# Definitions of Acronyms and Terms Used in Mobile Electronic Controls

**PLC** – Programmable Logic Controller. This is a “computer” that accepts various inputs and makes a decision as to what action to various outputs need to occur. The decision is based on a program that is loaded into the PLC. For example, when you hit the “Emergency Stop” button, the program might shut off all outputs or it might shut off some and turn on others, depending on the program.

**CPU** – Central Processing Unit. This is the “computer chip” that is the brains of the PLC. It is designed in by the hardware manufacturer and optimized for each unit. You have little to no control over selecting a CPU other than the model PLC you select.

**Inputs** – These are devices that produce a signal to the PLC. For example, an ignition switch, limit switches, proximity switches, joysticks, proximity sensors and many other devices serve as inputs to the PLC.

**Outputs** – These are devices that produce work, motion, or activity. For example, electric motors and solenoids are common output devices. The PLC turns outputs on and off based on the inputs received and the logic program that is loaded into the PLC.

**I/O** – I/O is shorthand for inputs and outputs. The number of I/O that you have is one of the factors in determining the size PLC you will need. PLCs are often referred to by their I/O capabilities, such as 24 I/O or 48 I/O.

**HMI** – Human Machine Interface. The video displays that are commonly used today to display machine operating parameters, troubleshooting maps and other information that is needed by the machine operator are referred to as HMIs. The device is fairly simple. Programming it and designing custom graphics for each individual machine is not. How well or how poorly the graphics are designed and laid out greatly affects how easily and intuitively the machine can be operated.

**Keypad** – Keypads are typically used to input numbers for settings of timers, counters, etc. they are another form of input device.

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**SAE** – Society of Automotive Engineers. SAE is a global standards developing organization for engineering professionals. They define and set standards for transport industries including automobiles, trucks, and commercial vehicles.

**Bus** – This means any physical connection between or inside computers or components that function as parallel wiring. It could literally be parallel wiring or it could simply function that way.

**CAN** – Controller Area Network. CAN is a vehicle bus standard that allows microcontrollers and other devices (I/O) to communicate without a host computer. It is a message based protocol, designed originally for multiplex electrical wiring within automobiles.

**CAN Bus** – CAN bus is an SAE vehicle standard designed to allow microcontrollers and devices to communicate with each other over a standardized bus. It will always be two wires – CAN high and CAN Low – with two 120 ohm termination resistors, one on each end of the bus. If a multimeter were to measure ohms across CAN high and low, it would read 60 ohms.

**Node** – Any component that is connected to the network and is able to send/receive data.

**CAN Switches** – CAN switches are clusters of multiple switches that can communicate across the CAN Bus. You can literally have 8, 12, 16 or more switches communicating over two wires. This greatly reduces installation and wiring costs.

**ECM** – Engine Control Module. The engine control module is the brains of today's engine management system. It takes inputs such as coolant temperature, air temperature, airflow, exhaust temperature, exhaust oxygen content, engine knock sensor, and others and determines how much fuel to supply to the engine for optimal performance. This is generally not user changeable. Today, most machine PLCs interface with the ECM.

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**TCM** – Transmission Control Module. This is the equivalent of the ECM, except it controls the transmission. Often, machine PLCs must interface with the TCM as well as the ECM.

**J1939** – This is an SAE standard and defines the recommended practice used for communications and diagnostics among vehicle components. Most everything we use today in mobile machine control conforms to J1939 standards, which makes it easy to interface on the CAN. A benefit to J1939 is that it is very structured and well defined. An experienced technician could read most any non-proprietary raw J1939 data and be able to translate it.

**CANopen** – CANopen is another form of high-level communication over a CANbus. Like J1939, it was developed for networking in vehicle and mobile machine networks. In truth, J1939 and CANopen probably have more in common than not, but the way they are written and read is different. An analogy of J1939 and CANopen over CANbus could be a teleconference call of people speaking German and people speaking French. Using the same medium to speak, neither understand each other without translation. But two German speakers can communicate and two French speakers can communicate. The benefit of CANopen is its adaptability. An electronic data sheet can be created specifically for a device. This sheet can then be shared with another and the devices can act as extensions of each other. (Germans communicating with the French!)

**CodeSys** – CodeSys is a software that is commonly used for programming mobile PLCs. It is licensed to the manufacturer of the hardware for a fee and is free for users to download. Therefore, a CodeSys programmed PLC does not require you to buy expensive proprietary software. CodeSys is owned by 3S – Smart Software Solutions.

**Tier IV/Tier 4** – Tier 4 is the emission standard that almost all diesel engines installed in machines today must conform to. Tier 4 drastically reduced particulate emissions and nitrous oxide emissions of diesel engines.

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**Exhaust Aftertreatment** – In order to meet Tier 4 emissions, diesel engines machines must burn low sulfur diesel fuel and incorporate exhaust aftertreatment systems. Three of the more common after treatments are DPF (Diesel Particulate Filter), DEF (Diesel Exhaust Fluid), and EGR (Exhaust Gas Recirculation). Each of these might be used independently or in tandem. They all are implemented to achieve the same goal. What makes it more complicated than a Tier 3 engine is that these systems need to be monitored and controlled. The DPF condition needs to be monitored. If its soot load gets too high, it gets plugged. A burn off is then required where fuel is introduced to the exhaust to raise the temperature of the filter to burn off the soot. DEF must also be introduced to the system on a prescribed basis after the DPF. It then further reduces the negative emissions in the exhaust. When used, it is necessary for the fluid level to be monitored and displayed to the operator. The EGR valve recirculates some exhaust gas back into the combustion chamber lowering the oxygen level, this decreases the combustion temperature which then lowers the negative emissions produced in the exhaust.