LocalTalk Cable: Specifications

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TOPIC -----

Here are some specifications, and some questions and answers about LocalTalk networking issues.

DISCUSSION -----

Topology

Serial bus

Wiring

Shielded, twisted-pair

Signaling Standard

EIA standard RS422, balanced voltage

Signing Speed

230.4 Kbits/sec.

Signal Encoding

FMO (biphase space)

Frame Format

SDLC (Synchronous Data Link Control)

Maximum number of Connections per Network Segment

32

Node Identification

Self-configuring; no user action required

Architecture

Open

Connection

Passive drops

Access Method

Carrier-sense, multiple-access with collision avoidance (CSMA/CA)

• QUESTIONS & ANSWERS

Q) I've been experimenting with LocalTalk networking running inside metal conduit. My tests show that the LocalTalk network would not work at 300 feet within this metal conduit. The wire was Belden shielded twisted-pair apparently meeting Apple specifications.

1) Is Apple LocalTalk affected by running through metal conduit?

2) If diameter is important, how would 2-inch conduit affect it?

3) Does Apple publish a network installation/design guide with this issue in mind?

A) From the sounds of it, the conduit is affecting the impedance/capacitance of the LocalTalk cabling. Also, having the cable lying on the metal conduit could affect the impedance/capacitance. Also, consider these questions: Is the conduit grounded? Is it grounded to the same source as the shield of the LocalTalk cable?

The specification for LocalTalk (included below) only address what you need for the cable. If an external source changes any of those parameters (in this case, the impedance/ capacitance is most likely being affected), then the cable would not meet the required specifications. Apple does not test LocalTalk cabling under multiple conditions (in conduit, by large grounds, by power sources), because it would be difficult--if not impossible--to anticipate all the different possible environmental conditions that could affect a cable.

Other than "Inside AppleTalk," Apple does not publish any information about LocalTalk cables. We did notice that the cabling specification 062-0190-B is not included in the second version of "Inside AppleTalk."

After you verify that you are using the proper cable and connectors, see if the cable will work over the same distance when it is outside the conductor. If there are fire codes that require conduit installation, would Teflon cable satisfy the requirement?

Here are some basic specs:

- Cable Specification (sheet 5 of 10, drawing number 062-0190-B)
- Conductors: 22 AWG stranded 17 ohm per 300 meters
- Shield: 85% coverage braid
- Impedance: 78 ohm
- Capacitance: 68 pF per meter
- Rise time: 175 ns 0 to 50% at 300 meters
- Diameter: 4.7 mm (0.185 inches) maximum

Q) Why does Apple use a shielded pair wire (LocalTalk) when other manufacturers, such as Farallon, can perform the same function without shielding?

A) During the evolution of AppleTalk, a major concern for Engineering was the need to meet FCC Class B specifications for radiated emissions. To meet this specification using RS-422-type signalling, it is necessary to use shielded cable. This shielded cable also reduced EMI with the signal on the cable itself (incoming interference). This was all done in the interest of both the FCC specification and the need for data integrity in a variety of network installation locations. The ground (shield) prevents excessive RFI, while a resistor/capacitor combination reduces ground currents while offering a low-impedance path for high-frequency noise, further reducing EMI/RFI. Telephone wiring is suitable for use in normal environments, but in some cases, network performance suffers because of the lack of shielding. There have been instances where electrical interference has compromised the integrity of data on PhoneNET.

Q) With respect to the first question, why is the LocalTalk network length limited to 1000 feet?

A) The 32-node/1000-foot limit is a recommendation. It is specific to LocalTalk networks using this cabling scheme. The considerations for this limit are the average traffic generated by these nodes and the physical transmission limitations of LocalTalk. With 32 LocalTalk Connection Modules attached to a LocalTalk network, there is a very specific drop in the signal level on the network based on the characteristic impedance of the cable, the impedance of the secondary of the transformer, and the distance over which this signal must travel. The recommended limits are based on this maximum signal level drop over this distance with this number of nodes. More distance and/or more nodes could reduce the network signal below the acceptable data reliability limits, as well as the acceptance range of the receiver chips in the system.

From a traffic standpoint, only active nodes have an effect on the performance. However, both active and nonactive workstations affect the electrical characteristics of the network because each LocalTalk connector box (transformer-isolated) puts another load on the network, regardless of whether the workstation is on.

Q) What is the impedance of the LocalTalk cable? (Termination is documented in “Inside AppleTalk” as 100-ohm resistor, yet available

AppleLink information seems to indicate 78 ohms is the impedance of the cable. Isn't the terminator supposed to match the cable for minimal signal reflection?)

A) The impedance of the LocalTalk cable is 78 ohms, and the termination resistor is 100 ohms. To quote “Inside AppleTalk,” "A 100-ohm resistor is used, even though the characteristic impedance of the line is 78 ohms, because it gives adequate termination and minimizes resistive losses." Our interpretation of this statement is: If there is a 1:1 impedance match across the transformer, there will be maximum signal transfer through the transformer, which would reduce the signal level on the network side of the transformer. If there is too great a difference in the values of the terminator and the cable, once again there will be signal losses--this time on the node side of the transformer because of the mismatch. By compromising on 100 ohms, losses from perfect impedance matching and losses due to gross mismatch are minimized.

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