

# USER MANUAL

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MODEL 2703-X21  
**G.703/E1 Digital Modem**



**PATTON**  
**Electronics Co.**



An ISO-9001  
Certified Company

Part# 07M2703-X21-C  
Doc# 031111UC  
Revised 6/19/98

SALES OFFICE  
(301) 975-1000  
TECHNICAL SUPPORT  
(301) 975-1007  
<http://www.patton.com>

## 1.0 WARRANTY INFORMATION

**Patton Electronics** warrants all Model 2703-X21 components to be free from defects, and will—at our option—repair or replace the product should it fail within one year from the first date of shipment.

This warranty is limited to defects in workmanship or materials, and does not cover customer damage, abuse or unauthorized modification. If this product fails or does not perform as warranted, your sole recourse shall be repair or replacement as described above. Under no condition shall **Patton Electronics** be liable for any damages incurred by the use of this product. These damages include, but are not limited to, the following: lost profits, lost savings and incidental or consequential damages arising from the use of or inability to use this product. **Patton Electronics** specifically disclaims all other warranties, expressed or implied, and the installation or use of this product shall be deemed an acceptance of these terms by the user.

### 1.1 RADIO AND TV INTERFERENCE

The Model 2703-X21 generates and uses 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 and television reception. The Model 2703-X21 has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection from such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If the Model 2703-X21 does cause interference to radio or television reception, which can be determined by disconnecting the unit, the user is encouraged to try to correct the interference by one or more of the following measures: moving the computing equipment away from the receiver, re-orienting the receiving antenna and/or plugging the receiving equipment into a different AC outlet (such that the computing equipment and receiver are on different branches).

### 1.2 SERVICE

All warranty and non-warranty repairs must be returned freight prepaid and insured to Patton Electronics. All returns must have a Return Materials Authorization number on the outside of the shipping container. This number may be obtained from Patton Electronics Technical Service at **(301) 975-1007**. *Packages received without an RMA number will not be accepted.*

Patton Electronics' technical staff is also available to answer any questions that might arise concerning the installation or use of your Model 2703-X21. Technical Service hours: **8AM to 5PM EST, Monday through Friday.**

## 2.0 GENERAL INFORMATION

Thank you for your purchase of this Patton Electronics product. This product has been thoroughly inspected and tested and is warranted for One Year parts and labor. If any questions or problems arise during installation or use of this product, please do not hesitate to contact Patton Electronics Technical Support at (301) 975-1007.

### 2.1 FEATURES

- Synchronous network data rate of 2.048 Mbps
- Four selectable terminal rates: 256 kbps, 512 kbps, 1.024 Mbps and 2.048 Mbps
- Supports X.21 terminal interfaces on a DB-15 connector
- Both 75 ohm (BNC) and 120 ohm (modular) network terminations
- Selectable Internal (master) or Network (slave) clocking
- Loopback test modes
- Front panel LED indicators for power, network, master clock and test loop

### 2.2 DESCRIPTION

**The Patton Model 2703-X21 G.703/E1 Access Converter** wears several hats: As an *access product*, the Model 2703-X21 receives unstructured, synchronous 2.048 Mbps data from a G.703 network and sends it to a router, bridge, multiplexer or other device. As an *interface converter*, the Model 2703-X21 accepts 120 Ohm twisted pair or 75 Ohm dual coax network connections (both types of interfaces provided). Then it converts the signals to an X.21 format on a DB-15 connector.

As a *Rate Adapter*, the Model 2703-X21 lets a lower bandwidth device—256 kbps, 512 kbps, or 1.024 Mbps—connect to a 2.048 Mbps G.703 link. The Model 2703-X21 supports Internal (master) or Network (slave) clocking. Loopback test is built-in, and front panel LEDs monitor power, network, master clock and test loop. Several power supply options are available.

### 3.0 CONFIGURATION

The Model 2703-X21 is equipped with one DIP set containing eight switches (externally accessible), as well as seven jumpers (internal). These switches and jumpers allow configuration of clocking, data rate, and test options. The Model 2703-X21 is also equipped with an internal switch that allows selection of 115 or 230 VAC power inputs (Note: this switch is not present in Models 2703-X21-UI and 2703-X21-DC). This section describes switch and jumper locations and explains all possible configurations.

#### 3.1 EXTERNAL DIP SWITCH SETTINGS

The Model 2703-X21's DIP switch set is located on the underside of the unit (see Figure 1, below). Figure 2 (below), shows the orientation of the switch set. All possible settings for the Model 2703-X21's switches are presented in the summary table and descriptions on the following pages. If you have additional questions regarding configuration, contact Patton Technical Support at (301) 975-1000.

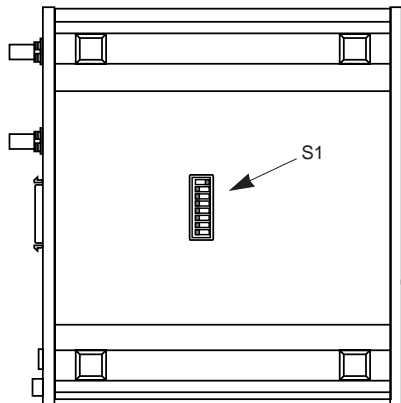


Figure 1. Underside of Model 2703, showing external DIP switch location

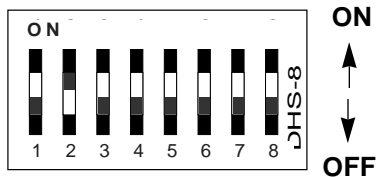


Figure 2. Close up of configuration switches

#### Switch Set S1

The configuration switches on S1 set clocking, rate adaptation, loopback enable, and data invert. The default settings are summarized in the table below.

S1 SUMMARY TABLE		
Position	Function	Factory Default
S1-1	Clock Master/Slave	On Master
S1-2	Rate Adaptation	Off
S1-3	Rate Adaptation	Off } 2.048 Mbps
S1-4	Test Enable	Off Front Panel
S1-5	Data Inversion	Off Not Inverted
S1-6	Not Used	Off N/A
S1-7	Not Used	Off N/A
S1-8	Not Used	Off N/A

#### S1-1: Master/Slave Clock

The setting for switch S1-1 determines whether the Model 2703-X21 provides the master clock, or is slaved to another clock source.

S1-1	Setting
On	Model 2703-X21 is master
Off	Model 2703-X21 is slave, (clock is recovered from the network)

### S1-2 and S1-3: Rate Adaptation

Switches S1-2 and S1-3 are set in combination to allow the Model 2703-X21 to adapt to terminal devices running at data rates of less than 2.048 Mbps (The network rate remains 2.048 Mbps regardless of the terminal rate adaptation setting). The setting you select should match the data rate of your terminal device.

S1-2	S1-3	Setting
Off	Off	2.048 Mbps
On	Off	1.024 Mbps
Off	On	512 kbps
On	On	256 kbps

**NOTE:** Revision B Firmware (or newer, Implemented 6/19/98) has been adopted to correct signal polarity at 1.024 Mbps, 512 kbps, and 256 kbps. To operate Revision B Firmware units with Revision A (or older) units at one of these sub-rates, you must invert the data (Switch S1-5 On. See Below) (Firmware revision level is printed on the label on the bottom of the unit).

### S1-4: Loopback Test Enable

Depending upon the setting of switch S1-4 the Model 2703-X21 will either be continually in loopback mode, or loopback mode will be enabled by pressing and holding the front panel switch. Since the front panel switch is spring loaded—it returns to “Normal” operation when pressure is released—this DIP switch provides a way of leaving the Model 2703-X21 in “unattended” loopback mode for remote test purposes.

S1-4	Setting
On	Continual “unattended” loopback mode
Off	Loopback activation by front panel switch

### S1-5: Data Inversion

The setting for switch S1-5 determines whether or not the data stream from the local DTE is inverted within the Model 2703-X21 before being passed to the G.703 network. The ability to invert the data stream may be necessary when the Model 2703-X21 is being used with an embedded G.703 device that inverts the data on the remote end. Normally, data inversion is not necessary.

S1-5	Setting
On	Data inverted
Off	Data not inverted

### S1-6, S1-7 & S1-8 Not Used

## 3.2 INTERNAL JUMPER SETTINGS

The Model 2703-X21's seven jumpers are located on the PC board inside the unit. To access the jumpers, follow these instructions:

1. Insert a flat head screw driver into an open slot on either side of the case, as in Figure 3. Twist the screw driver head slightly and the top half of the case will separate from the lower half, as in Figure 4, below.
2. Remove the Network Interface Module by lifting gently upward on it until it comes free from the Model 2703-X21 main PC board.
3. Slide out the Network Interface Module and locate the jumpers on the bottom side of the board.
4. Configure the jumpers according to the section below and return the Network Interface Module and cover to their proper positions.

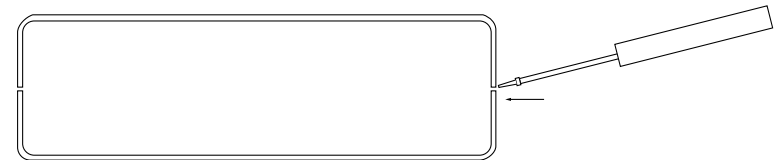


Figure 3. Opening the 2703 Case with a Small Screwdriver

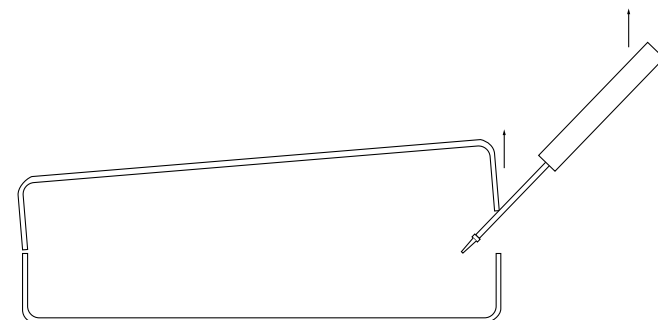


Figure 4. Opening the 2703 Case With a Small Screwdriver

The internal jumpers mounted on the Model 2703-X21's PC board (labeled LK1 - LK7) are used to configure the 75 ohm or 120 ohm network link parameters. Figure 5 (below) shows the location of the Model 2703's jumpers on the internal PC board.

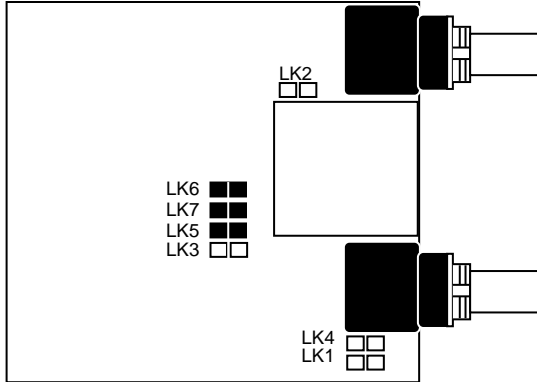


Figure 5. Jumper locations on Model 2703 PC board.

The table below shows the factory default jumper settings. Following the table are descriptions for each jumper.

JUMPER SUMMARY TABLE				
Jumper	Function	75 ohm	120 ohm	Factory Default
LK1	75 Ohm TX Shield to GND	On	Off	On (connect)
LK2	75 Ohm RX Shield to GND	Opt.*	Off	Off (disconnect)
LK3	<i>Reserved</i>			Off
LK4	120 Ohm Shield to GND	Off	Opt.	Off (disconnect)
LK5	Configuration Auto-Sense	On	Opt.	On (enabled)
LK6	75 Ohm Input Impedance	On	Off	} On (75 Ohm)
LK7	75 Ohm Input Impedance	On	Off	

\*Opt. = optional setting, all others are required for proper operation

**NOTE:** one combination of jumper settings is required for 75 ohm operation, and another combination is required for 120 ohm operation. The Model 2703 is factory configured for 75 ohm operation.)

### LK1: 75 Ohm Transmit Shield-to-Ground Connection

This setting determines whether the shield of the 75 Ohm (coax) transmit cable is connected to earth ground. This connection must be made when operating in 75 Ohm (unbalanced) mode. Conversely, this connection must not be made when operating in 120 Ohm (balanced) mode.

LK1	Setting
Strap On	75 Ohm TX Shield-to-GND Connection Made
Strap Off	75 Ohm TX Shield-to-GND Connection Broken

### LK2: 75 Ohm Receive Shield-to-Ground Connection

This setting determines whether the shield of the 75 Ohm (coax) receive cable is connected to earth ground. This connection is optional when operating in 75 Ohm (unbalanced) mode. This connection must not be made when operating in 120 Ohm (balanced) mode.

LK2	Setting
Strap On	75 Ohm RX Shield-to-GND Connection Made
Strap Off	75 Ohm RX Shield-to-GND Connection Broken

### LK3: DIP Switch S1-1 Enable

This strap is reserved for future use and must remain Off.

LK3	Setting
Strap On	Not a Valid Setting
Strap Off	Normal Setting

### LK4: 120 Ohm Shield-to-Ground Connection

This setting determines whether the shield of the 120 Ohm (modular) cable is connected to earth ground. This connection is optional when operating in 120 Ohm (balanced) mode. This connection must not be made when operating in 75 Ohm (unbalanced) mode.

LK4	Setting
Strap On	75 Ohm RX Shield-to-GND Connection Made
Strap Off	75 Ohm RX Shield-to-GND Connection Broken

### LK5: Configuration Auto-Sense

This setting determines whether the host can automatically sense the configuration of the Applique. The operation of the Applique is not affected by this jumper setting. Auto-sense should be enabled when operating in 75 Ohm (unbalanced) mode. Current interface standards do not list this feature for 120 Ohm (balanced) mode.

<u>LK5</u>	<u>Setting</u>
Strap On	Auto-sense enabled
Strap Off	Auto-sense disabled

### LK6 & LK7: 75 Ohm Termination Impedance

This jumper sets the termination impedance correctly for 75 Ohm operation. Both jumpers must be in place when operating in 75 Ohm (unbalanced) mode. Conversely, both jumpers must be removed when operating in 120 Ohm (balanced) mode.

<u>LK6</u>	<u>LK7</u>	<u>Setting</u>
On	On	75 ohm operation
Off	Off	120 ohm operation

### 3.3 POWER SUPPLY OPTIONS

The Model 2703-X21 is available with three power supply options:

The *Standard* power supply option (**Model 2703-X21** or **2703-X21-230**) is factory configured for either 115 or 230 VAC, depending on how the product is ordered, and is available with a variety of domestic and international power cords (see **Appendix C**).

The *Universal Interface* power supply option (**Model 2703-X21-UI**) operates in environments ranging from 85 to 265 VAC, with no re-configuration necessary (see **Appendix C** for available domestic and international power cords).

The *DC* power supply option (**Model 2703-X21-DC**) operates in 48 VDC environments and is equipped with a 3-pin "terminal strip" style DC power cord.

**WARNING!** There are no user-serviceable parts in the power supply section of the Model 2703-X21. Voltage setting changes and fuse replacement should only be performed by qualified service personnel. Contact Patton Electronics Technical support at (301)975-1007 for more information.

## 4.0 INSTALLATION

Once the Model 2703-X21 is properly configured, it is ready to connect to your system. This section tells you how to properly connect the Model 2703-X21 to the G.703 network and terminal device interfaces.

### 4.1 CONNECTION TO THE G.703 NETWORK

The Model 2703-X21 supports 2.048 Mbps communication over an unstructured G.703 network. Both 120 ohm twisted pair and 75 ohm coax interfaces are provided on the rear panel of the Model 2703-X21 (see Figure 6, below). Be sure the unit is configured properly to operate in either 120 ohm or 75 ohm mode, and that the network connection is grounded appropriately (see Section 3.0).

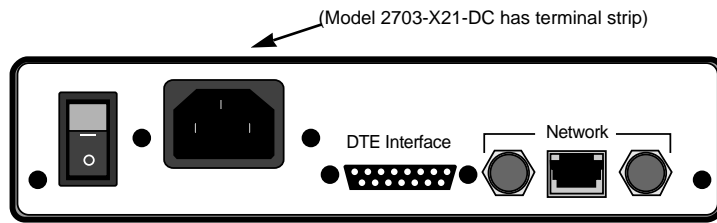


Figure 6. Model 2703 rear panel

#### 4.1.1 Twisted Pair (120 OHM) Connection

The Model 2703-X21 is equipped with a single RJ-45 jack for connection to a 120 ohm twisted pair G.703 network interface. The pinout of this jack is as follows:

<u>RJ-45 Pins</u>	<u>SIGNAL</u>
1 & 2 . . . . .	Receive pair (from network)
3 . . . . .	Shield reference point
4 & 5 . . . . .	Transmit pair (to network)
6 . . . . .	Shield reference point
7 . . . . .	Not used
8 . . . . .	Not used

#### 4.1.2 Dual Coax BNC (75 OHM) Connection

In addition to the 120 ohm twisted pair connection, the Model 2703-X21 is equipped with dual female BNCs (TX and RX) for connection to a 75 ohm dual coax G.703 network interface. The outer conductor of the coax cables is isolated from system earth ground.

### 4.2 CONNECTION TO THE TERMINAL DEVICE

The Model 2703-X21 is wired as a DCE, and—when configured properly—supports communication with an X.21 DTE device. The Model 2703-X21 is equipped with a DB-15 female connector and uses a standard X.21 patch cable, wired *straight through*. If you wish to construct your own terminal adapter cable, please consult the pinout diagram in **Appendix B**.

### 4.3 CONNECTION TO THE POWER SOURCE

As described in Section 3.3, the Model 2703-X21 is available with three power supply options: two AC and one DC. The two AC power supply options (Standard and Universal) use a female IEC power cord interface, for which Patton can supply various domestic and international power cords. Please refer to **Appendix C** for specific Patton part numbers when ordering power cords. The DC power supply option uses a 3-pin terminal strip interface (**Note:** Please refer to the Model 2703-X21 Service Manual for DC power supply wiring instructions).

## 5.0 OPERATION

Once the Model 2703-X21 is properly configured and installed, it should operate transparently. This sections describes power-up, reading the LED status monitors, and using the built-in loopback test modes.

### 5.1 POWER-UP

To apply power to the Model 2703-X21, first be sure that you have read Section 3.3, and that the unit has the proper voltage setting and fuse. *Failure to do so could result in damage to the unit and connected equipment, and may constitute a fire hazard.* Having checked the voltage setting, plug the AC power cord into both the Model 2703-X21 and the AC outlet. Then Power-up the unit using the rear Power switch. Note: the "PWR" LED should glow when power is applied to the unit.

### 5.2 LED STATUS INDICATORS

The Model 2703-X21 features four front panel LEDs that indicate the status of power, network connection, master clock and loopback test. Figure 7 (below) shows the front panel location of each LED. Following Figure 7 is a description of each LED's function.

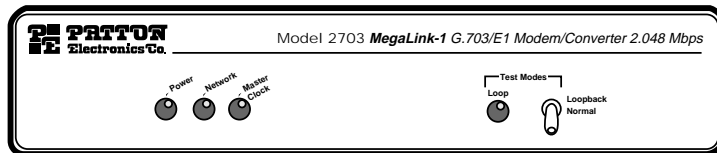


Figure 7. Model 2703 Front Panel

- Power - Glows red when the Model 2703-X21 is powered up.
- Network - Glows green when the Model 2703-X21 is receiving correctly encoded data from the line interface equipment.
- Master Clock- Glows green when the Model 2703-X21 is configured as the master clock unit.
- Loop - Glows green when the Model 2703-X21 is in loopback mode.

### 5.3 LOOPBACK TEST (LAL)

The Model 2703-X21 is equipped with a Local Analog Loopback (LAL) mode to assist in evaluating the operation of the local Model 2703-X21. Any data sent to the local Model 2703-X21 in this test mode will be echoed (returned) back to the user device. For example, characters typed on the keyboard of a terminal will appear on the terminal screen. To perform a LAL test, follow these steps:

A. Activate LAL by moving the front panel toggle switch UP and holding it in the "Loopback" mode. The "Loop" LED should glow. Once LAL is activated, the Model 2703-X21 transmit output is connected to its own receiver.

Note: The front panel switch is spring loaded, so it will return to "Normal" operating mode when pressure is released. To put the Model 2703-X21 in *continual* loopback mode, for the purpose of performing a BER test, move DIP switch S1-4 to the "ON" position (see Section 3.1).

B. Verify that the data terminal equipment is operating properly and can be used for a test. If a fault is indicated, call a technician or replace the unit.

C. Perform a BER (bit error rate) test on each unit. If the BER test equipment indicates no faults, but the data terminal indicates a fault, follow the manufacturer's checkout procedures for the data terminal. Also, check the interface cable between the terminal and the Model 2703-X21.



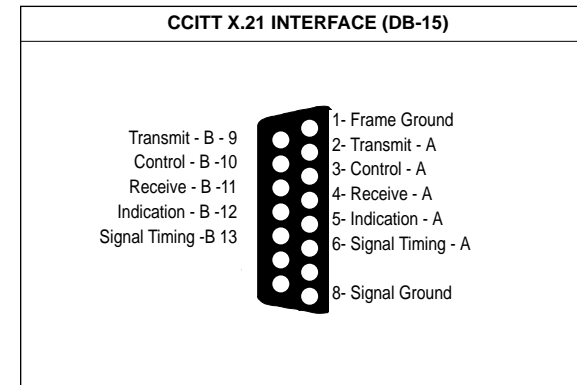
APPENDIX A

**PATTON MODEL 2703 SPECIFICATIONS**

<b>Network Interface:</b>	G.703
<b>Network Rate:</b>	2.048 Mbps
<b>Network Connectors:</b>	Two BNC (75 Ohm) and one modular RJ-45 connector (120 Ohm)
<b>Terminal Interface:</b>	X.21 on female DB-15 connector
<b>Terminal Rate:</b>	2.048 Mbps, 1.024 Mbps, 512 kbps or 256 kbps
<b>Diagnostics:</b>	Loopback Test
<b>Indicators:</b>	LEDs for power, network, master clock and loopback test
<b>Clocking:</b>	Internal (Master) or Network Recovered (Slave) clock
<b>Receiver Sensitivity:</b>	-10 dB (0dB = 2.4V)
<b>Power:</b>	85/265 VAC (switch selectable), 50/60 Hz; 85-265 VAC, 50/60 Hz (universal input option); 48 VDC (option)
<b>Temperature Range:</b>	0-50°C (32-122°F)
<b>Altitude:</b>	0-15,000 feet
<b>Humidity:</b>	5 to 95% noncondensing
<b>Dimensions:</b>	7.3" x 6.6" x 1.62" (185mm x 168mm x 41mm)
<b>Weight:</b>	2.02 lbs.

APPENDIX B

**MODEL 2703-X21 PIN CONFIGURATIONS**



APPENDIX C  
**FACTORY PARTS AND ACCESSORIES**

**C-1 Basic Standalone Units**

The Patton Model 2703-X21 standalone digital modem is available in three versions, depending upon the power supply installed. The Standard and Universal Interface versions are supplied with a power cord, *which must be specified in the model number when ordering*. The DC version is supplied without power cord.

All versions of the Model 2703-X21 are supplied without a terminal (DTE) interface cable. This cable may be ordered separately, or may be supplied by the user.

**Standard** power supply option,  
 switchable between 115 and 230 VAC .....**Model 2703-X21/\***

**Universal Interface** power supply option,  
 operates in environments ranging from  
 85 to 265 VAC.....**Model 2703-X21-UI/\***

**DC** power supply option,  
 operates in 48 VDC environments,  
 equipped with a 3-pin "terminal strip"  
 for DC power connection .....**Model 2703-X21-DC**

**C-2 AC Power Cords**

Power cord must be specified when ordering Models 2703-X21 or 2703-X21-UI. If power cord is omitted, suffix "K" will be assigned.

Ordering Suffix (*)	Power Cord Description
A.....	Continental Europe, CEE 7
C.....	Australia, New Zealand
D.....	United Kingdom
E.....	Denmark
F.....	France/Belgium
G.....	India
H.....	Israel
I.....	Italy
J.....	Japan
K.....	North America
L.....	Switzerland

Example: 2703-X21-UI/D = Universal Interface w/ UK power cord.

APPENDIX D  
**SAFETY WARNINGS AND REQUIREMENTS**

These warning notices apply to the Input Port, the port marked "Network".

**Warning:** The port marked "SAFETY WARNING: see instructions for use" does not provide isolation sufficient to satisfy the requirements of BS6301; apparatus connected directly to this port should either have been approved to BS6301 or have previously been evaluated against British Telecommunications plc (Post Office) Technical Guides 2 or 26 and given permission to attach. Any other usage will invalidate the approval of the Interface Module.

Interconnection of the Interface Module (the port marked "Network") directly, or by way of any other apparatus, with ports on other apparatus (marked or not so marked) may produce hazardous conditions on the network. Users should seek advice from a competent engineer before such a connection is made.

The Interface Module is approved as a Host Independent Appliqué. As such the Interface Module is only approved for use with a host, and with host attachments, that are either type approved in their own right, or, if supplied after March, 1989, are covered by terms of the General Approval number NS/G/1234/J/100003. A Host supplied under the terms of the General Approval number NS/G/1234/J/100003 satisfies the conditions of the paragraph above.

The Interface Module must not be modified in any way. Any form of modification invalidates the approval for connection, and the Patton warranty of the unit.

The terms of the approval require that there must be a minimum distance (5mm) between the Interface Module and any other part of the host, including other Interface Modules. This condition is met by default when the Appliqué is installed in a Patton enclosure in accordance with the instructions. If voltages greater than 250V are present in the host, users should refer to a competent safety engineer for advice.

It is a condition of the approval that a copy of these user instructions and safety warnings must be supplied with the host. Failure to provide the Interface Module user instructions with the host will invalidate the Appliqué approval.

Failure to install the Interface Module in accordance with these instructions will invalidate the approval. If you experience difficulties, or are in any doubt, please contact your Patton representative.

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