Traditional control systems employ equation-based control laws and fixed mathematical models, where feedback from the system is compared against specifications of desired system performance. We present an algorithm which employs model checking to generate provably correct control of high-assurance cyber-physical systems, using bounded linear temporal logic to formally specify performance requirements. Our algorithms leverages advancements in high-performance computing as well as algorithmic model checking to suggest that this is a practical approach for generating control of high-assurance cyber-physical systems.