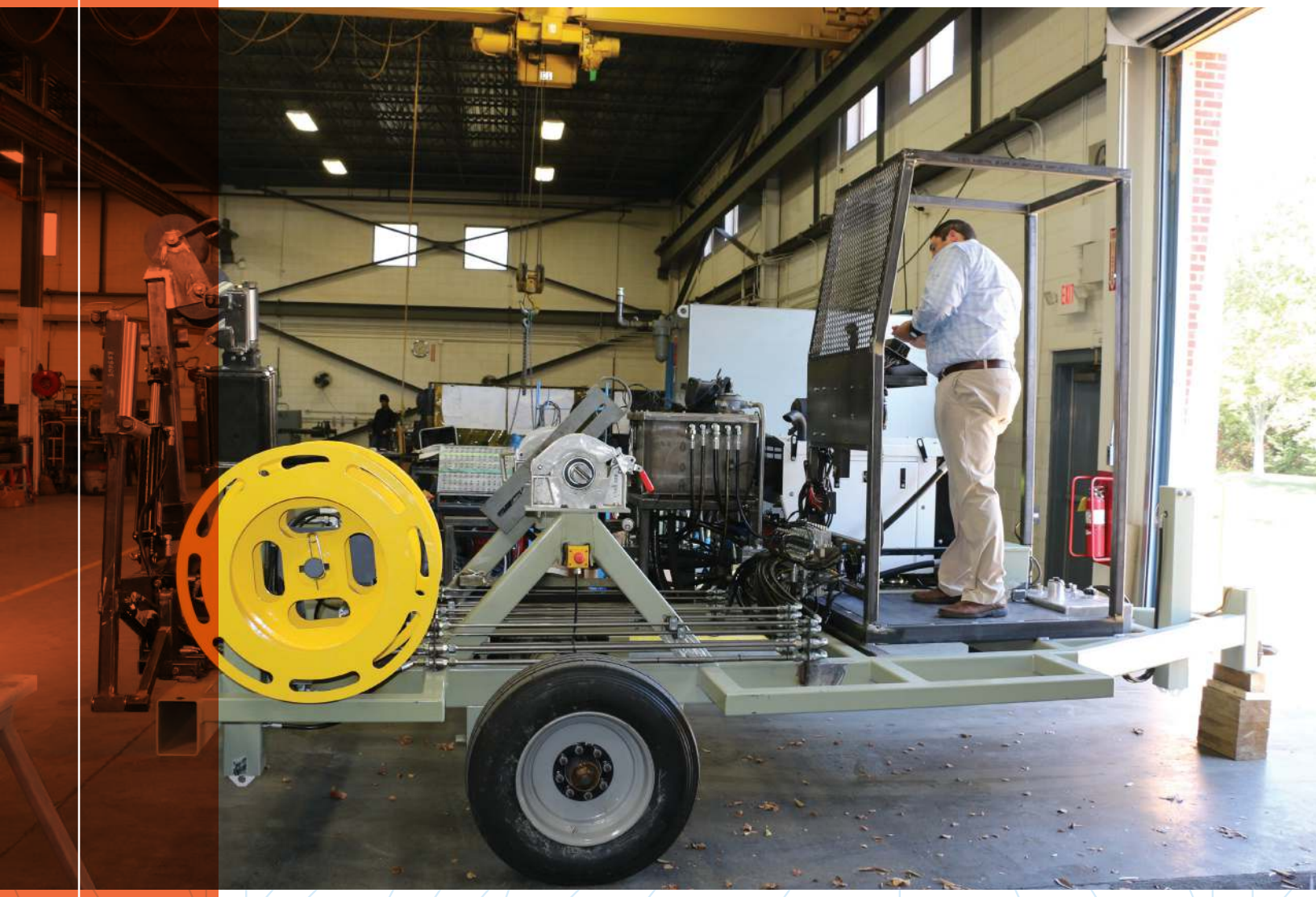
ELECTRONIC CONTROLS 101: A STARTUP GUIDE FOR MOBILE OEM'S



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HOW TO GET STARTED WITH ELECTRONIC CONTROLS

You probably find yourself in a similar situation as many mobile machinery OEMs - with the pressing need to upgrade the controls on your machine to bring it up to today's standards.

That means you need a video display (HMI) with graphics that are tailored to your machine. You need a programmable logic controller (PLC) to interface with your Tier IV engine and your hydraulic system. You need to upgrade your hydraulic joystick to CAN to simplify your wiring. And the list goes on.

But you soon find that you don't have the expertise within your company to do the engineering, design, and programming. This is a huge problem! Eventually, even some of the larger OEMs realize that it is best to hire someone who has this expertise to do this work for you.

Let's be upfront. Incorporating all of these changes is not going to be inexpensive because it involves lots of time by highly trained, skilled people. **But the long term advantages will pay for these improvements for years to come.**

To do so successfully, you will need to incorporate a complete system approach to upgrading your machine. This will require a lot of work by professionals that have a lot of experience implementing these systems on mobile equipment.

THE BENEFITS OF ELECTRONIC CONTROL SYSTEMS

First, why should you consider a total electronic control system for your machine?

1. A PLC adds flexibility for future upgrades and for adding or subtracting options. Programs, wiring harnesses, and hardware often can be configured to handle options without installing the actual option hardware. Sometimes, this is more cost effective than having a different wiring harness, controller, display, and software for each potential addition.

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2. A well designed electronic control system will offer you troubleshooting tools. This will enable your customer to get the machine back up and running more quickly and efficiently. For example, a common feature we incorporate into our software is a setup and troubleshooting screen that shows all inputs and outputs. By pulling up this screen, you can manually force outputs on and off to see if everything is working and you can observe input devices changing state to see if they are working. If one is not working, it's a simple matter of going to that specific device and checking the wiring or replacing the component. For safety reasons, this screen can also be password protected and made available only to qualified field service personnel for when a need arises.

3. A PLC, combined with proportional hydraulic controls, gives you a lot of flexibility in tuning the machine without orifices, springs, needle valves, etc. Additionally, once set, and mechanics can't mess with the settings. The machine will consistently operate as designed. If you need to modify the action of a particular output, it's a simple matter to build in a little more or less ramp time. Timers, delay on timers, and delay off timers are easily created in software. The sky's the limit here.

4. Save space on your mobile machine. A PLC, in most systems, will take up less space than relay systems and their enclosure. The hardware is "hardened" and designed to be exposed to the elements. So unless you have other reasons, there is no reason to have an enclosure as long as you have the correct electrical connections on your wiring harness. Also, a well-designed wiring harness will greatly speed up the wiring of your machine and reduce startup problems.

5. A custom programmed display can give the operator all the information they need and can improve safety if cameras and/or collision avoidance hardware is incorporated. A customer "splash screen" can be designed using your logo to further personalize the machine to your company.

6. A PLC can be interfaced with your engine's electronic control module (ECM) and can set engine RPM, monitor engine vitals, exhaust aftertreatment systems, and improve your machine efficiency. For example, you don't want your Tier 4 engine aftertreatment system to go into regeneration and cut its horsepower while your customer is trying to finish up an urgent job. A warning can be displayed and you can let the system regenerate after you've accomplished your heavy lifting.

(See Steps to get Started on the next page)

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FOLLOW THESE STEPS TO GET STARTED

1. **Write a brief description of what your machine does.**
   a. What conditions it operates under (extreme cold, extreme heat, extreme dust, etc.)?
   b. How does it need to move and interact with its environment?
2. **List every function on the machine and any other special information that may be useful.**
   a. What actuator is used for each function? How is the actuator is powered (i.e. hydraulic, electric, etc.)?
   b. How the function is controlled (manual, 12vdc on and off, proportional PWM, etc.)
   c. Provide a brief explanation of each function and how it might interface with other functions or safety interlocks. For example, maybe the seat belt should be fastened and the door closed before the propel function can be initiated.
3. Compile any existing documentation of similar machines that might be useful.
4. Contact an electronic controls integrator.

Doing a thorough job here will make it easier for the programmer/designer to estimate the hardware and programming cost of your machine. It will also save you money in the long run by minimizing "do overs" and "oh yeah, I forgot to tell you about that."

If you provide this information to your integrator, you will be off to a great start and you will save significant hours on the project!

Please feel free to contact us with any questions or if we can help implement the control system for your machine.