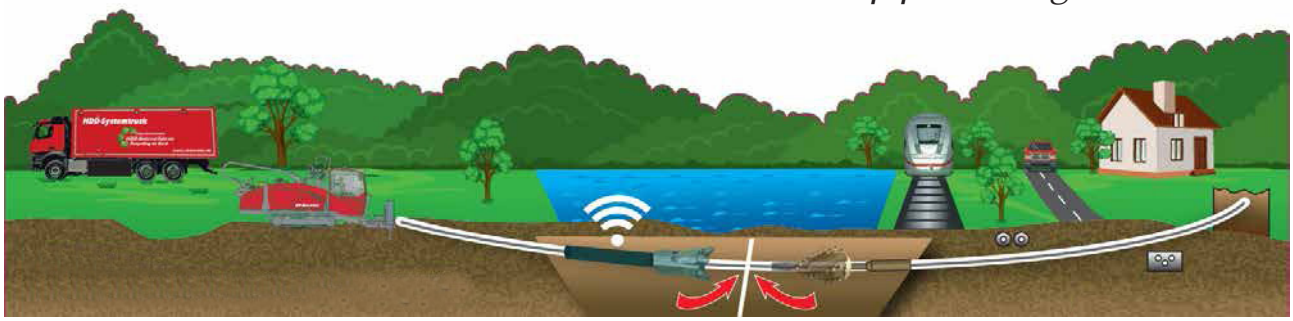
Faster drilling for faster Internet

Absolute CANopen encoders from Wachendorff provide position data in AT-Boretec's horizontal drill machines with automatic pipe feeding.



(Source: AT-Boretec)

In the scope of the area-wide expansion of mainly rural regions with glass fiber cables, underground works are a common sight in residential areas and along through-roads. To ensure that investments in high-speed broadband communications are not exceeding the budget estimates of the municipalities in road maintenance, underground construction companies mainly use horizontal drills. AT-Boretec from Schmallenberg (Germany) is one of the leading manufacturers of these mobile machines in Europe. In the current series, the Sauerland company is relying on automated feeding of drill pipes from a magazine. Wachendorff Automation has designed the robust encoder for positioning the gripper unit in a manner suitable for use on the construction site.

Distances of up to 500 m are not uncommon with the so-called horizontal flush drilling method. Especially in light soils, pipes and lines can be laid in the ground quickly and effectively with the horizontal directional drilling. Whether wastewater or glass fiber: Horizontal drilling technology has established itself in Germany over the past 20 years and is used especially for sealed surface environments. Powerdrill for soils and Rockdrill for rocks are the names of the two machine series from AT-Boretec. They are scaled in their performance to provide suitable working conditions for different pipe diameters, distances, and radii.

Precise cable laying

Instead of digging long trenches, AT-Boretec's systems first drive the pilot sewer from one excavation pit to the next with a simultaneous drilling and flushing process. Once the operator has hit the target, the drill head is replaced by a reamer, which in turn is connected to an empty pipe. When pulling back, the reamer expands the drilling section and simultaneously pulls in the pipe. These two work steps are usually sufficient for laying fiber optic cables. If pipes with larger cross-sections have to be laid, the second work step must be repeated and the drill channel enlarged in stages. For this purpose, various reamers with increasing drill diameters are then used. The general procedure remains the same - also with regard to the use of an emulsion of water and bentonite. The natural aggregate in the water lubricates the drill head, ensures that the removal of sediment can flow out of the bore channel and stabilizes the wall of the bore. The clay-based fluid is prepared on site in the mixing station on a truck and then pumped through the drill pipe to the drill head by a high-pressure pump on board the drill rig. Here the bentonite emerges through nozzles.

Automatic reloading of drill pipes

The pipe sections that the self-propelled drilling rigs carry in a magazine are between three to four and a half meters long. Depending on the model, 40 to 70 drill pipes can be stored. These are automatically removed by a hydraulically driven removal unit and bolted to the drill pipe. Longer pipe sections are recommended for long distances, as the drilling process does not have to be interrupted as often. When the drill pipe is extended, a gripper unit removes a pipe from the magazine, which is then bolted to the drill pipe in the ground by the drilling carriage.

Figure 1: Horizontal drills from AT-Boretec use the WDGA CANopen encoder from Wachendorff for accurate drilling and automated reloading of the drill pipes (Source: Wachendorff)

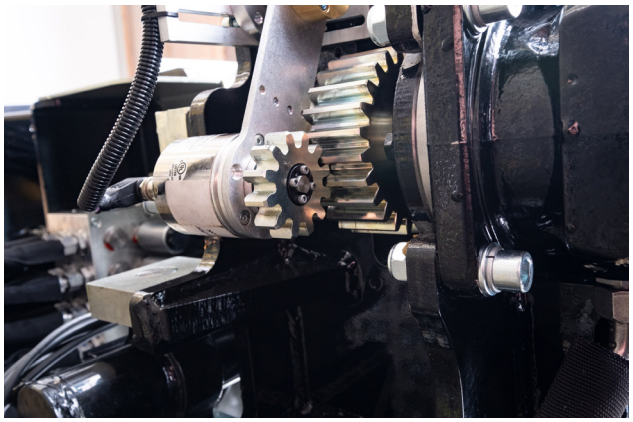


Figure 2: The encoder was fitted with specially adapted bearings and is installed without any protective enclosure; it provides the controller with the necessary data for positioning the removal unit of the drill pipe (Source: Wachendorff)

Figure 3: A status LED is integrated in the encoder housing and allows for a rapid diagnosis in the event of an error (Source: Wachendorff)

In previous machine generations, the operator had to manually unlock one magazine row after the other. In the current Powerdrill series, however, the row can be preselected via a touch display in the machine cabin. Removal then takes place automatically.

To ensure that the gripper unit knows how far it has to travel, a multi-turn WDGA encoder from Wachendorff Automation passes on the necessary position data to the controller via electrically-isolated CANopen communication. The encoder operates magnetically and is parameterized for a resolution of 18 bit in multi-turn operation. Implementing the company's patented Endra and Quattromag technologies it is wear- and maintenance-free as no gearbox and battery is used. Beside the base CANopen communication services (CiA 301), the encoder supports the CANopen device profile for encoders (CiA 406 version 3.2, class C2). A bi-color status LED indicates the operating conditions and errors according to the CiA 303-3 recommendation. Data exchange at bit-rates of up to 1 Mbit/s is possible.

Comfort for the operator and a machine that has an efficient performance when drilling are the offered advantages of the current AT-Boretec machine series. A Bluetooth interface in the operator's cab, a heating system for the cold season, and air conditioning in summer are provided. Automatic loading of the drill pipe also unburdens the operator, as they can remain seated in the cab and stay dry in the bad weather.

Heavy-duty encoder

Heavy-duty equipment is necessary to ensure the operational reliability and long service life of the encoder in this demanding application. "Construction site environments are one of the worst things that can happen to a sensor - even in such an exposed position" said Benjamin Ochsendorf, sales engineer at Wachendorff. The Wachendorff encoder is freely mounted under the pipe magazine and is directly exposed to the mud and moisture. For this reason, AT-Boretec was looking for a robust technology when selecting the sensor.

The WDGA multi-turn encoders have a protection class of IP67 (dust-tight, immersion up to 1 m depth) and can operate with a resolution of up to 43 bit (multi-turn) and up to 16 bit (single-turn). For use in horizontal drills, the shock- (5 000 m/s^2) and vibration-resistant (300 m/s^2) encoders are equipped with special bearings. They can support loads of 120 N axially and 220 N radially. Optionally, radial and axial bearing loads of up to 500 N each are also possible. In order not to transfer unnecessary forces to the sensor's axis of rotation, the AT-Boretec encoder is mechanically decoupled by a spring-toothed wheel construction. With a view to operational safety and fast diagnosis in case of error, a status LED is also integrated in the encoder housing. The used encoder has two M12 connectors enabling a flexible and mechanically robust integration into the CAN network. Additional adapters are not required. The necessary bus termination can also be integrated into the encoder if required.

Conclusion

Thanks to the robust design of the sensor, it is possible to use the WDGA encoder for the positioning system in AT-Boretec construction machines without further enclosures. The IP67-protection, coupled with constructive modifications, ensures that sludge and drilling fluids do not impair the reliable functioning of the encoder. ◀

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