Physical Media – SAE J1939 defines a physical median of shielded twisted pair. These 2 wires have a characteristic impedance of 120 Ω and they are symmetrically driven with respect to the electrical currents. The designations of the individual wires are CAN_H and CAN_L. The names of the corresponding pins of the ECUs are also denoted by CAN_H and CAN_L, respectively. The third connection for the termination of the shield is denoted by CAN_SHLD.

Physical Media Parameters for Twisted Shielded Cable

Parameter	Symbol	Min	Nom	Max	Unit	Conditions
Impedance	Z	108	120	132	Ω	Three meter sample length measured at 1 Mhz between the two sig. wires, with shield grounded, using open/short method.
Specific Resistance	r_b	0	25	50	mΩ/m	measured at 20 °C (1)
Specific Line Delay	t_p		5.0		ns/m	67% Vp(2)
Specific Capacitance	c_b	0	40	75	pF/m	Between conductors
	c_s	0	70	110	pF/m	Conductor to shield
Cable size						(3)
0.5mm² Conductor (20 AWG)	a_c	0.508			mm²	(4)
Wire insul dia.	d_{ci}	2.23		3.05	mm	
Cable diameter	d_c	6.0		8.5	mm	
0.8mm² Conductor (18 AWG)	a_c	0.760			mm²	(4)
Wire insul dia.	d_{ci}	2.5		3.5	mm	
Cable diameter	d_c	8.5		11.0	mm	
Shield Effectiveness			200	225	mΩ/m	Surface transfer impedance up to 1 MHz Test method per MIL-C-85485
Temperature Range	C	–40		+125	°C	Heat aging: 3000 hours per ISO 6722, Test with a mandrel 4-5x diameter of cable.(5)
Cable Bend Radius	r	4xdia of cable			mm	90 degree bend radius without cable performance or physical degradation

1. The differential voltage on the bus line seen by a receiving ECU depends on the line resistance between it and the transmitting ECU. Therefore, the total resistance of the signal wires is limited by the bus level parameters of each ECU.
2. The minimum delay time between two points of the bus line may be zero. The maximum value is determined by the bit time and the delay times of the transmitting and receiving circuitry.
3. Other conductor sizes available. Component insulation dimensions may be larger than those specified in SAE J1128. Design engineers should ensure compatibility between cables, connectors and contacts
4. Meet performance requirements of SAE J1128 for types GXL or SXL (includes drain wire where applicable)
5. 125°C or per OEM specification

Topology—The wiring topology of this network should be as close as possible to a linear structure in order to avoid cable reflections. In practice, it may be necessary to connect short cable stubs to a main backbone cable, as shown in Figure 7. To minimize standing waves, nodes should not be equally spaced on the network and cable stub lengths, dimension S in Figure 7, should not all be the same length. The dimensional requirements of the network are shown in Table 8.

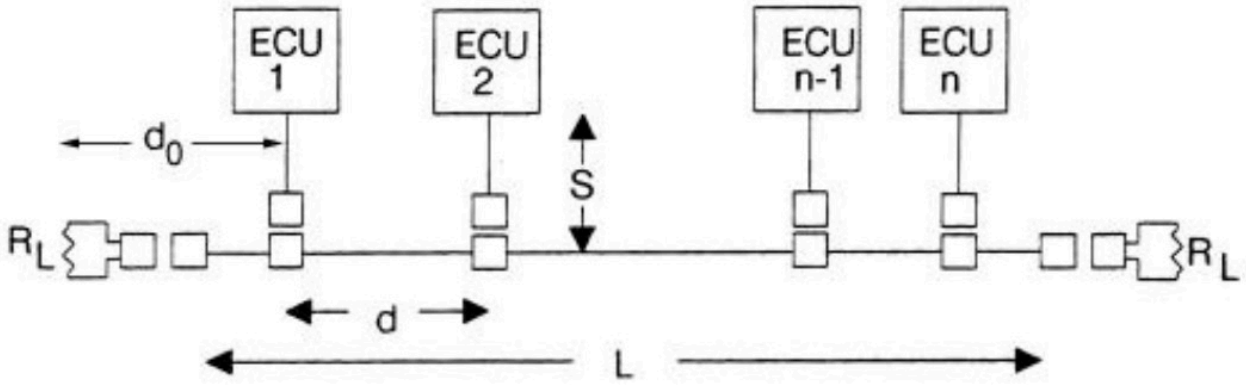

FIGURE 7—WIRING NETWORK TOPOLOGY

TABLE 8—NETWORK TOPOLOGY PARAMETERS

Parameter	Symbol	Min	Nom	Max	Unit	Conditions
Bus Length	L	0		40	m	not including cable stubs
Cable Stub Length(1)	S	0		1	m	Note 1
Node Distance	d	0.1		40	m	
Minimum Distance from R_L	d_0	0			m	R_L shall not be located within an ECU

1. The cable stub length for the diagnostic connector is 0.66 m maximum for the vehicle and 0.33 m maximum for the off-board diagnostic tool.

Shield Termination - The shield should be terminated by a wire conductor and directly grounded at only one point.

General guidelines (in order of importance) for direct termination of the shield are:

1. Connect to the point of least electrical noise
2. Use the lowest impedance connection possible
3. The closest connection to the center of the network should be used.