



Solderless Press-FIT Technology

DIGISOL Systems Limited



This document discusses the inner workings of how solderless (Press-fit) technology can be used to build innovative devices to work with each other in this rapidly growing technology industry.

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Introduction

In a span of 16 years the demand for Power Over Ethernet (PoE) and electronic components is steadily increasing making headway into applications. According to the new market research report published by MarketsandMarkets, the PoE market is expected to grow from USD 451.1 Million in 2015 to reach USD 1,048.3 Million by 2021, at a CAGR of 12.56% between 2016 and 2022¹.

Organizations are moving towards PoE, as it provides the flexibility of running power and data transmission over the same cable, this eliminates the need for additional wiring installations, making installations easier and saving cabling costs. From its development in the year 2003 the standard was set

Type	Standard	PSE Min O/P Power	Power Over
Type 1	IEEE 802.3af	15.4 W	2 Pairs
Type 2	IEEE 802.3at	30 W	2 Pairs
Type 3	IEEE 802.3bt	60 W	2 or 4 pairs class 0-4 , 4 pairs class 5-6
Type 4	IEEE 802.3bt	90-100 W	4 pairs class 7-8

to provide only up to 15.4 W of power, with emerging technology and systems the IEEE worked on updating the standard. The latest standard 802.3bt supports up to 60 W of power for Type 3 devices and up to 100 W for Type 4 devices.

PoE allows for the centralization of power into one location. And it supports new applications such as centralized building controls that can adapt to individual users and the internet of things (IoT).

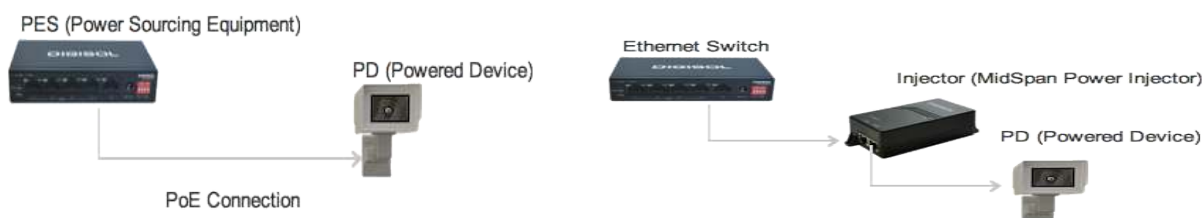
How does PoE Work?

PoE works on the principle of transmitting electric power and data to devices that are within or outside the perimeter of electric power. For PoE to work it is essential to have Power Sourcing equipment (PSE) and a Powered Device (PD).

PSEs are typically designed as mid-span or end-span devices. A **network switch** or **PoE Injector** act as power sourcing equipment and devices like IP Cameras, VoIP Phones or access points are used as powered devices.

Devices that are not PoE complaint use PSEs as midspan, this stand between the standard Ethernet switch and the end device to be able to deliver power and data over one cable. The end-span PSE is built into an Ethernet and is placed at the LAN endpoint opposite the PD.

Industry Standard PoE switches has the capability of power management, which enables connected PoE devices to power cycle.



What are the Benefits of PoE?

- 1) PoE enables device portability and hence makes it easier to install devices where power outlet is unavailable.
- 2) As power outlets are not necessary to be installed this helps in huge cost savings on cabling material, labour, and administration.
- 3) Eliminates the clutter of cables since only Ethernet cable are to the end devices
- 4) Promotes efficiency as there is centralized maintenance of power.
- 5) Allows intelligent devices to be connected to a single network providing seamless experience

PoE Applications and Footprints:

With growing technology trends, Internet of Thing (IoT) applications are now compatible with PoE devices. Home automations, robotics, smart wearable are now more efficient. The “Internet of Things” is exploding. The scope of IoT devices is growing rapidly, from 2 billion objects in 2006 to a projected 200 billion by 2020². Since the year 2016 we have seen a revolution in Artificial Intelligence Google assistance, Siri and Alexa have promoted the use of PoE.



Educational institutes and organizations are now heavily using wireless networks to eliminate cable costs as PoE capable access points can be installed anywhere.



Outdoor security cameras in corporates, schools and retails facilitate seamless operation as the system integrates with PoE.



Energy efficient LED bulbs can now be powered using PoE. It allows the consumer to control the bulbs with mobile apps or web based clients.

Structured Data Center Cabling

A structured cabling system defines a complete cabling system of the data center along with the hardware components, communication infrastructure (voice, data, video) and various management systems of a building (such as security access, access management system, etc.).

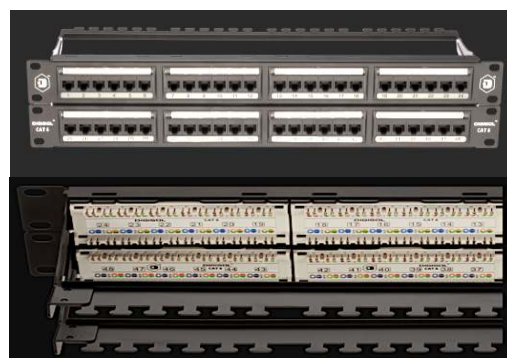
For a datacentre it is important to have a flexible and reliable cabling system, which can be achieved using a patch panel. The primary benefit of using patch panel is the improved organization and easier management of your network. Since there may be many cables or cable connections in the datacenter room, by using patch panels you can label the panels, which will help in identifying end devices connected to the panels in case of change management or disaster management. There are two kinds of patch panels Copper Patch Panels and Fiber Patch Panels. The most ideal patch panel for a datacenter is a copper patch panel.

What is Copper Patch Panel?

Copper patch panels are designed for copper cables like Cat5e, Cat6, Cat6a and Cat7 that are both shielded and unshielded. Cables coming into the panel are terminated using insulation displacement connector on one side and on the opposite side the modular connector plugs into the port which corresponds to the terminated wires. With the Ethernet patch panel, each pair of cables has an independent port

What is Solderless technology, Press-FIT?

To create solderless solutions that are lead-free and to maintain production efficiency for manufacturers the main challenge is to create on-board interconnect solutions. Soldering processes that are required to attach large connectors and other specialized interconnects are very difficult to convert to them into solderless lead-free products. This primary affects the heavy copper PCBs such as power interconnects.





Almost all electronic assemblies are soldered using infrared reflow. There are few components that are not compatible with this methodology and require alternative processes to attach them to the PCB for example connectors. These processes require an additional step of soldering either Wave Soldering or via hand soldering, which leads additional cost of manufacturing and also increases risk of oxidation. This eventually leads to degradation of the component. An innovative option to reduce and handle the costs and complexity is to use a solderless approach.

Electrical assemblies like blade and socket connections have been using this mechanism for many decades. Consider a blade that is attached to the component using the reflow process and a socket is fitted into the PCB during the reflow process. The board is then assembled, while this approach is straightforward, there are certain drawbacks.

These connections are mated and unmated several times which lead to lower insertion forces. Since these processes can create electrical resistance and inductance, this can impact the circuit designs leading to lesser efficiency. To eliminate situations like fretting many a times precious metals are required, which can lead to additional costs.

To mitigate these engineering costs and product efficiency a **Solderless Technology, Press-Fit** has gained momentum. Press-fit has enabled creation of new designs and products that are reliable than traditional solder joint components. Since it is lead-free and solder-free it adds a lot of flexibility in designing wide range of applications.

Lead free soldering solutions require an increase in temperature (125 – 150 degree centigrade) for soldering which increases the need for plastic material that are expansive in nature. This is mitigated by using press fit solderless technology. The advantage of using solderless press fit technology eradicates the need for using high temperature plastics that are not environment friendly.

One of the most important areas where this plays a major role is the automotive industry where the need for space can be minimized by the usage of press fit technology. Press-fit technology offers a solution for big connectors in combination with a reflow soldering process. By eliminating the high temperature solder process, press-fit pins eliminate the risk of solder slugs, which can jump during the assembly process, cold solder joints and flux residue, which potentially cause short circuits or PCB damage.

In manufacturing electronic devices surface mounting technology (SMT) is a state of the art soldering process step applying numerous electronic components to a PCB. Large soldering headers often disturb the SMT reflow process. The pins of the header and neighbouring components are obtaining a too low temperature, resulting in a defective soldering process. This can be solved by adding the header after the soldering process by means of press-fit technology. The press-fit pin insertion process is fast, cheap and reliable manufacturing process that allows a repair of the press-fit pin up to two times. Another important aspect of press-fit technology is reliability.

With an ever innovating industry of smartphones, the market trend is now moving towards battery life that lasts longer. Consumers expect to be able to use their phones for an entire day without having to recharge the battery. Manufacturers are responding by increasing battery capacity, and therefore battery size, but they face a challenge in doing so without increasing the thickness of the phones. Solderless press fit solution offers flexible PCBs that can tolerate bending around tight radii of curvature to fit everything into miniaturized space.

How does Press-Fit work?

Press-Fit is a solder free electrical assembly process that uses a tight fit and high-pressure mechanism where the terminals of a press-fit connector are inserted into through-holes in the printed circuit board, with the induced pressure it creates contact between the holes and the terminals to pass electric current.

Press fit pinions are also known as interference fit, the through-holes either be the exact size of the shaft or usually slightly undersized, when the two are pressed together, a tension is created which results in super high friction that allows force to be transferred through the assembly with essentially no loss or slippage as the friction force is greater than the rotary force being generated in the process.

Press-fit connectors are now popularly used in many applications like data and communication to transportation and mechanics and also hospital equipment. Press-fit pin is inserted in a compliant section which is slightly bigger than the PCB hole. Once the pin is inserted the compliant section gets compressed this is known as a Press-Fit Connection. The compliant section dynamically adjusts to a controlled variance in hole sizes.

A Compliant Pin is formed by using a flat sheet copper metal stamping and coining process. This process includes a precision punch and die tooling set. A Press fit Compliant Pin section is designed primarily to compress with a dynamic coefficient during press insertion into the circuit board. It is important to note that to adapt to a given finished hole diameter range as specified by the connector manufacturer. The Compliant Pin interference will create a gas tight mechanical interconnection to the PCB PTH thus providing a proven, dependable and reliable interface.

The functionality of such a system is dependent of the properties / characteristics of both of the components and their interactions. Characteristics and properties considered are listed below:

Properties:

- ☑ Drill Diameter of plated through hole
- ☑ Copper Tube Thickness
- ☑ Board Material and Base Material
- ☑ Design of Press Fit Pin and Plated through hole

Characteristic Features:

- ☑ Insertion and Retention force
- ☑ Contact Resistance and Current carrying capacity
- ☑ Hole Deformation coefficient

Benefits of Solderless Press-Fit in enterprise infrastructure

- ☑ Chemical-free process allows press-fit to boasts strong environmental credentials.
- ☑ Side-effects associated with solder vapour and welding flux residues are eliminated.
- ☑ Connector pins can be easily replaced.
- ☑ Low heat dissipation and thermal stress due to lower resistance.
- ☑ Reduces soldering defects like bridges, bad wetting and flux residuals
- ☑ It has the capacity handle high range of temperature from 125°C to 150°C and above with high current carrying capacity.
- ☑ Provides robust and reliable system performance which enables for a faster and more efficient manufacturing process.

DIGISOL'S SOLDER-FREE PATCH PANEL

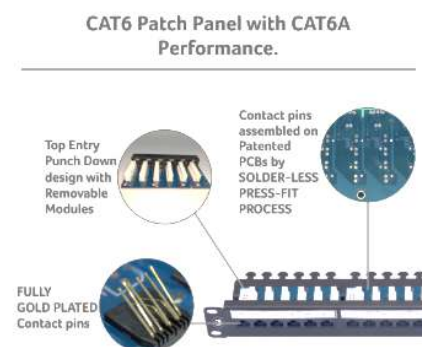
With Increasing demand of PoE applications and solder-free there is a need for products that are robust to oxidation and help in maintaining the efficiency of PoE Applications. **DIGISOL recently launched its Solder-free Patch Panel 90 Degree UTF Cat 6 Panel.** The patch panels have integral cable management shelf ensured for bend radius compliance. Exceeds ANSI/TIA/EIA-568-C.2 standard and supports 1000-BASE-T. CAT6 Performance equal to that of CAT6A.



The benefits of this product as depicted below:

Key Features offered by this Patch Panel:

- ☑ 90 Degree (Top Entry) Punch Down Design for Convenient Network Terminations
- ☑ Fully (360 degree covered) 30 microns Gold plated Contact pins, for better for POE Application.
- ☑ 6 Port Jack configuration specially designed & moulded in ABS Fire retardant material.
- ☑ Better transmission with CAT6 Performance equal to that of CAT6A
- ☑ 1U Patch Panel to Mount in any Standard Rack
- ☑ Contact pins and IDC mount pins are assembled in patented PCB by Solder-Less Press Fit Process



Technical Specifications:

Electrical:-

Current Rating	: 1.5amps
Insulation Resistance	: $\geq 500\text{m}\Omega$
Contact Resistance	: $\leq 10\text{m}\Omega$
DC Resistance	: $\leq 0.1\Omega$
DC/AC Volt Endurance	: DC 1000V/AC 750V 1 Min.

Mechanical:-

Plug Insertion Life	: ≥ 750 Cycles with FCC Compliant RJ-45 Plug
Plug & Jack Contact Force	: ≥ 100 Grams with FCC Compliant RJ-45 Plug
Plug Retention Force	: ≥ 11 LBF
Durability	: 200 Termination Cycles
Operating Temperature	: -10 Degree ~ 60 Degree
Operating Humidity	: 10% ~ 90% RH
Storage Temperature	: -40 Degree ~ 68 Degree

Physical:-

Panel Frame	: SPCC Powder Coating In Black Color
Housing	: High Impact Flame Retardant Plastic, UL 94V-0 Rated
PCB	: FR4, 1.6mm Thickness
Jack Wire	: 50 μ " Phosphor Bronze Gold Over Nickel Plating
Jack Configuration	: 6x4 Module Special Design
IDC Conductor	: 0.5 mm Phosphor Bronze, Tin Plating
Contact Compatibility	: 22~26 AWG Stranded and Solid Wires

PoE application products are inevitable. When Flux is used, high power flow over time leads to melting of flux, thus hampering the efficiency of PoE Applications before time. Contact pins assembled in Solderless Products by PRESS-FIT Technology, which helps Contact Pins remain shiny, results in better signal transmission at electron level. Using Solder less patch panels and keystones help in increasing the efficiency as Flux is absent.

Contact Pins in Solderless Products are 30 microns Fully Gold Plated, thus offering higher flexibility vs traditional stamped pins. This is another factor which contributes in better PoE efficiency. (Show image of the Solderless PCB with Contact pins)

You get CAT6A patch panel performance in a CAT6 Solderless Patch panel. So, Solderless Products are more robust to oxidation thus leading to longer life and improved performance. This solder free design avoids use of rare earth metals, avoids use of lead (Pb), which when disintegrated can soil Mother Earth

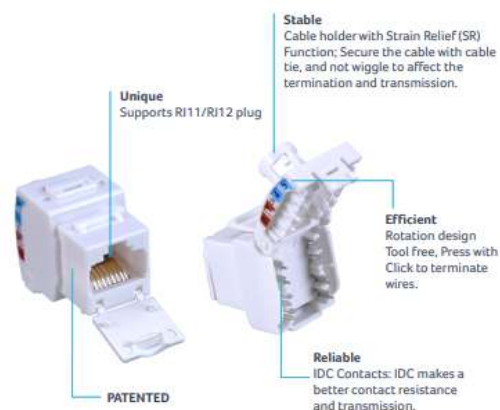
DIGISOL KEYSTONE CAT6 UTP TOOLLESS TYPE

DIGISOL Category 6 Keystone is Patented Toolless Design 50 Micron Gold Plating Suitable For 23~24 AWG Stranded and Solid Wire, Easy for Termination and Compliant to T568A and T568B Wiring Schemes.

Cat 6 cable is a newer version after Cat 5E these are certified to handle giga ethernet with a bandwidth of 250 mbps.

Key Features offered by this Keystone :

- ☑ Efficient Rotation Design Tool Free, Press with Click to Terminate Wires.
- ☑ Cable Holder with Strain Relief Function for Better Termination and Transmission.
- ☑ Reliable IDC Contacts with Colour Coding for Better Contact Resistance and Transmission.
- ☑ Fast, Easy, Reliable Termination.
- ☑ Removable Shutter Option.
- ☑ Patented Design.
- ☑ Keystone Jack Can Be Easily Terminated by Hand, Optional Termination by Hand Tool.



Technical Specifications:

References:

**Electrical:-**

Current Rating	: 1.5amps
Insulation Resistance	: 500 MΩ minimum
Contact Resistance	: 10 mΩ maximum
DC Resistance	: 0.1 Ω maximum

Mechanical:-

Plug Insertion Life	: 750 Cycles minimum
Plug & Jack Contact Force	: 100 Grams minimum using FCC-approved plug
Plug Retention Force	: 30 lbs minimum
Temperature	: -40° to 150°F (-40° to 68°C)

Physical:-

Housing	: High impact flame retardant plastic, UL 94V-0 rated
PCB	: FR4, 1.6mm Thickness
Jack Wire	: Phosphor bronze gold over nickel plating
Nickel Plating Base(Ni)	: 40μ~80μ
Gold Plating	: 50 microns
Connector	: Insulation displacement connector (IDC) Accept #23~24 AWG solid wire

1 "Power Over Ethernet Solutions Market by Type (PSE Controllers & ICs, PD Controllers & ICs), Device Type (Power Sourcing Equipment, Powered Devices), Application (Connectivity, LED Lighting Control), Vertical, and Geography - Global Forecast to 2022," MarketsandMarkets™ Inc., October 2016.

2 A guide to the Internet of Things; Intel, infographic; December IDC, Intel, United Nations



All Your Networking Solutions Under one roof

DIGISOL is spearheading government's "Make in India" through its made in India products and solutions. To Become the most admired IT Networking Brand, DIGISOL is working towards offering innovative and top-notch products and solutions.

DIGISOL Systems limited believes in innovation and to offer best in industry products. This has helped us in becoming a market leader and knowledge expert in providing Active and Passive Networking products for the past 25 years. We, at DIGISOL, are committed to provide best quality support services, both pre- sales (for SMB/SME) and post sales.

DIGISOL offers first-rate integrated after-sale-service and support, which consists of: -

Service Centres

DIGISOL Technical Assistance Centre (DTAC) which consists of DIGISOL's most efficient and highly skilled professionals that offers excellent state of services to the customers

DIGISOL has a widespread network of **63 Service centres** across India

Customers can connect to us for any query

Toll Free Number: 1800 – 209 – 3444

Email: helpdesk@digisol.com

Timing for Support: 9.00 am – 5:30 pm, Monday to Saturday

Service Centre: [Find your nearest service centre here](#)

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