

GLÖTZL Baumeßtechnik

CONVERGENCE MEASUREMENTS with LIGHT EMITTING DIODE MEASURING BOLTS

Type: GKV . .
Art. No.: 90.10



Levelling and Convergence Measurements

In modern tunnel construction, the mostly applied measuring methods are the levelling of tunnel roof ridges or other points of the tunnel reveal and the measurement of convergences of the tunnel formwork.

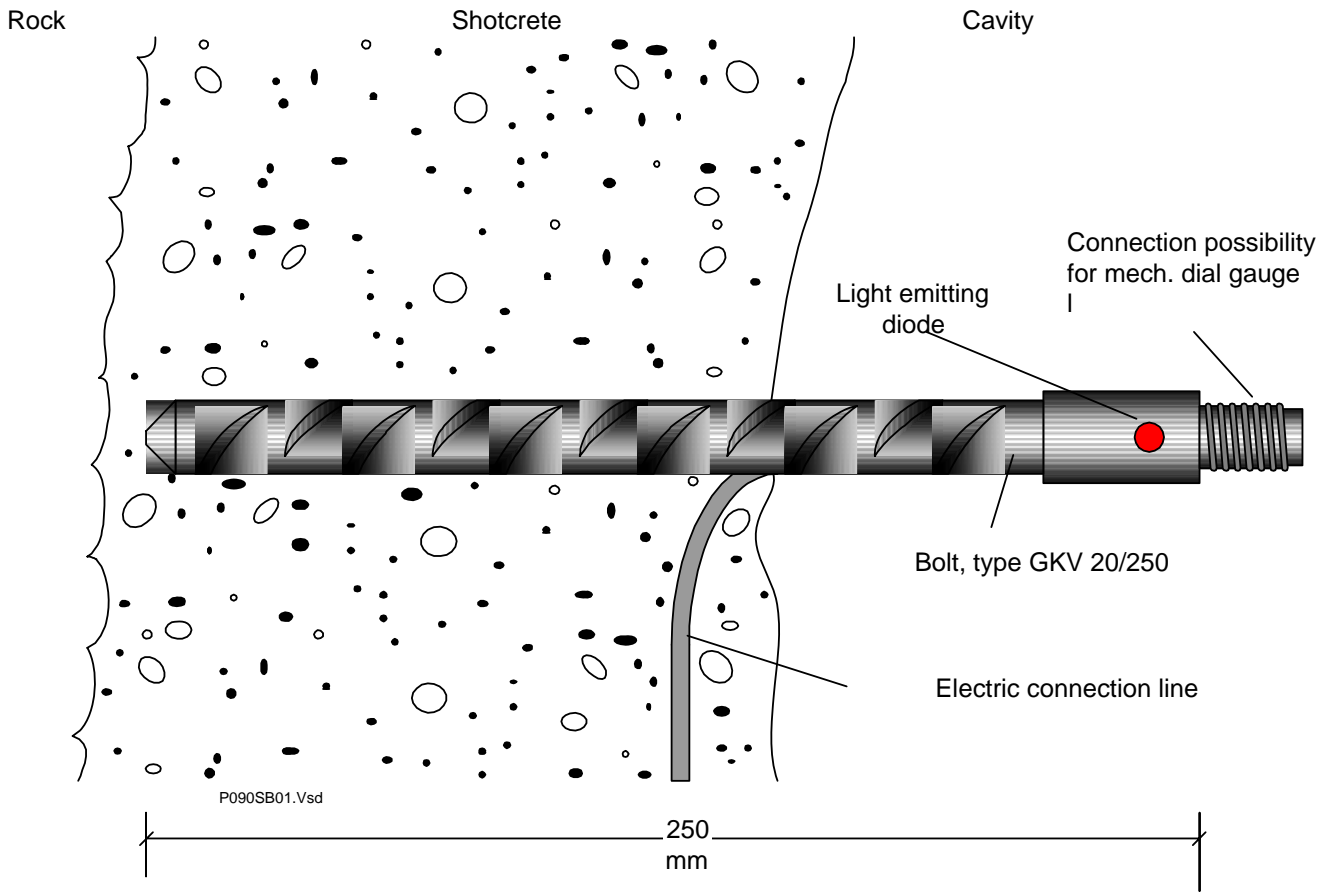
Levelling is done with the normally used instruments in construction industry. The levelling of the roof ridge can be done with an increased measuring accuracy of ± 1 mm by a special suspension device and be carried out by the surveying engineer in the course of the usual works on the tunnel site. The suspension device, type GST and STZ (see separate data sheet) can be combined with the convergence bolts KVK resp. KVM. By this, it is possible to join the distance changes, normally to the tunnel axis - arising during convergence measurements - to the height changes in the longitudinal tunnel axis which are measured at levelling of the roof ridge.

For establishment of a convergence cross section, the convergence bolts are relocated in the tunnel reveal, possibly directly after the regrating, then embedded in concrete or welded on tunnel arches. The convergence bolts are equipped with a thread with connection at the tunnel-sided end in which a measuring device - steel measuring tape or Invar wire - is fitted. The measuring tape is prestressed by springs with the convergence measuring instrument which is again fixed at an opposite placed convergence bolt. The distance change between the benchmarks is read at the convergence measuring instrument, for example with a mechanical dial gauge.

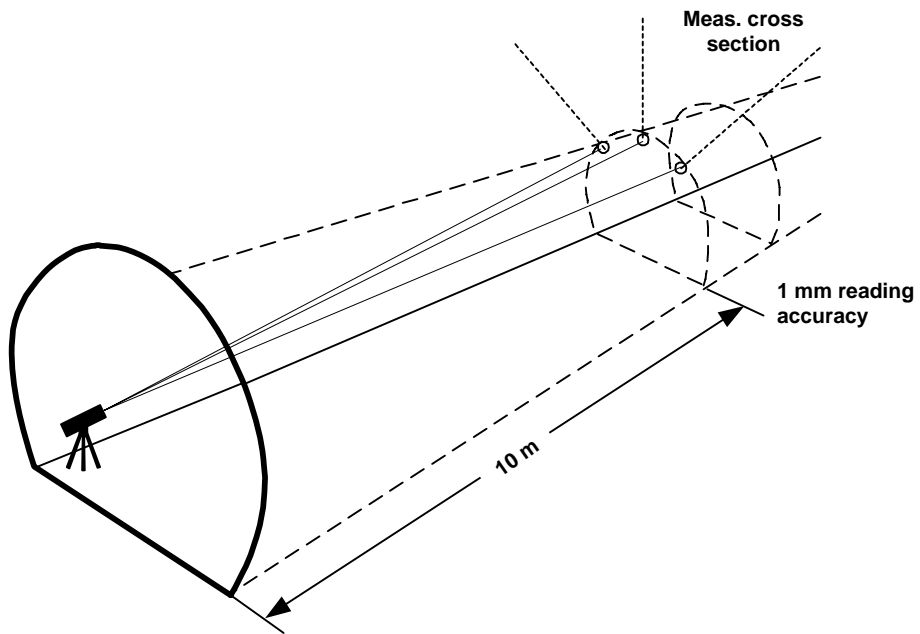
To reduce the impediments of the construction activities as far as possible, the recording of convergences by geodetic measurements is applied more and more. For this, a measuring bolt with light emitting diode resp. a bolt with attached reflector instead of the convergence bolts is embedded in concrete and its displacement is measured with a theodolite. By this method, measuring accuracies of ± 1 mm can be achieved which sufficiently corresponds to the claims of the static stability control for tunnel construction. Such measurements have the advantage - compared with the relative measurements between two movable points with the convergence measuring instrument - that the absolute displacements of the tunnel lining are measured while in case of convergence measurements with the convergence measuring instrument this is only possible in combination with at least one geodetic measurement.

Levelling and convergence measurements are the most fundamental measurements in tunnel construction and are normally carried out in all control and main measuring cross sections.

Schematic graph of the measuring bolts with light emitting diode



Measuring scheme of an optical convergence measurement with a theodolite



Convergence bolts, type GKV and GK, with light emitting diode

The convergence bolts, type GKV and GK, with light emitting diode, are installed in the same way than the conventional convergence bolts.

For assemblage, an electric connection to a current supply bolts has to be established besides the installation of the bolts.

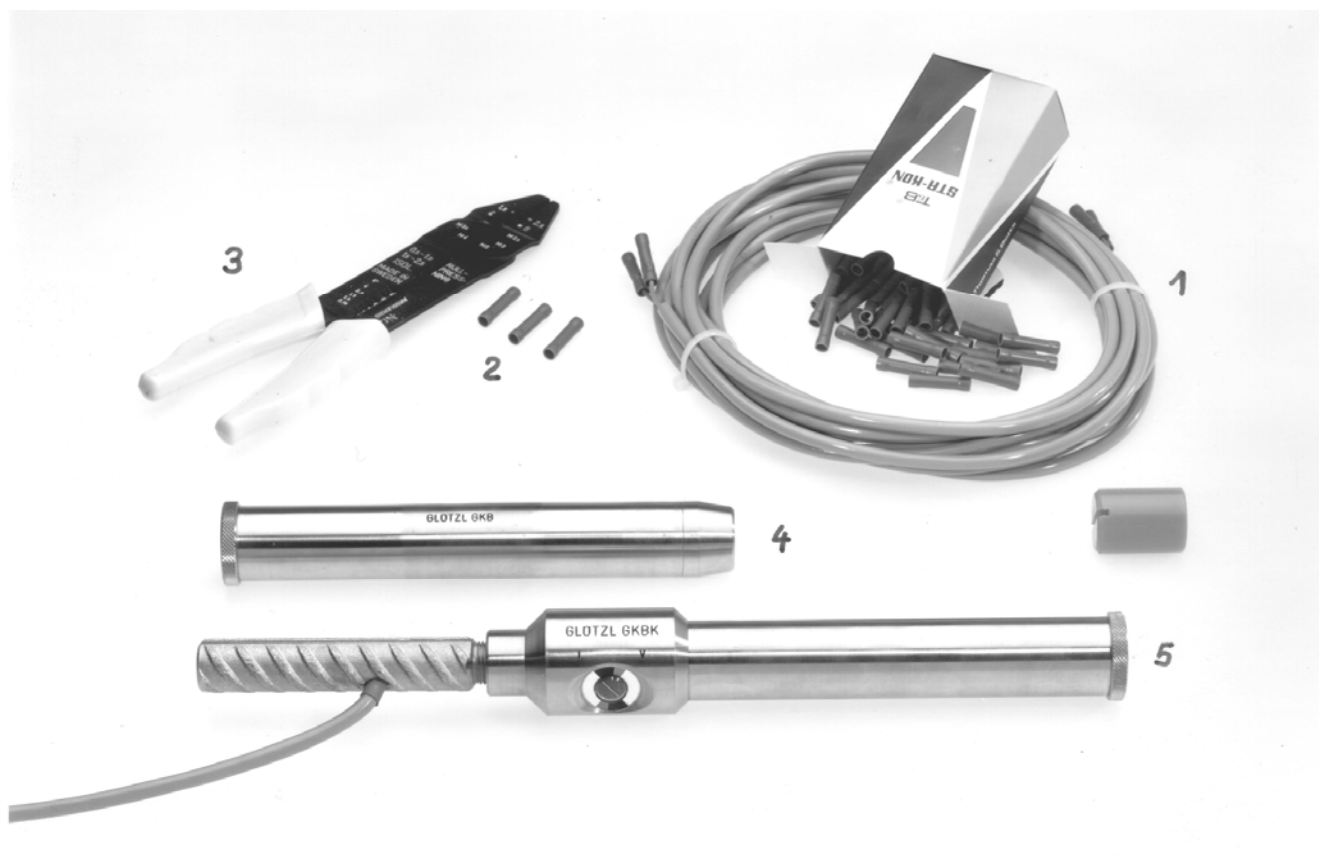


Figure: Assembly material and tools

Necessary for electric assembly of the convergence bolts:

Assembly material:

- (1) Connection line 2-core, 2 x 0.5 mm²
- (2) Insulating joint connector 1.5 – 2.5 mm²
- (3) Squeezing pincers for the joint connectors
- (without fig.) Adjusting key 6 kt., Allen key 2.5 mm

Current supply:

During operation, the current supply is screwed on a bolt, type GKE. Two models with battery operation are available, which can be equipped for accu operation.

- (4) Type GKB, battery housing
- (5) Type GKBK, battery housing with capacity indication

Accessories:

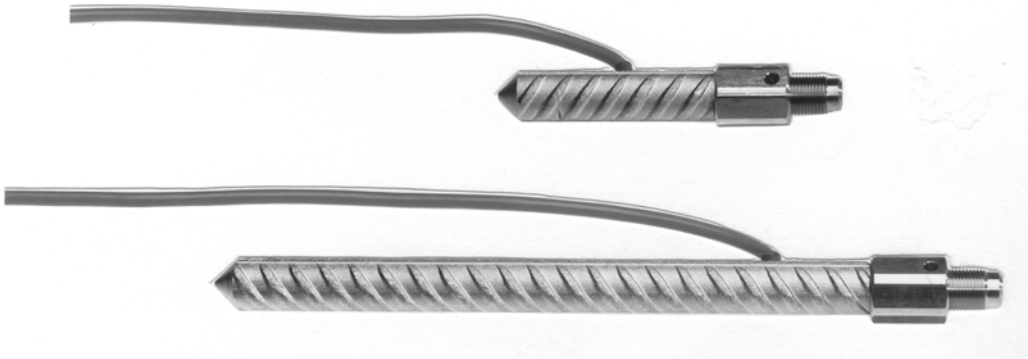
- Spare batteries each 3 baby cells 1.5 V (please only use leakage-proof batteries)
- Accu set for GKB and GKBK
- Charger for accu set

1. Convergence bolts, standard model

with light emitting diode and connection thread G 3/8". The measuring head is twistable for subsequent adjustment.

Material VA, bolts of steel Ø 20 mm, with galvanic surface protection

By the connection thread it is possible to measure these bolts with conventional mechanical measuring devices.



- Type GKV 20/250, Ø 20 mm, length 250 mm, standard model
- Type GKV 20/350, Ø 20 mm, length 350 mm
- Type GKV 20/100, Ø 20 mm, length 100 mm
- Type KS, protection cap of PVC, red

2. Convergence bolts with light emitting diode

Without connection thread. The measuring head is twistable for subsequent adjustment.

Material VA, bolts of steel Ø 20 mm, with galvanic surface protection.



- Type GK 20/250, Ø 20 mm, length 250 mm, standard model
- Type GK 20/350, Ø 20 mm, length 350 mm
- Type GK 20/100, Ø 20 mm, length 100 mm

3. Bolts for current supply

For each measuring cross section one piece necessary, steel Ø 20 mm, with galvanic surface protection and connection thread for current supply.



- Type GKE 20/250, Ø 20 mm, length 250 mm, standard model
- Type GKE 20/350, Ø 20 mm, length 350 mm, without figure
- Type GKE 20/100, Ø 20 mm, length 100 mm, without figure
- Type KS, protection cap of PVC, red