

A DIGITAL PHOTOGRAMMETRIC SYSTEM IN CADASTRAL MAPPING. Dr.eng. Nicolae Zegheru, eng. Antonia Fusoi, eng. Dan Gheorghiu, eng. Gabriela Galbură
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Zusammenfassung

Die Entwicklung der Rechentechnik und der rechnerunterstützten Anlagen für die graphische Darstellung waren Voraussetzung für die Automatisierung der photogrammetrischen und kartographischen Prozesse.

Das entwickelte digitale System der Katasterkartenherstellung, das ein Kodierungssystem der kartographischen Informationen verwendet, nützt die Möglichkeiten der Datenerfassung mit Hilfe der Stecometer, der Datenverarbeitung an Felix-Rechenanlagen, und deren Darstellung an der ARISTO - Kartieranlage, so wie die bestehende analytische photogrammetrische Auswertungstechnik, aus. Das genannte System sichert eine wesentliche Fehleranzahlreduzierung, als auch eine gesteigerte Geschwindigkeit der Erfassung, Verarbeitung, Speicherung und Darstellung der Katasterdaten und -informationen. Zugleich wird die Handarbeit wesentlich vermindert.

Die in dem System verarbeiteten digitalen Daten werden in einer Datenbasis gespeichert und bieten verschiedene künftige, für die Katasterprobleme spezifische, Anwendungsmöglichkeiten.

Maps of various categories and types are the main way to provide the user with special terrain data. It can be regarded as keeping up the natural human language, because the cartographic presentation established has been developed and improved in the course of time. Besides, the cartographic product has the advantage of presenting a large special data quantity synthetically and intuitively and performs the proper measurement accuracy conditions, as well.

Photogrammetric process computerization proper to the cadastral maps diminish their efficiency to a great extent due to the manual map drawing. As a consequence, an automatic mapping technology carried out by a computer being able to use cadastral data stored in its storage, in a specialized data base, is required.

Digital cadastral maps use numerical methods especially, because they need other subsequent processings requiring great precision; it is ensured by digital data, which unlike the graphical ones, make a better connection between the cadastral map and the terrain it represents. The possibility to reasonably manage digital cadastral data within a data base entails the automatic solution of all special cadastral problems, namely: surface computation boundary rectification, lotting and reallocation of land.

As regards the digital cadastral map, it is a digitally stored data collection, representing the graphical and information contents of the respective map. It can be carried out by a special technology, where all data are digital. The final results can be displayed in the usual graphical way, when the user requires it, using a plotter.

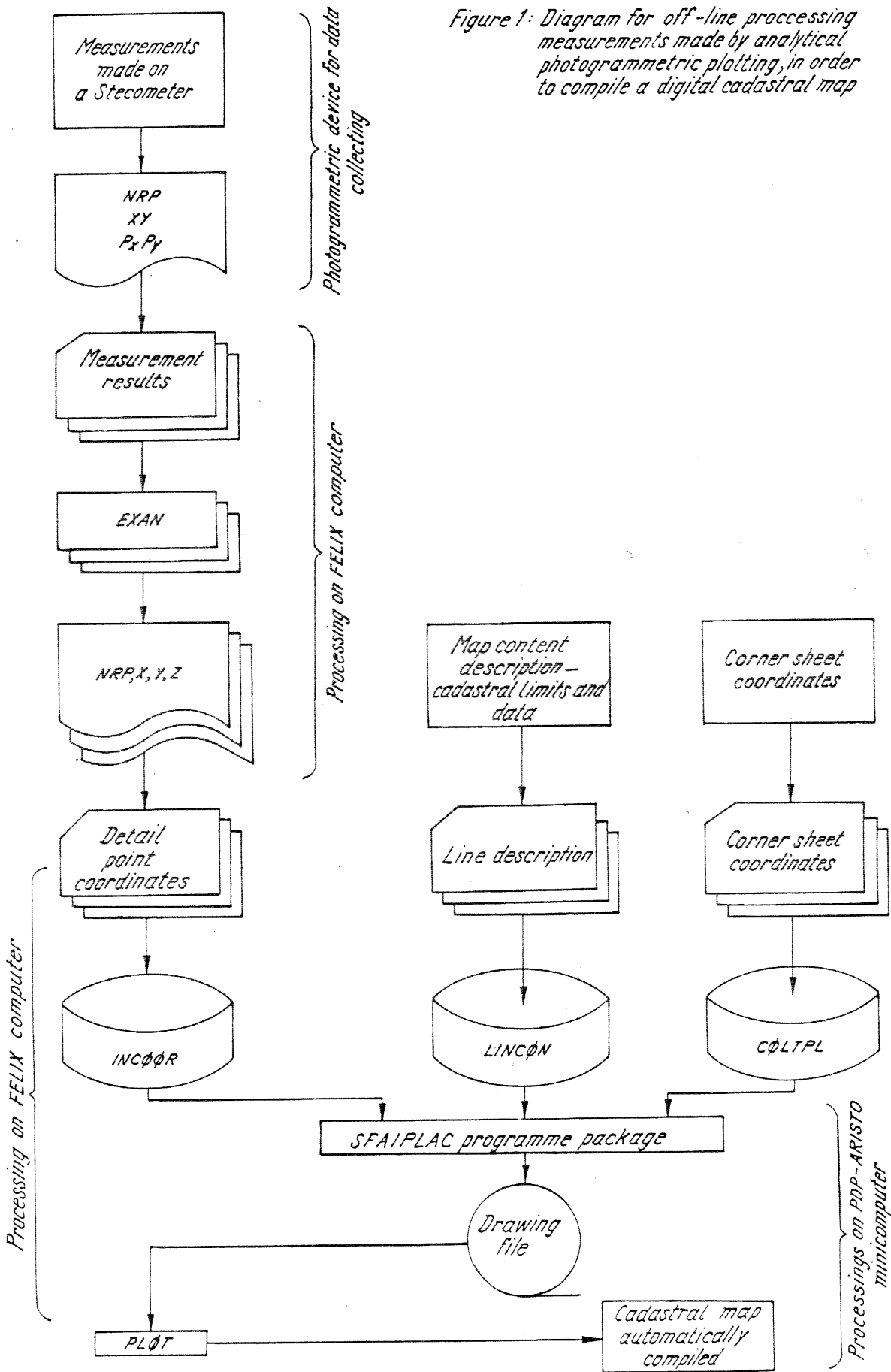


Figure 1: Diagram for off-line processing measurements made by analytical photogrammetric plotting, in order to compile a digital cadastral map

The automatic photogrammetric system for cadastral mapping (SFAIPLAC), which is the object of this paper, was designed to use input data obtained by analytical photogrammetric plotting (measurements made on a Stecometer and recorded on a G - type Coordimeter) to process data in a FELIX - C - 256 computer and to display results as a graphical representation, using ARISTO plotter (Figure 1).

Measurements made on a Stecometer related to the terrain features entail the digital cadastral data transpositions, such as land use category, its location, a.s.o.

The geodetic coordinates established after the analytical photogrammetric measurements have been made, showing the geometric configuration of the planimetric details, which are found within the zone to be represented on the map, are the large input data and are punched on cards (Figure 1), according to the endowment existing, when the system was designed. Coordinates for corners of all sheets required by the respective work are established in the preparatory work stage concurrently with the measurement performing. They are input into the computer storage together with the detail control point, geodetic coordinate inventory.

Having such input data, computer must be further instructed to properly carry out the map graphical compilation. To this end, a coding system giving all data related to a cartographic element in a computer-compatible format is developed; the user can employ it for cadastral map content coding, without difficulty.

The main characteristics containing the variety of shapes, sizes, colours and thicknesses employed to graphically code the important cartographic elements to be used in map content representation have been established, after analysing the graphical conventional signs. The importance of the above mentioned problem assigned the transformation of the cartographic coding unsuitable to the computer into a computer - compatible digital coding, as parameters. A proper principle to assimilate the above mentioned observation varieties, a principle able to code and decode the main features, using a computer - programmable algorithm, was chosen and finally developed.

Within the logical decision, a recognition of parameter values resulting from decoding is made at input stage, and a delivery of the graphical function compatible with PLOT - firm programme of ARISTO plotter is made at output stage.

The so-established coding system uses only digital characters, its entity structure presenting various advantages. Otherwise, the cartographic code is the only way to convert the map information taken from the aerial photograph into a computer-compatible information; in the same way, after digital processings have been accomplished, the cartographic code undergoing a decoding process governs the drawing programme development in a code - machine language, compatible with G2AGRAF unit command of the plotter used to obtain the graphical product (map sheet). The cartographic code is the input data for SFAIPLAC programme package, being a part of the so-called "line description". It gives the computer all the necessary data, so that the special designed software can develop the drawing programme for ARISTO

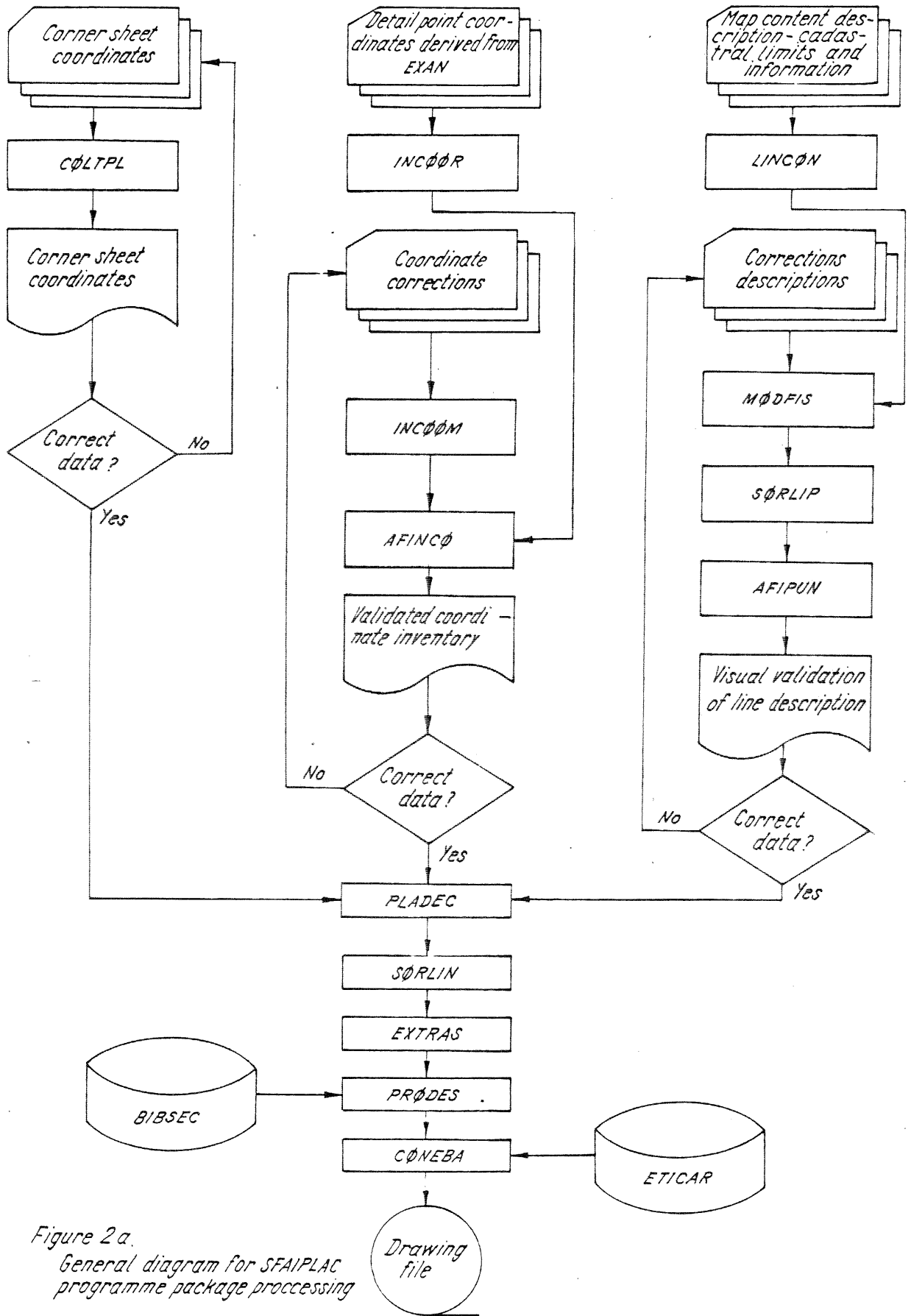


Figure 2a.
General diagram for SFAIPLAC
programme package processing

- EXAN* — *geodetic coordinate computations measured in the analytical photogrammetric plotting*
- CØLTPL* — *loads the file with map corner coordinates*
- INCØØR* — *loads the file with geodetic coordinates of the points derived from EXAN*
- INCØØM* — *modifies (corrects) the file developed by INCØØR*
- AFINCØ* — *makes the sorted coordinate inventory*
- LINCØN* — *loads the file with line descriptions*
- MØDFIS* — *modifies (corrects) the file developed by UNCØØN*
- SØRLIP* — *sorting programme*
- AFIPUN* — *correcting programme for line descriptions*
- PLADEC* — *makes frame intersections among the sheets and completes coordinate inventory with intersection points*
- SØRLIN* — *sorting programme*
- EXTRAS* — *retrieves all information for a certain sheet of the whole work*
- PRØDES* — *makes a sheet drawing programme in EBCDIC code*
- CØNEBA* — *makes drawing file conversion into ASCII code*

Figure 2 b

Processings within SFAIPLAC programme package

Data collection stations
(measurements made on
a Stereometer)

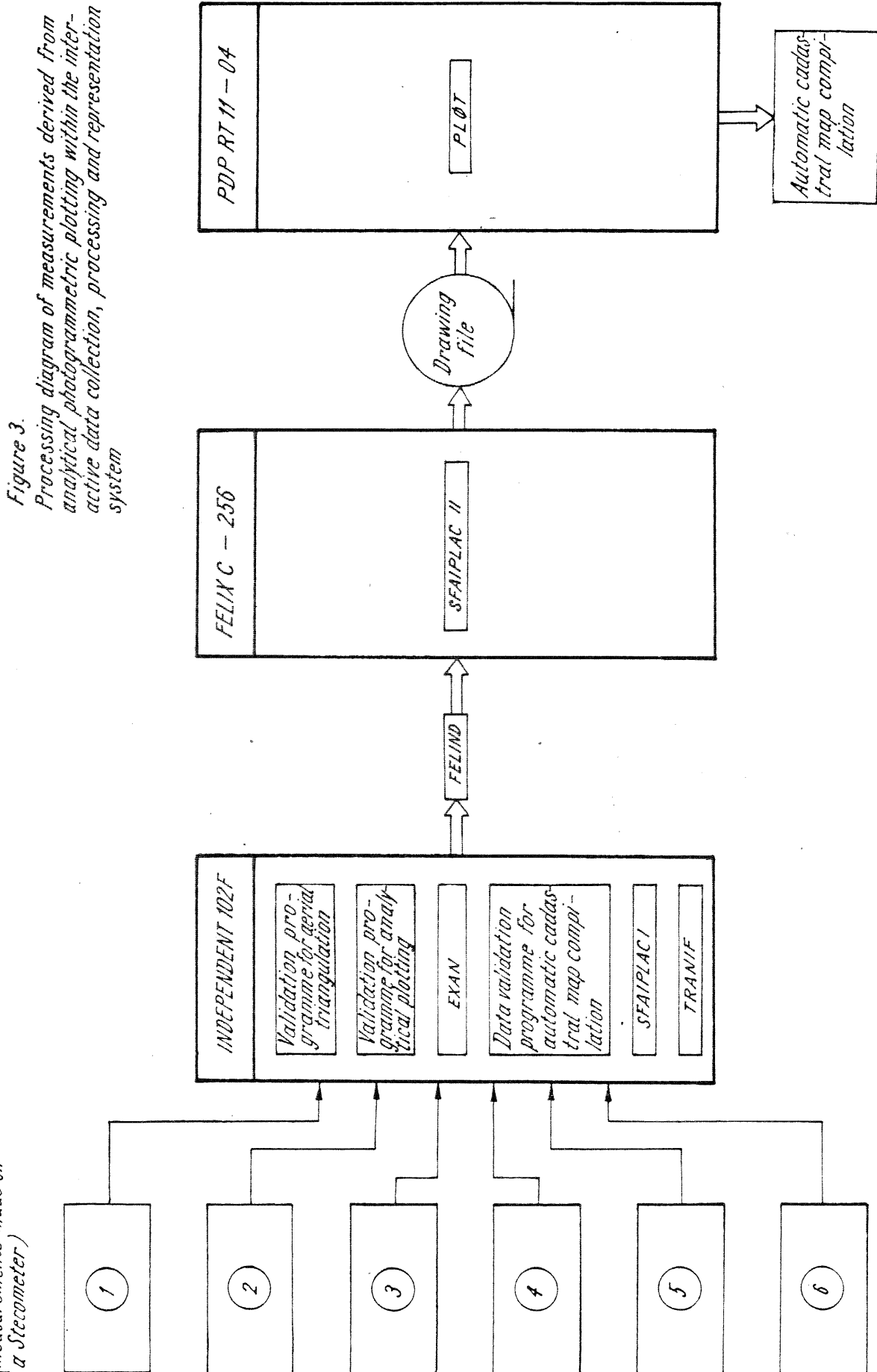


Figure 3.
Processing diagram of measurements derived from
analytical photogrammetric plotting within the inter-
active data collection, processing and representation
system

plotter. The line type to be used in map compilation is described by the cartographic code elements, as it was shown early. Point numbers, enclosed to the code, give information concerning the line length to be drawn. Point inventory in succession gives the characteristics of the respective line. Line descriptions define the geometric configuration of the planimetric details on the ground and assure the complete cadastral information, as well.

This input data is made concurrently with measurements on a Stecometer, and are delivered to the programme package as punched cards (Figure 2). Because the planimetric elements are not given in a pre-established order, they are selected according to colour, cartographic meaning, drawing instrument, a.s.o. A special conventional cartographic sign library (BIBSEC), as a direct access file, containing drawing instructions for all employed conventional signs, either special for line cartographic models or attached to some peculiar digital elements has been developed, so that the programme package becomes efficient. The drawing programme retrieval is assured by SFAIPLAC programme package, using the above mentioned cartographic code. The digital photogrammetric system for cadastral mapping, as it was initially conceived, gives the possibility to store all digital cadastral data into a specialized data base and can graphically compile the cadastral map, as well.

The bulk of the stored data can undergo any further digital processings, proper to cadastre and its requirements.

The system, we have just presented above, has been improved becoming an interactive system for photogrammetric data collection, processing and representation. So, Stecometers used in carrying out measurements have been on-line connected to a INDEPENDENT lo2 F minicomputer, using a suitable interface. As a consequence, EXAN and SFAIPLAC programme packages have being partly modified. The punched card input was replaced by data validation for the whole process, FELIX - C - 256 computer being used to develop only the proper drawing programme (Figure 3). Its software completion gives the possibility to develop the whole digital photogrammetric system for cadastral mapping, in an on-line regime. It requires the plotter on-line coupling to INDEPENDENT lo2 F minicomputer, as well.

In such a case, the system will become effective and profitable; it can accommodate many computational programmes meant for digital processings regarding cadastral problems only.

In the present-day variant, the digital photogrammetric system for cadastral mapping and the developed technology give the possibility, on the one hand, to compile maps high-efficiently, with a high precision and, on the other hand, to digitally store the cadastral map contents into a data base specially developed for such purposes, having all advantages and facilities which SOCRATE management system can afford.

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