

Case IH Magnum Autonomous Concept Vehicle

Based on a Magnum 370 CVT

Engine	8.7 liter FPT Industrial Cursor 9 engine
PTO power	305hp (227kW)
Rated power	367hp (274kW)
Maximum Boosted power	419hp (312kW)
Maximum torque	1,332lbf (1806Nm) @ 1500rpm
Transmission	Continuously Variable Transmission
Minimum speed	0.018mph (0.03kph)
Maximum speed	31mph (50kph)
Maximum rear lift capacity	22,487lb (10,200kg)
Number of hydraulic remotes	Six



Autonomous Concept Vehicle control systems

Base server connects to the tractor and portable control interface; it transmits and receives all operating data, including path planning activities and modifications to tractor and implement parameters using the communication network.

Machine functionality is controlled through a variety of sensors which automatically govern

- Ignition (engine start and stop)
- Acceleration and deceleration
- Engine speed (rpm)
- Steering angle
- Transmission controls. The concept Magnum tractor features a continuously variable speed transmission (CVT). The autonomous technology is also able to control a Full-Powershift transmission
- Rear linkage raise/lower and engagement of the rear PTO
- Front linkage raise/lower and engagement of the front PTO (if equipped)
- Front and rear hydraulic remote extend-retract-float functionality
- Engagement of the locking differentials
- Horn operation

The autonomous tractor can be controlled via

- Desktop computer
- Portable tablet interface, which can be mounted in another vehicle's cab to enable supervised autonomous activities or used as a standard tablet wherever the operator is.

The interactive user interface enables the operator to manually modify various implement parameters and or have these accomplished automatically based upon GPS field position, for example in the case of rate and section control. In the case of the planter used in conjunction with the concept tractor these included

- Planter system start – to start and prime the entire planter ready for work
- Planter master apply system – which starts and stops planting seed and fertilizer when working in the field (when conducting headland turns for example)
- Planter downforce – to control optimum seed bed
- Seed population (optional variable rate) – the quantity of seed planted per acre
- Bulk fill fan rpm – to control airflow which conveys seed from bulk fill tanks to seed meters on row units
- Vacuum pressure - to ensure that one single seed is picked up by the seed disc which will transfer it for planting into the ground

Critical notifier function on user interface alerts when

- Operating parameters become critical
 - Low fuel
 - Low input (seed, fertilizer etc.)
 - Seed population
 - Wheel slip – defined threshold to ensure optimal traction is maintained
- Operating issues such as warning codes
- Invalid GPS position
- Off-path error (when the vehicle deviates a pre-defined distance from the planned path)
- Communication between the vehicle and the base station is lost

Sensing and perception

The sensing and perception technology integrated into the Magnum autonomous concept vehicle to enable obstacle detection activities includes

- LiDAR (Light Detection Ranging) sensors use range finding laser technology to create a 3D point cloud in front of the tractor and across the entire implement width. As LiDAR does not use visible light, their operation remains unaltered day/night.
- An array of radars is mounted to the front of the tractor which detect objects containing water/metal which reflect the energy back. As radar does not use visible light, their operation remains unaltered day/night and in dusty conditions.
- Forward and rearward facing RGB cameras which provide a live video feed to the operating interface.

The tractor initiates the stopping sequence when an unidentified obstacle is detected within sensing range. The tractor then either awaits further instruction from the user interface, or if in the instance of an obstacle being subsequently removed from its path, as in the case of a vehicle, the tractor can automatically restart itself, if that setting has been selected.