LONG-DISTANCE MOTOR DRIVER

Device capable of highly repeatable positioning from a remote location. (Image: CERN)

For the needs of its scientific programme, CERN has developed a unique motor driver capable of highly repeatable positioning from a remote location up to 1000 metres away.

The technology can deliver reliable positioning with low mechanical overshoot and low vibration using any length of power cable up to 1000 metres. These features make it particularly well suited for remote applications, such as cabled inspection robots, in harsh environments where there are safety risks for direct human intervention, e.g. radioactive areas, underwater infrastructures, high temperature environments, etc. The device can also drive Stepper Motors or DC Motors (brushed or brushless), meaning that only one driver can be used for many applications.

When operating as a stepper motor driver, the motor driver can operate in either standard micro-stepping mode or in a closed-loop position control mode, if a position sensor is available. In the event of a sensor failure, it is capable of switching online from closed-loop position control to stepper mode without changing position. When operating as a brushed DC motor driver, a single driver can drive two motors reading a different encoder for each.

The technology has been validated in CERN's highly demanding environment and is currently deployed in the critical application of the LHC beam crystal collimators.

AREA OF EXPERTISE

- Robotics

TECHNOLOGY READINESS LEVEL

- Production

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APPLICATIONS

- All applications requiring precise and reliable positioning over long distances, especially in harsh environments (radioactive, underwater, high temperatures, etc.)
- Applications requiring high levels of both drive and mechanical diagnostics & monitoring (e.g. load torque monitoring).

FEATURES

- Provides highly repeatable positioning from remote locations up to 1000m away.
- Smooth operation with low vibration.
- Capable of driving stepper motors and DC motors (brushed and brushless).
- Can operate in either micro-stepping mode or in a closed-loop position control mode if a position sensor is available.
- Provides continuous operation in the event of a sensor failure by switching online from closed-loop position control to stepper mode without changing position.

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- "Step-less" motion mode (smooth motion profile automatically generated through interpolation of step inputs).
- Provides sensored or sensorless load estimation using available measurement inputs. Comparing the values using these two methods can also be very useful for monitoring the mechanical health of the system, including any degradation of the mechanics over time.
- Superior system diagnosis by acquisition of the most important operational parameters, such as current, position, etc. (e.g. by acquiring the status of limit and homing switches).
- Provides automatic current controller tuning.
- Ability to perform customised trajectory profiles defined by position and timestamp arrays.
- Automatic generation of trapezoidal speed profiles, if desired.
- Profinet interface.
- Ability to update drive firmware serially.
- Can be incorporated into a large-scale, multi-axis control system (acting as a slave to a master controller) or it can be used as a standalone position controller.

LIMITATIONS

- The technology has only been manufactured in limited quantities for CERN's scientific programme. The unit cost associated with high volume production would need to be determined.
- Currently the driver hardware is limited to motors with a maximum current of 10A and 120V DC supply.

The technology is currently deployed in the LHC beam crystal collimators. (Image: CERN)