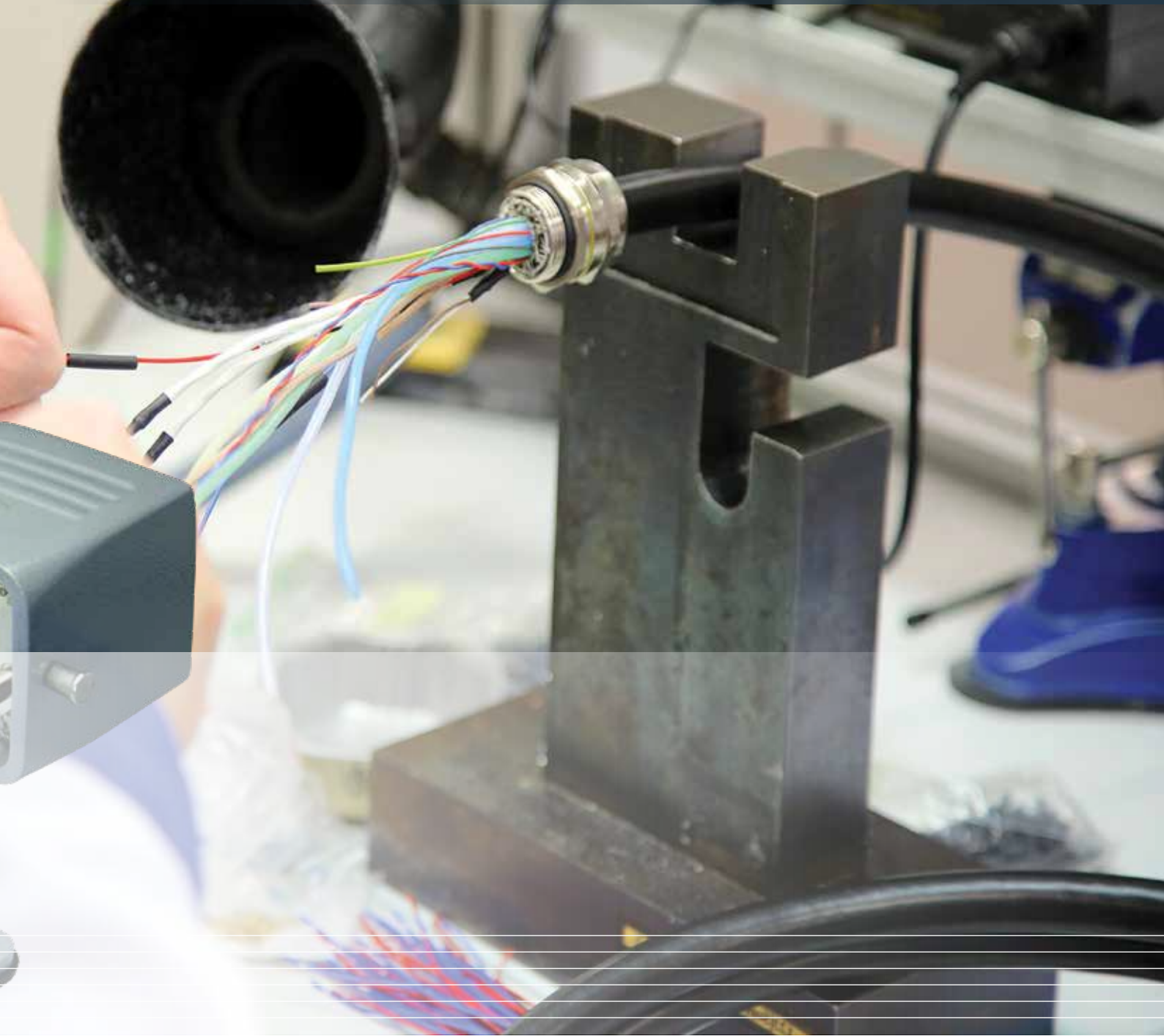


CONNECTORS

White Paper



THE SAFEST CHOICE
TELEREX

Checklist for Connectors & Cable Assemblies

INTRODUCTION

There are very few applications able to work without some form of interconnection. Whether these are medical devices, industrial machines or military equipment, they all require connectors to supply power or transmit electrical signals. However, the type of connector varies widely between the different applications. What do you need to consider when selecting a connector? Plus, what is required for a secure connection between the connector and cable? In this White Paper we look for the answers to these and other questions.

WHAT IS A CONNECTOR?

A connector enables an electrical connection to be made which can then also easily be disconnected. This could be an internal connection between the components inside a machine, or an outbound connection which, for example, connects devices to one another.

For a good and secure connection, a connector always comprises two parts, a male and female part. The female part supplies power, transmits signals or both. The male part is almost always connected to a cable and is the part that receives the power or signals.

VARIOUS TYPES OF CONNECTOR

Connectors come in a wide range of shapes and sizes. There are metal and plastic connectors, with various types of connection, which only supply power or conversely only transmit signals, variations that are watertight, etc. There are also connectors that are particularly suited for, for example, medical uses, industrial use or military applications.

Examples of the aforementioned connectors include:

- *Individual lamella and spring wire contacts*
These are contacts with diameters ranging from 0.76 to 50 millimetres, suited to numerous uses, such as building a docking system. Spring wire contacts can cope with currents of up to 2,000 amperes.
- *Circular connectors*
Circular connectors are available for testing and measuring equipment, data traffic, power cables for low and high voltage and even for the transfer of gases or liquids. The designs are just as diverse as the uses.



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- **Push-pull connectors**

This is a stand-alone category within the circular connectors group. Push-pull connectors are fitted with a locking mechanism that automatically 'engages' when the connector is inserted. Disconnection is only possible by sliding the sleeve or housing of the connector backwards, which prevents the connection from disconnecting when the cable is pulled. This characteristic means that push-pull connectors are particularly ideal for, for example, medical equipment, testing and measuring systems, sensor technology or critical military applications.

- **Board-to-board connectors**

This type of connector is intended for high-speed, high-density and high-power uses; consider stacking or interconnecting printed circuits at different angles.

- **LED connectors**

This burgeoning category is intended for the connection of LED applications. Consider circular and waterproof models with diameters ranging from 10 to 25 millimetres. The connectors are available with 2 to 14 contacts and can be loaded up to 30 amperes per contact.

VARIOUS ASSEMBLY OPTIONS

Not only is there a very wide range of connectors, but the options for attaching connectors to cables also vary enormously. Are you planning to squeeze, solder, crimp or screw the contacts? Is a Hot Melt (moulding) required to create a watertight connection? During assembly, does a significant tensile force on the cable and the connector have to be taken into account?

In practice, the foregoing are often considered (too) late in the development process of a machine and it is then discovered, for example, that the selected cables are too thick for the proposed connectors, the correct equipment for the assembly is unavailable, or that the connectors have a much longer delivery time than hoped.



CHECKLIST

Setbacks, like not having the correct assembly equipment and long delivery times, can have far-reaching consequences. For example, late delivery of a machine may result in the machine manufacturer incurring production downtime penalties. Through careless assembly, you risk short-circuit, electrical shocks or even fire. If the cable assemblies fail to meet the requirements, this may jeopardise the required certification of a system. Negative consequences of this kind can be prevented by critically appraising the connectors and cable assemblies during the actual design phase of a machine. A number of important questions are listed in the checklist below:

1. HOW MUCH MAY THE SOLUTION COST?

This is an important consideration. By answering this question, a number of options are immediately removed from the equation. For example, the prices of connectors can vary significantly. The desired quality and sustainability often play an important role in this thought process.

2. WHAT WILL BE CONNECTED?

For example, will sensors be connected? If so, how many? Do the connectors have to transmit only signals, or only power? Will the connector be mounted on a coaxial cable? This basic information is required in order to select the correct connector and subsequently also the correct mounting method.

3. WHICH TYPE OF CABLING HAS BEEN SELECTED?

Has the cabling already been selected? Or, for example, will a sensor be connected to which a cable is already attached? In this case, the specifications of the cable – such as thickness, construction and the number of cable cores – will partly determine the choice of connector. For example, if the cable is thick, this rules out a number of connectors because of the attachment method.

4. WHERE WILL THE CONNECTOR BE LOCATED?

Is only limited space available for a connector? If so, this has to be taken into account when selecting the connector. A direct connection with the printed circuit means, for example, that the printed circuit must always be located alongside the housing, which limits the freedom of choice.

5. WHAT ARE THE ENVIRONMENTAL FACTORS?

Will the machine be located in a humid environment, or will the ambient temperatures be very high? In this case, it is advisable to select a connector that can cope with these conditions. If work takes place in explosive atmospheres, under the ATEX 114 guideline, Ex certification may be required. Is there a risk of electromagnetic radiation in the environment? If so, a metal connector with a protected cable is the best option.



6. HOW ROBUST MUST THE SOLUTION BE?

Will a heavy cable create a greater tensile force to the connector? If so, traction relief for the transition from the cable to connector is required in order to prevent failure of the attachment. One alternative is a tougher cable, which would take the pressure off the connection, such as 'Drag Chain' cables. It is also worth knowing how often a connector will be disconnected. Is the purpose of a system to test other machines? If so, opt for a connector that is suitable for a high number of mating cycles.

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7. IS A HOT MELT REQUIRED?

Connections between the connector and cable are injection moulded with a hot melt glue which conceals the technology used, resolves a difference in thickness between cable and connector or creates a watertight connection. The shape of the injection moulding can also be personalised and a logo can be applied. Investment in a die and the selection of a good partner for the production process have to be taken into account, as applying Hot Melt is highly specialised work.

8. ARE THERE CERTIFICATION REQUIREMENTS?

Must a machine bear a CE (Conformité Européenne) marking that shows that the product meets legal requirements? Or is UL (Underwriters Laboratories) certification required for export to the United States, or Canada? If so, then the connectors and the cable assemblies must also meet the requirements that arise from the certifications. Correct assembly in accordance with the standards of the Institute for Printed Circuits (IPC) will certainly contribute to this.

9. IS THE CORRECT ASSEMBLY EQUIPMENT AVAILABLE?

Increasingly, the cable section is not connected with solder contacts but with crimped contacts attached to the connector. Special and expensive assembly equipment is required for that attachment. In this case, one option might be to contract out the assembly to a specialist party that already possesses the assembly equipment needed for the work.

10. CAN I TEST THE CABLE ASSEMBLIES?

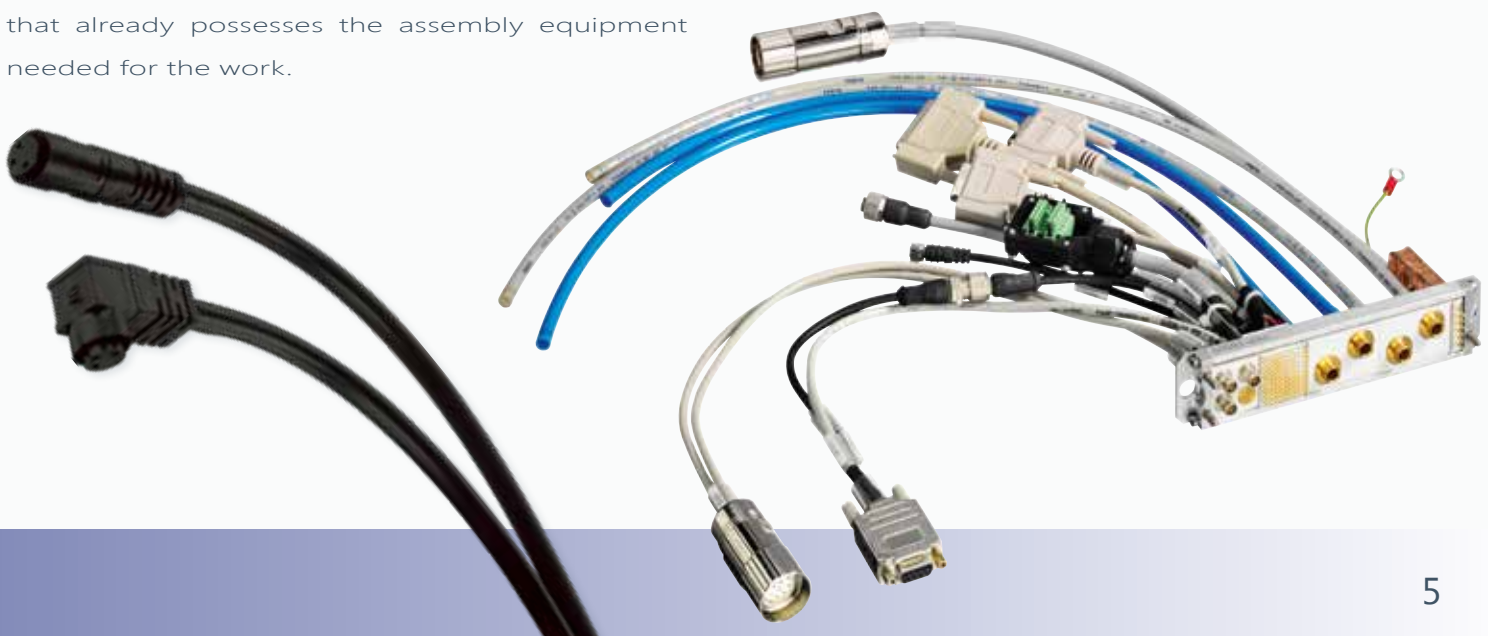
After assembly you will, for example, want to know for certain that the crimps are correctly positioned, that the connection between the connector and the cable is secure enough and that the Hot Melt actually keeps water out. To check this, you have to subject the cable assemblies to various tests using special test equipment.

11. DO I HAVE THE RIGHT PEOPLE?

The fitting of connectors can be a time-consuming task and requires certain skills. It may help, for example, to choose one 'family' of connectors produced by the same manufacturer, with which your engineers have previous experience. An alternative is to contract out the assembly to a specialist; this would leave your engineers with more time to continue to develop and perfect the systems.

12. CAN ALL MATERIALS BE DELIVERED ON TIME?

Good cable assembly depends on the availability of the correct components and assembly equipment, plus possessing the required knowledge and skills. At an early stage of the development of a machine, find out whether all components can be delivered on time. Late delivery of a machine because of, for example, (unexpected) long delivery times can result in the machine manufacturer incurring fines. In this case it makes better sense to arrange for a third party to perform the assembly.



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If you do decide to contract out the cable assembly, choose a party that will perform the work with due care. For example, it may be preferable for the assembly to be performed in Europe or even in the Netherlands. And does the proposed party have a comprehensive portfolio, the right assembly equipment and test equipment? Certifications may require that the work is performed in accordance with IPC standards.

Telerex is in a unique position. We supply a wide range of connectors and we can also carry out the assembly. Along with our customer, we determine exactly what is needed. We then procure the connectors, carry out assembly and provide the solution that is required at the right time. Only then will you receive our invoice. This therefore negates the need for pre-investment.

Would you like to learn more about our range of connectors and cable assemblies? Your contact person at Telerex would be happy to inform you of the various possibilities.

This is a White Paper produced by Telerex, part of the Eight Lakes Group.

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MODULAR CONNECTORS

This document mainly covers conventional connectors and cable assemblies, but we would also like to bring to the fore an important product group and the options this presents. We are talking about modular connectors, with which an infinite range of variations can be put together,



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not only variations in terms of shape and size, but particularly in the possible combinations of connector modules. These modular connectors can include a combination of high voltage and low voltage, compressed air, liquids, high-speed data and much more besides.

The housing and locking can be tailored to use and user requirements, varying from 10,000 to 100,000 mating cycles. These modular connectors enable all conceivable cable assemblies to be built. Owing to the versatile nature of these connectors, this involves truly specialist work.





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