

<http://swisstek.com>

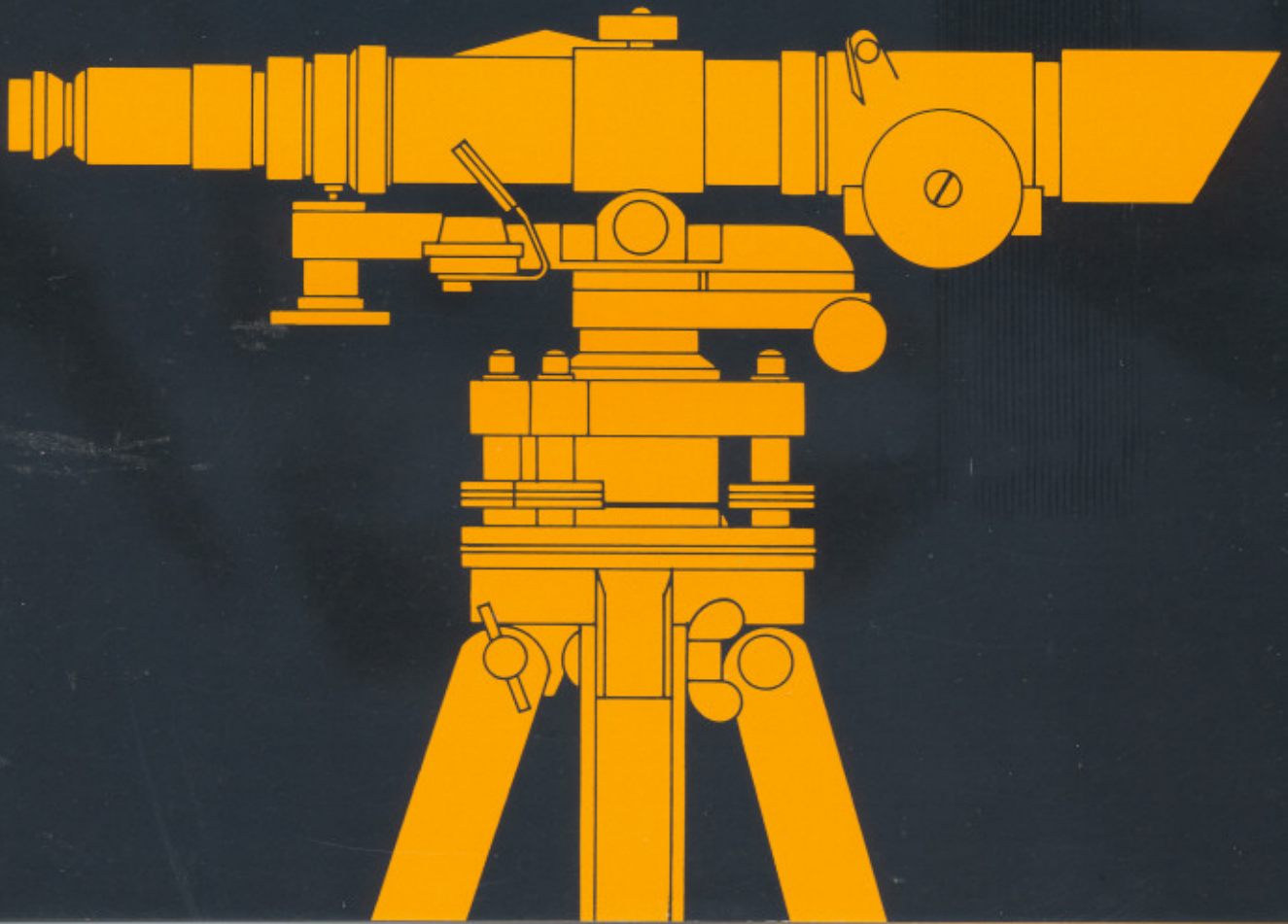


**Urs A. Reinhardt**  
General Manager  
Surveying Instruments  
Optical Tooling Theodolites  
Repaired-Serviced  
Bought-Sold-Traded

**Swisstek Inc.**  
10 Balsam Drive  
Brewster NY 10509  
Voice/Fax: 845 278-2335  
email: [urs@swisstek.com](mailto:urs@swisstek.com)  
cc: [urs@AutoLevel.com](mailto:urs@AutoLevel.com)



## The K&E Optical Leveling Kit and How to Use It





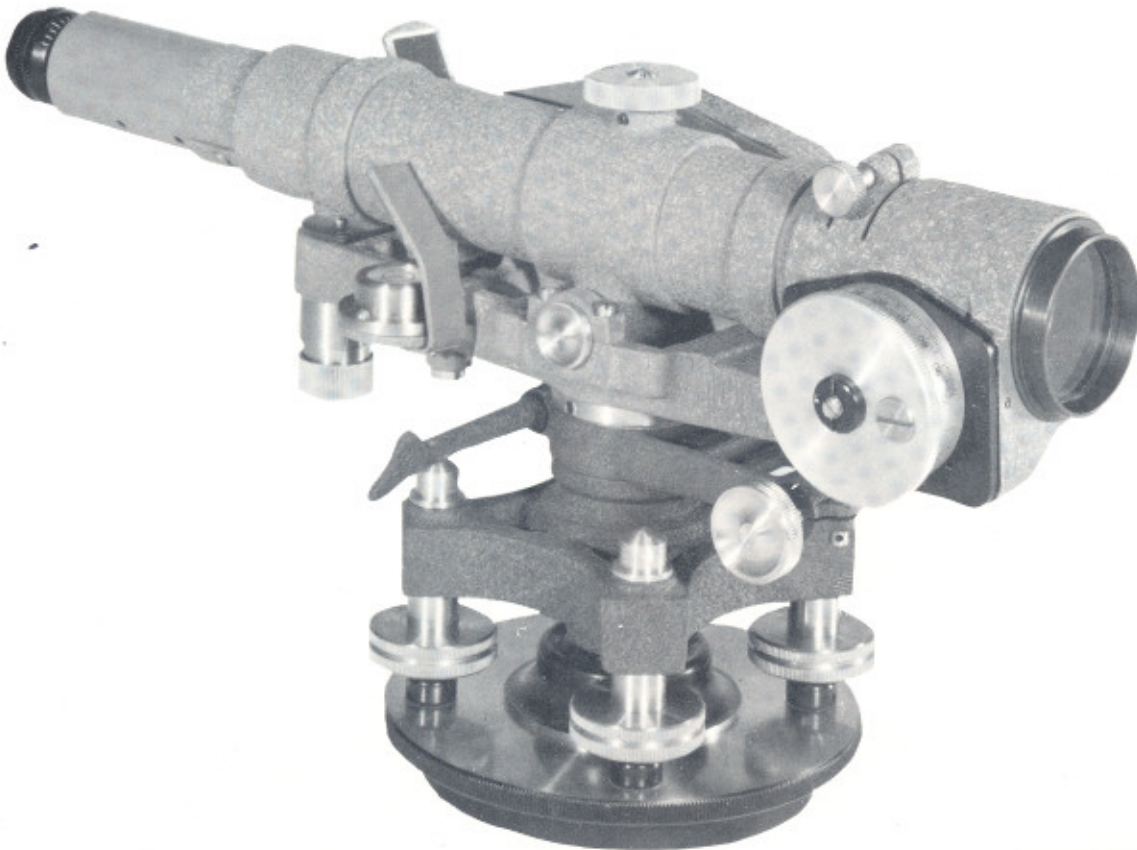
## Optical Alignment Equipment — designed for precision and speed in all of your leveling jobs.

Optics provide a plane of reference that is absolutely flat, weightless, and from which accurate measurements can be made. This is the principle in optical alignment — and in the K&E Optical Leveling Kit.

While optical alignment in industry is relatively new, its superiority to other methods has been thoroughly established. In the aircraft and missile industry, the use of optics has become essential from mock-up, through production tooling, to checking alignment of final product. Other industries as well are finding optical alignment a practical necessity. In many cases, present day tolerances cannot be held without optical devices.

One of the broad applications for optics is in the initial leveling and subsequent checking of all types of machinery. The results produced are far superior to older, conventional methods, and are achieved far more easily and quickly because there are no lines to stretch, and no machinist's levels, straightedges, surface plates, feeler gages or indicators required.

The K&E Leveling Kit is completely portable. It weighs only 23 pounds. You can carry it comfortably, set it up anywhere, and do almost any leveling job. Best of all, it's precise. Readings can be made to .001 inch.



# Four examples of precise work you can perform with the K&E Optical Leveling Kit.

## Foundation or Bed Plate Leveling

Establish a level line of sight. Place a scale on the surface of the work at several successive points. Then determine the displacement from surface to plane of sight.

Each successive surface is measured from this same unchanging plane of sight, and adjusted to conform to the level required.

Because there are no wires or solid measuring plates to move, work

is fast, easy and accurate. If leveling must be carried over long distances your optical line of sight may be extended indefinitely by moving the level and sighting back to the already established points.



## Differential Leveling

Determining the difference in elevation between two or more surfaces is a frequent problem. Checking the ways of certain types of machine tools is just one example.



## Profiling

By referencing an optical line of sight, it is easy to make accurate comparisons or measurements at any point on the surface. In this manner, the curved surface of the crown of a paper mill cylinder, or any other similar surface can be measured.



## Checking Movement of Equipment

At the time of installation, several targets can be established on the unit, and the position of the targets relative to a stable reference point can be noted. From time to time with the Leveling Kit, the relative positions of the targets are easily checked from the original reference point. The optical level will quickly reveal the exact amount of change from the original position.



# Special features make the K&E Optical Leveling Kit easy to use,

## What the K&E Leveling Kit consists of

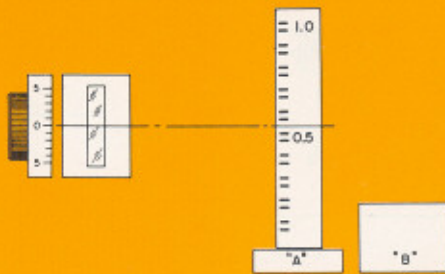
The major components of the K&E Optical Leveling Kit are a highly accurate tilting level (a telescope with a precision leveling system) . . . an optical micrometer . . . and a highly precise scale.

## Principles of Operation

Take a typical problem: To find the difference in elevation between surfaces "A" and "B" in the diagrams below.

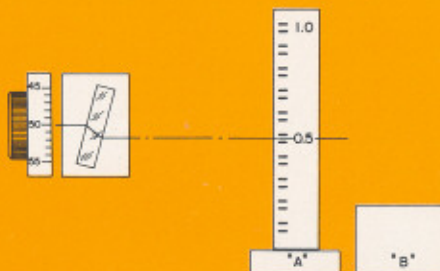
### Step 1.

Level telescope. Place scale on surface "A." Focus on scale. Turn micrometer drum to zero. This is now the permanent reference line from which all measurements will be made.



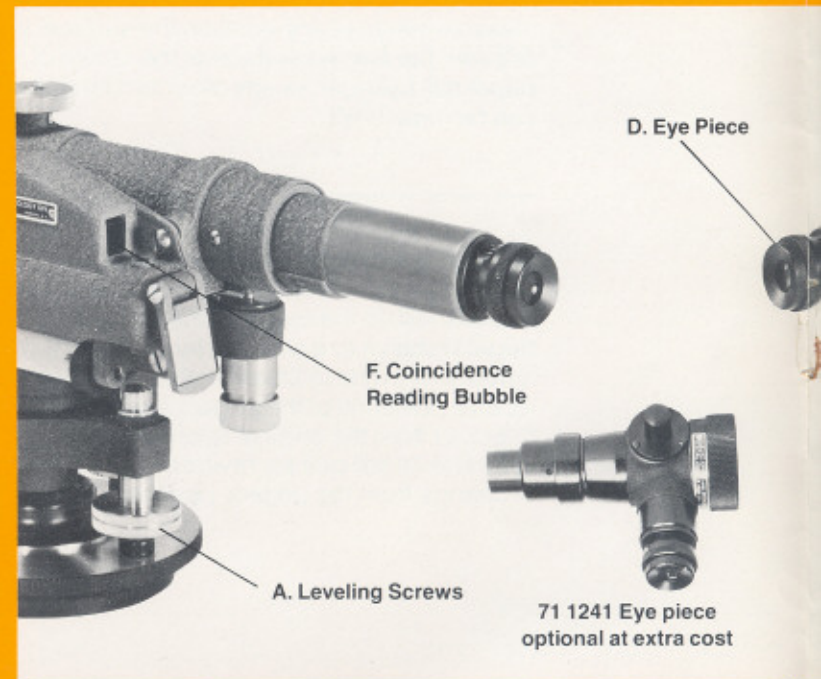
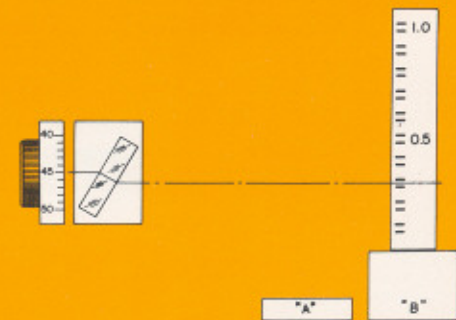
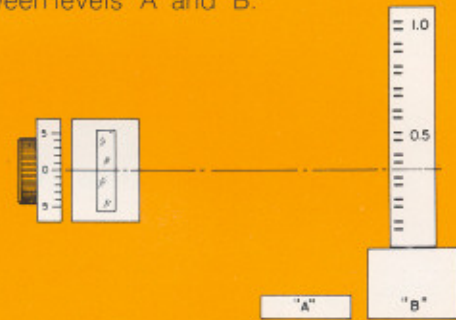
### Step 2.

To obtain "plus" reading, lower line of sight by means of the optical micrometer until it bisects first precision paired-line graduation which occurs on scale every tenth of an inch. Take the micrometer reading and add it to the scale reading to arrive at height of "A." The micrometer drum, graduated from 0 to  $\pm 100$ , indicates to 0.001 inch how far the line of sight has moved from its original reference point. In the example shown, it moves 0.050 to reach the nearest tenth of an inch on the scale, which is 0.5. The height is therefore 0.050 plus 0.5, or 0.550 inch.



### Step 3.

Move scale to surface "B." Repeating above procedure renders the height of surface "B" to be 0.345. Subtracting 0.345 from 0.550 gives the difference 0.205 inch between levels "A" and "B."



# extremely accurate

## How To Use The Telescope

### 1. Rough Leveling

The four leveling screws (A) are used to center the circular bubble (B) quickly and easily. A mirror (C) shows the circular bubble clearly. There's no need to walk around or turn the instrument itself.

### 2. Precise Leveling



The coincidence reading bubble (F) is used to precisely level the instrument. When the two ends of the split bubble are in line,

as shown, the telescope is level. The tilting wheel (G) is used to align the bubble.

### 3. Focusing on Scale

Look into the eyepiece (D) at the cross lines and adjust by turning knurled section until cross lines appear sharp and clear. Aim the telescope at the scale and focus on the scale by turning the telescope focusing knob (E). When properly focused, the scale will be sharp and clear with image erect.

### 4. Reading the Scale

The optical micrometer (H) provides the means for making precise readings. When the optical element in the micrometer unit is tilted by turning a graduated drum, the line of sight is moved *parallel* to itself. This displacement can be read to .001 inch on the graduated micrometer drum.

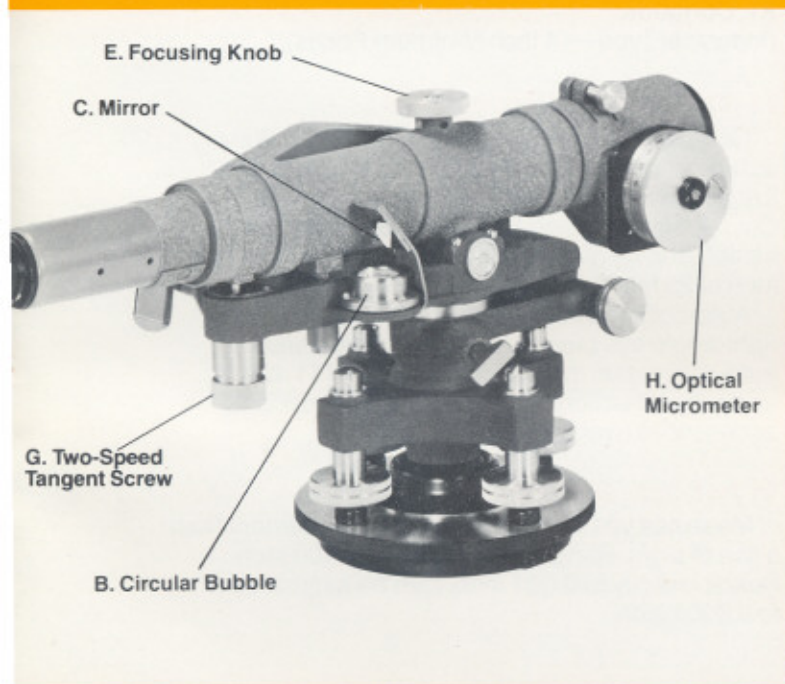
## WYTEFACE® Scales

K&E developed this type of scale for use with optical micrometers. The scale pattern is based on a long series of tests, made at Princeton University, to determine the pattern with the greatest reading accuracy.

The WYTEFACE scales are divided at every tenth of an inch. To allow the most accurate setting of cross lines there are four pairs of lines with different separations for sights of different lengths, as shown in the diagram. The "target" is the center of the white space between the lines.

The scales are printed on a pure white surface for greatest legibility. They are available in 3, 10, 20 and 40 inch lengths. A 10 inch scale and a scale holding magnet are provided with the K&E Optical Leveling Kit.

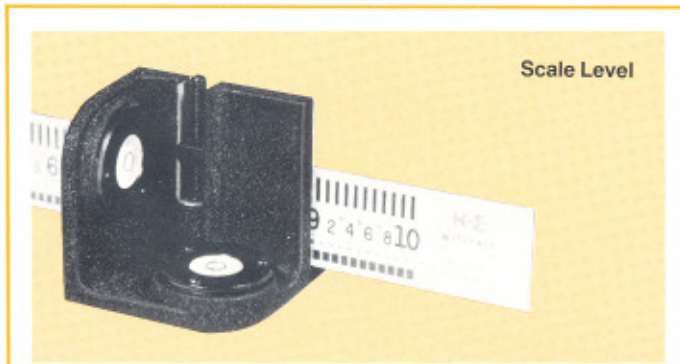
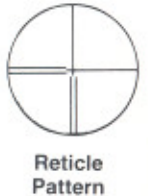
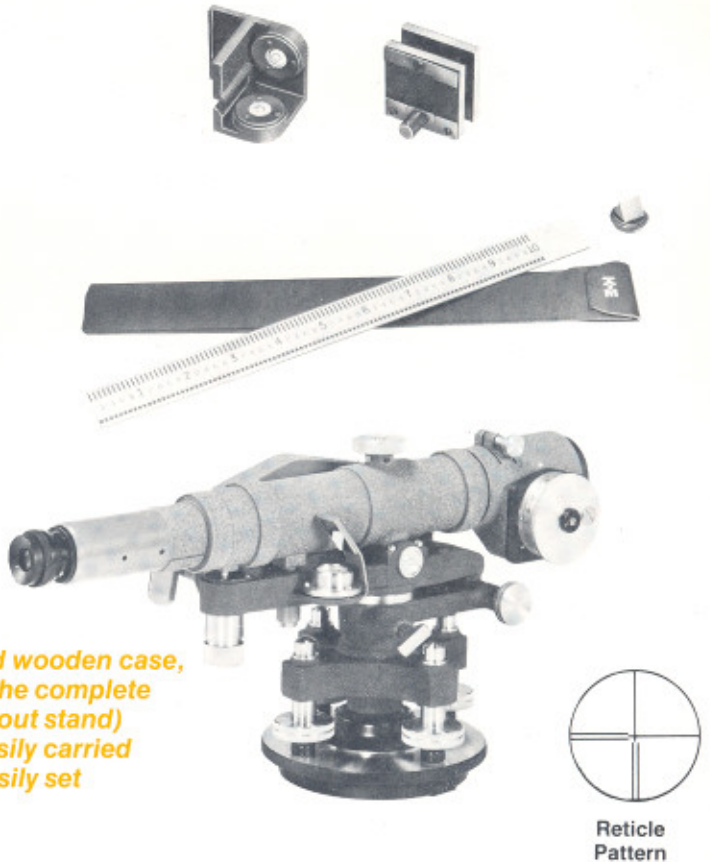
### Standard Target Pattern of Each Tenth



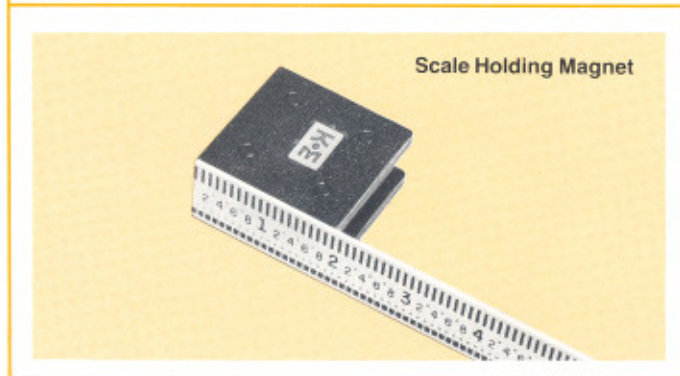
# The K&E Optical Leveling Kit is lightweight. . . .portable



*Furnished in a sturdy vinyl covered wooden case, with brass reinforcing corners, the complete K&E Optical Leveling Kit (without stand) weighs only 23 pounds. It is easily carried from job site to job site, easily set up and packed.*



Scale Level



Scale Holding Magnet

**What the Complete 71 3015 Optical Leveling Kit Contains**  
(Industrial Type — 4 Inch Minimum Focus)

### **71 3010 Paragon® Tilting Level**

Complete with four screw leveling head. Fully achromatic telescope. Magnification 20X to 30X. Erecting eyepiece. Minimum focus 4 in. Coincidence-reading level vial. This instrument will establish level planes to within 1 sec. of arc. (.0015 inch at 25 feet).

Auto-collimation conversion unit (71 1211), right-angle eye piece (71 1231), combination auto-collimation, projection eye piece (71 1241) and auto-reflection target (71 1140) are optional accessories available at extra cost.

### **71 1111 Optical Micrometer**

Measures vertical or horizontal displacement from a line of sight. Range, plus or minus 0.100 inch. Reads directly to 0.001 inch. Can be estimated to 0.0001 inch.

### 71 6010 Wyteface® Scale, 10 inches

The scale is described on page 5 of this folder. A 10 inch scale is supplied as standard equipment in the Leveling Kit. Three, twenty, and forty inch scales are available as optional equipment. The 40 inch scale has the first 19½ inches blank and the last 20½ inches graduated.

### 71 1260 Prismatic Eyepiece

The prismatic eyepiece is used in very low setups or when working close to walls, columns or similar obstructions. It may be rotated through 360°, giving an erect but reversed image.

### 71 3270 Scale Level

This level is used to set scales plumb or level. It can be attached to any steel scale up to ½ inch thickness and between 1 inch and 1½ inches in width. The two vials both have a sensitivity of 15 minutes of arc per 2 mm.

### 71 6065 Scale Holding Magnet

Holds a scale at right angles to any finished surface of magnetic metal. Overall size 2 x 2 x 1 inches.

Space is provided in the Kit for an extra Scale 71 6010 and Scale Holding Magnet 71 6065.

## Metric Kit

A kit with metric components is available on special order. Included is a Metric Optical Micrometer (71 1113) and a Metric Optical Alignment Scale (71 6041).

## K&E Optical Instrument Supports

K&E offers a full line of tripods and supports designed to complement the precision and reliability of the optical instruments. The following three types are recommended for use with the K&E Leveling Kit.

### HEAVY DUTY INSTRUMENT STANDS 71 5015 71 5025



Used where precision is the primary consideration.

Provides a very firm, stable support that can be safely used on hard floors. It is readily movable on three rubber wheels, which can be retracted into the stand. Height of the stand is adjustable from 24-41 inches for the 71 5015 and from 40-73 inches for the 71 5025. No. 71 5050 10 inch extension pieces can be used to increase the maximum height.

### PORTABLE INSTRUMENT STAND 71 5030



Used where portability is the primary consideration. Stability is not sacrificed despite the compactness and light weight (approx. 28 lbs.). Height adjustable from 31 to 51½ inches.

**For more information  
contact your nearest  
K&E branch or dealer**



### TRIVET 71 5070

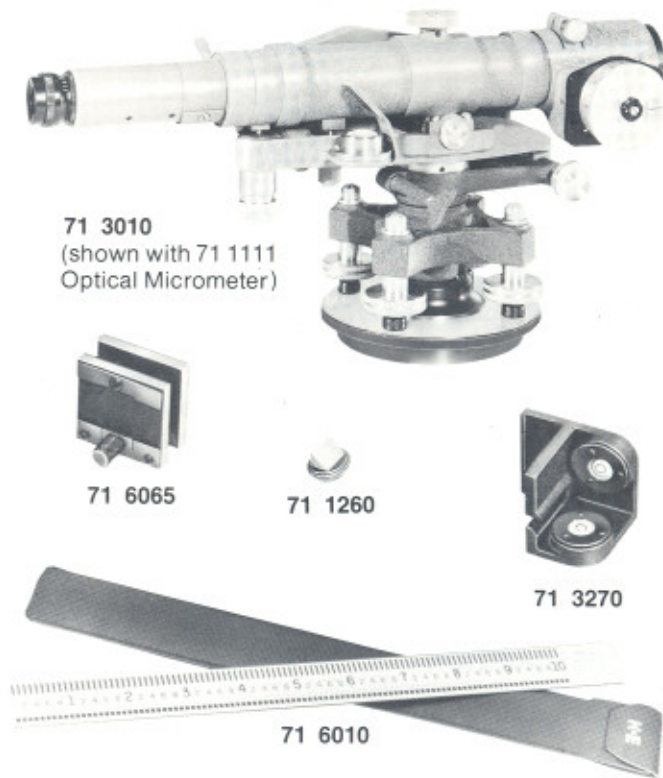
Used where low set-ups are required.



**Section I**  
**Introduction**

**1-5. SPECIFICATIONS**

Characteristic	Specifications
<b>Telescope:</b>	
Length	11¼ inches
Optical System	Fully erecting, achromatic
Magnification	Varies automatically from 20x at near distance to 30x at infinity
Focusing Range	4 inches to infinity
Resolving Power	4 seconds of arc (per Bureau of Standards test procedure)
Field of View	55 minutes at infinity, 5.2 mm at near distance
Effective Aperture	30 mm
Optics	Fully coated throughout
Reticle	All purpose, double glass, dustproof; cross-pattern with single lines top and right, paired lines bottom and left
Eyepiece	Erecting, achromatic; removable blank provided for Auto-Collimation Conversion Unit.
<b>Levels:</b>	
Circular Vial	Sensitivity 10 minutes per 2 mm movement
Level Vial	Coincidence-reading type, 2½x magnification, sensitivity 20 seconds per 2 mm movement
Tripod Plate	Threaded, 3½ x 8, U.S. Standard
Weight	11 pounds (approximately)
Carrying Case	Formica with foam rubber inserts and four large rubber supports; adjusting pin, center key, webbed strap



**Figure 1-2. 71 3015 PARAGON® Leveling Kit**

**1-6. ACCESSORIES**

The following accessories are available for use with the Tilting Level:

- 71 1111 Optical Micrometer
- 71 1113 Metric Optical Micrometer
- 71 1115 Optical Micrometer with Auto-Reflection Target
- 71 1211 Auto-Collimation Conversion Unit
- 71 1231 Right-Angle Eyepiece
- 71 1241 Combination Auto-Collimation, Projection, Right-Angle Eyepiece
- 71 1260 Prismatic Eyepiece\*
- 71 5511 Replacement Auto-Collimation Illumination Unit
- 71 3280 Coincidence Level\*

For description, installation, and use of these accessories, refer to the APPENDIX to this manual.

\*To order only