
**Optics and optical instruments — Geodetic
instruments — Field procedures for
determining accuracy —**

Part 3:
**Electro-optical distance meters (EDM
instruments)**

*Optique et instruments d'optique — Instruments géodésiques — Méthodes
de détermination sur site de la précision —*

Partie 3: Télémètres électro-optiques (instruments MED)



Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 12857-3 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 6, *Geodetic and surveying instruments*.

ISO 12857 consists of the following parts, under the general title *Optics and optical instruments — Field procedures for determining accuracy* :

- *Part 1 : Levels*
- *Part 2 : Theodolites*
- *Part 3 : Electro-optical distance meters (EDM instruments)*

Annexes A and B of this part of ISO 12857 are for information only.

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Optics and optical instruments — Geodetic instruments — Field procedures for determining accuracy —

Part 3:

Electro-optical distance meters (EDM instruments)

1 Scope

This part of ISO 12857 specifies field procedures to be adopted when determining and assessing the accuracy of electro-optical distance meters (EDM instruments) used in surveying for distances up to approx. 2 km.

These tests are intended to be operational and not tests for acceptance or performance.

The procedures are applicable to the determination of the accuracy of different instruments at one time or of one instrument at different times.

The field procedures can be applied everywhere without the need of special ancillary equipment and are designed to minimize atmospheric influences.

NOTE — Other International Standards for testing measuring instruments for building construction are available.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 12857. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 12857 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3534-1:1993, *Statistics — Vocabulary and symbols — Part 1: Probability and general statistical terms*

ISO 9849:1991, *Optics and optical instruments — Geodetic instruments — Vocabulary*

3 Definitions

For the purposes of this part of ISO 12857, the terms and definitions given in ISO 3534-1 and ISO 9849 apply.

4 General

The EDM instrument and its ancillary equipment shall be in known and acceptable states of adjustment by the user according to methods specified in the manufacturers' handbooks and used with reflector equipment recommended by the manufacturer.

The accuracy of EDM instruments is expressed in terms of the standard deviation of a single distance measurement taken on a given test line.

The test procedures given in this part of ISO 12857 are intended for determining the standard deviation $s_{\text{ISO-EDM}}$.

They further serve to determine the zero-point correction o .

Statistical tests should be applied to determine whether the standard deviation s obtained belongs to the population of the instrumentation's standard deviation, whether two tested samples belong to the same population or whether the zero-point correction o is zero.

5 Procedures

5.1 General

The following field procedures shall be adopted for determining the accuracy of EDM instruments, by a single survey team with a single instrument and its ancillary equipment.

The field procedures described in this part of ISO 12857 are based on distance measurements in all combinations on a test line with unknown nominal distances (see figure 1).

With these procedures scale errors of the EDM instrument cannot be detected. But scale errors have no influence on the standard deviation s_0 and on the zero-point correction o . In order to determine the stability of the scale, the measuring frequency of the EDM instrument should be checked by means of a frequency meter.

The zero-point correction obtained by these procedures is considered to be constant, i.e. it will be an average value which refers only to the range of the distances of the test line.

The results of these tests are influenced by meteorological conditions. These conditions will include different air temperatures and pressures. They shall be eliminated by the atmospheric correction of the raw distances. An overcast sky guarantees the most favourable weather conditions. Tests performed in laboratories would provide results which are almost unaffected by atmospheric influences, but the costs for such tests are very high and therefore they are not practicable for most users.

5.2 Test configuration

A straight line approx. 600 m long with seven points shall be established in a horizontal area or in an area with a constant slope. The points should be stable during the test measurements. In order to obtain representative values for the standard deviation and the zero-point correction, the points should be selected in such a way that the parts of the measured distances determined by phase measurement with the fine frequency are evenly distributed over the unit length (measuring scale) of the EDM instrument.

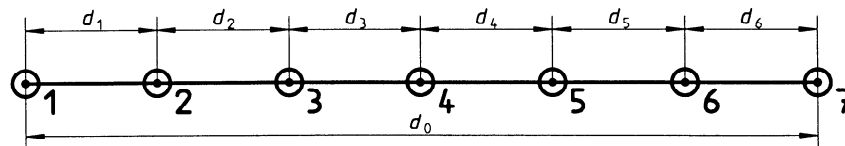


Figure 1 — Test configuration

A good configuration will be achieved if the six distances $d_1, \dots, d_6$ between the seven points of the test line are derived by the following procedure: $d_0 = 600$ m is the approximate length of the projected test line, λ is the wavelength, $\lambda/2$ is the unit length (measuring scale) of the EDM instrument. From these two values

$$B_0 = \frac{d_0 - 6,5\lambda}{15}$$

is derived. B_0 is rounded to the nearest value

$$B = n \cdot \lambda / 2$$

where n is an integer number.

With

$$C = \frac{\lambda}{72}$$

the six distances of the test line and the whole length d are calculated:

$$\begin{aligned} d_1 &= \lambda + B + 3C \\ d_2 &= \lambda + 3B + 7C \\ d_3 &= \lambda + 5B + 11C \\ d_4 &= \lambda + 4B + 9C \\ d_5 &= \lambda + 2B + 5C \\ d_6 &= \lambda + C \\ d &= 6\lambda + 15B + 36C \end{aligned}$$