

## Technology for measurement of potential water inflow collected ahead of the tunnel face

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### 1. Overview

Gathering of advance information on the situation of potential water inflow ahead of the tunnel face is extremely important in order to maintain construction safety. In long tunnels, in particular, it is difficult to conduct multiple surveys from the ground surface, so it is necessary to acquire information regarding the geology and potential water inflow ahead of the tunnel face by the horizontal boring. As a solution for this difficulty, we developed a system that enables accurate and continued automated measurement of spring water pressure and volume ahead of the tunnel face simultaneously with FSC-100. Evaluation of the information regarding water inflow obtained through this system in combination with the geological information obtained through FSC-100 enables assessment of the ground conditions ahead of the tunnel face and is useful in determining the necessity of countermeasures for water inflow.

### 2. Characteristics

Conventional surveying and measurement of spring water are conducted intermittently at the opening of the drilling shaft, but with this method it is difficult to obtain accurate information about spring water where there are multiple spring water zones. By applying the two technologies summarized below, the newly-developed system enables measurement of spring water pressure and volume long hole drilling.

(1) Measurement of spring water pressure at the tip

A self-powered water pressure measuring unit installed at the tip of the drilling machine makes it possible to measure the spring water pressure around the tip of the drilling hole. This enables gathering of precise information about the location and size of each spring water zones.

(2) Automated measurement of spring water volume at the mouth of the drilling hole

In long hole drilling, the volume of spring water is estimated by monitoring the drainage discharge at the mouth of the drilling hole. As an alternative solution to intermittent manual measurements, an electromagnetic flow meter is provided at the mouth, and in this arrangement, it becomes possible to measure possible water inflow automatically and continuously without human intervention.

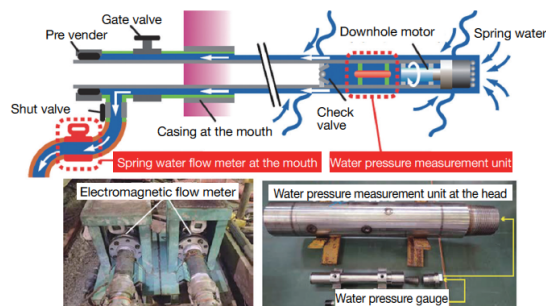


Fig. 1 Structure of the system for measurement of spring water pressure and volume