唐山尚新融大电子产品有限公司

TangShang ShangXinRongDa Eelctronic Co.,LTD

MIL-STD-1553B 隔离变压器

MIL-STD-1553B 耦合器

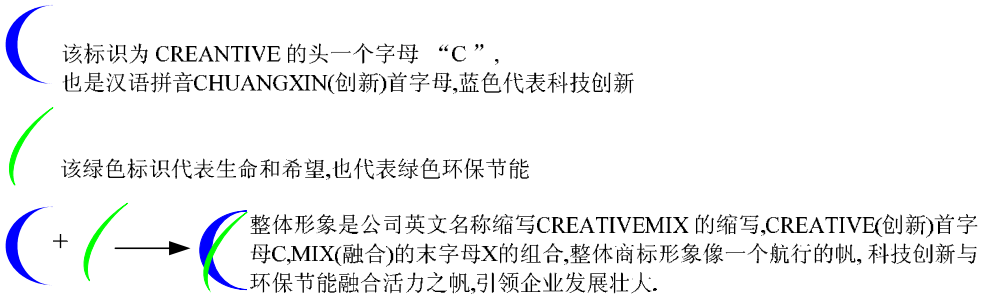
MIL-STD-1553B 芯片

MIL-STD-1553B 总线产品手册

2008

崇尚创新,有融乃大

商标解释



尚新融大注册于国内三大经济圈的“环渤海经济圈”最有潜力城市-----唐山境内，地处唐山曹妃甸新工业港口区所在地-----滦南县。尚新融大依托新唐山的发展动力和地理位置优势（离天津 1 小时，北京 2 小时车程，全程高速公路）、人才优势（拥有富足的劳动力，科技人才富足）；依托掌握核心技术和具有创新活力的人才团队，以“崇尚创新，有融乃大”为宗旨，为广大电力电子系统产品制造商提供电子节能绿色产品和服务；为军工用户提供高可靠性滤波产品、测试设备、电源系统、MIL-STD-1553B 产品、自整角机/数字变换器模块产品和解决方案。

尚新融大依托自己技术研发创新优势，主要研制生产三大类产品：

电力滤波产品（EMI），包括电源滤波器产品、电网主动滤波器、功率因数校正模块。电源滤波器产品系列齐全，可根据具体应用环境进行定做。电网有源功率因数补偿技术在国内处于领先水平，该技术满足国家倡导的节能降耗的需要，产品可应用到工业电力系统和军工船载、舰载、车载系统中消除电网谐波；我公司开发出的 1000-1500W 系列高功率密度铝基板功率因数校正模块，可应用到各类相应功率的 AC-DC 电源系统中或者 UPS 电源中，其高可靠性能满足军工船载、舰载、车载的要求。

专用测试设备或系统电源，如变压器伏秒乘积测试仪、铁粉心老化测试系统；电子负载、军用逆变电源，各类高功率密度模块产品。

军用标准或者军工通用产品，研制出国内正在普及的 MIL-STD-1553B 标准总线用全系列隔离变压器和耦合器产品并配套美国 DDC 芯片产品（资料下载 http://www.ddc-web.com/Products/MIL-STD-1553/）。其中耦合器和 NORH-HILL 公司一致(资料下载 http://www.northhills-sp.com/)，并销售美国 DDC 的 MIL-STD-1553B 总线芯片产品和连接线缆。 我公司研制自整角机/数字变换器模块产品，以其体积小、重量轻、可靠性高，广泛应用于雷达、导航、火炮等解算装置和随动系统中。

公司在北京设有研究机构、技术支持和服务部门。

企业愿景：创新型“节能、绿色高可靠性电子产品”品牌服务商
宗　　旨：创新改变人生，发展造就个人、企业、社会的共赢。
使　　命：以开拓思维谋求创新，以创新求发展，以发展提升员工、股东价值，提高顾客竞争力。
企业精神：
以开拓创新谋发展，以持续改进促完善；
以价值增值为己任，以共赢互进为目标。

一、 MIL-STD-1553B 总线系统介绍

1553B 总线标准全称 MIL_STD_1553B(以下简称 1553),它始于 1968 年初，1978 年 9 月 21 日，在获得正式的书面批准后，作为美国官方的文件公布发表。该标准作为美国国防部武器系统集成和标准化管理的基础之一，被广泛的用于飞机综合航电系统、外挂物管理与集成系统，并逐步扩展到飞行控制等系统及坦克、舰船、航天等领域。它最初由美国空军用于飞机航空电子系统，目前已广泛应用于美国和欧洲海、陆、空三军，而且正在成为一种国际标准。

1553 最初被作为一种连接不同子系统的通信总线来开发，实现系统间共享或交换信息。1553 具有极其优异的可靠性、较高的传输速率和抗干扰能力、比较轻的质量和长的电缆允许长度、十分成熟的技术。

作为总线标准主要用在以下场合：

- 信息需要在总线终端之间通过数字通信通道传输；
- 所有总线终端的和用于总线终端之间连接的电气接口需要的是标准定义的接口；
- 信息要求以一种可靠的、确定的、命令/回应的方式传输。

1553B 总线具有以下优点：

线性局域网络结构

合理的拓扑结构使得 1553 成为航空系统或地面车辆系统中分布式设备的理想连接方式。与点对点连接相比，它减少了所需电缆、所需空间、和系统的重量。便于维护，易于增加或删除节点，提高设计灵活性。

冗余容错能力

由于其固有的双通道设计，1553 通过在两个通道间自动切换来获得冗余容错能力，提高可靠性。通道的自动切换对软件透明。

支持“ 哑 ”节点和“ 智能 ”节点

1553 支持非智能的远程终端。这种远程终端提供与传感器和激励器的连接接口。十分适合智能中央处理模块和分布式从属设备的连接。

高水平的电器保障性能

由于采用了电器屏蔽和总线耦合方式，每个节点都能够安全地与网络隔离；减少了潜在的损坏计算设备的可能性。

良好的器件可用性

1553 器件的制造工艺满足了大范围温度变化以及军标的要求。器件的商品化使得 1553 得以广泛地应用在苛刻环境的项目当中。

保证了的实时可确定性

1553 的命令/响应的协议方式保证了实时的可确定性。这可能是大多数系统设计者在设计使命关键系统中选择 1553 的最主要的原因。

GJB289A-97《飞机内部时分制指令/响应型多路传输数据总线要求》简称 GJB289A，我国制定的与美国 1553 相对应的军用航空总线标准，GJB289A 兼容 1553。GJB289A 数据标准总线正在我国航空航天、武器平台等方面得到越来越多的应用，必将逐渐成为我国国防电子的重要的基础设施之一。

MIL-STD-1553B Data Bus Requirements

Communications Line:	
Cable Type:	Two-conductor twisted pair
Capacitance:	30 pF/ft. max.
Twist:	Four per foot min.
Char. Impedance:	(Zo) 70 to 85 ohms at 1 MHz
Attenuation:	1.5 dB/100 ft. @ 1 MHz max.
Bus Length:	Not specified
Termination:	Two ends terminated in resistors = (Zo) ± 2%
Shielding:	90% coverage min., 90% dual standby redundant
Cable Coupling:	
Stub Length:	Up to 20 feet (may be exceeded).
Stub Voltage:	1-14V p-p amplitude, line-to-line min. signal voltage, transformer coupled
Coupler Transformer:	Turns Ratio 1.41:1
	Droop <20% (1)
Overshoot/Ringing:	<+1V (1)
CMR:	>45 dB at 1 MHz (1)
Fault Protection:	Series resistors = 0.75 Zo ± 2% ohms

Notes:
(1) at 27 V p-p 250 kHz square wave.
CMR = Common Mode Rejection

图 1 MIL-STD-1553B 总线参数

1553B 总线为主从结构，采用曼彻斯特码（数字双相码），数据传输率为 1Mbit/s；1553B 最多可挂 31 个终端。

总线控制器（BC）到远程终端（RT）采用双绞屏蔽线传输。当终端离总线很近时（不大于 0.3 米），该终端可直接通过隔离变压器（和串入隔离电阻）与总线相接。当终端离总线较远时（最多不超过 6.1 米），要在隔离变压器与总线之间插入耦合变压器，如图 1 所示。

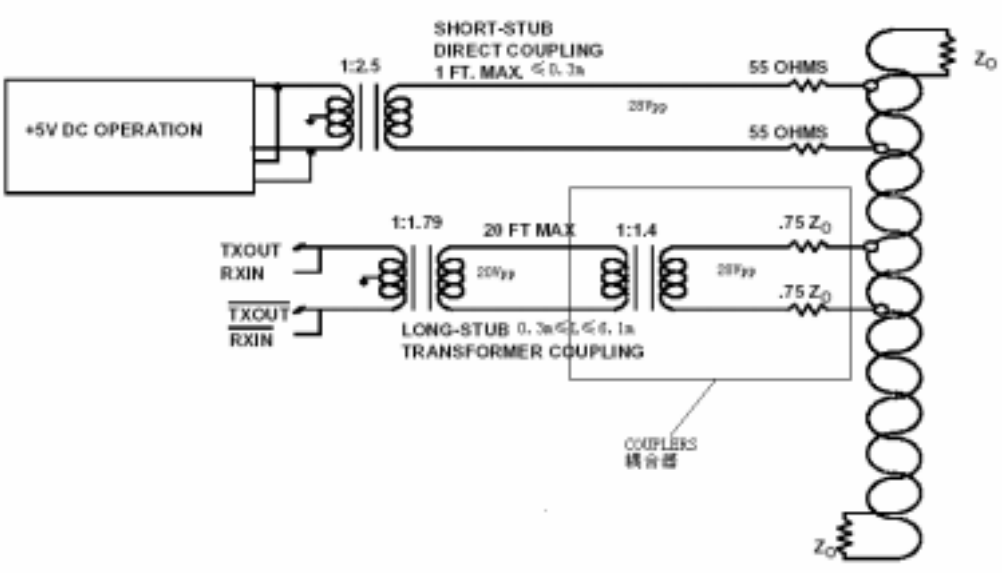


图 2 隔离变压器、耦合器的接法

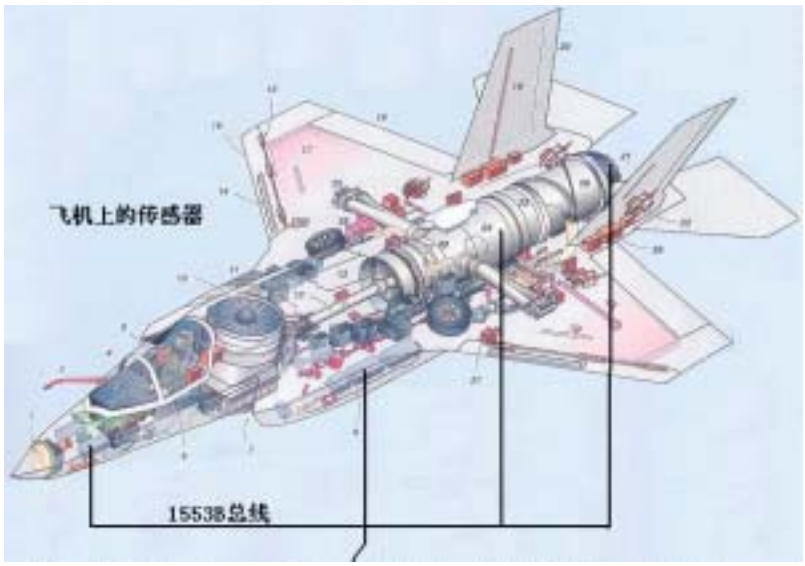


图 3 飞机总线系统

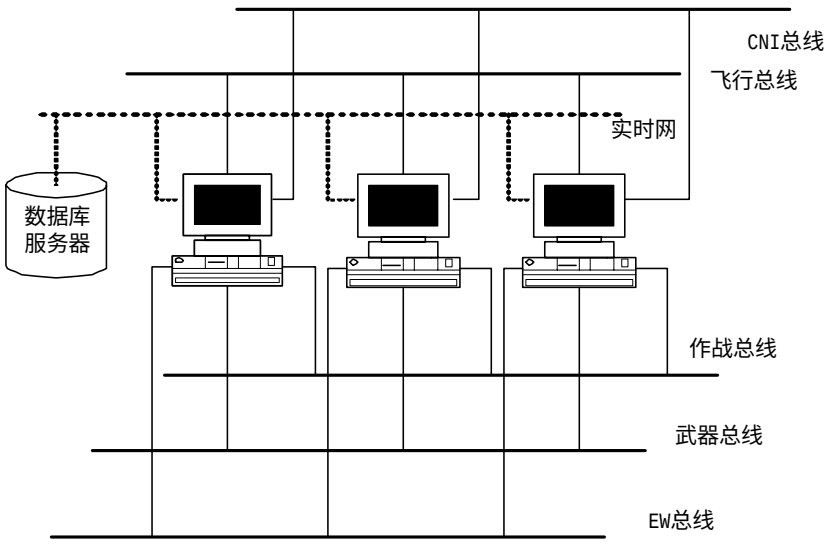


图 4 飞机上的总线系统连接图

二、MIL-STD-1553B 总线系统为什么要接隔离变压器和耦合变压器

总线系统与终端之间的耦合分为直接耦合和通过变压器耦合，无论是那种耦合，为了实现总线系统与终端之间的短路保护、直流隔离和阻抗匹配等问题必须接隔离变压器；

直接耦合方式时要求，总线接口与终端接口间的数据线距离不能超过 1 英尺（0.3048m），这种情况下直接使用隔离变压器即可，隔离变压器的匝数比和终端的电源有关具体见表 1；

但总线接口与终端间的数据线距离大于 1 英尺（0.3048m）时，必须使用变压器耦合方式（但是这种耦合方式原则上不能超过 20 英尺即 6.096 米），这时除了使用隔离变压器外必须使用耦合器，耦合器中的变压器的匝数比根据使用的终端电源电压的不同见表 1。

从表 1 中我们可以看出，耦合器中的变压器匝数比是固定的。连接方式需要屏蔽壳，有单路的也有多路的。耦合器分两种一种是在线式如图 5；种是盒式耦合器如图 6。

图 5 在线式双路耦合器

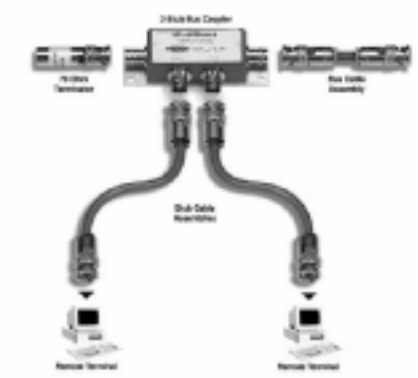


图 6 式双耦合器

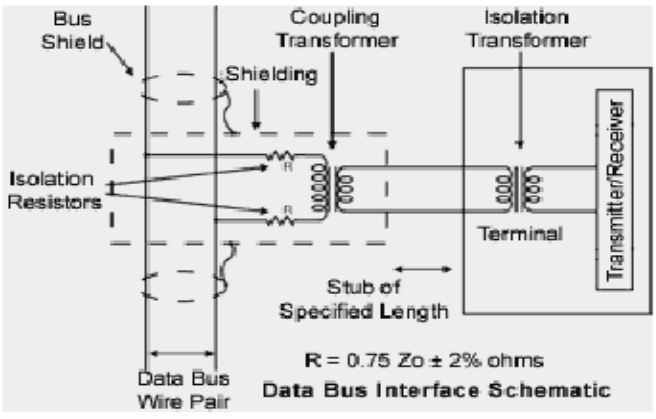


图 7 耦合器的电路连接

三、 我公司研制产品

全系列隔离变压器，见附件 1；微型在线式耦合器，可以实际应用情况进行定制，见附件 2。

SXRD PULSE TRANSFORMERS

MIL-STD-1553 TRANSFORMERS (US)

GJB289A-97 TRANSFORMERS (CHINA)

MADE IN CHINA

FEATURES

- ***Complete Line of Custom and GJB Units***
- ***For Use with MIL-STD-1553A and B, MacAir A-5690, A-5232, and A-4905 GJB289A-97(CHINA)***
- ***Low Profile***
- ***Epoxy Cased, Hermetically Sealed***
- ***-55°C to +130°C Operating Temperature Range***
- ***Built and Tested to MIL-PRF-21038 and MIL-STD-202 GJB1521-92(CHINA)***

DESCRIPTION AND APPLICATIONS

The military data bus specification, MIL-STD-1553, has brought about the need for versatile pulse transformers that meet all the electrical requirements of Manchester II serial biphase data transmission. Our various package styles provide the turns ratio configurations, component isolation, and common-mode rejection ratio characteristics necessary for MIL-STD-1553A and B compliance(CHINA GJB289A-97).

Hermetically sealed or epoxy cased, these transformers are mulitapped to accommodate existing system configurations.Encapsulated in accordance with MIL-PRF-21038, their tin-coated, copper-clad steel leads (epoxy-cased units) conveniently accommodate printed circuit board mounting. Sinusoidal or trapezoidal waveforms are accurately processed, making these transformers an excellent choice for any MIL-STD-1553A or B application.

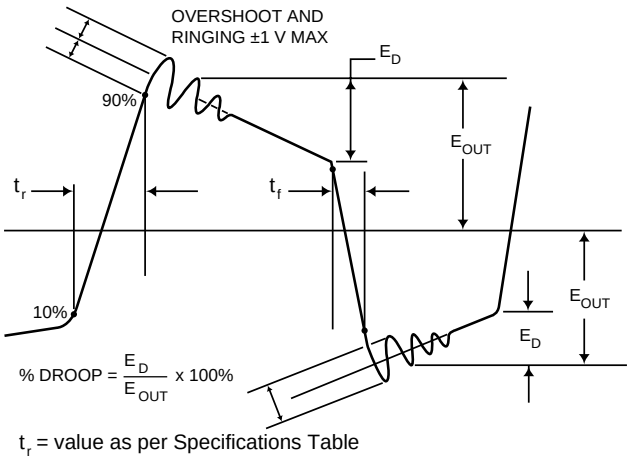


FIGURE 1. WAVEFORM INTEGRITY

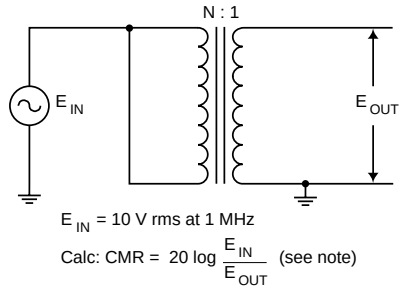


FIGURE 2. CIRCUIT FOR COMMON-MODE REJECTION

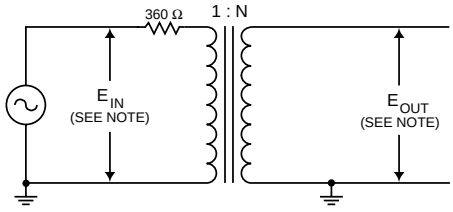


FIGURE 3. CIRCUIT FOR WAVEFORM INTEGRITY

PULSE TRANSFORMER CROSS REFERENCE LIST[1]

TRANSCEIVER TYPE	PIN NOS.	TURNS RATIO	TRANSFORMER CHARACTERISTICS						
			-Epoxy Unit -PC Mount -Ht. (see below) -Config. A -*Config. A	-Epoxy Unit -Flat pack -0.275" Ht. -Config. B	-Epoxy Unit -Surface Mt. -0.275" Ht. -Config. C	-Epoxy Unit -Flat pack -LPB Series -0.150" Ht. -Config. D	-Epoxy Unit -Surface Mt. -LPB Series -0.150" Ht. -Config. E	-Epoxy Unit -PC Mount -TST 9000 Series -0.280" Ht. -Config. F	-Epoxy Unit -Surface Mt. -TST 9000 Series -0.280" Ht. -Config. G
1	1-3:4-8 1-3:5-7	1.4:1 2:1	0.250" Ht. *25679 B-2203 (-02)	B-2343 (-17)	B-2387 (-12)	LPB-5009	LPB-5002	TST-9002	TST-9012
3A	1-3:4-8 1-3:5-7	1:2.5 1:1.75	0.220" Ht. *41429	B-3076	B-3110	LPB-5007	LPB-5000	TST-9000	TST-9010
2	1-3:4-8 1-3:5-7	1.20:1 1.67:1	0.275" Ht. *29854	B-3078	B-3063	LPB-5008	LPB-5001	TST-9001	TST-9011
5	1-3:4-8 1-3:5-7	1:1 1:0.707	0.300" Ht. *27765 B-2202 (-01)	B-2342 (-16)	B-2386 (-11)	LPB-5010	LPB-5003	TST-9003	TST-9013
3	1-3:4-8 1-3:5-7	1:2.5 1:1.79	0.250" Ht. B-3226 (-26)	B-3231 (-31)	B-3227 (-27)	LPB-5014	LPB-5015	TST-9007	TST-9017
	4-8:1-3 5-7:1-3	2.3:1 3.2:1	0.300" Ht. B-2205 (-04)	B-2345 (-19)	B-2389 (-14)	LPB-5012	LPB-5005	TST-9005	TST-9015
2	1-3:4-8 1-3:5-7	1.25:1 1.66:1	0.250" Ht. B-2204 (-03)	B-2344 (-18)	B-2388 (-13)	LPB-5011	LPB-5504	TST-9004	TST-9014
	4-8:1-3 5-7:1-3	2.12:1 1.5:1	0.250" Ht. B-2385 (-10)	B-2391(-20)	B-2390 (-15)	LPB-5013	LPB-5006	TST-9006	TST-9016

SPECIFICATIONS

PARAMETER	VALUE										UNITS
	BUS-25679	B-2203	BUS-27765	B-2202	BUS-29854	BUS-41429	B-3226	B-2205	B-2204	B-2385	
FREQUENCY RESPONSE Operating Range	75 to 1000	75 to 1000	75 to 1000	75 to 1000	75 to 1000	75 to 1000	75 to 1000	75 to 1000	75 to 1000	75 to 1000	kHz
COMMON-MODE REJECTION (CMR)	45 min.	45 min.	45 min.	45 min.	50 min.	45 min.	45 min.	45 min.	45 min.	45 min.	dB
ELECTRICAL REQUIREMENTS Terminal winding Resistance $(RDC)_2$											
• 1-3	3.5 max.	3.5 max.	3 max.	3 max.	1.9 max.	1.0 max.	1.0 max.	1.2 max.	3.2 max.	1.0 max.	Ω
• 4-8	3.0 max.	3.0 max.	3 max.	3 max.	1.9 max.	3.0 max.	3.0 max.	3.0 max.	3.0 max.	3.0 max.	Ω
Interwinding Capacitance	70 max.	70 max.	–	–	70 max.	45 max.	45 max.	70 max.	70 max.	70 max.	pF
Intrawinding Capacitance	–	–	30 max.	30 max.	–	–	–	–	–	–	pF
Winding Inductance											
• 1-3	7.5 min.	7.5 min.	7.5 min.	7.5 min.	7.5 min.	6.0 min.	6.0 min.	8.0 min.	7.5 min.	6.0 min.	mH
• 4-8	12 max.	12 max.	6 max.	6 max.	6 max.	–	–	7 max.	7 max.	6 max.	µH
PEAK-TO-PEAK VOLTAGE Terminals 1, 3 (Primary)	60 max.	60 max.	39.2 max.	39.2 max.	60 max.	60 max.	60 max.	60 max.	60 max.	60 max.	Vpp
PEAK PULSE CURRENTS $(AC)_3$ Terminals 1, 3 (Primary)	180 max.	180 max.	140 max.	140 max.	180 max.	180 max.	180 max.	180 max.	180 max.	180 max.	mA
DROOP	20 max.	20 max.	20 max.	20 max.	20 max.	20 max.	20 max.	20 max.	20 max.	20 max.	%
RISE TIME	150 max.	150 max.	150 max.	150 max.	150 max.	150 max.	250 max.	150 max.	150 max.	200 max.	ns
DECAY TIME$_3$	25 max.	25 max.	25 max.	25 max.	25 max.	25 max.	25 max.	25 max.	25 max.	25 max.	ns
OVERSHOOT	±1	±1	±1	±1	±1	±1	±1	±1	±1	±1	Vp
BACKSWING$_3$	none	none	none	none	none	none	none	none	none	none	
TURNS RATIO Terminals											
• 1,3:4,8	1.4CT:1CT	1.4CT:1CT	1CT:1CT	1CT:1CT	1.20CT:1CT	1CT:2.5CT	1CT:2.5CT	1CT2.3CT	1.25CT:1CT	1CT:2.12CT	
• 1,3:5,7	2CT:1CT	2CT:1CT	1CT:0.707CT	1CT:0.707CT	1.67CT:1CT	1CT:1.75CT	1CT:1.79CT	1CT:3.2CT	1.66CT:1CT	1CT:1.5CT	
Winding Tolerance (CT ±5%)	3	3	3	3	3	3	3	3	3	3	±%
TEMPERATURE REQUIREMENTS											
Operating (ambient)	-55 to +125	-55 to +130	-55 to +125	-55 to +130	-55 to +125	-55 to +125	-55 to +130	-55 to +130	-55 to +130	-55 to +130	°C
Storage	-55 to +130	-55 to +130	-55 to +130	-55 to +130	-55 to +130	-55 to +130	-55 to +130	-55 to +130	-55 to +130	-55 to +130	°C
PHYSICAL CHARACTERISTICS$_2$ Size	0.63 x 0.63 x Ht. (16 x 16 x Ht.) for all units										in (mm)
Weight	0.15 max. (4.26) for all units										oz (g)

PULSE TRANSFORMER CROSS REFERENCE LIST[1] (continued)

TRANSCEIVER TYPE	PIN NOS.	TURNS RATIO	TRANSFORMER CHARACTERISTICS							
			-Epoxy Unit -Flat pack -TST 9000 Series -0.280" Ht. -Config. H	-Epoxy Unit -PC Mount -TST 9100 Series -0.320" Ht. -Config. I	-Epoxy Unit -Surface Mt. -TST 9100 Series -0.320" Ht. -Config. J	-Epoxy Unit -Flat pack -TST 9100 Series -0.320" Ht. -Config. K	-Epoxy Unit -Flat pack -SLP Series -0.130" Ht. -Config. L	-Epoxy Unit -Surface Mt. -SLP Series -0.130" Ht. -Config. M	-Metal Unit -Flat pack -HLP Series -0.175" Ht. -Config. N	-Metal Unit -Surface Mt. -HLP Series -0.175" Ht. -Config. O
1	1-3:4-8 1-3:5-7	1.4:1 2:1	TST-9022	TST-9102	TST-9112	TST-9122	SLP-8019	SLP-8002	HLP-6009	HLP-6002
3A	1-3:4-8 1-3:5-7	1:2.5 1:1.75	TST-9020	TST-9100	TST-9110	TST-9120	SLP-8017	SLP-8000	HLP-6007	HLP-6000
2	1-3:4-8 1-3:5-7	1.20:1 1.67:1	TST-9021	TST-9101	TST-9111	TST-9121	SLP-8018	SLP-8001	HLP-6008	HLP-6001
5	1-3:4-8 1-3:5-7	1:1 1:0.707	TST-9023	TST-9103	TST-9113	TST-9123	SLP-8020	SLP-8003	HLP-6010	HLP-6003
3	1-3:4-8 1-3:5-7	1:2.5 1:1.79	TST-9027	TST-9107	TST-9117	TST-9127	SLP-8024	SLP-8007	HLP-6014	HLP-6015
	4-8:1-3 5-7:1-3	2.3:1 3.2:1	TST-9025	TST-9105	TST-9115	TST-9125	SLP-8022	SLP-8005	HLP-6012	HLP-6005
2	1-3:4-8 1-3:5-7	1.25:1 1.66:1	TST-9024	TST-9104	TST-9114	TST-9124	SLP-8021	SLP-8004	HLP-6011	HLP-6004
	4-8:1-3 5-7:1-3	2.12:1 1.5:1	TST-9026	TST-9106	TST-9116	TST-9126	SLP-8023	SLP-8006	HLP-6013	HLP-6006

Notes:
1. Numbers in parenthesis ( ) reference MIL-PRF-21038 dash numbers.
2. For configuration “A” only. See individual specifications for actual values.
3. Design parameter only. Not screened in production.

Transceiver Type 1 (Trapezoidal +5 V/-15 V)
- BU-61580X1
- BU-65170X1
- BUS-61559
- BUS-61553
- BUS-65153
- BUS-65142
- BUS-63105/25II

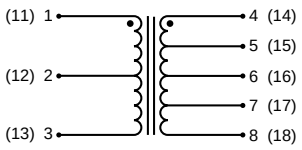
Transceiver Type 2 (Trapezoidal +5 V/-12 V)
- BU-61580X2
- BU-65170X2
- BUS-61560
- BUS-61554
- BUS-65154
- BUS-65143
- BUS-63107/27II

Transceiver Type 3 (Monolithic Trapezoidal +5 V)
- BU-61580X3
- BU-65170X3
- BU-61580X6
- BU-65170X6

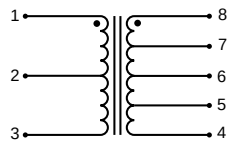
Transceiver Type 3A (Discrete Trapezoidal +5 V)
- BUS-61561
- BUS-61555
- BUS-63147/48

Transceiver Type 5 (Sinusoidal McAir)
- BU-61590X5
- BUS-65149
- BUS-63102

Consult Factory For:
- MIL-PRF-21038 QPL Part Numbers
- Special Marking
- Special Testing
- Special Packaging
- Source Inspection

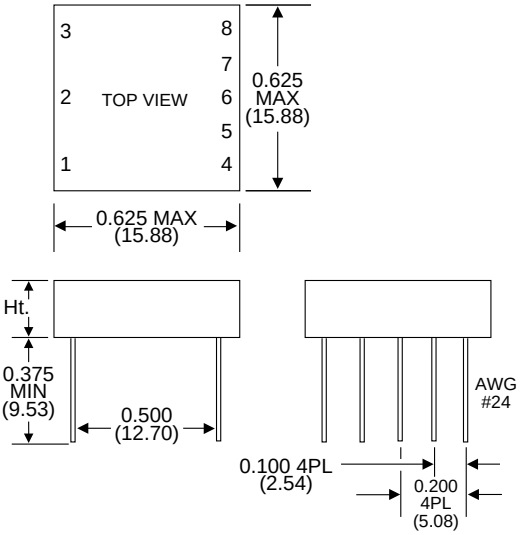


FOR ALL CONFIG. EXCEPT *CONFIG. A

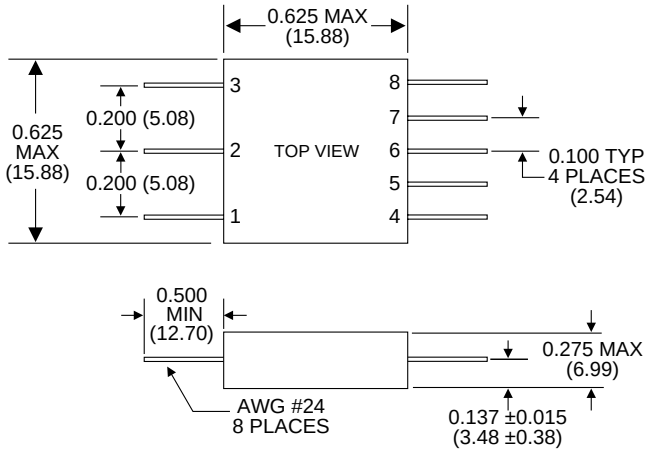


FOR *CONFIG. A ONLY

NOTE: Numbers in () are for TST Series Units.



CONFIGURATION A



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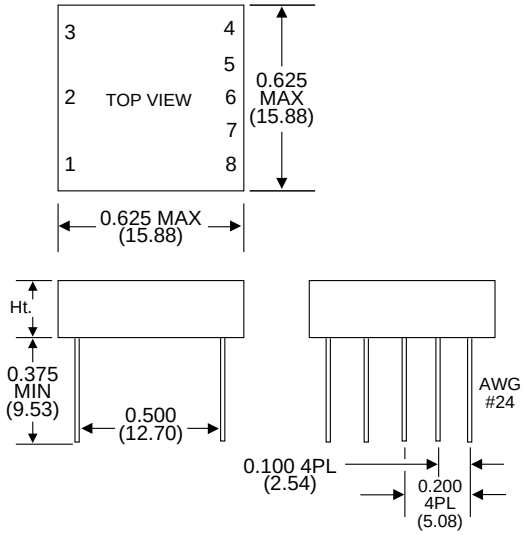
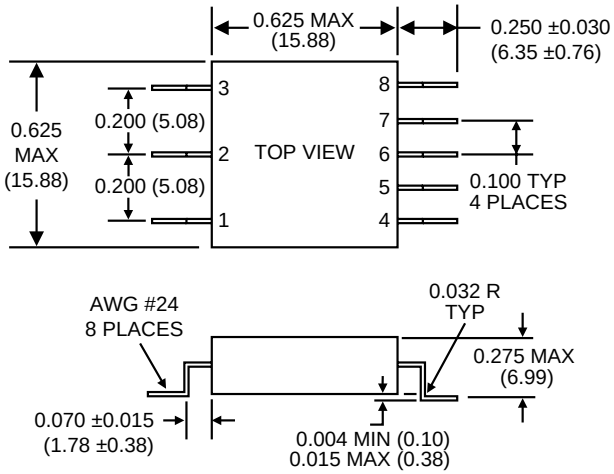


***CONFIGURATION A**



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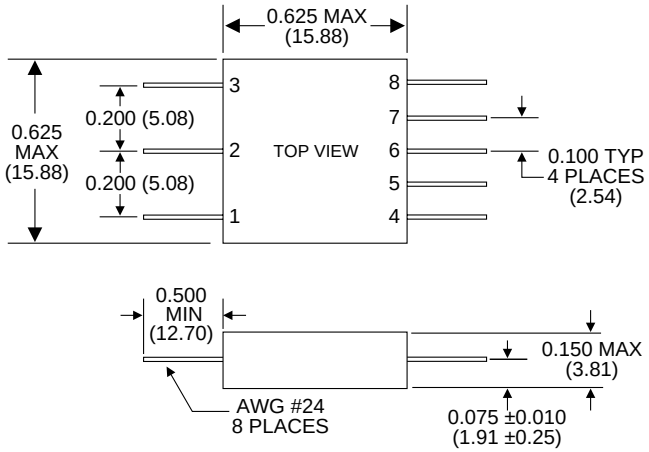
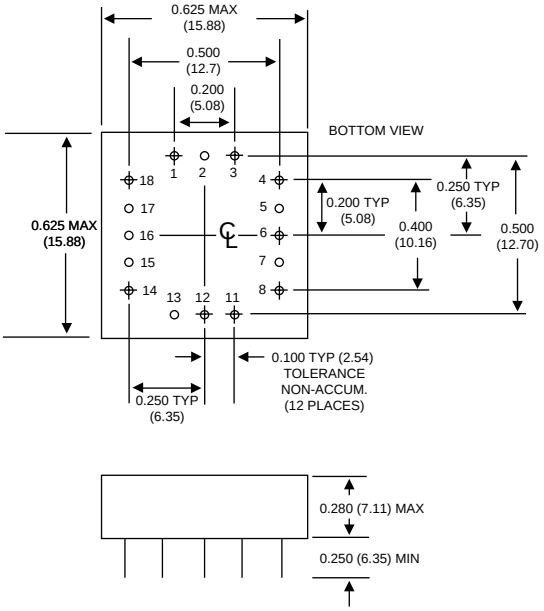


CONFIGURATION D



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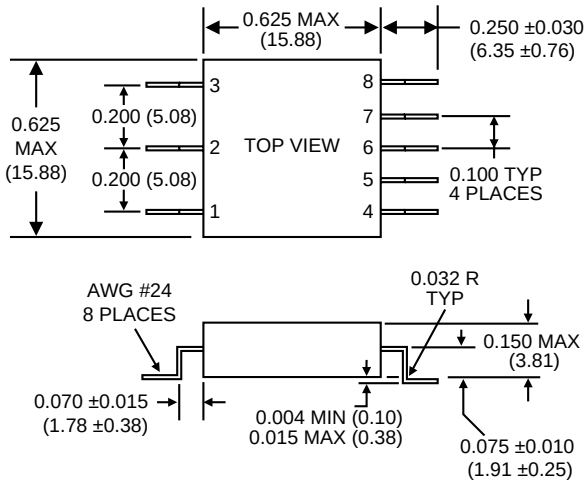

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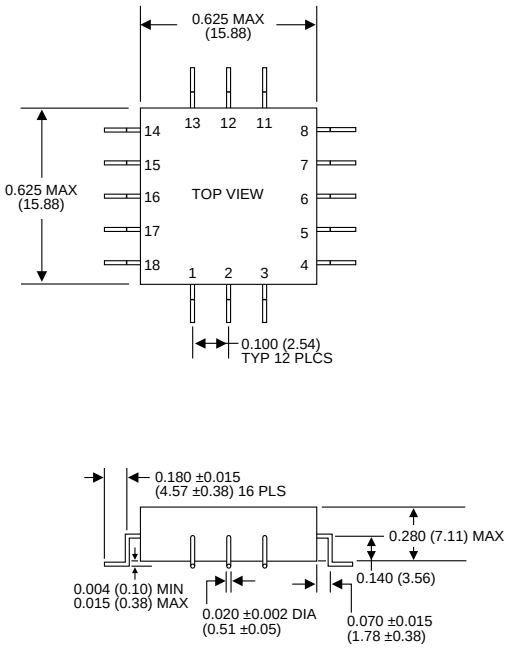

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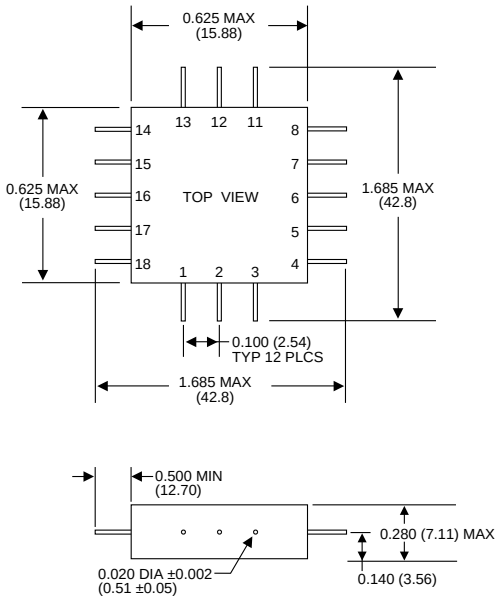

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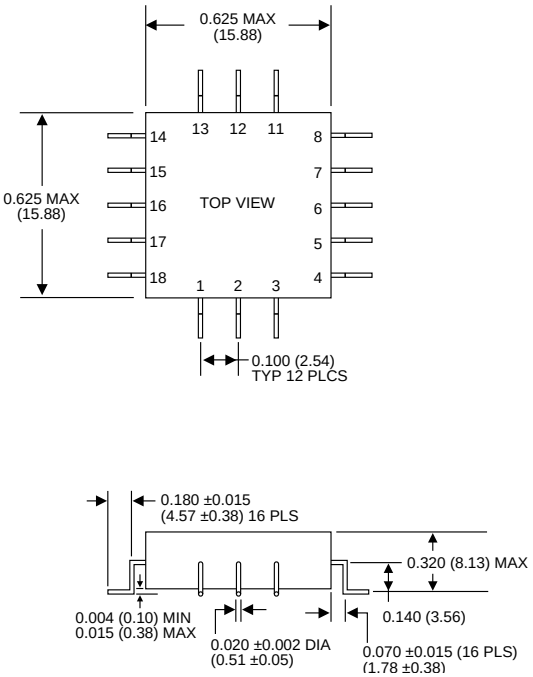

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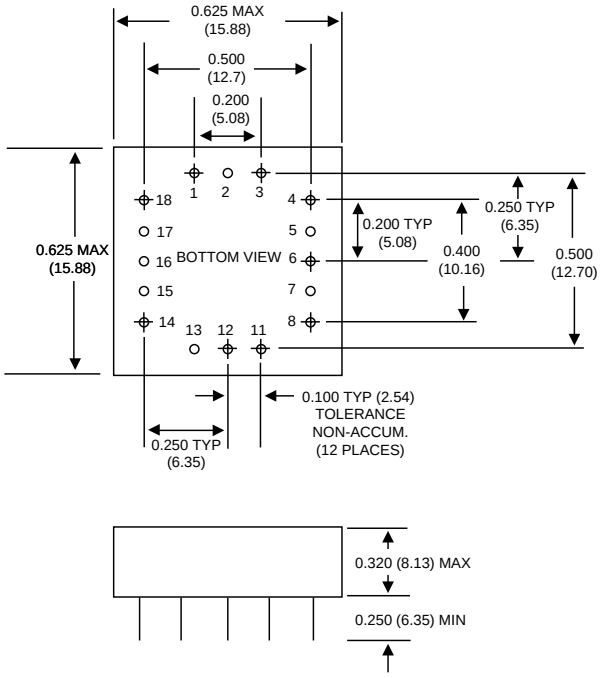
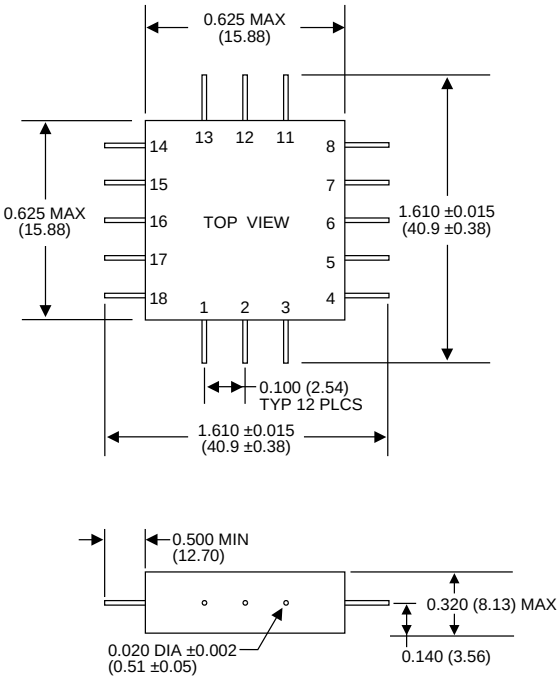


CONFIGURATION I



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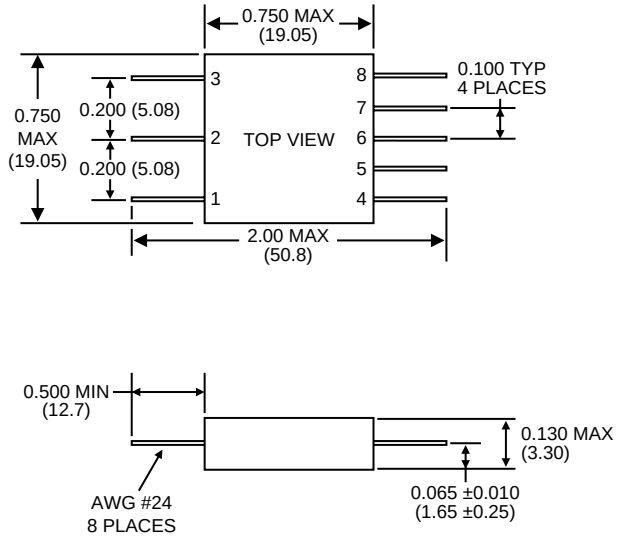

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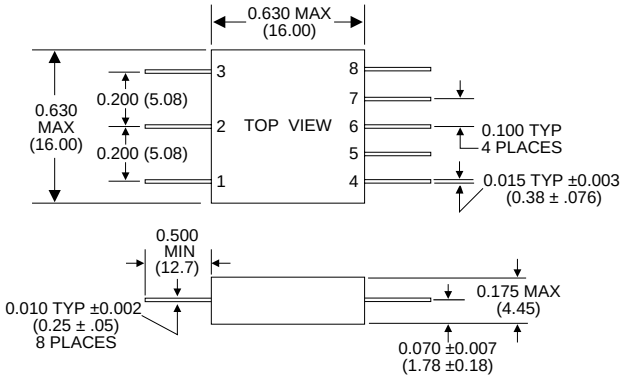
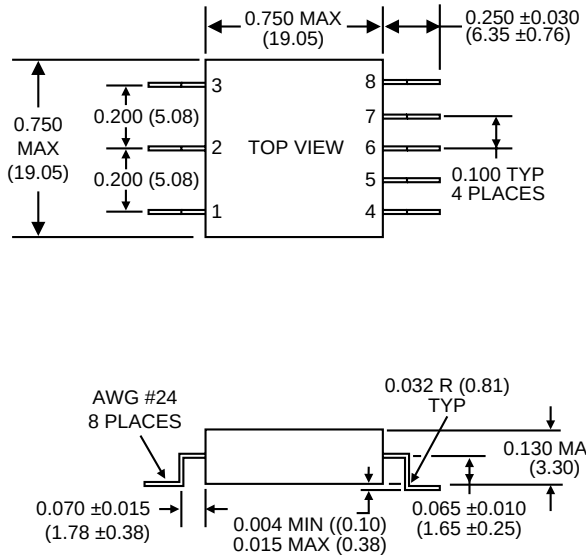
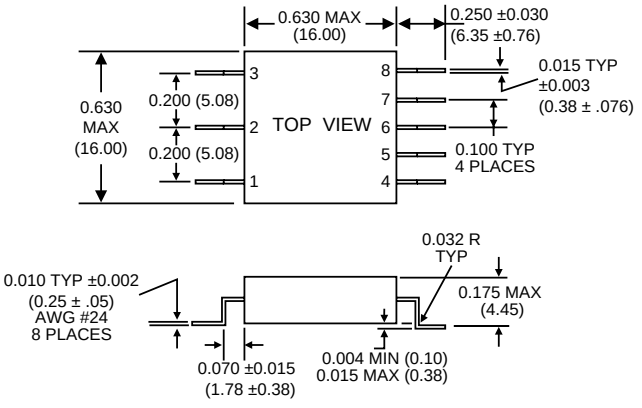


LEADS: GOLD PLATING OVER NICKEL-PLATED KOVAR
CASE: NICKEL-PLATED KOVAR

CONFIGURATION N



CONFIGURATION M



LEADS: GOLD PLATING OVER NICKEL-PLATED KOVAR
CASE: NICKEL-PLATED KOVAR

CONFIGURATION O

Factors in the Selection of MIL-STD-1553 Couplers, Connectors and Harnesses

There are four fundamental issues to be addressed in designing a MIL-STD-1553 data bus network. How they are addressed will have a profound impact on cost, reliability, and repair time. The four issues are as follows:

1. Integrated in-line harness vs. individual couplers
2. Single vs. multiple stub couplers
3. Connectors– multi-pin vs. triaxial, bayonet vs. threaded, and multi channel vs. single channel
4. Cable type– twinax vs quadrax

The circuitry of the coupler itself is defined by MIL-STD 1553 and not subject to design variation. The circuit specifications, though simple and straightforward, do not address variations from transformer to transformer within allowable parameters. Under normal conditions and usage most couplers are satisfactory and interchangeable, even with small variations in fault isolation resistor values, as long as they have the same nominal turns ratio. Some couplers have values as low as 50 ohm while others can be as high as 59 ohm. It must be remembered that their primary function is fault isolation, preventing an RT, BC or monitor stub cable problem from destroying the integrity of the bus.

In marginal networks where the guidelines have been stretched (long buses over 300 feet, long stubs over 25 feet or long uninterrupted runs between couplers groups), it is best to rely on vendors who manufacture their own transformers providing a degree of consistency not available from those who purchase transformers from several sources with differing design and unspecified performance parameters.

Requiring MIL-T-21038 transformers is not sufficient to insure repeatability. Issues such as balance, interwinding capacitance, and reflected energy are not addressed in MIL-STD-1553 and many of today's engineers are reluctant to get into LCR issues and network analysis. Instead, they prefer to go the "build-it-and-try-it" bench set-up route. The danger here is that repeatability/ interchangeability issues are not addressed.

Most networks are not that sensitive, but some are and when they are, you can have problems where certain nodes are sensitive to unspecified parameter variations.

Assuming you have a proper network, its reliability will depend, in large part, on the number and type of connectors used. All else is pretty much fixed by the number of stubs, ie; the number and type of transformers, resistors, PC boards, solder joints, etc. The number and type of connector used is a variable you can control. The number of connectors will be determined by the number of bulkhead feed-throughs in the platform, the type of coupler used, and the LRU connector configuration. Coupler, connector and wire trade-offs are discussed below.

Coupler Types

There are two types of couplers to choose from, the in-line type and the flange-mounted connectorized box type. Examples of each can be seen in Figures 1 through 10. Each has its own advantages and disadvantages.

In-line couplers offer the highest reliability and significantly lower weight but have installation and repair problems. They usually are laced into cable bundles or secured to bulkheads with clamps. To be repaired or replaced the new coupler must be spliced in which entails soldering in with splice kits utilizing high temperature heat guns. Use of a heat gun in a wiring bundle frequently causes damage to the surrounding wires. Splices also suffer from not being inspectable for proper solder flow and joint cleanliness. The system cost compared to the box type is usually a wash, the difficulty of manufacture and testing being offset by fewer connectors.

Box type couplers have the advantage of easy fault isolation, flexibility in updating or bus configuration changes, and ease of installation and repair.

Fault isolation is made easier by the multiple connectorized break points and accessibility. Individual segments can be easily disconnected and/or replaced. Stubs can be swapped and couplers moved around.

Fig. 1. 4-stub coupler with Triaxial connectors. Used on C-17.

Fig. 2. 2-stub coupler with multi-pin connectors. Used on F-15E.

Fig. 3. DB50010 Flange-Mounted Coupler. Used on AC-130U

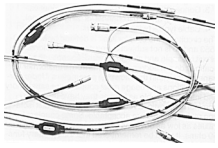


Fig. 4. DB40005 In-line coupler harness.

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Updates or configuration changes are easily implemented by strategically locating spare stubs, adding couplers or by replacing one coupler with another having additional stubs. The penalty for this flexibility and ease of maintenance is weight and less initial calculated reliability due to the additional connectors. The point here is that field repairs or splices made necessary by updates and troubleshooting seriously degrade initial reliability. It should be noted that assembling a harness from individual couplers with splices as opposed to having it manufactured without splices has the same problems but to a somewhat lesser degree. The splices, although made under better conditions, still have uninspectable solder joints.

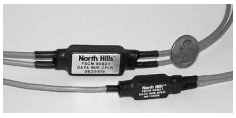

Fig. 5. DB 20005, Smallest 2-stub coupler.

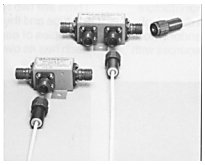

Fig. 6. Flange mounted couplers with MIL-C38999 connectors. Used on V-22

To illustrate this (See the following exhibit), a 16-stub bus network is examined for weight and MTBF (per MIL-HDBK-217) in both configurations — in-line harness and flange-mounted box types.

FLANGE MOUNT VS. IN-LINE COUPLERS 16-STUB BUS

ASSUME:

1. All wiring between LRUs and couplers is the same for both configurations and is excluded.
2. All couplers are single stub types.
3. The harness is a single entity without connectors, except at the LRU ends of the stub wires.
4. LRU connectors are the same for both configurations and are excluded.

WEIGHT:

Item	Qty	Flange Mount	In-Line
Couplers, 1 stub	16	16 x 65 gms = 1040 gms	16 x 8 gms = 128 gms
Mating Conn.	46	46 x 16 gms = 736 gms	O gms
Terminators	2	2 x 20 gms = 40 gms	2 x 6 gms = 12 gms
		1816 gms	140 gms
		3.91 lbs	.30 lbs
		Σ wt = 3.61 lbs. (1676 gms)	

MTBF: (+ 70 C AIRBORNE FIGHTER UNINHABITED):

Item	Qty	Flange Mount	In-Line
Couplers	16	16 x 1.38 = 22	16 x .7 = 11.2
Crimp Joints #2	138	(3 x 3 x 16) –2 =.68 (1)	None
Terminators	2	2 x .054 =.11	2x.054 =.11
Total Failures/10.6 hrs.:		22.79	11.31
MTBF (hrs.) =		43,879	88,417

1. 138 x 9.5x .00026 x 2 x 1 = .68
2. At connectors .3 Joints/ Cable Connector x 3 connectors/ coupler 2 ends with terminators = (3 x 3 x 16) –2 = 138 joints

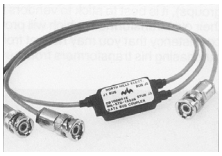

Fig. 7. In-line coupler with connectors. Used on OH-58.

Fig. 8. Flange mounted coupler with multi-pin connector. Used on B-52.

In conclusion, going from flange-mounted couplers to in-lines in an integrated harness can save over 3 1/2 pounds per bus in a 16 coupler configuration. Weight savings will be proportionately higher or lower with fewer or more stubs and may vary if multi-stub couplers are used. In addition, MTBF is vary if multi-stub couplers are used. In addition, MTBF is more than doubled from 43,000 hrs to 88,000, which also will vary with the number of stubs.

The only negatives associated with in-line harnesses is in repairability. Flange-mounted couplers can be easily replaced as can the interconnecting cable, while with an integrated harness, sections are repaired by splicing or replacement of the harness as a unit. Splices require heat in the wire bundle which can cause subsequent problems and the joint is not inspectable. The degradation incurred by splices should not be underestimated.

Most bus network integrity problems and overall weight are associated with the cable connectors, hence integrated harnesses have very real advantages in both reliability and weight due to their elimination. Additionally, in-line couplers generally have a lower VSWR or reflected energy coefficient resulting in smaller reflections on the bus.

A compromise between the flange-mounted box type and the integrated harness type network is the segmented harness type network. By segmenting the harness with a few judiciously placed connectorized breaks and the use of multi-stub couplers, you can significantly improve repairability and maintenance time. The bus can be readily broken down, troubles isolated and faulty segments replaced without splices at a relatively small cost in weight and calculated MTBF. Spares requirements can be reduced if several of the segments can be made identical. Multi-stub couplers in either in-line or flange mounted box types can reduce failure rates simply by eliminating solder joints and/or connectors used to connect single stub couplers.

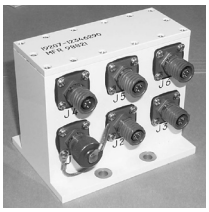

Fig. 9. Coupler for armor. Uses MIL-G-3899 connectors. Used on M1A2, tank.

Fig. 10. NH12864 2-stub flange mounted coupler.

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CONNECTOR AND CABLES

All users of MIL-STD-1553 data bus couplers eventually face the decision of what type of connector to use for their bus connections, both at the coupler and at the equipment box. Although quite specific on most technical aspects of the bus, MIL-STD-1553 does not address the connector issues nor do other military or industrial standards with the exception of MIL-STD-1760. Therefore, the following should provide some guidance for making the most appropriate cost-effective solution.

The issues to be addressed are:

- Threaded vs. bayonet vs. acme threaded
- Individual vs. multiple channel
- Multi-pin vs. triaxial

The trade-offs in threaded vs. bayonet vs. acme threaded are cost, lead time, reliability, and maintainability. The highest reliability can be obtained with safety wired threaded connectors. Unfortunately they are prone to crossthreading and the safety wiring is labor intensive. They are not usually stock items and lead times can run to 20 weeks. Price can be high depending on type chosen.

Bayonet types, generally more available, are somewhat less reliable but are used in many applications in the three-lug and four-lug configurations. They are easiest to mate and de-mate and cannot be crossthreaded. Keying can be achieved by using a mix of 3- and 4-lug configurations.

A particular type of threaded connector is the MIL-C-38999 Series III. This connector has an acme (very coarse) thread with ratchet override. The ratchet override provides a torque preload which assures a reliable mate in high vibration and shock environments. They are virtually impossible to crossthread or strip. They are also large, heavy, costly and have long lead times.

There are no right or wrong choices. All types have advantages and disadvantages. The decision should be guided by the real environment, cost, and lead time. Also, some time spares will be needed and 26 weeks lead time may present operational problems, so avoid modified connectors (shortened backs, special plating, etc).

Once the connector type has been selected the insert arrangement must be determined. The choices are:

- Individual triaxial type.
- Multiple triaxial contact type.
- Standard multi-pin.

Individual triaxial connectors are available from several sources. Many have second sources. They are available in standard (BNC size) or subminiature sizes— threaded or bayonet. Threaded versions have various key arrangements and the bayonet versions have two, three, and four-lug variants. Two-lug variants should be avoided for obvious reasons. Three and four-lug types have a good track record. Where weight is a factor the subminiature should be used. All have proven satisfactory in airborne environments and equally satisfactory from an electrical point of view. Certain types are readily available off-the-shelf at modest cost while others will have 10-18 week lead time and can be quite costly. Some feature solder attachment, some tool crimp, and some wrench crimp. Experience shows that the quality of the joint is most dependent on the care of its assembly. All methods appear to work well as long as the operation is performed properly. It is best to avoid any method requiring skill, judgment or proficiency. None of the above types are MIL connectors except for MIL-C-49142 which covers the BNC size types in both threaded and bayonet styles. Unfortunately, these are silver plated, not nickel or tin plated. (more on the plating to follow). MIL-C-38999 Series III also offers a single channel size 9 but it is rather bulky for aircraft use.

Separate connectors for each 1553 cable (as opposed to a single connector for multiple cables) can make troubleshooting easier in the system and ease cable run layout design, but they take up room and will have less reliability since there will be more connectors.

Multiple triaxial contacts in one connector will offer improved reliability and inserts are available in a variety of MIL shell styles and sizes. The size 8 triaxial inserts (M3909/90 and M3909/91) are, however, quite costly and can have quite long lead times. They, as well as the shells, are QPL items and are multiple-sourced. If an insert is available with the proper number of size 8 contacts it is possible that the weight of the one connector will be less than the weight of the individual connectors. When you do the analysis, don't forget to count the back shells and clamp, if required in the installations. Lead time can sometimes be a problem for both the contacts and the shells, particularly if non-standard keying is selected on the shell.

Standard multi-pin connectors have been found to be entirely satisfactory for bus connections with the only caveat being that the shield must be dressed close to the pins, within a half to one inch. The shield termination must be within the backshell. Failure to do this will open the system to interference problems. The advantage of multi-pin connectors is cost, weight, and lead time while the penalty is a slight reduction in calculated MTBF and arguably a vulnerability to pick-up. Virtually any MIL connector can be used as long as there are sufficient pins (in a multi-channel arrangement) to isolate the high and low pairs from each other with ground pins. On a coupler this is not a real problem because all the wires have the same signals, but in an equipment box, channel A should have reasonable isolation from channel B. Experience has shown 60 dB isolation is easily accomplished without problems. Several major systems are operational, including the F-15, which use multi-pin connectors on the couplers and have performed satisfactorily. With judicious connector type selection, the cost savings can be significant. Some argue that the triaxial contact is superior from a performance point of view since the multi-pin will present a large impedance discontinuity, but considering that the coupler interior discontinuity is begun within a half inch of the pin or contact

anyway, the point is moot and the effect very small compared to the coupler. Bulkhead joints and feed throughs with cable on both sides are a different matter.

Having selected the connector type and insert arrangement there only remains the question of body **plating and intermetallic compatibility.** With systems having lifetimes measured in decades and connectors being exposed to very vile environments, metallic compatibility is a must. The ideal, from a long-term corrosion point of view, is to have all surfaces and interfaces tin plated. This is not always possible and can be very expensive. Some manufacturers use a nickel plate which experience shows works quite well. 500-hour salt spray tests have been passed with nickel and only cosmetic discoloration occurred. Still, tin on tin works best. Also, keep in mind that all surfaces must be compatible. Mating connectors should always have the same plating. On the couplers, specify that the case be plated with the same material as the connector body. Remember— rust (and corrosion) never sleeps. It works 24 hours a day.

The single stub vs. multiple-stub is not a critical issue unless taken to extremes. Experience has shown there are only a few general guidelines. If only single stubs are to be used they should have several feet separation so there are individual discontinuities in the impedance. If too close they will become one large discontinuity. Multiple-stub couplers work well up to eight stubs. Beyond that the discontinuity becomes larger than desirable for true buses with a finite length. For bench top applications when the couplers tend to resemble a star coupler, more than eight does not seem to present problems. Using multiple-stub couplers in either in-line or flange-mounted box type will be less expensive, lighter weight, and more reliable with no downside. Lumping couplers in multi-stubs configuration should be considered as long as the resulting stub lengths can be kept under twenty five feet and the total wire and coupler weight is less than implementing other solutions. You should also avoid spacing groups of couplers with one hundred foot cable lengths because reflections can cause bit errors by creating multiple zero crossing on the last bit of a data word.

Cable type selection should be governed by several factors, among which are cost, weight, shielding and capacitance. For lab use, the standard MIL-C-17/176-00002 is fine. It is low cost, readily available and provides adequate performance. In aircraft applications, weight and shielding take on added importance. Obviously, weight and shielding trade off against each other. In addition, extra shielding results in a stiffer, harder-to-work-with cable that requires larger bend radii. For severe high noise environments, the cable should have a mu-metal shield for magnetic field attenuation. It is more costly, heavier and hard to work with but a conventional double-shielded cable will not provide the magnetic field isolation that mu-metal does. The mu-metal shield also provides EMP protection from nuclear bursts and is a must for strategic systems. There are several manufacturers. Do not underestimate the bend radii and stiffness issues which can be quite a problem in installation and repair, leading to kinks and subtle system degradation.

CONCLUSION

These, then, are the issues. How they are weighted must be determined by the application as well as personal preference. Obviously, safety of flight or a hazardous store will require a different weighing of the factors than a maintenance monitor. The decisions are:

- What is an acceptable MTBF level?
  (dollars for MTBF hours versus how much is good enough)
- Where to spend money to improve MTBF to an acceptable level?
- How much is it worth in initial cost and lifetime cost for repairs to go from 45,000 hrs to 88,000 hrs MTBF when the system as a whole has an MTBF of 100-200 hours?
- What is an acceptable trade-off of initial cost vs. total life cost including repairs and maintenance?

"The best" will vary from application to application.

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IN-LINE MICRO COUPLERS

North Hills provides In-line data bus couplers with up to five

applications where mounting can be accomplished by wiring the coupler into the harness. These units can be supplied with a variety of different connectors and cables (MIL-C-17/176-00002 is standard) or without connectors for splicing or integrating into harnesses. The standard stocked units are manufactured with 12 inch long (30cm or 300mm) MIL-C-17/176-00002 cable. Couplers can also be ordered with custom cable lengths and a variety of connectors for direct installation on any system. Using in-line couplers in your data network reduces the number of connectors which significantly improves the calculated reliability (MTBF).

transformer coupled s
2 inch specia
terminated

All resistors are 1 Watt per MIL-R-39007, Failure Grade S and mounted away from the transformer to minimize heating effects. The transformers are manufactured to MIL-T-21038. These couplers are Flight Qualified and have successfully completed a 1000 hour life test at +125°C and 100% duty cycle. Copies of test reports are available upon request. Space Qualified couplers are also available. Please refer to the appropriate data sheet for more information.

All products are 100 % tested and certified. For maximum system reliability multiple couplers can be daisy chained at the factory into an integrated harness with no splices. Specification Control Drawings are available to help you document the part selected for your application.

North Hills Model # DB10005 In-Line Micro Coupler.

Features:

- 1 Watt resistors
- -55ºC to +125ºC operating temperature
- Single or Multi-Stub

Benefits:

- Flight qualified
- Small and lightweight
- 100% Tested
- Can be supplied as a complete harness according to customer specification

Electrical Specifications:

All parameters are in accordance with MIL-STD-1553B and Notice 2.

Droop	20% Maximum (250 kHz)
Overshoot and Ringing	± 1.0V Peak (250 kHz square wave with 100 ns maximum rise and fall time)
Common Mode Rejection	-55.0 dB (Min) @ 1 MHz
Fault Protection	59Ω ± 1%, 1 Watt per MIL-R-39007
Turns Ratio	1:1.41
Stub Voltage	$1.0V_{PP}$ to $14.0V_{PP}$ transformer coupled
Operating Temperature	-55ºC to +125ºC
Storage Temperature	-55ºC to +150ºC
Electrical Notes (see coupler schematic diagram on page 2)	R1=R2= 59Ω(1 watt per MIL-R-39007), Z_0 = Nominal Line Impedance of Bus 78Ω, N = 1.41

Higher temperature units available. *Specifications subject to change without notice.*

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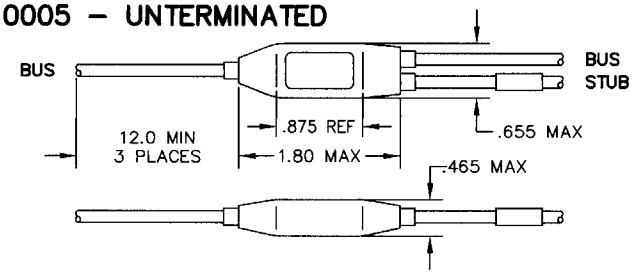
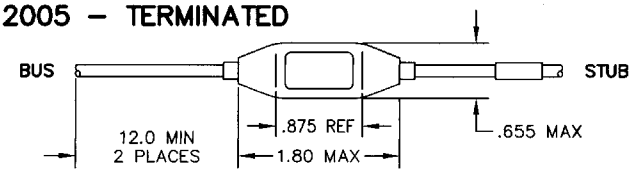
IN-LINE MICRO COUPLERS

The use of in-line couplers can reduce the number of connectors in the network thereby improving the calculated reliability significantly.

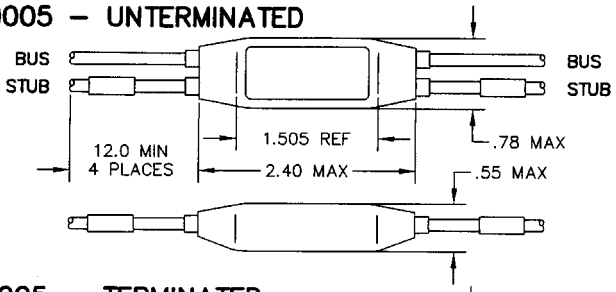
DB10005 – UNTERMINATED



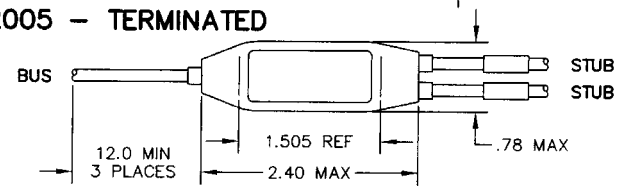
DB12005 – TERMINATED



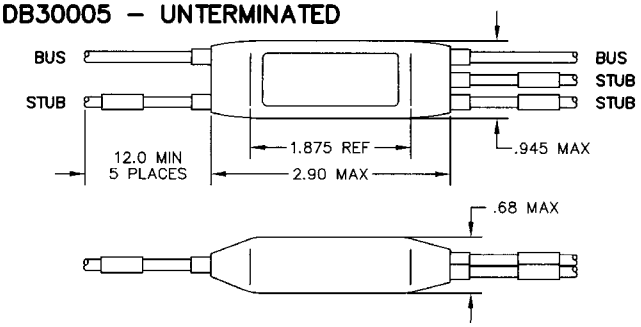
DB20005 – UNTERMINATED



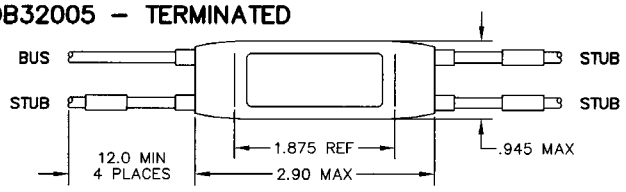
DB22005 – TERMINATED



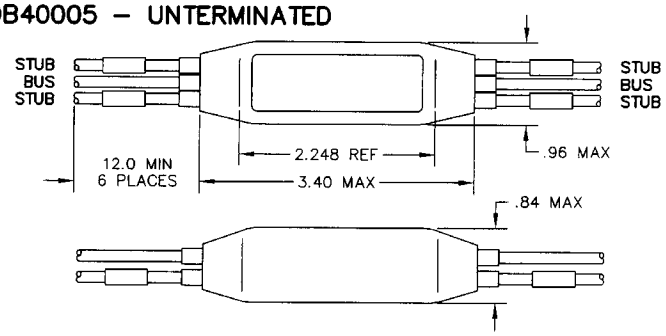
DB30005 – UNTERMINATED



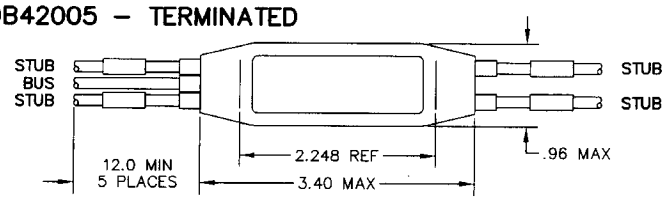
DB32005 – TERMINATED



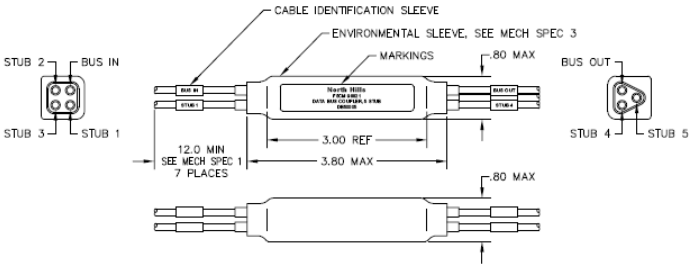
DB40005 – UNTERMINATED



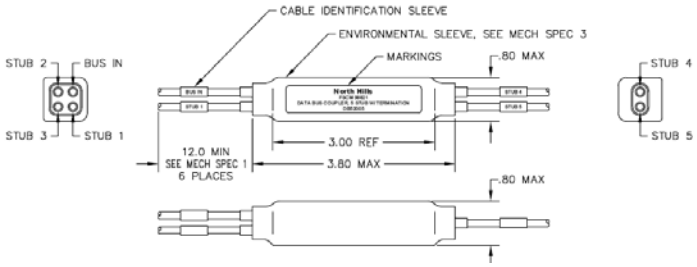
DB42005 – TERMINATED



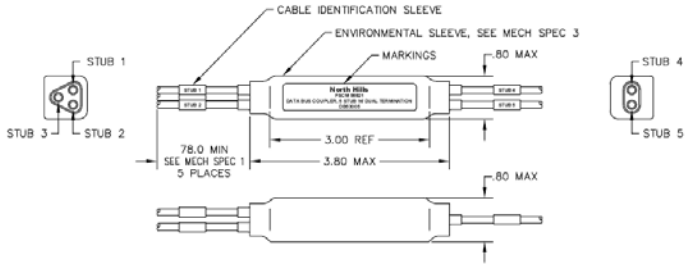
DB50005 - UNTERMINATED



DB52005 - TERMINATED



DB53005 - TERMINATED (2)



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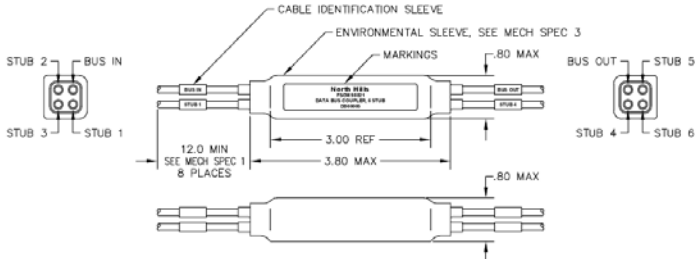
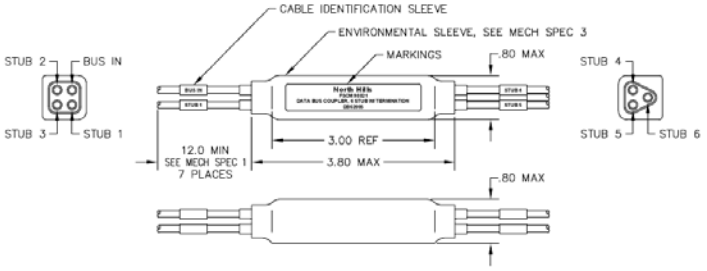
IN-LINE MICRO COUPLERS

The use of in-line couplers can reduce the number of connectors in the network thereby improving the calculated reliability significantly.

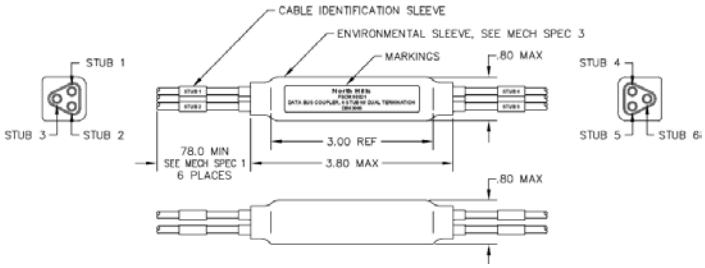
DB60005 - UNTERMINATED



DB62005 - TERMINATED

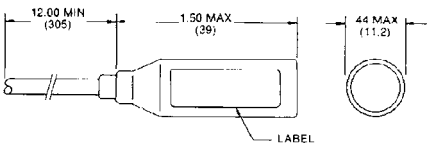


DB63005 - TERMINATED (2)

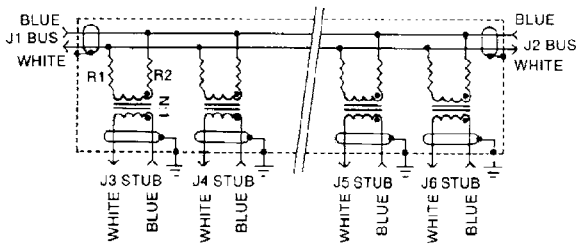


Terminator

DB03005



Coupler Schematic Diagram



Ordering Information:

Description	Model #	WT[1] (Gms)
Terminator	DB03005	6
1 Stub Coupler	DB10005	8
1 Stub Coupler with Terminator	DB12005	14
2 Stub Coupler	DB20005	18
2 Stub Coupler with Terminator	DB22005	24
2 Stub Coupler with 2 Terminators	DB23005	24
3 Stub Coupler	DB30005	28
3 Stub Coupler with Terminator	DB32005	34
3 Stub Coupler with 2 Terminators	DB33005	34
4 Stub Coupler	DB40005	50
4 Stub Coupler with Terminator	DB42005	56
4 Stub Coupler with 2 Terminators	DB43005	56
5 Stub Coupler	DB50005	NA
5 Stub Coupler with Terminator	DB52005	NA
5 Stub Coupler with 2 Terminators	DB53005	NA
6 Stub Coupler	DB60005	NA
6 Stub Coupler with Terminator	DB62005	NA
6 Stub Coupler with 2 Terminators	DB63005	NA

[1]Excluding cable. Consult factory for connectorized coupler assemblies or other cable lengths/types.

Accessories:
For external bus termination use DB03005.
Extended cables with MIL-STD-1553 twinax cable P/N 590M-17/176-00002
Splice with splice kit P/N 571-18-8002
Test with DBT100A.

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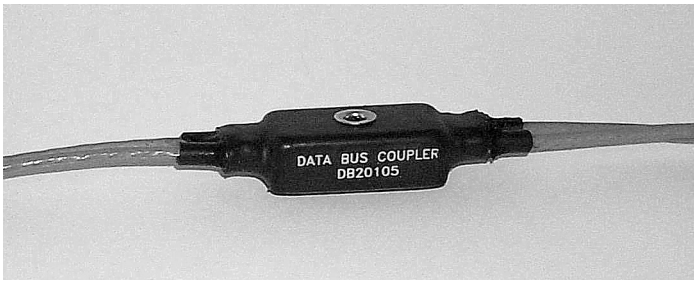
IN-LINE THROUGH-HOLE MOUNTED COUPLERS

North Hills provides In-line Through-Hole mount data bus couplers with up to four transformer-coupled stub output ports (units with more than four stubs are available on special order). These units are available with and without internal terminations and are for use in applications where the environment requires a stable, fixed mounting solution. These units can be supplied with a variety of different connectors and cables (MIL-C-17/176-00002 is standard) or without connectors for splicing or integrating into harnesses. The standard stocked units are manufactured with 12 inch long (30cm or 300mm) MIL-C-17/176-00002 cable. Couplers can also be ordered with custom cable lengths and a variety of connectors for direct installation on any system. Using in-line couplers in your data network reduces the number of connectors which significantly improves the calculated reliability (MTBF).

All resistors are 1 Watt per MIL-R-39007, Failure Grade S and mounted away from the transformer to minimize heating effects. The transformers are manufactured to MIL-T-21038. These couplers are Flight Qualified and have successfully completed a 1000 hour life test at +125°C and 100% duty cycle. Copies of test reports are available upon request. Space Qualified couplers are also available. Please refer to the appropriate data sheet for more information.

All products are 100% tested and certified. For maximum system reliability multiple couplers can be daisy chained at the factory into an integrated harness with no splices. Specification Control Drawings are available to help you document the part selected for your application.



North Hills Model # DB20105 In-Line Through Hole Mounted Coupler.

Features:

- Through-Hole mount
- Complete harnesses, any cable length or type
- Single or Multi-stub

Benefits:

- Flight qualified
- High reliability
- Fast turn around for custom units
- Low cost

Electrical Specifications:

All parameters are in accordance with MIL-STD-1553B and Notice 2.

Droop	20% Maximum @ 250 kHz
Overshoot and Ringing	± 1.0V Peak
Common Mode Rejection	-55.0 dB (Min) @ 1 MHz
Fault Protection	59Ω ± 1%, 1 Watt per MIL-R-39007
Turns Ratio	1:1.41
Stub Voltage	$1.0V_{PP}$ to $14.0V_{PP}$ transformer-coupled
Operating Temperature	-55ºC to +125ºC
Storage Temperature	-55ºC to +150ºC

Higher temperature units available.

Specifications subject to change without notice.

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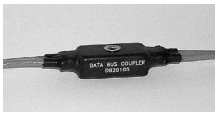
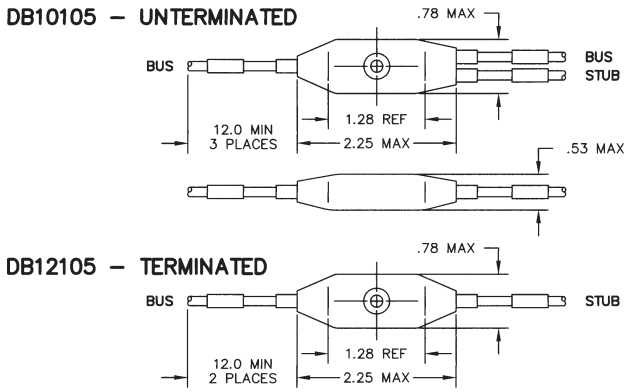


IN-LINE THROUGH-HOLE MOUNTED COUPLERS

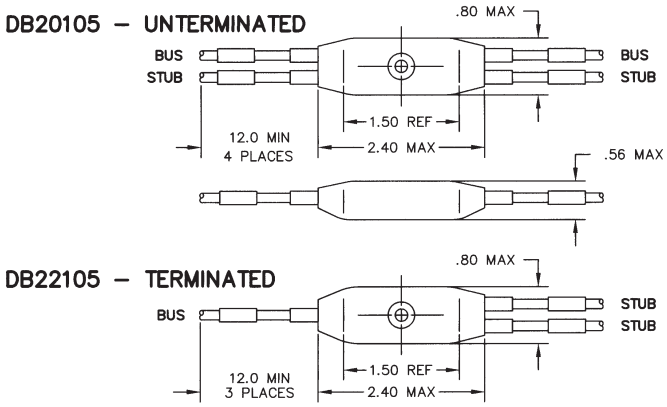
These couplers are Flight Qualified and Space Qualified units to SSQ 21676 and are available on special order.

Ordering Information:

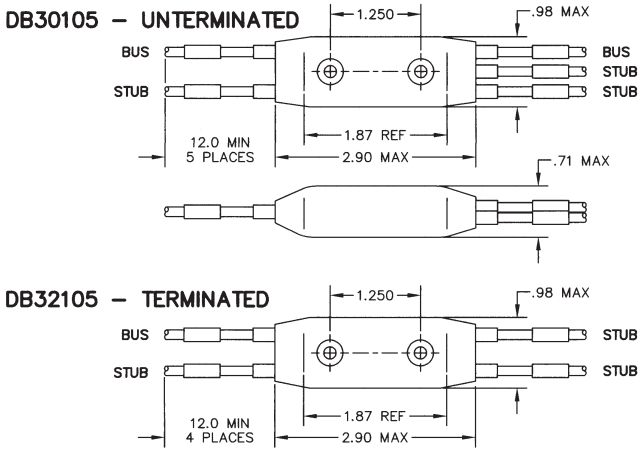
Single Stub



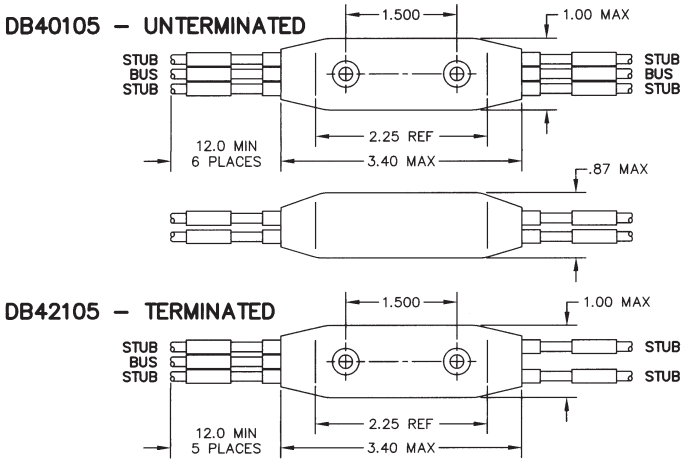
Two Stubs



Three Stubs



Four Stubs



All mounting holes are 0.164 Dia.; Weight without cable - 1 stub = 18 gm., 2 stub = 28 gm., 3 stub = 40 gm., 4 stub = 55 gm. All stubs are marked with a black marker. Patent Pending.

Accessories:

For external bus termination use	P/N DB03005
Extend cables with MIL-STD-1553 twinax cable	P/N 590M-17/176-00002
Splice with splice kit	P/N 571-18-8002
Test couplers and harnesses with Bus Network/Harness Tester	P/N DBT100A
Specifications subject to change without notice.	*Click here for a full list of accessories*

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IN-LINE MINI DATA BUS COUPLER

North Hills has developed a series of miniature data bus couplers for programs that are weight sensitive and have limited space and volume for installation. The couplers meet all MIL-STD-1553 electrical requirements and are manufactured using North Hills transformers and MIL-R-39007 one Watt minimum resistors. The parts can be purchased with internal termination resistors to further reduce installation complexity and parts count.

The couplers are supplied with one foot lengths of MIL-C-17/176-00002 cable without connectors for in-line splicing. Other lengths are readily available and connectors can be added if required. The couplers can also be provided as a fully tested harness assembly ready for installation.

North Hills Model # DB20015 In-Line Mini Coupler.

Features:

- Internal terminating resistor
- New slender design

Benefits:

- Easy to install -- reduces part count
- Ideal for programs that are weight sensitive and have limited space

Electrical Specifications:

All parameters are in accordance with IAW MIL-STD-1553B, Notice 1.

Droop	20% Maximum @ 250 kHz
Overshoot and Ringing	± 1.0V Peak (250 kHz square wave input with 100 ns maximum rise and fall time)
Common Mode Rejection	-45.0 dB (Max.) @ 1 MHz
Fault Protection	59Ω ± 1%, 1 Watt per MIL-R-39007
Input Impedance of Transformer[1]	3000Ω minimum (75 kHz to 1.0 MHz)
Stub Voltage	1.0V to 14.0V_{PP} transformer coupled
Operating Temperature	-55ºC to 125ºC
Storage Temperature	-55ºC to 155ºC
Electrical Notes	Isolation Resistors RS = 0.75 Zo (1W Min. Per MIL-R-39007) Termination Resistor RT = 76.8 ohms ± 1% (1W Min. Per MIL-R-39007) Nominal Line Impedance of Bus Zo = 77Ω Transformer Turns Ratio = 1:1.41 ± 3%

Higher temperature units available.

Specifications subject to change without notice.

[1] Individual input open-circuit

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MINI IN-LINE DATA BUS COUPLER

Ideal for programs that are weight sensitive and have limited space and volume for installation.

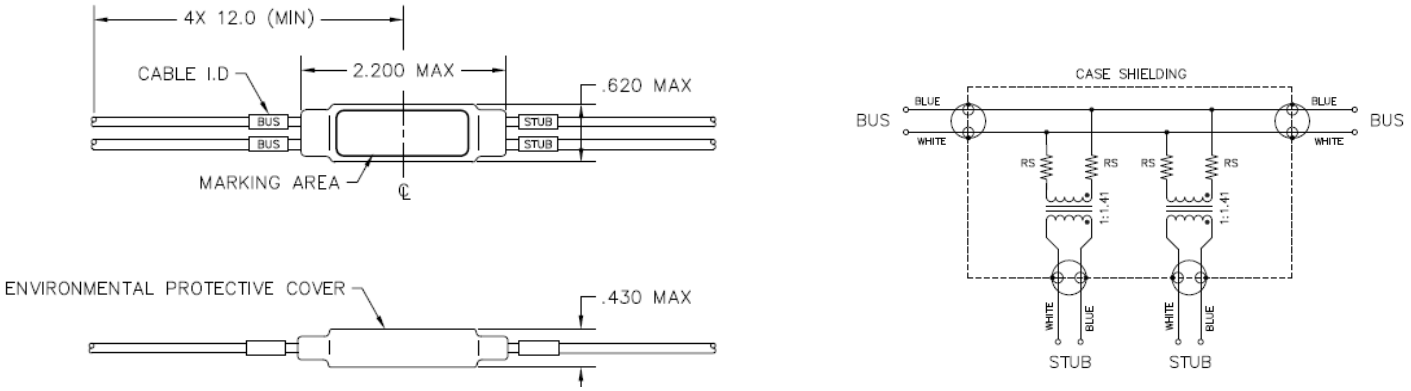

Figure 1.

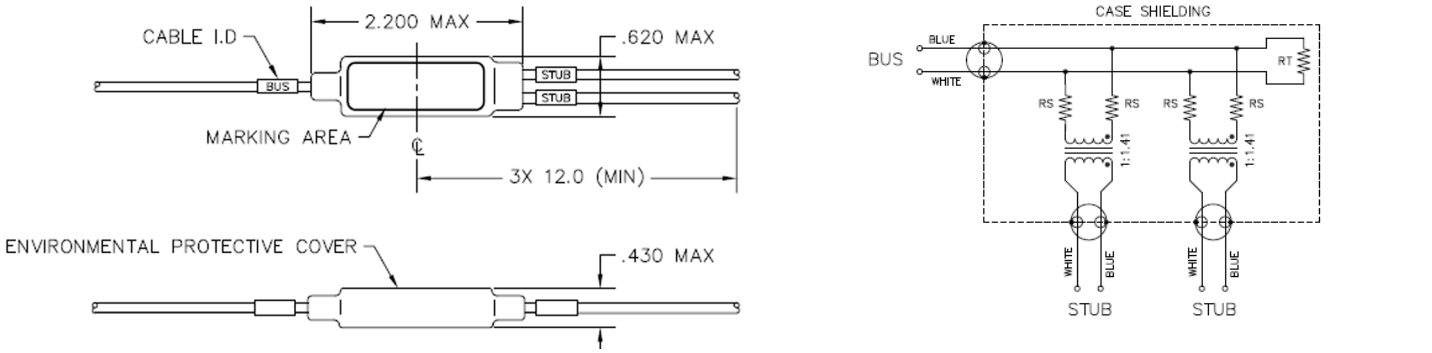

Figure 2.

MATERIAL SPECIFICATIONS:

Unless otherwise specified

Cable:	Per MIL-C-17/176-00002
Case Material:	Cold Rolled Steel, Hot Tinned
Weight :	15 grams (excluding cables)
Environmental Sleeve:	Per MIL-DTL-23053/5, Color: Black.
All cables identified with marked heat shrink sleeves.	
Dimensions include environmental protective cover.	

ORDERING INFORMATION:

Model #	Description	Figure
DB20015	2 Stub	1
DB22015	2 Stub with Terminator	2

Click here for a full list of accessories

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SUB-MINIATURE DATA BUS COUPLER

North Hills has developed a series of miniature data bus couplers for programs that are weight sensitive and have limited space and volume for installation. The sub-miniature data bus coupler is specifically designed for applications where the couplers must be firmly attached to the aircrafts surface. The couplers meet all MIL-STD-1553 electrical requirements and are manufactured using North Hills transformers and MIL-R-39007 one Watt minimum resistors. The parts can be purchased with internal termination resistors to further reduce installation complexity and parts count.

The couplers are supplied with one foot lengths of MIL-C-17/176-00002 cable without connectors for in-line splicing. Other lengths are readily available and connectors can be added if required. The couplers can also be provided as a fully tested harness assembly ready for installation.

North Hills Sub-Miniature Data Bus Coupler.

Features:

- Internal terminating resistor
- Through hole for mounting and case grounding
- Painted per MIL-P-23377 to resist fluids and solvents

Benefits:

- Easy to install -- reduces part count
- Ideal for programs that are weight sensitive and have limited space

Electrical Specifications:

All parameters are in accordance with IAW MIL-STD-1553B, Notice 1.

Input Impedance of Transformer[1]	3000 ohms minimum (75 kHz to 1.0 MHz)
Input Open Circuit	Z_o = 3000/Number of Stubs CABLE LENGTHS WILL AFFECT THE IMPEDANCE VALUE MEASURED
Droop	20% Maximum (250 kHz)
Overshoot and Ringing	± 1.0V Peak (250 kHz square wave input with 100 ns maximum rise and fall time)
Common Mode Rejection (CMR)	-45.0 dB (Max) @ 1.0 MHz
Termination Resistor (Models DB12305 & DB22305)	76.8Ω ±1% (1W Min Per MIL-R-39007)
Isolation Resistors ($0.75Z_0$)	59Ω ± 1% resistor in series with each bus winding connection
Stub Voltage	1.0V to 14.0V $_{PP}$ line-to-line, signal voltage (transformer coupled)
Operating Temperature	55ºC to +125ºC
Storage Temperature	-55ºC to +150ºC

[1] Individual input open-circuit

Specifications subject to change without notice.

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SUB-MINIATURE DATA BUS COUPLER

Ideal for programs that are weight sensitive and have limited space and volume for installation.

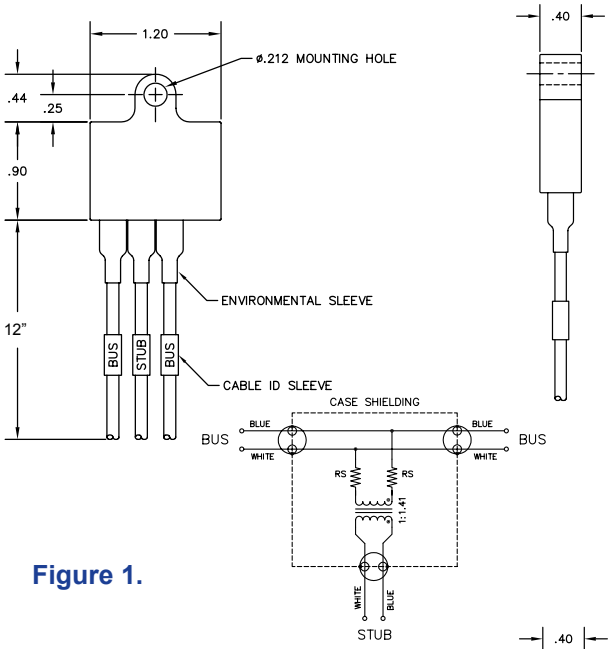

Figure 1.

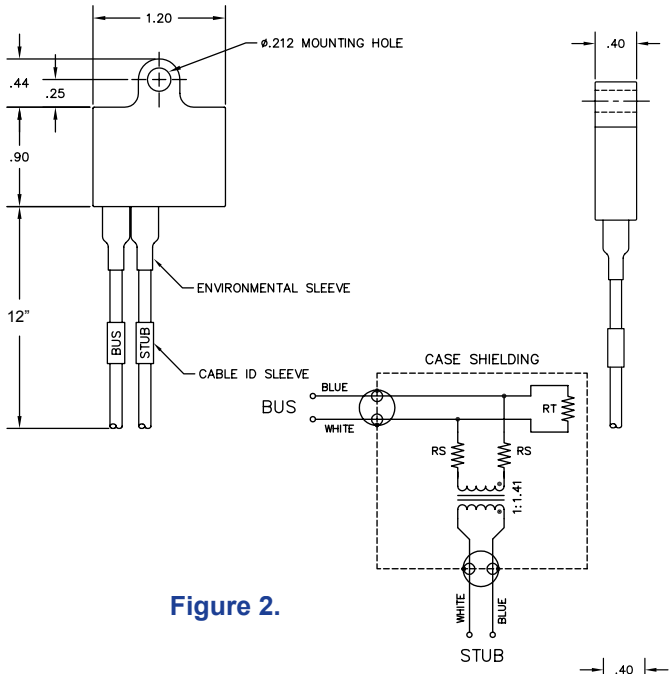

Figure 2.

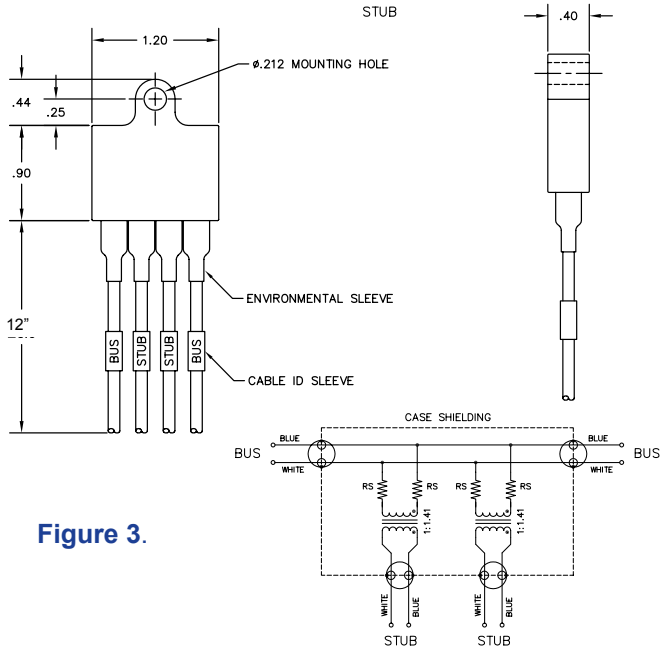

Figure 3.

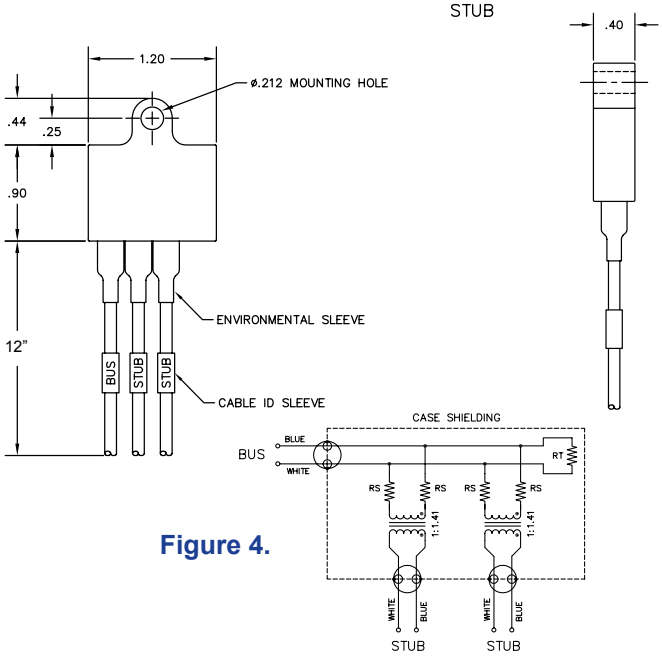

Figure 4.

MATERIAL SPECIFICATIONS:

Unless otherwise specified

Cable	Per MIL-C-17/176-00002
Case Material	Aluminum Alloy 6061-T651
Finish	Painted with one coat epoxy primer per MIL-P-23377 and 2 coats of polyurethane enamel per MIL-C-83286. The finished color shall be gloss white, color 17875, per FED-STD-595.
All cables identified with marked heat shrink sleeves	

ORDERING INFORMATION:

Model #	Description	Figure
DB10305	1 Stub	1
DB12305	1 Stub with Terminator	2
DB20305	2 Stub	3
DB22305	2 Stub with Terminator	4

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