

7840102 ITS – NETWORK DEVICES  
COMMENTS FROM INTERNAL/INDUSTRY REVIEW

\*\*\*\*\*

James T. Barfield, P.E.  
D3 Secretary  
850-415-9200

**Comment: (12-29-10) (submitted by Jennifer Williams)**

Based on my experience working in the networking field as a Systems Administrator, computer network/radio/electronics service technician, I offer the following observations to the specifications which have been generalized by references to EIA/TIA conformance statement contained in Section “784-2.2.3 Network Interface”.

NOTES - The EISA standard for the “5E” category includes a mandated conductor size of at least 24 AWG with termination strands untwisted a maximum of ½” (additional untwisted end lengths results in increased crosstalk and throughput data reduction). Cat5E/Cat6 - RJ45 connectors which employ load bars could ensure the “5E” specifications are met however are more tedious to assemble (if making up a cable).

\*\*\*It should be noted that there is an abundance of 26AWG cabling which is currently on the market which is a smaller gauge than the EISA specified 24 AWG minimum for CAT5E cabling resulting in poor performance in longer cable runs.

The smaller gauge would have a higher attenuation rating than that of 24 AWG for a specific cable length resulting in poor performance when cabling is at or near the maximum specified length.

For power over Ethernet applications, the smaller 26 AWG cabling limits the current carrying capacity (of the cabling) as compared to true 24AWG cabling.

When viewing the table below one should consider that the maximum cable run length for CAT 5E cable is 100meters (328 feet).

Employing cabling with less than standard mechanical and electrical specifications can result in wasted hours in troubleshooting network issues (latency, packet collisions/crosstalk/dropped packets, excessive voltage drop for PoE powered equipment, etc.).

FIGURE 1 - WIRE GAUGE ATTENUATION / VOLTAGE DROP TABLE

AWG gauge	Conductor Diameter Inches	Conductor Diameter mm	Ohms per 1000 ft.	Ohms per km	Maximum amps for chassis wiring	Maximum amps for power transmission
20	0.032	0.8128	10.15	33.292	11	1.5
21	0.0285	0.7239	12.8	41.984	9	1.2
22	0.0254	0.64516	16.14	52.9392	7	0.92
23	0.0226	0.57404	20.36	66.7808	4.7	0.729
24	0.0201	0.51054	25.67	84.1976	3.5	0.577
25	0.0179	0.45466	32.37	106.1736	2.7	0.457
26	0.0159	0.40386	40.81	133.8568	2.2	0.361

Cabling AWG Considerations - Attenuation & PoE

Electrical characteristics for Cat 5e UTP

Property	Nominal Value	Tolerance	Unit
Characteristic impedance @ 100 MHz	100	± 15	Ω
Nominal characteristic impedance @ 100 MHz	100	± 5	Ω
DC-Loop resistance	≤ 0.188		Ω/m
Propagation speed	0.64		c
Propagation delay	4.80-5.30		ns/m
Delay skew < 100 MHz	< 0.20		ns/m
Capacitance at 800 Hz	52		pF/m
Inductance	525		nH/m
Cutoff frequency	50323		Hz
Max tensile load, during installation	100		N
Wire size	AWG-24 (0.205 mm <sup>2</sup> )		
Insulation thickness	0.245		mm
Maximum current per conductor	0.577		A
Temperature operating	-55 to +60		°C

Response:

We concur with the points made by the commenter. The references to the governing EIA/TIA requirements are intended to require minimum 24AWG wire size, etc. We feel the existing language is sufficient to enforce the minimum wire size requirement, but will recommend that language be added to the Construction Inspection Checklist for 784 to verify such. Thank you for your feedback.

\*\*\*\*\*

Ata Tursucu  
Gannett Fleming  
813-831-8870

**Comment:**

I noticed that the 784 spec for encoders requires both the RTS/CTS and the XON/XOFF flow control for the serial ports. In addition it requires “RTS toggle for half duplex emulation.”

In general EIA-RS232 applications RTS is a Data Terminal Equipment (DTE) signal that is an input to the encoder’s serial port that the encoder should not toggle. However, the CTS is a Data Communication Equipment (DCE) signal that toggles after a set delay when the RTS becomes high.

None of the encoders that are on the APL support XON/XOFF flow control.  
None of the encoders that are on the APL support end to end (RTS/CTS) flow control that is required in “half duplex emulation.”

In general, the half duplex communication in the ITS field is used between a master traffic controller and slave traffic controllers over multi-drop lines. This half duplex communications is more commonly implemented as data only.

To my knowledge the master controller does not raise the RTS when it is polling a remote controller, it just sends the data to a specific controller address, all of the controllers on that multi-drop line receive the same polling data and only the remote controller whose address matches the address in the polling data responds to the poll.

Encoders supporting UDP multicast (logical multi-drop) in their serial ports can be used for half duplex emulation over Ethernet networks, without supporting flow control of any kind.

I would suggest the removal of the flow control requirements from the 784 spec for encoders.

**Response:**

You are correct. The document has been revised to reflect the desired minimum functionality and align with the typical capabilities of the equipment on the APL. Thank you for your attention to detail, feedback, and input.

\*\*\*\*\*