SLIP and operate at data rates up to 115.2 kbps.

The synchronous ports can be V.24, V.35, X.21 or RS-530. Interfaces V.24 and V.35 for the ports can be DCE or DTE layer 1 (user configurable). The X.21 and RS-530 interfaces can only be DTE. An optional DDS or ISDN interface can be provided for link 1. All the synchronous ports have an optional Ethernet and U-INT interface. When there is no interface at link 2, links 1 and 2 can operate as a 2B channel.

The APS-8/16/24 supports a wide range of applications. For information on the APS-8/16/24 features and applications, refer to the *RAD Packet Switching Applications Guide*.

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## 1.2 Technical Characteristics

### General

<i>Number of Ports</i>	3 synchronous ports, 8/16/24 asynchronous channels
<i>Indicators</i>	<ul style="list-style-type: none"> <li>• Power</li> <li>• Main links activity</li> <li>• Sub-channels activity</li> <li>• Loss of synchronization (3 indicators)</li> <li>• Error</li> <li>• Overflow</li> <li>• Test</li> </ul>
<i>Packet Size</i>	Up to 4096 bytes for X.25 Up to 8K for other protocols
<i>RAM Size</i>	2048 Kbytes

### Synchronous Link

<i>Number of Ports</i>	3
<i>Data Rate</i>	All the links aggregate up to 2 Mbps
<i>Interfaces</i>	RS-232/V.24, X.21, V.35, RS-530, U-INT, IR-ETH, DDS or ISDN (selected during ordering)
<i>Connectors</i>	RS-232/V.24: 25-pin D-type, female (DTE, DCE) X.21: 15-pin, female (DTE) V.35: 34-pin, (DTE, DCE) RS-530: 25-pin D-type, female (DTE) U-INT: IR-ETH: DDS: ISDN:
<i>Clocking</i>	External or internal clocking for receive and transmit paths

### Asynchronous Channels

<i>Number of Channels</i>	8, 16 or 24
<i>Data Rate</i>	Up to 115.2 kbps
<i>Interface</i>	RS-232/V.24 (DCE)
<i>Connector</i>	V.24: RJ-45

	<i>Protocol</i>	<i>Compatibility:</i> X.28, IP/SLIP	
		<i>IP:</i> Supports IP encapsulation over X.25 network (complies with RFC 1356) or Frame Relay network (complies with RFC 1490). Supports dial-up link for X.25 with X.32 protocols.	
	<i>Flow Control</i>	XON/XOFF or RTS/CTS	
	<i>Channel Log-on Messages</i>	Herald and bulletin (user definable)	
	<i>Command Modes</i>	<ul style="list-style-type: none"> <li>• CCITT Rec. X.28 and proprietary extensions</li> <li>• CCITT Rec. X.29</li> </ul>	
	<i>Terminal Handling</i>	Enhanced, handling beyond CCITT Rec. X.3 requirements.	
<b>Physical</b>	<i>Height</i>	4.4 cm / 1.7 in	
	<i>Width</i>	43.2 cm / 17.0 in	
	<i>Depth</i>	24.6 cm / 9.5 in	
	<i>Weight</i>	1.80 kg / 3.9 lb	
<b>Environment</b>	<i>Temperature</i>	0-50°C / 32-122°F	
	<i>Humidity</i>	Up to 90%, non-condensing	
	<i>Power</i>	<i>Supply</i>	115 or 230 VAC (as per order),
		<i>Voltage</i>	50/60 Hz
<i>Consumption</i>		15W	
<i>Fuse</i>		125 mA, 250V	

# Chapter 2

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## Installation

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### 2.1 General

This chapter provides mechanical and electrical installation procedures for the APS-8/16/24, and basic operating procedures.

The APS-8/16/24 is delivered completely assembled. It is designed for installation as a desk-top unit or mounted in a 19" rack.

After installing the unit, refer to *RAD Packet Switching Guide* for system configuration information and procedures.

In case a problem is encountered, refer to *RAD Packet Switching Guide* for test and diagnostics instructions.

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### 2.2 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 top.
  2. Take out the APS carefully and place it securely on a clean surface.
  3. Inspect the product for damage. Report immediately any damage found.
- 

### 2.3 Site Requirements

#### **Power**

The APS-8/16/24 unit should be installed within 1.5m (5 feet) of an easily-accessible grounded AC outlet capable of furnishing 115 or 230VAC, in accordance with the nominal supply voltage of your APS.

#### **Data Channel Connections**

The APS-8/16/24 has eight, sixteen or twenty-four RJ-45 connectors, one for each asynchronous data channel.

**Main Links Connections**

The APS-8/16/24 has three main links connectors. The main links connector depends on the ordered interface:

- RS-232/V24: 25-pin D-type, female connector
- X.21: 15-pin, female connector
- V.35: 34-pin
- RS-530: 25-pin D-type, female connector
- U-INT: RJ45, female connector
- IR-ETH: RJ45, female connector
- ISDN: RJ45, female connector
- DDS: RJ45, female connector

*RAD Packet Switching Guide* provides the pin allocations.

**Front and Rear Panel Clearance**

When the APS-8/16/24 is installed in a 19" rack, allow at least 90 cm (36 inches) of frontal clearance for operator access. Allow at least 10 cm (4 inches) clearance at the rear of the unit for interface cable connections.

**Ambient Requirements**

The ambient operating temperature of the APS-8/16/24 should be 0 to 50°C (32 to 122°F), at a relative humidity of up to 90%, non-condensing.

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## 2.4 Hardware Configuration Information

**General Information**

The APS-8/16/24 contains two different types of printed circuit boards (see Figure 2-1):

- The main board. This board contains most of the APS-8/16/24 circuits, and has four jumpers.

This paragraph provides information on the functions of the internal jumpers, and provides step-by-step instructions for setting these jumpers. The default settings for each jumper are also listed.

*Note*

*The default settings of the APS-8/16/24 jumpers are usually suitable for most applications. Check the default positions explained below. If the requirements for your application differ then, before APS-8/16/24 installation, set the internal jumpers in accordance with the requirements, as explained below.*

- All the other configuration actions are performed using the APS-8/16/24 command facility, after the installation is completed. Information and detailed instructions for these operations appear in *RAD Packet Switching Guide*.

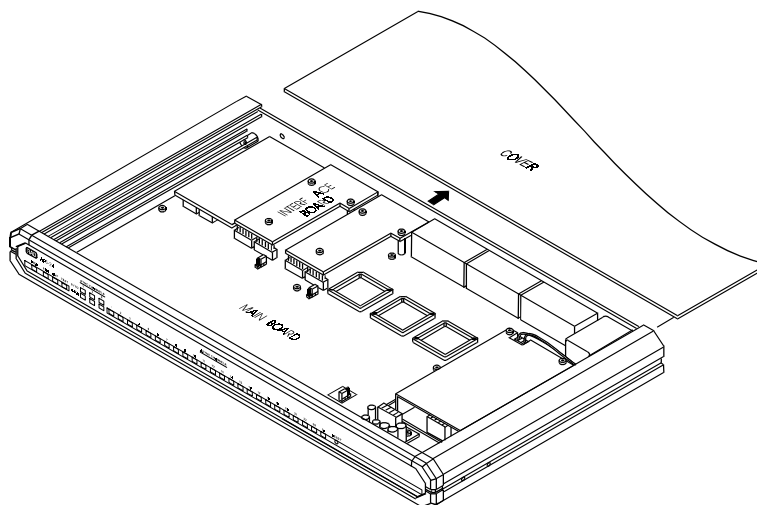


Figure 2-1 APS-24 Board

## Internal Jumpers



### Warning

*In order to avoid the possibility of electrical shock, always turn the power switch off and disconnect the power cable from mains before opening the APS-8/16/24.*

The APS-8/16/24 has three internal jumpers, designated JP6, JP9 and JP20. Refer to Figure 2-2 and use the following description.

### JP6, JP9, JP20

These jumpers are operational only when an IR-ETH or U-INT interface is installed. The default position of the jumpers when using IR-ETH is in the direction of the front panel. The jumpers control the links in the following manner:

- J20 controls link 1
- J6 controls link 2
- J9 controls link 3.

When working with a U-interface, the default position of the jumpers is in the direction of the back panel. The jumpers control the links in the same way as for IR-ETH.

Factory setting is the same as for the U-interface.



### INIT - NOR jumper, JP33

This jumper is used to select the default set of configuration parameters stored in the APS-8/16/24. The jumper has two positions:

**NOR** Normal operation.

**INIT** Initialization. Upon power-on, the APS-8/16/24 loads the default configuration (determined by the factory and common to all the APS-8/16/24 units).

Factory setting is NOR.

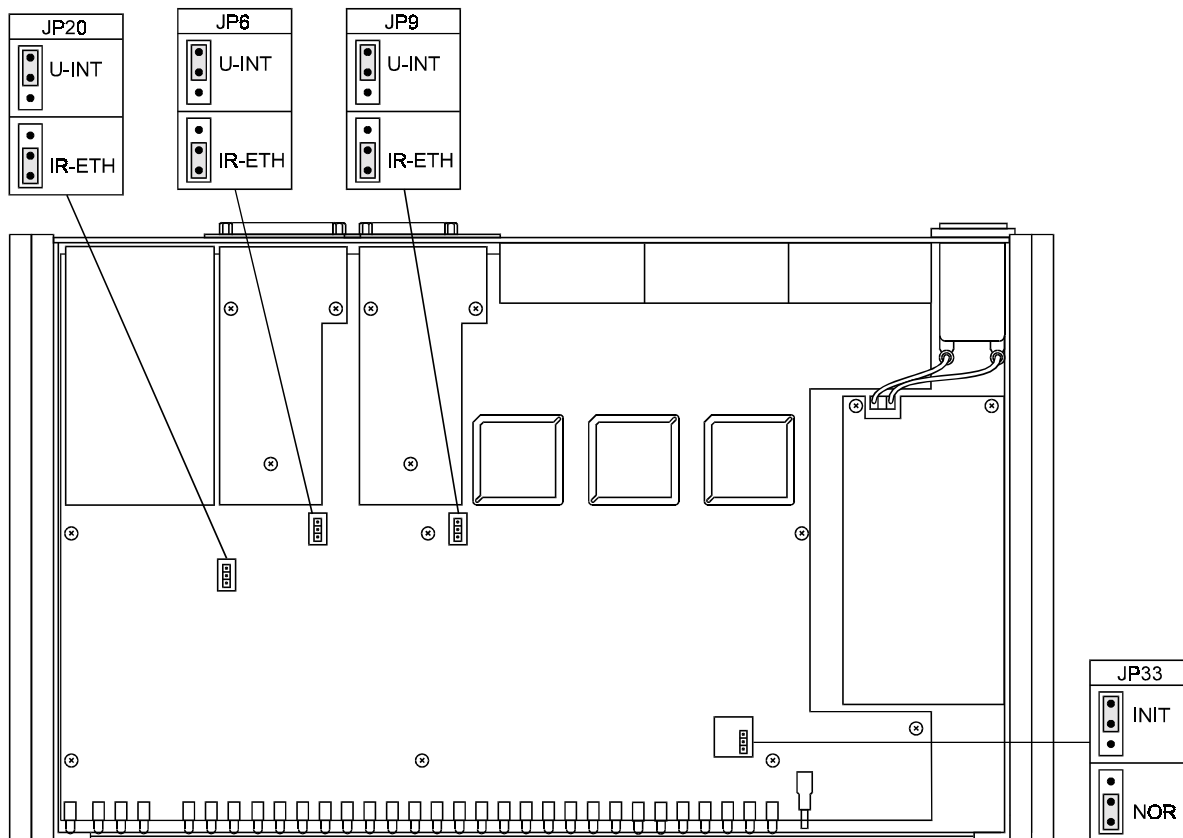


Figure 2-2 APS-24, Identification of Internal Jumpers

## Interface Board

The APS-8/16/24 is available with four types of removable interface boards.

The interface board types are:

- V.24 (RS-232) interface for DTE or DCE.
- V.35 interface for DTE or DCE.
- V.36 (RS-530) interface for DTE.
- X.21 interface for DTE.
- ISDN
- DDS
- U-INT
- IR-ETH



*To avoid the possibility of electrical shock, always turn the power switch off and disconnect the power cable from wall plug before opening the APS-8/16/24.*

The interface board determines the physical layer configuration of an APS-8/16/24 link.

When the board is a DTE interface board, the link receives its clock from outside and the clock parameter must be configured as external clock. (See *RAD Packet Switching Guide*.)

When the board is a DCE interface board, the link uses the APS-8/16/24 internal clock, and the clock parameter must be configured as internal clock. (See *RAD Packet Switching Guide*.)

## Jumper Setting Procedure



*To avoid the possibility of electrical shock, always turn the power switch off and disconnect the power cable from wall plug before opening the APS-8/16/24.*

1. Access the printed circuit board of the APS-8/16/24 by opening the screw fastening the top cover to the case. Remove the top cover.
2. Refer to Figure 2-2 and identify jumper locations and settings. Change settings as required.
3. Replace APS-8/16/24 cover, and fasten the screw. Do not exert excessive torque while tightening these screws.

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## 2.5 Installation in 19" Racks

The APS-8/16/24 can be installed in 19" racks. Unit height corresponds to 1U (1.75"). The width of the APS-8/16/24 is slightly less than the available mounting width.

An adapter kit provides the hardware necessary for installation of the APS-8/16/24 in 19" racks. The paragraph below provides step-by-step instructions for this procedure.



### Warning

Disconnect the unit from AC power while performing the following procedures.

### Installation of the APS-8/16/24 Unit

The rack adapter kit for the installation includes two short brackets. The brackets are fastened by means of screws to the two side walls of the case, as shown in Figure 2-3.

#### ► To install the APS-8/16/24 unit

1. Attach the two brackets to the side walls of the unit. Each bracket is fastened by means of two screws (with flat washers), which are inserted into the two front holes on the side wall (nuts are already in place, on the inner side of the wall).  
After attaching the brackets, the unit is ready for installation in the 19" rack.
2. Fasten the brackets to the side rails of the 19" rack by means of four screws (not included in the kit), two on each side.

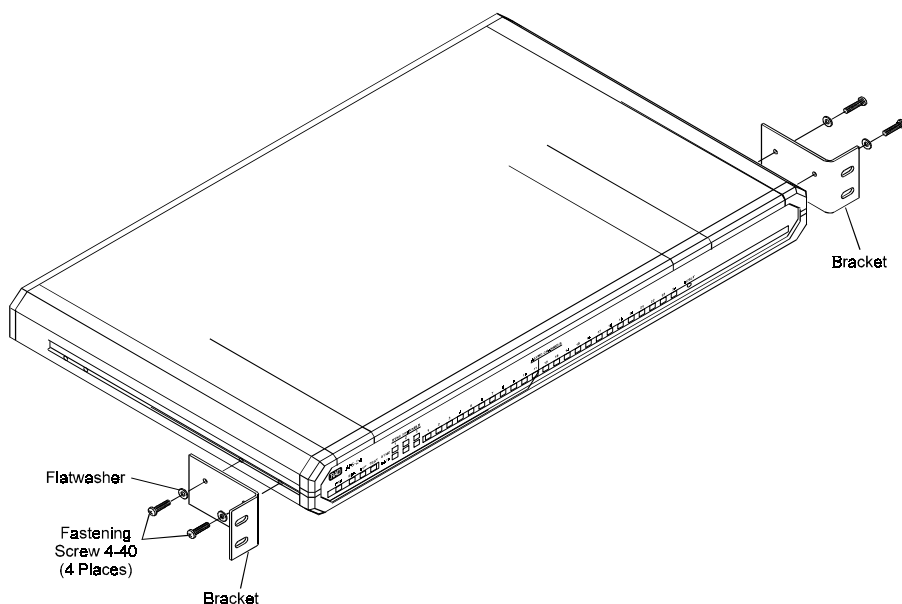


Figure 2-3 Installation of APS-24 in 19" Rack

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## 2.6 Cable Connections

### **General**

The APS-8/16/24 has three connectors located on the rear panel that serve the synchronous links, and RJ-45 connectors for the asynchronous data channels.

### **Asynchronous Data Channel Connections**

APS-8/16/24 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-end circuits), cross-over cables are required. Channel interfaces are asynchronous, therefore clock signals are neither supported, nor required.

### **Synchronous Links Connection**

APS-8/16/24 synchronous links interfaces are configured as DTE or DCE interfaces, intended for connection to synchronous modems that are capable of providing the clock signals that determine APS-8/16/24 synchronous link data rate. The synchronous link connector type depends on the APS-8/16/24 interface:

- RS-232/V.24: 25-pin D-type, female connector
- X.21: 15-pin, female connector
- V.35: 34-pin, female connector
- RS-530: 25-pin D-type, female connector
- ISDN: RJ45, female connector
- IR-ETH: RJ45, female connector
- DDS: RJ45, female connector
- U-INT: RJ45, female connector

### *Note*

*The user data cables and the links cables should be shielded, in order to comply with FCC rules. The APS-8/16/24 and its data interfaces will work well even if the cables are not shielded, but some radio interference may occur.*

## **Power Connection**

AC power should be supplied to the APS-8/16/24 through the 5 foot (1.5m) power cable terminated by a standard 3-prong plug. Connect the cable between the AC mains connector on the APS-8/16/24 rear panel and a standard grounded AC outlet.



## **Warning**

*BEFORE SWITCHING ON THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective ground conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding).*

*Make sure that only fuses with the required rated current, as marked on the APS-8/16/24 rear panel, are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.*

*Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.*

## **Grounding**

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal can make this instrument dangerous. Intentional interruption is prohibited.

# Chapter 3

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## Operation

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### 3.1 General

The APS-8/16/24 supports a wide range of applications. Some of these include:

- Public Network access via redundant links.
- Expansion of the number of asynchronous inputs, using RAD STM statistical multiplexers (proprietary).
- Running asynchronous data in X.25 packets over Frame Relay.
- Running asynchronous data directly over Frame Relay (e.g., SLIP protocol over Frame Relay).
- Routing between several Frame Relay devices or networks (Frame Relay to Frame Relay switching).
- Connection of devices supporting HDLC protocol to the X.25 or Frame Relay network.

### APS-8/16/24 Front Panel Controls, Indicators and Connectors

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### 3.2 APS-8/16/24 Controls, Indicators and Connectors

Table 3-1 lists the functions of the APS-8/16/24 front panel indicators and connectors. The numbers under the heading “Item” refer to the identification numbers in Figure 3-1.

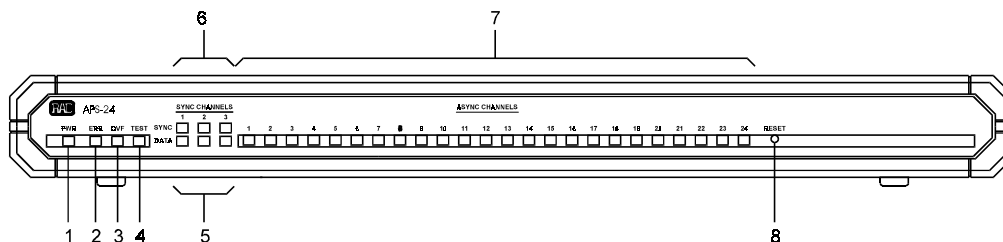


Figure 3-1 APS-24 Front Panel Controls, Indicators and Connectors

Table 3-1 Controls, Indicators and Connectors

Item	Control, Indicator or Connector	Function
1	PWR Indicator	Lights when the APS-8/16/24 is powered
2	ERR Indicator	Lights when a hardware malfunction is detected during the self-test automatically performed at power-up, or after pressing the RESET push-button.
3	OVF Indicator	Lights when APS-8/16/24 buffers are full. In a properly designed system, this condition usually indicates that one of the units connected to the APS-8/16/24 does not respond to the flow control commands sent by the APS, a condition that could be caused by incorrect configuration of the APS-8/16/24.
4	TEST Indicator	Lights to indicate that the APS-8/16/24 is in the diagnostics mode (one of the test loops active). Traffic is interrupted.
5	Main Links Activity Indicators	Indicators, one for each main link, lights when the corresponding link is active (receives or transmits frames).
6	SYNC Indicators	Indicators, one for each main link, indicate APS-8/16/24 synchronization status. <u>Condition:</u> <u>Indication:</u> Off                      APS-8/16/24 not powered On                        APS-8/16/24 powered and synchronized with the corresponding peer. Flashing                APS-8/16/24 is powered but not (Continuous)        synchronized with the corresponding peer.
7	Channel Activity Indicators	Indicators, one for each channel, light when the corresponding channel is active (receives or transmits data).
8	RESET push-button	Resets APS-8/16/24 internal circuits (including the data buffers) and initiates the power-up self-test.

**APS-8/16/24 Rear Panel Controls and Connectors**

Table 3-2 lists the functions of the APS-8/16/24 rear panel controls and connectors. The numbers under the heading “Item” refer to the identification numbers in Figure 3-2.

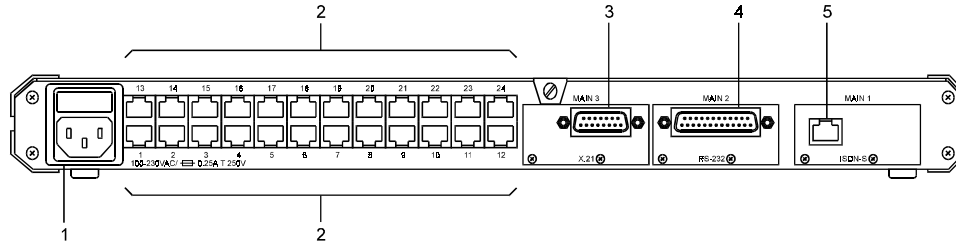


Figure 3-2 APS-24 Rear Panel Controls and Connectors

Table 3-2 Controls and Connectors

Item	Control or Connector	Function
1	Power Connection	AC power connector with integral fuse
2	Channel Connectors	Connection to the APS-8/16/24 channels (one connector per channel)
3,4,5	Links Connectors	Connection to main links

**3.3 Operating Instructions**

**General**

After preparing the module for operation as explained above, the APS-8/16/24 operates unattended. Operator intervention is only required when the APS-8/16/24 is set-up for the first time or must be adapted to new operational requirements.

*Note*

*APS-8/16/24 configuration is stored in a non-volatile memory, and is not affected when power is turned off.*

**Power-on**

Connect the power cable to the APS-8/16/24 rear power connector, then set the power switch to ON. The PWR indicator should light.

If none of the links to the peers are yet operational, the SYNC indicators of the APS-8/16/24 will flash. Wait until one of the links becomes operational, then check that the corresponding SYNC indicator stops flashing and lights continuously.

Check that after a short interval (during which APS-8/16/24 performs self-test), the ERR, OVF and TEST indicators are extinguished.

**Normal**

During normal operation, the PWR and SYNCs indicators should light



**Operation**

continuously and the TEST, OVF and ERR indicators must remain off.

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

**Power-off**

To turn the APS-8/16/24 off, plug out the power cable.

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### 3.4 Upgrading the Software

The product family supports a flash memory which enables updating the software via a terminal. It is not necessary to replace the EPROMS to upgrade the software. Once connected to the terminal, follow on-screen instructions to perform the upgrade.

► **To upgrade the software**

1. Connect the terminal to port no.1 on the device.
2. In the Main menu, select option 2. The System Control menu appears.

```
SYSTEM CONTROL MENU
-----
1.) Link down
2.) Link up
3.) Clear channel
4.) Clear LCN
5.) Update date
6.) Update time
7.) Reset statistics
8.) Rearrange NOURAM
9.) Reset
10.) Set default configuration
11.) Disconnect dial link
12.) Enable software upgrade

<enter> EXIT
```

3. In the System Control menu, select option 12. The following screen appears:

```
THIS ACTION WILL ENABLE YOU TO DOWNLOAD A NEW
SOFTWARE VERSION AFTER RESET.

In order to do so, please connect a terminal configured: 9600,N,
8,1 to Link no.1 and follow the instructions on the screen.

ARE YOU SURE? (YES/NO)
```

4. Type YES and press <ENTER>.

5. Reset the device by pressing the RESET button on the front panel of the module. If a problem occurs during the software download, the following screen appears:

```
Software MAY not be valid!  
Please select one of the following:  
1.) 9600 bits/s  
2.) 19200 bits/s  
3.) 38400 bits/s  
4.) 115200 bits/s  
5.) Run the existing software (NO download)
```

6. Select option 5 to run the existing software. The following message appears:

```
Please change terminal setting to:  
115200, N, 8, 1, LINK1  
Start the software download.
```

When the software is downloaded successfully, the following message appears:

```
CONGRATULATIONS  
Software loaded successfully.
```

---

---

### **3.5 What to do in Case of Malfunction**

#### **Preliminary Checks**

In case a problem occurs, the following actions will help you return the APS-8/16/24 to normal operation.

- Check that the APS-8/16/24 is powered (PWR indicator should light).
- Check that cables are properly connected.
- Check that the equipment connected to the APS-8/16/24 is powered and operates normally.
- Check APS-8/16/24 indications.
- Check the configuration of the APS-8/16/24 PAD and that of the remote PAD or switch correspond to the requirements of the equipment connected to its channels.

#### **Troubleshooting**

In case the preliminary checks do not correct the problem, press RESET or turn the APS-8/16/24 off, then turn it on again. If the problem repeats, refer to *RAD Packet Switching Guide* for additional operations.