A/S REGNECENTRALEN

# AN INTRODUCTION

REGNECENTRALEN was established in 1955 as a self-owned institution, connected with the Academy of Technical Sciences (ATV), with the purpose of developing manufacturing and selling electronic computers and data processing systems, as well as performing various types of data processing at its own service-centres.

In January 1964, REGNECENTRALEN became a limited company with shareholders from many large industrial and financial concerns in Denmark. Shares in the new company have also been made available to the staff.

REGNECENTRALEN has, after starting modestly in 1955 – with less than 10 employees developed into an organization with over 200 staff, the total of whose qualifications and experience are placed at the disposal of business and industry for the solution of data-processing problems, from calculations in the natural and mathematical sciences to office automation and the education and training of customers' staff.

REGNECENTRALEN has concentrated its resources, mainly into the development of electronic data-processing systems but has additionally, tackled many problems of a special nature. The first computer to be developed and built in Denmark was the DASK, introduced in 1958. DASK is well-known in Denmark in connection with a number of projects – for instance, DASK made prognoses for the last General Election, and the results were broadcast in Radio and T.V. Since DASK was introduced, it has been considerably improved by the addition of several external units, which increased DASK's effectiveness as a commercial data-processing installation. However, although it is still doing useful work, DASK is rapidly becoming old-fashioned and it is planned to relieve it completely of its routine jobs during 1965. Late in 1961, the prototype of a new data-processing system named GIER was ready. GIER, which is a fast and fully-transistored machine, had been tested during 1960/61 and attracted so much attention that it was decided to make it in serial production and sell it to businesses and institutions. Since the autumn of 1961, 20 GIER systems have been installed in Denmark, Norway, Germany, France, Sweden and Poland. The GIER System has, incidentally, also been used to make prognoses on the results of voting for T.V.

REGNECENTRALEN is expanding its production of GIER. The next series is being built in a newly-established factory in Præstø. Besides building GIER, this factory will produce the peripheral equipment that brought the GIER system into the limelight as a medium-sized, effective and economic data-processing system. Especial mention must be given to the very effective Card Reader and the extremely fast Punched Tape Reader. The Card Reader can sense 80 columns of punched information as well as 27 columns of pencil-marked information at the rate of 60.000 cards/hour. The Punched Tape Reader which has been designed and built exclusively by REGNECENTRALEN's own engineers reads tape at 2000 char./sec. This unit is highly satisfactory for use in off-line conversion from punched tape to magnetic tape.

REGNECENTRALEN has, so that full use can be made of GIER, made great efforts to establish a library of standard programs, which will be at the user's disposal. Likewise, programs of general interest, written by GIER users are systematically being collected for distribution to other GIER users.

REGNECENTRALEN's Compiler Group – currently engaged in writing COBOL compilers on contract basis – are justifiably proud of their success with the GIER ALGOL compiler. (ALGOL is rapidly winning world-wide acknowledgement as an international language for description of computational processes). GIER ALGOL is an almost unrestricted version of ALGOL 60, with many refinements; the compiler is one of the fastest and most effective to be found to-day, attracting attention from all over the world.

REGNECENTRALEN has periodic training-courses, both for its own personnel and for personnel from other concerns. As backing for these training programs, a large number of articles and manuals have been published, and have been used by Polytechnics and Universities, among others.

REGNECENTRALEN has a number of GIER SERVICE CENTRES in Denmark fully supported by a CDC-1604 A installed in Copenhagen. The CDC installation is one of the largest in the land and in a position to process really large and complicated jobs.

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# GIER SYSTEM

# SPECIFICATION

## SUMMARY

**General Characteristics:** single address binary computer with 64 powerful instructions (built-in floating point arithmetic and automatic address modification), buffered input/output, and simultaneous drum and magnetic tape operations, flexible interrupt system;
open-ended design allows arbitrary connection of peripheral equipment.

**First installed:** December 1960. Present Availability: 6 months.

**Country of Manufacture:** Denmark.

**Installation cost included in price** Carriage: f.o.b. Copenhagen.

**Warranty:** 6 months – includes Schooling, Programming and Technical Service in this period.

**Physical Characteristics:**
Floor area average system: 30 m²
Maximum floor loading: 900 kg/m²
Power requirement: 1–3.5 KW
Air conditioning requirements: 18–23° C.

**Operation Times:**

| | | | |
|---|---|---|---|
| Add: | 22 μs (Fixed point) | 66 μs (Floating point) | + time for normal address modification 27 μsec. |
| Multiply: | 155 μs (Fixed point) | 140 μs (Floating point) | |
| Divide: | 240 μs (Fixed point) | 190 μs (Floating point) | |
| Other: | 2 μs | to 27 μs | |

**Main Memory, type:** Ferrite Core Store with backing Drum Store

**Main Memory, size:** 1024 words, 12800 words

**Word Length:** 42 bits

**Peripheral Equipment Used:**

| | Function and Type | Maximum Numbers | Speed |
|---|---|---|---|
| Standard Equipment | Punched Tape Reader RC 2000 – photoelectric | 1 | 2000 char/sec |
| | Paper Tape Punch FACIT PE 1500 | 1 | 150 char/sec |
| | On-line Typewriter IBM | 1 | 8–12 char/sec |
| Optional Equipment | Off-line Typewriter Flexowriter | 1 | 8–12 char/sec |
| | Buffer Store ferrite core 4096 words | 2 | 6–13 μs/word |
| | Additional Drum Store 12800 words | 2 | 21 ms/track |
| | Magnetic Tape Unit CDC-range & AMPEX | 8 | 20.000–83.400 char/sec |
| | Card Reader Converted Bull D3 | 1 | 1000 cards/min. |
| | Line Printer Anelex Series 5 | 1 | 667 lines/min. |
| | MICR Reader CMC 7 | 1 | |
| | Digital Incremental Plotter Calcomp | 1 | |
| | Process Control Unit 63 analogue/digital signals with converters | 1 | |

**Software available:**
ALGOL 60 Compiler
HELP-Utility program library and input system
Extensive library of subroutines and ALGOL procedures for Mathematical and Numerical Analysis
Library of programs for Optics, Shipbuilding, Road-planning etc.
PERT

**General Comments:**
Adaptors available for off-line connections between Magnetic Tape Unit, Paper Tape Reader, and Line Printer.
Card Reader can sense holes and pencil marks, and can be used as off-line sorter.
Maintenance contract available for 3½ p.c. of cost of installation p. a.

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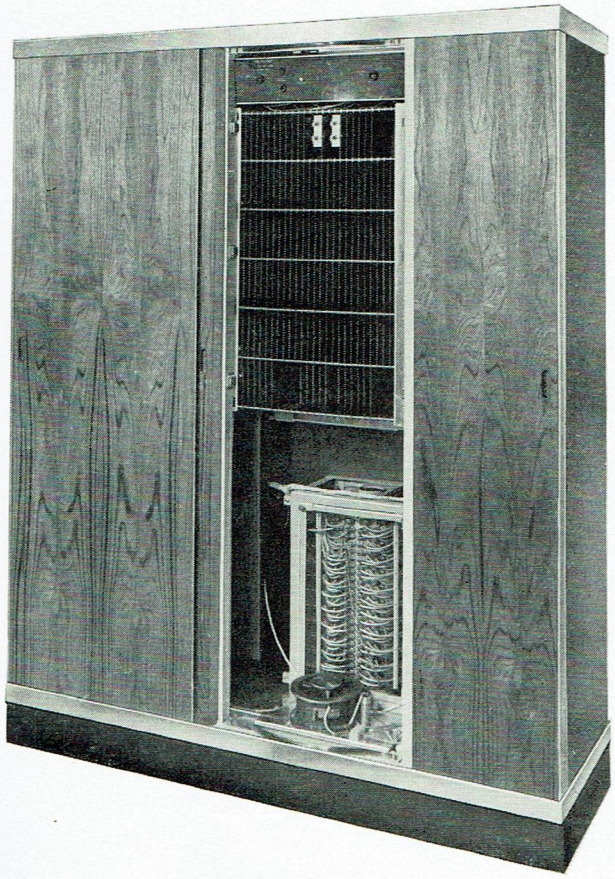
# GIER SYSTEM

# SPECIFICATION

## CENTRAL PROCESSING UNIT



GIER is a binary, parallel, single address electronic computer with built-in floating point arithmetic and powerful facilities for automatic address-modification and indexing.

The GIER central processing unit consists primarily of a number of control registers and an immediate-access ferrite-core store — the IAS — of 1024 words of 42 bits. (Each word is equivalent to 7 alpha-numerical characters or 12 digits). The cycle time is 10 μsec.

In addition to the IAS, there is a 2nd-level store — the DRUM — which has 320 tracks of 40 words each, giving a total capacity of 13,824 words. Drum transfers (in which information is copied from the IAS to the drum and vice-versa) are made simultaneously with other operations in GIER, at the rate of 20 ms per track. The capacity of the drum store may be extended by the addition of a further 2 drums, to a maximum of 38,400 words.

In order to cater for additional peripheral units and real-time phenomena, the central processor has been equipped with a general purpose 2-way DATA CHANNEL and can be equipped with an INTERRUPT unit. Information in the data channel can be transferred to and from the IAS at the rate of 5 μsec per word of 42 bits (in parallel). The interrupt unit comprises 12 interrupt channels and an associated masking register. Interrupts are signals which notify the computer of internal or external conditions that have arisen and require immediate action by the computer. An interrupt passing the mask will cause a program under execution to be interrupted, and a special subroutine dealing with the appropriate condition will be performed, after which control is returned to the original program.

The IAS may be supplemented by another 2nd-level store — the BUFFER — which is also a ferrite core store, with a capacity of 4.096 words. One or two of these buffers may be connected to the IAS via the data channel, with a rate of transfer of 6—13 μsec/word. Up to 4 magnetic tape units may be connected to GIER via each buffer.

| Operation times | addition | multiplication | division |
|---|---|---|---|
| fixed point | 49 μsec. | 180 μsec. | 270 μsec. |
| floating point | 93 μsec. | 170 μsec. | 220 μsec. |

| | weight | height | width | depth |
|---|---|---|---|---|
| Standard Processor | 500 kg | 193 cm | 144.6 cm | 54.2 cm |
| Buffer Store | 400 kg | 193 cm | 144.6 cm | 54.2 cm |

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# GIER SYSTEM

# SPECIFICATION

## THE CONSOLE

The console of the GIER system consists of a display panel and an auxiliary display panel, an electric on-line typewriter and also a punched tape reader and paper tape punch (the last 2 items are described separately).

The display panel, which is furnished with certain start and stop buttons, shows the contents of the various registers, indicates error conditions and can be used for operating the computer under manual control.

The auxiliary display panel is used to call the administrator of the HELP library, which includes an input program with symbolic addressing and a system of utility programs. For this a special interrupt button, the HP button, is used. When the HP button is pressed, the current program is interrupted, after which the contents of the IAS and all relevant registers are stored on the drum to enable the situation before the interrupt to be restored.

The typewriter is used for input/output of limited quantities of information; for instance, communication between the operator and HELP is normally accomplished by using the typewriter. The speed of the typewriter is 8–12 char./sec.

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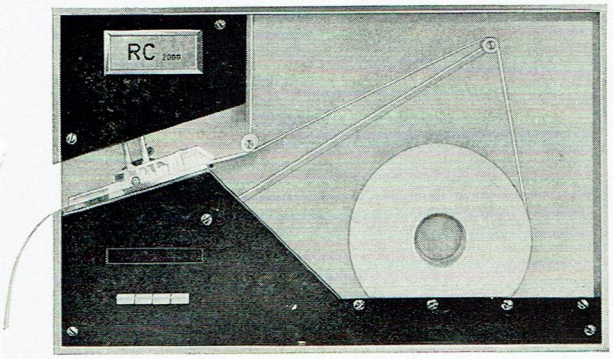
# GIER SYSTEM

# SPECIFICATION

## PUNCHED TAPE READER
### RC 2000




For the input of programs, data, etc. to the GIER System REGNECENTRALEN's new, high-speed, photo-electric punched tape reader – RC 2000 – is used. In the construction of RC 2000 the emphasis has been placed on reducing the number of moving parts to an absolute minimum by the use of electronic functions. The construction of the reading-head allows spliced tape to be read; splicing is made by means of special adhesive tape.

Top speed: 2000 char./sec. (= 5 metres/sec.)

RC 2000 is able to read standard 5/6/7/8 channel tape as well as Olivetti 6 channel square-hole tape.

Changing from one type of tape to another takes 10 seconds.

Insertion of tape spool takes 3 seconds.

Automatic stop at end of tape.

Ferrite core buffer: 256 8-bit words.

The reading speed is servo-controlled and depends on the number of characters in the ferrite core buffer.

Mains Supply:

| | |
|---|---|
| Voltage: | 115, 127, 220 (± 10 percent) |
| Frequency: | 50, 60 Hz |
| Power consumption: | 100 Watt |

The photo-electric reading head incorporates a device for the automatic fine adjustment of light intensity.

Fully transistorized.

Off-line converting, to GIER magnetic tape units, for instance, is possible.

| weight | height | width | depth |
|---|---|---|---|
| 30 kg | 32 cm | 52 cm | 44 cm |

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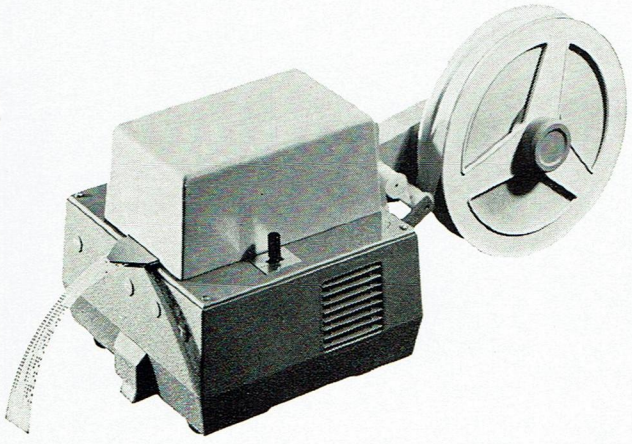
# GIER SYSTEM

# SPECIFICATION

## PAPER TAPE PUNCH

### FACIT PE 1500



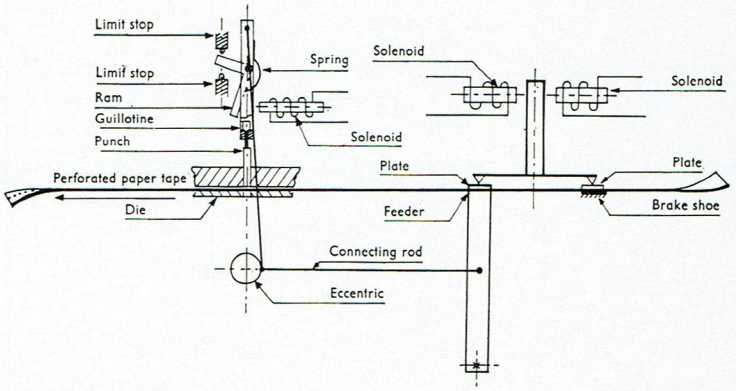
As output unit for results of limited volume, error-reports and program tapes etc. the Facit PE 1500 paper tape punch is used.

The PE 1500 punches information at a speed of 150 char./sec. on 5/6/7/8 channel paper tape. The paper tape is available in 300-meter-spools, the equivalent of 120,000 characters or 13 minutes continuous punching.

Punching is accomplished by a solenoid-controlled punch mechanism powered by the motor which also feeds the tape. It takes 0.3 sec. before a character can be punched, unless the punch signal is given within 5 sec. after the last character was punched; in this case it takes only 6.7 ms.

Power consumption when running at full speed is only 180 watt.

| weight | height | width | depth |
|---|---|---|---|
| 16.5 kg | 21.8 cm | 21 cm | 51.6 cm |

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# GIER SYSTEM

# SPECIFICATION

## LINE PRINTER

ANELEX

Anelex series 5 line printers can be connected to the GIER-System. The mechanical unit can be connected to GIER via a buffer unit. The printers can be supplied in different types ranging in speed from 330 lines per minute to 1250 lines per minute alphanumerical and 2500 lines per minute numerical printing. The maximum number of print positions is 160. The printer type which is normally the optimum for a GIER-System is 667 lines per minute each with 160 print positions. Other types are delivered on request.

The printer is normally equipped with a oneline buffer, which accepts the output from GIER character-by-character. During printing the buffer is scanned and is thus unable to accept further output. The buffer is released as soon as all characters have been printed, and as the characters on the print barrel are arranged in sequence of greatest frequency the buffer will on average be released in less than half a revolution, so that paper can be advanced and printing of the next line commenced before next revolution.

In some cases it will be advantageous to be able to buffer more than one line and in such cases a 256-character buffer can be supplied, to be inserted between GIER and the printer.

The printer is normally equipped with a character set of 64 characters consisting of the decimal digits, the alphabet (capital letters) and special signs. On special request other character sets can be supplied. (It is expected that a character set of 96 characters and CMC 7 characters will be available from January 1965). Coding of the characters for the printer is the same as for the typewriter. The code can be easily changed, however, by changing a code disc in the printer.

0123456789ABCDEF.,:;+-×/()[]=↑␣*
0123456789ABCDEF.,:;+-×/()[]=↑␣*
0123456789ABCDEF.,:;+-×/()[]=↑␣*

≠><'%&¤£$GHIJKLMNOPQRSTUVWXYZÆØÅ
≠><'%&¤£$GHIJKLMNOPQRSTUVWXYZÆØÅ
≠><'%&¤£$GHIJKLMNOPQRSTUVWXYZÆØÅ

The print density is 10 characters to the inch horizontally, 6 and 8 lines to the inch vertically. The buffer has a tabulation feature. Vertical format is controlled by a 8-channel punched paper tape. Paper is skipped with a speed of 27,5 inches (70 cm) per second. (A high speed skip is expected to be available from January 1965).

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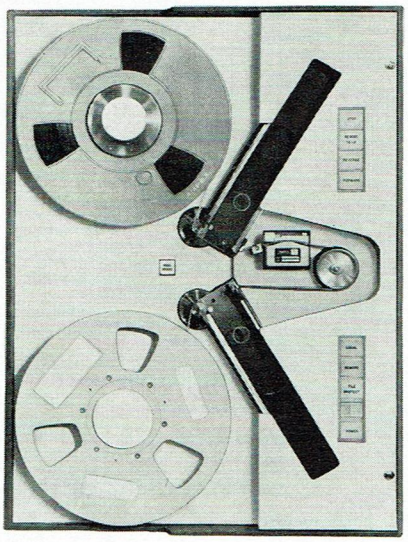
# GIER SYSTEM

# SPECIFICATION

PRELIMINARY

## MAGNETIC TAPE UNIT

AMPEX TM-7



Magnetic tape units — AMPEX TM-7 — are connected to GIER by means of a special adaptor — usually via a buffer of 4096 words, to achieve complete simultaneity.

The maximum rate of transfer is 20.000 char./sec. Wear of the tape is minimized by the use of a special capstan system.

The tape speed is 36 inch/sec. with a recording density of 200 or 556 char./inch.

The magnetic tapes are ½ inch wide, 800 m long, have 7 read/write tracks and are compatible with, for instance, IBM 729 and 7330; block length may be variable (cf. the tape utilisation table). The combined read/write head permits a "read-after-write-check".

The magnetic tape units have built-in tape cleaners and microprogrammed searching for, and sensing of, load-point and end-of-file marks.

Apart from the ordinary fields of application the magnetic tape equipment of the GIER system may be used for off-line converting from the RC 2000 paper tape reader by means of an additional electronic adaptor.

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# GIER Magnetic Tape Utilisation Table

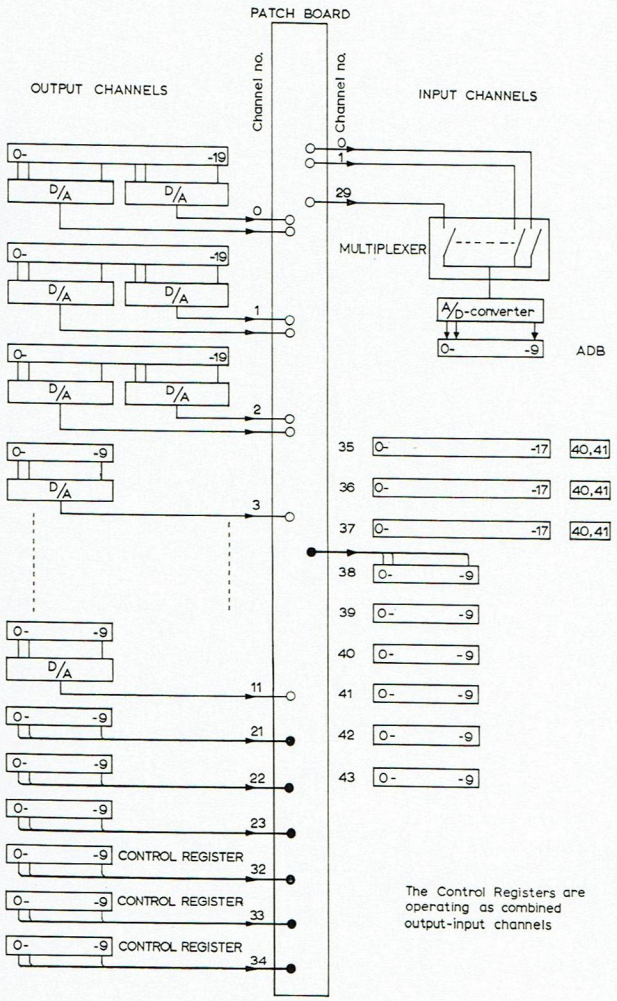
| No. af chars. per block | No. of blocks per reel | No. of chars. per reel | Percent utilisation |
|---|---|---|---|
| 10 | 37 501 | 375 010 | 2 |
| 20 | 36 643 | 732 860 | 5 |
| 30 | 35 823 | 1 074 690 | 7 |
| 40 | 35 039 | 1 401 560 | 9 |
| 50 | 34 289 | 1 714 450 | 11 |
| 60 | 33 570 | 2 014 200 | 13 |
| 70 | 32 880 | 2 301 600 | 14 |
| 80 | 32 219 | 2 577 520 | 16 |
| 90 | 31 583 | 2 842 470 | 18 |
| 100 | 30 973 | 3 097 300 | 19 |
| 200 | 25 953 | 5 190 600 | 32 |
| 300 | 22 333 | 6 699 900 | 42 |
| 400 | 19 600 | 7 840 000 | 49 |
| 500 | 17 462 | 8 731 000 | 55 |
| 600 | 15 745 | 9 447 000 | 59 |
| 700 | 14 336 | 10 035 200 | 63 |
| 800 | 13 158 | 10 526 400 | 66 |
| 900 | 12 159 | 10 943 100 | 68 |
| 1 000 | 11 300 | 11 300 000 | 71 |
| 2 000 | 6 625 | 13 250 000 | 83 |
| 3 000 | 4 686 | 14 058 000 | 88 |
| 4 000 | 3 625 | 14 500 000 | 91 |
| 5 000 | 2 956 | 14 780 000 | 92 |
| 6 000 | 2 495 | 14 970 000 | 93 |
| 7 000 | 2 159 | 15 113 000 | 94 |
| 8 000 | 1 902 | 15 216 000 | 95 |
| 9 000 | 1 700 | 15 300 000 | 96 |
| 10 000 | 1 537 | 15 370 000 | 96 |
| 11 000 | 1 403 | 15 433 000 | 96 |
| 12 000 | 1 290 | 15 480 000 | 97 |
| 13 000 | 1 193 | 15 509 000 | 97 |
| 14 000 | 1 111 | 15 554 000 | 97 |
| 15 000 | 1 039 | 15 585 000 | 97 |
| 16 000 | 975 | 15 600 000 | 97 |
| 17 000 | 919 | 15 623 000 | 98 |
| 18 000 | 869 | 15 642 000 | 98 |
| 19 000 | 825 | 15 675 000 | 98 |
| 20 000 | 784 | 15 680 000 | 98 |
| 21 000 | 748 | 15 708 000 | 98 |
| 22 000 | 714 | 15 708 000 | 98 |
| 23 000 | 684 | 15 732 000 | 98 |
| 24 000 | 656 | 15 744 000 | 98 |
| 25 000 | 630 | 15 750 000 | 98 |
| 26 000 | 606 | 15 756 000 | 98 |
| 27 000 | 584 | 15 768 000 | 98 |
| 28 000 | 563 | 15 764 000 | 98 |

Length of reel = 800 m = 16 012 800 char.
Inter-block gap = 417 char.
For GIER with 1 buffer, the longest block is 4096×7 = 28672 chars.

# GIER SYSTEM

# SPECIFICATION

## PROCESS CONTROL UNIT




To provide a means of communication between GIER and real-time physical processes such as analogue computers and industrial implementation systems, the GIER system can be extended by the addition of a Process Control Unit. This unit is connected to GIER via the data channel in the central processor and consists of a number of channels capable of receiving and sending information in the form of digital and analogue signals with appropriate A/D—D/A conversion.

Data transfers are completely controlled by the computer program. However, in order to make effective use of the process control unit it will often be necessary to operate it in connection with the interrupt unit. It may be necessary to attach DC amplifiers for signal-matching purposes.

The number of inputs and outputs currently available are as follows:

30 inputs for analogue signals including electronic multiplex and common A/D converter with buffer register.

12 inputs for digital information (9 10-bit registers and 3 20-bit registers).

15 outputs for analogue signals with individual buffer registers and D/A converters.

6 outputs for digital information (6 10-bit registers).

The above constellation has been designed and is being used for a linkage between GIER and an analogue computer and, incidentally, for several other research activities in the field of real-time computer control. The requirements for each user of the process control unit, will naturally be highly individual but the unit can, however, be adapted to almost every conceivable application.

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# GIER SYSTEM

# SPECIFICATION

## ALGOL 60 COMPILER

ALGOL 60 (ALGOrithmic Language) is an international programming language, i.e. a language which can be translated, by means of an electronic computer, into the language of the computer itself, the so-called machine code.

The main advantages of programming in ALGOL over programming in machine code are:

1) ALGOL is problem oriented – therefore programming is easier and less time-consuming; this applies especially to the corrections that usually have to be made during the preparation and revision of programs.
2) An ALGOL program is an English language description as well as a program and can thus be directly understood by others (also non-programmers).
3) ALGOL 60 is independent of the computer – therefore ALGOL programs may be used in electronic computers of various type and manufacture.


ALGOL has been constructed with the description of numerical and logical processes in mind. Thus an ALGOL program consists of a number of statements and expressions which describe, on the one hand, the calculations and, on the other hand, the sequence in which they are to be executed.

A special ALGOL conception, the procedure, has proved to be very useful. The procedure is a program-independent algorithm, and therefore forms the basis of the GIER System Library. Examples of such library procedures are matrix arithmetic, the solution of linear equations, least-squares, approximation of data, integration, special functions, etc.

ALGOL programs for GIER are punched in 8-channel papertape which is then translated by means of the GIER ALGOL Compiler. During compilation, which is performed at a speed equivalent to the generation of about 2,300 machine instructions/min., the program is tested for errors in grammar and relevant error messages are output on the typewriter. The object programs generated by the compiler are almost as effective as "hand-made" programs – which is partly due to the compiler's fully automatic, dynamic administration of the immediate-access and drum storages.

The compiler occupies normally 5,800 of the 12,800 words on the drum.

However, a special transient edition for compilation of very large programs has now become available. This 2-phase version occupies no more than 2,680 words on the drum, the 2nd phase being read in from paper tape during compilation.

The GIER ALGOL compiler has the following somewhat exceptional features:

Very fast translation (takes between 4 sec. and 3 min. per program).

It accepts the whole ALGOL 60 language, which makes the programs very readable and offers very extensive programming possibilities.

It accepts procedures in machine code.

The compiler does not stop during the translation if a grammatical error is observed, but after having informed the operator of the error, the erroneous instruction is erased from the program, after which the compiler continues checking for further errors. Thus one test run may often be sufficient to find all grammatical errors in the program.

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# SELECTED EXECUTION TIMES IN

# GIER ALGOL

| ALGORITHMIC ENTITY | EXAMPLE | EXECUTION TIME, MILLI-SECONDS |
|---|---|---|
| **Addition** | a + b | 0.12 |
| **Multiplication** | a × b | 0.18 |
| **Division** | a / b | 0.21 |
| **Square** | a ↑ 2 | 0.18 |
| **Cube** | a ↑ 3 | 0.4 |
| **Power, integer** exponent | a ↑ i | |
| abs (exponent) = 1 | | 3.8 |
| 10 | | 5.5 |
| 100 | | 8 |
| 1 000 | | 10 |
| 10 000 | | 12 |
| 100 000 | | 14 |
| 1 000 000 | | 16 |
| **Power, real** exponent | a ↑ r | 12 |
| **Subscripted variable** | | |
| 1 subscript | A[i] | 0.9 |
| 2 subscripts | B[i, j] | 1.2 |
| 3 – | C[i, j, k] | 1.5 |
| **Step-until element, constant step and simple upper limit,** each loop | **step** 1 **until** n | 0.6 |
| **Block with simple variables** | **begin real** a; **end** | 1.4 |
| **Block with array declaration** | **begin array** a [1:10]; **end** | 3.0 |
| **Reference to formal parameter called by name** | | |
| Actual parameter is | | |
| simple | | 0.4 |
| expression | | 3.2 |
| array identifier | | 0.0 |
| switch idetifier | | 0.0 |
| procedure identifier | | 0.0 |
| **Call of declared procedure** | | |
| having an empty procedure body | | |
| No parameter | P; | 3.8 |
| 1 parameter | Q(a); | 4.7 |
| 2 parameters | R(a, b); | 5.2 |
| 3 – | S(a, b, c); | 5.3 |
| **Call of standard procedure** | | |
| abs | abs(x) | 0.17 |
| arctan | arctan(x) | 6.6 |
| cos | cos(x) | 6.0 |
| exp | exp(x) | 5.8 |
| ln | ln(x) | 5.6 |
| sign | sign(x) | 3.2 |
| sin | sin(x) | 5.8 |
| sqrt | sqrt(x) | 6.2 |

# GIER SYSTEM

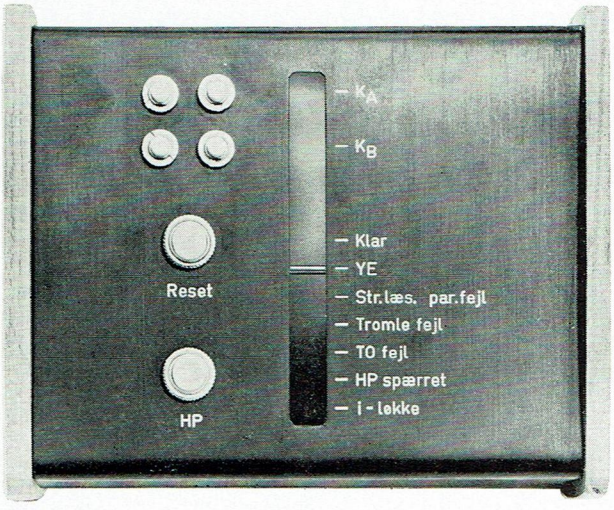
# SPECIFICATION

## THE ADMINISTRATIVE SYSTEM

## HELP

GIER is equipped with an administrative system called HELP for facilitating testing and running programs. The system comprises an interrupt mechanism, activated through the HP button, a central administration program monitored by typewriter input, and a number of subroutines among which the input program SLIP is the largest and most important. The others are subroutines for normal output, for storage dumps, for initializing, for comparison of sections of storage, and for tracing a program during the run.

The main features of the central administration and some of the utility subroutines are outlined here, while SLIP is treated in another specification.




**HP button and the HELP administrator.** Since the IAS is rather small the system is designed so that it occupies only 10 cells of the IAS during the run of a program. On the other hand it is obvious that, during an interrupt, the system must be able to use a much larger part of the IAS and yet be able for restore its contents before running is continued.

This is achieved by reserving the last 26 tracks of the drum for an "image" of the IAS during the interrupt. Since the system itself occupies the first 58 tracks of the drum the total store available to the programmer consists of 1014 cells of the IAS and about three quarters of the 320 drum tracks.

In the first 32 of the 58 reserved tracks writing is inhibited, so that it is impossible during a normal run to destroy the fundamental part of the HELP system.

At any stage of a run one can call for an interrupt by pressing the HP button with the following effect: The contents of the registers and the IAS are stored in the image on the last 26 drum tracks, and control is transferred to the HELP administrator which then waits for typewriter input describing what action is required. It is now possible to active any of the HELP subroutines or to make corrections in the stored program.

When the desired interruption has been performed, an end signal must be typed. Then the IAS and the registers are restored from the image and control is transferred to that point of the program at which it was interrupted.

**HELP utility subroutines.** The subroutines may be roughly divided into three categories according to their use before, during, and after a run:

a) **Before a run** is commenced one may use a subroutine for initializing the whole computer. After input of the program this can be copied to an unused part of the drum for later comparisons or for restoring the initial situation if something goes wrong during the run.

b) **During the run** one may use tracer subroutines i.e. subroutines which trace a program's activities making reports, for instance, when each jump is performed or when the contents of a selected register or cell change value. One may, also, cause storage dumps to be made every time a selected instruction is executed. HELP includes, furthermore, subroutines which can be used for the standard output of text and numbers.

c) **After the run** subroutines may be used for dumps of any part of the store, for comparison between the program before and after the run, and for output of the corrected program in a condensed form suitable for fast input.

If a user wants additional facilities it is easy to extend the HELP system to include new subroutines either in addition to or instead of some of the standard routines. If, on the other hand, the maximum available storage is required it is possible to confine the HELP systeme to 26 + 39 drum tracks instead of 26 + 58 tracks, thus sacrificing some of the facilities. But the 26 + 39 tracks are necessary if the interrupt mechanism, the administrator and the input routine SLIP is to be kept intact.

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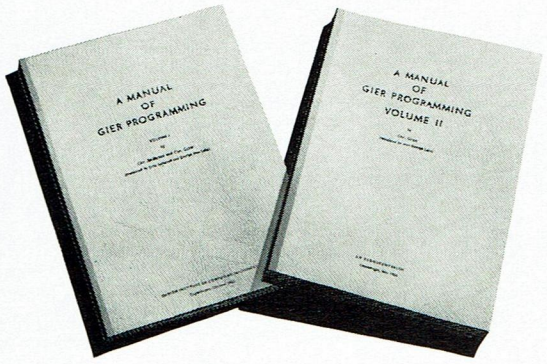
# GIER SYSTEM

# SPECIFICATION

## THE INPUT PROGRAM

## SLIP




The basic programming language used with GIER is called the SLIP language, i.e. the language accepted by the input routine SLIP (which means Symbolic Language Input Program). SLIP reads instructions, strings of text, and three types of numbers namely fixed-point and floating-point numbers and integers which may be packed with a maximum of four integers in each cell. The input may include comments [in square brackets, for instance] which are ignored by SLIP.

SLIP is a subroutine in HELP and is always called via the HELP administrator.

An important feature is that symbolic addressing is alowed in instructions. This means that the address constant and the increment of an instruction may be symbolic names whose values are defined through the use of the names as labels elsewhere in the program; the class of names available is, however, rather restricted. With respect to the use and scope of such names the SLIP language has a block structure very much like that of ALGOL:

a) Names must be declared in a block head before use and can be used within the block whose head contains the declaration, i.e. they are local to that block.

b) If a name is declared in each of several blocks inside each other, the name may have different values on each block level.

In the design of SLIP, special consideration has been made for ease in the use of symbolic names coupled with relative addressing.

During input an extensive syntactical check is performed and whenever an error is found an appropriate message is typed out. After this, SLIP continues to read in the program, skipping the remainder of the erroneous instruction or number. This implies that all the syntactical errors are often found in one sweep, and it also implies that if there are only one or two mild errors in a program, these may be corrected on the spot by means of HELP, and a test run can be carried through in spite of these errors.

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# GIER SYSTEM

# SPECIFICATION

## LIBRARY SERVICE

### CLASSIFICATION

0. **General Information**
0.0 General
0.1 Techniques
0.2 Programming
0.3 Organization

1. **Service Routines**
1.0 General
1.1 Executives
1.2 Hardware Test
1.3 Debugging
1.4 Demonstration

2. **Basic Data Processing**
2.0 General
2.1 Input
2.2 Output
2.3 Conversion
2.4 Sorting
2.5 Merging

3. **Mathematics**
3.0 General
3.1 Arithmetic
3.2 Computation of Functions
3.3 Approximation and Interpolation
3.4 Linear Algebra
3.5 Non-Linear Algebra
3.6 Calculus and Differential Equations
3.7 Combinatorials

4. **Mathematical Statistics**
4.0 General
4.1 Data Description
4.2 Correlation and Regression Analysis
4.3 Analysis of Variance
4.4 Multivariate Analysis
4.5 Time Series

5. **Operational Research**
5.0 General
5.1 Mathematical Programming
5.2 Scheduling
5.3 Inventory Control
5.4 Queuing Problems
5.5 Numerical Simulation

6. **Science and Engineering**
6.0 General
6.1 Chemistry and Chemical Engineering
6.2 Physics
6.3 Mechanics, Mechanical and Civil Engineering
6.4 Electrical Science and Engineering

7. **Business Applications**
7.0 General
7.1 Payroll
7.2 Sales Statistics
7.3 Banks

The GIER system LIBRARY is a centralized information service for GIER users.

It is absolutely necessary for users of a computer to have easy access to library routines i.e. programs or subroutines performing frequently recurring jobs.

The most important advantages in applying library routines are:

1) the library routines exist in a finished and tested form — the user is spared the task of programming and related debugging.

2) the library routines are intended to be as optimal as possible with regard to program length, running time, and accuracy — they are programmed by specialists.

A library routine is either prepared as a PROGRAM which solves a complete problem or as a SUBROUTINE which must be incorporated in a program, performing a certain part only of the processes of that program.

The GIER system LIBRARY comprises programs and subroutines coded in SLIP (Symbolic Language Input Program) and programs and procedures coded in ALGOL (ALGOrithmic Language) and other GIER publications.

The GIER system LIBRARY edits and INDEX and ABSTRACTS catalogue based upon a decimal system of classes (shown to the left on this specification). The INDEX is a table of contents of the Abstracts belonging to a certain class. Each line in the INDEX contains the classification code, name, and type of the publication. The ABSTRACT is a 5-line summary of each publication containing: information from the INDEX, function description, and order no.

The catalogue will be kept up-to-date at certain intervals by the publication of revised pages of INDEX and ABSTRACTS. The catalogue makes it possible for the GIER user to be promptly informed about the existence of a particular publication and thereafter to order the DETAILS in question.

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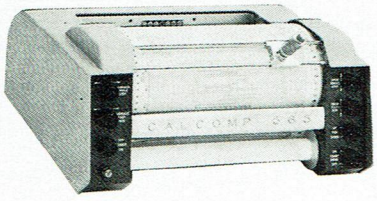
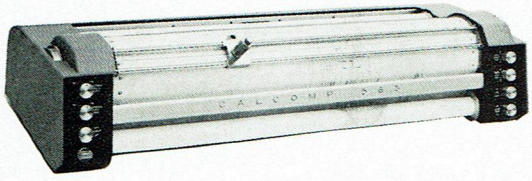
# GIER SYSTEM

# SPECIFICATION

## DIGITAL INCREMENTAL PLOTTER

CALCOMP





The time-consuming and tedious work of sketching curves through a number of computed points can be done by means of a CALCOMP Digital Incremental Plotter connected to GIER.

The plotter provides high-speed plotting of digital computer output. All models of the plotter are completely digital in operation, and operate solely under computer control. Since no analogue conversions or servos are used, problems of drift, noise, dynamic response, gain and scale factor settings are eliminated. Depending on the program the plotter can be used to plot points, continuous curves, curve-identification symbols, and letters and numerals. Data may be plotted on any type of scale – linear, logaritmic, or polar.

The principles of operation are the same for each of the models of the plotter. X-axis deflection is produced by motion of the drum carrying the paper, Y-axis deflection by motion of the carriage with the pen. These motions are carried out by two bi-directional stepping motors controlled by electrical pulses. Each motor has two inputs, one for the +X (+Y) direction and one for the –X (–Y) direction. An input pulse causes a stepwise motion in the corresponding direction of either 0.25 mm (0.01 inch), 0.13 mm (0.005 inch), or 0.1 mm depending on the model of the plotter.

The plotter is controlled from GIER by 10 variants of the data-channel output instruction (US), which are used to step the plotter in one of 8 directions and to raise or lower the pen from the surface of the paper.

All types of plotting – discrete points, continuous curves, or symbols – are accomplished through the stepwise movement of the paper and the pen. This completely digital operation eliminates problems normally encountered with analogue plotters, and provides an unusually high accuracy. The use of the digital incremental technique for symbol generation as well as for plotting provides complete flexibility in selection of curve identification symbols, scale markings, labelling and titling.

ALGOL procedures are available for output to the plotter. These include "initialize plot" for bringing the plotter into a well-defined starting position, "plot" for moving the pen (raised or lowered as appropriated) to the next point required, and "axes" for drawing the axes of the cartesian coordiante system with scale markings.

| CALCOMP MODEL NO. | Speed | | Step Size | Weight | Height | Width | Depth | Chart Paper | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | steps/sec. x-axis/y-axis | operations/sec. z-axis (pen) | mm | kg | cm | cm | cm | Width cm | Plotting width cm | Length cm |
| 506 | 300 | 10 | 0.1 | 24 | 25 | 100 | 37.5 | 80 | 75 | 36 |
| 507 | 300 | 10 | 0.1 | 15 | 25 | 46 | 37.5 | 30.5 | 28 | 36 |
| 563 | 200 | 10 | 0.26 (0.01'') | 24 | 25 | 100 | 37.5 | 80 | 75 | 36 |
| 564 | 300 | 10 | 0.13 (0.005'') | 24 | 25 | 100 | 37.5 | 80 | 57 | 36 |
| 565 | 300 | 10 | 0.26 (0.01'') | 15 | 25 | 46 | 37.5 | 30.5 | 28 | 36 |
| 566 | 300 | 10 | 0.13 (0.005'') | 15 | 25 | 46 | 37.5 | 30.5 | 28 | 36 |

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# GIER SYSTEM

# SPECIFICATION

## INSTALLATION LIST

APRIL 1964

| NAME | LOCATION | COUNTRY | BUSINESS | DATE INSTALLED |
|---|---|---|---|---|
| 1. Royal Danish Geodetic Institute | N. Farimagsgade 3 Copenhagen K | Denmark | Geodetics | Dec. 1960 |
| 2. Haldor Topsøe | Baunegaardsvej 73 Hellerup | Denmark | Chemical Engineering | Dec. 1961 |
| 3. Danish Atomic Energy Research Establishment | Risø | Denmark | Research and Development | Febr. 1962 |
| 4. A/S Regnecentralen | Guldsmedegade 3 Århus C | Denmark | Service Centre and Development | April 1962 |
| 5. A/S Regnecentralen | Smallegade 2 Copenhagen F | Denmark | Research and Education | May 1962 |
| 6. Hydro- og Aerodynamic Laboratory | Hjortekærsvej 99 Kgs. Lyngby | Denmark | Engineering and Development | June 1962 |
| 7. University of Copenhagen The Observatory | Østervoldgade 3 Copenhagen K | Denmark | Research | Aug. 1962 |
| 8. Bassin d'ESSAIS des Carenes | Boulevard Victor 6 Paris 15 | France | Research | Oct. 1962 |
| 9. Technical University of Norway Division of Automatic Control | Trondheim | Norway | Research | Dec. 1962 |
| 10. Technical University of Norway SINTEF | Trondheim | Norway | Education | Febr. 1963 |
| 11. University of Copenhagen H. C. Ørsteds Institute (Mathematical Institute) | Universitetsparken 5 Copenhagen Ø | Denmark | Education Research | May 1963 |
| 12. OECD Halden Reactor Project | Halden | Norway | Research and Development | April 1963 |
| 13. A/S Regnecentralen | Falkonerallé 1 Copenhagen F | Denmark | Service Centre | July 1963 |
| 14. Max-Planck-Institut für Kernphysik | Saupfercheckswег (69) Heidelberg | W. Germany | Research and Development | Oct. 1963 |
| 15. Burmeister & Wain A/S Shipyard | Strandgade 4 Copenhagen K | Denmark | Engineering | Oct. 1963 |
| 16. A/S Regnecentralen | Kastetvej 4 Aalborg | Denmark | Service Centre | Oct. 1963 |
| 17. Universytet Warszawski | Palace Kultury Warszawa | Poland | Research and Education | Jan. 1964 |
| 18. Technical University of Denmark Servo Laboratory | Lundtofte | Denmark | Research | April 1964 |

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