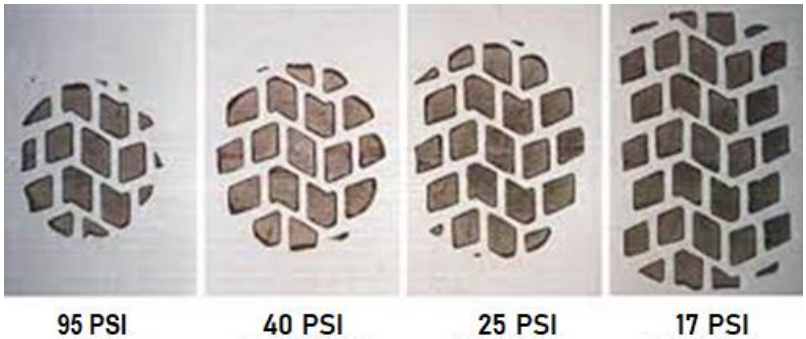
Central Tire Inflation Systems Explained

The Central Tire Inflation System (CTIS) vastly improves mobility when operating wheeled vehicles in the most severe off-road, soft-soil, washboard, rocky, muddy, sandy (beaches and dunes) or icy and snowy conditions. Suited for the defense, firefighting, utility, pipeline and forestry industries, to name a few, this automatic tire pressure adjustment system allows the driver to optimize tire inflation pressures from the cab while operating on varying terrains with the simple push of a button. Reduced tire pressure results in a much larger tire footprint, increasing the contact between the tire and the ground, providing significantly increased flotation, traction and ride comfort when operating in challenging terrain. These features often mimic tracked vehicle performance in even the worst terrain. Rough ride from washboard can be virtually eliminated.

In addition to improved performance and ride quality, CTIS can also significantly reduce soil compaction and ruts which can be particularly beneficial in environmentally sensitive areas and for maintaining better worksite roadways longer, thus enhancing site safety and reducing site damage and rehabilitation efforts.

Although most often used in conjunction with all-wheel drive, CTIS has proven so effective that non-all-wheel drive vehicles equipped with CTIS can actually outperform all-wheel drive vehicles without CTIS in many soft-soil conditions. As a result, nearly every tactical military vehicle worldwide is equipped with CTIS.

The CTIS interface allows operators to select from four terrain modes (Highway, Cross-Country, Mud/Sand/Snow & Emergency), each pre-programmed with set tire pressures and an over-speed setting. Selecting any of the terrain modes results in the system monitoring tire pressures at regular intervals and automatically adjusting them to the selected pressure targets (modes). Messages displayed on the Operator Control Panel indicate that tire pressures are being adjusted (up or down) and when target tire pressures have been achieved.



Another function of the CTIS is to maintain tire pressure in case of puncture or leak (which would otherwise result in a flat tire). Known as Run-Flat mode, the CTIS system reduces its pressure monitoring interval to nearly continuous and constantly provides pressurized air to the punctured tire(s), allowing operators to drive vehicles out of the worksite and potentially out of danger.

The CTIS system interfaces with the onboard vehicle CAN Bus, monitoring vehicle speed and gearing in real time, and provides both an over-speed warning (based on mode selection) and an automatic terrain mode bumper to ensure safe operation. Operators can run in an over-speed condition for short periods of time, for example, to preselect for an impending terrain change. Operating at over-speed will result in a warning message display and audible alarm. If vehicle speed is not reduced within a pre-set time, the CTIS system will automatically bump up the terrain mode to the appropriate speed-based setting and inflate the tires to the new target pressure. This staged approach provides for ultimate, automatic safe operation while allowing the operator to pre-select terrains as needed while protecting tires from damage.

Operating vehicles with reduced tire inflation pressure is approved by military tire manufacturers when running at lower vehicle speeds. Contrary to common perception, operating at reduced tire inflation pressure, at lower speeds, can extend tire life by lessening susceptibility to tire punctures and tread chunking. CTIS also improves fuel economy due to lower rolling resistance as the tire floats on the surface rather than sinking, slipping, and creating ruts in soft soil or sand.

How Does It Work?

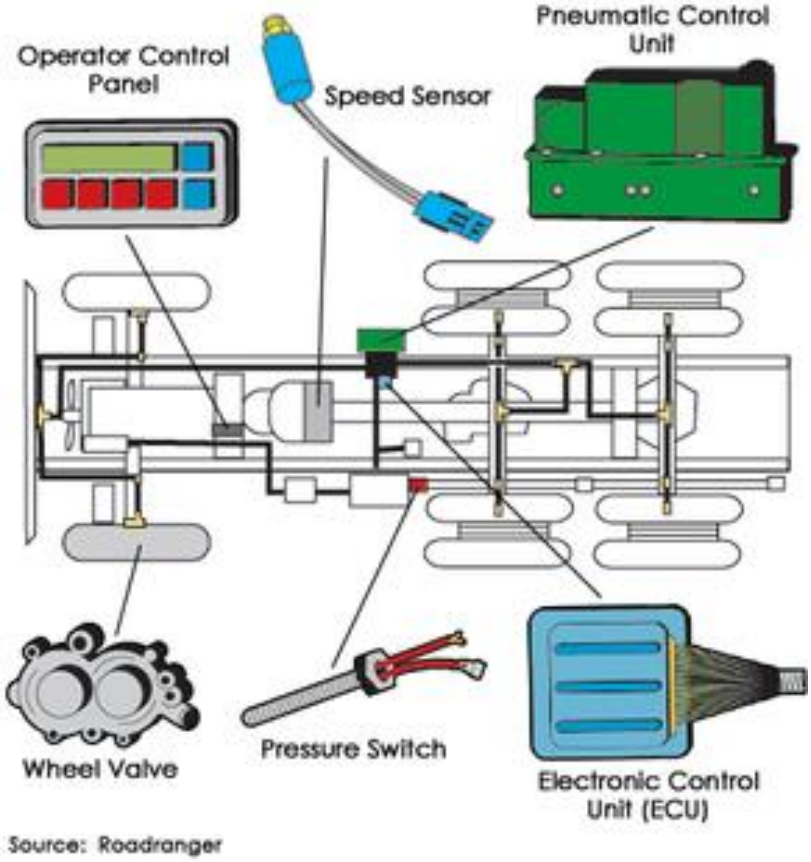
Wheel Valves. Each wheel end is equipped with a CTIS wheel valve. The wheel valve opens and connects to the CTIS control system whenever it is actively measuring or changing tire pressure. Otherwise, the wheel valve is closed, isolating the tire from the system and ensuring there are no leaks. This eliminates the need for manually operated shut-off valves when a vehicle sits idle for extended periods of time. This feature also helps extend air seal life when the vehicle is in motion and tire pressure adjustment is not needed.

CTIS Capable Wheels that are machined to accommodate and seal a wheel valve mounted to the wheel face. This arrangement allows air flowing through the wheel valve to pass into and out of the tire air chamber on request and to positively seal the wheel/tire from atmosphere. Most CTIS systems also use bead locks to prevent beads from “breaking” off of the wheel when maneuvering at low speeds so 2-piece wheels are usually used to best accommodate the bead lock installation. They also provide for tire changes in the field without traditional tire changing equipment.

CTIS-Capable Axles with special sealed air chambers and passages are required to allow the passage of air from the PCU air lines into the axle, into the wheel valve, through the wheel face and into the tire.

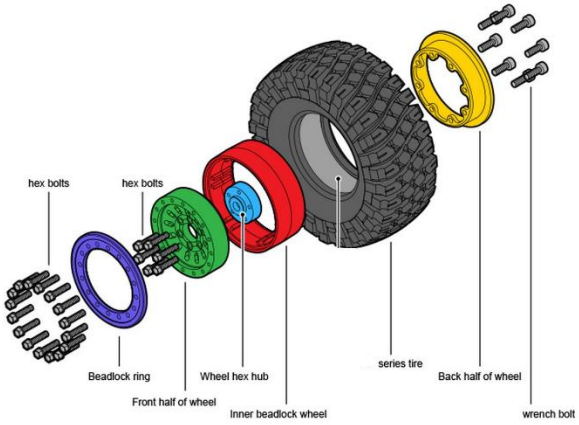
Pneumatic Control Unit (PCU) consists of electropneumatic valves and pressure sensors required to monitor and control the compressed-air system. It mounts on the vehicle chassis. CTIS provides independent wheel-end control ensuring fail-safe operation in the event of damage to the vehicle or wheel end. The CTIS wheel valve is completely sealed to the atmosphere at the wheel end ensuring reliable deep-water fording capability. Tire venting while deflating is routed back through the pneumatic control unit rather than at the wheel end.

Electronic Control Unit (ECU) is the "brains" behind the CTIS system, processing driver selections, provides decision making and logic execution. The ECU communicates with the vehicle CAN Bus, monitoring power, speed, etc., sends commands to the PCU which directly controls the wheel valves and senses tire pressures from the PCU. Electronic circuitry is completely sealed resulting in a rugged, environmentally robust package.



Operator Control Panel allows the driver to select tire-pressure modes to match current conditions. This dash-mounted panel displays current tire pressures, selected mode and system status. When the driver selects a mode setting, signals from the control panel are transmitted to the ECU to the PCU to the wheel valves.

Bead Locks installed in the 2-piece military wheels prevents the tire bead from "breaking" off the wheel and failing. The bead lock allows for vehicle operation at pressure settings nearing 0 PSI.



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https://www.mobilehydraulictips.com/on-the-go-tire-inflation-for-off-highway-vehicles/

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