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Microcomputer Glove Box Feedthrough and Installation

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*Microcomputer Glove Box
Feedthrough and Installation*

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MICROCOMPUTER GLOVE BOX FEEDTHROUGH AND INSTALLATION

by

James T. McFarlan and Raymond D. Olivas

ABSTRACT

A feedthrough mechanism for bringing data acquisition and control signals through a glove box wall is described in this paper.

Modern microcomputer (Macintosh or PC) data acquisition and control hardware that can perform a wide variety of process analytical and control functions is now available. Temperature and pressure measurements and digital control of solenoid valves are examples of common functions. A typical PC input/output (I/O) board such as the National Instruments AT-MIO-16 has 50 lines of combined analog and digital I/O. Electrical feedthroughs for glove boxes used in a nuclear materials environment are required to be hermetically sealed in order to facilitate safe operations. Hermetically sealed feedthroughs for 50 lines of I/O that can be readily installed on a glove box are not commercially available.

The industry standard signal cable used for connection to such an I/O board is a 50-conductor flat (planar) cable typically 2.505 inches wide with 0.050 inches between conductors. Typical termination of these cables calls for a 50-pin D-sub connector such as the Amphenol type 841-17-DDFR-A50S (socket) or P (plug).

The feedthrough selected to match this connector was the ITT Cannon type DDTBH50P00 (plug on both sides).¹ The ITT Cannon feedthrough is hermetically sealed, but lacks an easy method of mounting on a glove box access panel. This connector meets MIL-C-24308/9E² specifications (see Appendix).

To incorporate this device into a standard glove box feedthrough panel, a method of mounting and sealing was needed. Since the devices are limited in how much heat they can withstand without damage to the hermetic seal, the sealing method to the panel must be below a limiting temperature of

400°F ±10°F (204°C). This requirement eliminates sealing methods such as tungsten inert gas (TIG) brazing. No silver solder is commercially available to meet this criteria. A 60-40 tin-lead (standard electronics solder) with a melting point of 190°C was selected. Tin-lead solders are incompatible with the standard stainless steel feedthrough panels used on glove boxes at the Los Alamos Plutonium Facility. A secondary brass plate was designed to accept the D-sub device. A schematic of this plate is shown in Figs. 1a and 1b.

Fig. 1a. Mounting Plate for 50-Pin Feedthrough. Material is .125-inch brass.

Fig. 1b. Mounting Plate Hole Details.

To mount the connector body to the brass plate, the following steps are taken. The mounting plate and the connector are thoroughly cleaned with alcohol to remove dirt and grease. A small amount of Nokorode soldering flux is applied to the mounting plate and the connector is placed in the machined hole. A solder preform is then placed at the plate-connector interface and the entire assembly is heated in a furnace to a controlled temperature of 200°C. The connector is held in place by gravity during the heating process as shown in Fig. 2. When the solder melts, the assembly is removed from the furnace.

Fig. 2. Mounting Method.

To ensure a leak-tight seal, solder is worked around the connector while the assembly is still hot. The entire assembly is then allowed to cool to room temperature, and is helium leak tested.

The completed subpanel is then mounted on the stainless steel panel in much the same way as the stainless steel panel is mounted on the glove box, by using studs and a Viton gasket as shown in Fig. 3.

Fig. 3. The Completed Subpanel.

The need for connector locking devices is eliminated because considerable pressure is required to install or remove a 50-pin connector onto or from this feedthrough.

REFERENCES

1. *Hermetic Connectors*, ITT Cannon catalog HCC-2/1190 (ITT Corporation/ITT Cannon Canada, Whitby, Ontario, 1989). pp. 38–41.
2. "Connectors, Electric, Rectangular, Miniature, Polarized Shell, Rack and Panel, Plug, Pin Contacts, Hermetic, Class H and K," Military Standard MIL-C-24308/9E (Defense Materials Specifications and Standards Office, U. S. Department of Defense, 1975). 26 January 1989.

Appendix

MIL-C-24308 D Subminiature

D*H

D*H hermetically sealed connectors are designed to meet environmental conditions of extreme pressure differential. These connectors are part of the ITT Cannon D Subminiature series and are qualified to MIL-C-24308 (refer to page 41 for cross reference information). The hermetic seal prevents leakage and subsequent accumulation of corrosive moisture behind the connector. There are five basic shell sizes in both standard and thru-bulkhead designs which can accommodate from nine to 50 contacts. Polarization is achieved by the keystone

shape of the shell, a feature of all connectors within the D Subminiature series.

Locking devices are available for all shell sizes. Size 20 pin contacts are standard and have a current rating of 5 amps.† Eyelet, solder pot, and feed-thru contact terminations are available and can accommodate stranded wire up to #20 AWG. Operating temperatures range from -54°C to 150°C (-65°F to 302°F).

Your inquiries are invited regarding custom brazed component variations and special modifications.

† Military rating of #20 contacts or wires is 1.5 amps average, and 7.5 amps maximum. See explanation below.

How To Order

D*H

SERIES PREFIX _____	D	E	H	9	P	0	0	1
SHELL SIZE _____								
CLASS _____								
CONTACT ARRANGEMENT _____								
CONTACT TYPE _____								
FLANGE TYPE _____								
MOUNTING _____								
CONTACT TERMINATION _____								

SERIES PREFIX
ITT Cannon prefix

SHELL SIZE
E, A, B, C, D

CLASS
H - Hermetic

CONTACT ARRANGEMENT
See page 41.

CONTACT TYPE
P - Pin only

FLANGE TYPE
0 - Solid flange, no mounting or locking facilities
1 - Two .120 dia. mounting holes
2 - Two jackposts accepting No. 4-40 screws

MOUNTING
0 - Standard
4 - Shell brazed to plate; can be front or rear panel mounted

CONTACT TERMINATION
1 - Eyelet
2 - Solder pot
Printed circuit contacts - Consult factory

D*TBH

SERIES PREFIX _____	D	E	TB	H	9	P	0
SHELL SIZE _____							
SHELL STYLE _____							
CLASS _____							
CONTACT ARRANGEMENT _____							
CONTACT TYPE _____							
FLANGE TYPE _____							

SERIES PREFIX
ITT Cannon prefix

SHELL SIZE
E, A, B, C, D

SHELL STYLE
TB - Thru-bulkhead

CLASS
H - Hermetic

CONTACT ARRANGEMENT
See page 41.

CONTACT TYPE
P - Pin only

FLANGE TYPE
00 - Solid flange, no mounting or locking facilities
10 - Two .120 (3.05) dia. mounting holes
20 - Two jackposts accepting #4-40 screws on layout identification side
30 - Two jackposts on both sides (D*TBH only)

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Dimensions are shown in inches (millimeters).
Dimensions subject to change

Appendix (continued)

MIL-C-24308 D Subminiature

D*H

Materials and Finishes

Shell -	In accordance with ASTM 620, 619, 568 - Low carbon steel, plated with electro-deposited tin over cadmium over copper flash
Insulator -	Compression glass
Contacts -	In accordance with ASTM A108 - Steel, plated with electro-deposited tin over cadmium over copper flash

Military vs. ITT Cannon Current Ratings

The ITT Cannon rating for #20 contacts is 5 amps, which means 5 amps for all contacts simultaneously. MIL-W-5088 rates #20 contacts at 7.5 amps maximum. The explanation is as follows:

MIL-W-5088B, Paragraph 3.9.2.1.2 specifies:

"Table 1 current ratings for cables in bundles are based upon 15 or more cables carrying no more than 20% of the total carrying capacity of the bundle."

Table 1 specifies a current rating of 7.5 amps maximum for single wires in bundles of 15 or more wires. NOTE: Wires and contacts are both considered to be in the category of conductors.

Explanation

If 15 wires (normally rated at 7.5 amps per wire maximum, or at a total bundle current of 112.5 amps) are not to carry more than 20% of the total 112.5 amps, the average current rating per wire is 20% of 112.5 amps (total bundle capacity) divided by 15 (number of wires).

Conclusion

The Military rating of #20 contacts or wires is 1.5 amps average (based on 15 wires per bundle or 15 contacts per plug) vs an ITT Cannon rating of 5 amps.

Average Maximum Temperature vs Connector Size for various current ratings of mated pairs of D Subminiature connectors

Notes:

1. Free air condition. Connectors not shielded from ambient condition in any manner.
2. Confined condition. Connectors placed in insulated box (1 x 2 x 3.5) during test, with no moving air.
3. Average maximum temperature stabilization, 1 hour or less in all cases.
4. All contacts in each mated pair tested were wired in series with specified current flowing.
5. Ambient conditions 77°F, 50% rh.

Test Data

All voltages are measured from contact to shell, in unmated condition.

Voltage Rating (ac)	Sea Level	Altitude (feet)	20,000	50,000	70,000
Test (Max.)	750	625	225	175	
Insulation Resistance	5,000 megohms min. when tested per MIL-STD-202A, Method 302				
Contact Voltage Drop	6.67 millivolts per amp max. when mated with any Original D or GOLDEN-D connector receptacle				
Air Leakage Rate	1 micron cubic ft/hour max. (1.04 x 10 ⁻⁵ cc/sec.) at 1 atm pressure differential				
Vibration Resistance	Exceeds test requirements of MIL-STD-202, Method 204, Condition B				
Corrosion Resistance	Exceeds requirements of 48 hour salt spray exposure, tested in accordance with MIL-STD-202, Method 101				
Shock	Exceeds tests for MIL-STD-202 Method 213				
Ref. MIL C:24308					

D*H

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Appendix (continued)

MIL-C-24308 D Subminiature

D*H

Standard

D*H

Through Bulkhead

D*TBH

Note: Contact identification one side only.
Mounting capability either side.

Part Number by Shell Size	A ±.010 (0.25)	B* ±.010 (0.25)	C ±.005 (0.13)	D* ±.010 (0.25)	E ±.010 (0.25)	F ±.014 (0.36) -.005 (0.13)	G ±.010 (0.25)	H ±.010 (0.25)	J ±.010 (0.25)	K ±.008 (0.20)	M ±.015 (0.38)	X Solder	X Eyelet
DEH9P.*	1.208 (30.68)	.703 (17.86)	.984 (24.99)	.366 (9.30)	.498 (12.65)	—	.725 (18.42)	.369 (9.37)	.094 (2.39)	—	.334 (8.48)	.238 (6.05)	.161 (4.09)
DETBH9P.*	1.208 (30.68)	.703 (17.86)	.984 (24.99)	.366 (9.30)	.498 (12.65)	.112 (2.84)	—	—	—	.236 (5.99)	—	—	—
DAH15P.*	1.545 (39.24)	1.029 (26.14)	1.312 (33.32)	.366 (9.30)	.498 (12.65)	—	.932 (23.67)	.369 (9.37)	.094 (2.39)	—	.334 (8.48)	.238 (6.05)	.161 (4.09)
DATBH15P.*	1.545 (39.24)	1.029 (26.14)	1.312 (33.32)	.366 (9.30)	.498 (12.65)	.112 (2.84)	—	—	—	.236 (5.99)	—	—	—
DBH25P.*	2.093 (53.16)	1.589 (40.36)	1.852 (47.04)	.384 (9.75)	.498 (12.65)	—	1.479 (35.57)	.369 (9.37)	.103 (2.62)	—	.334 (8.48)	.238 (6.05)	.161 (4.09)
DBTBH25P.*	2.093 (53.16)	1.589 (40.36)	1.852 (47.04)	.384 (9.75)	.498 (12.65)	.128 (3.25)	—	—	—	.226 (5.74)	—	—	—
DCH37P.*	2.733 (69.42)	2.237 (56.82)	2.500 (63.50)	.384 (9.75)	.498 (12.65)	—	2.125 (53.98)	.369 (9.37)	.103 (2.62)	—	.334 (8.48)	.238 (6.05)	.161 (4.09)
DCTBH37P.*	2.733 (69.42)	2.237 (56.82)	2.500 (63.50)	.384 (9.75)	.498 (12.65)	.128 (3.25)	—	—	—	.226 (5.74)	—	—	—
DDH50P.*	2.640 (67.06)	2.133 (54.18)	2.406 (61.11)	.490 (12.45)	.610 (15.49)	—	2.000 (50.80)	.500 (12.70)	.103 (2.62)	—	.334 (8.48)	.238 (6.05)	.161 (4.09)
DDTBH50P.*	2.640 (67.06)	2.133 (54.18)	2.406 (61.11)	.490 (12.45)	.610 (15.49)	.128 (3.25)	—	—	—	.226 (5.74)	—	—	—

*Add contact termination mounting, and flange type, see part number explanation.

*Dimensions B and D are measured as outside dimensions from the start of the radius corner.

D*H

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Dimensions are shown in inches (millimeters).
Dimensions subject to change.

Appendix (continued)

MIL-C-24308 D Subminiature

D*H

Mounting Dimensions

Hermetic sealing is effective only when connectors are front panel mounted, except for brazed assemblies in which both shells are brazed to the plate. Brazed assemblies may be used for either front or rear panel mounting, and entire connector is subject to leak test. Consult factory for other rear mounting applications.

D*H

D*TDH

Part Number by Shell Size	C ±.005 (0.13)	P	S	U Min.	V Min.
DEH9P.*	.984 (24.99)	.735 (18.67)	.379 (9.63)	.794 (20.17)	.457 (11.61)
DETBN9P.*	.984 (24.99)	—	—	.794 (20.17)	.457 (11.61)
DAH15P.*	1.312 (33.32)	.942 (23.93)	.379 (9.63)	1.120 (28.45)	.457 (11.61)
DATBN15P.*	1.312 (33.32)	—	—	1.120 (28.45)	.457 (11.61)
DBH25P.*	1.852 (47.04)	1.433 (36.42)	.379 (9.63)	1.682 (42.72)	.477 (12.12)
DOTBN25P.*	1.852 (47.04)	—	—	1.682 (42.72)	.477 (12.12)
DCH37P.*	2.500 (63.50)	2.135 (54.23)	.379 (9.63)	2.330 (59.18)	.477 (12.12)
DCTBN37P.*	2.500 (63.50)	—	—	2.330 (59.18)	.477 (12.12)
DDH50P.*	2.406 (61.11)	2.010 (51.05)	.510 (12.95)	2.226 (56.54)	.583 (14.81)
DDOTBN50P.*	2.406 (61.11)	—	—	2.226 (56.54)	.583 (14.81)

Cross-Reference Chart

Military Part No.	ITT Cannon Part No.	Military Part No.	ITT Cannon Part No.	Military Part No.	ITT Cannon Part No.
M24308/9-1	DEH9P002	M24308/9-8	DBH25P001	M24308/9-15	DDH50P202
M24308/9-2	DAH15P002	M24308/9-9	DCH37P001	M24308/9-16	DEH9P201
M24308/9-3	DBH25P002	M24308/9-10	DDH50P001	M24308/9-17	DAH15P201
M24308/9-4	DCH37P002	M24308/9-11	DEH9P202	M24308/9-18	DBH25P201
M24308/9-5	DDH50P002	M24308/9-12	DAH15P202	M24308/9-19	DCH37P201
M24308/9-6	DEH9P001	M24308/9-13	DBH25P202	M24308/9-20	DDH50P201
M24308/9-7	DAH15P001	M24308/9-14	DCH37P202		

Contact Arrangements

Face View
Pin Insert

E
9
#20

A
15
#20

B
25
#25

Shell Size
No. of Contacts
Contact Size

C
37
#20

D
50
#20

Shell Size
No. of Contacts
Contact Size

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