

DEEP ICE CORE DRILLING EQUIPMENT DEPTH MEASUREMENT AND DRILLING PROCESS

by

PERRIN J.

Laboratoire de Glaciologie et Géophysique de l'Environnement du C.N.R.S.
St-Martin d'Hères, France.

The deep drilling equipment developed by the LGGE includes, apart from the core drill itself, a winch and a drilling tower on top of which is erected a 4 m stroke hydraulic cylinder supporting the sheave.

There are two means to move the drill up and down :

- the winch for high-speed raising and lowering of the drill ;
- the hydraulic cylinder for control of penetration, core breaking and core recovery at the surface.

It's then difficult to measure the depth with accuracy because of the two kinds of movement :

- the sheave rotation
- the hydraulic cylinder linear displacement.

We solved the problem by the use of an optical encoder and auxiliary sheave with the same diameter as the main one. The optical encoder axle is connected to the main sheave's one. Its case is fixed to the auxiliary sheave and is equipped by a slip ring assembly. When using the hydraulic

cylinder, the two sheaves rotate in opposite ways.

Both the hydraulic cylinder and the winch can be used simultaneously, whatever their relative movement.

The encoder delivers four different signals :

- 2 counting tracks A and B with 200 impulses per revolution out of phase of 90°
- 1 Up/Down signal
- 1 inverting Up/Down signal.

A digital sequential processor is used for two main functions :

- the permanent control of the encoder and of the measured depth
- the automatic positioning of the drill in the bore hole and on the surface during setting up or core recovery.

Control phase : The processor permanently controls the encoder signals. It informs the operator when a counting fault occurs. A logic processor allows to locate exactly the fault and its origin. This makes the

maintenance interventions easier.

Automatic drill positioning system acts as follows : The first cycle allows the drill positioning at the bottom of the bore hole. The second cycle allows the drill positioning at the surface. The winch rotation speed depends on the drill position in the hole. This rotation speed is determined by comparison between the drill depth and reference depth values. The first counter value increases when the drill is lowered and is equal to zero at the surface. The second counter value increases when the drill is raised and is equal to zero at the bottom of the hole. The two counters reset automatically.

A control terminal allows modification at all the parameters, such as :

- depth reference values
- timing
- counter value comparators.

