

Connecting the **EXPANDING** Backplane

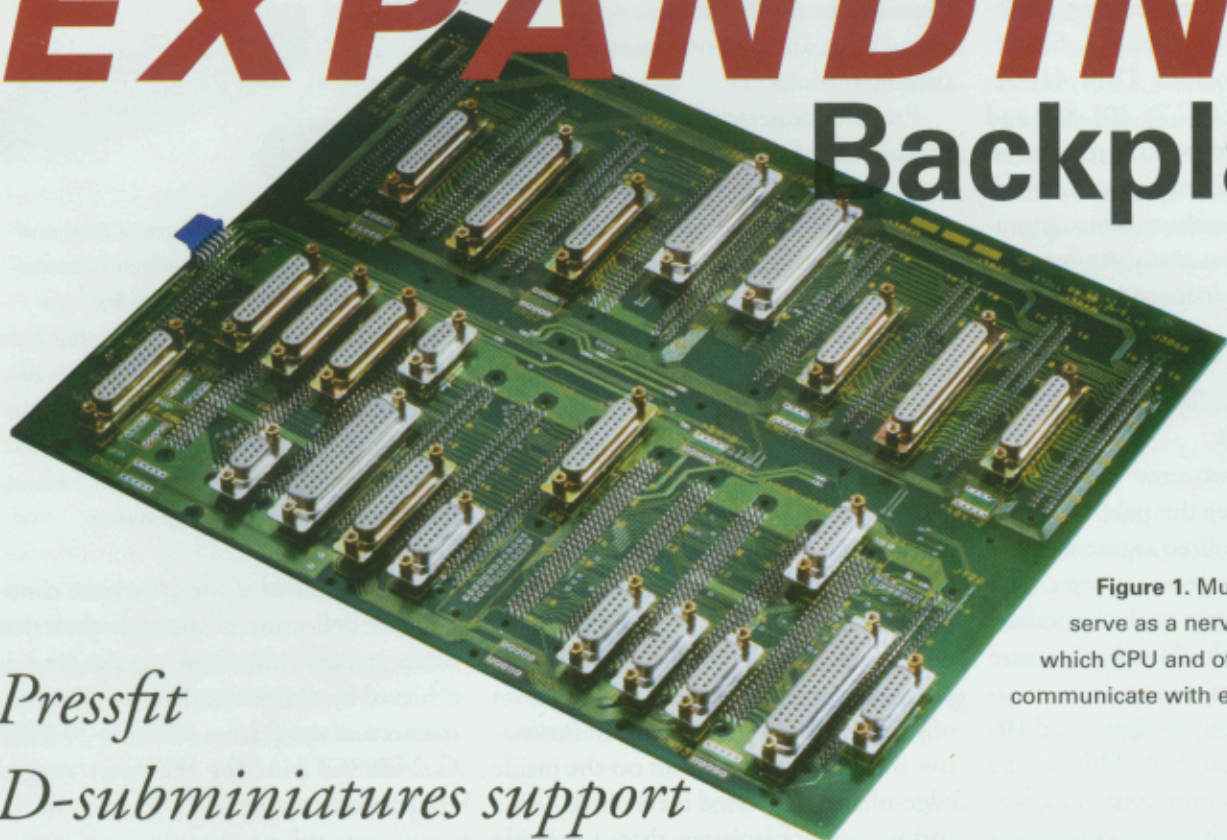


Figure 1. Multilayer backplanes serve as a nerve system through which CPU and other function cards communicate with each other.

Pressfit

D-subminiatures support design and assembly of multilayer PCBs.

The D-subminiature connector often is part of the input/output (I/O) interconnect path, connecting the main part of the system to peripheral devices. The parallel and serial ports on many personal computers (PCs) are connected to peripheral devices via cables that often use D-subminiature connectors at each interface connection. For larger computers and controls with complex bus systems, many daughtercards plug into a series of high density connectors on a multilayer backplane. This backplane serves as a nerve system through which the central processor unit (CPU) and other function cards communicate with each other (Figure 1). Often the I/O connections are positioned off the front of the function cards. However, in an effort to get cables to the rear, out of the way of operators and service technicians, the I/O is taken directly off the backplane, behind or to one side of the daughtercard connections.

In North America, this family of connectors represents over \$385 million in sales annually according to Chicago based Bishop and Associates. Fleck Research of Santa Ana believes they are used in the following market segments: 25% Computer, 24% Communications, 26% Datacom and Networking, 12% Mili-

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S P E C S H E E T

- ✓ **End Applications:** Data communications and networking equipment, computers and peripherals, and bus systems
- ✓ **Related Products:** PCBs, backplanes, mounting hardware, shielding, contacts, pick-and-place equipment
- ✓ **Main Points:** Pressfit D-subminiature backplane connectors used to interconnect PCs and larger computer systems to peripheral devices:
 - are available in many sizes with a range of options,
 - simplify design and manufacturing of multilayer PCBs, and
 - reduce costs related to automated assembly.

tary and the balance 13% go into many other areas including consumer applications, office equipment, medical equipment and others. These trapezoidal connectors with a rectangular, staggered pin field have been standardized by a multitude of organizations. Some of the pertinent standards include DIN 41652, Mil-C-24308C, CECC 75 301-802 and IEC 807-2/3. This connector remains an important I/O interface because it is readily available in numerous versions, is generally inexpensive, has many vendors, has good electrical properties and is physically rugged.

D-Subminiatures in the Backplane Industry

The backplane connector market has evolved rapidly over the past 10 years, representing a specialized segment of the D-subminiature connector market. The most significant change in the backplane market related to the D-subminiature connector is the transition from two- and four-layer designs to eight- and 10-layer counts and higher. This is the result of the trend toward four- and five-row backplane/daughtercard connectors with added ground and power layer requirements.

These higher layer count PCBs are becoming expensive components and are more sensitive to thermal stresses

involved in wave soldering operations. This has created a greater interest in finding pressfit components for the balance of the installed components on the backplane. Because I/O connectors typically go on the backplane's rear side, this is another reason to choose pressfit versions.

Pressfit connectors have another significant benefit: the expense of the higher layer count backplane makes a removable pressfit connector more desirable. Generally, most pressfit specifications require that the plated through hole in the backplane be capable of accepting the installation of up to three virgin contacts without damage. This allows backplane repair during the manufacturing process or in the field.

As with the many other areas of the networking and communications industry, the careful control of radiated noise and immunity from EMI (Electro Magnetic Interference) must be controlled by proper grounding practices. One version of pressfit connectors feature an innovative integral spring contact on the inside edge of the tin plated steel shell. This spring contact ensures that a reliable ground contact is made between the outside shell of the socket connector and the inside surface of the mated plug connector. Multiple closely spaced spring fingers eliminate gaps that would pass high fre-



Figure 2. These pressfit vertical plug and socket D-subminiature connectors manufactured by ERNI Components Inc. are designed for the demanding requirements of the backplane market. They feature tin-plated steel shells and PBT insulators and are available in nine-, 15-, 25-, 37- and 50-pin configurations with preinstalled stand-offs and other mounting hardware.

quency noise and at the same time eliminate the deflection of the male shell that often occurs when this grounding is achieved by dimples or detents. The plug connectors also feature solid size 20 (MIL C 24308C) pins for the most rugged applications.

The Pressfit Advantage

Today's networking hardware is increasingly complex. The expanding communications and networking industries are fueling demand for greater backplane volumes and backplanes with higher layer counts, thus automation is becoming essential. Pressfit components lend themselves to automated assembly, and pressfit assembly solves a myriad of manufacturing problems. The process eliminates soldering errors, flux problems, secondary cleaning steps and the use of environmentally restricted solution.

Automated assembly equipment that can handle pressfit components will ensure defective components are not pressed into place. This is done by accurately monitoring the insertion force profile against an acceptable set of defined limits.

Backplane designers now can choose from a wide supply of three- to seven-row, pressfit, high density backplane/daughter-

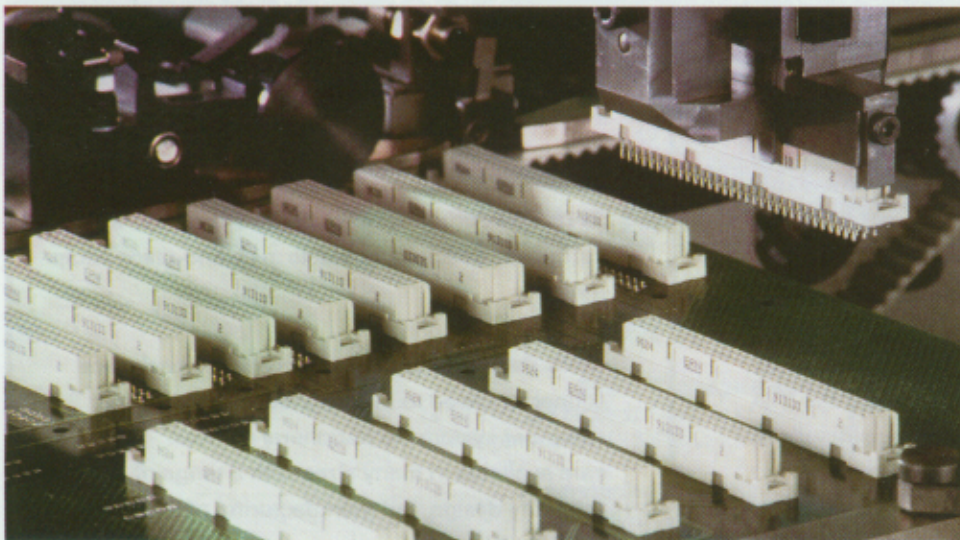


Figure 3. Semi- and fully automatic machines and hand-operated presses are used for higher volume pressfit applications. The ERNI Press Center, shown here, is capable of inserting more than 30 connectors/min on PCBs up to 31.4 x 23.6".

card connectors. Other pressfit components such as power connectors and component sockets also are available. Pressfit D-subminiature connectors are available from many companies as well (Figure 2).

The pressfit process results in a rigid assembly for vertical mounting. For that reason, additional hardware often is not needed to secure the connectors to the backplane PCB. However, threaded standoffs for optional screw mounting can ensure the ground path from the metallic shell of the connector has a reliable course to a ground pad on the PCB. If a cable assembly should mate with the backplane-mounted D-subminiature connector, other mounting hardware is available, such as #4-40 and M3 hex nuts.

Socket connectors from one manufacturer are designed for flat rock pressfit installation, which eliminates the need for specialized pressfit tooling. The socket contacts feature gold over nickel-plated, dual-beam contacts, ensuring a normal force greater than 0.8 newtons and greater than 200 mating cycles in accordance with DIN 41652. They also have been tested for resistance to shock and vibration, and show no discontinuity at up to 20 G from 10 to 2,000 Hz. One version of the pressfit terminal* has a patented compliant section, which has been tested and shown to require less insertion force than other pressfit designs. This same compliant zone, as part of another connector family, has been found to meet Bellcore TR-NWT 001217 requirements for large systems (SQ Req.III) including the mixed flowing gas test for outdoor environments.

Development of Assembly Equipment

Fully automated pick-and-place assembly equipment for through-hole and surface mount components has been available for some time and should be familiar to manufacturing engineers. Over the past several years, semiautomatic equipment has been developed for higher volume pressfit applications (Figure 3).

One manufacturer* has developed a range of equipment from semiautomatic and hand-operated presses to fully automated machines. For use in high volume applications, the fully automated equipment can insert more than 30 connectors/min on PCBs up to 31.4 x 23.6" (800 x 600 mm). Tooling for up to 10 different connectors is handled automatically. Delicate connectors can be unloaded from vacuum-formed plastic trays, and more durable connectors, such as all metal 10-pin power bugs, can be fed from vibratory bowl feeders. These bowl feeders and unloading stations can be serviced and refilled while the machine is operating without compromising the safety shielding that protects the operator.

PCBs are fed into the machine by a conveyor from outside the safety barrier. If connectors must be installed on both sides of the PCB, an optional station is available that turns the PCB over after one side has been completely assembled. These machines use simple modular backup tools to support the PCB against the force of the connector being inserted. The design is cost effective because it eliminates the specially designed backup plates for each backplane configuration, which often are necessary for conventional pressfit

assembly methods. Test and inspection stations ensure an accurate position and control of the connector during the pick-up, transport and insertion process.

Conclusion

With multiple source pressfit daughterboard connectors from two to seven rows and densities from 0.100" to 0.050" (2.54 to 1.27 mm), as well as pressfit component sockets, pressfit power connectors and pressfit D-subminiature I/O connectors, the backplane designer has all the manufacturing advantages pressfit technology offers. In many cases, complex backplanes can be designed to completely eliminate soldering.

The increasing layer count of high performance backplane and midplane designs, resulting from the use of daughtercard connectors with more than four rows, has made the design of full pressfit assemblies more attractive. Growing volume requirements of the communication and networking fields also have expanded the need to automate backplane assembly. The availability of pressfit D-subminiature connectors and fully automatic assembly equipment will simplify design and manufacturing tasks for today's equipment manufacturers. ✓

*Manufactured by ERNI Components Inc., Chester, Va.

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