

UNIVERSAL CABLE CIRCUIT ANALYSIS PROGRAM (UNICCAP) DESCRIPTION

1. GENERAL

1.01 This section describes the Universal Cable Circuit Analysis Program (UNICCAP). The program is a product of the Western Electric Company Engineering, Planning, and Analysis System (EPLANS), available to engineering and other personnel who are concerned with the solving of a wide variety of cable circuit design and operational transmission problems. UNICCAP provides rapid computation of such problems by the use of a computer. This section also provides information about the availability of the UNICCAP Manual, required in order to use the program, and the UNICCAP Reference Card.

1.02 This section is reissued to include Version 1.5 of the program, to delete all information pertaining to the use of the program (that information is now available in the UNICCAP Manual), and to provide ordering information for the UNICCAP Manual and UNICCAP Reference Card (see parts 2D and 2E).

2. PROGRAM DESCRIPTION

A. General

2.01 UNICCAP is an engineering tool for performing mathematical analysis of several types of cable circuits. It is used to replace manual computations and laboratory simulation of cable circuit design problems. Typical uses of UNICCAP include analysis for trunk design, outside plant design, special service applications, and calculations for data loop design.

2.02 To use UNICCAP, a user first looks at the basic cable circuit to identify the circuit components and establish the circuit requirements. UNICCAP does not require the user to be familiar with the operation of a computer or to have any previous knowledge of computer programming. The user is required only to provide specific

information to UNICCAP via a remote terminal keyboard such as a model 33 or 35 teletypewriter. The user then prepares the data from existing design records which are easily converted into a format and sequence as described in the UNICCAP Manual. UNICCAP immediately processes the problem and all requested output is returned to the user at the terminal. The user then analyzes the output information in terms of the circuit requirements and makes any desired changes. The changed data can be immediately resubmitted for further analysis and solution. This process can be continued until the user is satisfied that a suitable circuit is attained. The solution to the problem may consist of transmission parameters such as insertion loss, return loss, echo return loss, input impedance, output impedance, envelope delay distortion, dc analysis for resistance and current, primary and secondary constants for cable, P/AR values, etc.

2.03 At present, UNICCAP is an engineering tool for circuit analysis only and cannot generate or select an optimum cable circuit configuration or prescribe the type and location of transmission equipment. Its value is in its ability to rapidly perform the long and tedious calculations required to analyze transmission circuits. It can, however, generate appropriate settings for some equipment, thus relieving the user of repetitive use of equipment setting tables. The exercise of engineering judgment and decisions regarding the circuit design remain the responsibility of the engineer.

2.04 UNICCAP responds to a set of commands and to data that describes the cable circuit and the extent and nature of the analysis to be performed. The user has four types of operation (referred to as functions) available when executing UNICCAP. These are

- (a) Keyboard operation which provides complete interaction and control of the program by

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the user. The problem input data is not permanently stored.

- (b) Attended datafile operation where problem data is prestored in a datafile. The program will extract this data during processing and the user must be in attendance at the terminal to interact with the program as necessary.
- (c) Unattended datafile operation where problem data is prestored and processed as above; however, the user need not be in attendance. The program will solve the problem, terminate itself, and disconnect the terminal automatically.
- (d) Batch operation where the problem data is prestored and processed as above; however, the program will be run and the output printed at the computation center during the night. The results will be mailed to a prestored address.

The desired function is selected by entering the proper command at appropriate times during a user's terminal session. In addition to the UNICCAP operational functions, support capabilities are provided to input and edit datafiles, print out a datafile, and list the status of all datafiles. A comprehensive set of diagnostic comments is provided to aid a user in the correction of erroneous or unacceptable input data.

2.05 UNICCAP consists of a main program and a number of subroutines, all permanently stored in a computer. The computer is a time-share system, which is provided by a vendor. When accessed, the main program controls processing of the problem by calling the various required subroutines. The subroutines actually perform the analysis of the various cable circuits and facilitate the analysis of the following circuit configurations:

- (a) Straight line circuits with simple bridged taps
- (b) Double-conductor circuits within the main path of transmission (that is, parallel cable pairs with or without equipment and with or without bridged taps in between)
- (c) Circuits containing compound bridged taps (that is, a bridged tap off a bridged tap).

2.06 UNICCAP uses a transmission matrix (ABCD) as the mathematical means of cable circuit

analysis. The elements of a cable circuit are represented mathematically by generating an equivalent matrix. The matrices of all elements are used with appropriate matrix computations to derive an equivalent matrix representation of the total circuit. Finally, requested solutions are computed using appropriate terminations. UNICCAP accurately performs these mathematical functions as long as the user supplies *complete* and *accurate* input data.

2.07 Each circuit element description must contain all of the data necessary to define the represented component or components. To fulfill this requirement, UNICCAP utilizes a circuit element library concept. The library contains a list of all available elements, including those data items needed to define each element. The circuit element library will be expanded to cover other circuit components as demand dictates.

2.08 The library is an important segment of the program and, therefore, the user should refer to the library listing contained in the UNICCAP Manual or to the UNICCAP Reference Card when preparing his input data. Using the list will ensure that all parameters are included in the input information in the proper format. If any additions or changes to the library are made, new data is available to the user by using the manual update command. The UNICCAP Manual and UNICCAP Reference Card will be updated periodically.

B. Capabilities

2.09 UNICCAP is capable of processing an unlimited number of problems in succession during one terminal session. Each problem may contain an unlimited number of variations. The user can prestore a group of problems in a datafile and have UNICCAP process each in turn. This processing can be performed in an automatic "hands-off" fashion, or with user interaction during the process. Errors found in the input data of any one problem will not affect the processing of succeeding problems. If the user selects automatic processing, any errors found in a problem will be identified by diagnostic comments on output. The problem in which errors are found is skipped, but processing continues for the other problems in the datafile. If the user selects to interact with processing, then any diagnostic will be immediately typed out on the terminal and the program will wait for the user to take corrective action. The

user also has the option of manually accessing and controlling UNICCAP from the terminal keyboard. In keyboard execution, the user is responsible for supplying all input data and program commands at the time of program execution. Any errors found by the program must be corrected before processing will continue.

2.10 Outputs are calculated at frequencies specified by the user or supplied internally by UNICCAP. Frequency limitations for individual components are listed in the circuit element library. The user may utilize any set of up to 50 different frequencies to analyze a circuit.

2.11 If the user does not specify the required values for problem input, UNICCAP will often provide a set of **default** values using the parameters normally associated with the specific problem data requested by the user. Default values define the most common set of conditions on which to base problem solutions. These conditions are the same as those used in laboratory simulation. Defaults are used whenever possible, thereby allowing the program to continue processing. On request, the program will print out a status report indicating which defaults were used. The status report defines the termination and frequency defaults.

2.12 A complete set of diagnostic comments is also incorporated in UNICCAP. The diagnostic routines check each line of input data for compatibility and completeness. Whenever it finds obvious errors or missing parameters, the appropriate diagnostic is printed out, followed by the line in error with a question mark near the error. The user is then given the opportunity to take corrective action. If the user selects the unattended execution, the diagnostic comments will be listed with the output and problem processing will continue. In this case, the user may make corrections in the datafile and resubmit the problem at a later time. The diagnostics are provided as an aid to the user for completeness and format, but cannot determine the accuracy of input data.

2.13 UNICCAP has the capability of printing out a complete block diagram of the problem circuit as an optional form of output. This circuit diagram depicts the circuit configuration and circuit element data exactly as they were entered on input.

2.14 One of the important features of UNICCAP is its ability to choose equipment settings in a number of frequently encountered cases. These are all cases in which the user has chosen the circuit element, but the program goes on to choose settings. This removes tedious error-prone work from the user and makes it possible for him to concentrate on the real problem.

C. Version 1.5 of Program

2.15 The new circuit elements available to the user in Version 1.5 of UNICCAP include waterproof cable, metropolitan area trunk (MAT) cable, miniature load coils, and the artificial cable kit. No. 1 Electronic Switching System trunk circuits, dial-long-line equipment, precision networks, and extensions of the family of E6 repeater line build-out networks have also been added. UNICCAP will also be capable of handling metallic facility terminal (MFT) equipment. The program will not only analyze circuits containing this equipment, but will determine settings for circuits which include a 2-2, 2-4, or 4-4 MFT repeater in addition to other components such as an E6 repeater, impedance compensators, or precision networks.

2.16 New outputs include dc analysis for determining circuit resistance and current, primary and secondary constants for cable, envelope delay, envelope delay distortion, and P/AR. The stability of a circuit containing repeaters can be analyzed for a variety of terminations and the maximum usable gain determined.

2.17 Version 1.5 of UNICCAP also introduces application programs which couple the more basic transmission analysis capability of UNICCAP with specialized engineering analysis modules. One application program selects and/or sets delay and amplitude equalizers to meet specific conditioning requirements on data circuits. ESPD, which includes the 200-, 359-, 380-9, and 950-series equalizers, replaces the DELDIS and ADE950 programs. A second application program, T1 Fault-Locating Application Package (TFLAP), calculates received signal levels, signal-to-interference ratio, and other parameters for T1 fault-locating circuits. The third, Metallic Trunk Circuit (MTC), will analyze the new 2-4 wire trunk circuit for the No. 4 ESS.

D. UNICCAP Manual

2.18 All information pertaining to the use of UNICCAP is contained in a new UNICCAP Manual. This is a loose-leaf publication that permits change and updating to be accomplished in the most feasible manner. The manual contains sections on user instruction, references, application programs, and theory.

2.19 The UNICCAP Manual may be obtained by placing a standing order for

UNICCAP Manual—Publication PA 350129

from

Western Electric
Reproduction Service Organization
Department 4236
Building 23-6

Hawthorne Station
Chicago, Illinois 60623

A standing order is necessary to insure that any future updates to the Manual will be received.

E. UNICCAP Reference Card

2.20 Also available to the user is the UNICCAP Reference Card. This card, made of heavy paper, is pocket sized and folds out to display several pages. It contains all of the commands needed to execute the program. A copy of the circuit element library is included. It is intended to be a quick reference for the user who has become familiar with the program. The reference card can be obtained from the operating company EPLANS coordinator who, in turn, may obtain copies from a Western Electric Company EPLANS Software Services consultant.