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THE DEVELOPMENT AND SUPPORT OF THE NATO PROJECT OPAQUE U.S.A.F.--ETC(U)

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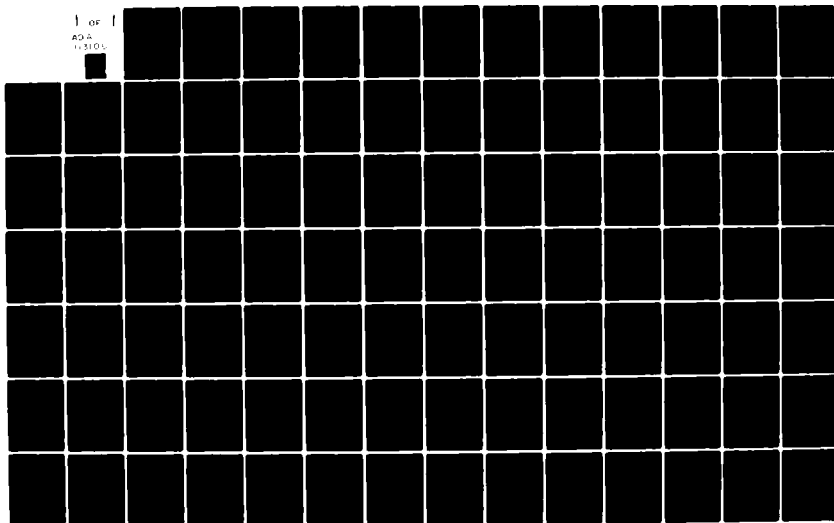
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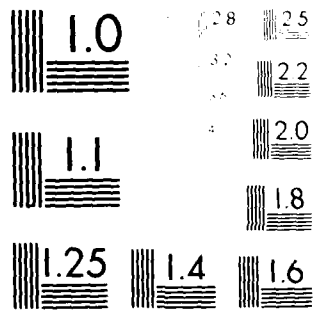
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THE DEVELOPMENT AND SUPPORT OF THE
NATO PROJECT OPAQUE U.S.A.F. SYSTEM
CONTROL PROGRAMS

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Final Report
1 July 1976 through 30 June 1978
30 December 1978

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20. ABSTRACT (continued)

files for producing time plots, histograms and tables. These files are available for subsequent repacking into the OPAQUE data bank format.

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We also wish to thank Dr. Robert W. Fenn and Mr. Eric P. Shettle, OPA Contract Monitors, for providing the challenge and the technical assistance in developing solutions to the problems of dealing with large data bases.

INTRODUCTION

This report describes the control programs that have been developed to edit, process, and analyze the digital data tapes produced at the U.S. Air Force Project OPAQUE¹ Field Station located in Meppen, Federal Republic of Germany (abbr. F.R.G.). The objective of Project OPAQUE is to gather continuous data from a series of measurements in the visible and infrared regions for a period of two years or more. The requirement for continuous measurement of the experimental parameters has resulted in the design of a microprocessor-controlled, automated field station that samples and records the digital data on magnetic tape. The time span involved and the corresponding volume of data generated has created a large data base that must be accessed, processed, and analyzed by the experimenters.

Early in the design cycle, the ULowell Research Team set forth the following objectives based on the large volume of data collected and the number of researchers that would require access to that data:

1. All programs should be developed for both interactive and batch modes of processing. This is to allow access and processing from the ULowell remote location or from any terminal connected to the Cyber 74/74 System Computer at A.F.G.L.
2. The user should have a reasonable measure of control over output formats, search, and edit procedures.
3. Along with the customary features of tabulating or plotting data points, some additional methods of presentation should be provided to allow visual interpretation of long-term performance. This capability is deemed useful in all phases of processing and in the determination of the reliability factors to be assigned the data provided to the data bank.

1. Fenn, R. W. (1978) OPAQUE, Vol. 1, AFGL-TR-78-0011

4. The programming language to be utilized is FORTRAN, and all subprograms are to be developed as "stand-alone" routines. This approach allows subprograms developed in one application to be used in other cases where the same algorithm is needed.
5. User access to the available programs should be through a simple control language. The control language chosen is one that has been developed by Prof. Robert J. Dirkman at the University of Lowell. Although the initial intent was to incorporate all programs in a system package, linked through this common control language, the core memory requirements for such a system dictate against doing so.

Using the objectives stated above, a number of programs have been developed and made operational on the A.F.G.L. Cyber 74/74 Shared Computer System. These programs are grouped according to the following functions:

Tape Editing and Tape Error Analysis

Raw Data File Generation

Sensor Performance and Analysis

Data Searching Procedures

Data Stripping into Minute, Second, and Four Second Data Files

Generation of the OPAQUE Data Bank Files

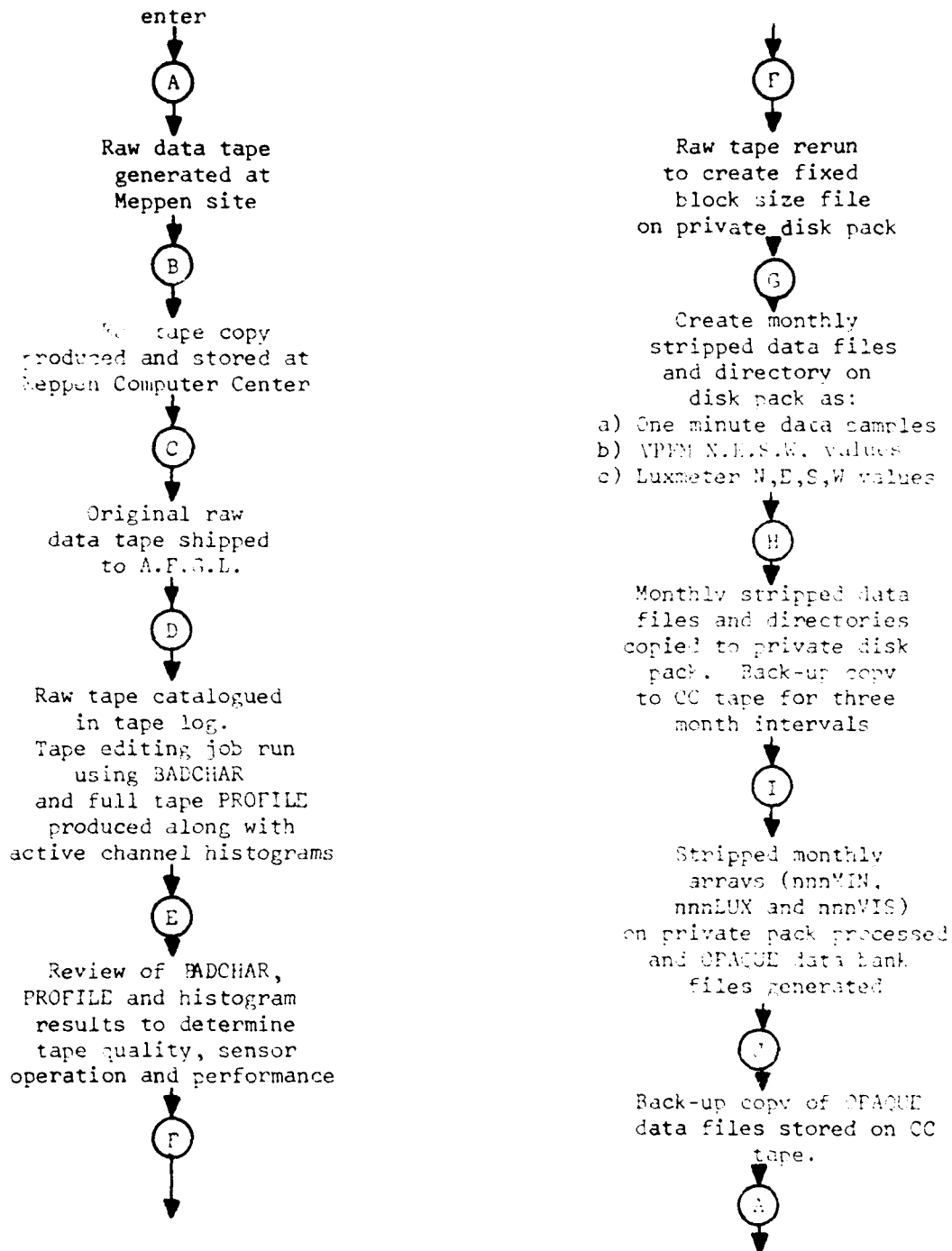
Data Plotting and Data Selection Display

It should be noted that the original program design was carried out on the ULowell Computer Facilities, which use the KRONOS operating system, after which they were transferred and made operational on the A.F.G.L. Computer System, which operates under the SCOPE operating system. All source programs are coded in FORTRAN and can be configured to operate in either batch or interactive mode. This report will emphasize the batch mode of operation as currently installed at A.F.G.L.

I. Overview of OPAQUE Data Processing Procedure

The accompanying flowchart, Figure I.A, shows the sequential processing steps that are performed on the OPAQUE data. The following comments are keyed to this figure using a letter code relating the comment line to the flowchart segment under discussion. Steps A through F are discussed in Part I, which describes the tape pre-processing phases; i.e., the raw data file generation and the sensor performance and analysis. Steps G through J are discussed in Part II, which describes the data searching and stripping procedures, generation of the OPAQUE data bank files, along with the plotting, selection, and display procedures.

- A The sequence starts with the generation of a raw data tape on the system data logger at the U.S. OPAQUE site at Meppen, F.R.G. The data logger characteristics are given in Section I.1, and the raw data tape format is described in Section I.2.
- B A back-up copy of the raw data tape is produced and stored at the Meppen Test Range Computer Center at Meppen, F.R.G. The back-up tape copies are retained until it is determined that the original raw data tape received at the Atmospheric Optics Branch is of usable quality. A raw tape processing program was developed and made operational by ULowell on the Meppen Computer Center TR-4 computer to strip out and dump selected raw tape hexadecimal blocks in display code. This program is described in Section I.3.
- C The raw data tapes are air mailed to A.F.G.L. with the ULowell research team maintaining the raw tape data bank. The raw tape data log is given in Section I.4.
- D Upon receipt at A.F.G.L., each raw data tape is edited to determine the



OPAQUE Data Processing Sequence - Figure I.A

quality of the data recording, viz, the number of invalid hex characters, the number of data and time word format errors, the number of block size errors, and end-of-record (EOR) and end-of-file (EOF) mark errors. The data tape utility program ILLCHAR, described in Section I.5 is used to perform this analysis. The data file is rewound and the sensor performance program STRPHEX is executed. The output of STRPHEX is a coded presentation that displays each active data channel over the complete time interval of the raw data tape, usually three days. In addition, STRPHEX can also produce a histogram plot for each active data channel for the raw tape duration. A complete description of STRPHEX is given in Section I.6.

- E The printouts produced by BADCHAR and STRPHEX are reviewed to identify potential problem areas in the data stripping and sequencing phases. Analysis of the STRPHEX outputs assists in determining current sensor status and operational values.
- F The raw data tape is rerun and the program BLOCK produces a data file of uniform block sizes on the private disk pack, MDATA1. Four consecutive raw data tapes are blocked and loaded to the disk pack for additional processing. A discussion of the program BLOCK can be found in Section I.7. It should be noted that the raw tape or the disk pack raw data file can be rerun with the program STRPHEX to obtain "quick-look" plots of selected sensor voltage outputs or sensor data frequency of occurrence.
- G The next phase involves stripping the one minute samples from the raw data disk files on the disk pack MDATA1 and packing and formatting these samples into the monthly minute files on system storage. Entries are made into the associated minute file directory regarding the time, date, and duration and file address of each raw data entry. An overview of the data stripping and file generation process is given in Part II.

The one minute data channel stripping program, NEWSTRIP, is described in Section II.1. A similar procedure is used to strip the four second illumination data from the Luxmeter into the monthly Luxmeter file and directory using the program STRPLX described in Section II.2. The Variable Path Function Meter (VPFM) data are also stripped from the raw data files on a monthly basis using the program STRPVS, which is described in Section II.3. To assist in the user interface with the program packages, a JOB control card procedure file has been developed for each of the three stripping operations above, named MINSTRIP, LUXSTRIP, and VISSTRIP. These procedure files contain the appropriate SCOPE control cards stored sequentially and executed by a control card call to the procedure file. The contents of the monthly stripped data files and their associated directories can be audited, depending on the file contents, using one of the status procedure files FILESTAT, LUXSTAT, or VISSTAT.

- H As each of the three types of monthly stripped data files is completed, it is copied onto the private disk pack, LOWELL, along with its associated directory. When three consecutive months of data has been stripped and loaded onto the private disk pack, a back-up copy of the contents of the private pack is made to a CC tape.
- I The stripped monthly data files are processed to produce the OPAQUE data bank formatted files using the programs ERIK, ERKLUX, and ERKVIS, which are described in Section II.5. The OPAQUE data bank files are stored on system disk storage and made available to the A.F.O.L. SU group for insertion of the associated meteorological and data reliability figures. The completed OPAQUE data bank files are then recorded on magnetic tape and sent to the data bank in the U.S. It should be noted that the stripping programs also can generate plots and histograms in scientific units from the stripped data files created in step H. These capabilities are described in Section II.4 below.

J A back-up copy of the OPAQUE data bank files is stored on CC tape for future use.

A The sequence is then repeated for additional raw data tapes.

The sequence described above was designed to handle the raw data tapes on either a production basis or a single tape job run using system procedure files that load and execute the appropriate main program and the required subprograms.

I.1 DATA LOGGER SYSTEM

The Data Logger System used in the collection, formatting, and recording of the data sensor outputs was designed and developed at A.F.G.L. based on an Intel 8008 microprocessor. The basic system consists of: eight program-controlled input ports, eight program-controlled output ports, a fourteen bit address bus, an eight-bit buffered data bus, 2,256 bytes of RAM and 256 bytes of PROM memory, along with a microprocessor controlled IEEE-488 programmable interface bus. The basic design criteria used was to retain complete system control in the memory-resident software control algorithm to allow maximum flexibility in sensor sampling time, sequencing, data formatting, and recording.

The processor communicates with the experimental instrumentation and the system peripherals (i.e., the teletype, the magnetic tape recorder, the system time/day clock, and the analog-to-digital converter) through the eight line, bidirectional, buffered data bus. Digital information is provided to the microcomputer in groups of eight bits, each bit being two-valued; i.e., 1 or 0. These groups of 8-bits constitute a byte, and provisions are made in the design to accept eight separate data input sources (called INPUT ports). These input sources can represent either STATUS information (i.e., the current state or phase of operation) or DATA from an external device.

In turn, the microcomputer can send out 8-bit bytes on the data bus and latch or store these bytes in any of the eight OUTPUT registers. The bytes stored in these output registers represent either a COMMAND or a DATA byte to the external devices.

The functional block diagram in Figure I.1.A shows the data logger with its eight INPUT ports and the eight OUTPUT registers. From this figure one

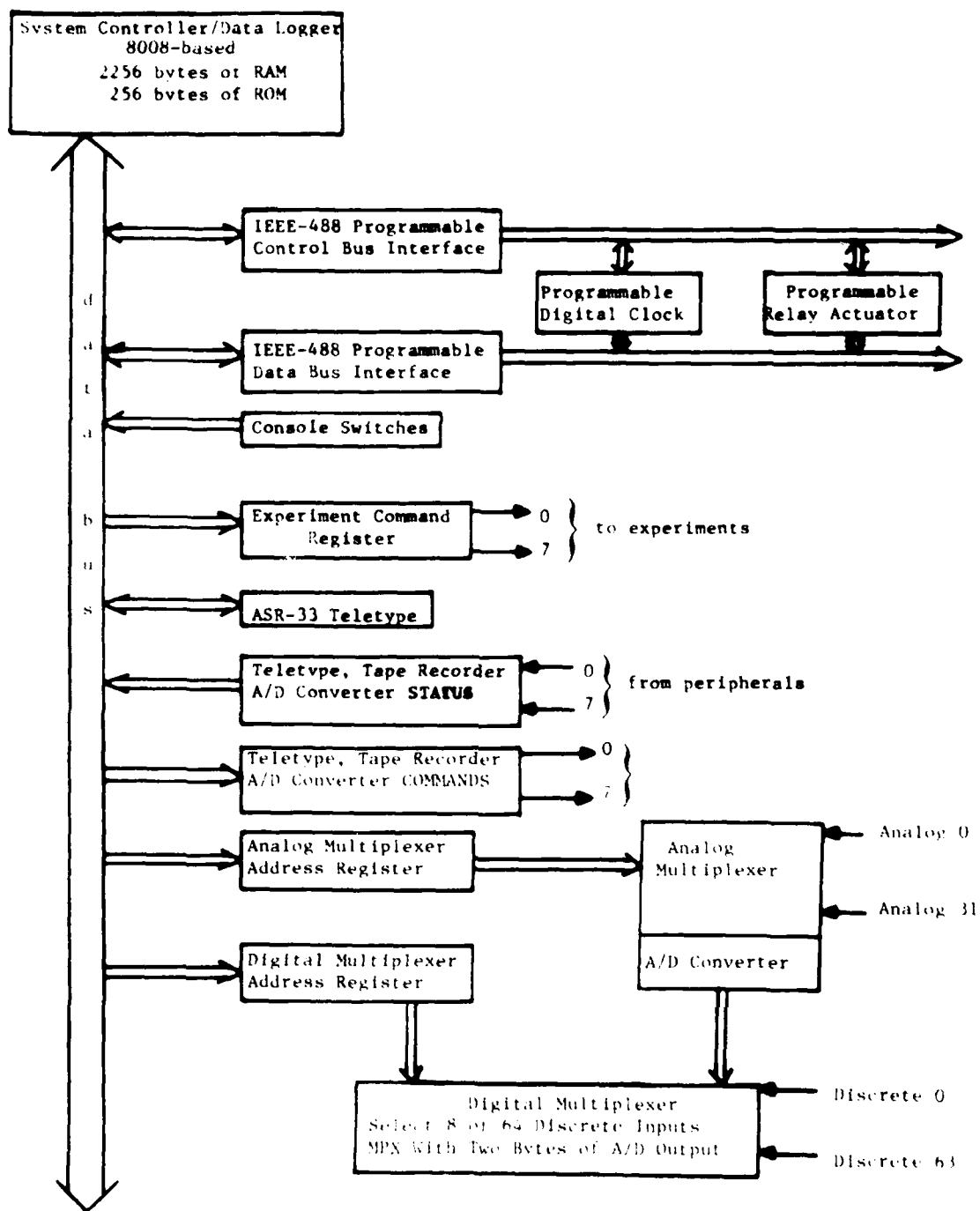


FIGURE I.1.A. DATA LOGGER FUNCTIONAL BLOCK DIAGRAM

can note that the microprocessor can provide a mapping of the eight input bytes onto the eight output registers. The dominant aspect of the figure is that the microprocessor forms the "link" between the INPUT ports and the OUTPUT registers. Thus, through the use of the appropriate control program (software, stored in memory) the microprocessor can "link" any INPUT port to any OUTPUT register(s), determine the STATUS of any connected, external device, or issue a COMMAND to any external device. As all data bytes pass through the processor from INPUT to OUTPUT, additional control operations, such as data formatting, can be performed on data bytes while passing through the data logger.

The central role that the processor plays is its ability to test for the current STATUS of a given device, the ability to accept DATA from a device, the ability to COMMAND a device to perform a specific operation or function, and to provide DATA to a specific device, all under the control of a program demonstrates the power of a software control structure. Essentially, one writes a short program to control each and every device connected to the data logger. These control programs are tailored to the characteristics of the devices and form the software control interfaces. The hardware portion of the interface resides in the device assigned INPUT port(s) and OUTPUT register(s).

In summary, the concept of separating the control structure into its hardware and software segments yields considerable flexibility and versatility to the data logger design. Although only eight INPUT ports and eight OUTPUT registers are currently provided, additional ports and registers can be added by providing the necessary hardware and the software control programs.

Data Sampling, Sequencing, and Format Control Programs

The data logger design, being microprocessor based, separates the control structure into hardware and software segments. The hardware segment provides eight programmable input ports and eight programmable output ports. The input ports allow entry of digital information from sources external to the data logger representing either STATUS information or DATA. The output ports provide either COMMAND information or DATA to external devices. In its simplest form, the data logger provides a mapping of the eight input ports onto the eight output ports. The control programs necessary to perform this mapping reside in a 2K random access memory in the data logger.

The flowchart given in Figure I.1.B shows the sequential control structure used to implement the software portion of the design algorithm. The flexibility of the design is retained through the use of a short MAIN program that calls the modular subprograms in the order shown. All data input and output operations are in the programmed I/O mode with reserved memory buffer areas available to the control program segments. The algorithm is cyclical in operation and runs continuously under the control of system STATUS "flags". These one bit signal lines are monitored by the program and cause system WAIT or system HALT, depending on the monitored signal. HALT conditions are typically END-of-TAPE, peripheral not READY, etc.

The data logger dynamic performance can be monitored through the switch-programmable panel display in octal or decimal digits and through the use of the utility program, QLOOK, that produces an ASCII formatted printout on the teletype of the most recent 256 hexadecimal data bytes written to the magnetic tape.

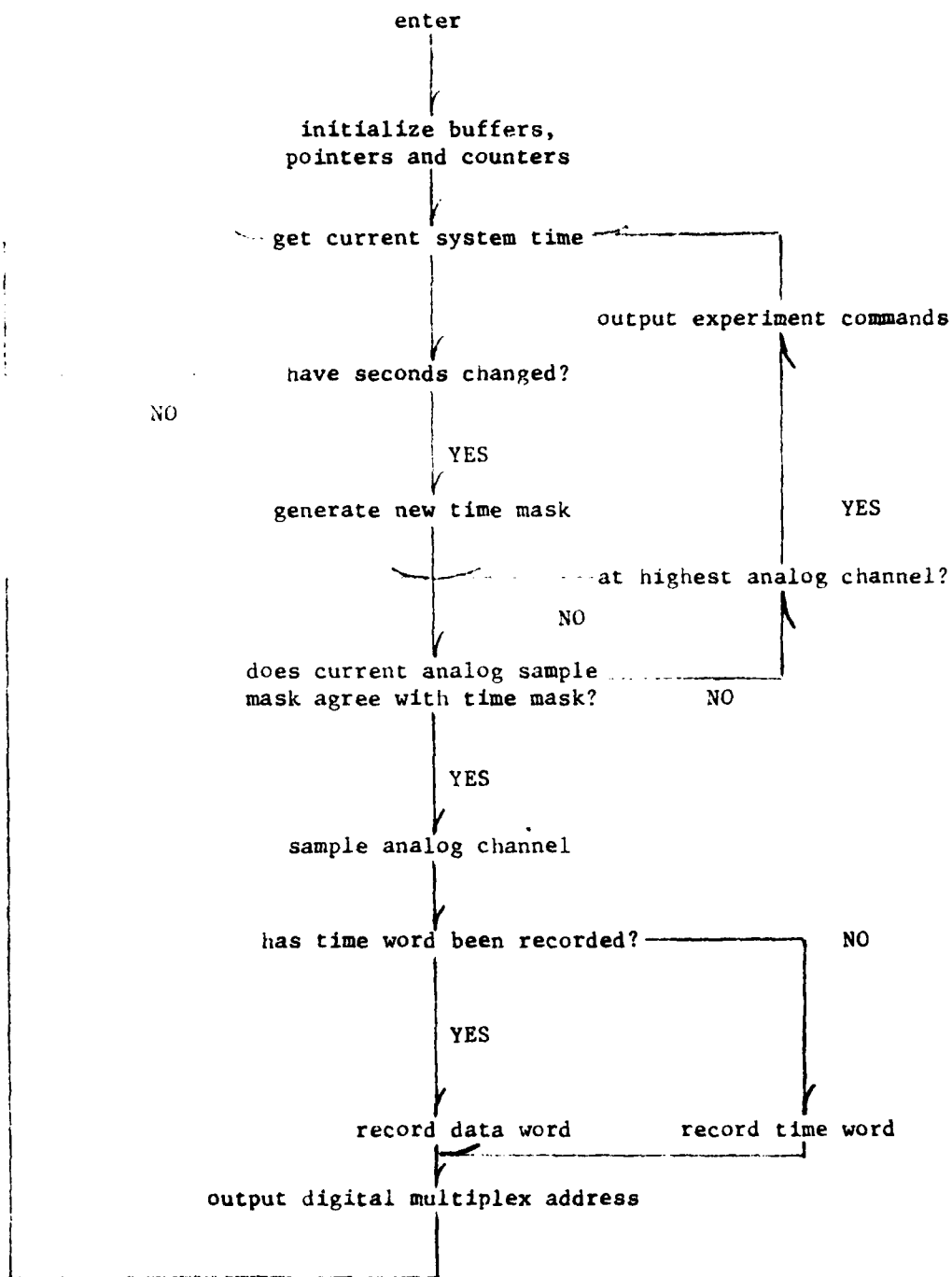


FIGURE I.1.B Data Logger Control Algorithm

Based on the NATO/OPAQUE data sampling rates and frequency, a complete set of control programs has been designed and developed. A combination memory map and listing of the programs that are currently operational at the Meppen Field Station is given below.

<u>Page</u>	<u>Address</u>	<u>Name</u>	<u>Function</u>
0	70-212	MAIN	The primary control sequence program
0	250-333	CH Test	Analog channel service program
1	200-312	TIME	Stores time values and determines one second and one minute time changes
1	000-162	CLOCK	Control program for HP Interface Bus addresses and reads digital clock
1	320-367	TPTFMT	Time Print/Record Format Control
2	000-017	TYMSYN	Determines four second, ten minute, and thirty minute intervals
2	070-113	STCK	Determines status of magnetic tape recorder
2	030-150	SCANSEC	Determines odd or even hour
7	100-112	LUXSEC	Detects four second intervals
7	150-177	LUXLOG	Synchronizes second counter to minute time changes
2	140-177	BLKSZ	Fixes block size of digital data recorded on tape
2	200-222	MRCDR	Controls the operation of the magnetic tape recorder
2	260-302	SHIFT	Controls the circular shifting of a twelve byte array-variable number of shifted positions
2	320-377	PACKER	Stores eight or six-bit ASCII values in BCD form
3	000-025	DPTFMT	Data Print/Record Format Control
3	100-140	HOUSE	Discrete channel control array
3	300-340	REQST	Analog channel control array
4	000-061	DIGMUX	Digital Multiplex control program
4	200-303	CLEAR	System initialization program
7	210-240	QLOOK	Prints last 256 analog channel samples on system teletype in ASCII
6	200-243	MIN	Outputs one minute commands to system experiments
6	100-122	CRLF	Carriage return/line feed control for the teletype

<u>Page</u>	<u>Address</u>	<u>Name</u>	<u>Function</u>
4	100-133	TWTFMT	Time word format control programs
4	140-162	DWTFMT	Data word format control program
5	000-047	BINLD	Binary loading routine for system generated paper type
5	100-163	PDUMP	Program to punch paper tape
5	200-247	PROGIN	Keyboard input routine
5	300-372	MDUMP	Program to print in ASCII
6	000-062	PNTBIN	Conversion program, octal to ASCII
6	250-267	BLKCTR	Taper recorder block counter program
6	300-357	INSTIN	Enter machine instructions from keyboard to memory
7	000-032	LOADER	Binary tape loading routine
7	050-060	LDLINK	Linking routine, used with QLOOK
7	242-273	XFER	Array transfer and format program
7	300-341	ADTEST	Analog channel address and display program
7	342-372	ENDE	Terminates recording at the end of the current block

The programs QLOOK, BINLD, PDUMP, MDUMP, INSTIN, ADTEST, and ENDE are utility Programs used for modification, testing, and diagnosis.

I.2 Raw Data Tape Format

The data recording format used consists of a time word followed by the data words for all channels to be sampled at that time. The asynchronous channel sampling used results in data word strings of various lengths. Each data channel can be programmed such that it is sampled at one or more of the following rates:

each minute, continuously

each minute for the first ten minutes of each hour

each second for the first ten minutes of each hour

each second for the first thirty minutes of alternate hours

every four seconds, continuously

Other sampling rates can be programmed as required.

A typical sample time string is given below where the three characters, ???, signify the start of a time word and the character, = , signifies the start of a data word.

```
???345120155 = 11007954 = 12006316 = 13006156 = 31457172 = 32466008 = 33464002
= 34466296???
345120156 = .....
```

As detailed in Table I.2.A, the day, hour, minute, and second value in the sample above is day 345 and time 12:01:55. The channel number appears after the data word sync/separator character, = . The channels in the sample above are 11, 12, 13 (VPFM samples), and 31, 32, 33, 34 (Scanning Nephelometer samples). This sample string is followed by the next time word given as day 345 at 12:01:56 and the next string of data words separated by the = character. The example above is generated from the packed, hexadecimal raw tape where the hex codes are converted to display codes. When originally installed, the data logger was programmed to

to record a packed 6-bit ASCII subset code but was reprogrammed for the 4-bit hexadecimal codes to conserve magnetic tape.

A detailed description of the data channel assignments, sampling rates, and the data word field use is given in Table I.2.A.

TABLE 1.2.A

Raw Data Tape Formats

Time Word Format - twelve 4-bit Hex characters as

???dddhhmmss where ??? identifies the start of a time word
 ddd is day of year
 hh is hour of day
 mm is minute of day
 ss is second of day

The time word identifies the start time of the analog data channel sampling sequence.

Data Word Format - nine 4-bit Hex characters as

=ccddaaaa where = identifies the start of a data word
 cc is the analog channel number
 dd is the discrete channel value
 aaaa is the number of "counts", proportional to the
 analog voltage input

Instrument Sampling Rates

The various sensors are sampled at one of the following rates:

every minute, continuously
 every minute for the first ten minutes of the hour
 every second for the first ten minutes of the hour
 every four second, continuously
 every second for the first thirty minutes of alternate hours

The standard OPAQUE reporting period is the first ten minutes of every hour. As indicated above, many of the sensors are sampled through the whole hour, and these non-OPAQUE samples will be reported separately.

<u>INSTRUMENT</u>	<u>DATA WORD FORMAT</u>		<u>SAMPLE RATE</u>	<u>SENSOR/OUTPUT</u>
MRI	=0000mnnn		1 minute, cont.	Channel 1
NEPHELOMETER	=0100mnnn		1 minute, cont.	Channel 2
(before Apr.78)	=0200mnnn		1 minute, cont.	Channel 3
	=0300mnnn		1 minute, cont.	Channel 4
AEG POINT	=0000mnnn		1 minute, cont.	Channel 1
VISIBILITY METER				
(after Mar. 78)		0=Run		
ELTRO VISIBLE	=04xgmnnn	g =		
TRANSMISSOMETER		1=Cal	1 minute, cont.	Transmission
NIGHT PATH	=0500mnnn		1 minute, cont.	Filter
RADIANCE METER	=0600mnnn		1 minute, cont.	Radiance
	=0700mnnn		1 minute, cont.	Range

INSTRUMENT	DATE WORD FORMAT		SAMPLE RATE	SENSOR/OUTPUT
VPFM	=1100mnnn		1 second/10 min	Photo Meter
	=1200mnnn		1 second/10 min	Azimuth
	=1300mnnn		1 second/10 min	Filter Position
LASER NEPHELOMETER	=1400mnnn		1 minute, cont.	RAF
	=1500mnnn		1 minute, cont.	Power Meter
	=1600mnnn		1 minute, cont.	Angle
	=1700mnnn		1 minute, cont.	Life
TURBULENCE (500 m BARNES IR TRANS.)	=20xfmnnn	0		
		f = 1	filter	
		2	position	1 minute, cont.
		3		D.C. Signal
BARNES (500m) IR TRANS.	=21xfmnnn	0		
		f = 1	filter	
		2	position	1 minute, cont.
		3		Transmission
BARNES (1500m) IR TRANS.	=22fxmnnn	0		
		f = 1	filter	
		2	position	1 minute, cont.
		3		Transmission
RAIN Gauge	=2300mnnn		1 minute, cont.	Rain Level
ILLUMINOMETER	=24gxmnnn	0	4 seconds, cont.	Vertical Sensor
	=25gxmnnn	g = 1	4 seconds, cont.	Horizontal Sensor
	=26gxmnnn	3	4 seconds, cont.	Azimuth
SCANNING NEPHELOMETER	=31gfmnnn	0	1 second/30 minΔ	Angle of Rotn.
	=32gfmnnn	g = to	1 second/30 minΔ	Scale Shift
		3		
	=33gfmnnn	0	1 second/30 minΔ	Photo Diode
	=34gfmnnn	f = to	1 second/30 minΔ	Monitor
		7		

<u>INSTRUMENT</u>	<u>DATA WORD FORMAT</u>		<u>SAMPLE RATE</u>	<u>SENSOR/OUTPUT</u>
EPFLEY PYROHELIOMETER	=36xxmnnn	0 g = to gain 3 sun sensor	1 minute, cont.	Direct Channel
	=37gfmnnn	1 f = to filter 9	1 minute, cont.	Filtered Channel

Note: In the data word format, x = do not care, f = discrete filter value,
 g = discrete gain value, m = high order digit of A/D count, and
 n = lower three digits.
 Δ = alternate hours

I.3 Utility Program OPAQUE

The utility program OPAQUE was developed for use on the TELEFUNKEN TR-4 computer system at Meppen. This program is a modification of the function subprograms ICHAR and NDIF and the subroutine DATE used in the main program STRPHEX described in Section I.6. The implementation of this program presented several problems in that the FORTRAN routines BUFFER IN, BUFFER OUT, and SHIFT are non-existent in the TR-4 version of FORTRAN. The program ran correctly on our second try, but turn-around time was quite long due to the machine cycle time.

The final version of OPAQUE allows the user to skip a specified number of tape records and convert the hex characters to display codes and print the next record. The program is used to assist the field personnel in determining the quality of the raw tape and in debugging system problems at the Meppen Computer Center.

I.4 Raw Tape Log

The raw data tapes are sequentially numbered for identification and cataloging purposes. The tape assignment is made at the Meppen field site using the prefix OPA and a three digit number. The raw data tape log is kept on the CYBER 74/74 system file, TAPEFILE, and can be listed out in two formats. The first is a sequential tabulation by OPA tape number giving the starting day of year and hour and the ending day of year and hour. The second format is a yearly mapping of data recordings using the day of month as the ordinate and the month of year as the abscissa with the OPA tape number indicating the daily AM and PM coverage.

The mapping for data year 1976 is given in Figure 1.4.A, the data year 1977 is given in Figure 1.4.B, and the data year 1978 (updated to June, 1978) is given in Figure 1.4.C.

A sample of the sequential tabulation is given in Figure 1.4.D for the current data year 1978.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE I.4.A. TAPE LOG FOR 1976

OPA/MEPPEN TAPE LOG FOR 1976

01JN ON 07/10/78

	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	0	19	0	0	25	26	31	31
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	19	19	0	0	25	26	31	31
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	19	19	0	0	25	26	31	31
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	13	19	19	0	0	25	26	31	31
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	14	19	19	0	0	26	26	31	31
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	14	19	19	0	0	26	26	31	31
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	15	19	19	24	24	26	26	31	31
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	19	24	24	26	26	31	31
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	19	24	24	26	26	31	31
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	19	24	24	27	27	31	31
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	19	24	24	27	27	31	31
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	19	24	24	27	27	31	31
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	24	27	27	31	31
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	24	27	27	31	31
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	24	27	27	31	31
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	24	27	27	31	31
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	25	27	27	31	31
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	21	25	25	28	28	32	32
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	26	29	29	33	33
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	26	29	29	33	33

FIGURE I.4.A. TAPE LOG FOR 1976

	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	33	33	38	38	46	46	53	53	64	64	74	74	84	84	90	90	97	98	104	104	112	112	121	121
2	33	33	38	38	46	46	53	53	65	65	74	74	84	84	90	91	98	98	104	104	112	112	122	122
3	33	33	38	38	46	46	53	53	65	65	75	75	84	84	91	91	98	98	104	104	112	112	122	122
4	33	33	39	39	47	47	54	54	65	65	75	75	85	85	91	91	98	98	104	104	113	113	122	122
5	0	0	39	39	47	47	54	54	66	66	75	75	85	85	91	91	99	99	105	105	113	113	123	123
6	0	0	39	39	47	47	54	54	67	67	76	76	86	86	91	91	99	99	105	105	113	113	123	123
7	0	0	40	40	47	47	56	56	67	67	76	76	86	86	92	92	99	99	105	105	114	114	123	123
8	0	0	40	40	47	47	56	56	67	67	76	76	86	86	92	92	99	99	105	105	114	114	123	123
9	0	0	40	40	47	47	56	56	68	68	77	77	86	86	92	92	99	99	105	105	115	115	124	124
10	0	0	40	40	47	47	56	56	68	68	77	77	86	86	92	92	99	99	105	105	115	115	124	124
11	0	0	41	41	48	48	56	56	68	68	77	77	86	86	92	92	99	99	106	106	115	115	124	124
12	0	0	41	41	48	48	57	57	68	68	78	78	87	87	92	92	99	99	106	106	116	116	124	124
13	0	0	41	41	48	48	57	57	69	69	78	78	87	87	92	92	99	99	106	106	116	116	125	125
14	0	0	41	41	48	48	57	58	69	69	78	78	87	87	92	92	99	99	106	106	116	116	125	125
15	0	0	42	42	49	49	59	59	69	69	79	79	87	87	93	93	99	99	107	107	117	117	125	125
16	0	0	42	42	49	49	59	59	70	70	80	80	87	87	93	93	99	99	107	107	117	117	126	126
17	0	0	0	0	49	49	59	59	70	70	80	80	87	87	93	93	99	99	108	108	117	117	126	126
18	0	0	0	0	50	50	60	60	70	70	80	80	87	87	93	93	99	99	108	108	118	118	126	126
19	0	0	0	0	50	50	60	60	70	70	80	80	87	87	93	93	99	99	108	108	118	118	126	126
20	0	0	0	0	50	50	60	60	71	71	81	81	88	88	94	94	99	99	108	108	118	118	127	127
21	35	35	44	44	50	50	60	60	71	71	81	81	89	89	95	95	99	99	109	109	119	119	127	127
22	0	0	44	44	51	51	61	61	71	71	81	81	89	89	95	95	99	99	109	109	119	119	127	127
23	0	0	0	0	51	51	61	61	72	72	81	81	89	89	95	95	99	99	109	109	119	119	128	128
24	0	0	0	0	51	51	61	61	72	72	82	82	89	89	95	95	99	99	109	109	119	119	128	128
25	0	0	0	0	51	51	61	61	72	72	82	82	89	89	95	95	99	99	109	109	119	119	128	128
26	36	36	45	45	52	52	62	62	72	72	82	82	89	89	95	95	99	99	109	109	119	119	129	129
27	36	36	45	45	52	52	62	62	72	72	82	82	89	89	95	95	99	99	109	109	119	119	129	129
28	36	36	46	46	52	52	62	62	73	73	83	83	90	90	96	96	99	99	109	109	119	119	129	129
29	37	37	0	0	53	53	64	64	73	73	83	83	90	90	96	96	99	99	109	109	119	119	129	129
30	37	37	0	0	53	53	64	64	73	73	83	83	90	90	96	96	99	99	109	109	119	119	129	129
31	37	37	0	0	53	53	64	64	74	74	83	83	90	90	96	96	99	99	109	109	119	119	130	130

FIGURE 1.4.B. TAPE LOG FOR 1977

OPA/MEPPEN TAPE LOG FOR 1978

RUN CN 37/10/78

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM	AM PM
1	0 137	137 137	144 144	151 151	160 150	0 0	0 0	0 0	0 0	0 0	0 0	0 0
2	131 131	137 137	144 144	151 151	161 161	0 0	0 0	0 0	0 0	0 0	0 0	0 0
3	131 131	138 138	144 144	151 152	161 161	0 0	0 0	0 0	0 0	0 0	0 0	0 0
4	131 131	138 138	145 145	152 152	161 161	0 0	0 0	0 0	0 0	0 0	0 0	0 0
5	131 131	138 138	145 145	152 152	162 162	0 0	0 0	0 0	0 0	0 0	0 0	0 0
6	132 132	139 139	145 145	152 152	162 162	0 0	0 0	0 0	0 0	0 0	0 0	0 0
7	132 132	139 139	145 145	153 153	162 162	0 174	0 0	0 0	0 0	0 0	0 0	0 0
8	132 132	139 139	145 145	153 153	163 163	174 174	0 0	0 0	0 0	0 0	0 0	0 0
9	132 0	139 139	146 146	153 153	163 163	174 0	0 0	0 0	0 0	0 0	0 0	0 0
10	0 0	140 140	146 146	154 154	163 163	0 0	0 0	0 0	0 0	0 0	0 0	0 0
11	0 0	140 140	146 146	154 154	163 163	0 0	0 0	0 0	0 0	0 0	0 0	0 0
12	133 133	140 140	146 146	155 155	164 164	0 0	0 0	0 0	0 0	0 0	0 0	0 0
13	0 0	140 141	146 146	155 156	164 164	0 0	0 0	0 0	0 0	0 0	0 0	0 0
14	0 0	141 141	147 147	156 156	164 164	178 178	0 0	0 0	0 0	0 0	0 0	0 0
15	0 0	141 141	147 147	156 156	164 164	178 178	0 0	0 0	0 0	0 0	0 0	0 0
16	0 0	141 141	147 147	156 156	164 165	179 179	0 0	0 0	0 0	0 0	0 0	0 0
17	0 0	142 142	148 148	157 157	165 165	179 179	0 0	0 0	0 0	0 0	0 0	0 0
18	0 0	142 142	148 148	157 157	165 165	179 179	0 0	0 0	0 0	0 0	0 0	0 0
19	0 134	142 142	148 148	157 157	166 166	180 180	0 0	0 0	0 0	0 0	0 0	0 0
20	134 134	142 142	148 148	157 158	166 166	180 180	0 0	0 0	0 0	0 0	0 0	0 0
21	134 134	143 143	148 148	158 158	166 166	180 180	0 0	0 0	0 0	0 0	0 0	0 0
22	134 134	143 143	148 148	158 158	166 167	180 180	0 0	0 0	0 0	0 0	0 0	0 0
23	135 135	143 143	149 149	158 158	167 167	180 0	0 0	0 0	0 0	0 0	0 0	0 0
24	135 135	143 143	149 149	159 159	167 167	0 0	0 0	0 0	0 0	0 0	0 0	0 0
25	135 135	143 143	149 149	159 159	167 167	0 0	0 0	0 0	0 0	0 0	0 0	0 0
26	135 135	143 143	149 149	159 159	168 168	0 0	0 0	0 0	0 0	0 0	0 0	0 0
27	136 136	143 144	149 149	159 159	168 168	0 0	0 0	0 0	0 0	0 0	0 0	0 0
28	136 136	144 144	150 150	160 160	168 168	0 0	0 0	0 0	0 0	0 0	0 0	0 0
29	136 136	0 0	150 150	160 160	168 168	0 0	0 0	0 0	0 0	0 0	0 0	0 0
30	137 137	0 0	150 150	160 160	170 170	0 0	0 0	0 0	0 0	0 0	0 0	0 0
31	137 137	0 0	151 151	0 0	170 170	0 0	0 0	0 0	0 0	0 0	0 0	0 0

FIGURE 1.4.C. TAPE LOG FOR 1978

OPA No.	BEGIN DAY	BEGIN HR	END DAY	END HR
131	2	9	6	5
132	6	8	9	11
133	12	12	12	15
134	19	21	23	10
135	23	10	27	5
136	27	9	30	9
137	30	9	34	6
138	34	8	37	9
139	37	9	41	9
140	41	9	44	13
141	44	13	48	8
142	48	8	52	13
143	52	14	58	12
144	58	13	63	10
145	63	11	68	8
146	68	9	73	11
147	73	11	76	9
148	76	10	82	8
149	82	10	87	9
150	87	10	90	9
151	90	10	93	14
152	93	14	97	9
153	97	9	100	9
154	100	9	102	10
155	102	10	103	13
156	103	13	107	9
157	107	9	110	14
158	110	15	114	9
159	114	9	118	5
160	118	8	122	3
161	122	9	125	8
162	125	8	128	13
163	128	14	132	9
164	132	9	136	1
165	136	13	139	9
166	139	9	142	9
167	142	14	146	5
168	146	8	149	13
169	0	0	0	0
170	150	14	151	14
171	0	0	0	0
172	0	0	0	0
173	0	0	0	0
174	158	13	160	9
175	0	0	0	0
176	0	0	0	0
177	0	0	0	0
178	165	9	166	14
179	167	8	170	9
180	170	9	174	5

FIGURE I.4.D. DATA TAPE LISTING, JANUARY-JUNE, 1978

I.5 UTILITY PROGRAM ILLCHAR

The program ILLCHAR determines the total number of invalid hex characters per tape record, the total number of invalid characters over the recorded length of the tape, the total number of all characters recorded, and the percent error. The program also detects changes in tape record sizes, which for a perfect tape remains fixed at 3060 characters per record. This program can be used in two modes of operation. The tally mode accumulates the total number of records read, the total number of bad characters, the total number of characters read, and the total number of records with bad characters. Any change in record size is printed out along with the record number at which the size changed. This mode is used to determine the quality of the raw data tape and assists in determining the amount of preprocessing required by a given data tape.

The second mode of operation allows a more detailed analysis of the characters in error by printing the location within the record and the invalid character codes as : ; < > . A raw dump of the tape in the region about the illegal character allows the user a means to correct the character. A modification to this mode checks the data format on the tape as being one of the two allowed patterns; i.e., the twelve character time tag sequence or the nine character data value sequence. This mode of operation is intended for interactive use.

This program package allows data recovery procedures useful in those cases where a character is incorrectly recorded and/or reproduced. It is also a necessary adjunct to the system provided routines for processing stranger types on the Cyber 70 systems at AFGL and Lowell. The flowchart for ILLCHAR is given in Figure I.5.A and a sample of the program output is given in Figure I.5.B.

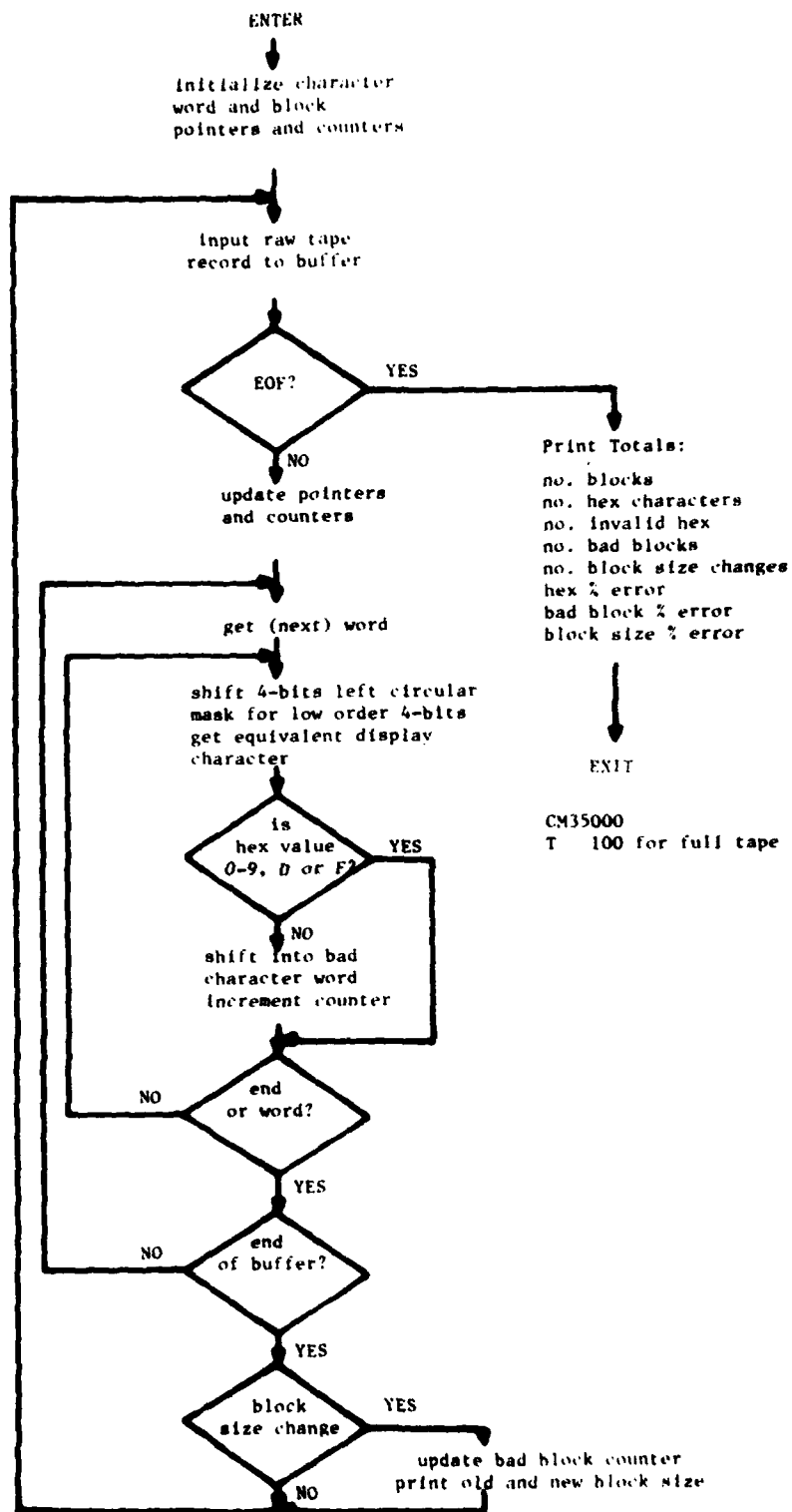


FIGURE I.5.A. FLOWCHART FOR PROGRAM ILLCHAR

TOTAL BLOCKS=120	TOTAL BAD BLOCKS=6	BLOCK PCT. ERROR=5.0
TOTAL NO. CHAR=316710	TOTAL BAD CHAR=21558	PCT. ERROR=6.8
TOTAL BLOCK SIZE CHANGES=90	in 120 BLOCKS	PCT. SIZE ERROR= 75

Figure 1.5.B. Sample Output of ILLCHAR

I.6 Raw Tape Program, STRPHEX

The sensor performance and analysis program, STRPHEX, was developed to process raw data tapes or raw data files and can be executed in either the interactive or batch mode of operation. In the interactive mode, the user can request any available option and then the system prompts the user for the necessary responses. The batch mode requires the use of fixed format control cards that perform the requested system options during the job run.

The options available in STRPHEX are:

1. Print selected portions of a raw data tape (file) converting the 6-bit ASCII or hexadecimal data coding to printer-display characters.
2. Generate a 60 line by 120 column line printer output that summarizes the activity of each analog channel called a PROFILE plot.
3. Collect all the data samples recorded on the raw data tape (file) for up to eight selected analog channels over the specified time interval. The data collected is stored in a program array for use by the remaining three options.
4. Produce a signal voltage vs time plot for all the analog data collected in Option 3.
5. Produce a plot that displays the frequency of data points at their respective analog voltage values within the abscissa time intervals.
6. Produce a histogram plot giving the number of data samples at each signal level for the total time interval selected.

Additional options can be added to this system program by the addition of the required linking program to the main program, STRPHEX, and assigning one of the unused option codes. The operational features of each of the active options is given below, and the general STRPHEX flowchart appears in Figure I.6.A.

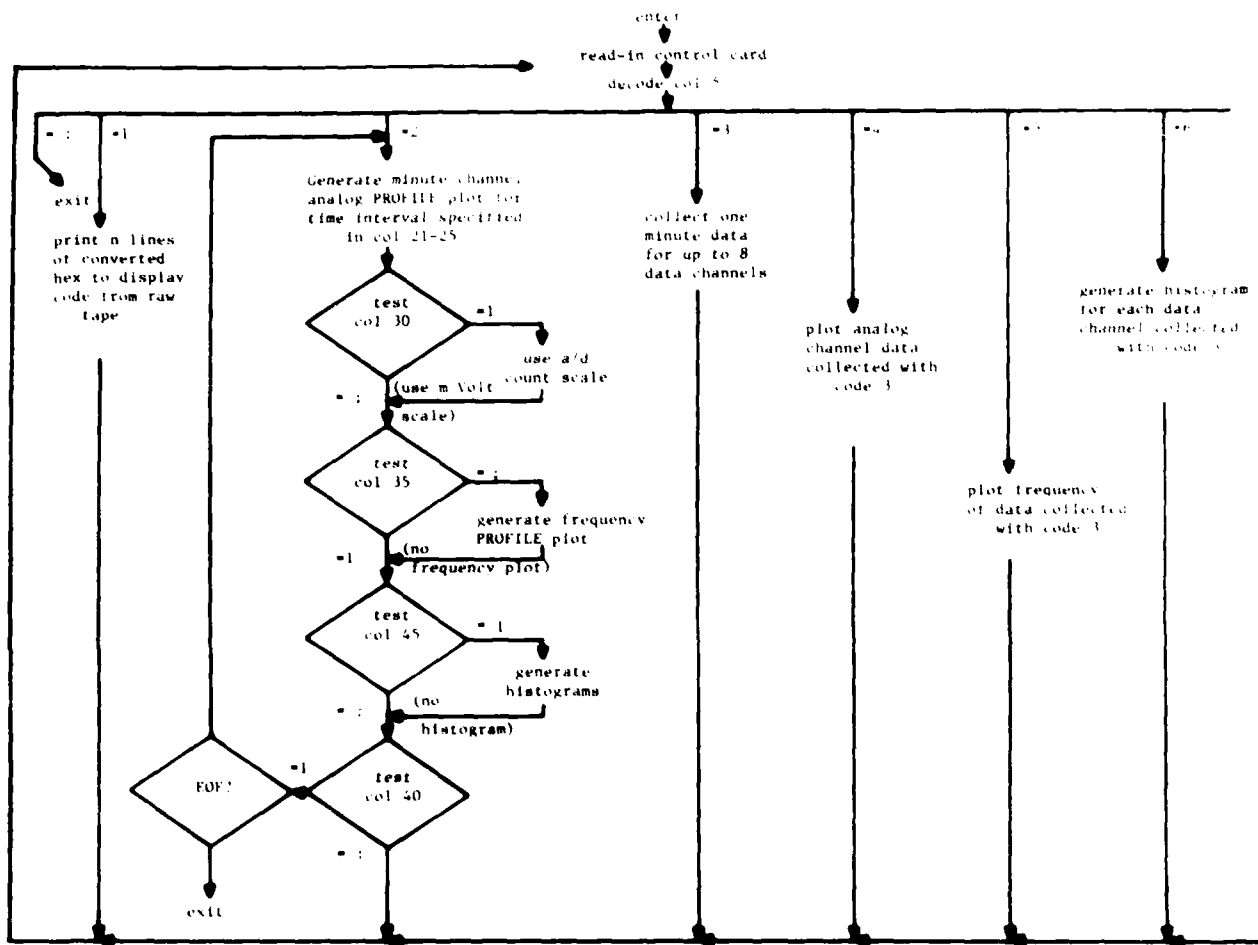


FIGURE I.6.A. FLOWCHART FOR PROGRAM STRPHEX

Option 1, Raw Data DUMP

This option is a utility routine to print out the contents of a data tape (file). The control card allows the data "dump" to start at either the beginning of information, the current tape position, or at a particular time and day on the data tape (file). The user determines the quantity of output and the time duration dumped by specifying the number of lines of output. (See Figure I.6.B).

Option 2, PROFILE Plots

The PROFILE option was developed to meet the need for a compressed form of display of all active sensor channels over time intervals ranging from two hours to over three days. Each of the rows in the plot represents an active sensor channel, and a letter code is used to represent the average of all the one minute data samples collected for the time interval displayed. The conversion for the letter codes representing the user select scale (either millivolts or A/D "counts") is printed below each plot. The time duration represented by each printed letter code is given by the total plot time in minutes divided by 120.

Two useful extremes then are the two hour PROFILE plots and the whole raw tape (file) PROFILE plot. The two hour PROFILES display the sensor outputs on a minute-by minute basis for 120 minutes and yield a detailed analysis method for determining sensor performance. Specifying the total raw tape time duration in minutes yields a single, compressed Profile plot giving all sensor outputs averaged over 30 or 40 minutes per point. This presentation is useful in determining longer-term sensor performance. Intermediate time intervals such as 4, 8, 12, or 24 hours can also be readily produced, the general theme being that the clustering or scattering of the sensor outputs about various values allows one to assess performance and establish short and long term data reliability figures.

The control card for this option allows selection of the starting point for

DUMP CHARACTERS PROGRAM

```

???077100017=00005599<011005869=02005931=03005887=04307526=05306373=06306720
=15006269=16006453=17006400=21312000=23006033<31456595=32456239=33454004=34
12006991=13006163=24324592=25320667=26327383???(77100052=11007775<12006987=
???077100118=11007753=12006978=13006150=24330583=25334660=2633730???<1=<400
=744801 62344<018567??<1=<4004<344401==6704801 64744<01858???(77100150=11
3757???(077100213=11007824=12006975=1300614??<1=<4008674<519=<170<91982674<=
?<1=<0311=11007822=12006973=13006150??<1=<400<8:04401>10744801 5=:44<01851?
0274=0=982030=811010:0=<110003??<1=<0403=11007813=10006981=13006152??=?<4
=988274<=<900174=0=98<43??4<1=98<474<0=985<74<=<910274=0=98<23??<1=<0417=1
8<12006985=1300615??<1=<4011<11007800=12006982=13006155??<1=<40104344401=>
61344<01855??<1=<4014034700181=7404014467408515<<340<1611:030700=0530637
9=14004110=15006269=16006579=17004001=21327071=23006033=314675??<1=<4015174
44801 62744<01858:??<1=<40156344401==744801 6<18006157=24334583=25334481<
38=03005849=04307505=05306369=06307670=07306983<11007765=12006991=13006162=
23006034=31477422=30476004=33474011=34476313=36066118=37064002???(77100627=1
344801 60:44<01855???(77100637=11007784=12006978=1300615??4<51=1034<91=000
5=744<01851??4<51=99 34<91=80474<=1=00174=11=:8<9:??<1=<40196744401==834480
05728=03005847=04307512=05306370=06307680=07307188=11007769=12006982=130061
21=23006034=31476507=32476319=33474004=34476325=36076020=37076003??<1=<401<
1=9344801 6=13006152??<1=<401< 344401=>0:44801 60:44<01854??4<51=94474<91=
006992=13006163???(77100755=11007780=12006999=13006162???(77100846=10007781=1
?<1=<0849=11007767<12006975=13006147???(77100858=11007788=12006982=13006153=
34040144 7408015<=740<0161274307516=05306373=06306187=07307190=11007776=120
04001=21327041=23006033=31477604<91=018:4<=1=00134=11=:8<4:4=82500174=<25800
83=25334491=26336147??<1=<40242744401>12744801 64344<01858???(77100919=110
01 5=744<01851??<1=<4024834<501=24:4<00100674<=0000000000001000??<1=<4024
756=12006990=1300616??<1=<0826=11007784=12006977=13006149=24334572=2533449
<17??<1=<4024 344001===:44801 5>744<01854???(77100939=11007780<12006977=130
1=<40252344401>09344801 5=:44<01851??<1=<0955<11007731=12006988=13006161??
02=24304574=25304500=26304001???(07704053490<115<3474<1140:498<1==83??<1=<40
0<560=25304555=26307664???(77101100=00007363=01004142=02005220=03005706=040
14004131=15004010=16006734=17004007=21306892=23006035=36034174=37034000??=
480<51593494<51657498<5=497??<1=<40488:490<9155:494<91617498<9=10???(771013
4=:4040110434080150=???(77101410<20304570=25319=:498<1<5<3??<1=<405063490<
94<649<26307124???(77101434=243045:494<11923498<1<443??<1=<40550:490<515=:
498<99=43???(77101702=24334588=25334500=26336747???(077101718=243345:494<=124
5666=03005839=04307529=05306371=06306375=07307188=14004127=15004007=1600693
1??<1=<40608:498<575<25304463=26306543???(77101834=243045:494<11153498<194

```

FIGURE I.6.B. RAW DATA TAPE DUMP SAMPLE

the PROFILE plot, specification of the duration of the plot in minutes, the scale to be used in the plot, the optional generation of a histogram for each active data channel, and a PROFILE-type plot giving the number of occurrences of each sensor for the plot abscissa values rather than sensor output values. The options allowed with PROFILE are shown in Figure I.6.A, the STRPHEX flowchart. (See PROFILE Figure I.6.C).

Option 3, Collect Data Routine

The remaining three options utilize a pre-loaded data array that is loaded from the raw data source by the routine, COLLD; i.e., collect data. The control card for this option allows user specified starting time and the duration of the data collection interval in minutes along with the channel numbers (up to eight) for which the data is to be collected. (See Figure I.6.D).

Option 4, Plot Sensor Output

This routine presupposes that COLLD has previously been run to collect the data for the sensor output that is to be plotted. The user can specify the starting time, the time duration of the plot with one or two discrete channels plotted at the top of the display. The plot is automatically scaled based on the minimum and maximum values and allows for the selection of linear or logarithmic scale. (See Figure I.6.E).

Option 5, Plot Sensor Output Frequency Values

As a variation to Option 4, this option produces a plot identical in all respects to Option 4 except that the display characters reflect the time sequence of the data points within the abscissa time increments. It is useful when used with Option 4 to determine the time-ordered sequence of values that are averaged for each point in the sensor output voltage plot. (See Figure I.6.F).

END-OF-DATA-FILE AT C/M/M/C= 112 9 57 1
FROM O/M/P= 108/ 14/ 69/ 70 C/M/M= 112/ 3/ 57/

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	250	500	750	1000	1250	1500	1750	2000	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000					

34.

DATA COLLECTION.	CURVE	CHAN	DISC	POINTS
	1	4	-1	1437
	2	5	0	1437
	3	6	0	1437
	4	7	0	1437
	5	21	0	362
	6	21	1	362
	7	21	2	358
	8	21	3	358

FIGURE I.6.D. SAMPLE DATA COLLECT OUTPUT

Option 6, Histogram Plotting

With this option, the data collected under Option 3 can be used to produce a histogram display for any or all of the sensor outputs stored in Option 3.

The careful reader will note that the Options 4, 5 and 6 all require the previous use of Option 3 to collect the data into a program array. These routines were designed to be used on the raw data for quick editing and preliminary analysis operations. These options are most useful when used on an interactive terminal in the study of selected sensor outputs over limited time durations. (See Figure I.6.G).

The overall program design of STRPHEX is seen in the subprogram linkage diagram given in Figure 1.6.H, where the re-linking and re-use of a small number of routines allows additional options to be easily developed. An example of this approach is the subroutine AUTOGM, which can be linked into the Option 2 PROFILE plots through the control card and also the ability to "parade" through a data source file with a fixed time increment from the beginning to the end of the information.

While the plots produced in Options 4, 5 and 6 are not in scientific units, the inclusion of the instrument calibration programs in STRPHEX as a user selected feature could be provided if deemed necessary.

HISTOGRAM PLOT FOR CHANNEL MET1- 00 WITH 4450 POINTS
 BEGINNING 07/14/69 ENDING 11/2/ 9/67

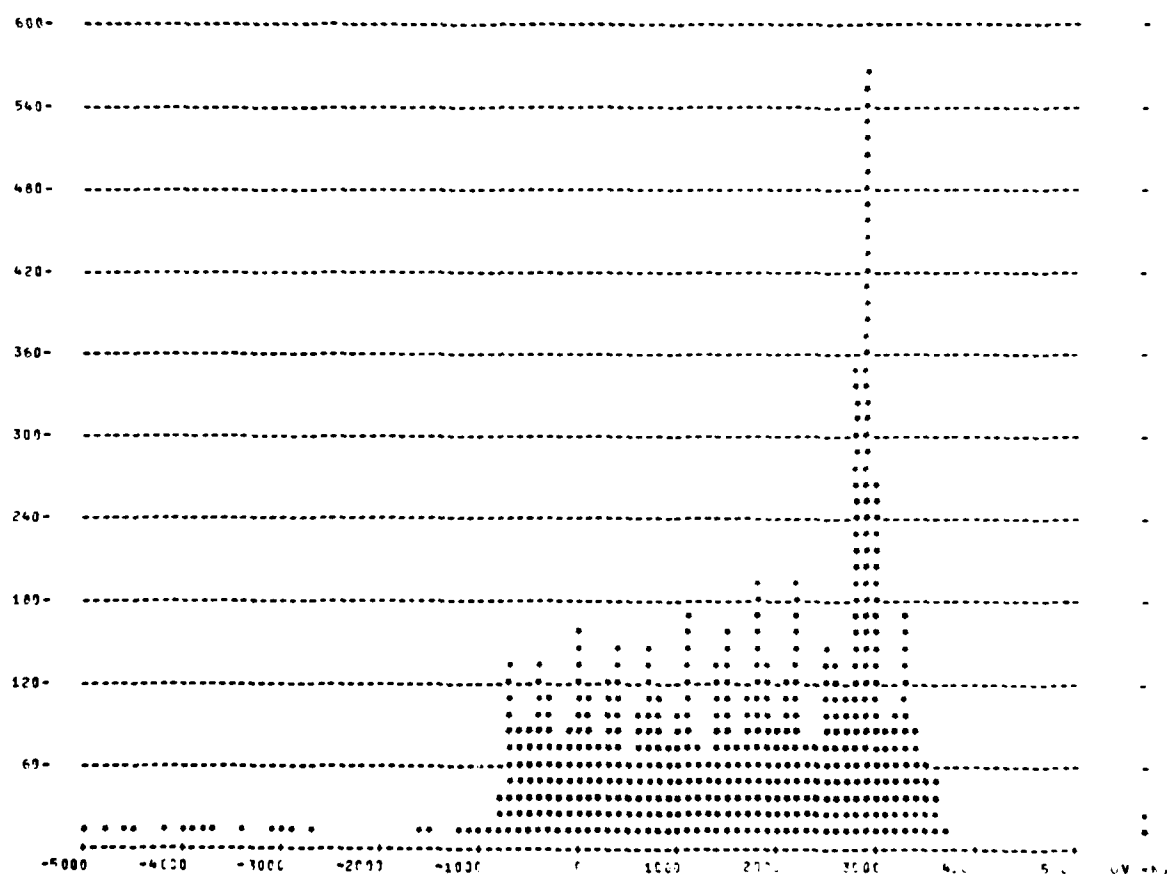


FIGURE I.6.G. HISTOGRAM PLOT FOR 4 DAYS DURATION, SAMPLING NEPHELOMETER DATA

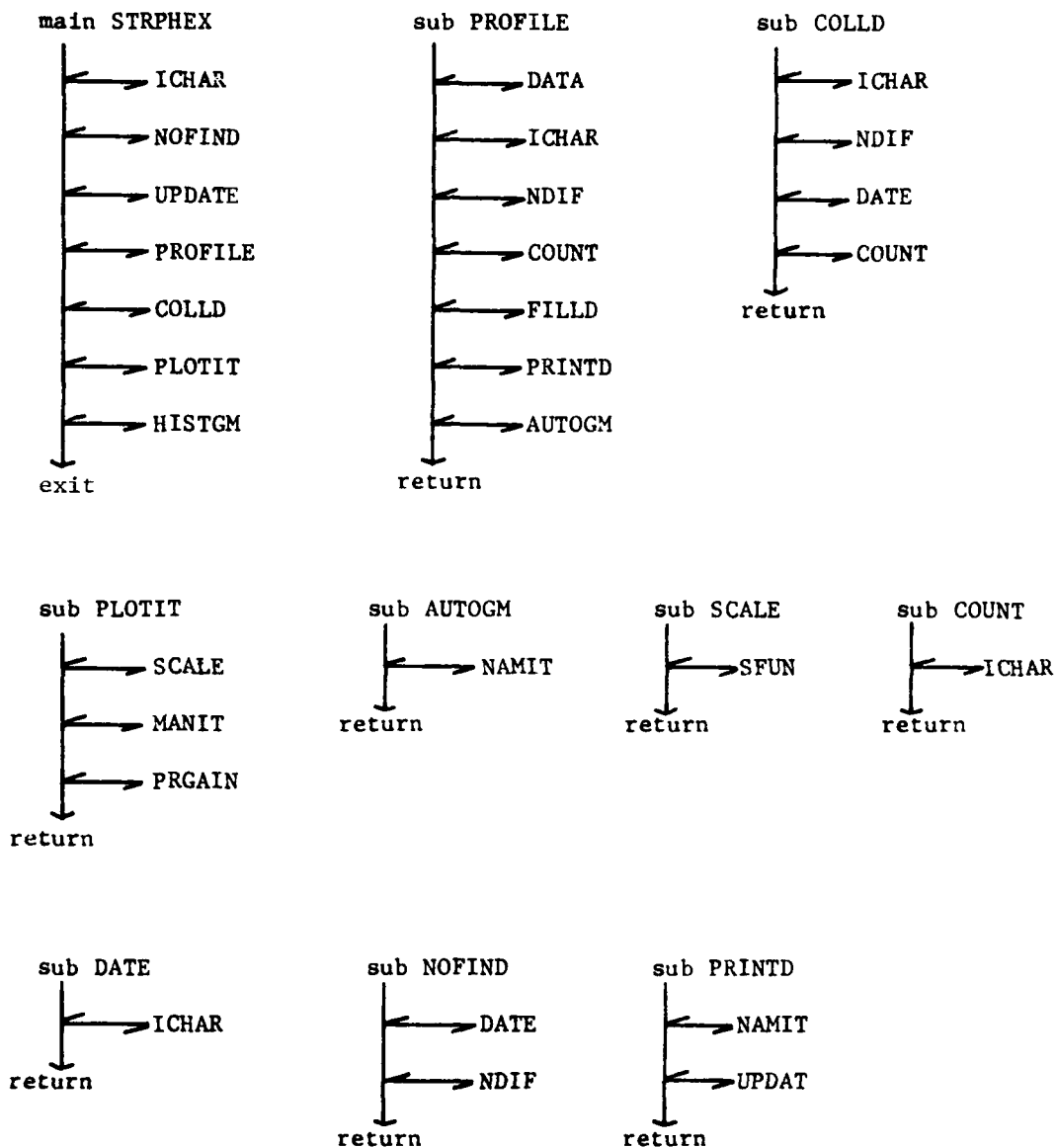


FIGURE I.6.H. STRPHEX Subprogram Linkages

I.7 Utility Program BLOCK

While the data logger system is programmed to produce raw tape records of 3060 hexadecimal characters, records of greater and less lengths are frequently encountered. The tape utility program, BLOCK, was developed to reblock input records of varying lengths into output records of a fixed size. The algorithm used may be likened to two circles, each rotating at a different velocity that transfer tape characters through a storage array. The input raw tape record of tape characters is stored on the periphery of the input circle. The input circle is then indexed to the first character and the record of characters is transferred to the storage array, starting at the next open position in the array. The loading of the tape characters from the input circle to the storage array is interrupted when the storage array has accumulated a fixed number of characters which are then transferred to the output circle. The output circle also interrupts the transfer process when it has received the number of characters determined by the output block size. The fixed block of characters is then transferred from the output circle to the disk-based data file and the process continues. The input circle also interrupts the process when it becomes empty and reads in a new record of raw data to be blocked. The process continues until the end of information mark is detected on the raw data tape files. Character processing is carried out similar to that performed by ILLCHAR, and the program printout indicates the total number of input records read, the total number of output records produced, the total number of input hexadecimal characters, the total number of invalid hex characters and the hex character percent error. This output information is compared to the output of ILLCHAR to determine the reliability of the raw data record blocking process. The flowchart for BLOCK is given in Figure I.7.A.

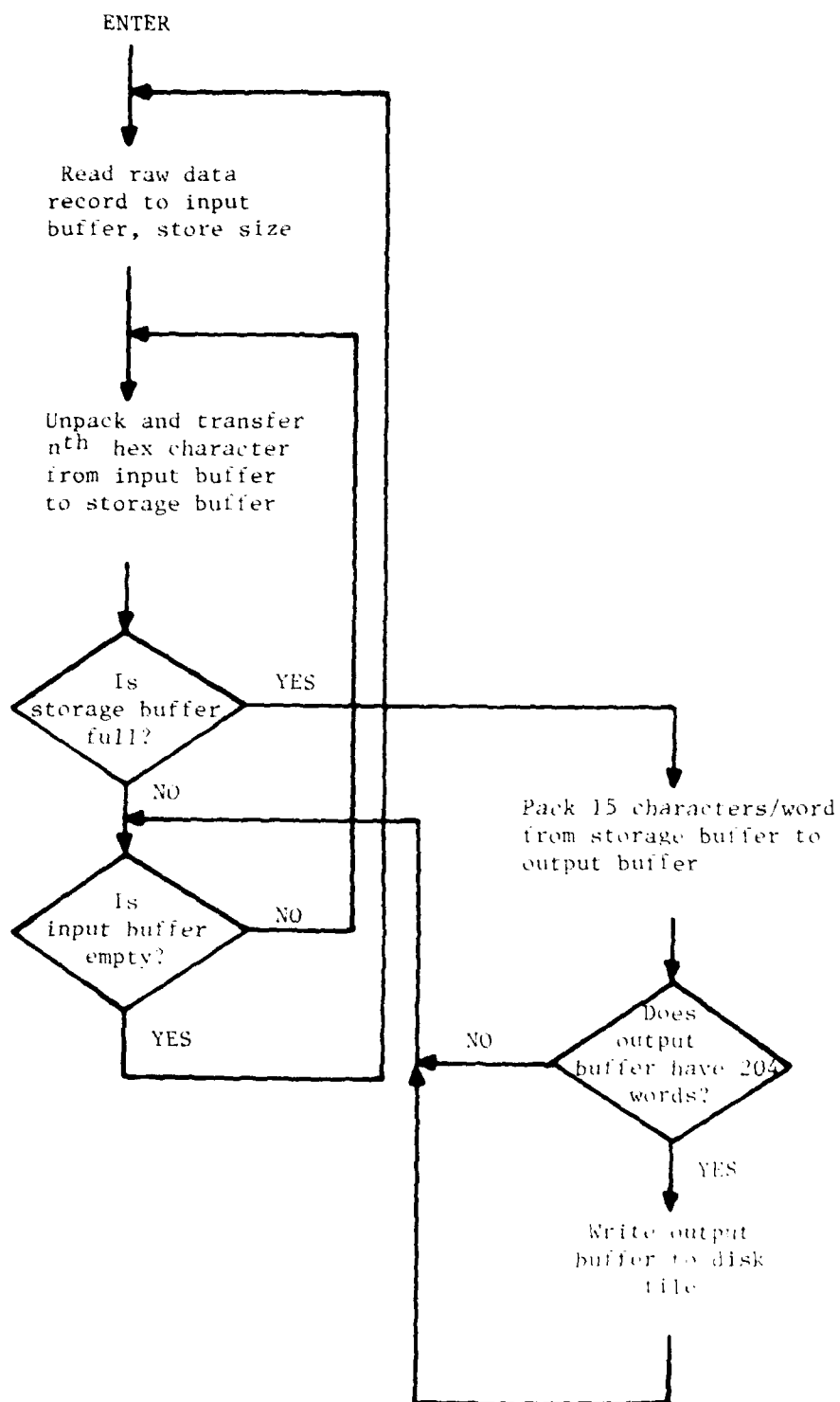


FIGURE 1.7.A. Flowchart for BLOCK.

II. OVERVIEW OF STRIPPING AND OUTPUT PROGRAMS

Figure II.A is an overview of the raw tape stripping program. Ten data files are involved in the program; these are indicated by the double bordered lines in the figure. The data files include the original raw data file described above, three stripped files and their associated directories, the CPACHE data file (ERIK), and two temporary files which are useful in constructing the other files. The various printer outputs which can be generated from each of the files are shown in the figure using parallelograms.

The names of the procedures required for initializing the files, stripping, and generating the outputs are shown with the directed lines in the figure. These names are actually procedure files. A procedure file is a set of system control commands necessary to attach the required files and execute the required programs to perform the procedure. The procedure can then be initiated with a single call statement which executes all the control commands in the file. In this way, the user need not be concerned with the detailed system control commands.

The data files involved are now described briefly:

RAW DATA FILE - This is the raw data tape described in section I.1.1. It is a permanent file copy of it. In general the data is organized for a three to five day period arranged sequentially on the tape with measurements in each day. Data in this format is recorded for that time with a time period limitation. In general the sequential nature of the raw data makes it impractical to obtain the entire data set for analysis. Thus, the sequential arrangement of data makes the data to be stripped from the raw data and it is not possible to strip a single file. Also, as noted,

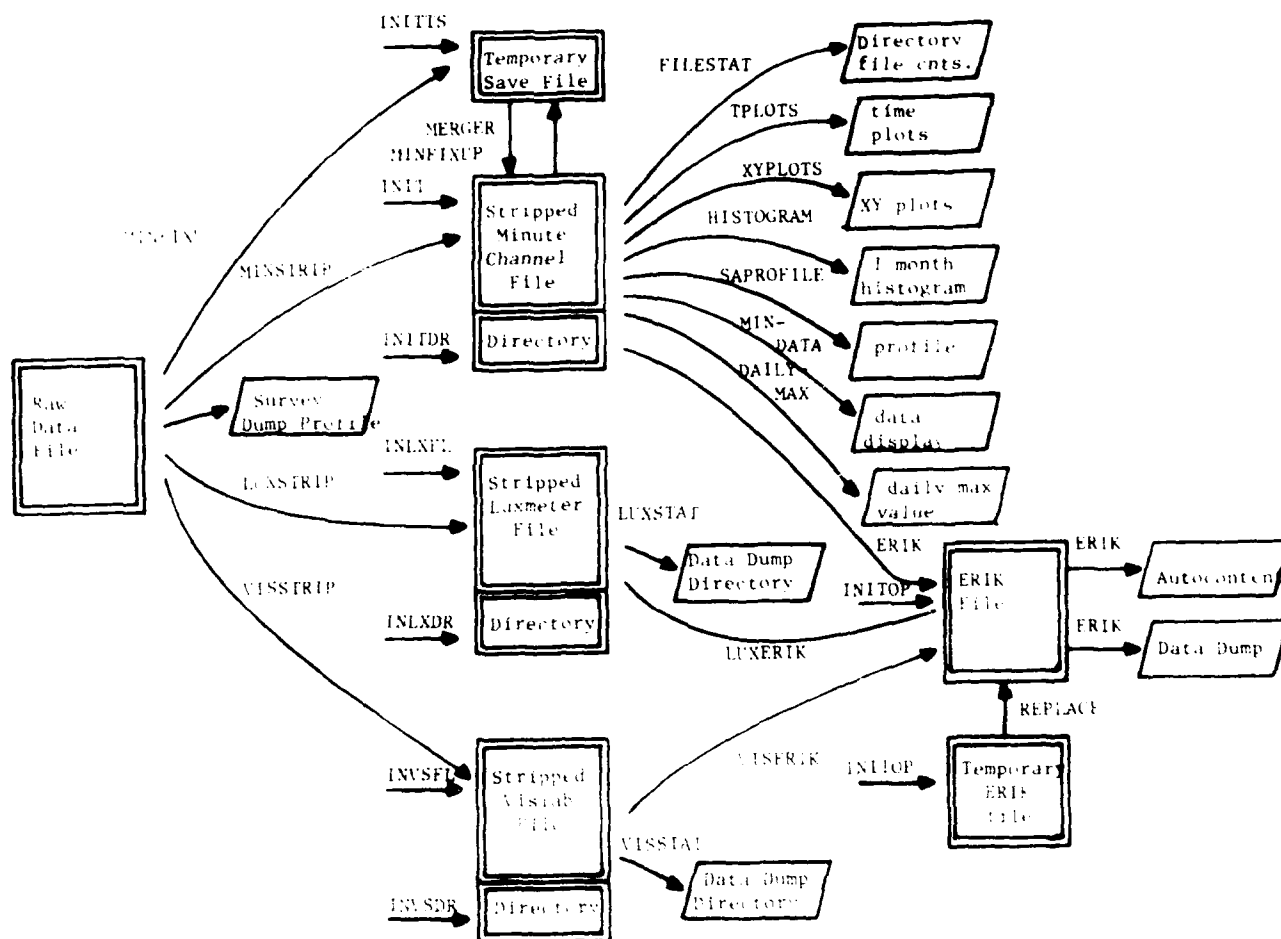


FIGURE 11.A. OVERVIEW OF STRIPPING AND OUTPUT PROGRAMS

contains the data stripped from 10 data tapes (one month which used more than 10 data tapes (such as April, 1978, or May, 1977), two Luxmeter Files were required). The data entered into the Luxmeter File are the values of α in the vertical and horizontal channels (in counts) when the direction of the rotating vertical channel corresponds to one of the compass points. Also, the time corresponding to each set of data and the direction in degrees (truncated to an integer) are entered. If the instrument is not rotating, no entries will be made into this file.

STRIPPED LUXMETER DIRECTORY - This contains data for each record in the stripped Luxmeter File. Entries are record number, raw time number, first and last data time in record, number of data times, and date record was added to file.

STRIPPED VISLAB FILE - This file contains the stripped Variable Path Function Meter (VPFM) data from the Raw Data File. Like the Stripped Luxmeter File, the Vislab File is also for a single month period containing up to 10 records, one for a single data tape. For months with more than 10 data tapes, two Vislab Files were required. Entries are made for each 10 minute period the instrument is recording (normally the first 10 minutes of each hour). Entries include the time of the first data point used for the 10 minute period, the first value, last value, maximum value, minimum value, and number of samples for each of the compass points. Also the filter used for the 10 minute period is entered.

STRIPPED VISLAB DIRECTORY - This contains data for each record in the Stripped Vislab File. Entries are the same as in the Stripped Luxmeter Directory described above.

ERIKFILE - The Erik File (OPAQUE Data Bank) contains values taken from the three stripped files described above. Each file is for a one month period and contains 31 records, one for each day. 85 values are recorded for each hour using the format given in Appendix I: "ERIKFILE/OPAQUE Data Bank Format". Values entered by the programs reported here include station number, date (year, month, day), hour, measurements cycle duration (10 minutes) and instrument data from the stripped arrays for a ten minute period during the hour (before April 12, 1977, 0923 CET for 30 minutes to 40 minutes past the hour; after that date, for the first 10 minutes of the hour). The initialization program for the Erik File initializes all 85 words for each hour; additional information to be input to the file from other sources include comment numbers, Meppen weather data, and quality integers for each measurement.

TEMPORARY ERIKFILE - This file is identical to the Erik File described above. It is useful for modifying a previously created Erik File if, say, the calibration should change for an instrument.

The procedure files and how they fit in the overall program are depicted in the overview Figure II.A. Except for the initialization programs, each has been stored as a permanent file. The initialization programs were not stored to minimize the possibility of accidentally reinitializing a partially created data file.

A brief description of the uses of each procedure file follows:

MINSTRIP - is used to study the contents of the Raw Data File and to strip the minute channel data from the Raw Data File to construct the Stripped Minute Channel File and corresponding Directory.

MINFIXUP - is used when it is desirable to use the Temporary Save File in the stripping process.

MERGER - is used when two records for the same half-day must be merged into one record as is required when raw tapes are changed.

FILESTAT - is used to print out a summary of the attached Stripped Minute Channel File and to print out the contents of the attached Stripped Minute Channel Directory.

LUXSTRIP - is used to strip the Luxmeter data from the Raw Data File to construct the Stripped Luxmeter File and corresponding Directory.

LUXSTAT - is used to dump portions of the Stripped Luxmeter File and its Directory.

VISSTRIP - is used to strip the VPFM data from the Raw Data File to construct the Stripped Vislab File and corresponding Directory.

VISSTAT - is used to dump portions of the Stripped Vislab File and its Directory.

TPLOTS - is used to generate time plots from the Stripped Minute Channel File.

XYPLOTS - is used to generate xy plots from the Stripped Minute Channel File.

HISTOGRAM- is used to generate one month histograms from the Stripped Minute Channel File.

SAPROFILE- is used to generate profiles of data contained in the Stripped Minute Channel File.

MINDATA - is used when it is desired to print scientific (calibrated) values from up to 7 specified channels over a specified time range from the attached Stripped Minute Channel File.

DAILYMAX - is used when it is desired to print out the maximum count (hourly maximums) of a selected channel from the attached Stripped Minute Channel File.

ERIK - is used to obtain the required values from the Stripped Minute Channel File to add to the Erik File, to print out a summary of the status of the Erik File, and to dump the contents of the Erik File.

LUXERIK - is used to obtain the required values from the Stripped Luxmeter File to add to the Erik File.

VISERIK - is used to obtain the required values from the Stripped Vislab File to add to the Erik File.

REPLACE - is used to replace all or a portion of a channel of the attached Erik File with the corresponding elements of the attached Temporary Erik File.

INIT - initializes the Stripped Minute Channel File

INITDR - initializes the Stripped Minute Channel Directory

INITTS - initializes the Temporary Save File

INLXFL - initializes the Stripped Luxmeter File

INLXDR - initializes the Stripped Luxmeter Directory

INVSFL - initializes the Stripped Vislab File

INVSDR - initializes the Stripped Vislab Directory

INITOP - initializes the Erik File

Although FORTRAN has library subroutine calls which can add records to an existing disk file when they are created, it has been found to be much safer to initialize the total file before it is filled with data. This is the purpose of the 8 initializing programs just described.

Examples of all the outputs which can be obtained from the data files described above and which are shown in the overview are presented in Figures II.B to II.P. These include:

- FIGURE II.B. SURVEY OF RAW DATA FILE SAMPLE (MINSTRIP)
- FIGURE II.C. DUMP OF RAW DATA FILE SAMPLE (MINSTRIP)
- FIGURE II.D. PROFILE OF RAW DATA FILE SAMPLE (MINSTRIP)
- FIGURE II.E. SORTED STRIPPED MINUTE CHANNEL DIRECTORY SAMPLE (FILESTAT)
- FIGURE II.F. STRIPPED MINUTE CHANNEL CONTENTS SAMPLE (FILESTAT)
- FIGURE II.G. TIME PLOT SAMPLE (TPLOTS)
- FIGURE II.H. XY PLOT SAMPLE (XYFLOT)
- FIGURE II.I. HISTOGRAM SAMPLE (HISTOGRAM)
- FIGURE II.J. PROFILE OF STRIPPED MINUTE DATA SAMPLE (SAPROFILE)
- FIGURE II.K. STRIPPED MINUTE CHANNEL DATA DISPLAY (MINDATA)
- FIGURE II.L. DAILY MAXIMUM VALUE SAMPLE (DAILYMAX)
- FIGURE II.M. STRIPPED LUXMETER DIRECTORY AND DATA DUMP SAMPLE (LUXSTAT)
- FIGURE II.N. STRIPPED VISLAB DIRECTORY AND DATA DUMP SAMPLE (VISSTAT)
- FIGURE II.O. ERIKFILE CONTENTS SUMMARY SAMPLE (ERIK)
- FIGURE II.P. ERIKFILE HOURLY DATA DUMP SAMPLE (ERIK)

```
REWIND
SURVEY,500,10
```

BLOCK	1	108/14/49/ 4
BLOCK	11	108/15/ 3/41
BLOCK	21	108/15/ 8/38
BLOCK	31	108/15/40/ 8
BLOCK	41	108/16/ 2/37
BLOCK	51	108/16/ 7/35
BLOCK	61	108/16/31/20
BLOCK	71	108/17/ 1/33
BLOCK	81	108/17/ 7/ 2
BLOCK	91	108/17/26/44
BLOCK	101	108/18/ 1/ 0
BLOCK	111	108/18/ 5/58
BLOCK	121	108/18/17/56
BLOCK	131	108/18/59/28
BLOCK	141	108/19/ 4/55
BLOCK	151	108/19/ 9/54
BLOCK	161	108/19/50/40
BLOCK	171	108/20/ 3/52
BLOCK	181	108/20/ 8/50
BLOCK	191	108/20/41/52
BLOCK	201	108/21/ 2/49
BLOCK	211	108/21/ 7/47
BLOCK	221	108/21/33/ 0
BLOCK	231	108/22/ 1/45
BLOCK	241	108/22/ 6/43
BLOCK	251	108/22/24/ 4
BLOCK	261	108/23/ 0/41
BLOCK	271	108/23/ 5/39
BLOCK	281	108/23/15/ 8
BLOCK	291	108/23/56/56
BLOCK	301	109/ 0/ 4/36
BLOCK	311	109/ 0/ 9/34
BLOCK	321	109/ 1/48/ 4
BLOCK	331	109/ 1/ 3/33
BLOCK	341	109/ 1/ 8/31
BLOCK	351	109/ 1/39/ 4
BLOCK	361	109/ 2/ 2/29
BLOCK	371	109/ 2/ 7/27
BLOCK	381	109/ 2/30/12
BLOCK	391	109/ 3/ 1/26
BLOCK	401	109/ 3/ 6/24
BLOCK	411	109/ 3/21/20
BLOCK	421	109/ 4/ 0/22

FIGURE 11.6. SURVEY OF RAW DATA FILE SAMPLE (MINSTRIP)

The command shown requests printing the first time found in 500 blocks, 10 blocks apart. This is adequate to "survey" the complete RAW DATA FILE. Only the first portion is shown.

DUMP, 2000

923/170040	01/2133751	1/23006020	/24334547/	25334617/2
6336731/36	076008/370	74002)))10	8144904/24	304548/253
04619/2630	6721)))108	144908/243	04552/2530	4606/26306
714)))1081	44912/2430	4549/25304	612/263066	98)))10814
4916/24304	549/253046	05/2630668	8)))108144	920/243045
54/2530459	9/26306682	)))1081449	24/2430455	0/25314610
/26306669)	)))10814492	8/24304548	/25304598/	26306659))
)108144932	/24304548/	25304591/2	6306649)))	118144936/
24304548/2	5304587/26	306642)))1	08144940/2	4304551/25
304582/263	06636)))10	8144944/24	304547/253	04585/2630
6619)))108	144948/243	04551/2530	4580/26306	615)))1081
44952/2430	4550/25304	581/263066	01)))10814	4956/24304
546/253045	82/2630658	9)))108145	000/000063	28/0100503
0/02005761	/03005906/	04307846/0	5306371/06	306484/073
06983/1400	6132/15006	253/160072	92/1700400	2/21306443
/23006021/	24304546/2	5304577/26	306582/360	84001/3708
4003)))108	145004/243	14544/2531	4580/26316	572)))1081
45008/2431	4547/25314	576/263165	66)))10814	5012/24314
549/253145	75/2631655	7)))108145	016/243145	43/2531458
0/26316541	)))1081450	20/2431454	8/25314577	/26316534)
)))10814502	4/24314544	/25314590/	26316520))	)108145028
/24314543/	25314580/2	6316511)))	108145032/	24314544/2
5314578/26	316504)))1	08145036/2	4314547/25	314574/263
16497)))10	8145040/24	314549/253	14573/2631	6487)))108
145044/243	14544/2531	4578/26316	472)))1081	45048/2431
4546/25314	578/263164	61)))10814	5052/24314	545/253145
78/2631645	2)))108145	056/243145	45/2531457	6/26316444
)))1081451	00/0000616	2/01005147	/02005803/	03005914/0
4307845/05	306372/063	06497/0730	6984/14006	118/150062
60/1600725	7/17004001	/21317265/	23006020/2	4314546/25
314572/263	16433/3609	6001/37094	001)))1081	45104/2432
4551/25324	570/263264	28)))10814	5108/24324	549/253245
71/2632641	3)))108145	112/243245	46/2532457	1/26326402
)))1081451	16/2432454	7/25324568	/26326393)	)10814512
0/24324550	/25324562/	26326389))	)108145124	/24324553/
25324558/2	6326381)))	108145128/	24324553/2	5324557/26
326370)))1	08145132/2	4324552/25	324554/263	26362)))10
8145136/24	324549/253	24557/2632	6347)))108	145140/243
24554/2532	4550/26326	342)))1081	45144/2432	4553/25324
548/263263	34)))10814	5148/24324	555/253245	45/2632632

FIGURE II.C. DUMP OF RAW DATA FILE SAMPLE (MINSTRIP)

The command requests printing 2000 characters following the pointer location from the raw data file. Time data (9 decimal digits) is preceded by three right parentheses; channel data (8 decimal digits) is preceded by a slash.

INSTANT, 2 8 PROFILE, 50

	PROFILE	BLOCK =										1										POINT =										1									
		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3										
TIME		0	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	1	2	3	4	5	6	7	1	2										
108/14/50/00	1-5-8-9	9	1	2	4	*	*	*	*	1	6-0	2	0-2-2	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*										
108/14/55/00	6-1-6-9	9	1	2	4	*	*	*	*	1	5-0	6	0-2-2	8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*										
108/15/00/00	3-4-8-9	9	1	2	4	7	4	0	2	1	4-0	7	0-2-2	4	3	0	0	7	0-0																						
108/15/05/00	6-1-6-9	9	1	1	4	8	4	0	1	1	4-0	7	0-2-2	0	4	0	0	7	0-0																						
108/15/10/00	6-1-6-9	9	1	1	4	*	*	*	*	1	1	4	0	2	0-2-2	5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/15/15/00	0-5-8-9	9	1	1	4	*	*	*	*	0	1	5-0	6	0-2-2	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/15/20/00	5-1-7-9	9	1	1	4	*	*	*	*	0	1	6-0	7	0-2-2	7	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/15/25/00	2-4-8-9	9	1	2	4	*	*	*	*	0	1	7-0	7	0-2-2	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/15/30/00	7-0-6-8	9	1	3	4	*	*	*	*	0	1	7-0	2	0-2-2	8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/15/35/00	3-3-7-9	9	1	3	4	*	*	*	*	0	1	8-0	6	0-2-3	5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/15/40/00	0-5-8-9	9	1	2	4	*	*	*	*	-0	1	9-0	7	0-2-2	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/15/45/00	5-2-7-9	9	1	2	4	*	*	*	*	-0	1	0-0	7	0-2-2	6	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/15/50/00	1-4-8-9	9	1	2	4	*	*	*	*	0	1	X-0	6	0-2-3	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/15/55/00	6-0-6-8	9	1	3	4	*	*	*	*	0	1	X-0	7	0-2-2	8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/00/00	3-3-8-9	9	1	3	4	8	4	0	0	1	X-0	7	0-2-3	4	7	0	0	7	0-0																						
108/16/05/00	6-1-6-8	9	1	3	4	7	4	0	0	1	9-0	2	0-2-2	0	1	7	0	7	0-0																						
108/16/10/00	6-1-6-8	9	1	3	4	*	*	*	*	-0	1	8-0	6	0-2-2	5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/15/00	1-5-8-9	9	1	3	4	*	*	*	*	0	1	8-0	7	0-2-3	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/20/00	6-1-6-8	8	1	3	4	*	*	*	*	0	1	7-0	7	0-2-2	7	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/25/00	2-4-8-9	9	1	2	4	*	*	*	*	0	1	6-0	2	0-2-3	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/30/00	-9-9-9-9	9	1	3	4	*	*	*	*	0	1	5-0	6	0-2-2	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/35/00	3-2-7-8	9	1	1	4	*	*	*	*	1	1	5-0	7	0-2-2	5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/40/00	0-5-8-9	8	1	3	4	*	*	*	*	F	1	4-0	7	0-2-2	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/45/00	5-1-6-8	8	1	2	4	*	*	*	*	0	1	4	1	2	0-2-2	6	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/50/00	1-4-8-9	8	1	2	4	*	*	*	*	0	1	5	0	6	0-2-2	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/16/55/00	6-0-6-8	9	1	2	4	*	*	*	*	0	1	6-0	7	0-2-2	8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/00/00	3-3-7-9	9	1	3	4	7	4	0	0	1	6-0	7	0-2-3	4	5	0	0	7	0-0																						
108/17/05/00	6-1-6-8	9	1	2	4	8	4	0	0	1	7-0	2	0-2-2	0	4	0	0	7	0-0																						
108/17/10/00	6-1-6-8	9	X	2	4	*	*	*	*	0	1	8-0	6	0-2-0	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/15/00	0-5-8-9	9	1	1	4	*	*	*	*	-0	1	8-0	7	0-2-2	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/20/00	6-1-6-8	9	1	1	4	*	*	*	*	-0	1	9-0	7	0-2-2	7	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/25/00	2-4-8-9	9	1	1	4	*	*	*	*	-0	1	X-0	2	0-2-2	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/30/00	-5-8-9-9	9	1	1	4	*	*	*	*	7	1	X-0	6	0-2-2-3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/35/00	3-3-7-8	X	1	1	4	*	*	*	*	0	1	X-0	7	0-0	5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/40/00	0-5-8-9	9	1	1	4	*	*	*	*	-0	1	9-0	7	0-2-2	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/45/00	5-1-6-8	9	1	1	4	*	*	*	*	0	1	8-0	2	0-2-2	6	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/50/00	1-4-8-9	9	1	0	4	*	*	*	*	-0	1	8-0	6	0-2-2	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/17/55/00	6-0-5-8	9	1	0	4	*	*	*	*	0	1	7-0	7	0-2-1	8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/00/00	3-3-7	X	9	1	0	4	9	4	0	0	1	5	*	7	0-2-2	4	1	1	0	7	0-0																				
108/18/05/00	6-1-6-8	9	1	0	4	*	*	*	*	0	1	6-0	2	0-2-2	0	8	0	0	7	0-0																					
108/18/10/00	6-1-6-8	9	1	0	4	*	*	*	*	1	1	5-0	6	0-2-1	5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/15/00	0-5-8-9	9	1	0	4	*	*	*	*	3	1	4-0	7	0-2-2	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/20/00	6-1-6-8	9	1	0	4	*	*	*	*	2	1	4	0	7	0-2-1	7	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/25/00	2-4-7-9	9	1	4	2	*	*	*	*	0	1	5	0	2	0-2-1	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/30/00	-1-6-8-9	9	1	3	3	*	*	*	*	0	1	5-0	6	0-1-1	0	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/35/00	3-2-7-8	9	1	2	3	*	*	*	*	0	1	6-0	7	0-1-1	5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/40/00	0-5-8-9	9	1	2	3	*	*	*	*	0	1	7-0	7	0-1-1	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/45/00	5-1-6-8	9	1	1	3	*	*	*	*	0	1	9-0	6	0-1-0	8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/50/00	1-4-8-9	9	1	1	3	*	*	*	*	0	1	8-0	7	0-1-1	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									
108/18/55/00	6-0-6-8	9	1	0	3	*	*	*	*	0	1	9-0	7	0-1-0	8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*									

FIGURE II.D. PROFILE OF RAW DATA FILE SAMPLE (MINSTRIP)

The commands shown request listing an indication of the data contained in the RAW DATA FILE for 50 times at 5 minute intervals. The integers printed are an indication of the values recorded. This number is calculated by taking the integer part of the absolute value of the count divided by 200. A negative sign indicates the counts were recorded as negative, an X indicates a value out of range, and an asterisk indicates no value present.

SORTED DIRECTORY

DAY- 59	HALF-1	RECORD- 1	TAPE- 1	ENTERED	4/11/ 74
DAY- 59	HALF-2	RECORD- 2	TAPE- 1	ENTERED	4/11/ 74
DAY- 60	HALF-1	RECORD- 3	TAPE- 1	ENTERED	4/11/ 74
DAY- 60	HALF-2	RECORD- 4	TAPE- 1	ENTERED	4/11/ 74
DAY- 61	HALF-1	RECORD- 5	TAPE- 1	ENTERED	4/11/ 74
DAY- 61	HALF-2	RECORD- 6	TAPE-51	ENTERED	6/26/ 74
DAY- 62	HALF-1	RECORD- 9	TAPE-51	ENTERED	6/26/ 74
DAY- 62	HALF-2	RECORD- 10	TAPE-51	ENTERED	6/26/ 74
DAY- 63	HALF-1	RECORD- 27	TAPE-51	ENTERED	6/26/ 74
DAY- 63	HALF-2	RECORD- 50	TAPE-51	ENTERED	6/26/ 74
DAY- 64	HALF-1	RECORD- 52	TAPE-51	ENTERED	6/26/ 74
DAY- 64	HALF-2	RECORD- 55	TAPE-51	ENTERED	6/26/ 74
DAY- 65	HALF-2	RECORD- 28	TAPE-51	ENTERED	6/26/ 74
DAY- 65	HALF-1	RECORD- 45	TAPE-53	ENTERED	7/ 3/ 74
DAY- 66	HALF-1	RECORD- 49	TAPE-51	ENTERED	6/26/ 74
DAY- 66	HALF-2	RECORD- 16	TAPE-53	ENTERED	7/ 3/ 74
DAY- 67	HALF-1	RECORD- 6	TAPE- 1	ENTERED	4/12/ 74
DAY- 67	HALF-2	RECORD- 44	TAPE-53	ENTERED	7/ 3/ 74
DAY- 68	HALF-1	RECORD- 8	TAPE- 1	ENTERED	4/12/ 74
DAY- 68	HALF-2	RECORD- 43	TAPE-53	ENTERED	7/ 3/ 74
DAY- 69	HALF-1	RECORD- 48	TAPE-51	ENTERED	6/26/ 74
DAY- 69	HALF-2	RECORD- 42	TAPE-53	ENTERED	7/ 3/ 74
DAY- 70	HALF-1	RECORD- 11	TAPE- 1	ENTERED	4/12/ 74
DAY- 70	HALF-2	RECORD- 12	TAPE- 1	ENTERED	4/12/ 74
DAY- 71	HALF-1	RECORD- 13	TAPE- 1	ENTERED	4/12/ 74
DAY- 71	HALF-2	RECORD- 14	TAPE- 1	ENTERED	4/12/ 74
DAY- 72	HALF-1	RECORD- 32	TAPE- 1	ENTERED	4/13/ 74
DAY- 72	HALF-2	RECORD- 33	TAPE- 1	ENTERED	4/13/ 74
DAY- 73	HALF-1	RECORD- 17	TAPE- 1	ENTERED	4/12/ 74
DAY- 73	HALF-2	RECORD- 18	TAPE- 1	ENTERED	4/12/ 74
DAY- 74	HALF-2	RECORD- 50	TAPE-51	ENTERED	6/26/ 74
DAY- 74	HALF-1	RECORD- 47	TAPE-51	ENTERED	6/26/ 74
DAY- 75	HALF-1	RECORD- 19	TAPE- 1	ENTERED	4/20/ 74
DAY- 75	HALF-2	RECORD- 20	TAPE- 1	ENTERED	4/20/ 74
DAY- 76	HALF-1	RECORD- 21	TAPE- 1	ENTERED	4/20/ 74
DAY- 76	HALF-2	RECORD- 22	TAPE- 1	ENTERED	4/20/ 74
DAY- 77	HALF-2	RECORD- 61	TAPE-50	ENTERED	6/ 7/ 74
DAY- 77	HALF-1	RECORD- 15	TAPE-50	ENTERED	6/23/ 74
DAY- 78	HALF-1	RECORD- 23	TAPE-50	ENTERED	6/23/ 74
DAY- 78	HALF-2	RECORD- 24	TAPE-50	ENTERED	6/23/ 74
DAY- 79	HALF-1	RECORD- 25	TAPE-50	ENTERED	6/23/ 74
DAY- 79	HALF-2	RECORD- 26	TAPE-50	ENTERED	6/23/ 74
DAY- 80	HALF-1	RECORD- 51	TAPE-51	ENTERED	6/26/ 74
DAY- 80	HALF-2	RECORD- 46	TAPE-51	ENTERED	6/26/ 74
DAY- 81	HALF-1	RECORD- 53	TAPE-51	ENTERED	6/ 7/ 74
DAY- 81	HALF-2	RECORD- 54	TAPE-51	ENTERED	6/ 7/ 74
DAY- 82	HALF-1	RECORD- 55	TAPE-51	ENTERED	6/ 7/ 74
DAY- 82	HALF-2	RECORD- 56	TAPE-51	ENTERED	6/ 7/ 74
DAY- 83	HALF-1	RECORD- 57	TAPE-51	ENTERED	6/ 7/ 74
DAY- 83	HALF-2	RECORD- 58	TAPE-51	ENTERED	6/ 7/ 74
DAY- 84	HALF-1	RECORD- 29	TAPE-52	ENTERED	6/26/ 74
DAY- 84	HALF-2	RECORD- 30	TAPE-52	ENTERED	6/26/ 74
DAY- 85	HALF-1	RECORD- 34	TAPE-52	ENTERED	6/26/ 74
DAY- 85	HALF-2	RECORD- 35	TAPE-52	ENTERED	6/26/ 74
DAY- 86	HALF-1	RECORD- 31	TAPE-52	ENTERED	6/26/ 74
DAY- 86	HALF-2	RECORD- 37	TAPE-52	ENTERED	6/26/ 74
DAY- 87	HALF-1	RECORD- 38	TAPE-52	ENTERED	6/26/ 74
DAY- 87	HALF-2	RECORD- 36	TAPE-52	ENTERED	6/26/ 74
DAY- 88	HALF-1	RECORD- 39	TAPE-53	ENTERED	6/26/ 74
DAY- 88	HALF-2	RECORD- 40	TAPE-53	ENTERED	6/26/ 74
DAY- 89	HALF-1	RECORD- 41	TAPE-52	ENTERED	6/26/ 74

FIGURE II.E. SORTED STRIPPED MINUTE CHANNEL DIRECTORY SAMPLE
(CONTINUED)

This is a chronological listing of the STRIPPED MINUTE CHANNEL
DIRECTORY for March, 1974.

RECORD - 7 DAY - 60 HALF - 1
GOT RECORD - 1 STRIPPED DATA FOR DAY - 60

1111111111222222222277777777773333334444444444555555555555
0123456789012345678901234567890123456789011234567890123456789

[illegible]

RECORD - 4 DAY - 60 HALF - 2
GOT RECORD - 4 STRIPPED DATA FOR DAY - 1060

11111111112222222222333333333344444444445555555555
J1 2345678901234567890123456789012345678901234567890123456789

[illegible]

FIGURE 11.F. STRIPPED MINUTE CHANNEL CONTENTS SAMPLE (FILESTAT)

(this sample shows an indication of the contents of two records from the attached STRIPPED MINUTE CHANNEL file in chronological order. Each number on the array is an indication of the number of samples stored in the particular minute specified. This number is calculated by adding 3 to the number of samples, dividing by 4, and taking its integer part of the result. Notice that here data is stored for the first 10 minutes of the hour.

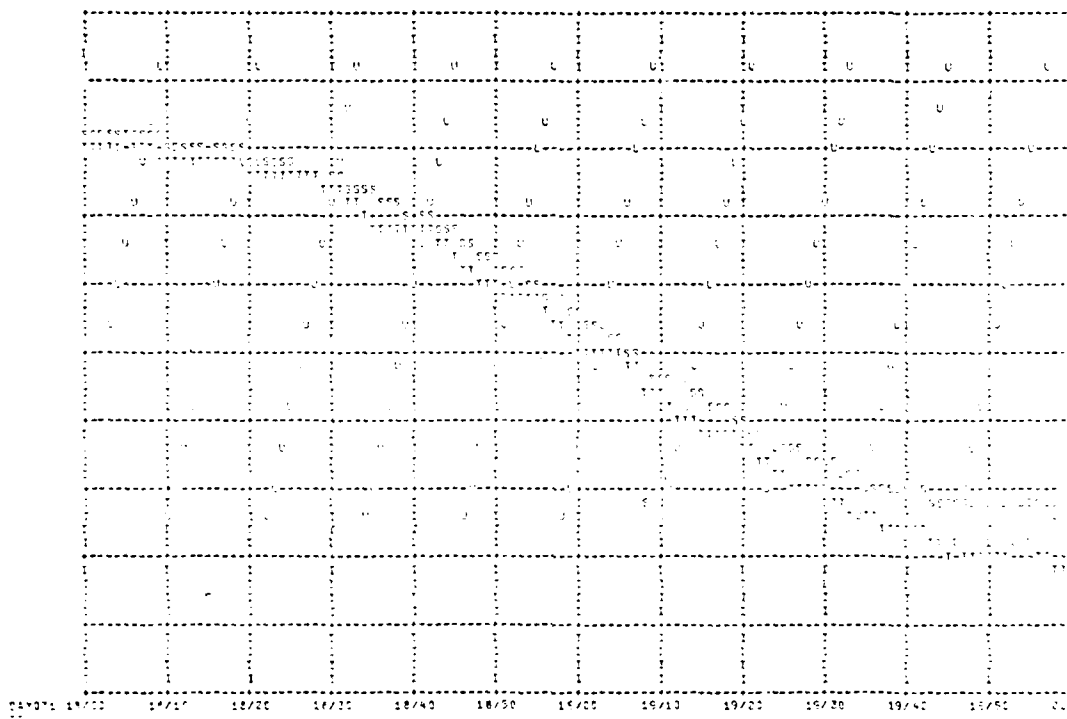
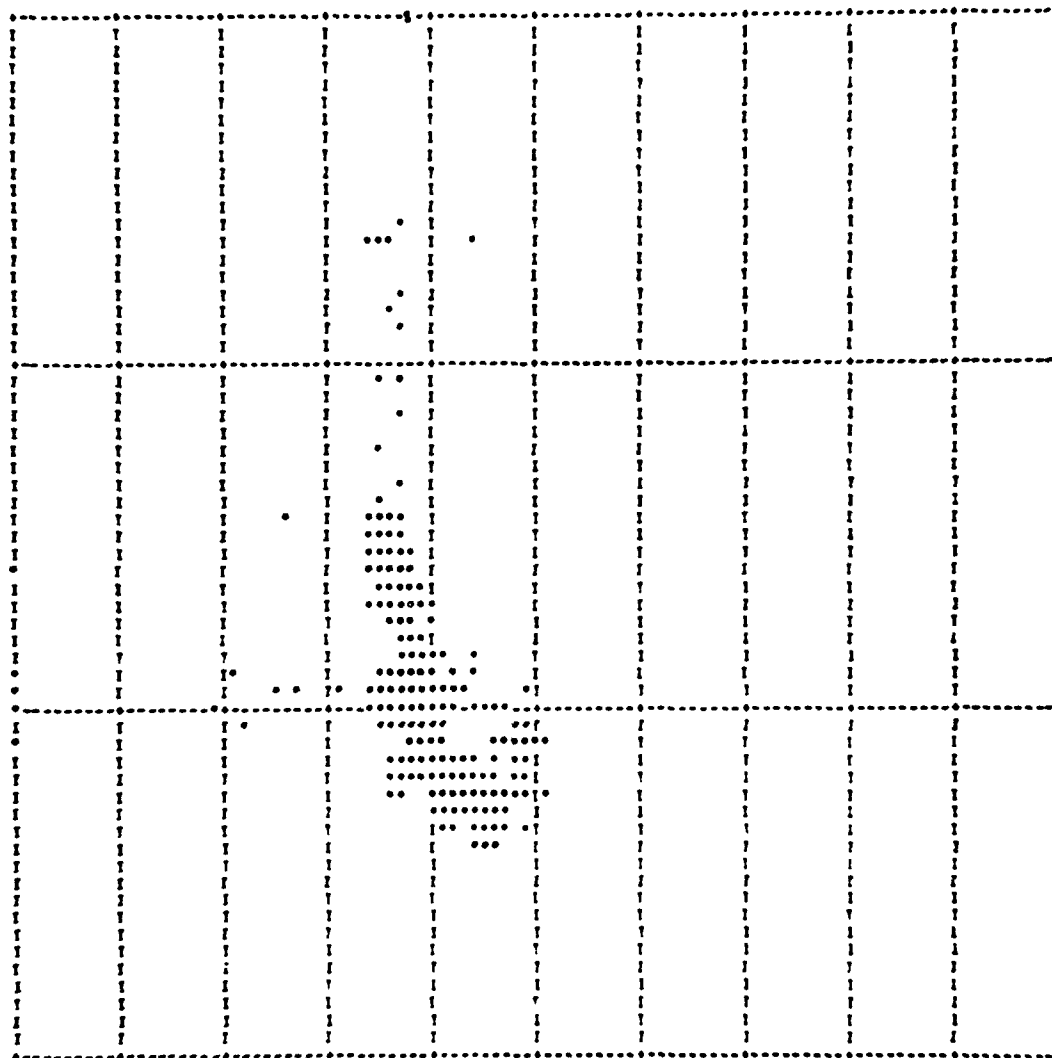


FIGURE II.G. TIME PLOT SAMPLE (TPLOTS)

The plot shown is the ILLUMINOMETER Horizontal channel (Channel 24), Vertical channel (Channel 25), and Azimuth (Channel 26) data in scientific units over a two hour period around nightfall.



SCATTER DIAGRAM - ELTRO VS BARNES (3-5 MICRONS)
 CHANNEL 219 (*) BOTTOM = 0. TOP = 100. EACH DIVISION = 1%.
 CHANNEL 4 (*) LOG SCALE, POTCH = 100% (-1) TOP = 100% (2)

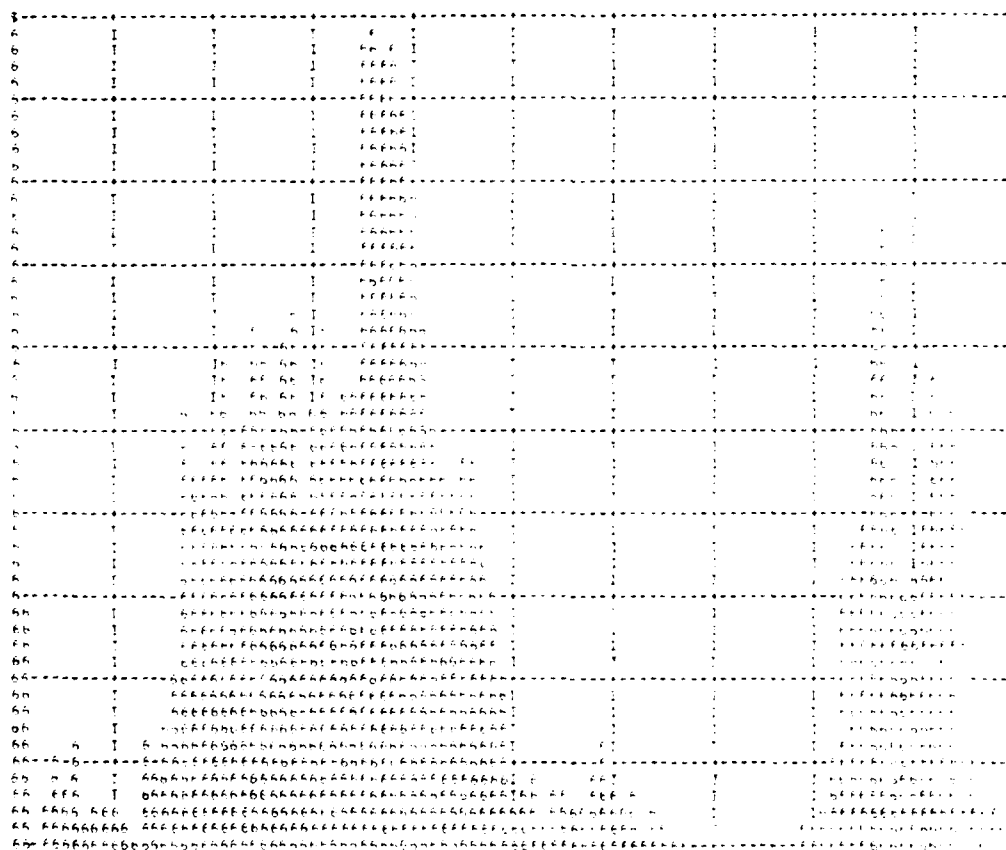
FIGURE II.H. XY PLOT SAMPLE (XYPLOT)

The plot shown is a scatter diagram over a 10 hour period of the Eltro vs Barnes transmissometer with 3-5 micron filter. The scaling values have been superimposed on the plot.

HISTOGRAM FOR CHANNEL 217
 MIN = 3. MAX = 107.
 NUMBER OF BINS = 10.
 NUMBER OF POINTS USED = 5475
 NUMBER OF POINTS OUT OF RANGE = 267

DISTRIBUTION

34	51	7	11	21	14	7	1	1	1
13	8	5	24	10	24	4	2	7	70
92	101	69	49	107	17	4	10	11	70
92	110	83	96	66	167	167	167	167	167
134	104	87	80	70	47	47	47	47	47
12	14	10	8	10	14	11	17	12	21
10	11	14	6	11	4	4	4	4	4
5	4	2	2	2	1	2	2	2	2
8	17	21	54	44	73	117	111	87	64
50	49	98	64	92	77	77	17	17	9



BARNES T-5 (FEC) MARCH, 1977

FIGURE 11.1. HISTOGRAM SAMPLE (HISTOGRAM)

This histogram is for the Barnes instrument with a system filter set to the whole month of March, 1977. It has been generated using the system filter set for this time period. The horizontal axis is transmittance (0.0 to 1.0) and the vertical axis is arbitrary.

PROFILE

STARTING RATE= 71/10/0

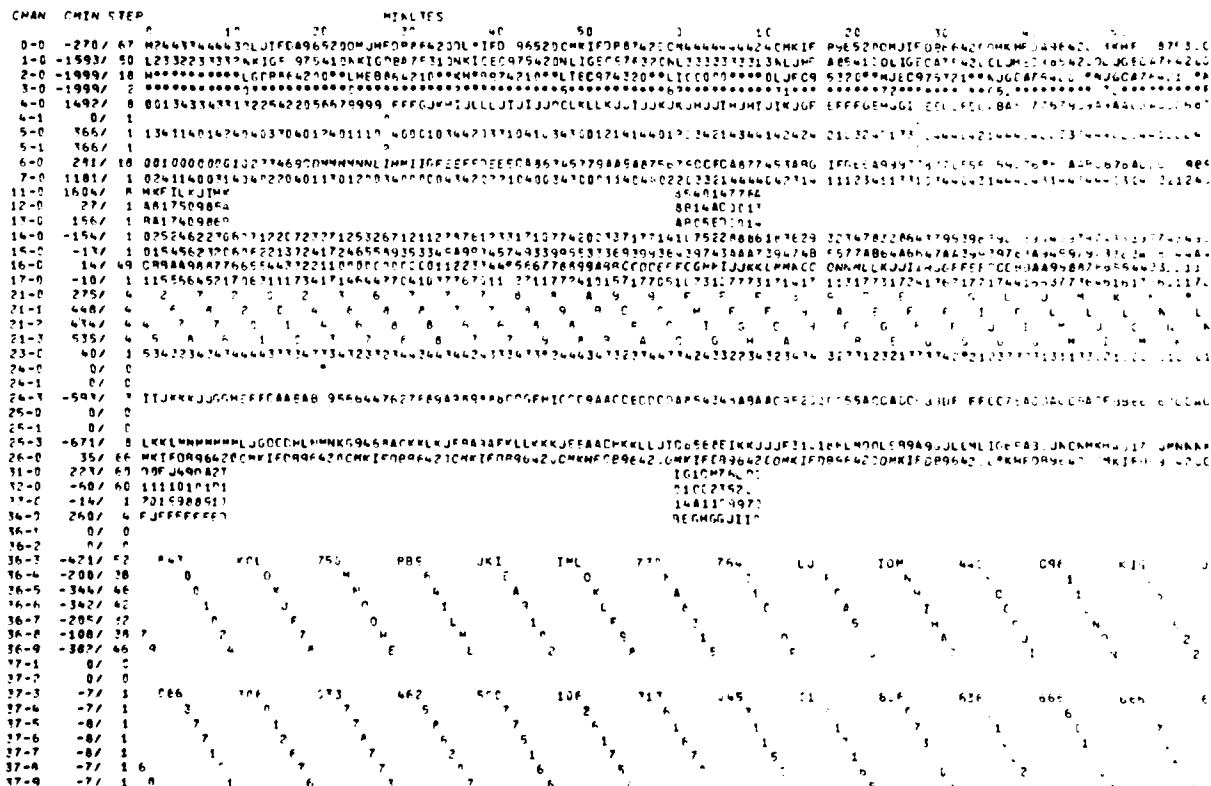


FIGURE II.J. PROFILE OF STRIPPED MINUTE DATA SAMPLE (SAPROFILE)

The profile shown gives an indication of the data contained in the STRIPPED MINUTE CHANNEL FILE for a two hour period in March. This profile has the same form as that mentioned in Section I.; that profile however is generated from the RAW DATA FILE.

```

71/11/ 0 1 33 9.29E+03 1 33 1.14E+04 1 33 7.72E+01
71/11/ 1 1 33 9.98E+03 1 30 1.87E+04 1 30 1.39E+02
71/11/ 2 1 31 1.12E+04 1 31 2.70E+04 1 31 1.38E+02
71/11/ 3 1 32 1.14E+04 1 32 2.47E+04 1 32 1.71E+02
71/11/ 4 1 33 1.18E+04 1 33 2.02E+04 1 33 2.01E+02
71/11/ 5 1 30 1.16E+04 1 30 1.13E+04 1 30 2.32E+02
71/11/ 6 1 31 9.98E+03 1 31 7.82E+03 1 31 2.61E+02
71/11/ 7 1 32 9.40E+03 1 32 6.90E+03 1 32 2.92E+02
71/11/ 8 1 33 8.96E+03 1 33 6.71E+03 1 33 3.22E+02
71/11/ 9 1 30 9.29E+03 1 30 7.23E+03 1 30 3.56E+02
71/11/10 1 31 9.18E+03 1 31 7.30E+03 1 31 2.67E+01
71/11/11 1 32 8.69E+03 1 32 7.37E+03 1 32 4.41E+01
71/11/12 1 33 9.51E+03 1 33 1.04E+04 1 33 7.78E+01
71/11/13 1 30 1.11E+04 1 30 3.30E+04 1 30 1.08E+02
71/11/14 1 31 1.22E+04 1 31 4.37E+04 1 31 1.40E+02
71/11/15 1 32 1.35E+04 1 32 4.95E+04 1 32 1.70E+02
71/11/16 1 30 1.31E+04 1 30 4.13E+04 1 30 2.87E+02
71/11/17 1 30 1.31E+04 1 30 1.90E+04 1 30 2.32E+02
71/11/18 1 31 1.31E+04 1 31 8.62E+03 1 31 2.63E+02
71/11/19 1 32 1.11E+04 1 32 6.29E+03 1 32 2.92E+02
71/11/20 1 33 1.12E+04 1 33 5.92E+03 1 33 3.24E+02
71/11/21 1 30 9.29E+03 1 30 5.22E+03 1 30 3.53E+02
71/11/22 1 31 8.69E+03 1 31 5.26E+03 1 31 2.44E+01
71/11/23 1 32 8.60E+03 1 32 6.41E+03 1 32 4.46E+01
71/11/24 1 33 9.40E+03 1 33 1.08E+04 1 33 7.78E+01
71/11/25 1 30 8.43E+03 1 30 1.46E+04 1 30 1.37E+02
71/11/26 1 31 8.78E+03 1 31 1.73E+04 1 31 1.40E+02
71/11/27 1 32 8.26E+03 1 32 1.56E+04 1 32 1.69E+02
71/11/28 1 33 8.96E+03 1 33 1.73E+04 1 33 2.81E+02
71/11/29 1 30 8.87E+03 1 30 9.51E+03 1 30 2.32E+02
71/11/30 1 31 8.35E+03 1 31 7.51E+03 1 31 2.62E+02
71/11/31 1 32 8.02E+03 1 32 6.41E+03 1 32 2.92E+02
71/11/32 9 99 9.00E+99 1 33 6.23E+03 1 33 3.23E+02
71/11/33 1 30 7.85E+03 1 30 6.02E+03 1 30 3.53E+02
71/11/34 1 31 8.02E+03 1 31 6.41E+03 1 31 2.51E+01
71/11/35 1 32 8.78E+03 1 32 7.73E+03 1 32 4.64E+01
71/11/36 1 33 8.60E+03 1 33 9.31E+03 8 88 8.98E+99
71/11/37 1 30 1.03E+04 1 30 2.43E+04 1 30 1.09E+02
71/11/38 1 31 9.98E+03 1 31 1.50E+04 1 31 1.40E+02
71/11/39 1 32 9.40E+03 1 32 1.63E+04 1 32 1.71E+02
71/11/40 1 33 8.60E+03 1 33 1.41E+04 1 33 2.81E+02
71/11/41 1 30 8.43E+03 1 30 1.12E+04 1 30 2.31E+02
71/11/42 1 31 9.29E+03 1 31 7.51E+03 1 31 2.62E+02
71/11/43 1 32 8.78E+03 1 32 5.63E+03 1 32 2.92E+02
71/11/44 1 33 8.69E+03 1 33 5.90E+03 1 33 3.22E+02
71/11/45 1 30 9.07E+03 1 30 5.35E+03 1 30 3.56E+02
71/11/46 1 31 9.18E+03 1 31 5.77E+03 1 31 2.63E+01
71/11/47 1 32 8.78E+03 1 32 6.84E+03 1 32 4.62E+01
71/11/48 1 33 7.93E+03 1 33 8.72E+03 1 33 7.66E+01
71/11/49 1 30 9.07E+03 1 30 1.65E+04 1 30 1.09E+02
71/11/50 1 31 9.07E+03 1 31 1.76E+04 1 31 1.38E+02
71/11/51 1 32 1.06E+04 1 32 4.08E+04 1 32 1.70E+02
71/11/52 1 33 1.08E+04 1 33 2.16E+04 1 33 2.02E+02
71/11/53 1 30 1.10E+04 1 30 2.08E+04 1 30 2.32E+02
71/11/54 1 31 1.08E+04 1 31 7.23E+03 1 31 2.61E+02
71/11/55 1 32 1.05E+04 1 32 6.02E+03 1 32 2.94E+02
71/11/56 1 33 8.69E+03 1 33 5.49E+03 1 33 3.24E+02
71/11/57 1 30 8.60E+03 1 30 5.35E+03 1 30 3.56E+02
71/11/58 1 31 9.29E+03 1 31 5.39E+03 1 31 2.53E+01
71/11/59 1 32 8.69E+03 1 32 6.65E+03 1 32 4.54E+01

```

MINUTE CHANNEL LISTING COMPLETE
END

FIGURE II.K. STRIPPED MINUTE CHANNEL DATA DISPLAY (MINUTE)

This array is a printout of the contents of the *ILLUMINOMETER* data (channels 24, 25, and 26) for a 60 minute period in March, 1967. For each channel 1 - 100, the value in scientific units with a 2 digit discrete value and a single integer representing the validity of the calibrated data. For the validity integer: 1 indicates data ok, 2 = physical variable out of range, 3 = no calibration data exists, 8 = data invalid, and 9 = data not present.

DAY - 75	NO VALID DATA FOUND	
DAY - 75	MAX COUNT - 579	TIME - 75/11/13
DAY - 75	MAX COUNT - 566	TIME - 75/12/ 3
DAY - 75	MAX COUNT - 556	TIME - 75/13/40
DAY - 76	MAX COUNT - 613	TIME - 76/10/25
DAY - 76	MAX COUNT - 696	TIME - 76/11/38
DAY - 76	MAX COUNT - 674	TIME - 76/12/26
DAY - 76	MAX COUNT - 604	TIME - 76/13/ 5
DAY - 77	MAX COUNT - 666	TIME - 77/10/15
DAY - 77	MAX COUNT - 664	TIME - 77/11/13
DAY - 77	MAX COUNT - 664	TIME - 77/12/15
DAY - 77	MAX COUNT - 650	TIME - 77/13/ 2
DAY - 78	MAX COUNT - 643	TIME - 78/10/12
DAY - 78	MAX COUNT - 505	TIME - 78/11/56
DAY - 78	MAX COUNT - 617	TIME - 78/12/ 1
DAY - 78	MAX COUNT - 500	TIME - 78/13/55
DAY - 79	NO VALID DATA FOUND	
DAY - 79	MAX COUNT - 653	TIME - 79/11/25
DAY - 79	MAX COUNT - 639	TIME - 79/12/ 2
DAY - 79	MAX COUNT - 643	TIME - 79/13/27
DAY - 80	NO VALID DATA FOUND	
DAY - 80	NO VALID DATA FOUND	
DAY - 80	NO VALID DATA FOUND	
DAY - 80	NO VALID DATA FOUND	
DAY - 81	MAX COUNT - 493	TIME - 81/10/36
DAY - 81	MAX COUNT - 507	TIME - 81/11/43
DAY - 81	MAX COUNT - 525	TIME - 81/12/30
DAY - 81	MAX COUNT - 498	TIME - 81/14/ 0
DAY - 82	MAX COUNT - 404	TIME - 82/10/35
DAY - 82	MAX COUNT - 441	TIME - 82/11/36
DAY - 82	MAX COUNT - 512	TIME - 82/12/51
DAY - 82	MAX COUNT - 523	TIME - 82/13/50

FIGURE II.L. DAILY MAXIMUM VALUE SAMPLE (DAILYMAX)

This shows the maximum count reached by the LUXMETER instrument for 4 hours around noontime on 8 consecutive days in March, 1977. This data is useful for checking long-term instrument drift.

DIRECTORY \$ GET,4 \$ DUMP,1,30 \$ DONE

DIRECTORY

RECORD-	1	TAFE-47	67/10/34/59	TO	0/ 0/ 0/ 0	ENTERED	4/27/	78
RECORD-	2	TAFE-49	75/11/ 9/ 2	TO	79/ 3/20/34	ENTERED	4/27/	78
RECORD-	3	TAFE-46	59/10/ 0/ 0	TO	0/ 0/ 0/ 0	ENTERED	4/27/	78
RECORD-	4	TAFE-48	70/10/18/13	TO	74/ 9/42/20	ENTERED	4/28/	78
RECORD-	5	TAFE-53	88/ 9/59/ 0	TO	89/14/ 1/36	ENTERED	6/ 7/	78
RECORD-	6	TAFE-50	77/10/ 0/ 7	TO	80/ 6/ 5/38	ENTERED	6/ 8/	78
RECORD-	7	TAFE-52	84/10/30/ 0	TO	88/ 9/44/30	ENTERED	6/ 8/	78
RECORD-	8	TAFE-51	81/10/36/ 0	TO	84/ 9/44/36	ENTERED	6/ 8/	78

GOT RECORD - 4 START DAY - 70/10/21/ 8

70/10/21/ 8	6085262	3100000545	3100000441	359
70/10/24/24	6085464	3000000557	3000000559	90
70/10/27/20	6085640	3300000560	3300000555	181
70/10/30/16	6085816	3200000563	3200000463	271
70/10/33/12	6085992	3100000554	3100000452	0
70/10/36/24	6086184	3000000553	3000000557	90
70/10/39/16	6086356	3300000533	3300000517	179
70/10/42/12	6086532	3200000531	3200000476	270
70/10/45/ 8	6086708	3100000551	3100000472	0
70/10/48/28	6086900	3000000574	3000000563	90
70/10/51/20	6087080	3300000570	3300000566	179
70/10/54/16	6087256	3200000574	3200000510	270
70/10/57/ 8	6087428	3100000557	3100000502	0
70/11/ 0/24	6087624	3000000561	3000000549	90
70/11/ 3/20	6087800	3300000555	3300000539	180
70/11/ 6/16	6087976	3200000547	3200000514	270
70/11/ 9/ 8	6088148	3100000555	3100000504	0
70/11/12/24	6088344	3000000561	3000000550	90
70/11/15/20	6088520	3300000575	3300000585	179
70/11/18/12	6088692	3200000565	3200000526	270
70/11/21/12	6088872	3100000569	3100000515	0
70/11/24/24	6089064	3000000565	3000000536	90
70/11/27/20	6089240	3300000559	3300000568	181
70/11/30/ 8	6089508	3100000546	3100000502	0
70/11/36/24	6089784	3000000566	3000000560	90
70/11/39/20	6089960	3300000567	3300000559	179
70/11/45/ 8	6090308	3100000541	3100000504	0
70/11/48/28	6090508	3000000542	3000000508	90
70/11/51/16	6090676	3300000555	3300000555	179
70/11/54/16	6090856	3200000554	3200000517	270

FIGURE II.M. STRIPPED LUXMETER DIRECTORY AND DATA DUMP SAMPLE (LUXSTAT)

The printout shows the directory and partial contents for the March, 1977, STRIPPED LUXMETER FILE. The contents dump indicates the time (in days, hours, minutes, seconds), the time in terms of number of seconds from the beginning of the year, the contents of horizontal and vertical ILLUMINOMETER channels, and the azimuth in degrees.

DIRECTORY

RECORD- 1	TAPE- 1	59/10/ 0/ 0	TO	61/18/19/14	ENTERED	4/13/ 78
RECORD- 2	TAPE- 1	0/ 0/ 0/ 0	TO	0/ 0/ 0/ 0	ENTERED	4/20/ 78
RECORD- 3	TAPE- 1	59/10/ 0/ 0	TO	61/19/19/14	ENTERED	4/13/ 78
RECORD- 4	TAPE-49	75/11/ 9/ 2	TO	77/ 0/ 0/74	ENTERED	4/25/ 78
RECORD- 5	TAPE-48	70/10/18/13	TO	74/ 9/43/ 0	ENTERED	4/25/ 78
RECORD- 6	TAPE-47	67/10/34/59	TO	70/ 8/38/40	ENTERED	4/25/ 78
RECORD- 7	TAPE-53	88/ 9/59/ 0	TO	92/13/34/ 0	ENTERED	6/ 7/ 78
RECORD- 8	TAPE-52	84/10/30/ 0	TO	90/ 4/40/ 0	ENTERED	6/ 8/ 78
RECORD- 9	TAPE-50	77/10/ 0/ 7	TO	80/ 6/ 7/27	ENTERED	6/ 6/ 78
RECORD- 10	TAPE-51	81/10/36/ 0	TO	84/ 9/44/52	ENTERED	6/ 6/ 78

GOT RECORD - 5 START DAY - 70/13/ 2/18

70/13/ 2/18				
1797	1797	1797	1797	1
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
158				
71/ 7/ 1/54				
1784	1777	1784	1777	2
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
162				
71/ 9/ 5/16				
1676	1740	1740	1676	2
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
168				
71/10/ 5/44				
1775	1775	1775	1775	1
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
165				
71/11/ 5/10				
1653	1623	1653	1623	2
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
160				
71/12/ 2/ 7				
1658	1658	1658	1658	1
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
168				
72/ 0/ 1/ 0				
1763	1758	1763	1758	2
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
158				

FIGURE II.N. STRIPPED VISLAB DIRECTORY AND
DATA DUMP SAMPLE (VISSTAT)

The printout shows the directory and partial contents for the March, 1977, STRIPPED VISLAB FILE. For each time are the 21 data values discussed in Section II.3.1.

[illegible][illegible]

The contents of the partial ERIKFILE for March 1 and 2, 1977, is indicated. The status of data for each of the entries from element 10 to element 85 is represented by an X, 0, or -. An X indicates data has been entered; an 0 indicates nothing entered yet; a - indicates that the file which should have generated the values has been processed but the data was either invalid or not present.

STATION - 71

DATE - 770301

HOUR - 0

DURATION OF MEASUREMENT CYCLE - 10

COMMENTS -

5 0
6 0
7 0
8 0
9 0

10 SFM 0

11	SSREG	-9.10E+90	34	NV	1.00E+31	56	TX	4.04E+91
12	SSFIN	-9.10E+90	35	FFREG	-1.00E+30	57	TA	2.96E+91
13	SSMAX	-9.10E+90	36	FFFIN	-1.00E+30	58	NT.5	-1.00E+30
14	SSMIN	-9.10E+90	37	FFMAX	-1.00E+30	59	A	-1.00E+30
15	NV	-9.10E+90	38	FFMIN	-1.00E+30	60	B	-1.00E+30
16	EGREG	6.73E+02	39	NV	-1.00E+30	61	C	-1.00E+30
17	EGFIN	9.12E+02	40	FSREG	-1.00E+30	62	D	-1.00E+30
18	EGMAX	1.17E+01	41	FSFIN	-1.00E+30	63	E	-1.00E+30
19	EGMIN	6.73E+02	42	FSMAX	-1.00E+30	64	F	-1.00E+30
20	NV	1.00E+30	43	FSMIN	-9.10E+90	65	G	-1.00E+30
21	FLREG	-9.10E+90	44	FO2	-9.10E+90	66	H	-1.00E+30
22	FLFIN	-9.10E+90	45	FO3	-9.10E+90	67	I	-1.00E+30
23	FLMAX	-9.10E+90	46	FO4	-9.10E+90	68	J	-1.00E+30
24	FLMIN	-9.10E+90	47	FO5	-9.10E+90	69	K	-1.00E+30
25	NV	-9.10E+90	48	FO6	-9.10E+90	70	L	-1.00E+30
26	EVH	-1.00E+30	49	FO7	-9.10E+90	71	Q2Q2	-1.00E+30
27	EVE	-1.00E+30	50	FO8	-9.10E+90	72	F2F2	-1.00E+30
28	EVS	-1.00E+30	51	FO9	-9.10E+90	73	P00	-1.00E+30
29	EVW	-1.00E+30	52	FO10	-9.10E+90	74	TTT	-1.00E+30
30	LPREG	7.17E+05	53	T1	3.00E+01	75	T08	-1.00E+30
31	LPFIN	5.47E+05	54	T2	4.50E+01	76	PPP	-1.00E+30
32	LPMAX	9.28E+05	55	T3	3.99E+01	77	F	-1.00E+30
33	LPMIN	7.64E+05						

78 MPIO 9999
79 FLTRQ 9999
80 LHYQ 99999999
81 NPQ 9999
82 VISLQ 99999999
83 EPPLQ 9999999999
84 RAPNO 99999
85

FIGURE 11.P. ERIKFILE HOURLY DATA DUMP SAMPLE (ERIK)

The values stored in the partial ERIKFILE 1 r hour 0 of March 1, 1977, are shown. The entry -9.10E+99 indicates that the file which should have generated that value has been processed, but the data was either invalid or not present. The entry -1.00E+30 indicates data has not been entered yet. Elements 78 to 84 indicates the data quality (initialized to 9's), and 85 is a spare data word.

II.1. MINUTE CHANNEL STRIP PROGRAM

The Minute Channel Strip Program (MINSTRIP) is used to study the contents of the Raw Data File and to strip minute channel data from it to construct the Stripped Minute Channel File and its directory. Items discussed here are the buffer input algorithms, the stripped array file, and directory structures, and the Minute Channel Strip Program capabilities.

II.1.1 BUFFER INPUT ROUTINES

The buffer input routines are routines by which the blocks of data from the Raw Data File are read in to form the character array (KH) from which the time and channel data is stripped.

There are two different algorithms; one for initializing the character array at the beginning of processing or when a command is issued which requires jumping a number of blocks, and one for continuously moving ahead during the stripping process. These are shown in Figures II.1.A and II.1.B.

Initializing the character array, KH, is done in 6 steps as diagrammed in Figure II.1.A. Notice that the character array contains a complete block of data plus a portion of the next block. This overlap is so that the character array can continuously yield data to the stripper. The raw data blocks are read into an intermediate buffer (BUFF) using the FORTRAN BUFFER IN statement, and BUFF is then decoded to form the character array, KH.

The technique for continuously moving ahead during normal processing is shown in Figure II.1.B. Here also 6 steps are necessary for the advancement.

II.1.2 STRIPPED MINUTE CHANNEL DATA & FILE STRUCTURES

The stripped minute channel data is stored in a single file containing up to 62 half-day records. Each file is for a one month period. Each half-day record requires 12240 central memory words and thus was a good compromise

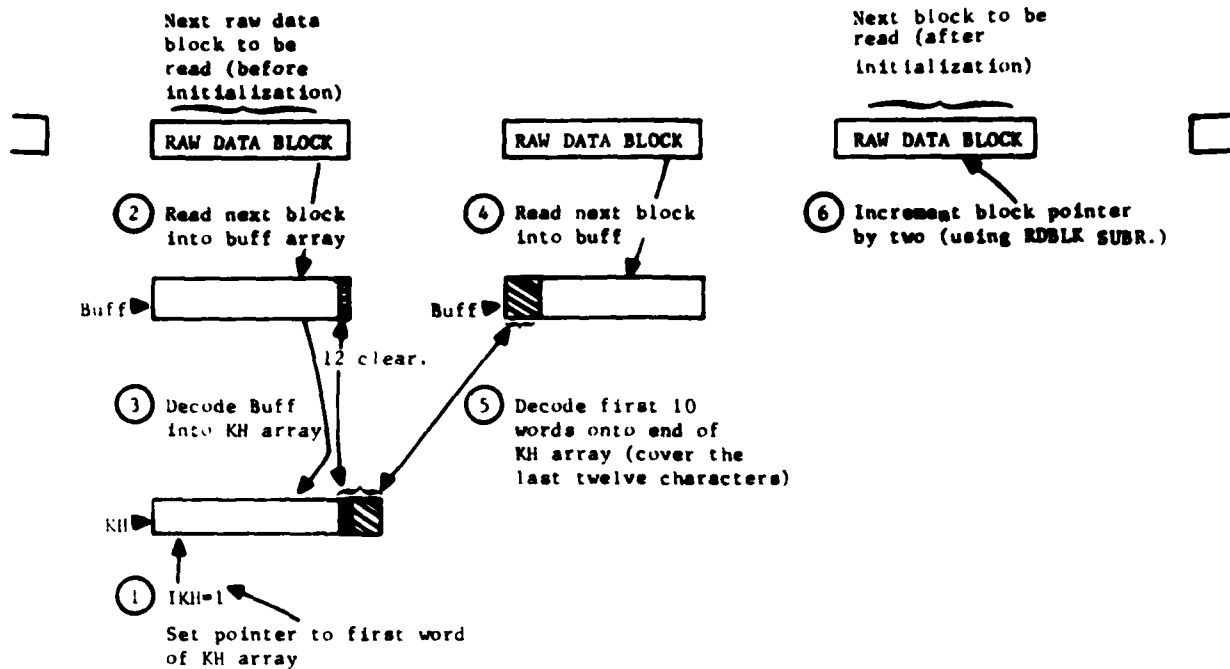


FIGURE II.1.A. CHARACTER ARRAY INITIALIZATION

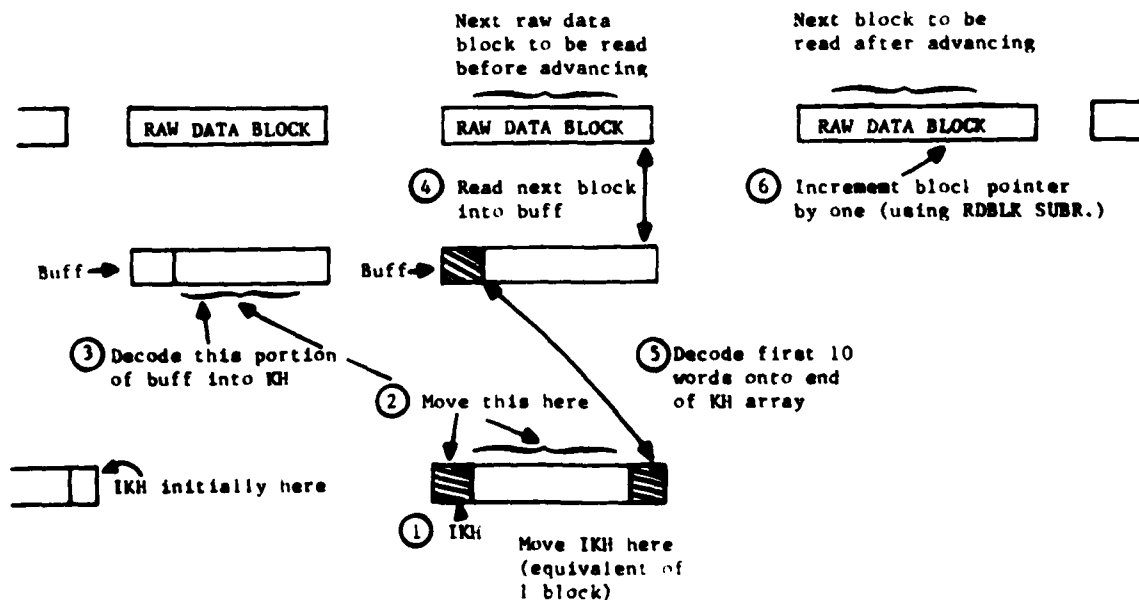


FIGURE II.1.B. ADVANCING CHARACTER ARRAY ONE BLOCK

between core memory storage and a reasonable time length. An additional record contains the half-day information for each of the 62 half-day records contained in the file and is used primarily for checking.

The time periods for the half-day records has been chosen according to the time that tapes are ordinarily changed at the Meppen site; hence, the first half-day starts at 10:00 and ends at 21:59; the second half of the record starts at 22:00 and ends at 9:59 of the following day. For example, the record, day 67, half 1, covers the period 67:10:00 to 67:21:59, and the record day 67, half 2, covers the period 67:22:00 to 68:09:59.

To put times on a manageable basis, all times stored and used in the programs are in terms of seconds from the beginning of the year. This conversion is handled by the function ITIME:

$$\text{ITIME}(\text{ID}, \text{IH}, \text{IM}, \text{IS}) = 60(60(24(\text{ID}) + \text{IH}) + \text{IM}) + \text{IS}$$

A similar inverse function performs the conversion back.

The data stripped from a single minute of the Raw Data File requires 17 words of the 12240 word array IDATA. The structure of these 17 words is shown in Figure II.1.C. The first word of the 17 stores the time of the data; the remaining 16 words contain the channel data packed two values per word.

The location of the data in the IDATA array for a particular minute is determined by a base subscript IBASE (in which word the time resides). IBASE is defined as follows:

$$\text{IBASE} = \text{Int} \left[\frac{\text{IT} - \text{ITS} + 2}{60} \right] \times 17 + 1$$

where IT is the data time

and ITS = 1111111111111111, 0 for half 1

and ITS = 1111111111111111, 0 for half 2

The location of each channel data in terms of IBASE is shown in Figure II.1.B.

The structure of a single data word is also shown in Figure II.1.C. Each channel data is stored in 24 bits (6 - 4 bit hex characters). How the value and discrete are obtained from the hex characters is also shown in the figure.

The Stripped Minute Directory contains room for 5 months of data. Currently each directory is used for only 1 month's data. For each record is contained: the record number, the tape number, day, half, and the date (day, month, year) that the stripped data was entered. An eighth entry for each record is a sorting integer. This is updated each time a record is added or modified. This array of sorting integer gives the record numbers in chronological order so that a sorted directory or sorted contents can be listed directly without sorting it each time.

II.1.3 MINUTE CHANNEL STRIP PROGRAM CAPABILITIES

The Minute Channel Strip Program allows the user to inspect the contents of a Raw Data File or strip data from minute channels. With the program one can:

- * survey all or a large portion of the tape file
- * access a particular data time or block on the tape file
- * study a small segment of the Raw Data File contents in detail using several routines:
 - i) Dump a segment of the Raw Data File.
 - ii) Show the next several data times.
 - iii) Generate a summary table (profile) of a segment of the Raw Data File contents (data times, which channels are present, and an indication of their values). The entries in the summary table can be one of the following: all data, every minute only, every five minutes only, every 30 minutes only, every hour only, or every 4 hours only.
- * strip the raw data from minute channels to create a Stripped Minute Channel File for a portion or for all of a half day record.
- * automatically strip a whole tape
- * merge two partial records of the same half-day
- * list the directory of half day records already stripped in the order they were input and chronologically
- * get a stripped data record from the disk file and load it into core
- * inspect the contents of the stripped data record residing in core.

The program can be used interactively on a time-sharing terminal. The command language is very simple to use so that the experimenter may desire

to use the program himself. The command language is also flexible; one may use statements which are very readable or use short abbreviations for convenience. The program can also be executed in batch mode so that results may be output on the line printer.

To use the program one must first attach it, the desired Raw Data file, and the Stripped Minute Channel File and Directory residing on the disk. First there is a short log-in procedure in which the user specifies the current date and is requested to input the stripped tape number and the form of coding on the Raw Data File (either hex or character).

11.2 LUXMETER STRIP PROGRAM

The Stripped Luxmeter File and Directory structure and Luxmeter Strip Program capabilities are presented below.

11.2.1. STRIPPED LUXMETER FILE AND DIRECTORY STRUCTURE

Data for the stripped Luxmeter is stored in files which hold one month's data. Each record in the file is intended to hold the stripped data from 1 Raw Data File.

The Luxmeter instrument (which measures the horizontally and vertically incident illumination) is continuously rotating in a clockwise direction viewed from above, and the data to be entered into the Stripped Luxmeter File is that when the vertical axis is in the direction of the compass points. The average rotation rate is 12 minutes per revolution or 30° per minute. The instrument sample time is 4 seconds so that the instrument rotates through 2° between each sample. The algorithm used in selecting the samples is as follows: the first sample between $0^\circ \pm 2^\circ$, $90^\circ \pm 2^\circ$, and $180^\circ \pm 2^\circ$, and $270^\circ \pm 2^\circ$ is taken as the north, east, south, and west sample respectively.

To determine the required size of the Stripped Luxmeter File, we note that at 12 minutes per revolution we should obtain 1 sample for the file every 3 minutes. Assuming a raw data tape may be up to 4 days long, we need to store at least $60/3 \times 24 \times 4 = 1920$ samples per file. For each sample we store four values:

1. The data time (in seconds from the beginning of the year)
2. The horizontal channel data (channel 24) $(COUNT \times 10000 \text{ minus } 118311.0)$
3. The vertical channel data (channel 25) $(COUNT \times 1000000 \text{ minus } 118311.0)$
4. The azimuth (channel 10) (in degrees from north) (in degrees)

Consequently we use an array dimensioned 4 x 2000 in the program. If the raw data for a particular sample was an overflow, 9999 is stored as the value for channel 24 or 25. If the raw data was not all integer digits or the leading bit was not zero, 8888 is stored as the value for channel 24 or 25.

For each record entered into the Stripped Luxmeter File, the following entries are made in the Directory:

- (1) Record # (1 to 10)
- (2) Raw Tape #
- (3) First data time in record
- (4) Last data time in record
- (5) Number of data times contained in record
- (6), (7), (8) Date record was entered in file (day, month, year)

Since there may be up to 10 records per file, the directory information array is dimensioned 8 x 10. Several months required more than 10 data tapes; two Luxmeter Files were generated for those months.

II.2.2 LUXMETER STRIP PROGRAM CAPABILITIES

With the Luxmeter Strip Program the user can do the following:

- * strip all or a portion of the attached Raw Data File using a time efficient algorithm (strip) or a slightly less efficient algorithm (claw), which is more impervious to bad raw tape data, and load it into the Stripped Luxmeter File
- * list the directory or records in the Stripped Luxmeter File
- * get a stripped data record from the attached Stripped Luxmeter File
- * dump any portion of the record in core

To use the program, one must use a procedure call as described above. There is a short log-in procedure (identical to that in the Minute Channel Stripping Program). The strip commands may then be used.

II.3 VISLAB STRIP PROGRAM

The Vislab Strip Program strips data from the Variable Path Function Meter (VPFM). The Stripped Vislab File structure is presented below. The Directory structure is identical, and the user's instructions are nearly the same as the Luxmeter Strip Program; only differences will be mentioned below.

II.3.1 STRIPPED VISLAB FILE STRUCTURE

Like the Stripped Luxmeter File, each record holds the stripped data from 1 raw data tape, and 10 records comprise a one-month file.

The VPFM instrument, unlike the Luxmeter, does not rotate at constant rate but rather positions itself and dwells at a compass point for a short interval of time. The algorithm used is to select all points which are within ± 2 degrees of the compass points and process them. For some periods of time the instrument was not rotating, and for this the algorithm accepts all points and assumes the instrument is east directed.

Data is normally recorded onto the raw tape once per second during a 10 minute period each hour. The stripping technique stores data meeting the direction criteria above for this 10 minute period and then is processed to obtain first, last, max, and min values for storing in the stripped array. Values outside the physical range of the readings are not used. Also the filter, which is assumed not to change over a ten-minute period is also inserted into the array.

For each 10 minute period the stripped file contains the following values:

1. Time (in seconds after the beginning of the year) of the first data point
 2. First value
 3. Last value
- } for north direction ($0^\circ \pm 2^\circ$)

- 4. Max value } for north direction ($0^\circ \pm 2^\circ$)
- 5. Min value }
- 6. Number of samples used
- 7-11. Same as 2-6 but for east direction ($90^\circ \pm 2^\circ$)
- 12-16. Same as 2-6 but for south direction ($180^\circ \pm 2^\circ$)
- 17-21. Same as 2-6 but for west direction ($270^\circ \pm 2^\circ$)
- 22. Filter used

Assuming that a raw data tape may be up to 5 days long (this was determined to be a better figure than the 4 day period used for the Luxmeter File), we must store the 22 elements a total of $5 \times 24 = 120$ times. Hence, the stripped data array is dimensioned 22×120 in the program.

The directory structure is identical to that used for the Luxmeter File.

II.4. MINUTE CHANNEL OUTPUTS

Routines have been written to obtain graphical outputs and tables from the Stripped Minute Channel Files. Typical samples are shown in Section II.

One can obtain:

1. time plots over any time scale (up to one month) (See Figure II.G.)
2. xy plots (up to one month) (See Figure II.H.)
3. histograms (up to one month) (See Figure II.I.)
4. two-hour stripped array profiles (See Figure II.J.)
5. data tables for up to 7 channels over specified period of time (See Figure II.K.)
6. daily maximum counts (See Figure II.L.)

All of the plot routines use a "plot composition algorithm". An array, which will be the plot, is first cleared and a grid is applied. Next, each function is applied by inserting characters at appropriate locations in the array. Finally, the composed array is printed out.

The configuration of axes used on the plot routines is shown in Figure II.4.A. The grid is determined by 4 numbers:

number of divisions in vertical direction ($ndiv_v$)

number of points per division in vertical direction (npd_v)

number of divisions in horizontal direction ($ndiv_h$)

number of points per division in horizontal direction (npd_h)

For the grid shown, these numbers are 8,5,5,10 respectively. The only restrictions on the grid size is:

$$ndiv_v * npd_v \leq 60$$

$$ndiv_h * npd_h \leq 120$$

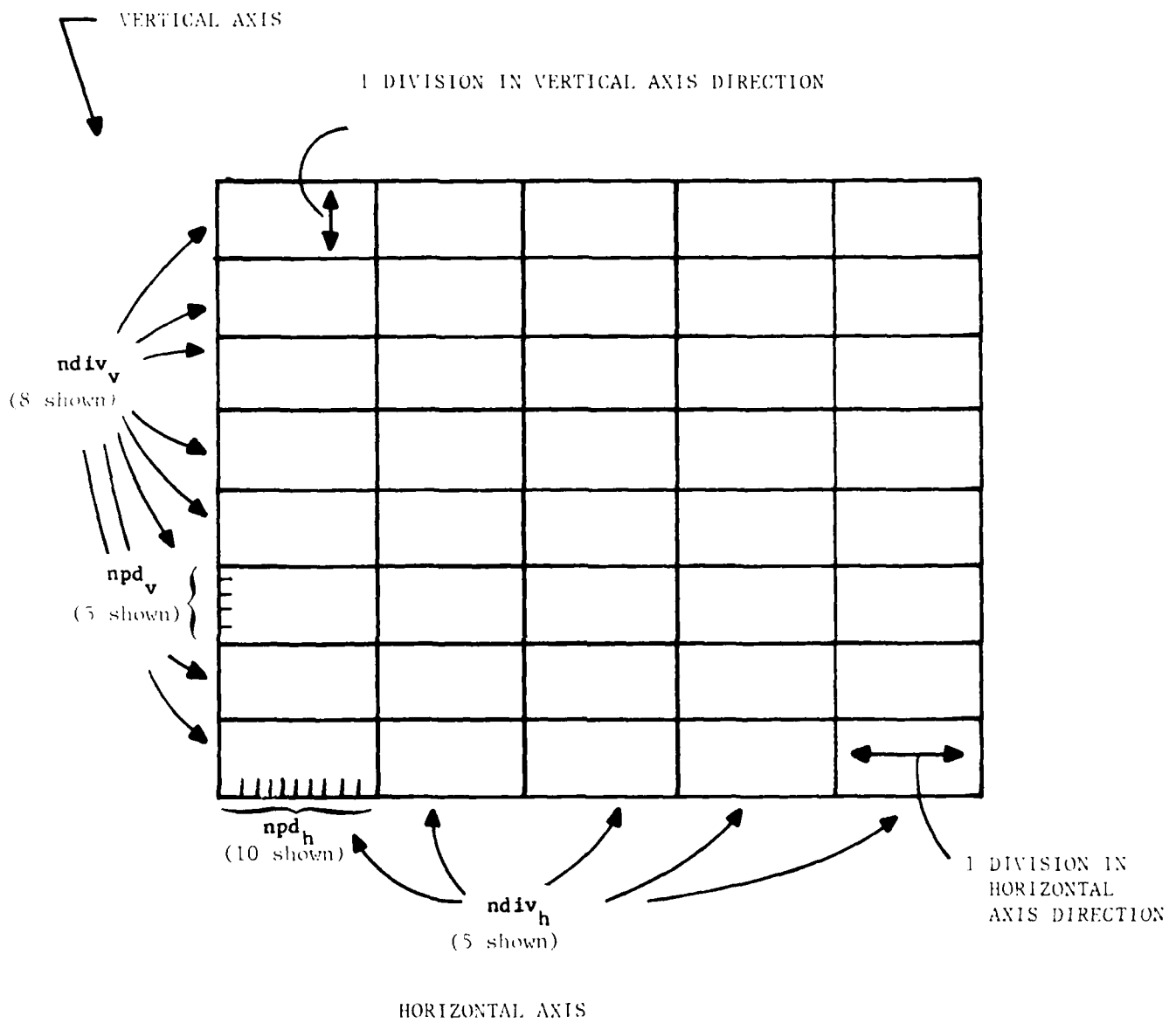


FIGURE II.4.A. Grid Configuration.

For time plots it is necessary to specify the number of minutes per division in the horizontal direction. This should be selected so that each space is at least one minute.

There are three options for scaling the variables to be placed in the grids.

Option 0 - automatic linear scaling. The bottom and top magnitudes are selected with an automatic scaling routine.

Option 1 - linear scaling. The values of the function at the bottom and top of the graph are specified by the user.

Option 2 - logarithmic scaling. The decipowers at the bottom and top of the graph are specified by the user. (decipower is the exponent i in 10^i)

Every channel to be plotted can be scaled separately. If no scaling is specified, Option 0 is used as default.

To make the plots as clear as possible, unique characters have been assigned to each possible function. Different filters for the BARNES instrument have different plot characters. These have been applied consistently whether the plot is a time plot or histogram. For example, the MRI Channel 2 data will always be plotted using the character B. A list of current channel numbers and the corresponding plot symbols used are given in Figure II.4.B.

LIST OF CHANNEL NUMBERS

CHANNEL NUMBER	PLOT SYMBOL	DESCRIPTION
0	A	MRI NEPHELOMETER Channel 1
1	B	MRI NEPHELOMETER Channel 2
2	C	MRI NEPHELOMETER Channel 3
3	D	MRI NEPHELOMETER Channel 4
4	E	ELTRO TRANSMISSOMETER Output
5	F	NIGHT PATH Filter
6	G	NIGHT PATH Output Signal
7	H	NIGHT PATH Range
11	J	VPFM Photo Meter
12	K	VPFM Azimuth
13	L	VPFM Filter Position
14	M	LASER PAR
15	N	LASER Power Meter
16	O	LASER Power Meter
17	P	LASER Gain
21	Q	BARNES IR TRANSMISSOMETER (without regard for filter)
210	6	BARNES IR TRANSMISSOMETER with filter 0
211	7	BARNES IR TRANSMISSOMETER with filter 1
212	8	BARNES IR TRANSMISSOMETER with filter 2
213	9	BARNES IR TRANSMISSOMETER with filter 3
23	R	RAIN GAUGE
24	S	ILLUMINOMETER Horizontal
25	T	ILLUMINOMETER Vertical
26	U	ILLUMINOMETER Azimuth
31	V	SCANNING NEPHL Angle
32	W	SCANNING NEPHL Scale Shift
33	X	SCANNING NEPHL Photo Diode
34	Y	SCANNING NEPHL Monitor
36	Z	EPPLEY PYROHELIOMETER Filtered Channel
37	*	EPPLEY PYROHELIOMETER Direct Channel

Figure 11.4B Channel Numbers
and Plot Symbols

II.5 GENERATING OPAQUE DATA FILE (ERIKFILE)

The Erik file is a monthly file containing values generated from the three stripped files, the Stripped Minute Channel File, Luxmeter File, and Vislab File. Three separate procedure files, ERIK, LUXERIK, and VISERIK are used to obtain values for the Erik file from each of the three stripped files. ERIK also contains several routines to output information from the Erik file.

II.5.1. ERIKFILE STRUCTURE

The Erik file is a one-month file containing 31 records, one for each day of the month. For months containing less than 31 days, 31 records are still used for simplicity; the extra records are merely neglected. Each daily record contains an array dimensioned 85 X 24. There are 85 entries for each hour of the day. There is one entry for each of the 78 data words in the standard hourly OPAQUE data set (see Fenn¹), and one entry for each of the 7 different types of optical measurements, which indicate the reliability of the data. The entries are derived from a 10-minute period following the hour, Mean Local Solar Time. For tapes before April 12, 1977, this 10-minute period was between 30 and 40 minutes past the hour on the data logger clock (consistent with the local time zone). After that date the data logger clock was adjusted to Mean Local Solar Time, so this 10-minute period was the first 10 minutes of the hour. The first program was written for this latter case but corrected to accept times between 30 and 40 minutes past the hour. The program must be readjusted for processing data collected after April 12, 1977.

The 85 entries collected each hour consist of several different kinds defined in the document "Meppen Measurements Input Into OPAQUE Data Bank", which is reproduced in Appendix I. The 85 words for each hour was initialized as follows:

1. Fenn, R. W. (1978) OPAQUE, Vol 1, AFGL-TR-78-0011

1. (station number) 71
2. (date) year, month, day, packed into 6 rightmost digits
3. (time) hour (0,1,2,...,23)
4. (duration of measurement cycle) 10
- 5-10 (comments and scattering-filter-humidity) 0
- 11-57 (measurement values) $-1 \times 10^{+30}$
- 58-77 (weather data) $-1 \times 10^{+30}$
- 78-85 (data quality) appropriate number of 9's

The processing of measurement values are of several types:

1. The MRI Photopic channel, Eltro, Horizontal Luxmeter, Night Path Luminance, and the east direction VPFM required the beginning value, end value, max value, min value, and number of samples used in the 10 minute period.
2. The vertical Luxmeter required one value from each of the four compass points.
3. The VPFM samples in the south, west, and north compass points were required in addition to the 5 values above for the east direction.
4. The direct Eppley required the beginning and end value.
5. The filtered Eppley and Barnes instrument required values entered, depending on the filter being used for the measurement.

If the values were supposed to be added to the array but were not either because the values were not physically present, or it was not possible to interpret the data, then the -1×10^{30} was changed to -9×10^{99} so that it is possible to distinguish between these two cases.

11.5.2. ERIK PROGRAM CAPABILITIES

The ERIK Program allows the user to process data from the Stripped Minute Channel File into the format necessary for the Erik File over a time period specified by a begin and end time. It also allows the user to output the contents of the Erik File in several forms:

1. contents summary of a given record
2. contents summary of all 31 records in the file
3. dump of all values of a given day between specified hours
4. dump of all values starting and finishing at specified days
5. display of specified channels only between specified days

Finally it allows the user to replace one particular channel of the attached Erik File with the corresponding channel of the attached Temporary Erik File over a specified time range.

Conclusions

The similarity of many of the programs described in Part I and Part II is due to the sequential nature of the data recording format and the need for a "quick-edit" approach to complement the stripping and formatting of the data base for subsequent access. The volume of data being processed requires that pre-editing of the data is a necessary prerequisite to stripping and formatting for it provides information on the data tape recording quality along with data parameters that serve as processing checks and verification. In attempting data recovery on especially "noisy" recordings, an independent means of verification is mandatory.

The programs described in this report constitute a complete system package to be used in the accessing, processing, reduction, and analysis of the OPAQUE data base generated at the U.S.A.F. field station in Meppen, Fed. Rep. of Germany. While some of the programs are unique to this application; i.e., the instrument calibration package and the specific data file packing algorithm, most of the programs can be readily adapted to other applications. All of the raw data tape utility, editing, processing, and display programs can be readily reconfigured to operate with different tape recording formats. The general format of the data files can be used in the processing of data from other sources, and the modularity of the structure allows numerable variations in the sequence of processing steps. Additional algorithmic modules can be linked into the program packages with the appropriate user-defined commands.

The use of procedure files to call and execute the system programs greatly simplifies the user-system interface. From the user standpoint, the elimination of a large number of control cards from the JOB run deck allows one to concentrate on the interpretation and analysis of the computer printout rather than correct control card errors.

Appendix I

ERIKFILE/OPAQUE DATA BANK FORMAT

<u>Data Bank Word No.</u>	<u>Data Item</u>	<u>Measurement</u>	<u>Data Logger Channel</u>
1	Station No.	= 71	
2	Date - Year, Month, Day		
3	Time		
4	Duration of Measurement Cycle	= 10	
5	Comment Numbers	= 000	
6	" "	= 000	
7	" "	= 000	
8	" "	= 000	
9	" "	= 000	
10	Scattering x100 + Filter x 10 + Humidity		
11	S _S BEG		
12	S _S FIN		
13	S _S MAX	MRI Nephelometer	2
14	S _S MIN	(After Mar 78 AEG Point Visibility Meter)	
15	N _V	= Number of Measure- ments	
16	E _g BEG		
17	E _g FIN		
18	E _g MAX	Eltro Transmissometer 4-0	
19	E _g MIN		
20	N _V		
21	E _L BEG		
22	E _L FIN		
23	E _L MAX	Horizontal Luxmeter	24
24	E _L MIN		
25	N _V		
26	E _V ^N (North)		
27	E _V ^E (East)		
28	E _V ^S (South)	Vertical Luxmeter	25
29	E _V ^W (West)		(compass points from 26)

<u>Data Bank Word No.</u>	<u>Data Item</u>	<u>Measurement</u>	<u>Data Logger Channel</u>
30	L _p ^{NT} BEG		
31	L _p ^{NT} FIN		
32	L _p ^{NT} MAX	Night Path Luminance	6 (with 5 & 7
33	L _p ^{NT} MIN		
34	NV		
35	F _p ^E BEG		
36	F _p ^E FIN		
37	F _p ^E MAX	Vis Lab. Variable Path Function Meter	11 (Directions from 12)
38	F _p ^E MIN		
39	NV		
40	F _p ^S		
41	F _p ^W		
42	F _p ^N		
43	E _o ¹	$\lambda = 0.945$	37 f = 1
44	E _o ²	$\lambda = 0.4$	37 f = 1
45	E _o ³	$\lambda = 0.87$ Eppley Filtered	37 f = 1
46	E _o ⁴	$\lambda = 1.06$	37 f = 4
47	E _o ⁵	$\lambda = 0.75$	37 f = 5
48	E _o ⁶	$\lambda = 0.55$	37 f = 6
49	E _o ⁷	photopic	37 f = 7
50	E _o ⁸	$\lambda = 0.3$ to 3.5	36 BEG
51	E _o ⁹	Direct Eppley	
52	E _o ¹⁰	$\lambda = 0.3$ to 3.5	36 FIN

Data Bank Word No.	Data Item	Measurement	Data Logger		
			Channel	Before	After
53	T ₁	3-5μ EEG		Day 96 f = 0	Days 96-145 f = 1
54	T ₂	8-12μ		f = 3	f = 3
55	T ₃	8-13 Barnes Transmissometer	f = 2	f = 2	f = 2
56	T _x	Open or 4μ	f = 1	f = 0	f = 0
57	T ₈	3-5μ FIN	f = 0	-	f = 1
58	D _T ^{1/2}	Contel			
59	A				
60	B				
61	C				
62	D				
63	E				
64	F				
65	G				
66	H				
67	I				
68	N	Cloud Cover			
69	dd	Wind Direction at 10m			
70	ff	Wind Speed at 10m			
71	d ₂ d ₂	Wind Direction at 2m			
72	f ₂ f ₂	Wind Speed at 2m			
73	PPP	Pressure			
74	TTT	Temperature			
75	T _d T _d T _d	Dew Point Temp			
76	rrr	Rain Rate			
77	E	General Ground State			
78	QQQQ	Packed MRI Data Quality			
79	QQQQ	Packed Eltro Data Quality			
80	QQQQQQQQ	Packed Luxmeter Data Quality			
81	QQQQ	Packed Night Path Data Quality			
82	QQQQQQQQ	Packed Vis Lab Data Quality			
83	QQQQQQQQQQ	Packed Eppley Data Quality			
84	QQQQQ	Packed Barnes Data Quality			
85	RRR	Total Rain for Past Hour			

23 (Total Rain)