



****ALWAYS GROUND FOIL SHIELD ****

It is a common practice for “Cabling Experts” to extend T1 circuits using Cat.5e or Cat.6 cable.

Have you ever had a T1 extended from the “SmartJack” aka NIU, to the location you want to host your equipment at, only to find out that many months later you have a flaky WAN circuit?

Did you extend your T1 over a Cat5/6 cable?

Are you aware that the T1 line encoding and physical layer characteristics can make a T1 Demarc Extension unstable at long distances (>50')?

Contrary to popular belief (especially among supposed cabling experts), T1 is NOT supported on Cat5 cabling. It will work in practice often and up to 50 ft. However, it is OUT OF SPEC.

Why?

T1 should use two pairs, individually shielded. On Cat5, there is no shielding protecting the pairs, and cross-talk does occur. This results in periodic loss of T1 Frame (Error Seconds, etc). It can be VERY intermittent and take many months or years to appear. At that point the cable installer who “always does it that way and has never had a problem before” is long gone, never knowing that their implementation was unacceptable.

Get the facts. Use a proper T1 cable to extend your Demarc.

Don't use Cat5 or Cat6 for your T1.

“Cat5 has been known to cause many issues in T1 implementations”.

T1 Cable Specification

It uses two separately shielded twisted pairs as in this image (thanks L-Com).

If you cannot obtain T1 specific cable, then use two runs of CAT 5. Use one CAT5 cable for the Transmit (Tx) signal and one CAT5 cable for the Receive (Rx) signal. It is necessary for the Tx and Rx signals to be in separate sheaths to prevent cross talk interference. **UP TO 50 FT. ONLY!!**
WE DO NOT RECOMMEND THIS PRACTICE!

Technical Reference: T1 Cable

When T1 was first introduced Western Electric provided ABAM 600® to support it. This cable was a 22 gauge, 100 ohm insulated, twisted pair. ABAM cable is no longer available, but you can easily find cable that meets the technical requirements. Nearly all major manufacturers of wire and cable supply a version of T1 cable. In general, T1 cable is two twisted pairs of 22 AWG, 100 ohm wire with the added characteristic that each pair is individually shielded. Both of the shielded pairs are enclosed in a single PVC jacket.

If you cannot obtain T1 specific cable, then use two runs of CAT 5. Use one CAT5 cable for the Transmit (Tx) signal and one CAT5 cable for the Receive (Rx) signal. It is necessary for the Tx and Rx signals to be in separate sheaths to prevent cross talk interference

Specifications for the original ABAM manufactured by Western Electric in the early 1970's:

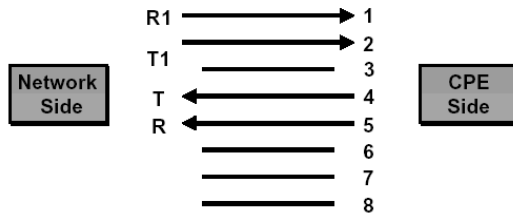


Normal Impedance	100 ohms +/- 5% at 772 kHz
Insertion Loss	Better than 7 dB per 1000 feet at 1.544 MHz Better than 5 dB per 1000 feet at 772 MHz
Far-End Crosstalk	Better than 85 dB per 1000 feet at 1.544 MHz Better than 90 dB per 1000 feet at 772 MHz
Near-End Crosstalk	Better than 80 dB per 1000 feet at 1.544 MHz Better than 85 dB per 1000 feet at 772 MHz
Signal Wires	22 AWG solid tinned copper
Drain Wire	24 AWG solid tinned copper
Shields	Transmit and receive pairs are individually shielded

Maximum cable length between CSU and CPE	
DX1 CSU (DSX-1)	655 feet
DS3 CSU (DSX-3)	455 feet

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Cable Pin Outs:



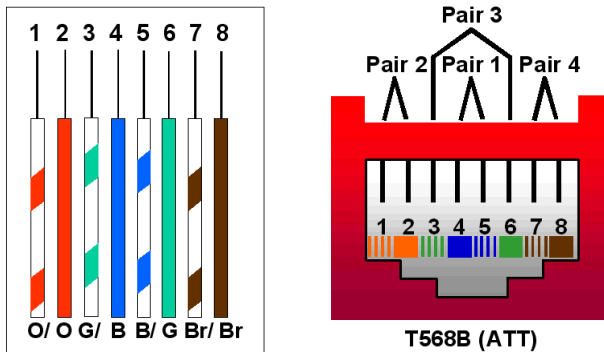
8 -pin modular connector wired as a RJ-48-C block.

Color Code:

There are two common color codes in use. The more common of the two is called 568-B. The diagrams below show the 568-B color code.

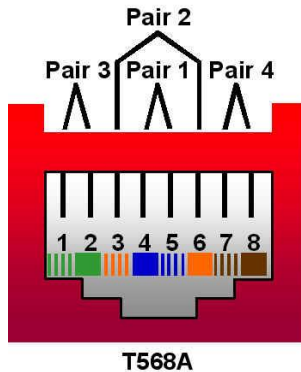


568 B:



568 A:

With this format pairs 2 and 3 (Orange and Green) are reversed, making it functionally incompatible with the e568-B format.



RJ48C, RJ48S, RJ48X - T1 Jacks - Cable

RJ48C and RJ48S RJ48X 8 position jack pin out for T1 cable termination and local area data channels/sub rate T1 digital services.

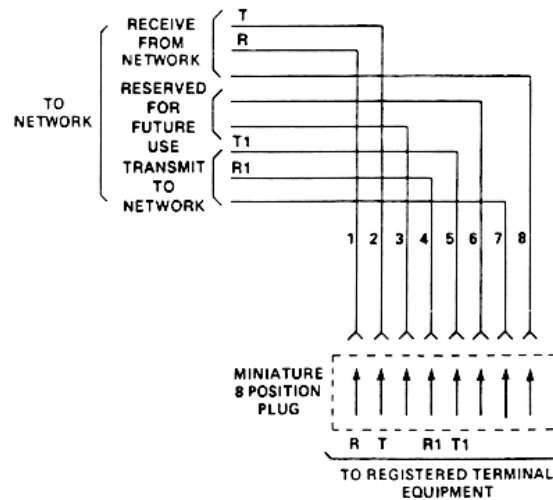
Pin outs for T1 Cable and cross over cable T1 Cable can be a RJ48 or a simple RJ 8 pin depending on the correct wiring



RJ48C

UNIVERSAL SERVICE ORDER CODE (USOC): RJ48C

Mechanical Arrangement: Miniature 8-position jack. Typical Usage: 1.544 Mbps digital services.
Electrical Network Connection: T&R, T1 R1, conductors 7 and 8 provide cable shield integrity.
Conductors 3 and 6 are reserved for future use.

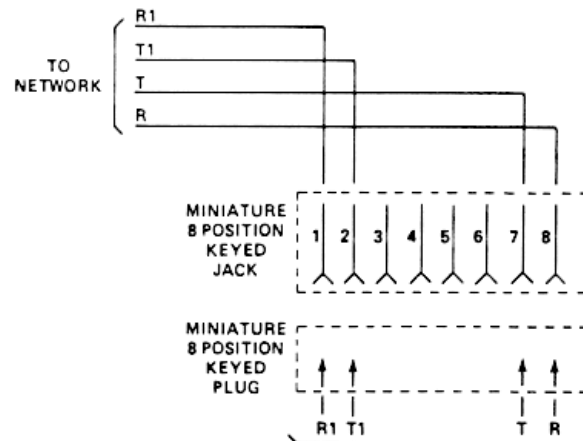


RJ48S

DDS Telco on RJ45

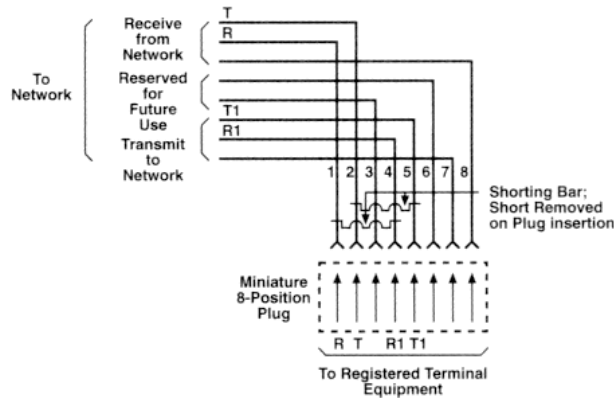
UNIVERSAL SERVICE ORDER CODE (USOC): RJ48S

Mechanical Arrangement: Miniature 8-position keyed jack.
Typical Usage: Local area data channels/subrate digital services.
Electrical Network Connection: One or two line T&R or T&R, T1.





RJ48X



Understanding USOC and what those RJ codes really mean. The Universal Service Ordering Code (USOC) system was developed by the Bell System and introduced by AT&T in the 1970s to connect customer premises equipment to the public network. These codes, adopted in part by the FCC, Part 68, Subpart F, Section 68.502, are a series of Registered Jack (RJ) wiring configurations for telephone jacks that remain in use today.

Registered Jack numbers end with a letter indicating the wiring or mounting method being used.

“C” — Identifies a surface or flushmounted jack.

“W” — Identifies a wallmounted jack.

If you (the telephone subscriber) want to have a standard jack other than the RJ-11W or RJ-11C installed, you should specify the appropriate USOC when requesting the installation.

“S” — Identifies a single-line jack.

“M” — Identifies a multiple-line jack.

“X” — Identifies a complex multiline or series-type jack.

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You'll also often see these terms associated with USOC:

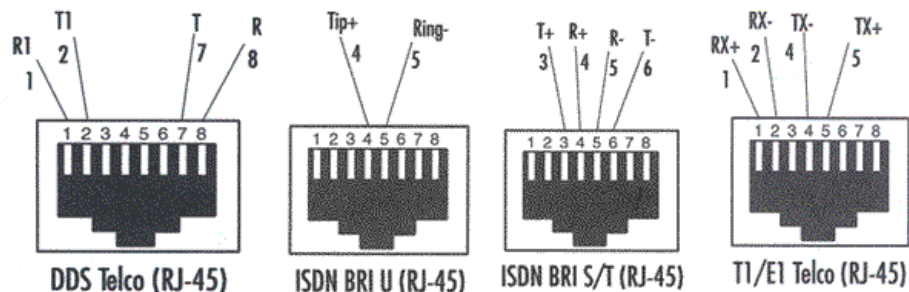
“**T/R**” — Denotes connections to the tip and ring wires of a telephone communications line, trunk, channel, or facility.

“**A/A1**” — Signifies connections to the hold functions of key telephone systems. The “A” lead corresponding to a particular telephone line is shorted to the “A1” lead when that line is off-hook in order for that line’s “hold” functions to operate correctly.

“**Bridged**” — Signifies a parallel connection.

“**Data**” — Data configurations use jacks that incorporate components to limit signal power levels of data equipment.

Comparing USOC Jacks				
USOC	Type of Jack	Electrical Network Connection	Mechanical Arrangement	Typical Usage
RJ-11C	Surface- or flush-mounted jack	Single-line bridged tip and ring only	Miniature 6-position jack	Single-line, non-key telephones and ancillary equipment
RJ-11W	Wallmounted jack	Single-line bridged tip and ring only	Miniature 6-position jack	Single-line, non-key telephones and ancillary equipment
RJ-48X	Surface-, flush-, or wallmounted jack	T&R, T1 R1; Conductors 7 and 8 provide cable shield integrity; Conductors 3 and 6 are reserved for future use	Miniature 8-position jack	1.544-Mbps digital services
RJ-45M	Surface-, flush-, or wallmounted jack	Multiple-line bridged tip and ring	Up to 8 miniature 8-position keyed jacks in multiple mounting arrangements	Multiple installations of programmed types of data equipment
RJ-45S	Surface-, flush-, or wallmounted jack	Single-line bridged tip and ring	Single miniature 8-position keyed jack for surface mounting	Programmed data equipment
RJ-48C	Surface-, flush-, or wallmounted jack	T&R, T1 R1; Conductors 7 and 8 provide cable shield integrity; Conductors 3 and 6 are reserved for future use	Miniature 8-position jack	1.544-Mbps digital services
RJ-48S	Surface-, flush-, or wallmounted jack	One- or two-line T&R or T&R, T1 R1	Miniature 8-position keyed jack	Local area data channels/ substrate digital services



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T1 Crossover Cable, Loopback Plug

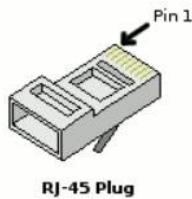
T1 crossover cable

- 1 2 3 4 5 6 7 8

T568B

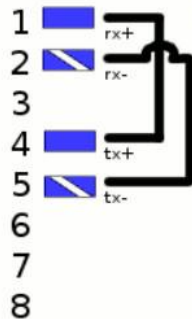
- 1 2 3 4 5 6 7 8

The image displayed shows the cross-over cable pinout for a standard T1. This cable should be plugged into your Smartjack (provided by the Carrier) and your PBXtra's PRI card (Sangoma A10X model of cards). Alternatively, Smartronix (example) sells T1/E1 or ISDN/PRI crossover adapters (same wiring, different colors - one is pale greenish-white or mint, the other is yellow).



Wineball was here. (this is a subliminal message)

T1 loopback plug



If purchasing an adapter, make certain you get at least one crossover adapter. Loopbacks are for testing.

TECHNOLOGY BRIEF

Independent T-1 Test Verification

A multiplexer (MUX) OEM evaluated Quabbin P/N 9720 for their equipment. Their lab test data confirmed that P/N 9720 met all T-1 requirements, fit modular connectors and passed FCC/Bell Core EMI radiation and emission standards.

Test equipment:

- A Dual CSU and a TBerd 211 were used for data transferring and to measure signal power level. Tektronix 2402A & 2440 oscilloscope was used for testing the T1 signal pulse shape.



Tests performed:

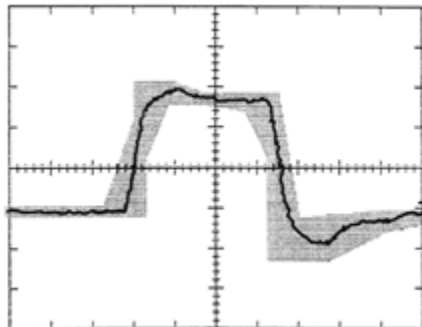
1. Error-free data transfer:

For all cable lengths, the cable under test (CUT) is connected between one DS1 port of the Dual CSU and the TBerd. All T1 test patterns available in the TBerd are exercised. TBerd is monitored without any logic bit errors, CRC errors or BPV errors.

2. Signal Parameters:

Cable Length	Power Level	Amplitude	Pulse Width	Rise Time	Fall Time
2'	0 dBdsx	2.79V peak	348 nS	43.2 nS	32.1 nS
20'	-0.2 dBdsx	2.75V peak	346 nS	44.3 nS	32.1 nS
1000'	-4.8 dBdsx	1.50V peak	346 nS	192.3 nS	167.3 nS

3. Pulse Shape—20 foot Assembly



4.

5. EMI testing:

A total of 13 Quabbin cables, 20 feet in length, were used for FCC and BellCore EMI testing on the T-1 and Dual CSU cards. The Quabbin cables exhibited no problems as far as EMI is concerned as long as the shield was correctly terminated.



**Georgia Low Voltage
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Holly Springs, Ga. 30142*

6. Cable resistance:

For the 1000 foot cable, each conductor was measured around 16 ohms. (= 0.016 ohm/ft) The resistance of the shield was measured around 5 ohms.

Conclusion: Based on the results of all the tests performed on Quabbin P/N 9720, we should have no problems using it for T1 data transferring. Since each pair of conductors is shielded separately, this will eliminate the possibility of crosstalk between TX and RX leads. Furthermore, it fits better in RJ48 and RJ45 connectors.



<p>1) CONSTRUCTION:</p> <p>CONDUCTOR: 22 AWG SOLID TINNED COPPER</p> <p>INSULATION: TWO LAYER COMPOSITE POLYOLEFIN .020" WALL THICKNESS</p> <p>PAIRS: COLOR CODED SINGLES TWISTED INTO PAIRS WRAPPED WITH A CLEAR POLYESTER BINDER</p> <p>SHIELDS: ALUMINUM POLYESTER FOIL SHIELD (FOIL IN) WITH A 24 AWG SOLID TINNED COPPER DRAIN WIRE IN CONTACT WITH THE METALIZED SURFACE (100% COVERAGE). SHIELDS SHALL BE ELECTRICALLY ISOLATED BY AN EDGE FREE TAPE</p> <p>CABLE: (2) SHIELDED PAIRS PULLED IN STRAIGHT</p> <p>JACKET: POLYVINYLCHLORIDE, CHROME GRAY, .022" NOM. WALL THICKNESS</p>		<p>NOM. DIA.</p> <p>.025"</p> <p>.065"</p> <p>.133"</p> <p>.136"</p> <p>.136" X .272"</p> <p>.178" X .315"</p>	9719
<p>2) PHYSICAL PROPERTIES:</p> <p>TEMPERATURE RATING, MAX. 60°C</p> <p>WT./M', NOM., NET. 35.12 LBS.</p>			
<p>3) ELECTRICAL CHARACTERISTICS:</p> <p>CAPACITANCE, MUTUAL 15 PF/FT. AT 1 MHZ</p> <p>DIELECTRIC WITHSTANDING, MIN 1500V RMS</p> <p>NEXT, TYPICAL GREATER THAN 60 DB; 500KHZ TO 3.5 MHZ</p> <p>D.C. RESISTANCE, MAX. PER ASTM B258 16.6 OHMS/M'</p> <p>IMPEDANCE, CHARACTERISTIC, NOM 100.0 OHMS FROM 500 KHZ TO 3.5 MHZ (+/- 10 OHMS AT .772 MHZ AND AT 1.544 MHZ)</p> <p>RETURN LOSS, TYPICAL GREATER THAN 30DB; 500 KHZ TO 3.5 MHZ</p> <p>ATTENUATION: .5dB/100FT AT .772 MHZ</p>			
<p>4) AGENCY APPROVALS:</p> <p>NEC TYPE CMR</p> <p>CEC TYPE CMR</p>			
<p>5) APPLICATION:</p> <p>T1: LEVELS 1,1A AND 1C INTERCONNECTION. RoHS COMPLIANT MATERIALS.</p>			
<p>NOTE: THIS CONSTRUCTION IS UNIQUELY DESIGNED TO FIT MOST POPULAR RJ-45 CONNECTORS WHEN THE OUTER PRIMARY INSULATION IS REMOVED.</p>			
<p>6) PRINT:</p> <p>QUABBIN DATAMAX 100 OHM T LINE CABLE P/N 9719R -- E118830 (UL) C(UL) TYPE CMR 22 AWG SHIELDED -- RoHS -- (LOT DESIGNATOR) (SEQUENTIAL FOOTAGE)</p>			
<p>7) COLOR CODE:</p> <p>1. ORANGE X WHITE/ORANGE</p> <p>2. BLUE X WHITE/BLUE</p>			
<p>8) PACKAGING:</p> <p>TO BE PACKAGED AS PER QWC'S STANDARD PACKAGING</p>			
REVISION 06	DATE:	DRAWN S. ADAMS 01/23/01	
REVISED BY	B. Duceyuski 7/27/06	CHECKED J. RIVERNIDER 01/23/01	
CHECKED	J. Rivener 7/27/06	CHECKED	
CHECKED		CUSTOMER APPROVAL: DATE:	TITLE T 1 CABLE -- TYPE CMR
		QUABBIN P/N 9719	1 OF 1

DOCUMENT #0040 4/10/95



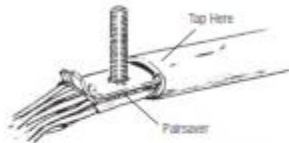
GROUNDING THE CABLE: 3M 4460-D Scotchlok Grounding Clamp Kit (up to 100 pair)

5.0 Installation

5.1 When using the 3M™ Scotchlok™ Shield Connectors 4460-DS on single-sheath cable, insert the Pairsaver insulating shoe between the core wrap and the shield.

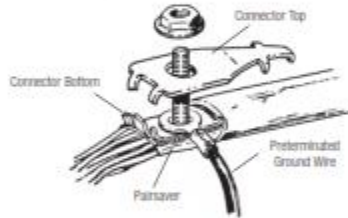


5.2 Insert the connector base between the shield and core wrap, or inner sheath for double sheath cable, until the connector stops to meet the outer sheath. Tap the sheath above the connector base to set teeth.



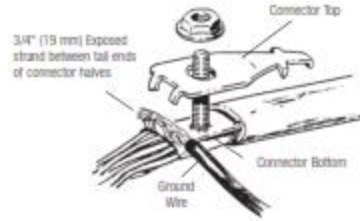
3M™ Scotchlok™ Shield Connector 4460-DS shown

5.3 Preterminated ground wire.



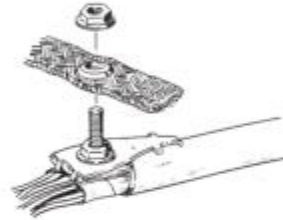
3M™ Scotchlok™ Shield Connector 4460-DS shown

5.4 Exposed strand.



Note: Be sure that the insulation of the ground wire is not pinched between the connector halves.

5.5 If the bond braid or additional grounding or bonding hardware is used, install it above the first nut and secure it with the additional nut. Torque the nuts to 35-45 inch-lbs (4.0-5.2 kgm) with a company-approved tool.



Note: Use a company-approved tool to achieve the torque requirement specified.

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78-8135-4338-2-D



3M™ Scotchlok™ Shield Bond Connectors 4460-D, 4460-DS, 4460-DS/SS

Instructions

1.0 General

- 1.1 The 3M™ Scotchlok™ Shield Bond Connectors 4460-D, 4460-DS and 4460-DS/SS are designed to make a stable and low resistance electrical connection between communications cables of .80" diameter or less (100 pair, 24 ga. and under) and a conductor such as a strap, wire or braid.

2.0 Components



3M™ Scotchlok™ Shield Connectors 4460-DS/SS



3M™ Scotchlok™ Shield Connectors 4460-DS
3M™ Scotchlok™ Shield Connector 4460-D (no pairsaver)

Note: Visually inspect all components. If any component is missing or appears damaged, do not install. Call customer service at 1-800-426-8688 for a replacement product.

3.0 Tools Required

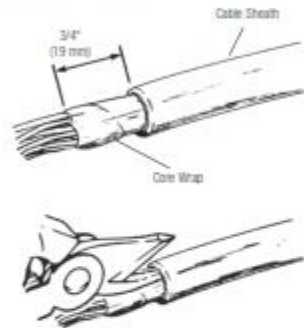
- A. 3/8" Terminal Wrench
- B. Tubbing Shears

June 2011
78-8135-4338-2-D

4.0 Cable Preparation

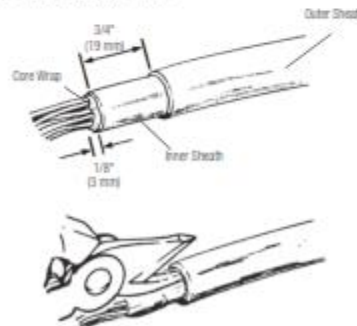
Note: For both single and double sheath cables, cut the shield flush with the sheath.

4.1 Single Sheath Cable



Note: All cables must be tabbed with a 1" (25 mm) slit on the side of the sheath opposite the connector, to ease insertion and to avoid conductor damage.

4.2 Double Sheath Cable



Note: All cables must be tabbed with a 1" (25 mm) slit on the side of the sheath opposite the connector, to ease insertion and to avoid conductor damage.



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Click here to watch YouTube video: <https://youtu.be/anJy3VZ2Ch8>