

## PERFORMANCE DATA OF THE P-SERIES PLANICOMP

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### 1. INTRODUCTION

Zeiss presented two new products in the spring of 1987: PHOCUS, the new photogrammetric and cartographic software system for collecting, editing and managing geometrical and alpha-numerical data, and the P-Series Planicomp, a new series of analytical plotters. PHOCUS supports the P-Series, one of the most important data collecting instruments, very effectively through a new kind of flexible and convenient handling.

The P-Series consists of three different instruments:

- The P 1 Planicomp, a high-power unit for all types of photogrammetric applications (Fig. 1)
- The P 2 Planicomp, which contains the proven and still state-of-the-art C 120 Planicomp zoom viewer (Fig. 2)
- The P 3 Planicomp, a low-cost plotter designed mainly for plotting single models (Fig. 3)

The three plotters, their common basic concept and their special features are described in detail in the following.

### 2. P-SERIES CONCEPT

The design of the P-Series is based on the long years of positive experience gained with the C 100 family. In the eleven years that have passed since the presentation of the C 100 Planicomp at Helsinki in 1976, there was no need to make any major changes in these instruments. So the proven elements have been retained for the P-Series viewers. All instruments feature moving photocarriages and a fixed optical system in a stable, self-supporting casting. This layout contributes considerably to the high instrument precision. The operator views the photo carriers through photocarriage windows driven by precision lead screws and servo-controlled DC motors.

All P-Series Planicomp feature optical systems for swing correction of the stereomodel photos, zoom lenses for variable photo viewing and the typical black/luminous floating mark for optimum setting in bright and dark photo areas. The focussing system allows positives and negatives to be used.

The tremendous progress in electronic component design was taken advantage of in redesigning the control electronics. Using a microprocessor allows the basic task of analytical plotters, namely computing the mathematical relationships between the 2 x 2 photo coordinates and the three-dimensional spatial coordinates, to be relocated into the viewer. This relieves the host computer of time-consuming real-time photocarriage control operations. The calculations required for incremental measurement, which are also very time-critical and time-consuming, are also performed by this microprocessor. A standard data interchange interface enables the analytical plotter to be used with any host computer because the installed HP IB interface, which conforms to the very strict IEEE 488 standard, is available from all computer manufacturers. From a hardware point of view this intelligent viewer control unit called P-Processor makes the stereoplotter behave like any computer peripheral such as a terminal or a printer.

Another innovation with a major impact on stereoplotter handling is free-handed guiding with the P-Cursor (Fig. 4), which enables the floating mark to be guided three-dimensionally in the model.

Moving the cursor on the surface of a high-resolution digitizing tablet causes planimetric floating mark movement in the model, while elevation setting is done with a thumbwheel. A patented speed-controlled transmission system ensures micron-precision point setting, line following and rapid point location without having to bother about changing transmission ratios. The integration of further useful controls makes the P-Cursor the central control element for the P 1 and the P 3. The five function keys, which can be programmed freely, can for example be used for calling programs and initiating measurements.

Pressing a button (MOVE TO button) in the Tablet Absolute Mode causes the floating mark to be moved automatically to the point set with the cursor e.g. on a contact print or on an existing map.

### 3. P 1 PLANICOMP

The P 1 Planicomp is characterized by a large, desk-like work surface with the photocarriages sunk in at the rear, and a central viewing arm. The zoom lens, which can be set separately for the two ray traces, has a magnification range of 5x to 20x and a field of view of 40 mm at 5x magnification. Switchover between pseudoscopic and binocular left or right contributes to the universal applicability of the instrument in photogrammetry. Dove prisms afford optical swing correction of both photos of a stereo pair. Optical ray trace ports for VIDEOMAP and CCD cameras are standard. An example of the use of CCD cameras, apart from correlation with the C 100 Planicomp, is the digitization of air photo color selections for forest damage assessment. In this application a filter wheel is inserted between the photo and the CCD camera under host computer and P-Processor control. Another special feature of the P 1 is the large size of the photocarriages (330 mm x 240 mm).

A digitizing tablet with an active range of 800 mm x 400 mm is integrated in the work surface of the P 1 for free-handed guiding. Together with the P-Cursor it affords complete measurement control. In the P 1, the P-Cursor replaces the handwheels, foot disk and foot switch which continue to be available as options.

### 4. P 2 PLANICOMP

The viewer of the P 2 has been derived virtually unchanged from the zoom viewer of the C 120 Planicomp. The mechanical and optical elements for photocarriage movement and the viewing system have been retained. The P 2 has photocarriages with a standard size of 240 mm x 240 mm, a zoom lens with 7.5x to 30x magnification, and various viewing switching options. Handwheels and foot disk are proven input controls. The photogrammetric panel, which has become superfluous thanks to the new flexible and convenient handling features offered by the PHOCUS software, has been dispensed with.

The work surface installed instead of the panel affords optimum placement of the computer terminal and the PHOCUS command panel.

The integration of the C 120 viewer in the P-Series offers the possibility to convert a user's C 100 viewer into a P 2 viewer.

### 5. P 3 PLANICOMP

The P 3 Planicomp is a compact desktop instrument with a very low width of about 110 cm. This has in part been achieved by overlapping travelling ranges. Nevertheless all model overlaps (up to 100 %) are possible. The intentional restriction to orthoscopic model plotting ("base in"), which also allowed the optical ray trace to be simplified, reduces the production with the result that the P 3 has become a very low-cost analytical plotter.

The viewing optics has a common zoom lens with a magnification range of 5x to 20x and a field of view of 40 mm at 5x magnification. Free-handed guiding with P-Cursor and digitizing tablet (size 594 mm x 420 mm) is standard. Handwheels, foot disk and foot switch are optional as for the P 1.

This P 3 configuration is intended primarily for topographical mapping and might play a major role in substituting the large number of analog instruments. The optional second eyepiece may be very useful for operator training or for interpretation and planning functions. The second observer can sit next to the operator and reach all controls with the computer terminal or graphics display unit being well visible.

### 6. P-SERIES APPLICATION BENEFITS

In stereo mapping the magnification range of the instrument and the resulting field of view are major criteria. A large field of view offers a clear view of the mapping area and facilitates orientation in the model. The P-Cursor with its function keys and menu-drive capability

is very useful for object-oriented mapping because the operator can arrange the large number of object codes and measurement functions clearly. If, for map revision, the old map is oriented on the tablet, the floating mark can be positioned by means of the MOVE TO button using this map. This facilitates direct comparison between the map content and the actual condition shown by the aerial survey photo.

The large photocarriages of the P 1 offer the additional advantage that two stereomodels can be set up at the same time for fast and convenient transition from one model to the next.

In plotting terrestrial stereomodels, floating mark guiding in any spatial plane is particularly important. This is why the guiding plane of the cursor or the handwheels can be rotated in any desired object plane, e.g. a house facade. Movements perpendicular to the guiding plane can then be controlled with the thumbwheel or the foot disk.

In triangulation measurement, optics switching is a must for fast measurement. During bridging within a strip, the fixed photo remains on the photo carrier so that it must not be oriented again. The tie points are set automatically for measurement - precisely in the fixed photo and approximately in the new photo.

In single-photo measurement, e.g. for bundle block adjustment, binocular viewing of the photo is required for easy and fatigue-free measurement.

Orienting a contact print on the digitizing tablet absolutely with the photo coordinates system can speed up point measurement considerably because the photo carriages can then be preset quickly to the marked points with the MOVE TO button.

## 7. CONCLUSIONS

The P-Series Planicomp enables Zeiss to present and offer three instruments that differ in cost and performance, and the user to select the system that is best suited to his application and investment intentions.

Combined with PHOCUS, the photogrammetric and cartographic software system, the P-Series will certainly continue the success of the C 100 family in the field of analytical photogrammetry.

## REFERENCES

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## ABSTRACT

The common concept of the P-Series Planicomp, a new series of analytical plotters from Carl Zeiss, is presented and the differences between the three instruments are described. Application-oriented innovations are discussed briefly.

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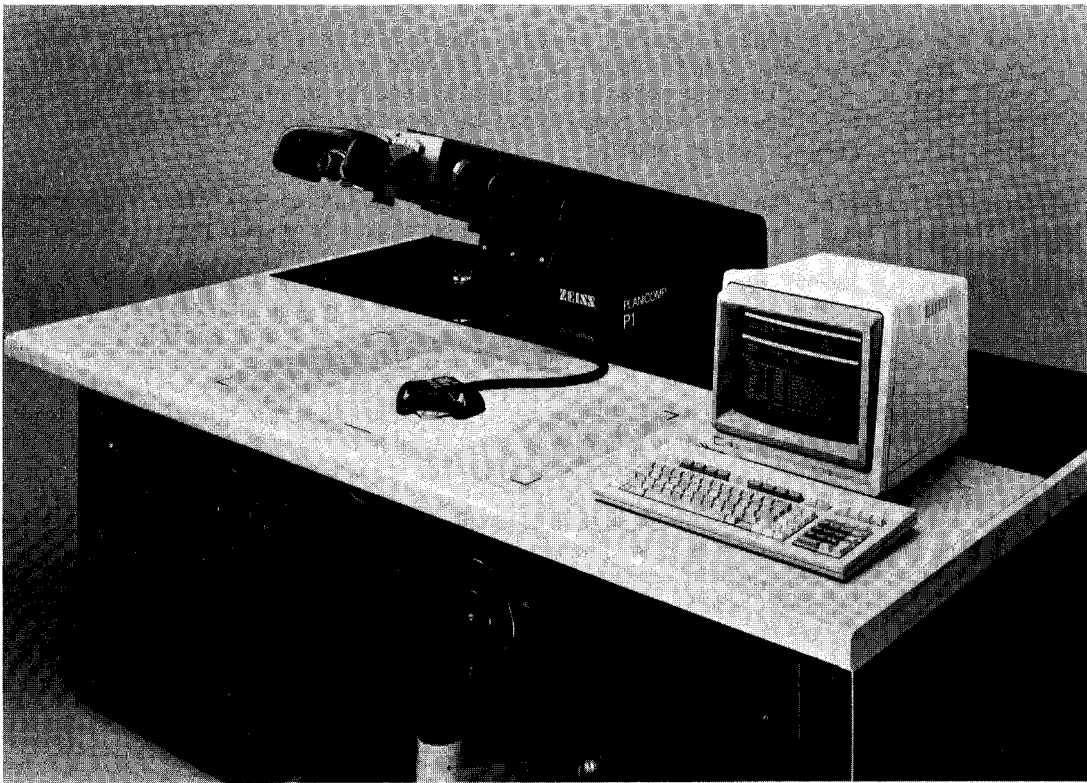


Fig. 1: The High Power P 1 Planicomp Analytical Plotting System

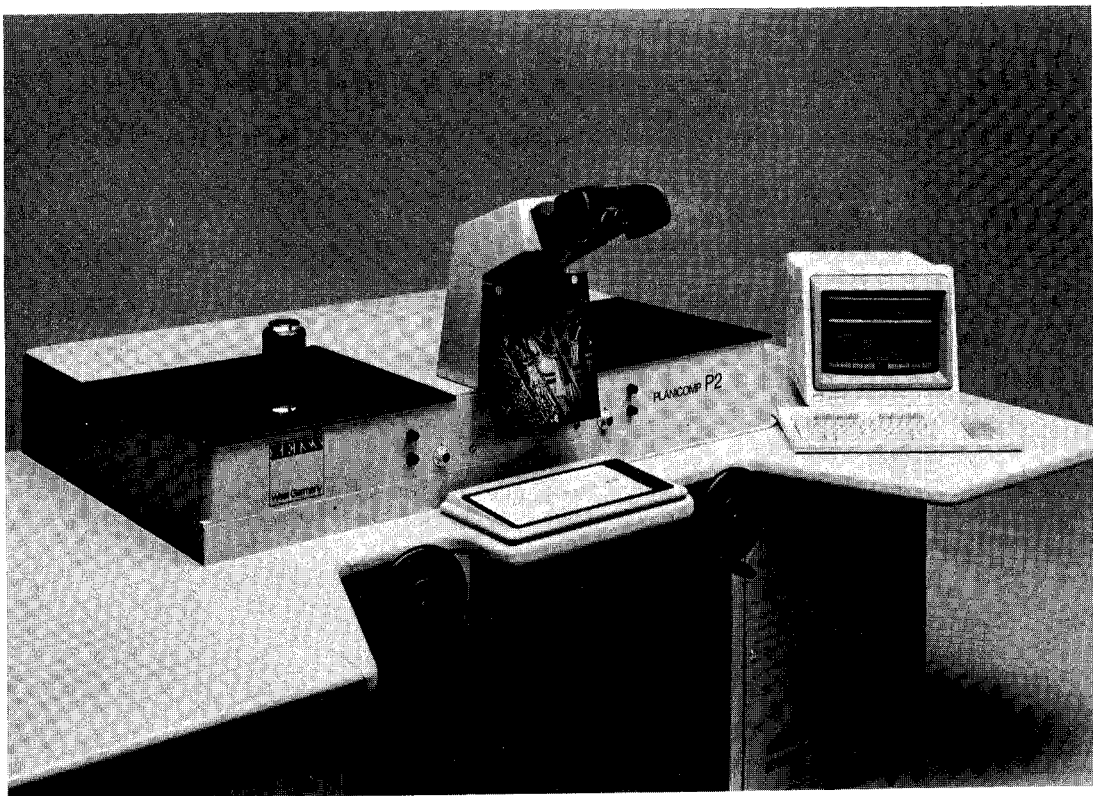


Fig. 2: The Proven P 2 Planicomp Analytical Plotter

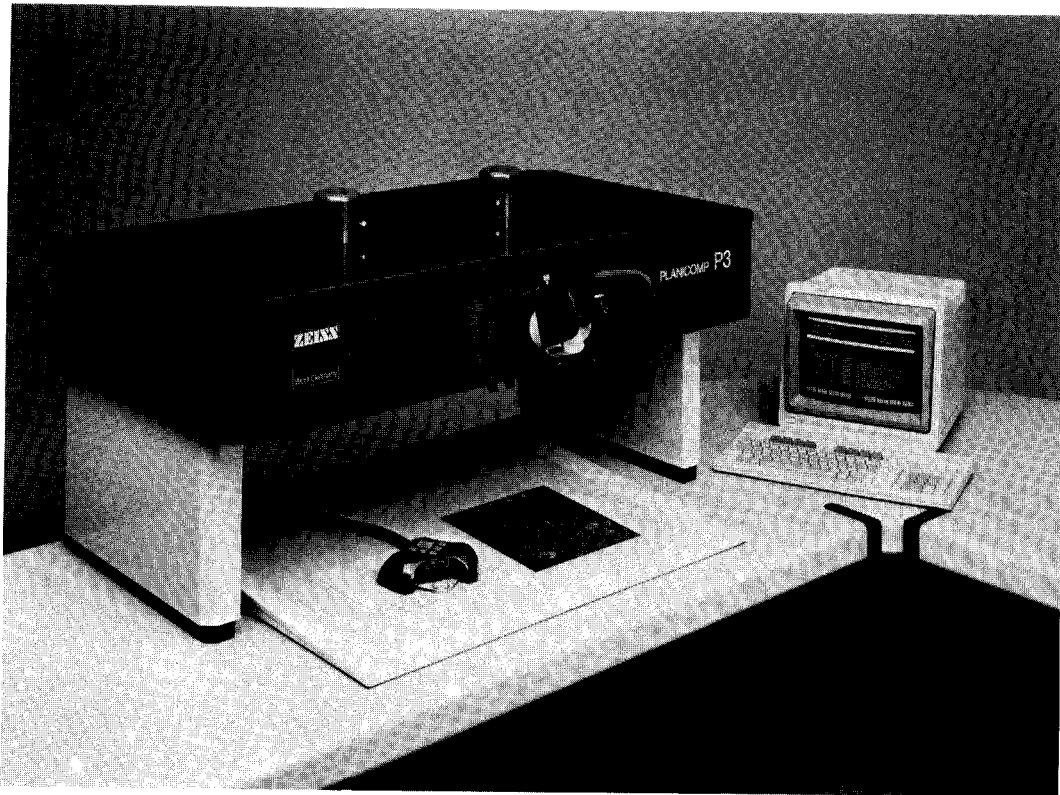


Fig. 3: The Low-Cost P 3 Planicomp Analytical Plotting Workstation

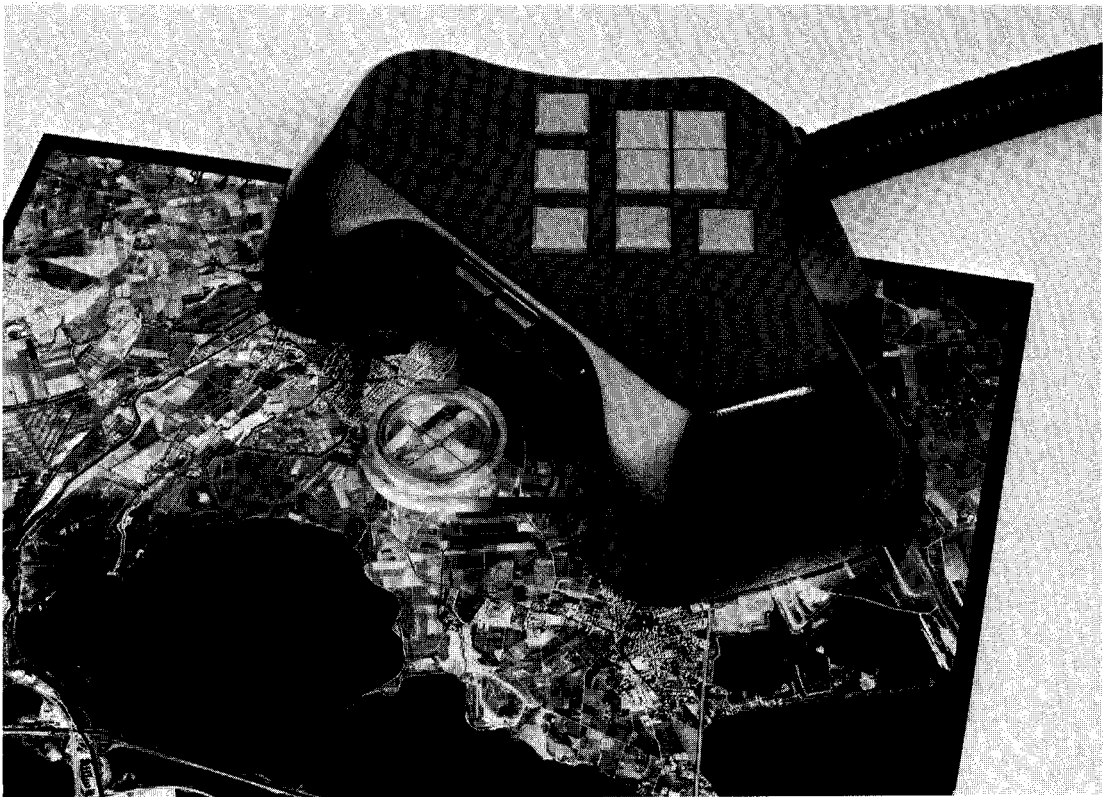


Fig. 4: The Ergonomic Planicomp P-Cursor