New servomotor connector technology enables miniaturization, increases integrity

Servomotors are an integral part of today's automation industry, but traditional circular connectors prohibit the miniaturization of such motors due to connector size and the need to isolate power from signal lines. ITT, Electronic Components has developed innovative technology in the CmX connector series to address industry concerns and enable further miniaturization of servomotors.

ITT worked closely with its customer base to identify the areas of growth for current and future servomotors applications and to address the miniaturization and rising cost concerns associated with traditional circular connectors. The CmX interconnection solution fulfills existing customer needs and is in the position to become an industry standard for future servomotor applications.

The CmX connector is currently offered in three sizes – Cm2, Cm3 and Cm5 – which cover a power range of less than 5A to more than 40A. The different sizes correspond to power wire and cable diameters.

What is a servomotor?

Servomotors are constructed from three basic parts:

- an electric motor varying in size and power with a stator housing and a rotor (shaft); occasionally brakes and a gear head mechanism;
- an electronic rotation management device, also called an encoder or resolver, that controls and manages the motor's motion; and
- connector receptacles to allow mating with two connector cables.

Servomotors draw power proportional to the mechanical load, typically with a range of less than 5A to 100A.

Figure 1: (L) Servomotor with traditional circular connector termination. (R) Servomotor with CmX connector.

A typical servomotor looks like a rectangular box with a rotary shaft coming out of one end and two circular connectors on the other end. One connector contains the power contacts, which are usually three power wires of various sizes dependent on the electrical load, one ground contact and lower current contacts for the brake or temperature control functions. The other connector contains low electronic current contacts for the encoder or resolver wires. Most servos work with voltages between 4V and 6V.

Servomotors are typically used in applications where the shaft rotation must be precisely controlled with incremental rotations and speed variations. This shaft rotation creates movement for robotic arms, machine jigs and components, linear translations and fine equipment positioning.

Challenges of traditional circular connectors

As electronics has evolved and components have become smaller and smaller, servomotors have followed suit. But miniaturization in the field has been limited by the size of circular connectors needed to link the motor to the power source. Despite the decrease in servomotor size, circular connectors were limited by outdated technology that didn't allow for miniaturization. Traditionally, two circular connectors are attached to the top of the servomotor housing, but even the smallest-profile circular connector limits the use of servomotors in space-sensitive applications.

ITT's CmX series reduces cost of ownership

While the sizes of servomotors were decreasing, the connector costs remained the same, and in some cases increased. Servomotor manufacturers and circular connector companies began exploring ways to address sizing and other concerns while reducing costs for the cable-to-motor interface. ITT, Electronic Components worked closely with major servomotor companies to develop a connector solution that was simple, robust and met industry standards, an offered drastically reduced overall costs.

When used for servomotor applications, circular connectors require a large number of components, a number that is doubled when considering that two connectors are needed for each application. That equals twice the weight, number of parts, assembly time, size, parts needed in inventory, shipping costs and packaging size.

ITT simplified the connection design in its CmX Series connector, reducing the number of parts and drastically lowering the cost incurred, a key benefit to those using servomotors in miniaturized applications. OEMs can purchase CmX connectors with one part number as opposed to two with traditional circular connectors, simplifying on-hand inventory and ordering. Fewer parts increase integrity and reliability for both parts and the total assembly.

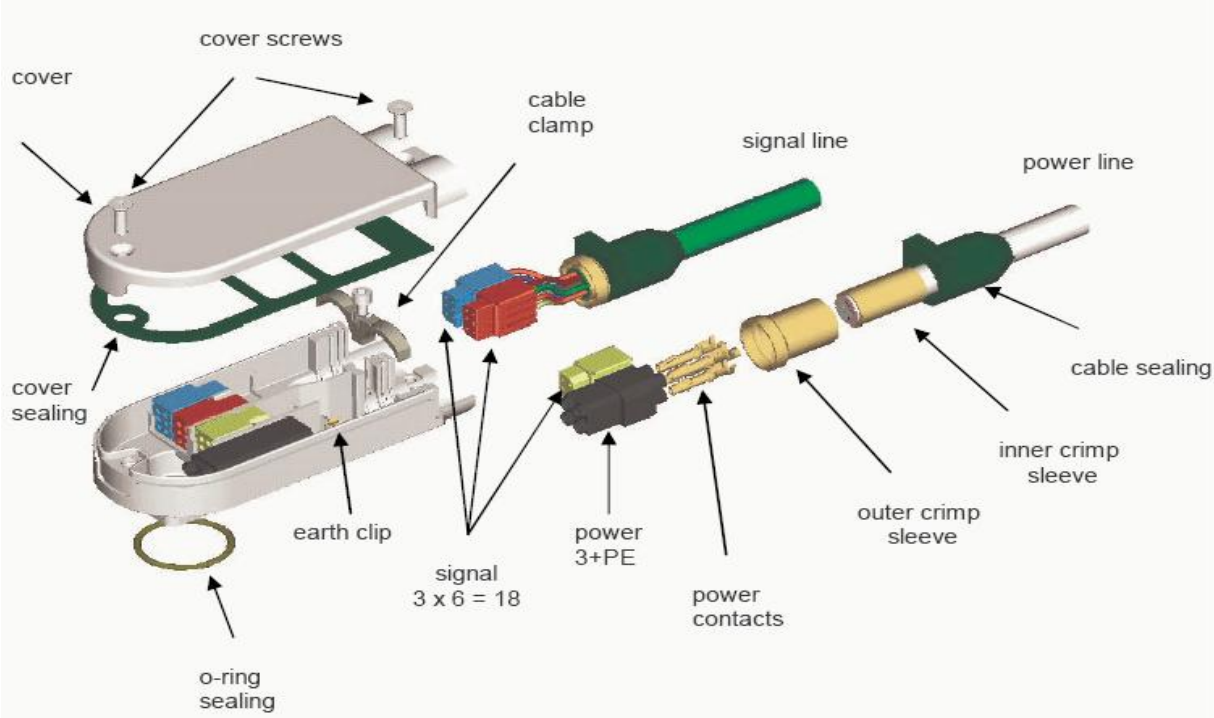

Figure 2: Standard version of the CmX servomotor connector.

Furthermore, the CmX connector design eliminates the need for bulky and long strain relief parts, as assembling the connector onto the servomotor secures the internal wiring and provides sufficient resistance to external strain forces. A traditional circular connector plug consists of the insert mating part of the connector and several parts required for sealing, shielding and strain relief, all of which are fitted in a long, heavy end bell housing. With the CmX connectors, the metal strain relief and shielding rings are crimped with simple crimp die tool; the rubber sealing boot is simply fitted onto the cable before the crimping operation. This consequently offers higher strain relief resistance and sealing performances.

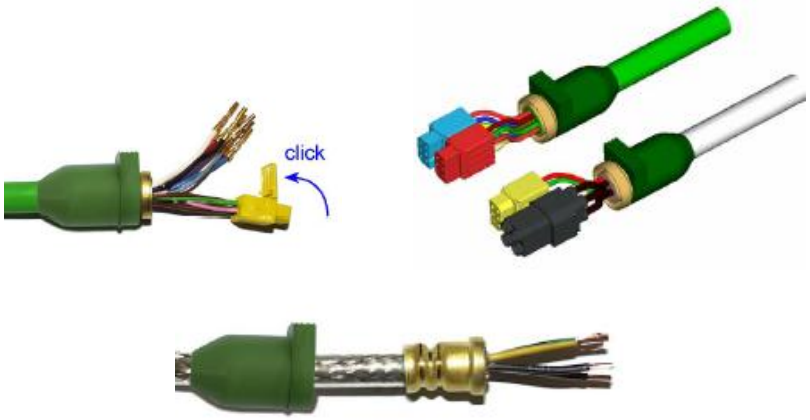

Figure 3: Simplified crimping and strain relief in the CmX connector.

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ITT's innovative size break-through

ITT's CmX line of smaller-sized servomotor connectors addressed the growing need for small connectors on servomotors with a flange size of 100mm or smaller, and is scalable for larger applications. The CmX connector series replaces a number of various-sized conventional circular connectors – connectors that require at least twice the length and four times the diameter to house the same components as CmX connectors.

A CmX connector reduces the connector footprint on the servomotor by half, and is a third of the height of traditional circular connectors. ITT's design also includes a new clamp technology that minimizes the space required for cable strain relief, shielding and sealing components. With the Cm3™ connector – the first offering in the CmX line – these components are housed in an area just 3cm (1.2in) long, where traditional circular connectors require 10cm (3.9in).

Figure 4: The Cm3™ connector from ITT installed on a servomotor.

When reducing the size, ITT was also able to reduce the mass of the servomotor connector, a concern for many manufacturers. Higher mass negatively affects the integrity and performance of the connection as well as the servomotor, which is countered by the CmX series' low mass. For example, the Cm3 connector is just 170g, which is less than half the mass of two heavier, bulkier traditional circular connectors.

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The sizes available in the CmX connector series are dependent on the power the servomotor requires and the wires needed to provide this power. Each size of CmX connector has varied dimensions for the power cable entry and power connector. But the feedback cable entry and feedback connector dimensions are relatively unchanged across the range of CmX connectors, allowing for parts standardization.

The Cm3 Series connectors feature IP67 sealing, a housing that contains a single power insulator and three feedback insulators. Each feedback insulator has six signal contacts, separated by metal shielded walls, two sealed entries for power and feedback cables and a first-make/last-break power ground contact electrically linked to the shell.

The Cm3 connector series is completely sealed and shielded for high reliability. Internal shielding within the Cm3 connector preserves signal integrity even though the connector can mix up to four power circuits at 12A and 18 signal lines at 3A. With traditional circular connectors, two separate connectors are needed to keep power and signal lines isolated. The CmX connector meets IP67 ratings, meaning that the assembly is protected from dust and can be submerged in water to 1 m (3ft) for up to 30 minutes without any leakage. Operating temperature for the CmX connectors range from -40°C to 125°C.

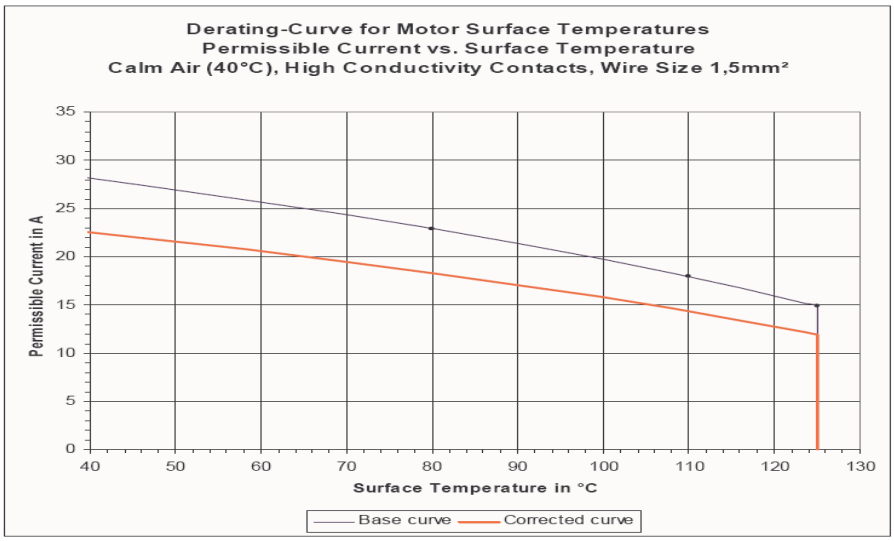

Figure 5: Derating curve for ITT's Cm3 connector.

Drastically improved production assembly

Traditional circular connectors require a number of tools and extended clearance around the servomotor for installation. The CmX Series connectors replace two bulkier circular connectors, reducing the number of parts by half, and its simple harnessing onto the servomotor reduces assembly time by nearly 50% by simplifying the process.

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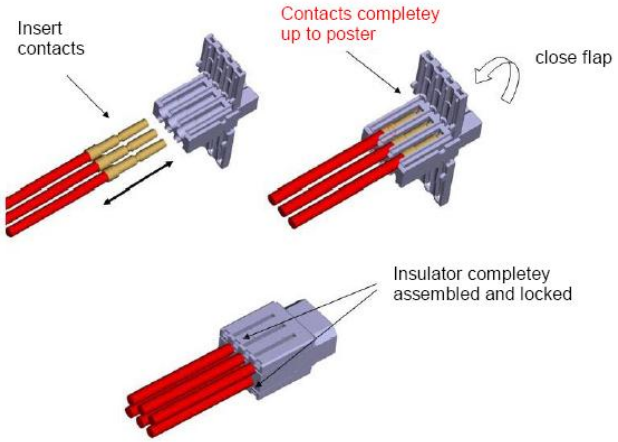
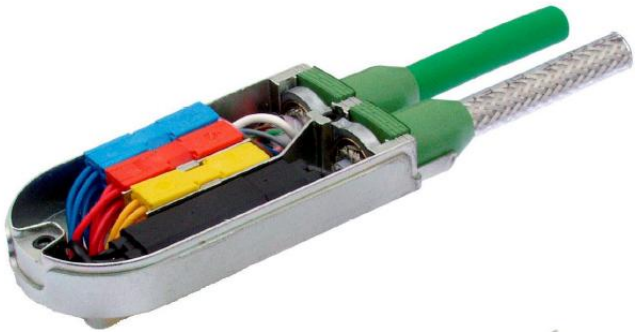
The new installation process for the CmX connectors is possible because:

- Wires are regrouped through one servomotor housing hole compared to two with traditional circular connectors;
- No special tools are required for connection, just a simple hex screwdriver;
- Each contact remains secured with a secondary locking feature that allows contact removal by hand, if necessary;



- Shielding walls are integrated to separate power signals from sensitive electronic signals built into the CmX connector housing; and

- Each connector is assigned a mechanical color key, further simplifying assembly and mating.



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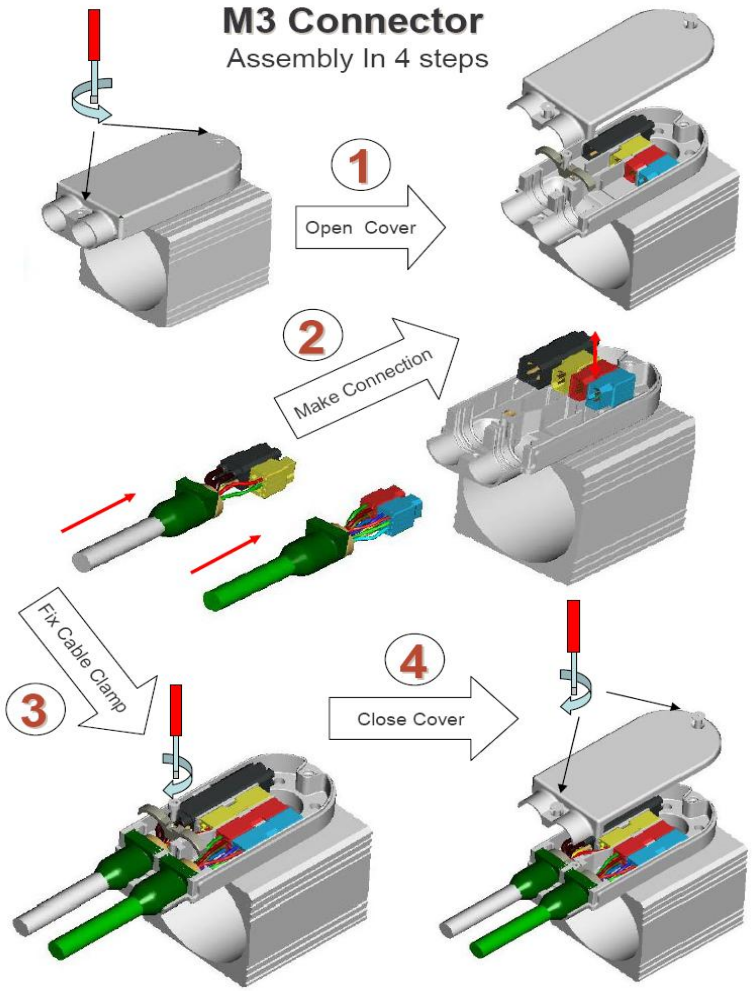
These installation features enable installers to simply connect or disconnect the cables or plug with its corresponding servomotor CmX receptacle housing and inserts without the need for any specific tool. Mismatches when mating or unmating the CmX connectors are extremely safe due to the specified insert colors and mechanical coding. Hazardous electrical situations can be avoided as contacts are protected according to rigorous specifications. Four simple steps are needed to install or disconnect the CmX connectors, and no real training is needed to guarantee a safe, robust and efficient installation.



Smaller connectors for a range of servomotor applications

The first offering in ITT's CmX connector line is the Cm3™ connector, designed for servomotors with a flange size of 100mm x 100mm or less. The Cm3 connector meets all requirements for DIN EN61984 safety compliance and has a 48V signal rating, operating voltage of up to 630V, and current ratings of 2A for signal and 18A for power. A zinc die cast shell, Fluor rubber sealing parts, high temperature insulator material and high quality contacts ensure a rugged, reliable design.

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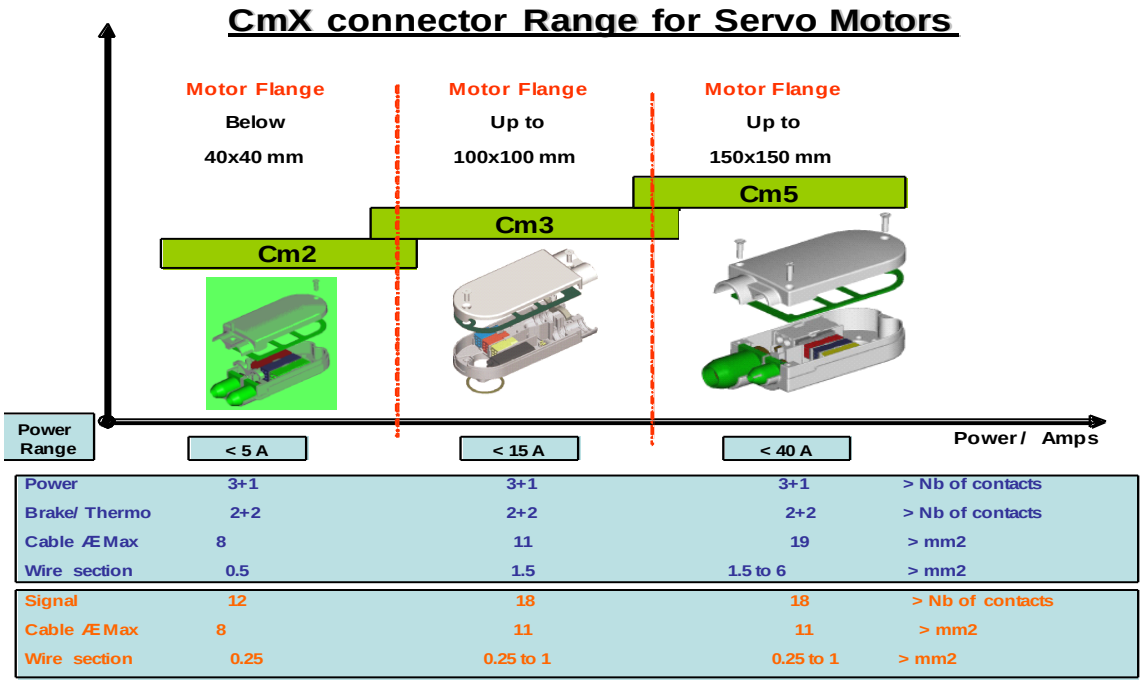

Figure 7: The CmX connector range.

ITT is currently developing the Cm5 connector for larger flanges and higher-powered motors and a smaller Cm2 connector for servomotors with a flange size of 40mm x 40mm. All CmX connectors meet IEC 60068, 60352, 60512, 60529 and VG95373 standards, and are UL approved or are undergoing UL testing, depending on the CmX version. When completed, the full CmX line will include connectors for all sizes of servomotors.

ITT, Electronic Components (www.ittcannon.com) is an international supplier of connectors, interconnects, cable assemblies, switches, dome arrays, keypads, multi-function grips, panel switch assemblies, I/O card kits and smart card systems.

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