WhitePaper:
Electronic Connector Counterfeits and Copies

PROTECTING YOUR COMPANY, PROTECTING YOUR CUSTOMERS!

Knock-offs of electronic components, such as connectors, can cause big problems for purchasers, particularly if the purchasers are inaccurately informed as to what they are buying. Indeed, these parts are often deliberately designed to superficially resemble or imitate premium parts that have been manufactured with more stringent design specifications and that offer greater ultimate performance. That means that unwittingly using them as a component in an otherwise quality product could lead to accelerated equipment failure or malfunction, or to deficits in the performance of the particular end product, such as lower quality broadcast or recorded video, less accurate testing/measurement results, or other detrimental consequences

that could impact the reputation of the manufacturer in the eyes of their customer. More concerning still is when these components find their way into medical devices, aerospace, and military applications, or into similar equipment or devices that may have life or death implications.

This issue, however, can be surprisingly complicated, with many nuances. We at LEMO provide this white paper to help our customers, potential customers and the connector-using industry at large make more informed decisions and better shield themselves from civil and criminal penalties, as well as more effectively avoid damage to their corporate and product quality reputations among their customer base.

COUNTERFEIT VS. COPY—DIFFERENT DESIGNATIONS, EACH CARRYING SIGNIFICANT CAUSE FOR CONCERN

The term “counterfeit” is a technical, legal term, meaning an item produced using form or functional aspects protected under formal intellectual property rights that have not been granted to the producer by the proper owner of those rights. Whether or not an imitating item is technically a counterfeit is usually decided on a case by case basis in a local court of law, and the onus can be on the rights holder to prove that they had previously applied for the appropriate rights in the particular jurisdiction, and that these rights are properly maintained in accordance with local laws.

Companies that are found to be producing counterfeit goods can face potential civil and criminal liability, such as fines and payments of damages, as well as the confiscation of their goods. More importantly, purchasers and users of these parts can also face similar civil and criminal liability, often irregardless of whether they knew the purchased parts were counterfeit or not.

Reading between the lines, if a local government does not accept or allow a particular intellectual property legal protection; if a third party company is able to copy a product aspect that is not protected in their jurisdiction; or if the original manufacturer of a product in other

ways fails to protect their patent, trademark, copyright or other intellectual property under local laws, then these copies may be technically legal in that country, even if specific aspects often thought of as wholly unique, such as look and feel of the item or even trade names are brazenly recreated.

Of significant note, however, is that even if a product is deemed legal under local laws when manufactured, purchased or used wholly within the confines of that particular country, it may be considered an illegal counterfeit as soon as it—individually or as a component in a larger product—crosses the border into a country where those aspects are properly protected, immediately opening both the seller and the purchaser up to potential legal ramifications in that country.

While the legal status of a component is obviously of critical importance to a purchaser, it is only the first "test"—there are many other more inherent characteristics of a part that can cause significant damage to a purchaser's operations and professional reputation, even if said copy is technically legal.

Quality connectors are meticulously engineered components designed to hold extremely tight tolerances using carefully specified materials selected to meet the demands of the application, and LEMO often receives requests by customers to investigate unexpected product failures that turn out to involve knock-off connectors. In addition, LEMO also diligently purchases knock-offs on the open market and analyzes them using sophisticated testing equipment. Common deficiencies and issues experienced in the field include:

- Inferior mechanical performance—quality connectors often provide several thousand mating/de-mating cycles. We have seen connector copies that become hard to operate and then fail after a few hundred, with pins bent or worn away. (See Appendix A, Figure 3)

- Inferior electrical and temperature performance—Premium connectors need to stand up, as advertised, to the applications for which they are intended, and manufacturers need to stand

behind them and ensure that their components do so. In one case, for example, a genuine LEMO connector was rated for a temperature performance of more than 300ºF at the outer housing and more than 480ºF at the insulator. A justifiably angry customer contacted us because their connectors were melting at temperatures as low as 200ºF. Upon examination, they turned out to be knock-off connectors presented to suggest that they were actual LEMO products. Using components like these, surfaces can blacken or melt in production during high temperature processes such as soldering, or by the heat generated by standard operating use, creating overheat conditions and/or shorts between contacts, precipitating fast failure of equipment. We've even heard of knock-off connectors destroyed by routine sterilization processes. (See Appendix A, Figure 1 & 1A)

• Inferior materials—in order to achieve promised performance, premium connectors need to make use of premium, high performing materials. On knock-offs, gold tinted metal can replace real gold, significantly reducing conductivity and inviting short term corrosion in many applications. In plastic connectors, premium connector manufacturers will use high quality engineering polymers such as PEEK as the insulator, whereas knock-offs often use materials with significantly lower performance characteristics, sometimes even coloring the plastic in an apparent attempt to mislead the eye.

• Dangerous materials—Much has been written about radioactive scrap metals contaminated with Cesium-137, Cobalt-60 and other dangerous isotopes, often recovered from razed nuclear power plants in second- and third-world nations, finding their way into the supply chain and melted into products for resale to unwitting buyers. Premium manufacturers have reliable sources of supply for quality, safe and proven materials and demand information on traceability and sourcing of raw materials. Those looking for the cheapest source of supply might have less formal relationships with suppliers and ask fewer questions. Similarly, premium suppliers tend to take seriously their commitments to international directives such as the Restriction of Hazardous Substances Directive (RoHS), which maintains agreed upon limits on hazardous substances such as lead, mercury and cadmium. It is not uncommon to find greater levels of these substances in knock-offs than is considered acceptable by RoHS requirements.

• Visibly sloppy machining and finishing—Knock-off manufacturers sometimes make use of less skilled labor; use low quality, non-maintained, dulled grinders and tools; and/or create environments that don't allow for time to properly complete each part. Stray metal burrs or chips that are conductive, uneven machining, improperly packed insulation material leading to shorts or loss of signal, or inconsistent polishing or plating and subsequent lack of overall sheen are not uncommon findings. (See Appendix 1, Figure 5 & 5A)

• Ethical considerations—Many quality organizations, both component manufacturers and their equipment manufacturing customers, find it a point of pride to ensure their employees, customers, investors and other stakeholders that they work to stay on the right side of ethical issues, such as avoiding purchasing from suppliers that may not eschew child or slave labor, or that make use of conflict materials, and that they maintain compliance with initiatives such as the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), an EU effort which addresses the production and use of chemical substances. Top tier suppliers can often make these assurances, and provide documentation to back it up. Knock-off companies may not be able to do so.

• Indeterminate Underwriters Laboratory (UL) recognition—Most electrical devices demand recognition of UL for safety and performance quality assurance, and top tier component manufacturers spare no effort and expense to ensure that their products meet or exceed these stringent requirements to fulfill their commitments to their customers. Knock-off companies often do not go to this trouble, and, in many cases, would not likely be able to meet the requirements. Nonetheless, some have been found to claim UL recognition, even fallaciously quoting the UL file number of their knock-off "victims."

• No FDA approval—Medical devices usually need to be approved by the Food & Drug Administration when sold in the U.S., and/or by similar medical oversight organizations in other countries. These approvals often center on materials used being tested and found safe for

medical applications. Knock-offs might not be submitted for approval, although erroneous claims might sometimes be made.

• Inconsistent products—Top tier suppliers are able to provide components that are consistent in specs and performance, lot to lot—even years later. This fits in better with the need of typical equipment production life cycles, which might be measured in decades. Knock-off companies might change specs based on latest batches of raw materials purchased or suddenly discontinue a component to chase a higher profit opportunity.

• Documentation, recordkeeping and traceability—Top tier suppliers maintain traceability back to the source of raw materials for purchases from vetted and proven Authorized Suppliers. Purchase details and origins of all raw materials that went into a specific connector can be traced by lot number. Manufacturers of electronic components should be able to readily provide documentation such as a Certificate of Conformance formally declaring that the purchase order requirements are met, including information such as manufacturer, distributor, quantity, date code and inspection date, and signed by the supplier's approved signatory. Knock-off companies might not maintain these details.

In addition, connectors sold by top tier connector companies usually come with value added services supporting the product itself. LEMO, for example, has an extensive network of support and design assistance experts located near key customer bases. They are established and set up to provide fast trouble-shooting assistance, as well as face-to-face product development expertise, with testing samples and technical guidance readily provided in many cases. Knock-off companies often operate out of a single fixed location and offer limited, if any value-added services. Top tier suppliers in our industry also tend to have proven business track records spanning several decades; knock-off companies tend to be relative newcomers, and many tend to come and go, potentially leaving customers in the lurch.

WHAT CONNECTOR COMPANIES CAN AND ARE DOING

Currently, electronics industry associations are tending to focus limited resources primarily on even more commonly pirated components such as chips for computers and smart phones. Furthermore, so far there is no formal partnership among connector manufacturers to combat counterfeit and copying issues, although informal discussions at trade shows and similar venues are not uncommon. Therefore, the onus is on each connector manufacturer to do what they can to protect their customers, end users and their own reputations and products.

While LEMO is, of course, not privy to the internal efforts of other connector companies, we can share a little of what we are doing, and encourage other connector companies to take similar proactive stances, if they are not doing so already.

LEMO has been proactive in this regard for more than a decade, and the current cornerstone of our efforts, incorporating what we have learned and guiding how we proceed, is encapsulated in our three-pronged LEMO Group Anti-Counterfeiting Policy—Prevent, Respond, Fight.

We work to prevent issues by taking such actions as training our people and educating our customers on the counterfeiting/copying problem, using such tools as letters, diagrams and informational tools such as this white paper. The policy also calls for proactive due diligence to be applied to our own sourcing to ensure that we use only the highest quality, authentic raw materials in our products.

The starting point for the Response prong of our efforts is to first work to ensure that our intellectual property is fully and continually protected to the extent of local laws in every one of the dozens of countries where we serve customers. From there, we are creating a standard process by which anyone in the company anywhere in the world has a mechanism and a process by which to gather the appropriate evidence of a potential infringement and have a point person to send it to in our global Legal Department in Ecublens, Switzerland. Appropriate action is taken, while details and evidence will be placed in a centralized database so that actions can be monitored.

If the global Legal Department determines that illegal counterfeiting has likely occurred, the Fight can take many forms on behalf of our customers. The first step is usually a cease and desist or warning letter to the alleged counterfeiter. If the counterfeit products have entered a jurisdiction illegally, then customs agents are notified. Alleged counterfeit products are often seized and their dealers detained and/or fined. For example, international trade shows in Western countries can be a fruitful—and highly illegal—venue for counterfeiters to visibly or surreptitiously present their wares, and LEMO—with the generous help of customers and local officials—has been very successful in shutting down these alleged infringers wherever they appear. We have also aggressively protected our rights in local courts, and have been extremely successful here as well. For example, in 2017 in China alone we initiated more than 35 lawsuits, and we have won most of them, with some actions still pending as of this writing.

Many of these efforts above are works in progress. Indeed, the LEMO Group Anti-Counterfeiting Policy is meant to be a living document, with efforts being continually refined and added to over time in response to real world needs. Additional aggressive efforts on the drawing board may include more and more training and communications, sophisticated authenticity coding techniques, online reporting mechanisms and much more.

HOW TO AVOID BECOMING A VICTIM

Even if your connector supplier is working diligently to protect you and your customers against the loss of revenues and reputation that can occur by using substandard components, they cannot be everywhere at once. Purchasers need to also perform their own due diligence in order to make informed decisions.

• Know your seller — Most top tier connector manufacturers supply their products only directly or through an authorized reseller/distributor network, with representatives hand-picked for their industry knowledge and reliability, and specially trained in the use and applications of the components. Most manufacturers maintain a list of these valuable partners on their web sites. For example, LEMO USA's current distributors are Digi-Key Corporation; Heilind Electronics;

Imtron Corporation; Mouser Electronics Inc.; PEI Genesis; Powell Electronics and Sager Electronics. If you receive an offer for “genuine parts” from another source, such as a local distributor not on the list; an international shipper; or see them offered on an international or domestic shopping portal, they are likely not genuine, regardless of any claims. If in doubt about the legitimacy of a particular supplier, contact the manufacturer. For example, send an email to info-us@lemo.com with “Legitimate Supplier?” in the subject line and we will get back to you on it.

• Look for the brand name on the component — The name of the manufacturer is one of the most heavily protected aspects of intellectual property, and even countries relatively lax in providing protections are often less tolerant of inappropriate uses of another company’s name. Few knock-off manufacturers are brazen enough to put another company’s name on their products, although it does happen. All genuine LEMO connectors will have the “LEMO” (metal) or “REDEL” (plastic) brands etched on them. In many countries, third party manufacturers can make use of the brand value of another company’s name in their advertising, such as using phrases such as “LEMO-like,” “LEMO compatible” or “LEMO substitute.” These are obviously vague claims that have no meaning as to performance or materials, and, obviously, indicate a knock-off, although not necessarily a legal or illegal one. (See Appendix A, Figure 3)

• Examine the appearance—more common is to attempt to copy the look and feel of a connector, with varying degrees of skill and success. This is in spite of the fact that these identifying features are usually protected as intellectual property as well. In LEMO’s case, for example, two of the key look and feel aspects of genuine connectors are the red dot and, especially, the unique chocolate block pattern, created to suggest the company’s founding in Switzerland, a country known for high quality chocolate as well as high quality, original push-pull connectors. On genuine LEMO connectors (as shown in the image on the left), the red dot is pad printed. The red color will also not be easily rubbed or worn off a genuine product. The chocolate block pattern is often six across, although it does vary based on the size of the connector. More important is that on a genuine product the blocks will be evenly cut and

consistently polished. We've also seen knock-offs with a LEMO part # stamped on them. Compare the stamp with a genuine article—although the number may be the same, the font and style of the numbers may not be. (See Appendix A, Figure 2)

• Compare product to photo—Sometimes knock-off manufacturers will take an actual photo of a premium connector—often illegally culled from the other company's product catalog—and use it in their own sales descriptions. Obviously, this is not what they have to sell! Be sure to look at the actual product sent—not the photo—when determining authenticity. Comparing the product received with the photo shown can often be a dead giveaway.

• Price—Common sense should suggest that if an unfamiliar supplier is offering the "same" product for a significantly lower price than what you paid last time from a legitimate dealer, or significantly lower than offers received from other distributors, then it is not likely to really be the same product.

• Alert partner companies— Large device manufacturers can also become victims not through their own actions but through those of third party companies, usually smaller operations, that make ancillary equipment or accessories that are made to be used in conjunction with the main device. If the connector on a third party product is a knock-off not made to the specs that the OEM requires, the entire system can fail when the end user operates it. The end user, not knowing where the "weak link" is located, will of course send the whole system back to the manufacturer of the original device, charging it with being defective. Similarly, downstream repair facilities may retrofit using knock-off parts. Care should be taken to alert these valuable partners that you "Recommend the use of (name of connector brand(s))" in your correspondence with them.

• Alert your assemblers — There might not be a feedback loop to alert you if a technician on the floor is experiencing frequent abnormalities such as blackening or melting when welding or working with components. Ensure that there is a mechanism to quickly inform appropriate parties so that action can be taken to eliminate problems quickly and minimize damage.

Most important is to remember that we, as well as other top tier connector manufacturers you may work with, are always on your side. For example, if you ever have any questions about the authenticity of a LEMO product, send photos to info-us@lemo.com, and put “Counterfeit?” in the subject line and we will investigate. We suggest that it be done early, before a company proceeds too far into using potentially inferior products in their production process, and runs the risk of loss of revenues or reputation, or even opens itself up unnecessarily to potential civil or criminal penalties.

When it comes to counterfeiting, the good news is that many jurisdictions that in our opinion may have been more-friendly to alleged counterfeiters in the past are evolving to demonstrate greater respect for the intellectual property of others. The bad news is that counterfeiters are definitely getting better at imitating the look and feel of goods, and making inferior and even dangerous products look more and more like the real thing. Protecting ourselves and our customers against such knock-offs is a never ending job. In reality, counterfeiting probably can never be stopped altogether, but we believe it can be curtailed significantly. Like the home in the neighborhood with an alarm or a dog, counterfeiters will be more likely to move on to victims who are less aware, non-proactive and easier pickings. At LEMO, we will continue to be informed, aggressive, proactive, and do everything in our power to ensure that we and our customers are never the easier picking.

APPENDIX A – PHOTO EXAMPLES

FIGURE 1: TOP: AUTHENTIC REDEL. BOTTOM: COUNTERFEIT. COUNTERFEIT REDEL - 150°C MAX OPERATING RATED TEMPERATURE. CLEARLY THESE MATERIALS ARE SUB-STANDARD

FIGURE 1A: AUTHENTIC REDEL ON LEFT AND COUNTERFEIT ON RIGHT

FIGURE 2: LEMO B SERIES: IMAGE ON TOP IS COUNTERFEIT AND BOTTOM IS AUTHENTIC LEMO B SERIES: NOTE ON COUNTERFEIT CONNECTOR THE RED DOT IS OUT OF ALIGNMENT AND THE FINISH IS INFERIOR.

FIGURE 3: COUNTERFEIT CONNECTOR: THE RECEPTACLE AND THE PLUG CAN MIS-MATE, POTENTIALLY CAUSING MECHANICAL DAMAGE TO THE CONTACTS AS WELL AS POSSIBLE DAMAGE TO THE SIGNAL AND POWER WITHIN THE EQUIPMENT

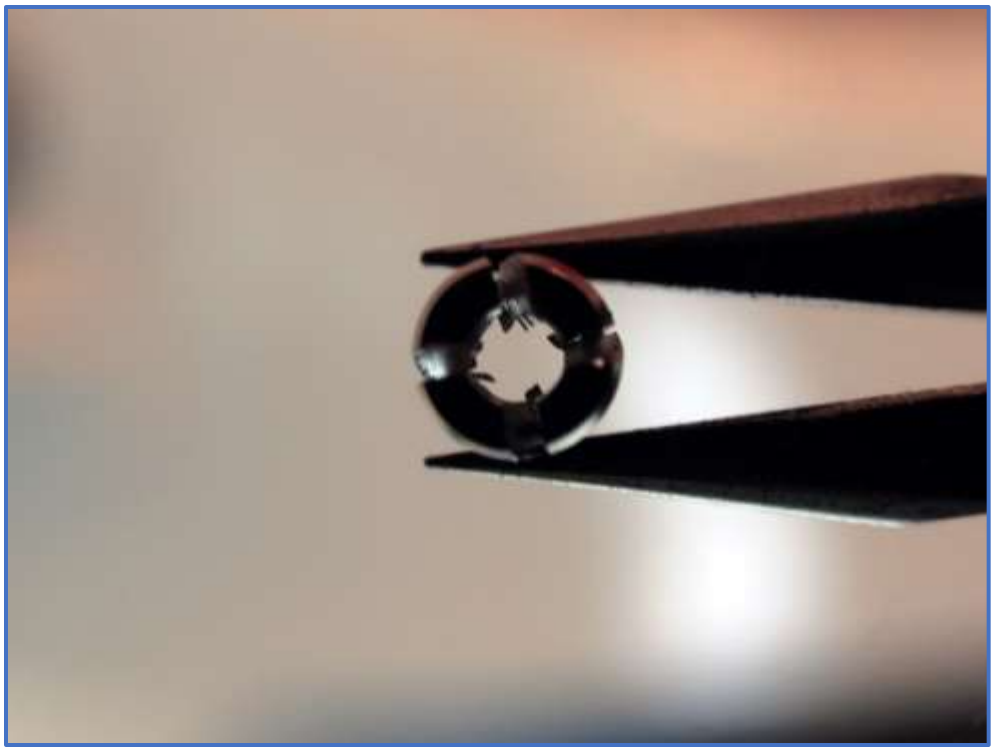

FIGURE 4: COUNTERFEIT CONNECTOR: THIS IS AN INTERNAL METAL COMPONENT (COLLET) THAT STILL HAS BURRS LEFTOVER FROM THE MACHINING PROCESS. IF ONE THESE BURRS FLAKED OFF IT COULD GET INTO THE ELECTRICAL CONTACT AREA AND POTENTIALLY CAUSE A SHORT.

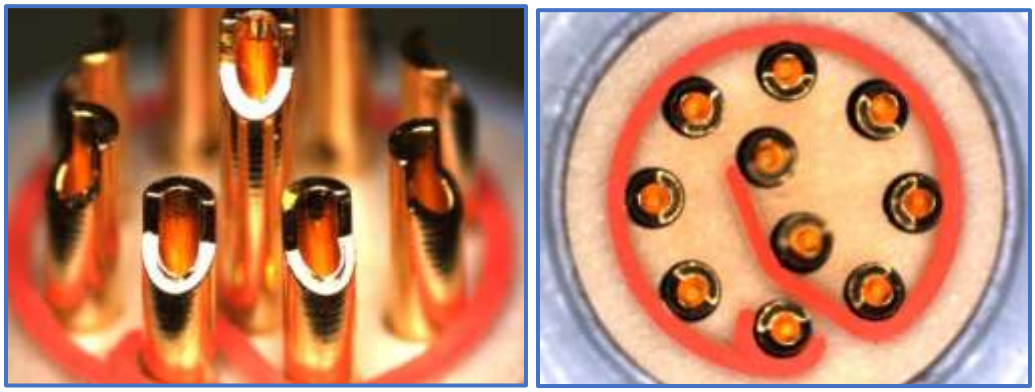

FIGURE 5: REDEL SOLDER CUP DETAIL: CUPS ARE VERY CLEAN AND PIN IDENTIFICATION PATTERN IS CLEARLY MARKED

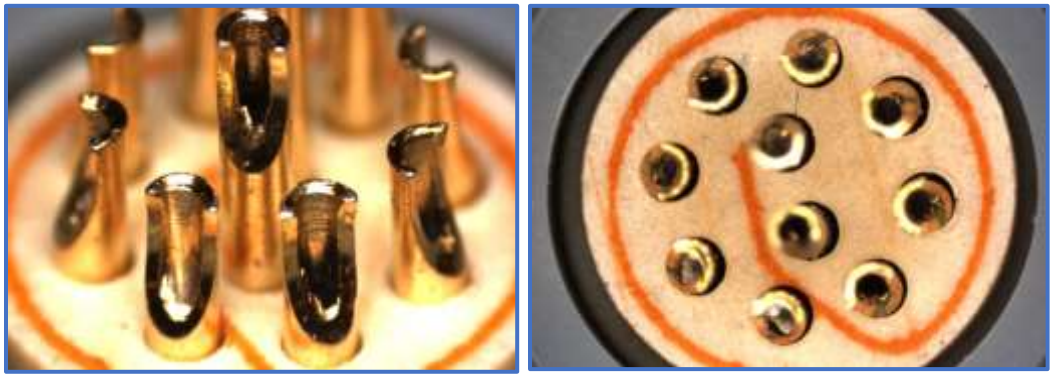

FIGURE 5A: COUNTERFEIT SOLDER CUP DETAIL: NUMEROUS BURRS IN THE CUPS CAN RESTRICT CONDUCTOR INSERTION AND PIN IDENTIFICATION. NUMBERING PATTERN IS NOT CLEARLY MARKED.

FIGURE 6: LEMO CONNECTORS: ALWAYS LOOK FOR THE LEMO BRAND NAME