MATE ROV Competition Tech Bulletin - MATE Expected Work Practices

MATE ROV Competition safety inspectors have observed a wide variation in workmanship in the development of ROVs, control systems and non-ROV devices. At one end, well-crafted devices meet industry expectations with boards that are fastened in-place, connections that are secure, and wiring that is neatly organized. At the other end, devices use haphazard wiring, pins stuck into sockets, electronic boards hanging loose and not secure. These systems are examples of what industry does not expect or accept. Haphazard wiring, including loose and misplaced connections leads to companies having technical issues at the competition. Safety inspectors and judges have observed companies using pin jumpers to connect to sockets on their Arduino or other boards. Pin jumpers are fine for prototyping a system, but are considered loose connections in a final, delivered product. All connections should be soldered or use terminal connections with screw or spring locks.

With this in mind, the MATE ROV Competition is now challenging companies to up their game and bring systems up what could be considered minimum industry standards. These apply to ROVs, surface control systems and non-ROV devices (ie: profiling floats). To reflect this:

- Circuit boards – must be securely mounted on to a frame or backboard. Loose, dangling boards are not acceptable.
- Circuit board wiring – all connections should be soldered or through terminal connections with screw or spring locks. Pin jumpers should not be used in the final system and will not pass safety inspection.
- No exposed wiring – insulation must be trimmed so that the insulation starts where the wires terminate. Exposed copper wires are potential short-circuits.
- Wire routing – Wires should be routed paying attention to high power wires (supply and motor loads) and low power control wiring. Separation of these types of signals should be designed into the system wherever possible. Crossing of these two types should be done at right angles to minimize any capacitive coupling that may induce system problems. Spaghetti wiring is not acceptable for delivered products.
- Strain relief – strain relief is the process of providing a protection of wiring as it passes through walls from one system to another. This is typically from inside an enclosure to outside. Drilling a hole and passing wires through is not acceptable. The wires are not protected from damage by the wall. Within a system, rubber grommets may be used as wires pass through a wall. When going from inside an enclosure to outside, a true strain relief must be used. This can come in the form of a bulkhead connector to a cable gland.

- Encapsulating – some companies have taken to encapsulating their electronics in permanent epoxy resin. This satisfies the requirements for no exposed wiring, but these devices must be secured and not dangling.
- Batteries (where allowed) – batteries must be secured in a plastic or metal battery pack. Soldering or taping batteries together and then taping them into a package is not acceptable.

Examples of Arduino Shields with Solder or Terminal Block terminations for wires.

- General Search Arduino uno prototype shield
- Amazon – DIYables Proto Screw Shield
- Arduino Mega Terminal Block Shield
- Arduino Uno Stackable DIY Expansion with solder holes for signals

Examples of Strain Relief for wires passing from inside an enclosure to outside

- Google search for Cable Gland
- IP68 Rated Cable Glands on Amazon
- Electrical Strain Relief at Home Depot, Sizes vary from 3/8" to 2"
- Bulkhead Connector Examples at DigiKey.com

Additional Resources:

- Close-Barreled Fastener Termination
- Ferrule Pin Termination
- Molex MX150L Connectorization
- Solder Sleeve Wire Termination