EXPERIMENTAL TESTS OF A MULTICHANNEL OPTOELECTRONIC LONGITUDINAL DEFORMOMETER

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Test results are presented for a multichannel optoelectronic longitudinal deformometer MOED-1p at the “Oktyabrsky” mine of the Norilsk deposit with which rock strains and displacements were monitored around an observation working located in the area of a tectonic fault. Basic versions are developed for installing the transducers of the instrument with fixing of the datum-mark support both within the depth of the rock mass and also at the side wall of the working. A relationship is established between the designed technical and actual characteristics of the instrument.

A multichannel optoelectronic longitudinal deformometer (MOED-1p) [1] developed in the mining geophysics laboratory of the Institute of Mining, Siberian Branch of the Russian Academy of Sciences, previously proven in the Borok quarry in Novosibirsk [2] and on a test bench with model block medium structures [3], was subjected to careful checking and testing under underground conditions of the “Oktyabrsky” mine of the Norilsk deposit. The aim of the study was to evaluate the efficiency of the instrument under these conditions and to determine the conformity of the designed and actual technical characteristics in monitoring strains and displacements of geoblocks within the body of a rock mass. Versions of the schemes were developed simultaneously for installing transducers and placing the basal support beyond the contour space for detailed monitoring of strains and displacements of geoblocks during periods of carrying out blasting operations and between explosions (development of quasi-static processes around a working).

1. PROGRAM AND SEQUENCE OF MOED-1P INSTRUMENT TESTS

The test program for the MOED-1p instrument included the following items:
1. to check the conformity of the actual and designed instrument technical parameters;
2. to determine the technological possibilities of the measurement system with respect to its operational installation and dismantling in boreholes with diameters of 76, 105, and 165 mm;
3. to evaluate instrument efficiency with an autonomous power supply in an operating regime for measuring rock strains in the near-contour area of a pillar in carrying out blasting operations and within the period between explosions;
4. to check the resource capabilities of the instrument during prolonged strain measurement;
5. to develop versions of transducer installation schemes in the rock mass under conditions when: a) the basal support is fastened in the mouth of the borehole, b) the basal support is fastened in the bottom of the borehole, c) transducers are installed with a constant interval for the measurement zones, and d) transducers are installed with a variable interval for the measurement zones;
6. to evaluate the ranges of actual strains and the pitch of rock disintegration zones around a working with the aim of refining the required measurement limits and the transducer installation schemes.


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A model specimen of a multichannel optoelectronic longitudinal deformometer MOED-1p was presented for testing that contained:

- Measurement module (transducer) ................................................................. 8 pieces
- Basal support (datum-mark) ........................................................................... 1
- Recorder ........................................................................................................... 1
- Coupling rods 0.5 and 1 m long ................................................................. 16
- Hydraulic pump ............................................................................................... 1
- Storage battery ................................................................................................. 3

Strain and displacement measurements in the rock mass were performed at a depth of 600 m close to a tectonic fault in prospect ort (PO) 6/7 of panel 6 of section No. 2 of pit No. 1 of the “Oktyabrsky” mine during carrying out blasting operations in the faces of prospect entry (PE) 5-84-9 and 5-78-1.

In order to check the operating efficiency of the MOED-1p instrument and possible circuit diagrams for transducers, rock pillars were selected in the region PO 6/7 (pickets (PK) 128–132 and 132–136) that are at the boundary of a tectonic fault. A plan of the section with the location of faces and places for instrument installation is given in Fig. 1. Places are shown on it for carrying out blasting operations, boreholes for instrument installation, boundaries of the tectonic fault, and the position of the filling rock masses. There is rock caving in the section selected within the fault zone. The dimensions of the pillars monitored (in plan) are 20×55 m (PK 128–132) and 30×35 m (PK132–136).

Relief boreholes with a diameter of 105 mm drilled in pillars over pickets 128–132 and 132–136 in the direction of the tectonic fault the an angles of 10–20° with respect to the axis of the face of PE 5-84-9 were used for instrument installation. The distance from the development heading up to picket 132 ahead of testing was 50 m. During tests the face of the working advanced by 10 m in the direction of instrument installation.

![Diagram](image-url)

Fig. 1