APPENDIX E

PATTON MODEL 2090 SERIES POWER SUPPLY INTERFACE

Main 5VC power jack (J1)
    Center Pin: +5VDC @ 300 mA
    Outer Barrel: Ground

Auxillary Power: Supplied to Pin KK on V.35 connector

USER
MANUAL

MODEL 2090 Series
FT1 to V35
Interface Converter

PATTON Electronics Co.

ISO 9001

An ISO-9001 Certified Company

TABLE OF CONTENTS

1.0 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.

1.1 WARRANTY STATEMENT

Patton Electronics warrants all Model 2090 Series 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. This product contains no serviceable parts; therefore the user shall not attempt to modify the unit in any way. 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. In the event the user detects intermittent or continuous product malfunction due to nearby high power transmitting radio frequency equipment, the user is strongly advised to use only data cables with an external outer shield bonded to a metal or metalized connector.

1.2 CE NOTICE

The CE symbol on your Patton Electronics equipment indicates that it is in compliance with the Electromagnetic Compatibility (EMC) directive and the Low Voltage Directive (LVD) of the Union European (EU). A Certificate of Compliance is available by contacting Patton Technical Support.

WARNING!⊗   This device is not intended to be connected to the public telephone network.

1.3 RADIO AND TV INTERFERENCE

The Model 2090 Series 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 2090 Series 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 2090 Series does cause interference to radio or television reception, which can be determined by disconnecting the cables, 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).

1.4 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 Support at:

telephone: **(301) 975-1007**
email: **support@patton.com**
web address: **http://www.patton.com**

NOTE: 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 Patton Model 2090. 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 arise during installation or use of the unit, contact Patton Electronics Technical Services at (301) 975-1007.

2.1 FEATURES

- Operates over 4-Wire T1 (DS1) Circuits
- Supports Unstructured Rates at 1.544 Mbps
- Supports Common Framed nx56/64 rates up to 1.536 Mbps
- Seven Easy-to-Read LED Indicators Monitor Data & Diagnostics
- Internal or Receive Loopback Clocking
- Also Works as a High-Speed Point-to-Point Modem
- Compact Size Plugs Directly into a Router, Switch or other DTE
- Made in USA

2.2 GENERAL PRODUCT DESCRIPTION

The Model 2090 Series T1/FT1 to V.35 Interface Converters continue Patton's tradition of high quality, *miniature* access products. The Model 2090 Series plugs directly into the WAN port of a switch, router or multiplexer. The Model 2090 converts the V.35 signals to a single T1 or FT1 connection at data rates of 1.544 Mbps (unstructured), nx64, and nx56 (n=1, 2, 3,....24). Moreover, the starting channel can be set to any value from 1 to 24. It's a great way to connect high speed data, video, or audio directly to T1/FT1.

The Model 2090 Series is easily configurable using pc-board mounted DIP switches. Use the DIP switches to set D4 and ESF framing modes, AMI or B8ZS line coding, clocking modes, Line Build Out, Data Rate, and starting channel. Connecting directly to the V.35 interface, the ultra-compact Model 2090 attaches without using additional cables. Twisted-pair line connections are facilitated by a modular RJ-48C jack on the rear of the unit.

Seven easy-to-read LED indicators monitor data, network, test signals, and proper setup. Model 2090 is available for 120 VAC or 100-240 VAC Universal Interface (UI), or even DTE Interface power operation.

2.3 SUPPORTED APPLICATION

The Model 2090 allows equipment with V.35 interfaces to connect directly to a T1/FT1 access port. The 2090 can also be used as a high-speed short haul modem for campus applications.

### 2.3.1 The 2090 as the Interface between the Telco and CPE

The Model 2090 Series provides T1/FT1 connectivity between a router and a spare port on a Frame Relay Switch (See below).
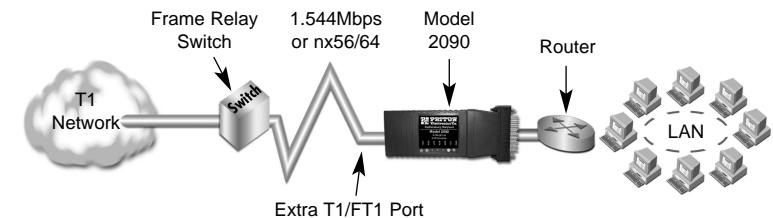
2.3.2 The 2090 as a High-Speed Short Range Modem

The Model 2090 Series can also be installed into high-speed campus applications. In this application, a pair of Model 2090 Series units operate as short range modems (See below).
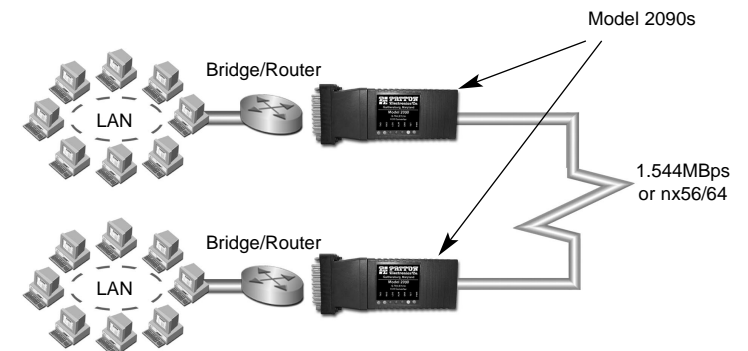
3.0 CONFIGURATION

Before placing the Model 2090 into service, the unit must be configured to match both the DTE and T1 interface parameters. Configuration is accomplished using pc board mounted DIP Switches.

3.1 CONFIGURATION USING DIP SWITCHES

Configure the Model 2090 using a DIP switch package located on the bottom side of the printed circuit board (See Figure 1, below).
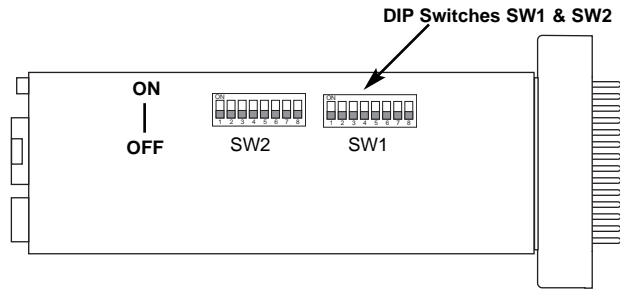

Figure 1. Model 2090 Series bottom view, showing location of DIP switches

The Model 2090 DIP switches can be configured as either "On" or "Off". Figure 2 (below) shows the orientation of the DIP switches with respect to ON/OFF positions.
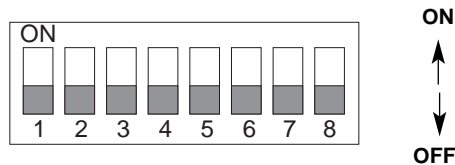

Figure 2. Close up of DIP switches showing ON/OFF positions.

3.1.1 DIP Switches SW1 and SW2

The configuration switches on the DIP switch pack will allow you to specify data rates, line framing and coding, DSO rate, clock mode and Line Build Out (LBO). Factory default settings of all switches are shown in the table below.

SWITCH SETTING SUMMARY TABLE			
Position	**Function**	**Factory Default**	**Selected Option**
SW1.8	Data Rate	On	
SW1.7	Data Rate	On	1.536 Mbps
SW1.6	Data Rate	Off	(DTE Rate)
SW1.5	Data Rate	Off	
SW1.4	Data Rate	Off	
SW1.3	Starting Channel	Off	
SW1.2	Starting Channel	Off	Starting From
SW1.1	Starting Channel	Off	Channel 1
SW2.8	Starting Channel	Off	
SW2.7	Starting Channel	Off	
SW2.6	Line Build Out	Off	0dB
SW2.5	Line Build Out	Off	
SW2.4	Line Code	Off	B8ZS
SW2.3	Frame	Off	ESF
SW2.2	DS0 Rate/Clock*	On	64 kbps
SW2.1	Clock	Off	Network

* In unframed mode, SW2.2 is used with SW2.1 to determine the clocking mode. In framed modes (ESF or D4) only network and internal clocking are available. In unframed mode, where the DTE data rate is 1.544 Mbps, a third clocking option is available-external clocking, in which the 2090 derives its transmit timing source from the DTE (See Appendix D for external timing pin data).

Switches SW1.8, SW1.7, SW1.6, SW1.5 & SW1.4

These switches set the DTE date rate. Each setting represents an nx56/nx64 setting. The chart below shows the switch settings and the acheived DTE data rate.

MODEL 2090 DTE DATA RATE					
SW1.8	SW1.7	SW1.6	SW1.5	SW1.4	DTE Data Rate
Off	Off	Off	Off	Off	1544 kbps (unframed)
Off	Off	Off	Off	On	56/64 kbps (n=1)
Off	Off	Off	On	Off	112/128 kbps (n=2)
Off	Off	Off	On	On	168/192 kbps (n=3)
Off	Off	On	*Off*	*Off*	224/256 kbps (n=4)
Off	Off	On	Off	On	280/320 kbps (n=5)
Off	Off	On	On	Off	336/384 kbps (n=6)
Off	Off	On	On	On	392/448 kbps (n=7)
Off	On	Off	Off	Off	448/512 kbps (n=8)
Off	On	Off	Off	On	504/576 kbps (n=9)
Off	On	Off	On	Off	560/640 kbps (n=10)
Off	On	Off	On	On	616/704 kbps (n=11)
Off	On	On	Off	Off	672/768 kbps (n=12)
Off	On	On	Off	On	728/832 kbps (n=13)
Off	On	On	On	Off	784/896 kbps (n=14)
Off	On	On	On	On	840/960 kbps (n=15)
On	Off	Off	Off	Off	896/1024 kbps (n=16)
On	Off	Off	Off	On	952/1088 kbps (n=17)
On	Off	Off	On	Off	1008/1152 kbps (n=18)
On	Off	Off	On	On	1064/1216 kbps (n=19)
On	Off	On	Off	Off	1120/1280 kbps (n=20)
On	Off	On	Off	On	1176/1344 kbps (n=21)
On	Off	On	On	Off	1232/1408 kbps (n=22)
On	Off	On	On	On	1288/1472 kbps (n=23)
On	On	Off	Off	Off	1344/1536 kbps (n=24)

Notes:
1. **SW2.2 is used to set the DS0 rate to 56 kbps or 64 kbps.**
2. **For unframned operation, 1544 kbps, set SW1.8, SW1.7, SW1.6, SW1.5 & SW1.4 to OFF**

Switches SW1.1 SW1.2, SW1.3, SW 2.7 & SW2.8

These switches set the starting channel. The starting channel is the first channel that carries valid data. This channel can be set to any value between 1 and 24. All additional channels are arranges in contiguous order. If the starting channel is other than 1, then the maximum possible bandwidth will be less than 1536 kbps. For example, if the starting channel is set to be 12, then the maximum bandwidth is limited to 13x64 kbps (channels 12~24), or 832 kbps. This must be kept in mind when setting the starting channel. The Model 2090 will flash the ERR indicator LED if the switch setting is invalid. Refer to section 5.1 for a more detailed explanation of the ERR LED function.

T1 STARTING CHANNEL					
SW1.3	SW1.2	SW1.1	SW2.8	SW2.7	T1 Starting Channel (maximum value of n)
Off	Off	Off	Off	Off	1 (24)
Off	Off	Off	Off	On	2 (23)
Off	Off	Off	On	Off	3 (22)
Off	Off	Off	On	On	4 (21)
Off	Off	On	Off	Off	5 (20)
Off	Off	On	Off	On	6 (19)
Off	Off	On	On	Off	7 (18)
Off	Off	On	On	On	8 (17)
Off	On	Off	Off	Off	9 (16)
Off	On	Off	Off	On	10 (15)
Off	On	Off	On	Off	11 (14)
Off	On	Off	On	On	12 (13)
Off	On	On	Off	Off	13 (12)
Off	On	On	Off	On	14 (11)
Off	On	On	On	Off	15 (10)
Off	On	On	On	On	16 (9)
On	Off	Off	Off	Off	17 (8)
On	Off	Off	Off	On	18 (7)
On	Off	Off	On	Off	19 (6)
On	Off	Off	On	On	20 (5)
On	Off	On	Off	Off	21 (4)
On	Off	On	Off	On	22 (3)
On	Off	On	On	Off	23 (2)
On	Off	On	On	On	24 (1)

Switches SW2.6 & SW2.5 Line Build Out

These switches are used to set the line build out (LBO). The LBO controls the pulse shape and attenuation of the signal sent to the network. The amount of LBO depends on the length of cable used on the T1 side.

SW2.6	SW2.5	LBO
Off	Off	0 dB, 0-133 ft
Off	On	-7.5 dB
On	Off	-15.0 dB
On	On	-22.5 dB

Switch SW2.4 Line Coding

This switch is used to set the line code. There are two line coding options available through the DIP switches: B8ZS and AMI. The line code refers to the way that the signal-the sequence of ones and zeros sent to the T1 equipment-is encoded. AMI reverses the polarity of consecutive pulses. B8ZS is identical to AMI, except that, under certain circumstances, the alternate polarity rule is deliberately violated.

AMI: This stands for "Alternate Mark Inversion." The 2090 transmits data as a sequence of ones and zeros. Ones are usually sent as pulses, and zeros as spaces (no pulse). In order to maximize transmission range, every pulse is of the opposite polarity of the preceding pulse. AMI does nothing else. Maintaining network integrity requires a minimum pulse density (ones desity) of the signal being transmitted on the network. AMI does not inherently provide for this feature. Thus, if a long sequence of zeros happen to be sent, the network may suffer. To meet this requirement using AMI requires one of two methods: Reduce the rate of each time slot (DS0) to 56 kbps, so that the last bit can be used to guarantee the minimum ones density. Or, make sure that the DTE sends data in such a way that ones density is always maintained. For this reason, B8ZS may be preferred over AMI.

B8ZS: This stands for "Bipolar 8 Zero Substitution." This line code ensures minimum ones density. Long sequences of zeros are specially encoded. This line code allows any data pattern to be transmiited without causing ones density problems. Thus, it allows the use of 64 kbps timeslots.

SW2.4	Line Code
Off	B8ZS
On	AMI

Switch SW2.3 Line Framing

This switch is used to set the frame. There are three framing modes available in the Model 2090 Series: ESF, D4 and Unframed. When SW1.8~SW1.4 are turned off, the unit is set to unframed operation, and SW2.3 is ignored. Otherwise, SW2.3 is used to set the frame to either ESF or D4.

SW2.3	Frame
Off	ESF
On	D4

Note:
1. **For unframed operation, 1544 kbps, set SW1.8, SW1.7, SW1.6, SW1.5 & SW1.4 to OFF.**
2. **For unframed operation, SW2.3 is ignored.**

Line Framing Options

D4/Superframe: The D4 framing format, as specified in AT&T TR62411 is the standard in which twelve frames make up a superframe. All signaling and synchronization is done in-band.

Extended Superframe: Extended Superframe, as specified in AT&T TR 54016, consists of twenty-four (24) T1 frames. The framing bits are now used for framing, CRC and the Facility Data Link (FDL). The FDL allows maintenance messages and information to be passed between the 2090 and the Central Office.

Switch SW2.2 DS0 Channel Rate

This switch is used to set the DS0 rate in framed modes; in unframed mode, this switch is used with SW2.1 to set the clocking mode.

SW2.2	DS0 Rate
Off	56 kbps
On	64 kbps

Switch SW2.1 Clock Mode

This switch is used to select the timing source for transmitting data to the T1 port. External clocking is available only in unframed mode (DTE data rate of 1544 kbps).

CLOCKING AND FRAMING MODES			
Function	SW2.2	SW2.1	Clocking Mode
Framed Mode (ESF/D4)	Don't Care	Off	Network
	Don't Care	On	Internal
Unframed Mode	Don't Care	Off	Network
	Off	On	Internal
	On	On	External

NOTE: When using the Model 2090 to terminate a T1 port, the 2090 must be set to network clock. When using the Model 2090 as a high-speed short range modem, one unit of the link must be configured for Internal Clock mode, and the unit on the opposite end must be configured for Network Clock mode.

4.0 INSTALLATION

The Model 2090 is equipped with a DTE, network, and power interface. This section briefly describes connection to each.

4.1 DTE INTERFACE CONNECTION

The DTE interface is a V.35 DCE presented as an M/34 male connector. This interface is designed to plug directly into a DTE interface (See Appendix D for V.35 interface pin assignments).

4.2 NETWORK INTERFACE CONNECTION

The Network Line Interface is an eight position keyed modular jack configured as a RJ-48C. This interface will need to be configured to match the line parameters (i.e. framing, line coding) supplied by the connected equipment.

NOTE: If the Model 2090 Series is being used for private short range modem applications, the twisted pair cable connected to its port will need to be a cross-over cable. See Appendix D for Interface pin assignments.

4.3 POWER CONNECTION

The Model 2090 Series is powered via a supplied external transformer and is factory configured for either 120VAC or 100-240VAC operation. This connection is via the barrel jack on the rear of the 2090. The Model 2090 can also be powered via the DTE interface when supplied with +5VDC @ 300mA to Pin KK. See Appendix D for more information.

DC Power Supply

The 36-60 VDC DC to DC adapter is supplied with the DC version of the Model 2090. The black and red leads plug into a DC source (nominal 48VDC) and the barrel power connector plugs into the barrel power supply jack on the 2090.

5.0 OPERATION

Once the Model 2090 is installed and configured properly it is ready to place into operation. This section describes the function of the LED indicators, the use of the loopback test modes and the control port.

5.1 LED DESCRIPTIONS

The Model 2090 Series is equipped with seven LED indicators that monitor the status of communication. Figure 3 (below) shows the location of the LEDs on the Model 2090 Series front panel.
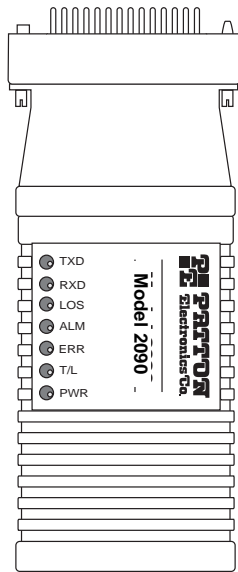
Figure 3. Top of Model 2090, Showing LED Indicators

TXD   (Transmit Data) glows green to indicate data flow to Model 2090 from the DTE.

RXD   (Receive Data) glows green to indicate data flow from the Model 2090 to DTE.

LOS   (Loss of Sync) glows red to indicate a network Loss of Frame or Loss of Signal condition.

ALM   (Alarm) glows red to indicate that one of several alarm conditions exist. These conditions may be local alarms or remote alarm conditions. Alarms may occur due to:
- Loss of Synchronization
- Loss of Frame
- AIS (Blue Alarm)
- Yellow Alarm

ERR   (Error) flashes to indicate errors. There are several flashing patterns to indicate the type of error.

Invalid Switch Configuration: It is possible to request more bandwidth than is possible. For instance, if you set the starting channel to 12, and you select a number of timeslots exceeding 13, the unit will not be able to satisfy your request. In that case, the ERR LED will flash once a second (fi second on, fi second off). When the unit detects an invalid setting, it will ignore the setting and default to a full T1 (bandwidth = 24 channels, starting channel = 1). This will continue until you set the switches to a valid setting. The invalid switch configuration condition overrides other error conditions.

• **Errored Second:** In ESF or SF framing, if the unit detects a frame error, the ERR LED will flash briefly once a second.

• **Framing Mismatch:** the ERR LED flashes briefly once a second when framing modes are mismatched.

• **Loss of Signal:** When there is no signal at the network interface, the ERR LED will flash briefly once a second.

TST   (Test/Loop) glows yellow to indicate that the unit is in a test mode. The unit may be in any one of the following modes:

- D4 Line Loop (CO initiated)
- ESF Line Loop (CO Initiated)
- ESF Payload Loop (CO Initiated)

PWR   (Power) glows green to indicate that the unit is receiving power.

5.2 CENTRAL OFFICE LOOPS

The 2090 also responds to central office initiated loop commands. When in D4 framing mode, the 2090 will implement the "loop up" command when it recognizes the pattern "10000" in the data stream for a minimum of 5 seconds. The "loop down" command is implemented by the pattern "100" in the data stream for a minimum of 5 seconds.

When operating in ESF framing mode, loopback commands are issued via the Facility Data Link (FDL). The line loop message will cause a loop back before data enters the framer portion of the converter. The payload loop message will cause the 2090 to loop data after the framer portion of the converter.

The 2090 will respond to Universal Loopback Deactivate to clear all central office loops.

PATTON MODEL 2090 SERIES SPECIFICATIONS

WAN Speed:	1.544 Mbps
WAN Connection:	RJ-48C
Nominal Impedance:	100 Ohms
DTE Interface:	Integral V.35, M/34 male
Line Coding:	AMI/B8ZS
Line Framing	D4/ESF
Receive LBO:	Automatic
Transmit LBO:	Selectable - 0, 7.5, 15, or 22.5 dB
Clock Options:	Internal, external and network clock
Diagnostics:	Responds to CO initiated D4 loopup and loopdown codes, ESF line loop and payload loop FDL messages, Universal Loopback De-activate message.
Standards:	AT&T TR62411, ANSI T1.403, TR54016
Power Supply:	120VAC, 60 Hz to +5VDC 300mA wall-mount transformer or Universal Input 100-240VAC, 50-60Hz, +5 VDC, 3A wall-mount transformer
Dimensions:	3.5"L x 2.1"W x 0.78"H (9.0 x 5.3 x 1.9 cm)

APPENDIX B

PATTON MODEL 2090 SERIES CABLE RECOMMENDATIONS

The Patton Model 2090 Series operates at frequencies of 20kHz or less and has been performance tested by Patton technicians using twisted-pair cable with the following characteristics:

Wire Gauge	Capacitance	Resistance
19 AWG	83nf/mi or 15.72 pf/ft.	.0163 Ohms/ft.
22 AWG	83nf/mi or 15.72 pf/ft.	.0326 Ohms/ft.
24 AWG	83nf/mi or 15.72 pf/ft.	.05165 Ohms/ft.

To gain optimum performance from the Model 2090 Series, please keep the following guidelines in mind:

• *Always* use **twisted pair** wire—this is not an option.

• Use twisted pair wire with a capacitance of 20pf/ft or less.

• Avoid twisted pair wire thinner than 26 AWG (i.e. avoid higher AWG numbers than 26)

• Use of twisted pair with a resistance greater than the above specifications may cause a reduction in maximum distance obtainable. Functionality should not be affected.

• Many environmental factors can affect the maximum distances obtainable at a particular site.

APPENDIX C

PATTON MODEL 2090 SERIES FACTORY REPLACEMENT PARTS AND ACCESSORIES

Patton Model #	Description
2090/CM/120	T1/FT1 to V.35 Interface Converter (V.35 M/34 Male, 120VAC)
2090/CM/UI	T1/FT1 to V.35 Interface Converter (V.35 M/34 Male, 100-240VAC Universal Input)
07M2090	User Manual

PATTON MODEL 2090 SERIES INTERFACE PIN ASSIGNMENT

RJ-48C T1 (DS0) Network Interface
(RJ-48C Female Modular Jack)

Pin #	Signal	
1	RX Data (RING 1)	} From T1 Port
2	RX Data (TIP 1)	
4	TX Data (RING)	} To T1 Port
5	TX Data (TIP)	

PATTON MODEL 2090 SERIES INTERFACE PIN ASSIGNMENT

M/34 Connector, Terminal Interface

Pin #	Signal
A	GND (Earth Ground/Shield)
B	SGND (Signal Ground)
D	CTS (DCE Source)
E	DSR (DCE Source, Always On)
F	CD (DCE Source)
L	LL (Local Loop, DTE Source)
M	TM (Test Mode Indicators, DCE Source)
N	RL (Remote Loop, DTE Source)
P	TD (Transmit Data +, DTE Source)
R	RD (Receive Data +, DCE Source)
S	TD/ (Transmit Data -, DTE Source)
T	RD/ (Receive Data -, DCE Source)
U	XTC (Transmit Clock +, DTE Source)
V	RC (Receive Clock +, DCE Sourcce)
W	XTC/ (Transmit Clock -, DTE Source)
X	RC/ (Receive Clock -, DCE Source)
Y	TC (Transmitter Clock +, DCE Source)
AA	TC/ (Transmitter Clock -, DCE Source)
KK	Aux. Power Input (+5VDC @ 300mA)