T-40 SERIES

PHYSICAL CAPABILITIES AND CABLING GUIDE

Revision H

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1 About this document

The **T-40** series is a flexible set of devices for protocol mediation. They can also be used for customer specific applications on a dedicated basis.

This document describes the **physical** capabilities and interfaces of the **T-40** series devices when used for protocol mediation and access functions. It is part of a set of documents that describe the **T-40** series. Protocols and other vertical features and functions are described in a separate document.

1.1 Applicability

The **T-40** series is a progressively evolving product set. This document covers the following devices:

- Forty Port **T-40**: Revision 2011 hardware series.
- Forty Port **T-40**: Revision 2017 hardware series.
- Forty Port **T-40**: Revision 2021 hardware series.
- Forty Port **T-40**: Revision 2023 hardware series.
- Four Port **T-40L***: Revision 2013 hardware series.
- Single Port **T-40S**: Revision 2012 hardware series.
- Three Port **T-40SR**: Revision 2021 hardware series.

The hardware series of any **T-40** device may be acquired remotely via SNMP MIB-II with the following linux command:

```
snmpget -v1 -c ${COMM} -Ov ${IPADDR} 1.3.6.1.2.1.1.1.0
```

Where ${COMM} is the SNMP community assigned to the device. The default is **public**. The ${IPADDR} is the address of the **T-40** device.

A sample shell script that acquires and decodes the **T-40** device type is listed as Appendix A of this document.

* The **T-40L** was manufacturer discontinued in **2019**.
  Existing deployed devices continue to receive ongoing support and new features.
  Consider using the **T-40SR** for any new deployments.

1.2 Access Port Groups

The **T-40** Series has the concept of access port groups

The forty port **T-40** has either five or ten access port feature groups depending on the hardware revision. The 2021 hardware revision, and thereafter, has ten access port feature groups, and the prior revisions have five.

The forty port **T-40** with five access port feature groups implement RS-232 serial interfaces of eight ports per group.

The forty port **T-40** with ten access port feature groups implement RS-232 serial interfaces of four ports per group.

The **T-40L*** has a single four port multimode serial feature group**.**

The **T-40SR** has a single three port RS-232 serial feature group.

The **T-40S** has a single port multimode serial feature group.

2 Device Description

2.1 Codes, Codes, Codes…

The entire **T-40** series is covered by the following government codes:

Export Control Classification Number (ECCN) – 5A992.c
Harmonized Code (HTS) – 8517.62
US Census Schedule B Code -- 8517.62.0010
Country of Origin – United States (Florida)

The following table is per device:

	CLEI	CPR	FRC	ECN
T-40-EM	IPMS710KRA	N70*AZJ*	477C	753
T-40-E8	INM9D10HRA	N70GZJ	477C	753
T-40-E16	INMKV00FRA	N70LDR	477C	753
T-40-A	INM9C10HRA	N70GZD	477C	753
T-40L*	IPMZW00HRA	N70CDV	477C	753
T-40S	IPMZV00HRA	N70CDU	477C	753
T-40SR-EM	INM9H10HRA	N70GZH	477C	753
T-40SR-E1	INM9G10HRA	N70GZM	477C	753
T-40SR-A	INMJE10FRA	N70KZC	477C	753
T-40-LTCN	INM9F10HRA	N70GZL	477C	753
T-40-ETNC	INM9E10HRA	N70GZK	477C	753

2.2 Physical Dimensions

T-40-EM	Width = 17.0” x Depth = 6.3” x Height = 1.72” (1U)
T-40-E8	Width = 17.0” x Depth = 6.3” x Height = 1.72” (1U)
T-40-E16	Width = 17.0” x Depth = 6.3” x Height = 1.72” (1U)
T-40-A	Width = 17.0” x Depth = 6.3” x Height = 1.72” (1U)
T-40L*	Width=6.14” x Depth = 4.3” x Height = 1.91”
T-40S	Width=2.62” x Depth = 4.3” x Height = 1.18”
T-40SR-EM	Width=2.62” x Depth = 4.3” x Height = 1.18”
T-40SR-E1	Width=2.62” x Depth = 4.3” x Height = 1.18”
T-40SR-A	Width=2.62” x Depth = 4.3” x Height = 1.18”
T-40-LTCN	Width = 17.0” x Depth = 6.3” x Height = 1.72” (1U)
T-40-ETNC	Width = 17.0” x Depth = 6.3” x Height = 1.72” (1U)

2.3 Capacity

	#LAN	#Ports (RS-232)	#Ports (Balanced or MultiMode)	#Synchronous
T-40-EM	2	0 to 40	0 to 20	Up to 40
T-40-E16	2	0 to 40	0 to 16	Up to 16
T-40-E8	2	0 to 40	0 to 8	Up to 8
T-40-A	2	40	0	None
T-40L*	1	Multi-Mode	4	Up to 4
T-40S	1	Multi-Mode	1	Up to 1
T-40SR-EM	1	3	None	Up to 3
T-40SR-E1	1	3	None	Up to 1
T-40SR-A	1	3	None	None
T-40-LTCN	2	N/A	N/A	N/A
T-40-ETNC	2	N/A	N/A	N/A

***** The **T-40L** is manufacturer discontinued although existing deployed devices continue to receive ongoing support and features.

2.4 Environmental Properties

Operating Temperature:	-5° to 50°C (23°F to 124°F) per GR-63-CORE, and GR-3108-CORE.
Operating Humidity:	5% to 90% non-condensing per GR-63-CORE, and GR-3108-CORE.
Altitude:	From 60 m (197 ft.) below sea level to 1800 m (5905 ft.) above sea level and less than 4000 m (13122 ft) de-rated by 2° C per 300 m per GR-63-CORE, and GR-3108-CORE.

2.5 Operating Load

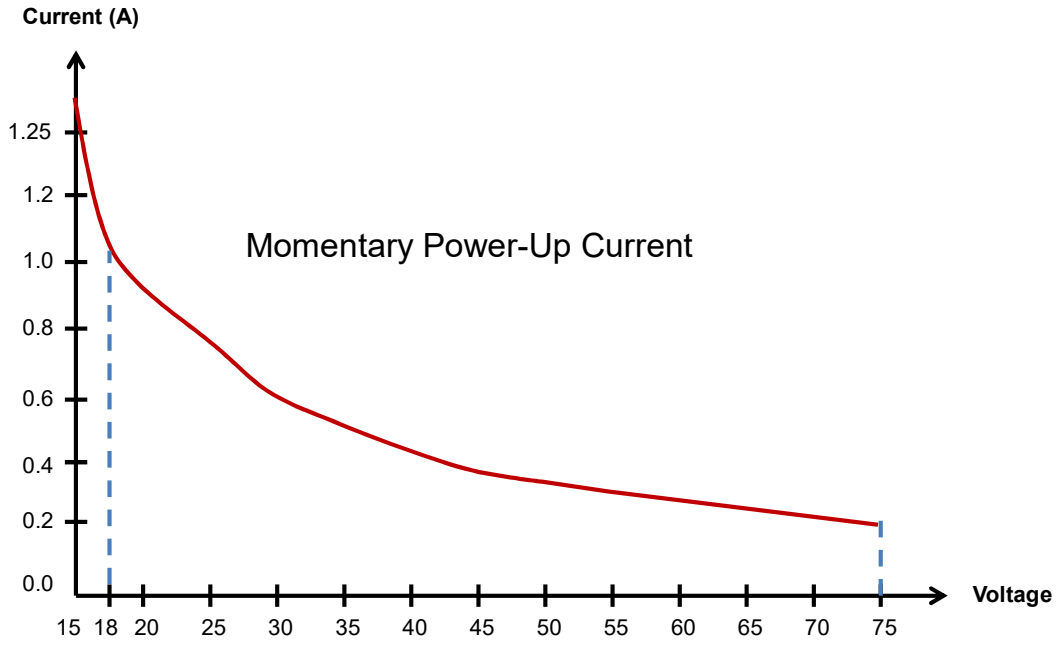
Device	Voltage (Range)	Amperage
T-40-EM	48 (18 – 75)	75ma @ 48V Nominal
T-40-E16	48 (18 – 75)	75ma @ 48V Nominal
T-40-E8	48 (18 – 75)	75ma @ 48V Nominal
T-40-A	48 (18 – 75)	75ma @ 48V Nominal
T-40L*	48 (36 – 72)	50ma @ 48V Nominal
T-40S	48 (36 – 72)	33ma @ 48V Nominal
T-40SR-EM	48 (36 – 72)	33ma @ 48V Nominal
T-40SR-E1	48 (36 – 72)	33ma @ 48V Nominal
T-40SR-A	48 (36 – 72)	33ma @ 48V Nominal
T-40-LTCN	48 (18 – 75)	75ma @ 48V Nominal
T-40-ETNC	48 (18 – 75)	75ma @ 48V Nominal
T-40-EGTP	48 (18 – 75)	75ma @ 48V Nominal

2.6 Fuse

The **T-40** is recommended to be fused at 1.25 Amps.

If a larger fuse is used, it cannot be greater than 3.0 Amps.

If a smaller fuse is to be utilized, consult the following table for the momentary power-up current. The power up current will exist for at most 350 milliseconds but the fuse will open the circuit if undersized. A “slow” fuse may be slightly undersized. Consult the fuse manufacturer specification for the allowable tolerance.



The dashed blue lines represent the operating voltage limits of the **T-40** of 18-75 Vdc.

2.7 Interfaces

2.7.1 Power

The **T-40** series platform accepts DC power input directly from a nominal 48V DC power source which connects to the three position (return, -48, and frame ground) terminal block labeled 48V DC on the faceplate. The power, although labeled to meet NEBS requirements, is polarity insensitive. The **T-40** series will self-correct any incorrect polarity. The terminal block connectors accommodate 12 AWG (American Wire Gauge) to 24 AWG wire. A strain-relief clamp is available separately for DC wire stabilization. While the voltage is listed as 48VDC nominal, the actual allowed voltage range is shown on the table in the previous section of this document. Dual power feeds are accommodated with a commercially available external dual diode device.

A separate AC power supply is available which plugs into a standard 115/240V AC outlet. The power supply has a six-foot cable that terminates with stranded ends. The ends are connected to the 48VDC power inputs. Polarity is corrected automatically.

2.7.2 Serial Console

On the **T-40**, and the **T-40L***; the out of band serial console is an RJ45 connector on the face of the unit. On the **T-40S**, it is on pins 18 and 25 of the DB25. On the **T-40SR**, serial port #1 is used as a serial console for initial configuration; and/or if port #1 is not needed in the deployment.

The serial console connects as a data terminating equipment (DTE) to an asynchronous device and uses RS-232C signaling. The serial console is configured as 9600 bps, 8 bits, no parity and one stop bit. See the console cable section for a pin description of the connector.

2.7.3 10/100 LAN

Each of the two LAN connections on the **T-40** series is a 10/100 Ethernet interface on the front of the unit and are labeled "**LAN1**", and "**LAN2**". The interface requires a standard RJ45 terminated Category 5 twisted-pair data cable.

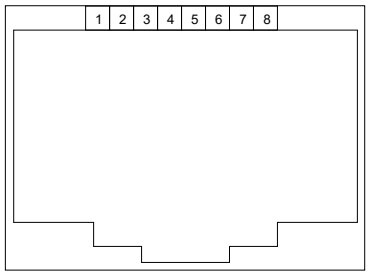
The **T-40L***, **T-40S,** and **T-40SR** have a single LAN interface labeled "**LAN1**". All three support 802.3af "Power Over Ethernet". PoE is implemented by both methods defined by 802.3af. They are the bias between the TX group (Pins 1, 2). and the RX group (Pins 3, 6). Alternatively, the bias between pins 4, 5 and pins 7, 8.

The LAN interface will automatically negotiate the speed and duplex with the network interface PHY if configured as such. This configuration is the default. Each LAN interface may also be set to a fixed speed and duplex.

Also, the hardware for each network interface is Auto-MDIX so that a cross-over cable is never required.

The definition of each LAN RJ45 is as follows:

RJ45 Female Pin Numbering



Pin	Symbol	Function	Signal Type
1	Tx+	Data Transmission +	Output
2	Tx-	Data Transmission -	Output
3	Rx+	Data Reception +	Input
4	NC		
5	NC		
6	Rx-	Data Reception -	Input
7	NC		
8	NC		

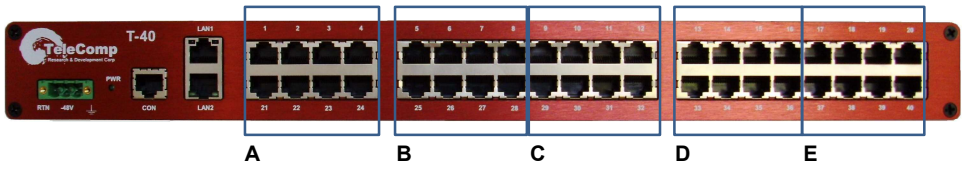
2.7.4 RJ45 Access Ports

2.7.4.1 T-40

The **T-40** platform access ports are RJ45. Depending on the serial number, these may have five port groups and are RS-232 only; or ten feature groups that are defined as an order option at manufacture.

For devices with five port group, each port group is eight ports as shown by the following diagram.

T-40 Port Groups

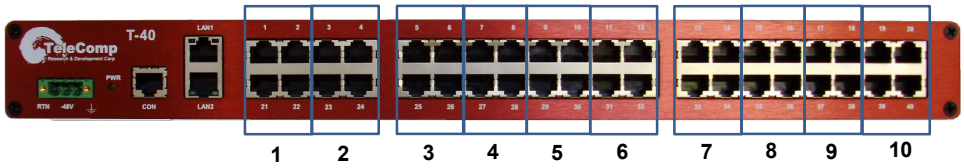


Group	Upper Row	Lower Row
A	1-4	21-24
B	5-8	25-28
C	9-12	29-32
D	13-16	33-36
E	17-20	37-40

These five port groups each have an aggregate limit for synchronous port operation. All ports may operate at 115.2Kb in asynchronous protocols regardless of the synchronous aggregate limit on the group. The maximum speed for synchronous operation is 56Kbps, and is subject to the 76.8Kbps aggregate limit of the port group. The software assures that only valid configurations are allowed into service.

For devices with ten feature groups, each group is associated with four RJ45 and their function is defined at time of manufacture.

T-40 Feature Groups



Group	Upper Row	Lower Row
1	1-2	21-22
2	3-4	23-24
3	5-6	25-26
4	7-8	27-28
5	9-10	29-30
6	11-12	31-32
7	13-14	33-34
8	15-16	35-36
9	17-18	37-38
10	19-20	39-40

These ten **T-40** feature groups are up to four ports each depending on the options used at time of manufacture.

The max baud rate for asynchronous protocols on any port is 115.2Kbps.

The maximum baud rate for synchronous protocols is 115.2Kbps.

The aggregate group limit for synchronous operation is 230.4Kbps.

On personality feature groups with four ports (e.g. RS-232), all four ports may operate at 56Kbps synchronous simultaneously. Or, in any combination such that the sum of the four ports does not exceed the aggregate group limit of 230.4Kbps.

The individual feature configurations are specified in separate sections of this document.

2.7.4.2 T-40SR

The **T-40SR** platform access ports are RJ45 and may use any of the RS-232 cabling adapters defined in this document.

Front

AFT

The max baud rate for asynchronous protocols on any port is 115.2Kbps.

The maximum per port baud rate for synchronous DCE operation is 56Kbps.

The maximum per port baud rate for synchronous DTE operation is 19.2Kbps.

There is no aggregate group limit.

2.7.5 DB25 Access Ports

The **T-40L*** and **T-40S** access ports are DB25.

The **T-40L*** is as follows:

And the **T-40S** is as follows:

The **T-40S** and **T-40L*** implements the Multimode serial interface. The DB25 RS-530 female connector provides support for software-selectable device interfaces (RS-530, V.35 and RS232-C).

The DB25 RS-530 interface is a native DCE. The female connector electrically presents a data terminal equipment (DCE) interface and supports RS-232C directly.

The DB25 support either asynchronous and/or synchronous protocol sets. Physical DCE and DTE modes are supported. Logical modes may be DCE or DTE as configured. Configuration is software selectable on a per port basis. Baud rates up to 115.2kbps are supported in asynchronous modes, and 56K in synchronous modes. Synchronous ports support both NRZ & NRZI encoding.

The **T-40L*** supports asynchronous protocols on any port at rates up to 115.2Kbps. Synchronous protocols are supported on port 1 at up to 56Kbps, and ports 2-4 at up to 19.2Kbps.

The **T-40S** supports asynchronous protocols at a rate up to 115.2Kbps. Synchronous protocols are supported at up to 153Kbps. When operating at rates above 56K, it is recommended that a balanced physical mode (e.g. V.35, V.11, RS-530) be utilized.

2.7.6 LEDs

The faceplate contains light emitting diodes (LEDs) used to report activity and status.

LED Function	LED Color	LED Description
PWR	Green	Unit Power Indicator
Link	Green	Link Indicator (One per LAN)
Activity	Green	Activity Indicator (Blink) (One per LAN)

3 PERSONALITY GROUPS

The **T-40** allows ten RS-232 Serial port groups.
The **T-40S** contains a single Multi-Mode Serial port.
The **T-40SR** contains a single three port RS-232 Serial port group.
The **T-40L*** contains a single four Multi-Mode Serial port group.

3.1 RS-232 Personality Group

The RS-232 personality may be optioned at manufacture for a feature group. It provides up to four RS-232 ports.

RJ45 Pin Definition for the RS-232 Personality Group

RJ45 Pinout	Direction	Async Usage	Sync Usage
1	**Open***	**Open***	**Open***
2	T-40 Input	RTS or CTS	Clock In (DTE)
3	T-40 Input	Data Input	Data Input
4	T-40 Input	DTR or DCD	DTR or DCD
5	T-40 Output	Data Output	Data Output
6	T-40 Output	DTR or DCD	DTR or DCD
7	Signal Ground	Signal Ground	Signal Ground
8	T-40 Output	RTS or CTS	Clock Out (DCE)
Shield	Frame Ground	Optional FG	Optional FG

Note: Pin 1 on the RJ45 is **open** for RS-232 personality for backward compatibility of the serial port adapter cabling. This allows the use of prior generation patch panels and RJ45 to DB25 adapters.

T40L* / T-40S DB25 Pin Definition for the RS-232 Personality Group

:

Pin	Function	EIA	RS-232
1	Common Chassis Ground	Shield	*
2	DTE Transmitted Data	BA	U
3	DTE Received Data	BB	U
4	Request to Send	CA/CJ	U
5	Clear to Send	CB	U
6	Data Set Ready	CC	U
7	Signal Ground	AB	*
8	Data Carrier Detect	CF	U
15	Transmit Timing (Tx Clock)	DB	U
17	Receiver Timing (Rx Clock)	DD	U
18	T-40S Serial Console Receive	*	U
20	Data Terminal Ready	CD	U
21	Remote Loopback	RL	U
24	External Transmit Timing	DA	U
25	T-40S Serial Console Transmit	*	U

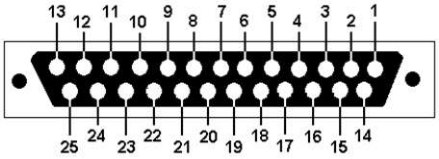
U → Unbalanced

The **T-40S** serial console pins 18 and 25 are only defined on the **T-40S**.

3.2 Multimode Serial Personality Group

T40L* / T-40S DB25 Pin Definition for the Multimode Personality Group

T-40S Multi-Mode Serial Port



Pin	Function	EIA	RS-232	V.35	RS-530A
1	Common Chassis Ground	Shield	*	*	*
2	DTE Transmitted Data	BA	U	A+	A+
3	DTE Received Data	BB	U	A+	A+
4	Request to Send	CA/CJ	U	U	A+
5	Clear to Send	CB	U	U	A+
6	Data Set Ready	CC	U	U	U
7	Signal Ground	AB	*	*	*
8	Data Carrier Detect	CF	U	U	A+
9	Receiver Timing (Rx Clock)	DD		B-	B-
10	Data Carrier Detect	CF			B-
11	External Transmit Timing	DA		B-	B-
12	Transmit Timing (Tx Clock)	DB		B-	B-
13	Clear to Send	CB			B-
14	DTE Transmitted Data	BA		B-	B-
15	Transmit Timing (Tx Clock)	DB	U	A+	A+
16	DTE Received Data	BB		B-	B-
17	Receiver Timing (Rx Clock)	DD	U	A+	A+
18	T-40S Serial Console Receive	*	U	U	U
19	Request to Send	CA/CJ			B-
20	Data Terminal Ready	CD	U	U	U
21	Remote Loopback	RL	U	U	U
22	RS-530 DSR B- (not RS-530A)	RI / CC			See Note
23	RS-530 DTR B- (not RS-530A)	CD			See Note
24	External Transmit Timing	DA	U	A+	A+
25	T-40S Serial Console Transmit	*	U	U	U

U → Unbalanced A+ → Balanced Positive B- → Balanced Negative

The **T-40S** serial console pins 18 and 25 are only defined on the **T-40S**.

4 SELECTING THE CABLING ADAPTER

The **T-40** uses standard RJ45 cabling for serial interfaces. These allow for inexpensive cabling that can be manufactured in the field if necessary. The RJ45 interfaces are also backward compatible with many legacy devices dating as far back to the early 1980s. With the appropriate cabling adapters, most all serial interfaces can be accommodated.

This section presents some tables to assist in choosing the correct cabling adapter for a particular application.

4.1 HDLC & SLDC

This section itemizes HDLC and SDLC bit synchronous protocols. They include BX.25, X.25, XOT, and various others.

DXE	Duplex	Clock Type	Carrier	Cabling Adapter
DCE	FDX	Normal	Constant	DCE Synchronous
			Switched	DCE Synchronous
		Recovered	Constant	DCE Asynchronous
			Switched	DCE Asynchronous
	HDX	Normal	Constant	DCE Synchronous
			Switched	DCE Synchronous
		Recovered	Constant	DCE Asynchronous
			Switched	DCE Asynchronous
DTE	FDX	Normal	N/A	DTE Synchronous
		Recovered	N/A	DTE Asynchronous
	HDX	Normal	N/A	DTE Synchronous
		Recovered	N/A	DTE Asynchronous

It should be noted that clock recovery from the data stream requires NRZI encoding which has sufficient transitions. All isochronous interfaces using HDLC have NRZI encoding.

4.2 Asynchronous

This section itemizes standard Asynchronous protocols.

DXE	Duplex	Cabling Adapter
DCE	FDX	DCE Asynchronous
	HDX	DCE Asynchronous
DTE	FDX	DTE Asynchronous
	HDX	DTE Asynchronous

Asynchronous protocols do support switched carrier, and modem control. However, those options do not affect the selection of the cabling adapter.

Note that these asynchronous adapters are “standard” as used by legacy networks such as Datakit / BNS. Any existing cabling from these legacy devices can be re-used.

5 CABLING

This section gives cabling examples.

5.1 Console Cables

The serial console interfaces on all the **T-40** devices are essentially 3 wire interfaces. Only the TxD, RxD, and SG pins are relevant. The serial console is only needed to set the initial IP network configuration. Thereafter, any of the **T-40** network consoles may be used to modify the device configuration.

This section will suggest a “Universal Cable Set”, and also provide the pinout configuration for all the adapter configurations.

Consoles are always configured as 9600 baud, 8 bits, 1 stop bit, and no parity. Flow control should be disabled. Any terminal emulation program for the PC will suffice (e.g. Hyperterminal, or PuTTY).

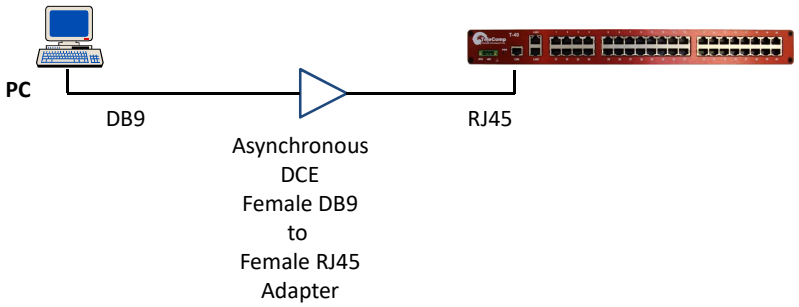
5.1.1 Universal Console Cable Set

The universal console cable set is the minimum number of cables that are needed for on-site technical support of any of the **T-40** series devices. Most of the DT series devices, and the IP-MPA may also be supported with the same cable set. The notable exception is the DT-9480 which has a unique DB25 adapter and will not be addressed in this document.

A PC, laptop, or tablet computer is capable of serial interface. On some, this is a DB9 directly on the PC. But, for most, this is now achieved with a USB to DB9 Serial adapter cable. Either way, it presents a DB9 Male connector which is an asynchronous DTE.

The **T-40** serial console cable is per the following diagram:

T-40 / T-40S / T-40L Serial Console Cable

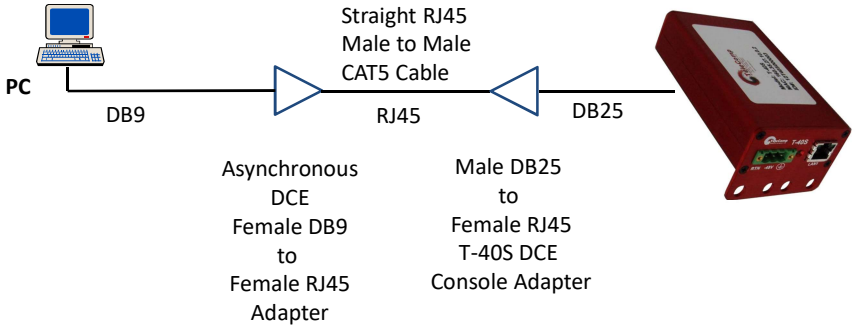


The **T-40** serial console consists only of a DB9 DCE to RJ45 adapter. This cable set may be used for the **T-40**, **T-40L***, DT-4180, DT-4284, DT-4000, and DT-6061 devices.

The **T-40S** serial console is on two unused pins (18 and 25) of the **T-40S** Multi-Mode DB25 connector.

The serial console to the **T-40S** would use the same base cable set as the **T-40**, but adding a DB25 DCE console adapter to route the signals to those dedicated pins.

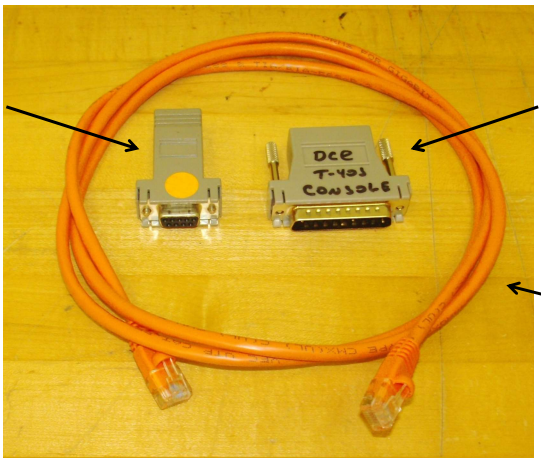
T-40S Serial Console Cable



The **T-40S** serial console cable set may also be used on the older **IP-MPA**. It is, however, notably different from the **DT-9480** serial console cable which will not be covered in this document.

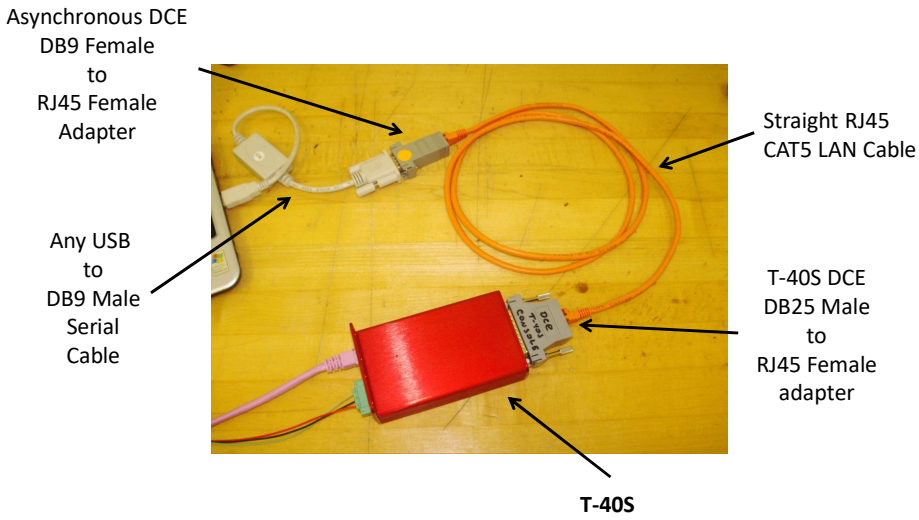
The **T-40** Universal console cable set is shown below:

T-40 Series Universal Cable Set



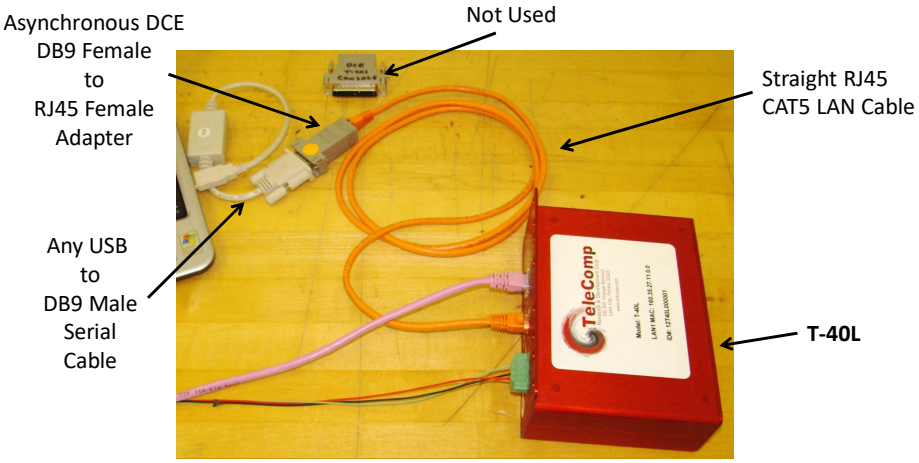
When the universal cable set is used with a **T-40S** and a small laptop PC, it appears as follows:

T-40 Series Universal Cable Set with T-40S



When the universal cable set is used with a **T-40L*** and a small laptop PC, it appears as follows:

T-40 Series Universal Cable Set with T-40L



5.1.2 The DCE DB9 to RJ45 Console Adapter

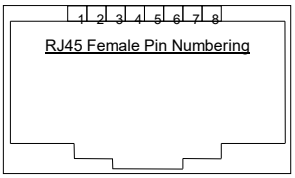
Personal Computers use a 9 pin DB9 interface for serial communications. The terminal emulation programs may require certain lead status. Since console connections are generally implemented as three wire interfaces (i.e. RxD, TxD, and SG); this may pose a problem for the terminal emulation programs.

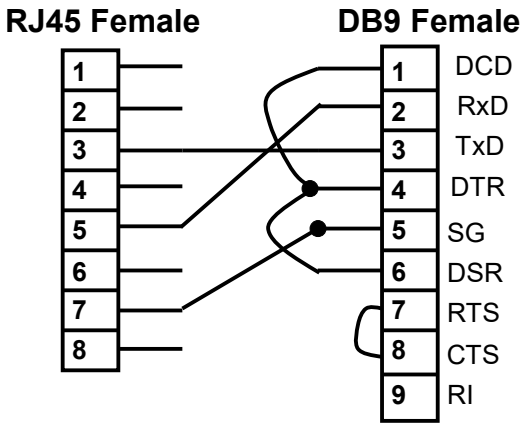
Below is depicted the wiring of a DB9 to RJ45 adapter which eliminates the problems associated with these terminal emulation programs. It is used with a standard straight category 5 RJ45 cable.

This adapter is used with the **T-40** console. It may also be used with any other RJ45 console including the DT-4180, DT-4000, DT-4284, UMI, UTM, et al. For use with the **T-40S** serial console, an additional **T-40S** Console adapter from RJ45 to DB25 DCE Male is required.

This adapter is shown in the previous section as a component of the universal console cable set.

DB9 DCE Console Adapter





Note: This cable for use on console ports only.

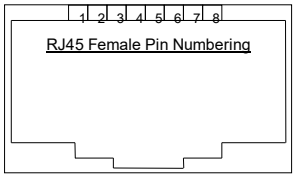
Use with a straight CAT-5 RJ45 cable.

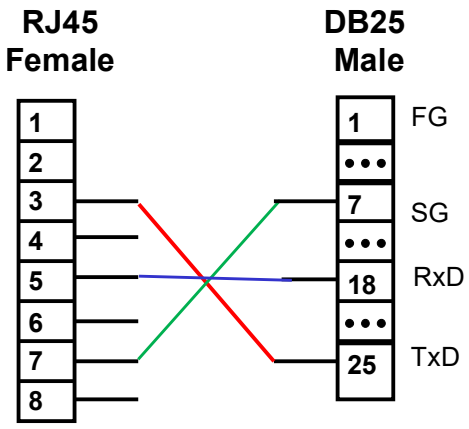
5.1.3 The T-40S DCE DB25 Console Adapter

The **T-40S** implements the serial console as an RS-232 interface on pins 18 and 25 of the DB25 connector. It is used only for initial configuration of the IP parameters. Thereafter, the **T-40S** is connected directly to the Network Element and the serial console is no longer utilized.

This diagram shows the DCE RJ45 to DB25 adapter to connect the **T-40S** serial console. This is the adapter used in the "universal console cable set" referenced in an earlier section.

T-40S DCE Console Adapter





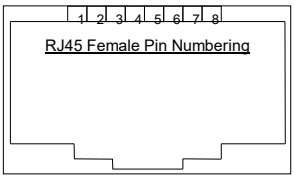
This cable adapter may be used with a split DB25 to permanently wire the serial console to another RJ45 console port without any other adapter.

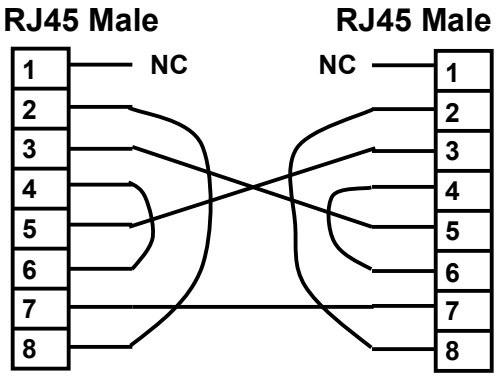
5.1.4 The RJ45 to RJ45 Crossover Console Cable

The RJ45 to RJ45 console cable implements a three wire interface for attaching to a console on a T-40. There is signal looping at either end. It is used to connect a serial console directly to a standard RS-232 RJ45 serial port. No adapter is required. It may also be used in conjunction with an Asynchronous DCE or DTE adapter to provide console interfaces for personal computers or terminals where looped signals are required.

The diagram for the console cable is as follows:

RJ45 to RJ45 Console Cable





Note: This cable for use on console ports only.

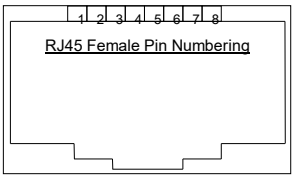
5.2 RJ45 RS-232 Cabling

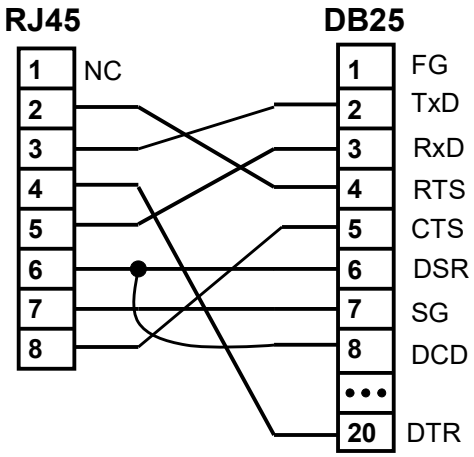
The RJ45 cabling for RS-232 is backward compatible to prior series and legacy devices. They can also be used on DT devices, SAMs, and Datakit TY interfaces.

5.2.1 The Asynchronous DCE Adapter

Depicted below is the cabling description for the asynchronous DCE adapter to be used with all RJ45 ports configured with a protocol of asynchronous (or raw) and a cable type of DCE. The adapter is backward compatible with legacy DT, SAM, and Datakit TY interfaces.

Asynchronous DCE Adapter

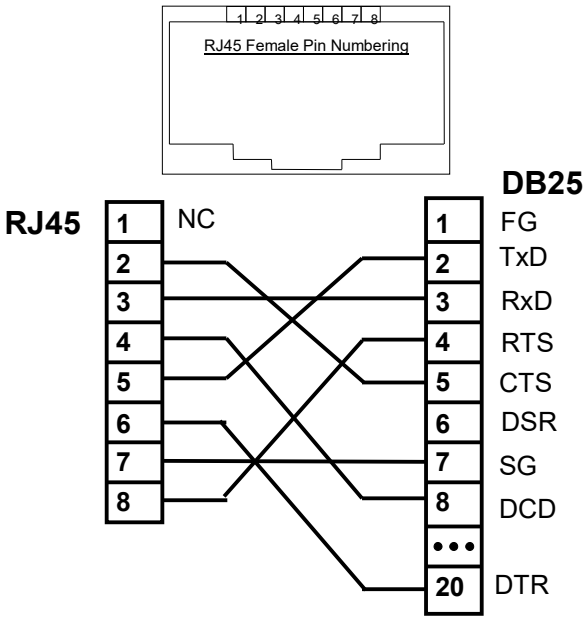




5.2.2 The Asynchronous DTE Adapter

Depicted below is the cabling description for the asynchronous DTE adapter to be used all RJ45 ports configured with a protocol of asynchronous (or raw), and a cable type of DTE. The adapter may also be used with SAMs, MSMs, TYs, and DT series devices. Generally, this interface adapter is used with Modem connections.

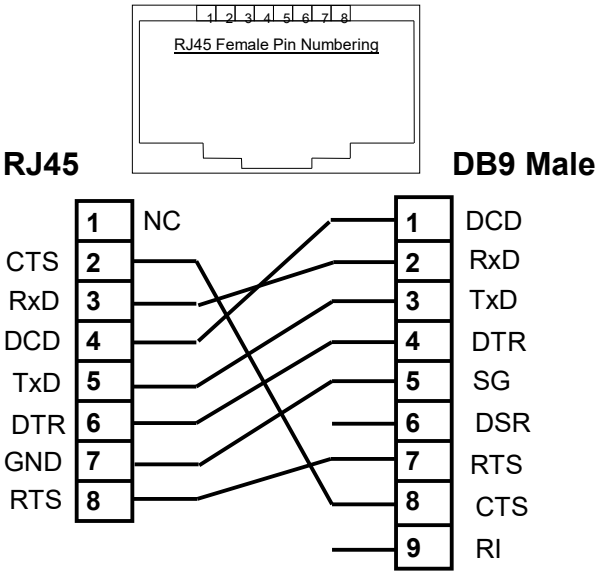
Asynchronous DTE Adapter

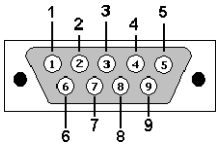


5.2.3 The Asynchronous DB9 DTE Adapter

Depicted below is the cabling description for the asynchronous DB9 DTE adapter to be used with all RJ45 ports configured with a protocol of asynchronous (or raw), and a cable type of DTE. The adapter may also be used with SAMs, MSMs, TYs, and DT series devices. Generally, this interface adapter is used with Modem type devices.

Asynchronous DB9 DTE Adapter



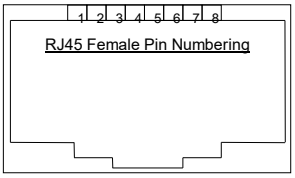


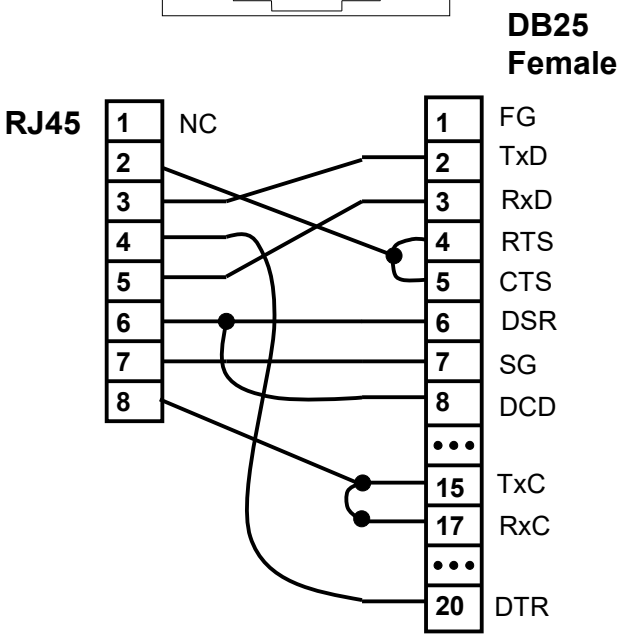
DB9 Male Pin Numbering

5.2.4 The Synchronous DCE Adapter

The diagram in this section is for the Synchronous DCE adapter to be used with RS-232 RJ45 ports configured as a cable type of synchronous DCE. The adapter may also be used with SAMs, and DT series devices. This adapter is applicable when the port is providing the clocking to the interface between itself and a device. This version of the diagram is backward compatible. Alternative wiring for the clocks is possible.

Synchronous DCE Adapter

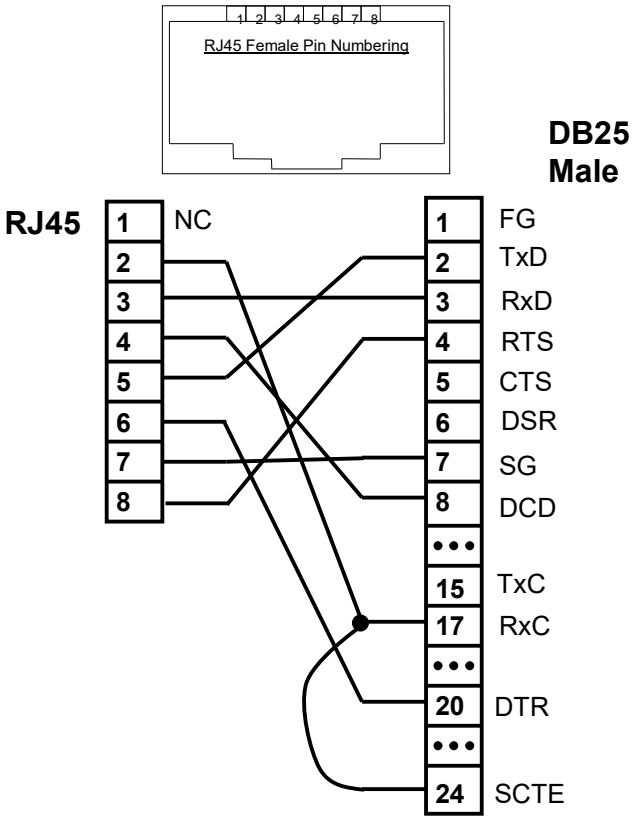




5.2.5 The Synchronous DTE Adapter

Depicted below is the cabling description for the Synchronous DTE adapter to be used with RS-232 RJ45 ports configured as a cable type of synchronous DTE. The adapter may also be used with SAMs, and DT series devices. This adapter is applicable when the port is receiving the clocking to the interface between itself and a device. Generally, this interface adapter is used with Modem connections.

Synchronous DTE Adapter

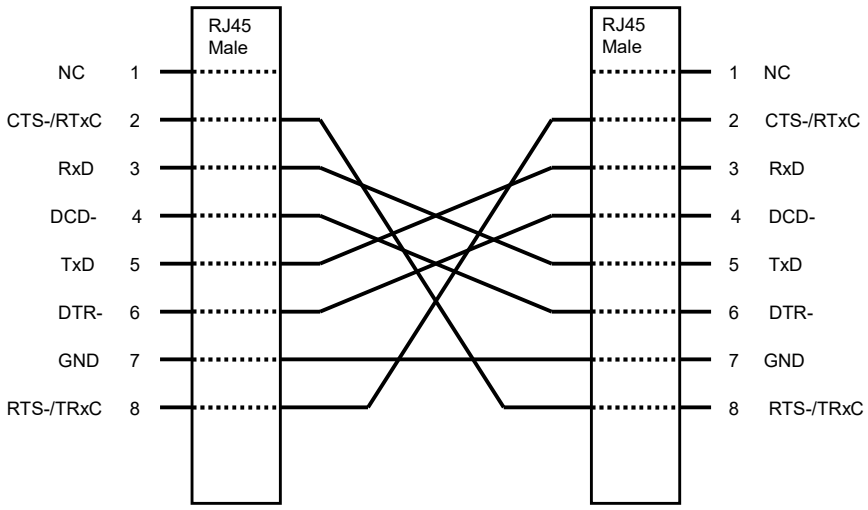


5.2.6 The RJ45 to RJ45 Full Crossover Cable

It is sometimes useful to interconnect two devices without adapters. The full cross-over cable will accomplish that function and preserve all of the lead functions. It is a generic cable that will work with any standard RJ45 serial port, any Datakit / BNS series interface, and many other popular device interfaces.

A diagram of that cable is as follows:

RJ45 Full Cross-Over Cable



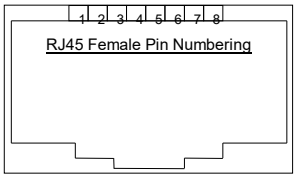
5.2.7 Cabling to a Westronic WS2000 E2A Remote

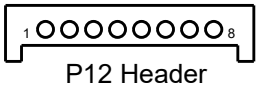
The **T-40** series is able to accept the E2A protocol on any of its ports. The Westronic WS2000 is an E2A remote interface for discrete scan points.

The Westronic WS2000 presents wire wrap pins on a TELZON wire wrap block. The cabling may also be done to the P12 connector on the WS2000 backplane. Both are depicted in this section.

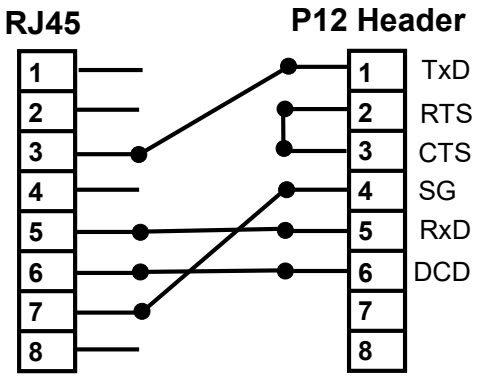
The **T-40** port is configured as follows:
Port <#> prot=e2a dxe=dce pap=on swcar=off.

T-40 - WS2000 Serial Cable





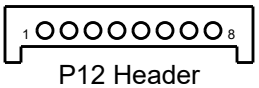
P12 Header
(WS2000 View)



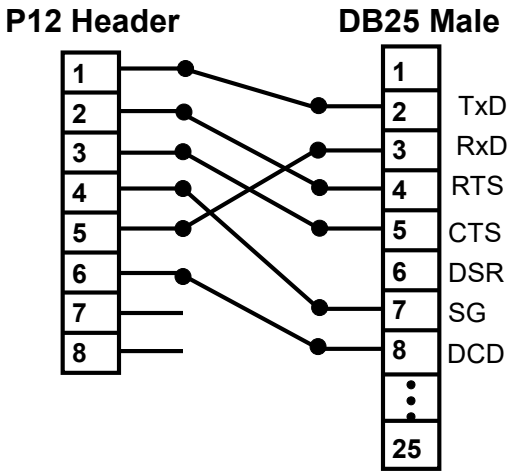
Consult the specialized application note on the Westronic WS2000 RTU interface for additional information.

The **T-40S** and the **T-40L*** use the following cable to the Westronic WS2000.

T-40S / T-40L WS2000 Serial Cable



P12 Header
(WS2000 View)



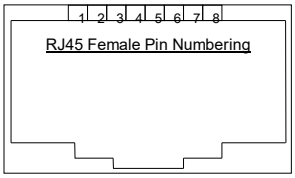
5.2.8 Cabling to an AT&T SAC E2A Remote

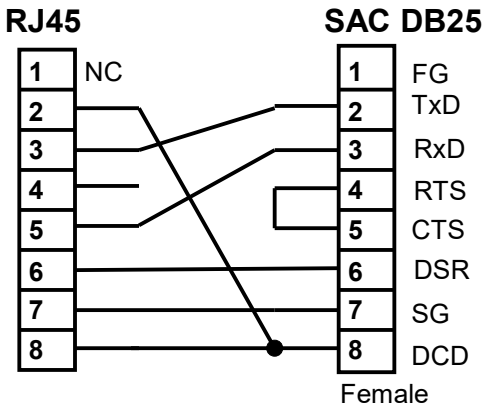
The **T-40** is able to accept the E2A protocol on any of its ports. The AT&T SAC is an E2A remote interface for discrete scan points.

The AT&T SAC presents a DB25 Male connector. A special adapter depicted below must be used to interface to the AT&T SAC.

In addition, the port is configured as prot=E2A, DXE=DTE, and PAP=ON. The originate and receive options for the port are dependent on the deployment.

T-40 to E2A SAC Adapter





5.2.9 Cabling to an AT&T General Telemetry Processor (GTP)

The AT&T General Telemetry Processor is an E2A remote interface for discrete scan points.

The AT&T GTP presents a DB25 Female connector that is a physical DTE.
The adapter used to connect to the AT&T GTP is the standard RS-232 **synchronous** DCE adapter with a DB25 male.
See the prior section for the RJ45 to DB25 wiring diagram.

The configuration of the port is as follows:
port <port num> type=orig prot=e2a
port <port num> dest=<eTNC IP Address> dport=<eTNC TCP Port>
port <port num> dxe=dce swcar=on
rs <port num>

5.2.10 Cabling to a DPS Network Telemetry Processor (NTP)

The **T-40** provides support for a non-standard variant of the E2A protocol used by the DPS NTP.

The DPS Network Telemetry Processor (NTP) is a replacement for the AT&T General Telemetry Processor (GTP). The NTP consists of three shelves: A control Shelf (Shelf 1), a discrete point shelf (Shelf 2), and a TBOS serial shelf (Shelf 3). The internal modem used for E2A transport to the NTP resides in shelf 2 and is connected to the control shelf via a DB9 labeled P3 on the back of the control shelf. This “Modem” card substantially alters the E2A protocol.

Connection of the DPS NTP to the virtual bridge network is as follows:
Remove the DB9 cable from P3 on the control shelf.
Attach a null modem DB9 Male to DB25 Male to P3 on the Control Shelf.
Attach a DB25 Female synchronous DCE adapter to the DB25 end of the DB9 to DB25 cable.
The DPS “Modem” card is no longer required and may be removed from the shelf.

The configuration of the port is as follows:
port <port num> type=orig prot=dps
port <port num> dest=<eTNC IP Address> dport=<eTNC TCP Port>
rs <port num>

5.2.11 Cabling to an Isochronous LTS

The ports on a **T-40** support the option of recovering clocks from the data lines for synchronous protocols. When clock recovery is used, the encoding for these protocols must be NRZI.

The NRZI option is reliable for bit stuffed protocols such as SDLC, but is subject to failure in a BiSync due to the potential for insufficient bit cell transitions. This is not a limitation on the **T-40**, but rather a fact of the encoding itself. The NRZI encoding on SDLC data streams is by far, the most common variant of these protocols. It is this NRZI encoding which is used on the isochronous LTS connections.

In order to use a **T-40** port with recovered clocks, it should be programmed with the protocol, the line encoding, the operation on the data, the baud rate, and the recovered clock.

Consider the following command:

port <#> prot=sdlc baud=1200 enc=nrzi dxe=dce clk=rcvd fill=flag

This command instructs the **T-40** that the port is SDLC NRZI with recovered clocks. The baud rate is required in order to properly recover the clocks from the data, and must match the peer. The **dxe=dce** instructs the **T-40** that it should control CTS from the peer DTEs RTS, and not wait to send data. The **clk=rcvd** instructs the **T-40** that the clocks are to be recovered from the data rather than on a separate EIA lead.

The **fill=flag** option is the default for an SDLC port and specification of the option is not required unless the port had been previously configured otherwise.

Please note that this configuration would use the **asynchronous** DCE adapter.

The isochronous configuration is available on the **T-40S** DB25, any port of a **T-40SR**, and also on port #1 of a **T-40L***. The recovered clock option is not available on ports 2-4 of a **T-40L***.

Note: It is **absolutely important** that the clock pins on the LTS are not connected when isochronous operation is used. These are pins 15 and 17 on the LTS DB25. The LTS will internally drive the pins and the interface will not function if connected externally.

In the event that the port is to be connected to a modem device operating in 2-wire (half duplex) mode, and the port is to be the DTE in that configuration. The **T-40** port would need to assert RTS and wait for CTS before sending data to avoid corruption on the half duplex interface.

The following command would issue that configuration.

port <#> prot=sdlc baud=1200 enc=nrzi dxe=dte clk=rcvd fill=mark

Note that the only difference is the **dxe=dte** option. This instructs the **T-40** to assert RTS when there is data to send, and then wait for CTS to be asserted by the DCE before actually sending the data.

The **fill=mark** idles the line between frames in the mark state as opposed to flags. Some modem devices do not handle flag idled lines well. If that is the case, then this option should be used. It doesn't hurt to mark fill on DTE ports. Please note that this configuration would use the **asynchronous DTE** adapter.

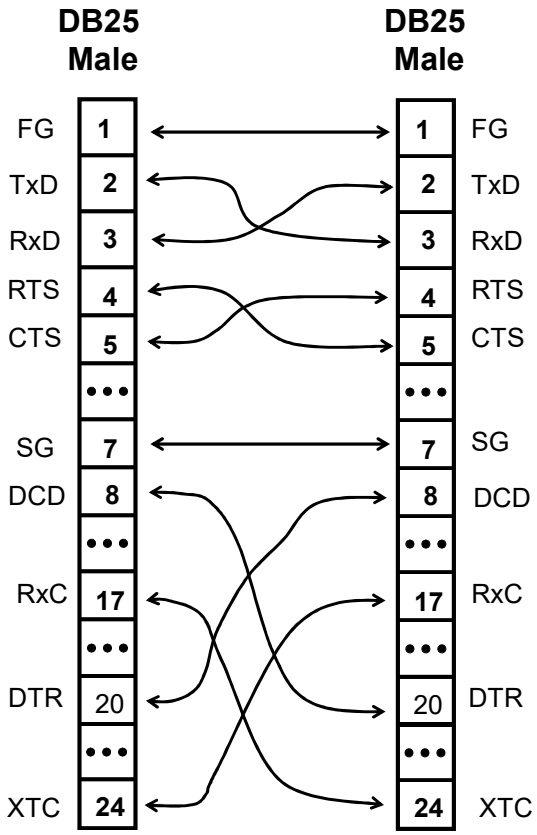
5.3 DB25 Null Terminal for RS-232

The **T-40S** and the **T-40L*** have DB25 multimode ports that are native DCE. It is sometimes necessary to interface with another DCE such as a modem or network switch. In that situation, a Null Terminal is used.

If the protocol to be utilized is synchronous with normal clocks, it is important that the NULL Terminal supports synchronous clocks.

The following is a diagram of a NULL terminal that supports synchronous clocks.

T-40S RS-232 CrossOver Cable



These NULL terminal adapters are also used with the legacy SAM8 and SAM16 multiplexors. The AT&T **#846-384923** NULL terminal is such an adapter.

In addition to using the NULL terminal, a modem must be configured so the RxC and TxC are **in phase** with each other. That configuration is modem specific and is covered in a separate app note.

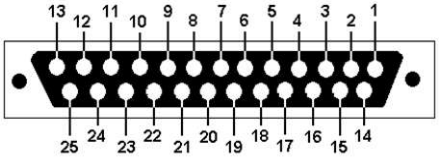
5.4 DB25 Multimode Cabling

5.4.1 DB25 Multimode Port Definition

The **T-40S** serial interface is multi-mode. The four **T-40L*** may also have multimode interfaces. As such, they are software configurable for RS-232, V.35, and RS-530 modes. The multi-mode ports are also software configurable for DCE and DTE operation. Each port is a native DCE and may be crossed for DTE operation.

The following diagram depicts the multi-mode serial pin-out on the DB25:

T-40S Multi-Mode Serial Port



Pin	Function	EIA	RS-232	V.35	RS-530A
1	Common Chassis Ground	Shield	*	*	*
2	DTE Transmitted Data	BA	U	A+	A+
3	DTE Received Data	BB	U	A+	A+
4	Request to Send	CA/CJ	U	U	A+
5	Clear to Send	CB	U	U	A+
6	Data Set Ready	CC	U	U	U
7	Signal Ground	AB	*	*	*
8	Data Carrier Detect	CF	U	U	A+
9	Receiver Timing (Rx Clock)	DD		B-	B-
10	Data Carrier Detect	CF			B-
11	External Transmit Timing	DA		B-	B-
12	Transmit Timing (Tx Clock)	DB		B-	B-
13	Clear to Send	CB			B-
14	DTE Transmitted Data	BA		B-	B-
15	Transmit Timing (Tx Clock)	DB	U	A+	A+
16	DTE Received Data	BB		B-	B-
17	Receiver Timing (Rx Clock)	DD	U	A+	A+
18	T-40S Serial Console Receive	*	U	U	U
19	Request to Send	CA/CJ			B-
20	Data Terminal Ready	CD	U	U	U
21	Remote Loopback	RL	U	U	U
22	RS-530 DSR B- (not RS-530A)	RI / CC			See Note
23	RS-530 DTR B- (not RS-530A)	CD			See Note
24	External Transmit Timing	DA	U	A+	A+
25	T-40S Serial Console Transmit	*	U	U	U

U → Unbalanced A+ → Balanced Positive B- → Balanced Negative

5.4.2 Winchester-34 V.35 DCE Cable

The DCE RS-530A standard pin layout of the DB25 is also described in the previous section. In this section, the wiring to a Winchester 34 interface for a V.35 interface is described. This can be achieved with a low cost off-the-shelf wiring adapter, off the RS-530 to V.35 shelf cable, or by a custom cable. It should be warned that there are many different wiring adapters and the cross-connects must be verified. The author has checked the FA058 (with female V.35 sockets), and FA059 (with male V.35 pins). These adapters are made by Black Box, and others.

Similar adapters are available from other sources with the same wiring.

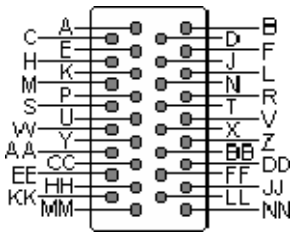
Please be aware that the FA058 / FA059 mentioned in this section; and the wiring in this section are V.35 DCE only. They should not be used for RS-530A interfaces as some pins on V.35 are unbalanced, and balanced on RS-530A.

FA058 Wiring Adapter

The Winchester-34 layout for V.35 is as follows:

V.35 Female Winchester-34

A – Chassis Ground
C – Request to Send
E – Data Set Ready
P – DTE Transmitted Data (A+)
S – DTE Transmitted Data (B-)
U – Terminal Timing (A+)
W – Terminal Timing (B-)
Y – Transmit Timing (A+)
AA – Transmit Timing (B-)



B – Signal Ground
D – Request to Send
F – Data Carrier Detect
H – Data Terminal Ready
R – DTE Received Data (A+)
T – DTE Receive Data (B-)
V – Receive Timing (A+)
X – Receive Timing (B-)

The following table indicates the connections between the multi-mode DB25 and Winchester-34 header. The adapters described are not cross-over; so the definition is the same regardless of whether it has male or female V.35 face. The cable is DCE.

DB25 Pin (Male)	Winchester-34	Note
1	A	Common Ground
7	B	Signal Ground
6	E	Data Set Ready (U)
4	C	Request to Send (U)
5	D	Clear to Send (U)
8	F	Data Carrier Detect (U)
20	H	Data Terminal Ready (U)
2	P	DTE Transmit Data (A+)
14	S	DTE Transmit Data (B-)
3	R	DTE Receive Data (A+)
16	T	DTE Receive Data (B-)
24	U	External Transmit Timing (A+)
11	W	External Transmit Timing (B-)
17	V	Receiver Timing – Rx Clock (A+)
9	X	Receiver Timing – Rx Clock (B-)
15	Y	Transmit Timing – Tx Clock (A+)
12	AA	Transmit Timing – Tx Clock (B-)

5.5 Discrete Port Cabling

The **T-40** Series supports discrete port operations. A discrete port is used for telemetry purposes called scan and control points. These points may have common or isolated grounds dependent on the cabling.

The RJ45 serial ports on the 40 port **T-40** platform, or on the three port **T-40SR;** when used as a discrete; each supports three points. Up to 120 scan points on the platform.

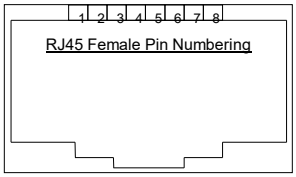
The DB25 serial ports on the 4 port **T-40L*** each supports five scan points, or up to 20 on the platform.

The **T-40S** single DB25 port may be configured as a discrete with five scan points.

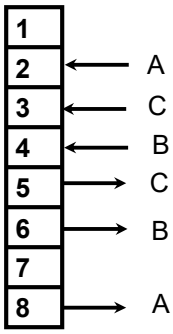
5.5.1 RJ45 Scan Point Cabling

The **T-40** port interfaces are via an RJ45 connection that implements RS-232 level interfaces. These are reused for scan points per the following pinout:

T-40 Scan Point RJ45 Wiring



RJ45

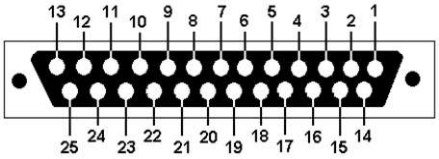


Each of the scan point circuits has an emitter and a receiver. These are connected to the scan point closure switch to create the scan point circuit. The voltage levels on these circuits are RS-232 level.

5.5.2 DB25 Scan Point Cabling

The **T-40S** and **T-40L*** scan points use EIA circuits on each Multi-Mode serial port to implement 5 scan points. The T-40 series multi-mode DB25 interface will use the EIA RS-232 voltage levels when used for scan point interfaces.

T-40S Multi-Mode Serial Port

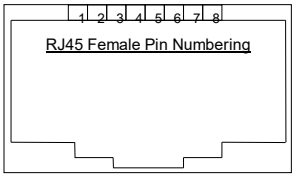


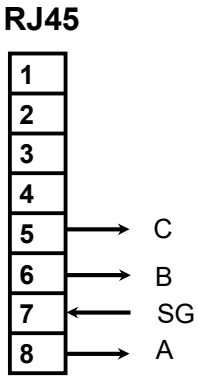
Pin	Nominal Function		Scan Point
1	Common Chassis Ground		*
2	DTE Transmitted Data	←	A
3	DTE Received Data	→	A
4	Request to Send	←	B
5	Clear to Send	→	B
6	Data Set Ready	→	E
7	Signal Ground		
8	Data Carrier Detect	→	C
9	Receiver Timing (Rx Clock)		
10	Data Carrier Detect		
11	External Transmit Timing		
12	Transmit Timing (Tx Clock)		
13	Clear to Send		
14	DTE Transmitted Data		
15	Transmit Timing (Tx Clock)		
16	DTE Received Data		
17	Receiver Timing (Rx Clock)	→	D
18	T-40S Serial Console Receive		
19	Request to Send		
20	Data Terminal Ready	←	C
21	Remote Loopback	←	E
22	RS-530 DSR B- (not RS-530A)		
23	RS-530 DTR B- (not RS-530A)		
24	External Transmit Timing	←	D
25	T-40S Serial Console Transmit		

5.5.3 RJ45 Control Point Cabling

The T-40 port interfaces are via an RJ45 connection that implements RS-232 level interfaces. These are reused for control points per the following pinout:

T-40 Control Point RJ45 Wiring





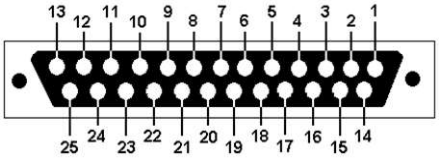
Notes:

- Pin 7 is the Signal Ground, and the return for any control points on the port.
- Signal Ground is not used for scan points via relay closures. However, they must be used for control points to close the circuit.
- Control points must have an in circuit diode to avoid reverse voltage. Consult the discrete port application note for more information.

5.5.4 DB25 Control Point Cabling

The **T-40S** and **T-40L*** control points use EIA circuits on each Multi-Mode serial port to implement 5 control points. The T-40 series multi-mode DB25 interface will use the EIA RS-232 voltage levels when used for discrete point interfaces.

T-40S Multi-Mode Serial Port



Pin	Nominal Function		Control Point
1	Common Chassis Ground		*
2	DTE Transmitted Data		
3	DTE Received Data	→	A
4	Request to Send		
5	Clear to Send	→	B
6	Data Set Ready	→	E
7	Signal Ground	←	SG
8	Data Carrier Detect	→	C
9	Receiver Timing (Rx Clock)		
10	Data Carrier Detect		
11	External Transmit Timing		
12	Transmit Timing (Tx Clock)		
13	Clear to Send		
14	DTE Transmitted Data		
15	Transmit Timing (Tx Clock)		
16	DTE Received Data		
17	Receiver Timing (Rx Clock)	→	D
18	T-40S Serial Console Receive		
19	Request to Send		
20	Data Terminal Ready		
21	Remote Loopback		
22	RS-530 DSR B- (not RS-530A)		
23	RS-530 DTR B- (not RS-530A)		
24	External Transmit Timing		
25	T-40S Serial Console Transmit		

Notes:

- Pin 7 is the Signal Ground, and the return for any control points on the port.
- Neither the Signal Ground, nor the Frame Ground, is used for scan points via relay closures. However, they must be used for control points to close the circuit.
- Control points must have an in circuit diode to avoid reverse voltage. Consult the discrete port application note for more information.

6 Appendix A – HW Identification Script

The following is a simple shell script that uses SNMP MIB-II to determine the hardware series of the T-40 device. The script is included with the utilities host support package.

```
#
# T40Type: This shell outputs the HW type and series of the
#          found at the specified IP address.
#          Usage:
#            T40Type < IP Address >
#
# Note #1: The COMMUNITY String should be assigned properly.
#          The default in this shell is "public", but many times
#          that community is intentionally disabled by security.
#
COMM=public

#
# Check to make sure there is an argument.
# Can't really do an IP address verification in a shell.
#
if [[ $1 == "" ]];
then
        echo "Usage: T40Type <IP Address of Device>"
        exit 1
fi
IPADDR=$1

#
# Get the SNMP MIB-II System Description
# -- Use to determine HW type & Series.
#
output=`snmpget -v1 -c ${COMM} -Ov ${IPADDR} 1.3.6.1.2.1.1.1.0`

#
# Check the output for the appropriate indications of
# the Hardware Series.
#
if [[ ${output} == *"T-40 T-40 Rev. 2023 Hardware"* ]];
then
        echo ${IPADDR} is a T-40 AM11
        exit 0
fi

if [[ ${output} == *"T-40 T-40 Rev. 2021 Hardware"* ]];
then
        echo ${IPADDR} is a T-40 AM8
        exit 0
fi


if [[ ${output} == *"T-40 T-40 Rev. 2017 Hardware"* ]];
then
        echo ${IPADDR} is a T-40 AM5
        exit 0
fi

if [[ ${output} == *"T-40 T-40 Rev. 2011 Hardware"* ]];
then
        echo ${IPADDR} is a T-40 AM2
        exit 0
fi
```

```
if [[ ${output} == *"T-40 T-40S Rev. 2012 Hardware"* ]];
then
        echo ${IPADDR} is a T-40S AM2
        exit 0
fi

if [[ ${output} == *"T-40 T-40SR Rev. 2021 Hardware"* ]];
then
        echo ${IPADDR} is a T-40SR AM2
        exit 0
fi

if [[ ${output} == *"T-40 T-40L Rev. 2013 Hardware"* ]];
then
        echo ${IPADDR} is a T-40L AM1
        exit 0
fi

if [[ ${output} == *"IP-MPA IP-MPA Rev. A Hardware"* ]];
then
        echo ${IPADDR} is an IP-MPA AM1
        exit 0
fi

#
# Didn't recognize the T-40. Possibly it's something else.
#
echo ${IPADDR} "is not a T-40 Series Device."
echo "Output returned from SNMP is " ${output}
exit 1
```

7 AUTHOR

Comments and Questions regarding this document, or the products covered within this document, should be addressed to the author.

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