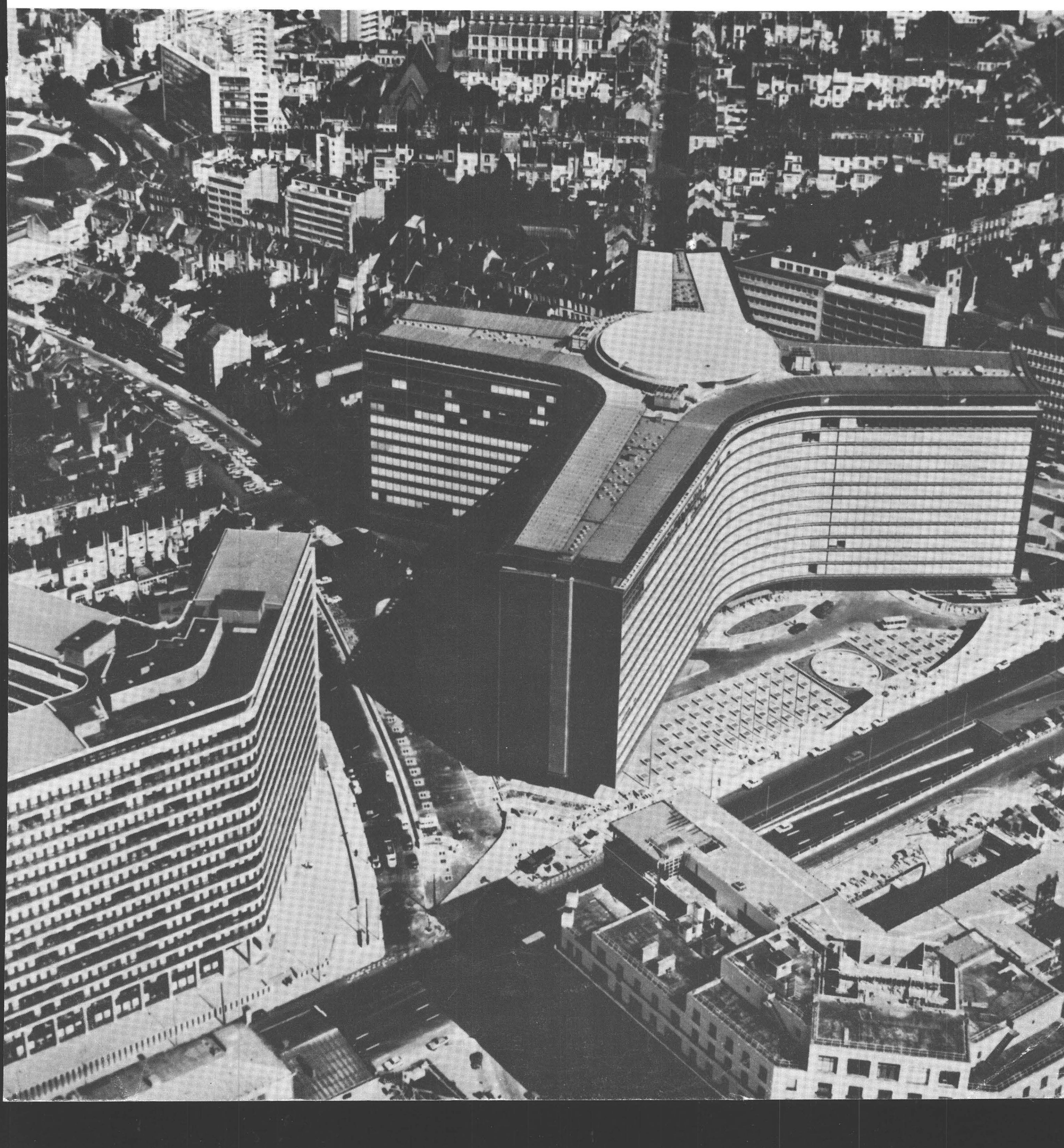
CAMAC bulletin

A publication
of the
ESONE Committee

ISSUE No 1
June 1971



From the editor

This is the first issue of a publication designed to bring you news about the CAMAC standard for modular data handling equipment.

Those who are not familiar with CAMAC will find an introduction to CAMAC and the ESONE Committee which developed it. There is also a list of published papers for further reading.

For users of CAMAC equipment there is a Products Guide, including most currently available equipment, and also announcements of new products by the manufacturers. In this issue "Applications Notes" presents descriptions of CAMAC systems for use in nuclear physics, medicine, and environmental studies.

CAMAC Bulletin also includes official announcements from the ESONE Committee about its activities and specifications. The vigorous programme of work to extend and support the CAMAC standard is highlighted in a report on the 1970 ESONE Annual Conference and in statements by the chairmen of the four working groups.

This issue of the Bulletin has been produced by volunteers from several member laboratories of ESONE, backed by willing contributors and the encouragement of the ESONE Committee. It would not have been possible without the generous help of the Commission of the European Communities, who have printed and distributed it free of charge.

The Editorial Working Group hopes to produce three issues of the Bulletin each year, and welcomes contributions from readers. Particularly welcome are descriptions of CAMAC systems, short announcements of new products from manufacturers, news of hardware and software developments by laboratories, and short papers from firms or laboratories describing topics of general interest and relevance to CAMAC.

Undoubtedly the mailing list for this issue has not been accurate or complete. Readers are therefore asked to complete one of the reply cards from the back cover if they wish to be on the mailing list for the next issue. Please send a reply card even if this issue was sent to the correct name and address. The additional information on the card will help in adjusting the balance of interest between users and manufacturers, and between nuclear and other applications.

CAMAC
bulletin

Editorial Working Group:

W. Attwenger
R.C.M. Barnes
W. Becker
H. Bisby
H. Meyer
M. Sarquiz

Editor:
R.C.M. Barnes

Correspondence to:

the Secretary of the
ESONE Committee
W. Becker, CCR Euratom
I- 21020 Ispra (Va) Italy

Printed and distributed by:

Commission des
Communautés Européennes
rue de la Loi, 200
1040 Bruxelles - Belgique.

On the cover:

View of the main building of the Commission of the European Communities (Berlaymont), the birthplace of the bulletin.

On the left, the "Charlemagne" building, at present center for negotiations between EEC and countries which are candidates for EEC entry.

(Photo IMBEL)

Cher Lecteur,

Une heureuse coincidence me procure l'occasion de m'adresser à vous pour présenter le premier numéro du Bulletin CAMAC qui est une des conséquences de la diffusion considérable des travaux du Comité ESONE.

Ce Bulletin est destiné à assurer essentiellement une meilleure information des utilisateurs du Système CAMAC en leur donnant des renseignements pratiques directement utilisables.

Par ailleurs, nous souhaitons vivement que ce Bulletin vous procure un moyen d'établir des contacts directs avec d'autres collègues qui travaillent dans différents domaines et sont confrontés avec des problèmes similaires.

Comme nous sommes persuadés que le but principal de toute publication est de répondre aux désirs de ses lecteurs, nous vous demandons de considérer ce premier Bulletin comme une maquette qui doit être mise au point avec l'aide de votre contribution. Dans ce but, je me permets de vous demander de nous faire part de vos suggestions et de vos critiques qui seront les bienvenues pour les prochains numéros.

Président (1970-71) du Comité ESONE

Dear Reader,

I am very happy to have the opportunity of introducing to you the first issue of the CAMAC Bulletin, which has come into being as a result of the greatly widening interest in the work of the ESONE Committee.

Essentially, the Bulletin sets out to provide a better service for users of the CAMAC system by giving them useful and practical information.

In addition, we sincerely hope this Bulletin will be a channel through which you can get in direct touch with colleagues elsewhere who are working in various fields and have similar problems.

We feel that the main object of any publication is to meet the needs of its readers, and regard this first Bulletin as a trial model which will be improved upon with your help. To achieve this, may I ask you to let us have your suggestions and criticisms, which will be welcomed with a view to future issues.

M. SARQUIZ

Chairman (1970-71) of the ESONE Committee

CONTENTS

ESONE AND CAMAC ... ... page	2
ESONE GENERAL ASSEMBLY 1970	4
APPLICATIONS NOTES	5
1. Analysis of Sleep EEG	5
2. Meteorological Data Logging	7
3. Pion-Proton Elastic Scattering	12
LABORATORY ACTIVITIES	15
1. CAMAC at CERN	15
2. FOCAL overlay ... ... page	18
PREPARATION OF PAPERS	20
NEW PRODUCTS	21
ESONE ANNOUNCEMENTS	26
ACTIVITIES OF THE WORKING GROUPS ...	27
MEMBERSHIP OF THE ESONE COMMITTEE	29
CAMAC PRODUCTS GUIDE	30
CAMAC BIBLIOGRAPHY	40

ESONE AND CAMAC

The ESONE Committee is an inter-laboratory organisation formed in the latter part of the 1950/60 decade. Dr. G. Giannelli, then Head of Electronics at the recently formed research centre of EURATOM (European Communities) at Ispra, encouraged a movement towards compatibility and interchangeability of electronic equipment in all the nuclear laboratories of member-countries of EURATOM. The outcome was a definition, by the Committee, of the "European Standard of Nuclear Electronics" in EURATOM report EUR 1831, issued during 1964.

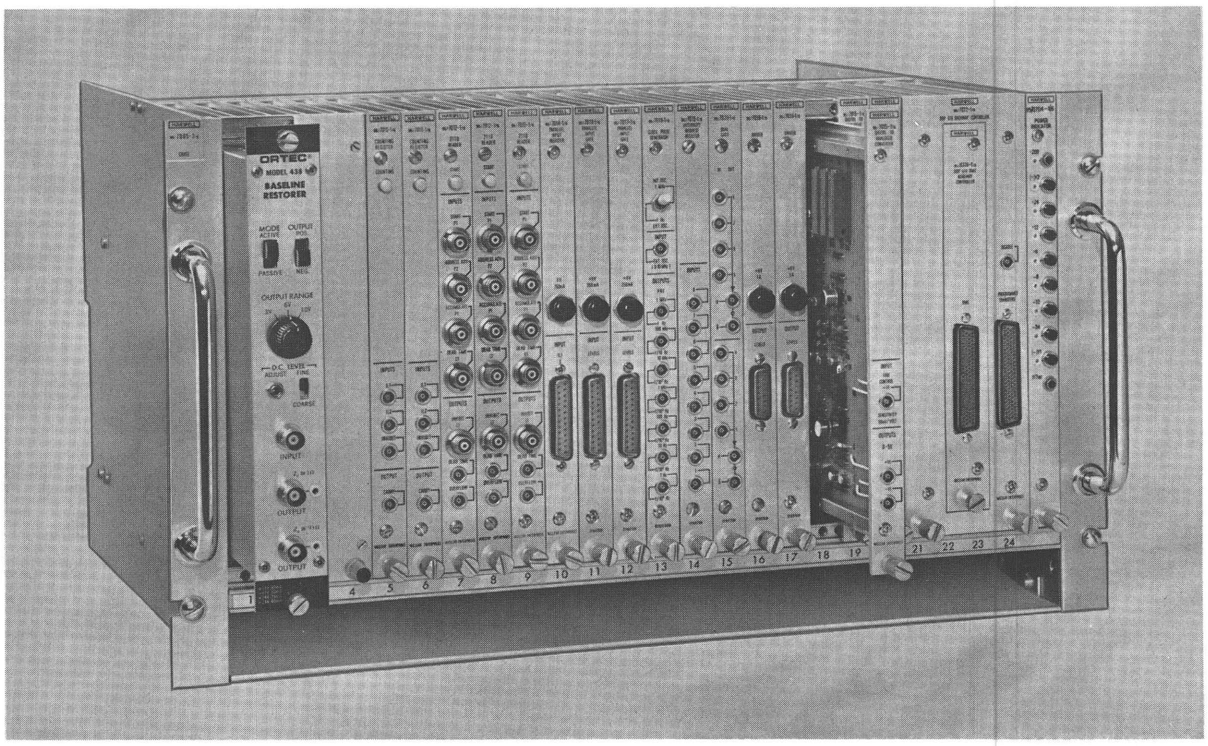
This equipment was modular in form and a 19 inch crate contained 8 single-width stations, each fitted with guidance and a socket. The sockets, into which modules plugged, were bussed together to supply standard power voltages to modules. Equipment of this variety is still designed and used in some of the laboratories concerned with its definition.

Since 1964, additional laboratories have joined the Committee, attracted by its aims which are:

"To formulate, recommend and promulgate practices, in areas where international standards do not exist, for application in the design and utilization of electronic equipment with a view towards encouraging interchangeability of equipment and common practices among laboratories, institutes and other organisations."

In 1966, the enlarged Committee began to examine the feasibility of a 'standard' scheme of interfacing computers to transducers and actuators in real-time systems, recognising that the integrated circuit element would revolutionise electronic equipment during the 1970/80 decade. Working Groups of appropriate specialists studied the mechanical format, the data transfer operations, the power voltages and the electrical signals which would be required for such a scheme. Their recommendations were agreed in 1968 and published in 1969 in EURATOM report EUR 4100 'CAMAC—A Modular Unit System of Electronics for Data Handling'.

This document was a foundation stone on which to build additional levels of compatibility. For example, EUR 4100 relates only to data transfers between modules and a common controller via the 'Dataway' in a single crate. Experience rapidly showed that CAMAC needed extending to multiple crate configurations linked by a second parallel highway—'the Branch Highway'—to a common branch driver or coupler. The standardisation of the highway and an associated typical crate controller (Type A) was again studied by a Working Group and its recommendations were accepted by the ESONE Committee in October 1970 and are now published in 'CAMAC—Organisation of Multi-Crate Systems'—EUR 4600 (Preliminary Issue).



CAMAC is a means of interconnecting many peripheral devices through a digital data highway to a data processing device such as a computer. The 24-bit data highway (the CAMAC 'Dataway') forms part of a standard crate in which are mounted plug-in 'modules' associated with the peripherals and a plug-in 'controller' associated with the data processor. The CAMAC specification defines the interaction between plug-in units and the crate in terms of mechanical, logical, and electrical characteristics which ensure compatibility between equipment from different sources.

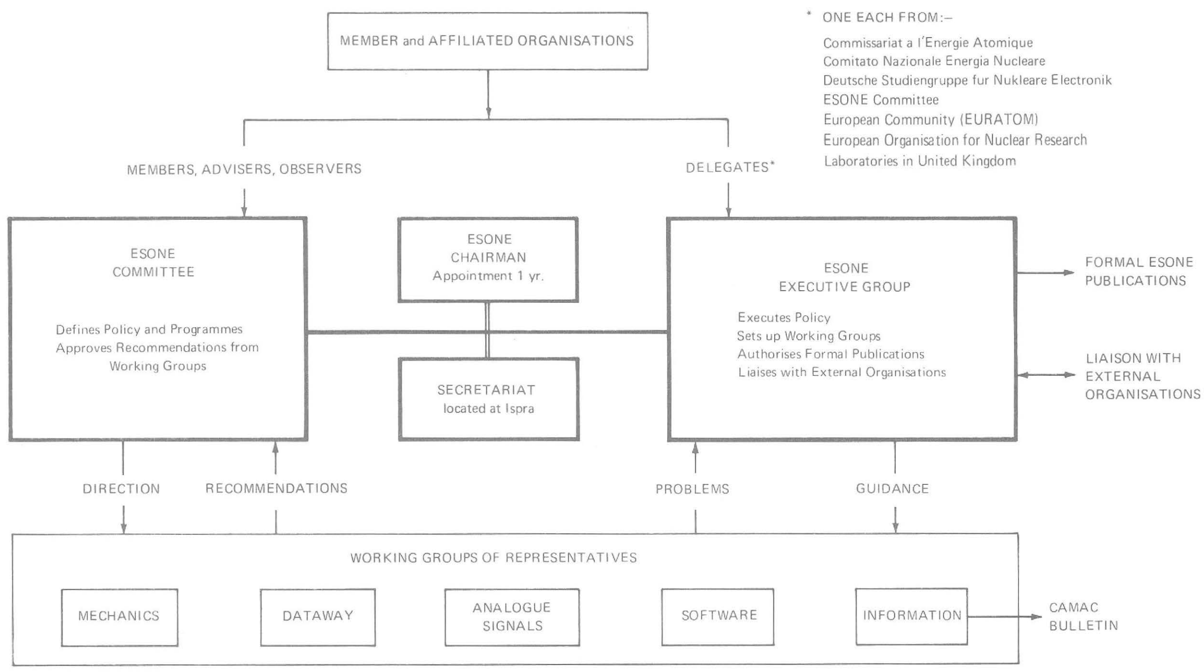


Fig. 1 ESONE Organisation 1970

Another Working Group has formulated and agreed recommendations for CAMAC amplitude analogue signals which are about to be published in EUR 5100. Recently, a Software Working Group has begun to study programming and language techniques to make software for CAMAC applications device independent and relatively easy to apply.

During this period more organisations joined in the work of the Committee which now comprises 29 national and international laboratories in Austria, Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Poland, Sweden, Switzerland, United Kingdom and Yugoslavia. Throughout, there has been close liaison with the USAEC NIM Committee, whose representatives have, directly or indirectly, contributed to the achievement of CAMAC, so much so that the CAMAC document EUR 4100 was endorsed by that Committee in March 1970.

In the early stages the ESONE Committee was able to operate on an impromptu basis; its growing size has however made necessary a more formalised structure and mode of operation. This is set out in a constitutional document 'ESONE 1970'. Briefly, there are two categories of membership, Full and Affiliated. Each full-member organisation can appoint one of its representatives to be a Committee Member and these members may have advisers from the same laboratory at ESONE General Assemblies or on Working Groups. Similarly, affiliated organisations can appoint Observers who may have advisers. No profit-making commercial organisation can be represented on the Committee. A different chairman is appointed at each ESONE General Assembly and is also the chairman of a small Executive Group of members from, typically, the larger organisations of which many of the laboratories form part *(fig. 1)*. The Committee defines the programme of work which is then allocated as specific tasks to working groups comprising appropriate experts. These working groups appoint their own chairman and secretary and are required to make unanimous recommendations to the Committee, for either unanimous agreement or reference back.

The Executive Group is responsible for authorising the subsequent publication of documents containing these unanimous recommendations. It has other responsibilities under general directives from the Committee and is the formal interface between the ESONE Committee and external organisations both commercial and non-commercial.

The Committee has a secretariat, at Ispra, supported by the European Communities (EURATOM). There are no membership fees, but member laboratories are expected to do work on behalf of the Committee and to provide accommodation for meetings. On this basis, it has been possible to release the detailed specifications of CAMAC so that any commercial and non-commercial organisation can use them without charge or any formal arrangement with the ESONE Committee.

CAMAC news

NIM MEETING A NIM Meeting was held in New York on November 4th 1970. The ESONE Chairman was invited to this meeting by L. COSTRELL, Chairman of the NIM Committee.

Discussion concerning CAMAC was concentrated on problems encountered in applying EUR4100 and on ways of improving NIM-ESONE collaboration by setting up corresponding working groups on "Dataway", "Mechanics" and "Software" in the U.S.

HIGHLIGHTS OF THE ESONE GENERAL ASSEMBLY

GENEVA–OCTOBER 1970

The choice of 'highlights' will differ according to one's point of view, therefore this report has to be in rather general terms.

Reflecting on previous General Assemblies, each had its own characterisation. One of the early assemblies was distinguished by the consolidation of our intention to collaborate. Another can be remembered for the agreement reached on the ESONE Standard and yet another by the confrontation between this Standard and NIM. More recently, one was notable for its acceptance of the idea of a new concept called, successively, 'Janus', 'New System' and finally 'CAMAC'. Since then one can recall the assembly which agreed on the CAMAC Specification and finally the one which recognised that CAMAC standardisation should expand into software and that the maintenance of CAMAC needed the support of an ESONE Committee structure. This 1970 assembly confirmed beyond all doubt that CAMAC has had a 'breakthrough', in recognition and usage, not only in and around the originating European laboratories but also by spreading to the West, to the North and to the East. This encouraging aspect was demonstrated by the large number of new representatives attending the 4-day Assembly at CERN, and by the support of so many instrument companies for a most impressive exhibition of CAMAC-compatible equipment.

All sessions of the Assembly were well attended by laboratory representatives who showed a keen desire to make progress on the topics discussed, particularly on the technical aspects of CAMAC, because the need to use CAMAC, to ease the work of designers and experimenters, has recently become more widespread and urgent in more laboratories than was previously the case.

Sixty-five representatives from laboratories attended the Assembly, more than double the number at previous assemblies. These came from Germany (14 representatives), CERN (13), United Kingdom (8), France (7), European Commission (4), Hungary (3), Italy (3), Switzerland (3), the Netherlands (3), Austria (2), U.S.A. (2), Greece (1), Poland (1), Rumania (1), Sweden (1) and U.S.S.R. (1).

Mr. M. Sarquiz of CEN Saclay (France) was unanimously elected ESONE Chairman for 1970/71 in succession to Mr. F. Iselin of CERN, Geneva. In his report, the retiring chairman gave an account of the intense activity by the Executive and Working Groups as well as the many contacts which took place during the year with other organisations, in particular the USAEC NIM Committee. A large portion of the activity had been dedicated to the preparation of an agreed organisation of multi-crate CAMAC systems. The draft document EUR 4600 from the Dataway Group was given unanimous acceptance which was a fitting reward for a notable piece of work. Other topics dealt with during the sessions resulted in acceptance of draft documents dealing with the constitution of the ESONE Committee and with Analogue Signals, the latter with a recommendation to the Analogue Signals Working Group that positive, rather than negative, polarity was preferred. Power supply voltages, the L and Q signals and mechanical aspects of plug-in units and crates were discussed. An amendment was accepted on guide-to-guide separation in a crate (see official announcements page 26). The future programmes of the Mechanics, Dataway and Analogue Signals Working Groups were reviewed and recommendations made. Particular interest was registered in the progress and programme of the Software Working Group.

The Assembly discussed the question of creating an ESONE Bureau. It was decided, as a temporary arrangement, to set up an Information Working Group in order to produce a CAMAC Bulletin for disseminating information on ESONE activities and CAMAC to a wide range of interests in other fields.

One significant highlight of the Assembly was the positive collaboration and frank discussions with colleagues in America, represented on this occasion by Mr. L. Costrell, Chairman of USAEC NIM Committee, and the degree of interest and active participation by new members and guests from the U.S.S.R. and several European Countries including Poland, Hungary, Rumania, Sweden, and Greece.

For the first time, an exhibition of CAMAC-compatible equipment was associated with an Assembly. It is not appropriate in this report to review the wide range of components, units, crates and power supplies which were exhibited. A general impression can be gained by stating that 30 companies participated and 60 company representatives were present. Ten companies came from the U.K., 5 each from France, Germany and Switzerland, 2 from U.S.A. and 1 each from Belgium, Italy, the Netherlands and Austria. Situated in the upstairs foyer of the Conference/Restaurant block at CERN, the exhibition gave both users and suppliers a unique opportunity to meet each other in an informal, relaxed atmosphere. It is rare for exhibitors to have an audience which is 100% interested and expert, and for the audience to find such a concentration of well-informed company representatives. This more than anything else made the exhibition a great success. A joint session of the Assembly, between company and laboratory representatives, was certainly the best attended of all the sessions and there was a frank exchange of views about CAMAC. A suggestion for a repeat of the exhibition at the next Assembly was greeted with acclaim by both groups of representatives.

Summarising, the 1970 General Assembly will be remembered for its intimate association with an exhibition of hardware and proved, in its content and efficiency, adequate to the important status reached by CAMAC during the previous year.

CAMAC APPLICATION NOTES

1

AUTOMATIC ANALYSIS OF SLEEP ENCEPHALOGRAMS

by

André Simmen

SEN ELECTRONIQUE, GENÈVE

SUMMARY Modern medicine is interested in studying the various stages of sleep. Sleep-Encephalograms recorded over the period of one night on magnetic tapes can be analysed by an electronic system in about half an hour.

Standard CAMAC-Modules from SEN, together with some special analog modules, are used in this system which has been developed by SEN Electronique in collaboration with the Psychiatric Clinic of Bel-Air/Geneva.

Human sleep is an attractive subject of research; especially interesting is the study of the so-called sleep stages. The durations of the different sleep stages and their sequence throughout the night are shown by analysis of the Electro-encephalogram (EEG). The visual inspection of these graphs is time consuming and varies slightly from one examiner to another. By an automatic analysis quick and reproducible results can be obtained which allow comparisons and further calculations especially by statistical methods.

Principles of the Analysing System

SEN ELECTRONIQUE–in collaboration with the Psychiatric Clinic of Bel-Air in Geneva–has developed a system which allows an automatic analysis of sleep EEG *(fig. 1)*. Its procedure is as follows:

During the night a 7-track analog tape recorder is connected to the output of a standard EEG equipment. In addition to the EEG the eye movements (EOG), the muscle activity (EMG), the respiration (ESG) and the electrocardiogram (ECG) are recorded *(fig. 1)*. Afterwards this tape is analysed by a system consisting of a small computer (NOVA) combined with analog and digital measuring electronics realized in CAMAC. The cheapest output device is a typewriter. Other peripherals like plotters or visual display are optional. The computer calculates the diagnosis and prints out for every minute of the night: the sleep stage (awake, stage I, stage II, stage III, paradoxical sleep), the number of rapid eye movements (REM), a number corresponding to the slow eye movements (SEM), minimum and maximum muscle activity, heart and respiration rate. Some comments are added, if necessary. For this analysis the tape runs 16 times faster than for the recording, i.e. a whole night is analysed in about half an hour (the print out of the results may take slightly longer). Therefore one analysing equipment can analyse the tapes of several patients within one day. The record of the original signals is retained on the tape, which is an important advantage for research laboratories. The quantitative information on EOG, EMG, ECG and ESG which is printed out could not be available by visual methods unless a technician worked for days or weeks counting signal peaks and measuring slopes and amplitudes.

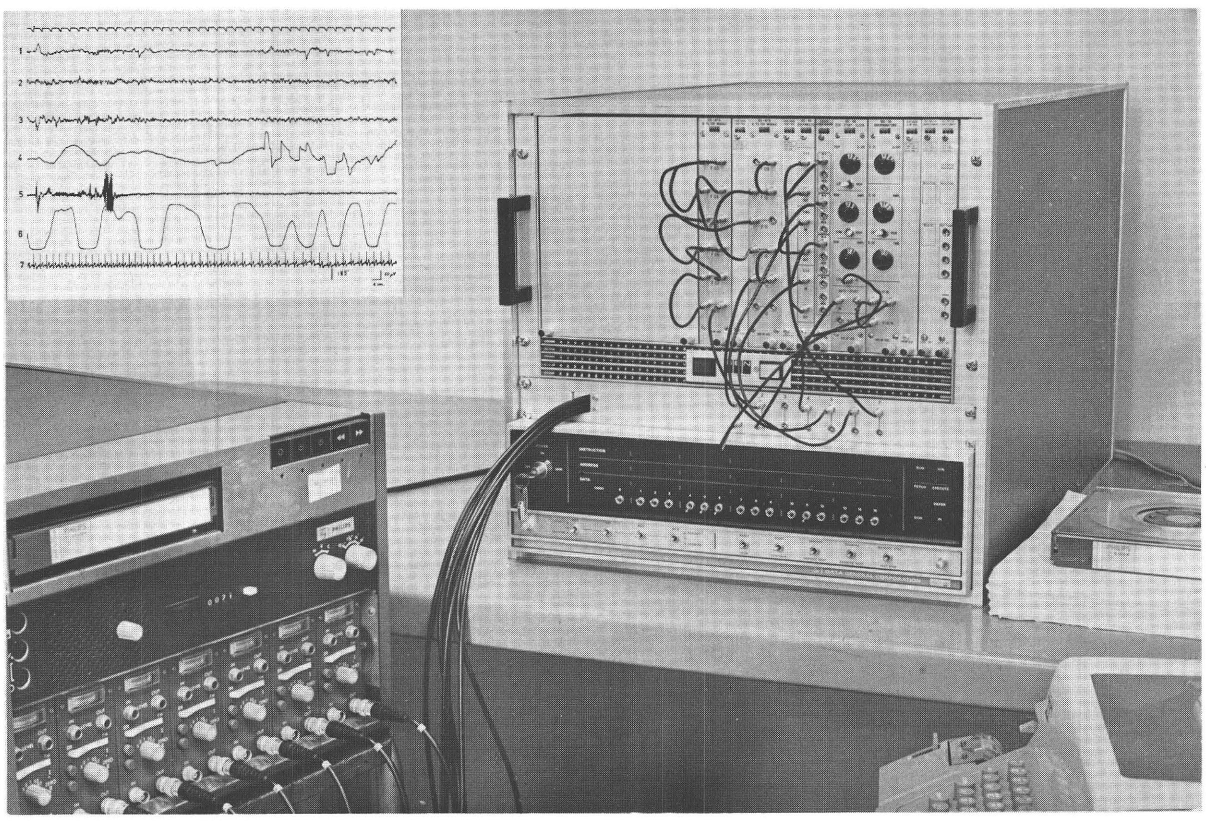


Fig. 1 Analysing system. Top left: graphs No. 1, 2, 3 = EEG, No. 4 = Eyes, No. 5 = Muscle, No. 6 = Respiration, No. 7 = ECG.

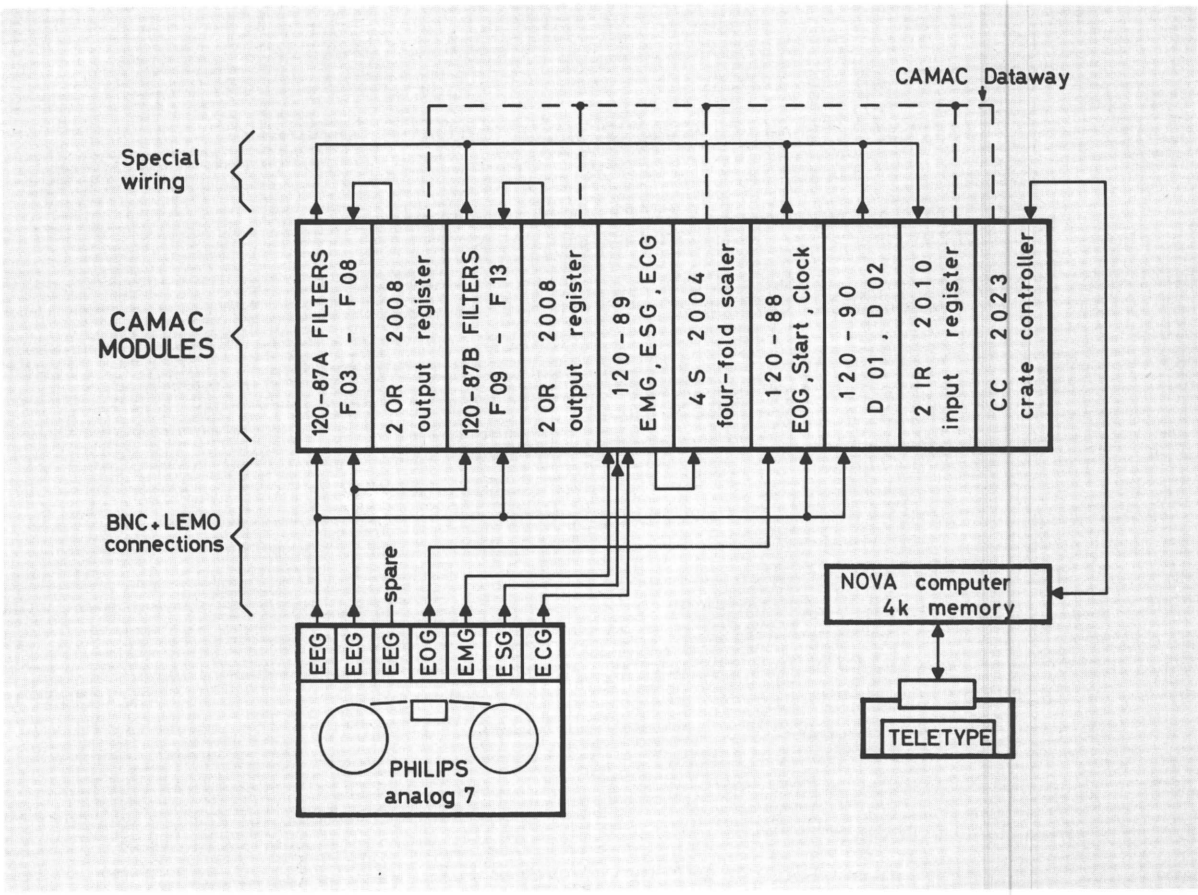


Fig. 2 Block diagram of the analysing system

Details of CAMAC Equipment

The analysing system (block diagram shown in fig. 2) contains analog and digital electronics. The analog modules (type numbers 120-87 to 120-90) extract characteristic patterns out of the record or digitize analog values. This brings about a vast reduction of data. The EEG tracks are analysed by discriminators (D01, D02) measuring slopes, amplitudes, widths and by band-pass filters (F03–F13). The filter modules contain amplitude discriminators which sense the rectified output signal of the band-pass filters. The discriminator levels are computer-controlled through the output registers 2 OR 2008. Rapid and slow eye movements are distinguished by their rise time. The muscle activity is integrated and digitized by a voltage-to-frequency converter. The respiration (ESG) and the Electrocardiogram (ECG) are reshaped to extract the rate.

These analog modules have been designed specially for this application whereas the digital modules are standard SEN products. The above mentioned 2 OR 2008 output registers set the discriminator levels in the filter modules.

The 4 S 2004 Four Fold Scaler counts the frequency and rates of the EMG, ESG and ECG analysers. The 2 IR 2010 input register reads the state of the different discriminators and the CC 2023 crate controller links the CAMAC crate to the Nova computer.

The timing is given by a crystal-controlled clock which requests a program interrupt every 10ms. The interrupt subroutine transfers the information contained in the input register and periodically also the scaler contents into the computer. The program sums up the results collected during 3·75s (which corresponds to 60s of the night since the analysing speed is 16 times faster than the recording speed). Then it calculates and prints out the diagnosis for this minute of the night while it collects the results of the next minute. The flow chart of the diagnostic program has been determined by a detailed analysis of several records.

The connections between the analog and digital modules are partly done by "special wiring" at the back of the modules as indicated in fig. 2. The "special wiring" consists of flat cables connected to a printed circuit. This solution offers simpler and faster design of the special analog modules as the electronics of the standard digital modules has not to be redesigned and included in these special modules. Moreover test and maintenance are made easier.

Advantages of using CAMAC

The realization in CAMAC of this analysing system offers several advantages. The user has the possibility of adding other modules like visual display drivers or new measuring channels. The crate and half of the modules are standard equipment which means reliability, short delivery and good price. The software subroutines which read scalers or input registers and set output registers, as well as the program interrupt handling, are standard and are used in other applications.

2 A METEOROLOGICAL DATA LOGGING SYSTEM IN THE CAMAC STANDARD

by

L.D. Ward

ELECTRONICS AND APPLIED PHYSICS DIVISION
AERE HARWELL

SUMMARY The article describes a data logging system designed in the CAMAC standard to monitor meteorological parameters. The system is controlled by a computerless controller, the 7025 Programmed Dataway Controller, working to a program of instructions held in a plug-board. Various digital and analogue channels are scanned at 10 minute intervals with the output being punched on paper-tape for subsequent computer analysis.

Introduction

The data logger described in this article was designed for meteorological monitoring stations used in a project which is studying atmospheric pollution in a district where there is a high concentration of industry and frequent mists[1]. Each monitoring station has three air samplers (for particulate pollutants, ammonium ions and sulphate ions) and a data logger linked to sensors for air temperature, humidity, solar radiation, wind direction and speed, rainfall, visibility, and radon count. The air samples are taken hourly, and trigger a data logging scan to record the other parameters on punched paper-tape for subsequent computer analysis. In order to allow for fluctuating weather conditions there are intermediate data logging scans at 10 minute intervals, triggered by timing signals from the nephelometer which measures visibility.

Four such monitoring stations are employed, three being in the district under study and the fourth acting as a control station in a relatively pollution-free district.

Data Logger Configuration

The logging instrumentation has been developed to the CAMAC specification and consists of 9 plug-in units housed in a standard crate as shown in fig. 1. The system is under the control of a 7025 Programmed Dataway Controller, a computerless controller in the Harwell 7000-Series interpretation of the CAMAC standard[2]. This unit works to a program of instructions set up by diode-pins in a 7077 Plug-board Store, and is capable of organising Dataway transfers and doing simple processing of the data received.

Digital pulse inputs are taken into standard 7010 24-bit 15MHz scalers, and into two additional registers in the special unit 69E/43 Scaler and Timer. This unit also monitors the two sources of scan triggers, which are the particulate air sampler's hourly pulse and the 20-second trigger output from the nephelometer. This latter trigger source is scaled down by a divide-by-30 circuit in the 69E/43 to provide triggers for the 10 minute scans. Scans are initiated when the 69E/43 issues a LAM signal to release the Programmed Dataway Controller from its 'Pause for trigger' condition.

Analogue inputs are taken through individual amplifiers and multiplexed using reed relays in the 69E/44 Multiplexer. Coupled to and automatically triggered by this unit is the 7028 Analogue-to-Digital Converter. This is a standard Wilkinson type 8-bit converter with inputs in the range 0 to +5V and a conversion time of 25μs.

The binary coded output is transferred as 8-bit bytes via the Dataway to the 7065 Punch Driver. The 60 character/sec punch is coupled to the 7065 through an associated power unit.

The two units 69E/43 and 69E/44 were specially designed for this system, and perform functions which could mostly be provided now by standard units in the Harwell 7000-Series.

Analogue Input Channels

The data logger has three low level analogue inputs with signals less than 50mV and one high level analogue input in the range 0 to 5V.

Dry-air temperature sensing over the range $-10°$C to $+35°$C is by means of a platinum resistance thermometer located in a Stevenson's Screen. The resistance thermometer is connected to a Kelvin double-bridge circuit located 10 metres away at the data logger. A 4-wire connection is used in order to compensate for changes in resistance. The bridge circuit gives an output of 1mV/°C through 550Ω.

Two further platinum resistance thermometers are connected to a differential bridge circuit to give a reading of wet bulb depression from 0 to 10°C. From this reading and that of the dry air temperature, a value for relative humidity is calculated in the final analysis. The analogue output from the bridge is 1mV/°C differential through 550Ω.

The third low-level analogue input is from a solarimeter giving 0 to 40mV through 80Ω and corresponding to 0 to 80mW/cm^2.

A value for wind direction is obtained by smoothing the output from a sensitive wind vane. A twin-ganged precision potentiometer is attached to the spindle of the wind vane and has its two component halves at a relative angular setting of 180°. The analogue output is switched from one potentiometer to the other when the winding dead-space is approached. In this way oscillations of the output across a discontinuity are avoided. The two potentiometers have trimmer resistances to enable the outputs to be matched and to provide for a smooth change-over. The output is

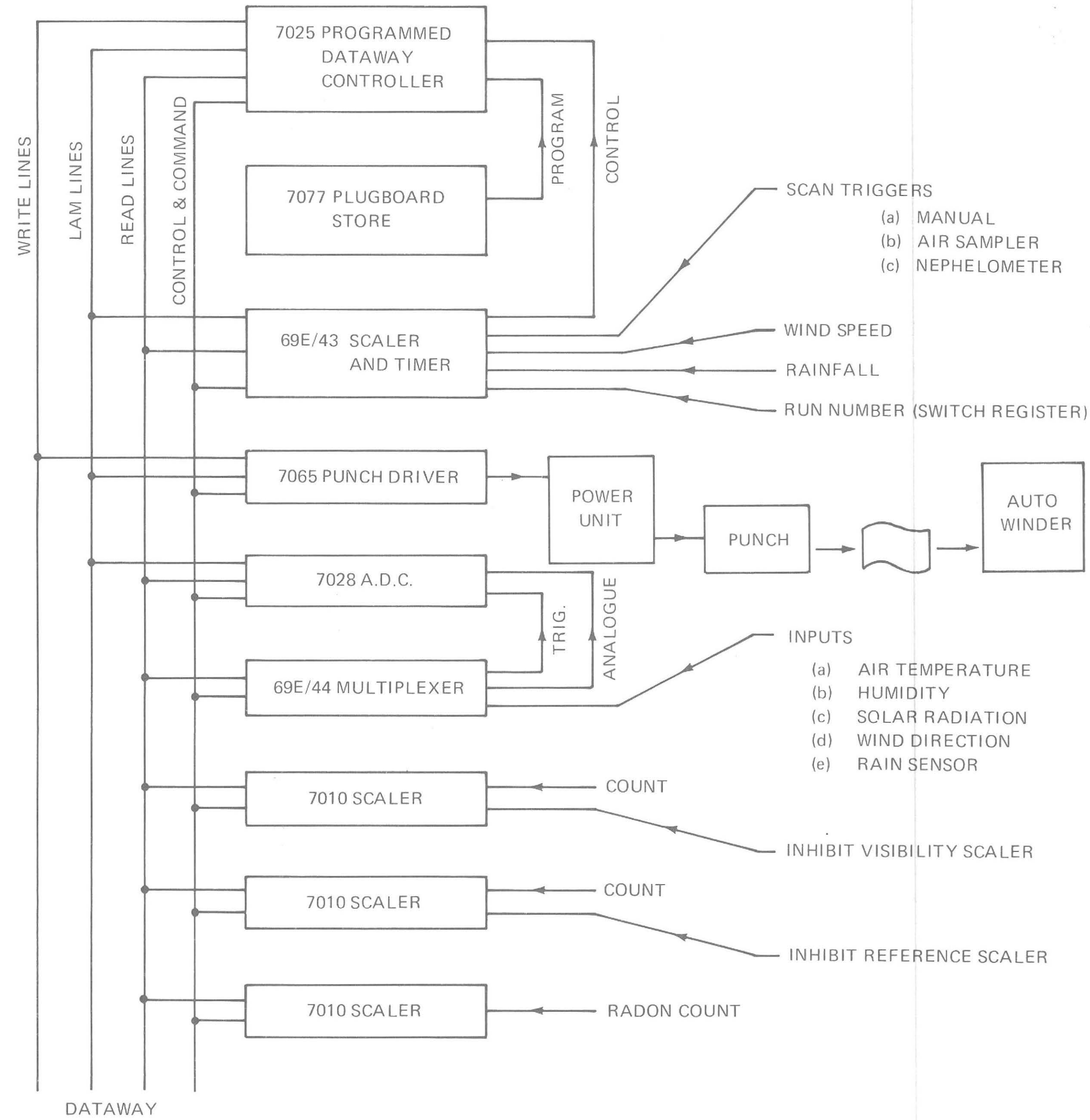


Fig. 1 Data logger configuration

smoothed with a time constant of approximately 5 minutes and thus provides a mean reading of wind direction when sampled.

The four analogue channels are taken through individual amplifiers and multiplexed by a series of Dataway commands into the Analogue-to-Digital Converter.

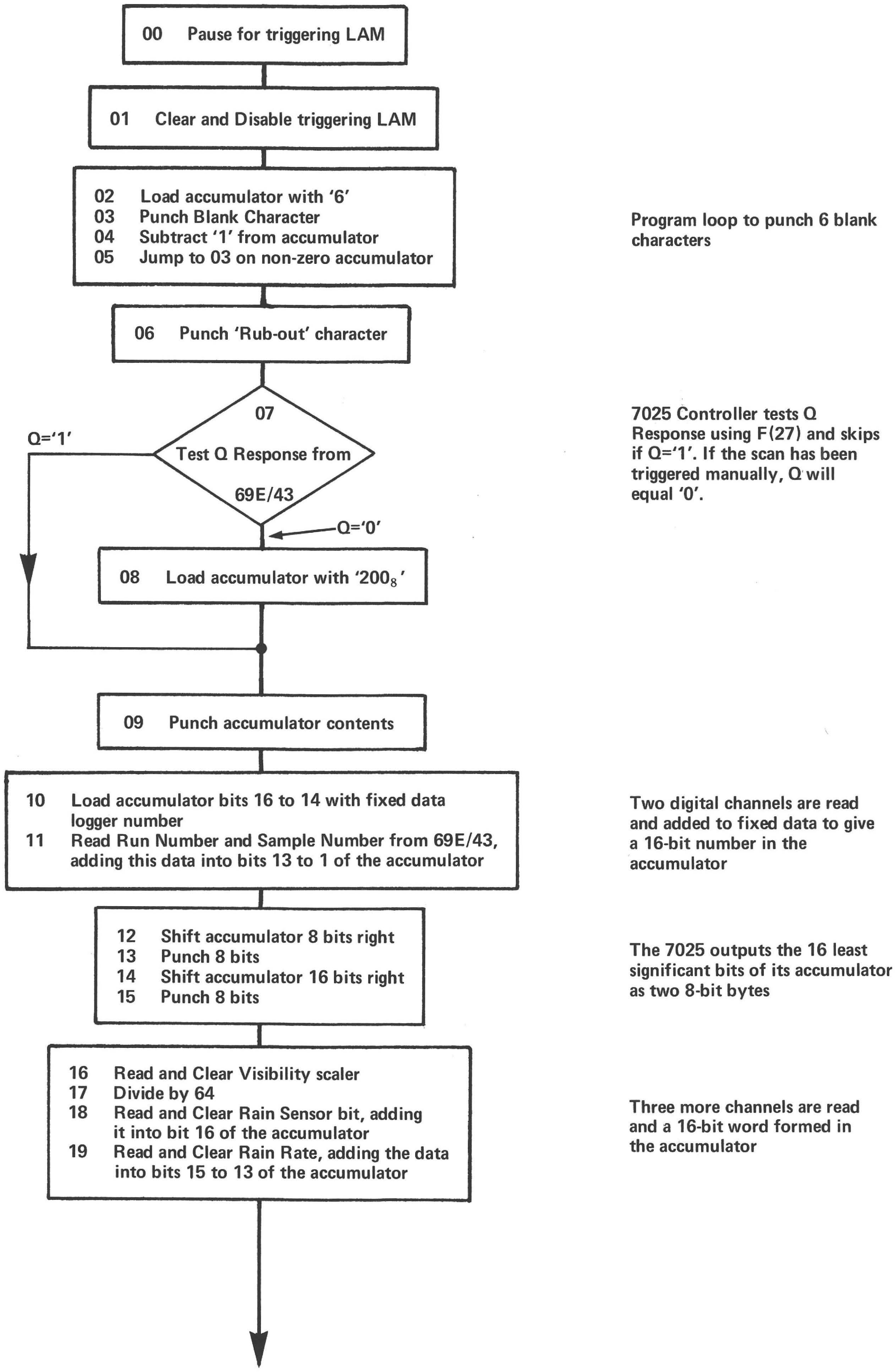
Digital Input Channels

During each 10 minute interval between logs the data logger counts pulses from 5 digital input channels. These relate to Radon count, visual range, nephelometer reference, wind speed and rain rate. At the time of logging, the digital level from the rain sensor is also sampled.

A geiger counter is located in the particulate air sampler above the previous hour's sample. Output pulses are counted in a 24-bit 15MHz scaler and the count noted with each 10 minute log. From the results the concentrations of Radon daughters are deduced and a measure obtained for the vertical stability of the atmosphere.

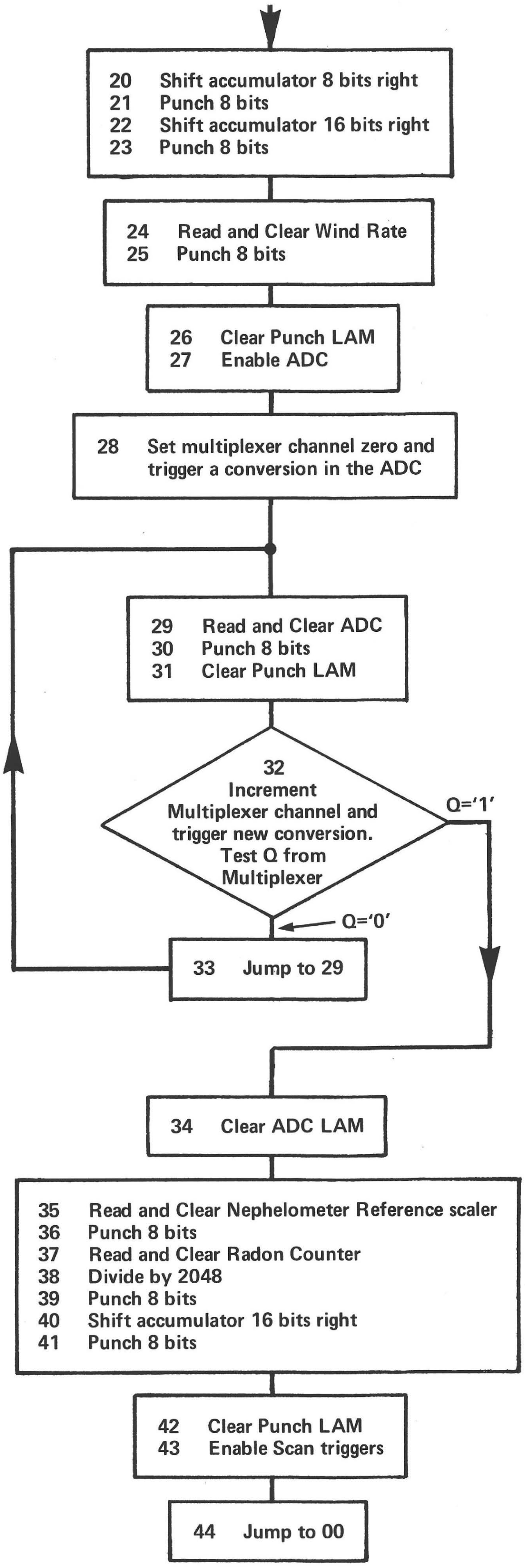
A value for visibility is obtained by means of a stabilised integrating nephelometer developed at Harwell. This instrument takes a spot measurement of the scattered light coefficient of the atmosphere at 20 second intervals, and presents the output as a digital pulse train to the data logger. The pulses are fed via a level converter into a standard 24-bit 15MHz scaler and are integrated over the 10 minute interval between successive logs. A second output pulse train from the nephelometer provides a reference calibration reading for the instrument and is recorded in a similar fashion in a second 15MHz scaler. From these readings the subsequent analysis yields the visual range between 40m and 40km with an accuracy of 10%.

text continued on page 11 . . .



continued on page 10 . . .

Fig. 2 Data logger flow diagram



The word is punched on tape as two 8-bit bytes

Set first analogue channel

The 7025 organises a Dataway command to increment the channel number and trigger a new conversion. At the same time it tests the multiplexer Q response for channel overflow. Q='1' for overflow.

The remaining two digital channels are read and punched out on the tape

The program returns to await a new scan trigger

Fig. 2 *(continued from page 9)*

A sensitive anemometer gives a 9V output pulse from a Schmitt trigger for each revolution of the spindle. The total count over the sampling period is obtained in an 8-bit scaler and gives a measure of the mean wind speed over that period. The range covered is 0 to 35km/h.

A measure of the rainfall during the sampling period is obtained by counting the output from a tipping bucket rain gauge. This device closes a relay contact for each 0·2mm of rain collected.

The presence of light rainfall is detected by means of a rain sensor that closes a relay contact when wetted. The sensor has a small heater with an effective drying time equal to the 10 minute sampling interval. The one bit of digital information thus indicates the occurrence of rain since the last log.

Logging Sequence

In the quiescent state between logs the Programmed Dataway Controller tests for the presence of an interrupting LAM signal. Scans are initiated by the generation of a LAM from the Scaler and Timer. Once released from the Pause condition, the Programmed Dataway Controller sequences through its program of 45 instructions as listed in fig. 2.

Six rows of blank characters followed by a rub-out are punched on the paper-tape to signal the start of a new data block. Header information is then added to indicate the data logger number, the run number for that logger, and the number of the hourly sample at present in the particulate air sampler. The Controller then successively reads and clears the digital inputs, grouping them into 8-bit bytes before punching in order to reduce the volume of tape output. The analogue inputs are multiplexed by Dataway command and the digitised results read and cleared from the 8-bit ADC. The tape output from the punch is fed onto an automatic tape winder.

Additional Facilities

In the event of a failure of the power supplies, a stand-by battery power unit automatically maintains power on the sample number register and its associated input circuits. The particulate air sampler itself is also protected against mains failure, and hence by continuing to count hourly output pulses the logger retains its record of real time. Recovery after a mains failure is automatic and is synchronised to the particulate air sampler output.

Logs of all inputs for test purposes may be triggered manually by means of a front panel push-button on the Scaler and Timer. Logs initiated in this manner are distinguished from the scheduled scans by means of a 'Test Run' bit added to the tape output.

REFERENCES

1. **EGGLETON, A.E.J.** The Chemical Composition of Atmospheric Aerosols on Tees-side and its Relation to Visibility. Atmospheric Environment. Pergamon Press, 1969, Vol.3, pp 355–372.

2. **WARD, L.D., MITCHELL, G.S.L., RICHARDS, J.M.** A Programmed Controller in the CAMAC System. UKAEA Report. AERE–R6334, HMSO 1970.

APPLICATION NOTES continued on page 12 . . .

CAMAC news

NUCLEAR SCIENCE SYMPOSIUM The Nuclear Science Symposium sponsored by the IEEE was held in New York from November 4 to November 6, 1970.

During the session devoted to Data Acquisition, three communications on CAMAC were given:

- "A time shared system for multiple independent laboratories" by Joel BIRNBAUM, IBM Watson Res Center.
- "An accelerator instrumentation and control system using CAMAC" by Lowell KLAISNER from National Accelerator Laboratory.
- "Versatile CAMAC crate controller for computer based data acquisition systems" by M.G. STRAUSS from Argonne National Laboratory.

Joined to this Symposium were two tutorial sessions on CAMAC where the whole CAMAC system was described (EUR4100 and EUR4600), illustrated by various examples of applications.

The papers from these two tutorial sessions will be published in the April 1971 issue of the IEEE Transactions on Nuclear Science (Vol. NS-18, No. 2).

3 EXPERIMENT ON PION-PROTON ELASTIC SCATTERING UNDER 100MeV

by
J. Duclos (DPhN/HE) and M. Sarquiz (SE)
COMMISSARIAT A L'ENERGIE ATOMIQUE
CEN SACLAY

General

The purpose of this experiment is to study the elastic scattering of pions on hydrogen nuclei in the 30MeV to 100MeV energy field.

The Nuclear Physics (High Energy) Department at Saclay in co-operation with the Clermont-Ferrand Faculty of Sciences will set up this experiment on a secondary beam of $10^6 \pi/s$ pions produced by the electron beam (400MeV/600μA) of the Saclay Ormes-des-Merisiers linear accelerator hitting a copper target.

As the effective cycle of the machine is 10μs every millisecond, the mean pion flux of $10^6 \pi/s$ which is indicated represents an instantaneous flux of $10^8 \pi/s$. This flux is detected by a 'rose' of ten photomultiplier scintillators (monitors) located in the axis of the beam to reduce the counting rate per channel to a $10^7 \pi/s$ value compatible with the 10ns resolving power of the pre-scalers.

The mean rate of the scattered pions is in the order of 1 to $10\pi/s$, but it is foreseen that one occurrence only will be recorded per burst.

These pions are accompanied by electrons which will be ultimately separated according to their energy loss (dE/dX) in a scintillator.

Experimental arrangement *fig. 1*

The essential measurement is that of the rate of pions scattered (n/N) in a given direction in relation to the incident beam (scattering angle θ). The scattering geometry is cylindrical about the axis of the incident pions.

The scattering angle is determined by means of two magnetostriction type spark chambers which will give two points on the trajectory of the scattered pion, thus enabling θ to be calculated.

These chambers are triggered by the coincidence signal (pilot signal) between two scintillation detectors (photomultipliers + plastic scintillator) arranged in pairs at the perimeter of the spark chambers.

One of the detectors of each pair also determines the loss of energy of the particle (pion or electron) which has crossed it. This measurement will result in a loss-of-energy spectrum whose characteristics will, inter alia, enable the pions to be separated from the electrons when the results are processed.

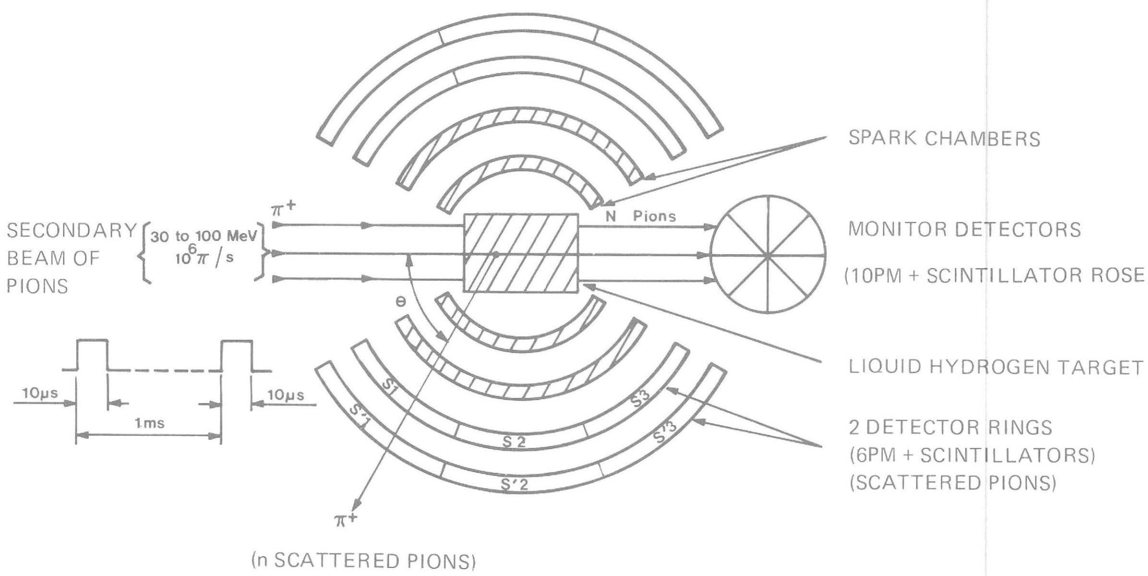


Fig. 1 Pion-proton elastic scattering experiment (detection device)

Electronic instrumentation *fig. 2, fig. 3*

The instrumentation carries out three essential tasks:

1. Identifies an occurrence, then starts the measurement of all its parameters
2. Codes the data of occurrence
3. Transfers the digital data to the computer (PDP 15/20)

The first task is carried out by functional units in the Renatran fast electronics standard (discriminators, coincidence circuits, etc., see Nuclear Instrumentation No.33) which together generate a pilot signal which starts up the spark chambers and opens the counting and decoding gates of the other units.

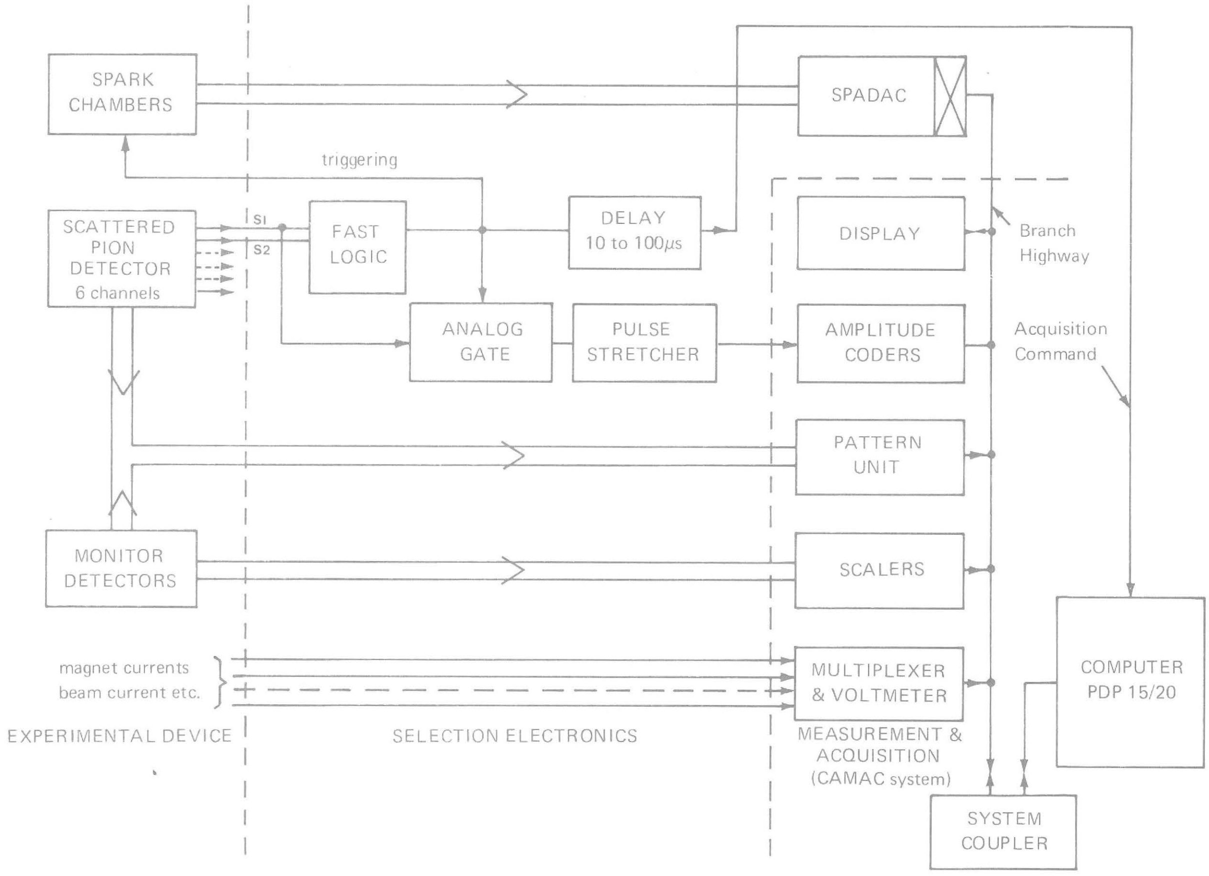


Fig. 2 Simplified functional diagram of instrumentation

The coding of the data from the spark chambers is carried out by a special SPADAC type chronometering system from SEN (Geneva).

The remainder of the coding, and the transfer of data to the computer, is carried out by instrumentation in the CAMAC standard.

The unscattered pions are counted by 4 x 16-bit scalers (JEB-20) preceded by 100MHz pre-scalers which simply divide by four.

The configuration of detectors which are hit by scattered pions during the detection of an occurrence is recorded by means of 16-bit pattern units (JRC-10).

The coding of the energy loss of the particles in the scintillation detectors is carried out by 512-channel

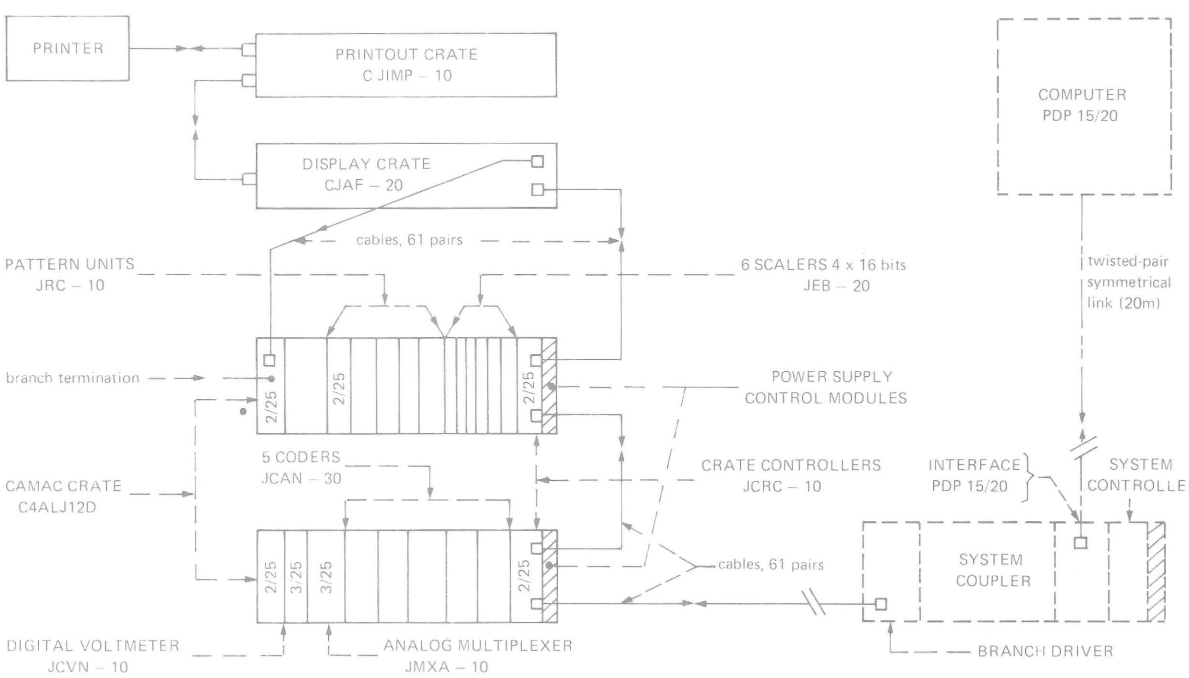


Fig. 3 Acquisition system of the Nuclear Physics (High Energy) Department

analogue-to-digital converters (JCAN-30). Lastly, a few essential parameters of the experiment (magnet currents, electron beam currents) are monitored by a 16-channel analog multiplexer (JMXA-10) in conjunction with a digital voltmeter (JCVN-10).

All this equipment is contained in two CAMAC crates (C4ALJI2D) each of which is fitted with a Crate Controller Type A (JCRC-10) and interconnected to form a 'branch'. This is connected to the computer through a system coupler consisting of a base crate containing a system controller which organises transfers between a branch driver and an interface to the computer. The data output from the SPADAC system is also connected to this branch.

The transfer of data to the PDP 15/20 computer is initiated by the appropriately delayed pilot signal, which triggers an interrupt state to start an acquisition sub-program of all the data relating to an occurrence which at first sight seems interesting.

The maximum time allocated for this acquisition is in the region of 900μs.

Additionally, a clock periodically initiates the transfer of test information such as that of electron beam intensity, count rate of the rose units and magnet currents.

After a number of acquisitions of this sort, the program will transfer the data together with the test results on to a magnetic tape for subsequent processing in the computer. It is foreseen that the computer will also present the histograms of the loss of energy in the detectors, as well as the status of the experimental parameters at the user's request.

In order to adjust the experiment in the initial phase, an off-line display crate (CJAF-20) coupled with a printout crate (CJIMP-10) gives the user the possibility of acquiring and testing some results in the absence of any connection with the computer. After this adjustment phase, the display crate can be used under the control of the computer to display near the experiment a particular parameter selected by the user.

Conclusion

By adopting an organisation complying with the CAMAC standard for this system of data acquisition the user will have every possibility of modifying and extending his device, without having to re-think the transfer of data. Furthermore, the 'system coupler' provides for the addition of other 'branches' allocated to different experiments.

For descriptions of CAMAC equipment used in this system see: Bulletin d'Instrumentation Nucléaire, No.40 (Supplément au Bulletin d'Informations Scientifiques et Techniques, No.149, June 1970).

APPLICATIONS NOTES Papers describing the use of CAMAC systems in the widest possible range of applications are invited from firms and laboratories for publication in future issues of CAMAC Bulletin. Contributions need not be original, but should describe the application in a way which is interesting to readers from entirely different disciplines, and should emphasise the rôle of the CAMAC equipment.

LABORATORY ACTIVITIES In addition to commercially-available CAMAC equipment, which appears in the New Products and Product Guide sections of this bulletin, many laboratories are developing equipment and software.

This issue of CAMAC Bulletin includes a paper on the development of a range of equipment at a major international laboratory.

Other contributions and short announcements are invited for the Laboratory Activities section of the bulletin.

LABORATORY ACTIVITIES

1

CAMAC AT CERN

by
F. Iselin, A. Lang, B.A. Löfstedt, A. Maurer, O. Ph. Nicolaysen, A. Orêve, Ph. Ponting, J.P. Vanuxem
GROUP ELECTRONICS 2, NUCLEAR PHYSICS DIVISION (NP), CERN

SUMMARY The article describes briefly the CAMAC activity in Nuclear Physics Division. It indicates the efforts to encourage industry by specifying modules, and buying them, and also the design activity on more complex units such as computer interfaces, special controllers and in general non-repetitive items.

The first CAMAC System Controller 1 is surveyed and then the present developments for the various computers in NP.

Introduction

The Nuclear Physics Division—an active participant in ESONE—is gradually moving into CAMAC, and many experiments (including those of visiting scientists) are planned on the Intersecting Storage Rings (ISR) or beginning on the Proton Synchrotron (PS). Many computers are involved, making an acute need for control systems (IBM 1800, IBM 1130, Hewlett-Packard 2115/16, EMR 6130, PDP-11). The presently used 'old CERN standard' system has for many years used common crate and intercrate highways but is now becoming obsolete.

The wide recognition of CAMAC should encourage industry to produce a large choice of modules with competitive prices. CERN intends to use these commercial sources whenever possible and, if the conditions of choice and cost are fulfilled, this may even be extended to some controllers (interfaces), provided they meet CERN requirements. On both aspects CERN-NP has made direct contacts with firms and propagated ideas to ensure that basic modules and interfaces are adequate.

This philosophy should relieve designers from routine tasks and make more time available for systems study and proposals, and also for the design of special non-iterative equipment such as interfaces or special modules. The earlier CERN modules will not be described here since they have been specified and are bought from industry. Only the System Controller 1 will be presented, since it is a working example of various ideas embodied in a flexible controller which was designed before the publication of EUR4600 on Multicrate systems. All present controller designs are being made on the basis of EUR4600.

Various CERN CAMAC blue leaflets have been produced with the intention of informing quickly and permanently CERN colleagues and others on what was going on or what was required. Some of these informal leaflets are listed at the end of this paper.

System Controller 1 and Various Controllers

After the ratification of EUR4100, which defines fully the CAMAC crate and the Dataway, CERN-NP started designing a prototype model of a general purpose control system called 'System Controller 1' (SC1). This SC1 was intended to be very flexible in view of the many requirements expressed by potential users. In addition, many other modules were designed to fit into this SC1 scheme, which included a 'Branch Highway' (called Vertical Highway) with bidirectional Read/Write data, T_A/T_B (for distance compensation) and a single common BD. The full system is described in CERN-NP CAMAC Note 21-00.

The major ideas put into the SC1 are:

- *A special 'Control Highway'* linking programme modules. The system may therefore consist of many sources of commands, the priority being determined by an 'Executive Controller' which also provides the Branch driving output. The computer interface is part of the SC1 as one of its programme sources and, as such, can without difficulty be merged with other computer interfaces and programme sources (Display, Print, LAM search, etc.).

- *Remote programme units* (RPUs) such as the Print Controller and Display Controller may be plugged into CAMAC as normal units. A special Fetch-Execute unit (F-X) in the control highway chain extracts instructions from the RPUs and executes them via the Executive Controller.

- *LAM search* This is also in the control highway chain and can search for LAMs without involving a computer. When a LAM is found an output is provided to trigger the required action (for example the F-X unit corresponding to Print).

The System Controller 1 was first used with a computer interface to an IBM 1800. The system is now on-line to a PDP-15, using a PDP-15 interface (Heidelberg group) following the SC1 specifications.

Present Activity

It was soon recognized by users, designers and industry that it was a pity to have various multicrate systems with different philosophies and different (Branch) highways. The new document EUR4600e on Multicrate systems represents another result of successful European collaboration between laboratories to define an agreed scheme. The NP-El 2 is now redesigning interfaces and other units according to EUR4600e.

The present activity of the NP-Electronics 2 is now mainly concentrated on the problems of interfaces with computers, mixing two (or more) sources, a special 'manual controller' and CAMAC systems study.

The two main reasons for putting the effort on these problems are, first, that many firms became aware of the potential CAMAC market inside and outside the nuclear research field (see CERN-NP CAMAC Note 23-01); and second, that modules are simple to design and to implement and the complicated part of the logic has been shifted to the crate controllers and interfaces.

Manual ('Automatic') Controller (see CERN-NP CAMAC Note 30-00) This unit was designed to meet the needs of many physicists and stands between a minicomputer and a manual controller. The present unit has the following facilities:

- Sequential scan (Read) with various selectable choices (number of words, octal, decimal, double word length 2 x 16 bits).
- Nixie display (8 decades).
- Full Binary to Decimal converter.
- Programme loop (single or repeat) with the possibility of external (generally wired) programmes and choice of Clear action.
- Possible extension to many displays.
- Various outputs depending on the plug-in unit used. (Typically printers, paper tape, magnetic tape.)

General interface system adaptable to various computers To simplify further design and construction certain common ideas were introduced for an interface designed according to EUR4600e. The principle consists of having plug-in cards (for example in a CAMAC module), each card having special attributes such as Read/Write/Driver/Interrupts. A system of internal highway (bus) lines is provided, interconnecting all cards. The computer may address any card and therefore extra features can be added by using a 'special feature' card. Some of the features we consider desirable in an interface have been given in CERN-NP CAMAC Note 31-00. They are mainly:

- Normal programme control.
- Sequential scan (successive address).
- Block transfer (constant CNAF, scan in module)
- GL operation with some particular L reserved for use as 'Sync' in certain block transfers.
- Multi-addressing of crates (for example Interlaced Read/Write operations using different multi-address registers).

Further features are:

- Control word (loaded by the computer) to indicate how the interface should proceed. For example sequential with starting address, number of words, final N, max. A and special Q activity.

NOTE: It is also proposed to use Q in certain cases as a synchronizing signal to allow the maximum computer rate (every CAMAC cycle). This is an important point for applications where maximum speed is required and where the data produced in the module may occasionally be delayed. The "missing Q" procedure (placed by control word) would cover this case. If Q=0 means end *or* wait then the interface must look at the BD Demand line and a particular L.

Interfaces to specific computers The general interface system has been used in conjunction with the following computers:

- *IBM 1800.* An interface has been produced and is working in a preliminary set-up (CERN-Holland-Lancaster-Manchester experiment).
- *IBM 1130.* An interface has been designed and is being made.
- *Hewlett-Packard.* An interface was projected using the same philosophy, but the quantity needed was going to be fairly high and it was decided to contact a commercial firm.
- *Hewlett-Packard.* A single crate interface, or crate controller, has been designed and was used in an experiment (CERN-CAEN). (See CERN-NP CAMAC Note 27-00.) Some of these units are now produced in collaboration with CERN-TC (Track Chamber Division).

- *EMR 6130.* A single crate interface was produced. It is a minimum unit with programme control only and was made for test purposes.
- *EMR 6130.* An interface containing all points described above and probably more, including multi-branch driving possibility, will be designed (El 2) to equip the Ω project. This project is a general purpose particle detecting system consisting of a large number of chambers in a magnetic field. It is a major project in NP, but other CERN divisions and many other universities and laboratories in Europe are involved (Rutherford, English universities, Ecole Polytechnique Paris).

Simpler interfaces are also proposed to equip other channels of the EMR 6130, guaranteeing Input/Output timing independency for very busy channels.

System Crate. Various proposals have been studied for multi-sources and multi-branch systems. Keeping in mind the 'control highway' of the System Controller 1 the solution of a system crate was considered. It is a normal CAMAC crate with specific line allocations, agreed with other laboratories, to allow commands and data to travel simultaneously, and an allocator (in the control station) to decide which programme source has priority access to defined branch drivers. For the moment there is not a great demand here: perhaps the time is not yet ripe for the use of such a solution in NP.

'Mixing box'. This has been designed simply to connect two programme sources (made according to

EUR4600e) to feed one, or more, branches. It is mainly intended to combine a computer interface with, for example, a manual controller (also made according to EUR4600e) or any other source following those specifications.

The Multi-Branch System proposed originally uses a special branch path setting using Code N31 (or any unused N code). When this code is present the 7 multi-address lines for crates are used to choose a branch. The BTA line also receives another name (BBTA) to provide similar protection against distance timing difficulties as in the Branch highway. This proposal avoids the use of spare lines. If these spare lines are allocated, the same principle may be used replacing N31 by a signal. ESONE discussions are now going on on this subject.

Uses of CAMAC in other CERN Divisions. The ISR Division intends to provide a data link to distribute control data (such as beam current and beam position) to nuclear physics experiments or to collect data about the performance of the ISR. The connection between experiments and the link is proposed as a CAMAC module. The PS (Proton Synchrotron) Division is also looking into the use of CAMAC in certain control room applications.

CAMAC Product References. Full documentation on commercial and non-commercial CAMAC modules has been put in a computer for easy listing, retrieval and correction. The final form and content will depend on the reactions of the readers. A filtered version of this CAMAC Products References appears in this bulletin.

SELECTED CERN-NP CAMAC BLUE-NOTES

(Available from Mr. J. Halon, CERN-NP)

NOTE NO.	TITLE	TYPE NO.
1-00	CAMAC CERN-NP Options	
8-00	Pattern A (Pattern Unit A)	021
9-00	Parameter A (Parameter Unit A)	022
11-00	Miniscaler	002
14-00	Digest of CERN-NP CAMAC External Control Logic (XCL)	029
15-00	Preset Scaler	025
16-00	Microscaler	003
19-00	SCRO (Spark Chamber Read Out)	041
20-00	XY RCDR (2-Coordinate Recorder)	042
21-00	System Controller 1	
23-01	CAMAC Products Reference	
25-00	Introduction to CAMAC	
26-00	LAM Grader (Look-at-Me Grader)	064
27-00	HP-CC (HP-CAMAC Single Interface)	066
28-00	D-to-A CVTR (Digital to Analogue Converter)	030
29-00	D-to-A CVTR (Digital to Analogue Converter with Histogram Generator)	052
30-00	CAMAC Manual Controller	047
31-00	CERN-NP Type 057 CAMAC Interfaces and their use	057
32-00	Pattern B (Pattern Unit B)	071
33-00	2 IN REG (Dual Input Register)	072

2 FOCAL OVERLAY FOR CAMAC DATA AND COMMAND HANDLING

by

F. May, H. Halling*, K. Petreczek‡

ELEKTRONIK-INSTITUT DER ÖSTERREICHISCHEN
STUDIENGESELLSCHAFT FÜR ATOMENERGIE GES.m.b.H.
REAKTORZENTRUM SEIBERSDORF, AUSTRIA

SUMMARY An overlay for FOCAL DEC-08-AJAE-LA has been developed to allow data and command handling with CAMAC systems. Data can be stored and handled like normal variables. The overlay is especially useful for the execution of test routines and for rather slow control systems with data handling. To complete the system it is intended to develop a CAMAC interrupt handler, which allows interrupt programming in FOCAL. A disk-tape monitor system will be developed later.

The intention in writing an overlay for FOCAL§ has been to produce an easily programmed on-line system for CAMAC. Attaching an overlay for CAMAC to an existing programming system avoids the laborious task of developing a completely new system, although various disadvantages must be taken into account. The work on an overlay for FOCAL 8AJAE to handle CAMAC data and commands, should be assessed from this point of view.

The system works with a crate controller, which has been developed at the Reactor-Center Seibersdorf[1]. This crate controller needs, besides the normal CAMAC C, N, A, F, additional information on the type of command, called the crate function CF. In addition, information on the format (BCD or Binary) has to be added, which is called the format-byte FB. To enter a CAMAC statement the asterisk is used, which means that the routines for the high speed reader have been removed. This has been done to make it simple to enter a CAMAC statement and to save memory locations. This way a CAMAC statement can be typed on the teletype as follows:
*Δ CF, C, N, A, F, FB, HW, (LW), (Q).

For statements without data transfer FB, HW, and LW are omitted. Q is typed only if the Q response is expected and storage of Q is wanted.

HW and LW mean high order word and low order word respectively, where LW is the less significant 12 bit group of a CAMAC data word. If FB is typed as a '1', data on the teletype has to be typed in one word (up to 8 388 607_{10} = $2^{23}-1$, LW is omitted) as a decimal number. The CAMAC data register as referred to by C, N, A, will accept the typed number as a binary. For the read operation the reverse holds. A binary number in the register will be typed as a decimal on the typewriter. For FB = 2 the data is again typed as a decimal, but the CAMAC data register will accept it as a BCD number. In this case the maximum number which can be transferred is 999 999_{10}.

If FB = 3 is typed, data on the typewriter must be entered as a two word number in octal format. In this case the data is transferred to the wanted register as an octal number exactly as it has been typed on the typewriter. (The maximum number which can be transferred is 7777_8, 7777_8). The number which is typed first is transferred to the more significant 12 bit group of a CAMAC data register and the second to the less significant one. This mode of data transfer is desirable in cases where definite groups of bits have to be set or reset. This is necessary if a CAMAC data register is used as a control-register controlling different apparatus in an experiment. (e.g. motors on, off, speed of motors etc.)

A more detailed list of CAMAC statements is given below:

CAMAC command without data handling:
  *Δ O, C, N, A, F, (Q)
CAMAC crate commands–
  clear : *Δ 1, C
  initialise : *Δ 2, C
  inhibit set : *Δ 3, C
  inhibit reset : *Δ 4, C
Read LAM (conditioned) : *Δ 5, C, L, R
CAMAC commands accompanied by data transfer:
  read : *Δ 6, C, N, A, F, FB, HW, (LW), (Q)
  write : *Δ 7, C, N, A, F, FB, HW, (LW), (Q)
  transfer write :
    *Δ 8, C, N, A, F, (Q)

C = Crate address
N = Module address
A = Subaddress
F = CAMAC Function
HW = more significant 12 bit group of CAMAC data word } FB = 3
LW = less significant 12 bit group of CAMAC data word } FB = 3
HW = CAMAC data word for FB = 1 or 2
Q = Response
L = number of LAM in question (Module address)
R = 1 if LAM in question = 1

* Now at KFA Jülich
‡ Now at Fa IBB, Wien
§ Trademark, Digital Equipment Corporation. A conversational programming language for Formulating On-line Calculations in Algebraic Language.

Format Byte FB	Typed data	Data in CAMAC register
1	1 word decimal	binary
2	1 word decimal	decimal
3	2 words octal	binary

One should recognize that all numbers in a CAMAC statement can be handled as variables and any statement can be typed under a separate line number. The Module address N for instance can be typed as a variable N and the read command can be executed for N = 1 to 10.

There are now two versions of the overlay[3], one for 4K FOCAL and one for 8K FOCAL. In the 4K version no format routines for BCD and OCTAL are included (FB is omitted), in order to save memory locations. One part of the overlay occupies the locations normally used for the high speed reader routines, which are removed as mentioned before. The other part occupies the locations of the extended functions of the floating point package. The format routines for the 8K versions are located in memory field No. 1. The work on interrupt routines is not yet finished, although it is intended to produce a system which allows the programming of interrupt routines in FOCAL too. Fast interrupt routines could be written in Assembler language.

A provisional version of the described overlay has been demonstrated by the Electronic-Institute of Jülich, positioning stepmotors and handling data from a triple-axis spectrometer at the exhibition at Hannover (29.9–3.10.70). In addition the same system has been shown by the Electronic-Institute of the Reactorcenter Seibersdorf at the CERN CAMAC exhibition in October 1970 (12–16.10.70).

Literature

1. CAMAC Crate Control for a PDP8 and a CAMAC 24 bit counter. (W. Attwenger, F. May, R. Patzelt, J. Schwarzer) Ispra: Nuclear Electronics Symposium 6–9.5.68.
2. Listing of FOCAL: DEC-08-AJAE-LA.
3. A more detailed description of the complete overlay will be published in DECUSCOPE.

Acknowledgement

The authors express their warm thanks to Mr. PILLMANN and Mr. MARSCHIK from Reactorcenter Seibersdorf and Mr. ZWOLL and Mr. POFAHL from KFA Jülich for very helpful discussions and assistance in doing the tedious task of writing and assembling the programs.

PREPARATION of PAPERS for the CAMAC BULLETIN

Manuscripts

1. Manuscript must be typed on one side of the sheet only.
2. Manuscript should be typed on alternate lines.
3. *Length* of the paper should have about 1200–1600 words (max. 2000).
4. Preferred language: *English*
5. The *title* of the paper should be typed in capital letters. The name of the author, his business affiliation, and city and state, should follow on separate lines in upper and lower case letters.
6. *Major headings* should be underlined.
7. *Subheadings* should be underlined and placed flush on the left-hand margin of the page on a separate line.
8. A brief *summary* should be included at the beginning of the paper. If the text is not in English an English version of the summary is highly appreciated.
9. *References:* List and number all bibliographical references at the end of the paper. When referring to them in the text, type the corresponding reference number in superscript form as shown at the end of this sentence[1].
10. *Page numbers:* Number each page at the top of the page.
11. Use only standard *symbols* and abbreviations in text and illustrations.

Illustrations

1. *Drawings and photographs:* Supply original ink (not pencil) drawings, and semi-matt prints of all photographs, at least twice the final size.
2. The author's name and the Figure number should be indicated lightly in pencil on the back of each illustration.
3. *Captions:* List all captions with Figure numbers on a separate sheet, regardless of whether or not they appear on the text.

NEXT ISSUE OF CAMAC BULLETIN Have you completed one of the reply cards from the back cover of this bulletin? It is essential that you do this if you want to receive the next issue. Please be careful to give your full name and address, exactly as needed for posting CAMAC Bulletin to you. There are extra cards for any of your colleagues who would like to read CAMAC Bulletin.

NEW PRODUCTS

AEG-TELEFUNKEN

Parallel Output Register, MS PO 1, 1230/1

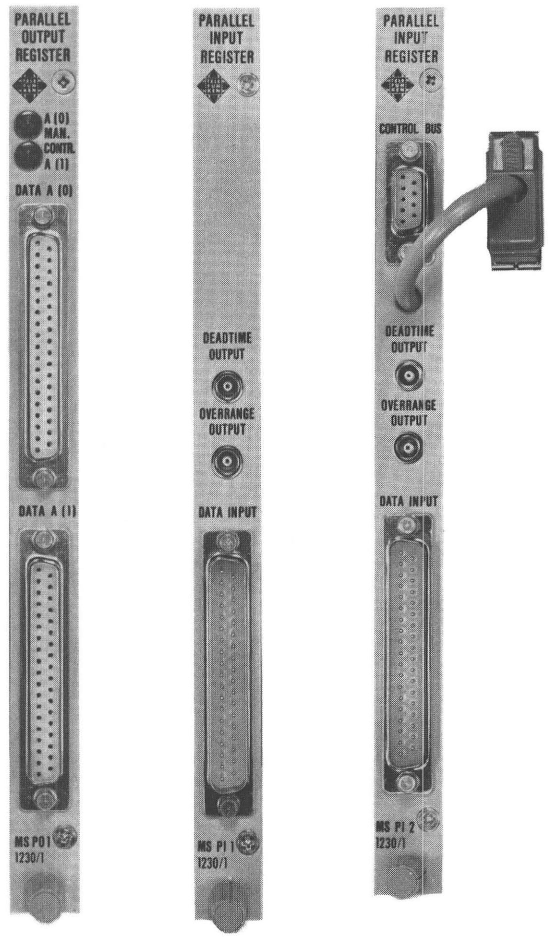
This single-width module has two 24-bit registers which interface data transfers of two 24-bit words or four 12-bit words from a computer via the CAMAC dataway to external devices. Data is stored within the registers until it is overwritten by new data.

The unit has been developed for use in CAMAC-NIM hybrid systems to control NIM compatible units. Each register has an extra bit, set up by F(24)/F(26) and indicated by a front panel lamp, which can be used to switch over from computer control to manual control for parameter adjustments within the external devices.

Parallel Input Registers, MS PI 1 and MS PI 2, 1230/1

These two single-width modules are for data transfers of 16-bit words (24-bit optional) from external equipment to a computer via the CAMAC dataway. A register buffers the data stored in it on demand from the external device.

On account of their special 'Ready' signals the input registers are particularly suitable for the data transfer from ADCs. The ADCs of AEG-TELEFUNKEN, type MS AD 1/2/3, 1105/1, and also converters of the firms LABEN and NUCLEAR DATA can be connected to the registers. The type MS PI 2 is also equipped with a control bus to detect the correlation of valid data from different ADCs in multiparameter experiments.



AEG-Telefunken Elisabethenstrasse 3 Postfach 830 79 ULM Germany Tel. (0731) 1921

BORER ELECTRONICS COMPANY

24-bit Preset Scaler, Type 1001

Preset Scaler Type 1001 is a single channel 24-bit 30MHz binary counter that is equipped with special overflow circuitry for preset count and preset time operation. The register can be pre-loaded by means of the dataway write lines with the complement of a required count so that an incoming data pulse train merely has to fill the remaining capacity. Patch pin 1 has been wired to produce a single pulse of approximately 200ns coincident with the first overflow pulse (this is additional to LAM). Facilities are incorporated to permit the overflow pulse to be initially enabled and, later, to be disabled once the preset count has been recognised. Thereafter the instrument continues to work as a conventional scaler producing the normal LAM per overflow until it is again pre-loaded. Inputs to the Counter, Gate and high impedance bridging Inhibit connectors are all at standard ESONE-CAMAC level. (Available.)

Dataway Display

A single-width accessory module that will be found especially useful during the setting-up phase of an experiment. The module connects with all points on the Crate dataway and will memorise and display the latest dataway operation until replaced by a further operation (Display Mode). In the alternative mode, On-Line selected by a front panel switch, it is possible to both write in and read out information to and from the appropriate memories using the R and W lines. All memories, and hence the corresponding display (with the exception of the Inhibit) can be manually reset by a push-button. No memory is included for the Inhibit since the Crate Controller contains a flip-flop which determines the state on the I-line. (In preparation.)

Borer Electronics Co. Solothurnstrasse 65 Biberist CH-4500 Solothurn 22 Switzerland Tel. 065-48822

DIGITAL EQUIPMENT CORPORATION

PDP-15 CAMAC Interface Model Number: CA15A

GENERAL DESCRIPTION

The CA15, designed and manufactured by Digital, serves as a branch driver for PDP-15 systems. Up to 7 crates may be used with the CA15 to provide the user with a very flexible, high speed, data acquisition system. Data is transferred using the multi-cycle data channel facility of the PDP-15, or under program control. Data can be transferred autonomously from any number of CAMAC devices. The CA15 is fully operational and is presently in use in a large experimental laboratory.

FEATURES

Mechanical

Standard cabinet with indicator assembly and power supplies. Rack space is available for housing up to 3 CAMAC crates.

Electrical

Input power	120/240V a.c. +10%, 47–63Hz
Module type	M-series (TTL logic)

Data word formats

single–18 bit
double–24 bit (18LS & 6MS)

Operational modes

Block Mode Transfers (via 3 cycle data channel) with three Address Schemes: Constant FCNA, Sequential FCNA, and Quasi-sequential FCNA.
Programmed control transfer
Special

Demand servicing modes

Two autonomous data channel facilities via LAM 23 & 24. API via LAM 19–22, and PI via LAM 1–18.

Speed

Overlapped CAMAC and data channel operation:
Read ~ 200kHz Write ~ 150kHz

RELIABILITY & MAINTAINABILITY

Designed for reliability using proven, noise-immune M-series logic. Features are built in to test the CA15 independent of and without CAMAC equipment.

AVAILABILITY

Delivery 3–5 months after receipt of order.

Digital Equipment Corporation 146 Main Street Maynard Massachusetts U.S.A. 01754

EKCO INSTRUMENTS LIMITED

Ekco Instruments Ltd. have announced a new range of CAMAC peripheral interface modules. This complete family of interface modules act as link units between CAMAC systems and a wide range of peripheral devices. Data and control signals pass through interface modules to or from teletypewriters, line printers, paper tape readers, paper tape punches, magnetic tape units and other devices. Few, if any, software modifications are necessary when changing from one module type to another, as they all operate with a common command structure.

Typical of the new range is the Teletypewriter Interface 7061 which is a fully duplex interface between CAMAC dataway and a serial telegraph channel, e.g. ASR33/35. Provision is made for requesting input data from the teletypewriter tape reader and for controlling motor start. A control register permits control of additional facilities and reduces the amount of programming required. This interface can be used in a number of operational configurations: Input mode, output mode, with simultaneous but independent input and output, or with input reflected onto the output.

Two teletypewriter interfaces can also be connected as a data link between two CAMAC installations, with a transfer rate many times that used in teletypewriter systems.

The remaining four modules in the family are Peripheral Readers and Drivers, which transfer eight parallel data bits. Adaptable handshake control ensures that the operation is synchronised to the speed of the peripheral. Two modules are fully compatible with the logic and signal levels of British Standard Interface BS4421 and two operate with similar logic at TTL signal levels.

EKCO Instruments Ltd. Southend-on-Sea Essex England SS2 6PS Tel. Southend-on-Sea 49491

FRIESEKE & HOEPFNER

In 1971 Frieseke & Hoepfner will produce the first batch of modules for a new CAMAC scaler-timer system, the FHC 1300, designed especially for small-to-medium scaler systems. The system can run under manual control without needing or influencing any crate controller, or can be switched to computer control from the front panel. In either mode the system controller has access to all counting registers and status information. A very flexible start/stop control allows many different schemes, e.g. preset count, preset time, and changing of time intervals, and ensures compatibility with scalers from other manufacturers. By special input circuitry and lay-out a good noise immunity is achieved.

The system includes a 6 decade 10MHz (30MHz optionally) scaler with preset from front panel or dataway, a similar scaler with preset from dataway only, a start/stop unit with 100Hz time base, a quartz controlled timebase generator, a display for a single scaler and one for up to 12 scalers and an input/output interface for connecting, for example, a teletype.

Frieseke und Hoepfner GMBH 852 Erlangen-Bruck Postfach NR.72 Germany Tel. Erlangen (09131) 171

GEC ELLIOTT

The following CAMAC modules are in various stages of development and will be available for delivery during 1971:

		DELIVERIES FROM
OD 1601	Dual 16-bit output driver	June
OD 1605	Dual 16-bit power output driver, with Read facility	June
TR 0801	Paper tape reader interface (for Electrographics Reader)	June
TP 0801	Paper tape punch output driver (for Facit 4070)	June
TD 0801	Typewriter drive unit	August
ADC 0801	8-bit 20μs analogue to digital converter	June
ADC 1001	10-bit 20μs analogue to digital converter	June
ADC 1201	12-bit 20μs analogue to digital converter	June
DAC 1001	Dual 10-bit 5μs digital to analogue converter	August
BDC 2401	24-bit 5μs binary to decimal (BCD) converter	August

In addition to the above modules our programme includes the development of modularised CAMAC couplers and controllers.

A common Executive module together with a module particular to a specific computer forms a single crate coupler, or by the addition of a branch driving module a multicrate coupler can be assembled. (The first available interface will be for the Digital Equipment PDP 11; modules for other computers will follow.) The design of these system modules allows for the addition of several command sources, such as autonomous transfer controllers and manual controllers. The latter item will be suitable for controlling non-computer systems in such applications as data logging or computer-independent display.

GEC-Elliott Process Instruments Ltd. Century Works Lewisham London, S.E.13 England Tel. 01-692-1271

HEWLETT PACKARD

Hewlett Packard has recently produced a very flexible computer controlled system (HP5406B) which is also CAMAC compatible.

The system includes a HP2114B or HP2116B computer, up to sixteen ADC (mod. 5416B) with 13-bit resolution and peripheral devices such as oscilloscopes, mag. tapes or discs.

The system is driven with a software package particularly suitable for nuclear applications, such as gamma spectroscopy, neutron spectroscopy, or multiparameter coincidence experiments.

One or more CAMAC crates can also be connected to the system via a special CAMAC Branch Driver box (made by Borer–Solothurn, Switzerland) and two standard micro-circuit cards (HP15187A) placed in the 2116B (or 2114B).

The operator can also very easily insert a CAMAC software driver in the standard 5406 software in order to be able to adapt the instrument to several experimental requirements. The CAMAC driver may then be called into operation with a simple TTY command.

Transfer of data blocks to and from CAMAC crates can be achieved also under DMA (Direct Memory Access) control. The typical transfer time of 16-bit data words is then only about 6μs.

Hewlett-Packard (Schweiz) AG. 7 rue du Bois-du-Lan 1217 Meyrin-Genève Switzerland Tel. (022) 415200

JORWAY CORPORATION

Model 80A 200MHz Dual 24-bit Scaler

This unit is a faster version of our Model 80. It contains two 24-bit scalers with a minimum counting speed of 200MHz. It is completely compatible with all of our CAMAC scalers and so will allow a simple way of up-grading an existing scaler system. Where a faster speed would help the system, these channels could be replaced without affecting system controls.
Functions used: F0, 9, 25
Single-width module
Availability: March, 1971

Model 64 Fast Coincidence Latch

The Model 64 will accept up to 8 input signals and look for coincidence with a common strobe signal. Each input is discriminated and shaped and the leading edge is used for coincidence timing. A coincidence between the leading edge and the strobe signal of one nanosecond or more will set a flip-flop. A front-panel light will indicate when a coincidence has occurred. All 8 flip-flops are OR-connected together to generate a LAM signal. In addition a fast analog sum is provided to indicate how many coincidences have occurred, for use with decision logic. A Test signal is provided that will set all the flip-flops. All functions and subaddresses are fully decoded.
Commands used: F0, 2, 8, 9, 10, 24, 25, 26
Single-width module, 8 data inputs, 2 bridged strobes, 1 analog output (all LEMO), 8 indicators, one N light
First delivery: January 15, 1971

Jorway Corporation 27 Bond Street Westbury New York 11590 U.S.A. Tel. (516) 997-8120

NUCLEAR ENTERPRISES

9017 Driver

A recently introduced Nuclear Enterprises CAMAC-compatible plug-in is the Driver type 9017. This general purpose unit embodies:

- a 24 bit output register/driver
- a 24 bit input gate, and
- an interrupt bistable that can be set from an individual front panel coaxial socket.

The 24 output lines, provided at a multipin front-panel output socket, are capable of sinking 50mA or of withstanding +40V with respect to earth potential.

The 24 input lines, to CAMAC specification, are accepted at a further multipin front-panel socket.

7011 CRT Display Driver

The Display Driver 7011 provides control facilities for the display of digital information on a CRT. The principal operating configurations are the Spectrum and Point Plot modes. In both modes the delay between bright-up and the call for new data can be preset or omitted to suit the user's display system. Axes, ordinates and marker lines can be drawn with a minimum of instruction data.

Dataway Display

The Dataway Display system consists of a Dataway Buffer type 9018 and Dataway Display type 9019. The 9018 is a single-width CAMAC module buffering the 72 dataway signal lines to a set of front panel sockets. Each output is capable of sinking 50mA or withstanding +12V with respect to earth. The 9019 is a 19 inch rack mounted unit with lamps indicating the state of the 72 signal lines.

Nuclear Enterprises Ltd. Bath Road Beenham Reading Berkshire RG7 5PR England Tel. Woolhampton 2121

SAIP-CRC/SCHLUMBERGER

Manual Branch Control Set, CCMB 10

This Set permits adjustment and maintenance of modules, crates and branches. It includes highway drivers, branch timing and branch specific display; a 'Branch Command Crate' (type CCOB 10, 19 inch crate with a height of 4 units = 7 inches); and a 'Manual Branch Controller' (type TCMB, a special non-standard plug-in unit.)
Delivery: September 1971

Crate Controller ('A'), JCRC 50

Main Features: This module is built strictly according to CAMAC specification EUR4600 (2/25 width). Some improved characteristics are provided especially concerning:

- The input current standards
- The gates between R and BRW and between W and BRW
- Safety for crate controller address in a branch

Delivery: February 1971

Manual Dataway Controller, JCMC 10

Main Features: Allows Dataway control of one or two transfers to a module in a continuous manner, or transfer by transfer, or step by step.
Cycle duration: continuously adjustable from 0·8μs to 16ms, with internal or external synchronisation.
Width: 8/25
Delivery: June 1971

SAIP-CRC/Schlumberger (Schlumberger Instruments et Systèmes) Centre d'Instrumentation Nucléaire
38, Rue Gabriel-Crié 92-Malakoff France Tel. 253-87-20, 735-99-10

SIEMENS A.G.

Siemens Crate Controller Type 'A'

The Crate Controller, type 'A', provides the connecting link between the branch highway and the dataway. The basic specifications are guided by the EURATOM Reports EUR4100 and EUR4600. The Crate Controller (double-width unit) is available and satisfies all recommended specifications in addition to the mandatory requirements.

The input current of the branch highway inputs is less than 0·3mA. The branch highway outputs can supply a current of 150mA max. Gates with open collector outputs are provided. The outputs to the dataway are also equipped with 'pull-up' resistors and clamping diodes. The unit is equipped for multi-branch operation: it is disabled with an external, off-line signal.

A protective circuit prevents several Controllers with the same address going to an on-line status. In this case, the indicators for the crate addresses are less brightly illuminated. The protective circuit can be disconnected.

Because the connections between the printed circuit cards are accomplished by plug-receptacles, the resultant short lead lengths inhibit interference and, additionally, this construction permits very convenient serviceability.
Available: mid-1971

Siemens AG Wernerwerk F. Messtechnik Rheinbrueckenstrasse 50 75 Karlsruhe—West Germany
Tel. (0721) 5951

SEN ELECTRONIQUE

A Modular Scope Display System

SEN Electronique offers users of CAMAC systems a unique *modular* CRT display system with possibilities ranging from simple point-by-point plotting to elaborate alpha-numeric display with automatic straight line generation.

Among other design criteria, modularity was given great importance in order to allow CAMAC people to purchase exactly the display functions they require, not more. Should the requirements grow, a more elaborate display system can be assembled at a later time.

A short characterization of the system:

- Basically 1024 point resolution in both directions
- Command structure and logic for data transactions through *direct memory channel,* an essential feature with non-storage 'scopes.
- Efficient and uniform L-logic to deal with the slow writing speed of storage 'scopes
- Special module to drive Tektronix storage displays
- All-digital vector generation for accuracy and stability
- Simple summation of deflection and unblanking signals in multi-module arrangements
- Matches almost all commercial CRT display instruments
- Built-in logic for light pen

A list of several display functions provided by single modules and combinations follows:

DISPLAY FUNCTION	MODULE(S) REQUIRED
• Simple X-Y plots	DD 2012
• Y versus X, automatic stepping in the X direction	DD 2012
• Pure alpha numeric	CG 2018
• Curves or histograms with labels, titles or text	DD 2012 and CG 2018
• Graphics involving automatic straight line generation	DD 2012 and VG 2028
• Elaborate graphics with text	DD 2012, VG 2028 and CG 2018

The SDD 2015 is used with any of the above configurations if a storage 'scope is used.

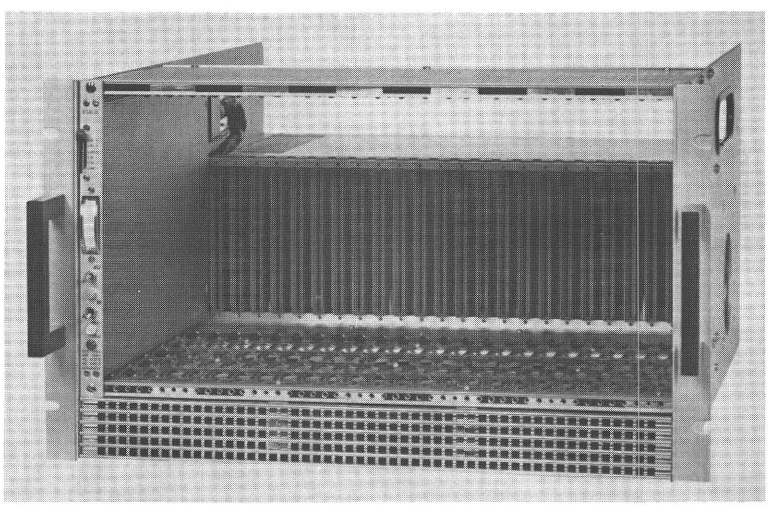
SEN Electronique 31, Avenue Ernest-Pictet 1211 Geneve 13 Switzerland Tel. (022) 442940

SAPHYMO-SRAT

Saphymo-Srat, specialists in regulated power supplies, have undertaken big efforts in the study and development of CAMAC power supplies. Three families of supplies have been developed or are in preparation:

- Autonomous versions (available 1971) – C4ALJ12 – C6ALK12 – C7ALJ13 –
- Versions for 'medium power in blocks' (available 1971) – C4BiP203 etc...
- Versions for 'high power in racks' (under study, 1971)

Powered crates (C4/C6/C7 ALJ13D) are available, equipped with all dataway connections. A double layer board with metallised holes, special cabling, and an extra board for the supplies is used (prototypes using wire wrapping are in preparation for industrial production, end 1971).



Powered crate C7ALJ13D (200W d.c. power, 570mm crate depth)

Saphymo-Srat 51, Rue de l'amiral-Mouchez 75, Paris-13ème France Tel. 588-16-39

ESONE ANNOUNCEMENTS

ESONE Chairman

As stated in the *'Highlights of the 1970 Annual Conference'*, M. Sarquiz from CEN Saclay has been elected unanimously by the General Assembly as Chairman of the ESONE Committee for the period from the end of the 1970 Annual Assembly until the end of the 1971 Annual Assembly (to be held probably in the beginning of October).

ESONE Handbook

The ESONE Handbook, containing the rules and constitution of ESONE, with lists of member laboratories and delegate organisations, has been accepted by the Committee and will be available on request within a short period from the secretary, W. Becker. It includes sections on Terminology, General Introduction—ESONE, Part 1—the ESONE Committee, Part 2—The Executive Group of the ESONE Committee and an Appendix.

Branch highway organization

A preliminary issue of *'CAMAC: Organization of Multi-Crate Systems, Specification of the Branch Highway and CAMAC Crate Controller Type A'*, to be published under EUR4600, has been made on strong demand from industry, and will be available from the secretary. It can be considered as a provisional but official publication until EUR4600 is distributed. There are now about 6 months for further comments from the ESONE Committee and the NIM Committee while translations are being made.

The paper has been approved by the Committee.

Power supply voltage (6V)

The request for modifying the 6V power supply voltage, made by the NIM Committee, was withdrawn during the New York NIM Meeting, Nov. 4, 1970.

Mechanics

Two changes in dimensions have been approved by the ESONE Committee and therefore became part of the CAMAC Standard:

(a) increase of the width of the crate guide slot from 2·1 ±0·1mm to 2·6 ±0·1mm. As a consequence, in drawing 1 (EUR4100), detail A, 2·1 ±0·1 has to be replaced by 2·6 ±0·1;

(b) increase the guide separation from 200·9 ±0·1mm to 200·9 +0·7, –0·1mm. As a consequence, in drawings 1 and 3 (EUR4100) 200·9 ±0·1 has to be replaced by 200·9 +0·7, –0·1mm.

The two changes have been accepted in order to facilitate production and to avoid possible interferences due to accumulated tolerances. The changes will be incorporated in the next edition of EUR4100.

New Members of the ESONE Committee and New Applicants

The Instituut voor Kernphysisch Onderzoek (IKO), Amsterdam, Netherlands became a member laboratory, represented by Ir. E. Kwakkel.

The Instytut Badan Jadrowych, Swierk K/Otwocka, Poland became a member laboratory, represented by Dr. R. Treckinski.

The Aktiebolaget Atomenergi Studsvik, Sweden became a member laboratory, represented by Dr. Per Gunnar Sjölin.

The Nuclear Research Center "Democritus" of the Greek Atomic Energy Commission in Athens, Greece, became a member laboratory, represented by Dr. Ch. Mantakas.

There are several new applicants to become full member laboratory or affiliated laboratory of the ESONE Committee.

1971 ANNUAL GENERAL ASSEMBLY AND EXHIBITION

The Annual General Assembly of the ESONE Committee will be held on 5th, 6th and 7th October 1971, at Centre d'Etudes Nucléaires, Saclay, France. Facilities will be provided for an exhibition of CAMAC equipment by manufacturers, and the programme will include joint sessions with company representatives. Full details will be available soon from the Secretary of the ESONE Committee.

Members of Working Groups should note that Monday 4th October will be set aside for Working Group meetings as required.

OBITUARY We regret to announce the death on 8th December 1970 of Prof. Dr. Sc. nat. Ernst Baldinger, the representative of the University of Basel on the ESONE Committee. Prof. Baldinger had been associated with the work of ESONE since its early years.

ACTIVITIES OF THE ESONE WORKING GROUPS

At present the ESONE Committee has authorised five working groups to investigate specific aspects of CAMAC. The Information Working Group is responsible for this bulletin. The Mechanics Working Group deals with the mechanical constructional standards for CAMAC crates and plug-in units. The Dataway Working Group covers digital interconnections via the Branch Highway and front panel connections as well as the Dataway. The Analogue Signal Working Group is responsible for standards for analogue signals via front panel connectors. Programming techniques for CAMAC systems are studied by the Software Working Group. The current programmes of work of these four groups are outlined below.

Dataway Working Group

Chairman: Mr. H. Klessmann, HMI, Berlin

The specification of the Branch Highway and Crate Controller Type A is available as a preliminary issue from members of the ESONE Committee. Work has started on translations into French and German, and the Working Group aim to release the final text of Euratom Report EUR4600 in May, 1971. An extension to this specification, using some of the reserved lines in the Branch Highway, is being studied as a means of allowing systems with more than one controller and more than one branch.

Experience with the basic CAMAC specification EUR4100 has shown up a number of difficulties of interpretation and presentation. The Working Group is investigating these, and expects to propose revisions and recommended interpretations which are not incompatible with existing equipment.

The CAMAC Branch Highway is essentially suitable for fast data transfers over rather restricted distances. The Working Group hopes to consider transmission within CAMAC systems over longer distances (for example, more than 50m).

Many of these problems concern both the Dataway and Software Working Groups. Close contact will be maintained between the two groups, through those members who serve on both groups and through other informal contacts.

Analogue Signal Working Group

Chairman: Dr. K. Tradowsky, KFZ, Karlsruhe

The Working Group presented proposals for amplitude analogue signals at the General Assembly, for discussion by ESONE members and the representative of the NIM Committee. The conference showed a strong preference for positive signals, and invited the Working Group to make appropriate changes to the specification.

The Executive Committee and the Chairman have agreed to publication of the specification after these changes have been made. A pre-print of the analogue signal specification will therefore be issued in the first quarter of this year.

A meeting of the Working Group will be arranged in the middle of 1971, in conjunction with a meeting of the Dataway or Software Working Groups, at a time when it is convenient for members of the NIM Committee to attend.

The Working Group will present the pre-print, or a revised text if necessary, at the General Assembly in the autumn, for acceptance as the final specification.

Mechanics Working Group

Chairman: Mr. F.H. Hale, AERE, Harwell

Since the General Assembly at Geneva in October 1970 the Working Group has:

1. Re-defined the Crate Edge Connector with particular reference to:
   (a) Entry guidance
   (b) Entry and extraction forces
   (c) Width of contacts
   (d) Realistic tolerancing
   (e) Relationship with jacking screw.
2. Re-defined the printed plug end of the module circuit card with particular reference to:
   (a) A datum for all dimensions
   (b) Avoidance of cumulative tolerances
   (c) Tolerancing the contact width
   (d) Re-considering chamfers in relation to Dataway socket details
   (e) Indicating whether a chamfer is to be included at the upper corner.
3. Reviewed the module jacking screw specification in relation to the edge connector card plug specifications, so as to ensure satisfactory operation.

In order to complete its present programme the Working Group hopes to:

4. Clarify the crate ventilation aperture for both upper and lower guides—including the disposition of designated ventilation areas.
5. Recommend module ventilation conditions.
6. Recommend printed circuit card overall dimensions and fixing centres in the interests of interchangeability.
7. Discuss possible effects of temperature changes on tolerances.

Software Working Group

Chairman: Mr. I.N. Hooton, AERE, Harwell

The Software Working Group has listed the CAMAC Input-Output operations that will be required by users. The current task is to define a machine independent language in which the user may specify the operation or sequence of operations he requires.

Future activities will include an examination of the linkages required between CAMAC language statements and the main body of the user's program. This study will be concerned with both the CAMAC language and the operating system.

Extensions of the language to provide either simpler or more complex statements will be studied.

ESONE/NIM COLLABORATION The close liaison between the ESONE Committee in Europe and the NIM Committee in the U.S.A. has been maintained recently by the participation of Mr. F.A. Kirsten (Chairman, NIM/CAMAC Dataway Working Group) in meetings of the ESONE Dataway and Software working groups at the Rutherford High Energy Laboratory in England. The ESONE Committee was represented by Mr. I.N. Hooton at meetings of the NIM/CAMAC working groups on the Dataway and Software (first meeting) from 27 to 29 April at Los Alamos, New Mexico, U.S.A.

This interchange of expert representatives is particularly vital at the present time when both Dataway Working Groups are studying the interpretation of the CAMAC Specification, EUR4100, and both Software Working Groups are beginning intensive programmes of work.

CAMAC INSTRUMENTATION
27 and 28 October 1971

A course at the Harwell Post-graduate Education Centre for engineers, scientists and others who have a direct interest in the subject of real-time operations with computers and other processing devices for measurement and control.

The lectures are by members of Harwell staff and are based on their experience in formulating the standard, applying it to the development of the extensive range of Harwell 7000-Series CAMAC-compatible equipment, and setting up operational systems.

The course is intended for users rather than for equipment designers. It presents the original CAMAC specification, covering communication between plug-in modules and a controller via the Dataway within a rack-mounted crate, and also the later extension to communication between crate controllers and a system controller via the Branch Highway of a multi-crate system. Other lectures deal with the principles of CAMAC modules and controllers and of programming for CAMAC systems. Practical examples are drawn mainly from the Harwell 7000-Series, and there is a visit to an installed system.

Course fee: £20 (accommodation not included)

Application forms from: Education and Training Centre (P)
AERE Harwell
DIDCOT Berkshire
England

CAMAC news

INSTRUMENTATION EXHIBITION IN SACLAY From December 10 to December 11 the Electronic Department of Saclay presented its annual exhibition of recent nuclear instrumentation developments.

Of course CAMAC instruments were on the spot and two systems were operating for demonstration purposes:

- One around a PDP-8I orientated toward automatic tests and evaluations.
- The other around a 19-bit computer from TELEMECANIQUE (T2000) used with a programmable set of modules for nuclear spectrometry and radioactivity measurements.

During a conference joined to this exhibition, three communications on CAMAC were presented to a large number of participants from industry and from various research establishments. The proceedings of this conference will be available in the *"Bulletin d'Instrumentation Nucléaire"* no. 42.

MEMBERSHIP OF THE ESONE COMMITTEE

This list shows the member organisations and their nominated representatives on the ESONE Committee. Members of the Executive Group are indicated thus*.

International	European Organisation for Nuclear Research (CERN)	*F. Iselin**	Geneva, Switzerland
	Centro Comune di Ricerca (Euratom)	*W. Becker** *L. Stanchi*	Ispra, Italy
	Bureau Central de Mesures Nucléaires (Euratom)	*H. Meyer**	Geel, Belgium
Austria	Studiengesellschaft für Atomenergie	*R. Patzelt*	Wien
Belgium	Centre d'Etude de l'Energie Nucléaire	*L. Binard*	Mol
England	Atomic Energy Research Establishment	*H. Bisby**	Harwell
	Daresbury Nuclear Physics Laboratory	*B. Zacharov*	Warrington
	Rutherford High Energy Laboratory	*M.J. Cawthraw*	Chilton
France	Centre d'Etudes Nucléaires de Saclay	*M. Sarquiz**	Gif-sur-Yvette
	Centre d'Etudes Nucléaires de Grenoble	*J. Lecomte*	Grenoble
Germany	Deutsche Studiengruppe für Nukleare Elektronik c/o Physikalisches Institut der Universität	*B.A. Brandt*	Marburg
	Deutsches Elektronen-Synchrotron	*D. Schmidt*	Hamburg
	Hahn-Meitner-Institut für Kernforschung	*H. Klessmann*	Berlin
	Kernforschungsanlage Jülich	*K.D. Müller**	Jülich
	Gesellschaft für Kernforschung	*K. Tradowsky*	Karlsruhe
	Institut für Kernphysik der Universität	*W. Kessel*	Frankfurt/Main
Greece	"Demokritus" Nuclear Research Centre	*Ch. Mantakas*	Athens
Italy	Comitato Nazionale Energia Nucleare (CNEN)	*B. Rispoli**	Roma
	CNEN Laboratori Nazionali	*M. Coli*	Frascati
	CNEN Centro Studi Nucleari	*F. Fioroni*	Casaccia
	Centro Studi Nucleari Enrico Fermi	*P.F. Manfredi*	Milano
	Centro Informazioni Studi Esperienze	*P.F. Manfredi*	Milano
	Istituto di Fisica dell'Università	*G. Giannelli*	Bari
Netherlands	Reactor Centrum Nederland	*P.C. van den Berg*	Petten
	Instituut voor Kernphysisch Onderzoek	*E. Kwakkel*	Amsterdam
Poland	Instytut Badan Jadrowych	*R. Treckinski*	Swierk K/Otwocka
Sweden	Aktiebolaget Atomenergi Studsvik	*Per Gunnar Sjölin*	Nyköping
Switzerland	Institut für Angewandte Physik der Universität	*E. Baldinger†*	Basel
Yugoslavia	Boris Kidrič Institute of Nuclear Sciences	*M. Vojinovic*	Vinča, Beograd

Liaison with the USAEC NIM Committee is maintained through:

L. Costrell	(Chairman)	National Bureau of Standards	Washington D.C.
F.A. Kirsten	(Dataway Working Group)	Lawrence Radiation Laboratory	Berkeley, California
S. Dhawan	(Software Working Group)	Yale University	New Haven, Connecticut
D.A. Mack	(Mechanics Working Group)	Lawrence Radiation Laboratory	Berkeley, California
N.W. Hill	(Analog Signals Working Group)	Oak Ridge National Laboratory	Oak Ridge, Tennessee

CAMAC PRODUCTS GUIDE

This guide consists of a list of CAMAC equipment which is believed to be offered for sale by manufacturers in Europe and the U.S.A. The information has been taken from a CAMAC Products Reference compiled by CERN-NP-EL II from manufacturers' catalogues, advertisements and written communications available to them on 17th November, 1970. Some changes have been made in order to include more recent information and to remove items which were duplicated, not available commercially, or not in CAMAC format.

The number of items of commercially available CAMAC equipment is increasing rapidly and it is therefore not possible to guarantee the completeness or accuracy of this list, although it is hoped that most products and manufacturers have been included. Inclusion in this list does not necessarily indicate that products are fully compatible with the CAMAC specifications, nor that they are recommended or approved by the ESONE Committee. Similarly, omission from this list does not indicate disapproval by the ESONE Committee. Users are advised to obtain detailed information from the manufacturers or their agents in order to check the compatibility and operational characteristics of equipment.

The equipment list includes the abbreviated name of the manufacturer, and is followed by a list of full names and addresses, to which it is linked by manufacturers' codes indicating the country and firm, for example CH-BO for Borer Electronics Co. of Switzerland. The arrangement of the equipment list is based on classification according to the main operational application of each item. This has the advantage that the main classes of unit (such as scalers, I/O registers and gates, crates, etc.) are grouped together. Some other units are difficult to classify using the available information, and readers are therefore advised to search under several categories.

Most CAMAC modules in this list have generalised front-panel connections, with signal standards and connectors following the CAMAC recommendations. Some other units, including computer interfaces, are fully compatible with the CAMAC crate and Dataway but have specialised external connections for use with particular items or classes of equipment. In this list some units with specialised non-CAMAC front panel connections are marked thus *, and units with specialised interconnections to controllers are marked thus §.

INDEX OF PRODUCTS

BRANCH HIGHWAY: COMPUTER COUPLERS, CRATE CONTROLLERS, TERMINATIONS

Branch Driver/Interface	2200	Borer	CH-BO
PDP-11 Branch Driver		SEN	CH-SE
PDP-15 CAMAC Interface	CA15A	Digital (DEC)	US-DE
Crate Controller (ESONE "A")	1501	Borer	CH-BO
Crate Controller "A"	ACC2034	SEN	CH-SE
Crate Controller "A"		Siemens	D-SI
Crate Controller "A"	JCRC50	SAIP	F-SA
Crate Controller	CC2402	GEC-Elliott	GB-EL
Crate Controller (ESONE "A")	CC2404	GEC-Elliott	GB-EL
Type A Controller	70	Jorway	US-JO
Termination Unit	1591	Borer	CH-BO
Branch Termination Unit	BT6601	GEC-Elliott	GB-EL
Branch Termination Unit	50	Jorway	US-JO

DATAWAY/COMPUTER COUPLERS

Crate Controller for Nova Computer *	CC2023A/B	SEN	CH-SE
Crate Controller for PDP-8 *	FHC8001A	Frieseke	D-FH
DDP-516 Dataway Controller *	7022-1	EKCO + Nucl. Ent.	GB-EN
Dataway Controller PDP-8 *	7048-2	EKCO + Nucl. Ent.	GB-EN
Auxiliary Controller PDP-8§*	7049-1	EKCO	GB-EK

OTHER SYSTEM UNITS

Start-stop Unit (for Scaler/Timer)	FHC1304	Frieseke	D-FH
Start-stop for Chronometry	JAM 10	SAIP	F-SA
Programmed Dataway Controller	7025-2	EKCO + Nucl. Ent.	GB-EN
Auxiliary Controller (for 7025) §	7080-1	EKCO + Nucl. Ent.	GB-EN
Store Interface (Core store for 7025) §	7067-1	EKCO + Nucl. Ent.	GB-EN
Plugboard Store §	7077-1	EKCO + Nucl. Ent.	GB-EN
Wired Store (Programme Module) §	7044-1	EKCO + Nucl. Ent.	GB-EN
Readout Control Unit	2152	LeCroy	US-LS
4-Fold "Busy Done" Module	BD2021	SEN	CH-SE
Overflow Driver		Siemens	D-SI
Control Signal Interface	7076-1	EKCO + Nucl. Ent.	GB-EN
Auxiliary Controller	7047-1	EKCO + Nucl. Ent.	GB-EN
Sequential Command Generator §	7037-1	EKCO + Nucl. Ent.	GB-EN
Command Generator §	7062-1	EKCO + Nucl. Ent.	GB-EN
Local Intercrate Interface §	7033-1	EKCO + Nucl. Ent.	GB-EN
Local Slave Dataway Controller §	7034-1	EKCO + Nucl. Ent.	GB-EN
Remote Intercrate Interface §	7035-1	EKCO + Nucl. Ent.	GB-EN
Remote Sub-Master Dataway Controller §	7036-1	EKCO + Nucl. Ent.	GB-EN

SERIAL INPUT MODULES

Serial Register (50MHz, 16 bit)	SR1601	GEC-Elliott	GB-EL
Dual Counting Register (2 x 12 bit)	701-1	EKCO Instruments	GB-EK
Dual Counting Register (2 x 16 bit)	703-1	EKCO Instruments	GB-EK
Duoscaler (CERN 002, 2 x 16 bit, 75MHz)	002	Nuclear Enterprises	GB-NE
Miniscaler, 30MHz (2 x 16 bit)	1002	Borer	CH-BO
Dual 150MHz 16-bit Scaler	2S2024/16	SEN	CH-SE
Microscaler, 25MHz (4 x 16 bit)	1003	Borer	CH-BO
Four-Fold 16-bit Scaler (CERN 003)	4S2003/50	SEN	CH-SE
Four-Fold 16-bit Scaler (100MHz)	4S2003/100	SEN	CH-SE
Four-Fold 16-bit Scaler (30MHz)	4S2004	SEN	CH-SE
4 x 16 bit Scaler (25MHz)	JEB 20	SAIP	F-SA
Quad Counting Register (4 x 16 bit)	706-2	EKCO Instruments	GB-EK
Serial Register (50MHz, 4 x 16 bit)	SR1603	GEC-Elliott	GB-EL
Serial Register (40MHz, 4 x 16 bit)	SR1606	GEC-Elliott	GB-EL
Serial Register (4 x 16 bit, 25MHz, CERN 003)	SR1605	GEC-Elliott	GB-EL
Microscaler (CERN 003, 4 x 16 bit, 25MHz)	003	Nuclear Enterprises	GB-NE
CAMAC 100MHz Quad Scaler	263	Nucl. Measurement	GB-NM
Counter 25MHz (24 bit)	Ms1/9103	Siemens	D-SI
Counter 250MHz		Siemens	D-SI
Scaler, 24 bit (20/10MHz)	JEB 10	SAIP	F-SA
Counting Register 15MHz (24 bit)	7070-1	EKCO + Nucl. Ent.	GB-EN
Special 24 bit Scaler (25MHz)	JEB 15	SAIP	F-SA
Dual 150MHz 24 bit Scaler	2S2024/24	SEN	CH-SE
Dual 100MHz Scaler (2 x 24 bit)	80	Jorway	US-JO
Dual 200MHz Scaler (2 x 24 bit)	80A	Jorway	US-JO
Quad Counting Register (4 x 24 bit)	709-2	EKCO Instruments	GB-EK
Quad 100MHz Scaler (4 x 24/16 bit)	2550	LeCroy	US-LS
Quad 100MHz Scaler (4 x 24 bit)	84	Jorway	US-JO
Dual Counting Register (2 x 3 BCD)	7040-1	EKCO + Nucl. Ent.	GB-EN
Dual Counting Register (2 x 4 BCD)	700-1	EKCO Instruments	GB-EK
Quad Counting Register (4 x 4 BCD)	707-2	EKCO Instruments	GB-EK
Quad Counting Register (4 x 6 BCD)	708-2	EKCO Instruments	GB-EK
Dual Increment Position Encoder	2IPE2019	SEN	CH-SE
Dual Coordinate Recorder *	XYRCDR/042	SAIP	F-SA
Bidirectional Counting Register (2 x 20 bits)	7071-1	EKCO + Nucl. Ent.	GB-EN

PRESET COUNTING REGISTERS (SCALERS)

Preset Scaler (30MHz, 24 bit)	1001	Borer	CH-BO
Preset Scaler (1 x 24 bit, 30MHz)	FHC1201A	Frieseke	D-FH
Preset Counting Register (24 bit)	703-1	EKCO Instruments	GB-EK
Preset Counting Register (16 bit)	7039-1	EKCO + Nucl. Ent.	GB-EN
Preset Counting Register (4 BCD)	704-1	EKCO Instruments	GB-EK
24 bit BCD Preset Scaler/Timer	FHC1301	Frieseke	D-FH
24 bit BCD Preset Scaler/Timer	FHC1302	Frieseke	D-FH
Six Decade BCD Preset Scaler	JEP 20	SAIP	F-SA
Preset Counting Register (6 BCD)	705-1	EKCO Instruments	GB-EK

PARALLEL INPUT REGISTERS

Parallel Input Register 16 bit	MSPI1	AEG-Telefunken	D-AE
Parallel Input Register 16 bit	MSPI2	AEG-Telefunken	D-AE
Parallel Register (16 bit, Indicating)	PR1601-1	GEC-Elliott	GB-EL
Parallel Register (16 bit, Indicating)	PR1603	GEC-Elliott	GB-EL
Parallel Input Register (16 bit)	7014-1	EKCO + Nucl. Ent.	GB-EN
Dual 16 bit Input Register	2IR2010	SEN	CH-SE
Parallel Register (2 x 16 bit, Indicating)	PR1602	GEC-Elliott	GB-EL
Parallel Register (2 x 16 bit, Indicating)	PR1604	GEC-Elliott	GB-EL
Dual Parallel I/P Reg (2 x 24 bit)	60	Jorway	US-JO
Interrupt Request Register	7013-1	EKCO + Nucl. Ent.	GB-EN
12 bit Priority Interrupt Register	63	Jorway	US-JO
Strobed Input Register NIM (12 bit)	SIR2026	SEN	CH-SE
Pattern Unit 16 bit (CERN 021)	16P2007	SEN	CH-SE
Gated Parallel Register	GPR0801	GEC-Elliott	GB-EL
Matrix Gate	MG6401	GEC-Elliott	GB-EL
Pattern Unit (16 bits)	021	Nuclear Enterprises	GB-NE
Fast Coincidence Latch (8 CH)	64	Jorway	US-JO
16 CH Discr/Coinc. Register	2340	LeCroy	US-LS
16 CH Coincidence Register	2341	LeCroy	US-LS

PARALLEL INPUT GATES

Input Gate 16 bit	CE710MU	EKCO Instruments	GB-EK
Parallel Input Gate (16 bit)	7017-1	EKCO + Nucl. Ent.	GB-EN
Parallel Input Gate (16 bit)	7018-1	EKCO + Nucl. Ent.	GB-EN
Input Gate 24 bit	CE713MU	EKCO Instruments	GB-EK
Input Gate 24 bit	CE714MU	EKCO Instruments	GB-EK
Parallel Input Gate (24 bit)	7059-1	EKCO + Nucl. Ent.	GB-EN
Parallel Input Gate (24 bit)	7060-1	EKCO + Nucl. Ent.	GB-EN
Driver (+ Parallel Input Gate, 24 bits)	9013	Nuclear Enterprises	GB-NE
Driver (+ Parallel Input Gate, 24 bits)	9017	Nuclear Enterprises	GB-NE
Dual Parallel I/P Gate (2 x 24)	61	Jorway	US-JO
Dual Parallel I/P Gate (2 x 24)	61-1	Jorway	US-JO

MANUAL INPUT MODULES

Parameter Unit (12 bit)	P2005	SEN	CH-SE
Parameter Unit	022	Wiener	D-WI
Word Generator	WG2401	GEC-Elliott	GB-EL
Word Generator	9020	Nuclear Enterprises	GB-NE
Parameter A	022	Nuclear Enterprises	GB-NE

DATA STORAGE MODULES

Quad Register 4 x 8 bit	715-2	EKCO Instruments	GB-EK
Quad Register 4 x 16 bit	716-2	EKCO Instruments	GB-EK
Quad Register 4 x 24 bit	717-2	EKCO Instruments	GB-EK
Transfer Register	7063-1	EKCO + Nucl. Ent.	GB-EN

PARALLEL OUTPUT MODULES

Output Register NIM (12 bit)	OR2027	SEN	CH-SE
Output Register (12 bit, NIM signals)	41	Jorway	US-JO
Output Register, CAMAC/NIM Hybrid		Frieseke	D-FH
Parallel Output Register (1 x 24 bit)	7054-3	EKCO + Nucl. Ent.	GB-EN
Dual 16 bit Output Register	2OR2008	SEN	CH-SE
Parallel O/P Register (2 x 24 bit)	MSP01	AEG-Telefunken	D-AE
Dual 24-bit Parallel Output Register	40	Jorway	US-JO
Output Driver (2 x 16 bit)	OD1601	GEC-Elliott	GB-EL
Output Driver (2 x 16 bit, with Read)	OD1605	GEC-Elliott	GB-EL
Driver (24 bit)	718-1	EKCO	GB-EK
Driver (8 bit)	7016-1	EKCO + Nucl. Ent.	GB-EN
Switch (12 relays)	7066-1	EKCO + Nucl. Ent.	GB-EN
Driver (16 bit)	9002	Nuclear Enterprises	GB-NE
Driver (+ Parallel Input Gate, 24 bits)	9013	Nuclear Enterprises	GB-NE
Driver (+ Parallel Input Gate, 24 bits)	9017	Nuclear Enterprises	GB-NE

DISPLAY MODULES

Display Driver X-Y-Z	DD2012	SEN	CH-SE
Storage Display Driver	SDD2015	SEN	CH-SE
Character Generator	CG2018	SEN	CH-SE
Vector Generator	VG2028	SEN	CH-SE
Display Driver	7011-2	EKCO + Nucl. Ent.	GB-EN
CRT Alphanumeric Display System	71	Jorway	US-JO
Display Alphanumeric Character Generator	2759	LeCroy	US-LS
24 bit BCD Display (for Scaler/Timer)	FHC1305	Frieseke	D-FH
6 Decade Nixie Display (for Scaler/Timer)	FHC1306	Frieseke	D-FH
Decimal Display	JAF 15	SAIP	F-SA

SPECIALISED INPUT/OUTPUT MODULES

Input/Output Interface (e.g. Teletype)	FHC1307	Frieseke	D-FH
Teletypewriter Terminal *	TWTML/045	SAIP	F-SA
Teletypewriter Driver *	7043-1	EKCO + Nucl. Ent.	GB-EN
Teletypewriter Interface *	7061-1	EKCO + Nucl. Ent.	GB-EN
Teletype Interface *	2720	LeCroy	US-LS
Spark Chamber Read-Out *	SCRO (041)	SAIP	F-SA
SCRO TML *	(NP 043)	SAIP	F-SA
Simplified Binary Display	JAF 20	SAIP	F-SA
Interface for Converter CA13B/CA25/C97 *	JCCA 10	SAIP	F-SA
2110 Reader (Ser ADC Adaptor) *	7012-1	EKCO	GB-EK
Scaler Reader (Harwell 2000-Series) *	7056-1	EKCO	GB-EK
Typewriter Drive Unit	TD0801	GEC-Elliott	GB-EL
Tape Punch Output Driver (Facit 4070)	TP0801	GEC-Elliott	GB-EL
Tape Reader Interface Unit	TR0801	GEC-Elliott	GB-EL
Delayed Pulse Generator (Stepping Motor)	7045-1	EKCO + Nucl. Ent.	GB-EN
Peripheral Reader	7064-1	EKCO + Nucl. Ent.	GB-EN
Peripheral Driver	7065-1	EKCO + Nucl. Ent.	GB-EN
British Standard Interface Reader * (BS4421)	7057-1	EKCO + Nucl. Ent.	GB-EN
British Standard Interface Driver * (BS4421)	7058-1	EKCO + Nucl. Ent.	GB-EN

CODE CONVERTERS

Binary-to-BCD Converter (24 bit, 5μs)	BDC2401	GEC-Elliott	GB-EL
Binary-to-BCD Converter	7068-1	EKCO + Nucl. Ent.	GB-EN
24 bit Binary-to-BCD (ASCII) Converter	2253	LeCroy	US-LS

ANALOGUE INPUT/OUTPUT MODULES

Time-to-Digital Converter	1005	Borer	CH-BO
Quad Time Digitizer	2801	LeCroy	US-LS

ANALOGUE-TO-DIGITAL CONVERTERS (ADC, DVM)

Dual 10 bit Digital Voltmeter	2DVM2013	SEN	CH-SE
8192 Channel ADC (2 Modules)	JCAN 20C/H	SAIP	F-SA
512 Channel ADC	JCAN 31	SAIP	F-SA
A-D Converter (8 bit, 20μs)	ADC0801	GEC-Elliott	GB-EL
A-D Converter (10 bit, 20μs)	ADC1001	GEC-Elliott	GB-EL
A-D Converter (12 bit, 20μs)	ADC1201	GEC-Elliott	GB-EL
A-D Converter (8 bits)	7028-1	EKCO + Nucl. Ent.	GB-EN
A-D Converter (12 + Sign bit)	7055-1	EKCO + Nucl. Ent.	GB-EN
Multi-Mode ADC (8 bit)	2243	LeCroy	US-LS
A-D Converter (10 bit)	2245	LeCroy	US-LS
A-D Converter	30	Jorway	US-JO

DIGITAL-TO-ANALOGUE CONVERTERS (DAC)

Dual 10 bit D-to-A Converter	2DA2011	SEN	CH-SE
D-A Converter (2 x 10 bit, 5μs)	DAC1001	GEC-Elliott	GB-EL
Digital to Analogue Converter	7015-1	EKCO + Nucl. Ent.	GB-EN
D-A Converter	31	Jorway	US-JO

SIGNAL PROCESSING MODULES

Fan Out Unit	FO0801	GEC-Elliott	GB-EL
HEX IL2 (Term) to IL1 (Unterm) Converter	7051-1	EKCO + Nucl. Ent.	GB-EN
HEX IL1 (Unterm) to IL2 (Term) Converter	7052-1	EKCO + Nucl. Ent.	GB-EN
QUIN L1 (Harwell) to IL1 (Unterm) Converter *	7053-1	EKCO + Nucl. Ent.	GB-EN
8 Ch Pulse Integrator	2227	LeCroy	US-LS

PULSE GENERATORS AND CLOCKS

Time Pulse Generator	FCH1303	Frieseke	D-FH
Timer		Siemens	D-SI
Quartz Controlled Clock	JHO10	SAIP	F-SA
Crystal Controlled Pulse Generator	PG0001	GEC-Elliott	GB-EL
Test Pulse Generator	TPG0202	GEC-Elliott	GB-EL
Clock Pulse Generator	7019-1	EKCO + Nucl. Ent.	GB-EN
Crystal Controlled Clock	51	Jorway	US-JO
Delayed Pulse Generator	7045-1	EKCO + Nucl. Ent.	GB-EN
Dual Programmed Pulse Generator	2PPG2016	SEN	CH-SE
Real Time Clock	RTC2014	SEN	CH-SE
Real Time Clock	CE712MU	EKCO Instruments	GB-EK

LOGIC FUNCTION MODULES

Control Generator	CG0301	GEC-Elliott	GB-EL
Dual Gate	7020-1	EKCO + Nucl. Ent.	GB-EN
Fan-Out	7021-1	EKCO + Nucl. Ent.	GB-EN

DELAY AND ATTENUATOR UNITS

Delay Box (CAMAC Controlled)	FHC4003B	Frieseke	D-FH
Programmed Attenuator	JATP 10	SAIP	F-SA
Dual Attenuator	9004	Nuclear Enterprises	GB-NE

MANUAL CONTROLLERS AND TEST EQUIPMENT

Manual Branch Control Set	CCMB10	SAIP	F-SA
Manual Dataway Controller	JCMC 10	SAIP	F-SA
Dynamic Test Controller	TC2402	GEC-Elliott	GB-EL
Branch Test Controller	BC2402	GEC-Elliott	GB-EL
Manual Dataway Controller	7024-1	EKCO + Nucl. Ent.	GB-EN
Dataway Display Unit		SAIP	F-SA
Dataway Test Module		Transrack	F-TR
Dataway Test Module	DTM	GEC-Elliott	GB-EL
Indicator	9014	Nuclear Enterprises	GB-NE
Dataway Buffer	9018	Nuclear Enterprises	GB-NE

CRATES: NO POWER, NO DATAWAY

Empty Crate		Sapeg S.A.	CH-SA
Empty Crate 7 Units, Ventilated	20860006	Knürr	D-KN
Empty Crate 5 Units	20800006	Knürr	D-KN
Empty Crates		Willsher + Quick	D-WQ
Empty Crate 5U/360	CM502530	Transrack	F-TR
Empty Crate 5U/525	CM502550	Transrack	F-TR
Crate, no fan, 6U/360	CM512530	Transrack	F-TR
Crate, no fan, 6U/525	CM512550	Transrack	F-TR
Crate, one fan, 6U/360	CM512531	Transrack	F-TR
Crate, one fan, 6U/525	CM512551	Transrack	F-TR
Crate, two fans, 6U/360	CM51232	Transrack	F-TR
Crate, two fans, 6U/525	CM12552	Transrack	F-TR
Empty Crate	MCF5CAMS	Imhof-Bedco	GB-IM
Empty Crate	MCF6CAMSV	Imhof-Bedco	GB-IM
Empty Crate	MCF6AMSVR	Imhof-Bedco	GB-IM
Empty Crates		Willsher + Quick	GB-WI
Crate (No Power, No Dataway)	CCH	RDT/DEL TURCO	I-RD
CAMAC Compatible Crate	NSI875DBWV	Nucl. Specialities	US-NS
System Bin (Unpowered)	RO BIN	RO Assoc.	US-RO

CRATES WITH DATAWAY, NO POWER

Crate Mainframe	1902	Borer	CH-BO
Unpowered Crate with Dataway	UPC2029	SEN	CH-SE
Crate, Fully Wired, 7U	20840006	Knürr	D-KN
Ventilated Crate	VC0010	GEC-Elliott	GB-EL
Crate	7005-2	EKCO + Nucl. Ent.	GB-EN
Recessed Crate	7006-2	EKCO + Nucl. Ent.	GB-EN

CRATES WITH DATAWAY AND POWER

Powered Crate	PC2006	SEN	CH-SE
Crate Plus Power Supply		Siemens	D-SI
Powered Crate	C4ALJ13D	Saphymo	F-SS
Powered Crate	C6ALJ13D	Saphymo	F-SS
Powered Crate	C7ALJ13D	Saphymo	F-SS

POWER SUPPLIES

Power Pack	1912	Borer	CH-BO
Regulator (Universal)	1922	Borer	CH-BO
Regulator (+ or -6V)	1925	Borer	CH-BO
Regulator (+ or -12 or 24V)	1926	Borer	CH-BO
Power Supply	PS2036	SEN	CH-SE
Power Supply Unit	C4ALJ12	Saphymo	F-SS
Power Supply Unit	C6ALJ12	Saphymo	F-SS
Power Supply Unit	C7ALJ13	Saphymo	F-SS
Supply Chassis	20820006	Knürr	D-KN
Power Supply (Low Power)	PS0002	GEC-Elliott	GB-EL
Power Supply Crate	CSA	RDT/DEL TURCO	I-RD
Power Supply Module 12V/24V	C301	RO Assoc.	US-RO
Power Supply Module 6V	C210	RO Assoc.	US-RO
Power Supply Module 6 and 24V	C211	RO Assoc.	US-RO
Power Supply Module 6 and 200V	C212	RO Assoc.	US-RO
Power Supply Module 6 and 12V	C213	RO Assoc.	US-RO
Power Supply Unit	C4BIP203	Saphymo	F-SS
Power Supply System		Grenson	GB-GR
Power Supply	9001	Nuclear Enterprises	GB-NE
Alarm Unit	1930	Borer	CH-BO
Alarm Unit	1931	Borer	CH-BO
Power Supply Control Module	TMC525	Transrack	F-TR
Supply Monitor Panel	MP1	GEC-Elliott	GB-EL
Supply Monitor Panel	MP2	GEC-Elliott	GB-EL
Power Indicator	7074-1	EKCO + Nucl. Ent.	GB-EN
Power Indicator	0704-1	EKCO + Nucl. Ent.	GB-EN
Power Supply Crate	MCF4PPC	Imhof-Bedco	GB-IM

VENTILATION EQUIPMENT			
Ventilation Unit, complete	20810006	Knürr	D-KN
Ventilation Unit, Hardware	20850006	Knürr	D-KN
Ventilating Blower Unit (1 Fan)	CGV1	RDT/DEL TURCO	I-RD
Ventilating Blower Unit (2 Fan)	CGV2	RDT/DEL TURCO	I-RD
EXTENDERS AND ADAPTERS			
Module Extender	ME2030	SEN	CH-SE
Module Extender	5U CAMAC	Transrack	F-TR
Extension Frame	EF1	GEC-Elliott	GB-EL
Extender	7007-1	EKCO + Nucl. Ent.	GB-EN
Extender	11	Jorway	US-JO
Card Extender	2040	LeCroy	US-LS
CAMAC/NIM Module Adapter	CNA2033	SEN	CH-SE
NIM Adaptor	7009-2	EKCO + Nucl. Ent.	GB-EN
MODULE PARTS			
Empty Modules		Sapeg S.A.	CH-SA
Blank Module with PC Board	BM2020	SEN	CH-SE
Empty Modules, Width 1U	20900018	Knürr	D-KN
Empty Modules, Width 2U	20900028	Knürr	D-KN
Empty Modules, Width 3U	20900038	Knürr	D-KN
Empty Modules, Width 4U	20900048	Knürr	D-KN
Empty Modules, Width 5U	20900058	Knürr	D-KN
Empty Modules, Width 6U	20900068	Knürr	D-KN
Empty Modules		Willsher + Quick	D-WQ
Empty Module, Width 1/25	TM50125	Transrack	F-TR
Empty Module, Width 2/25	TM50225	Transrack	F-TR
Empty Module, Width 3/25	TM50325	Transrack	F-TR
Empty Module, Width 4/25	TM50425	Transrack	F-TR
Empty Modules, Widths 5, 6, 8, 10, 12/25	TM5**25	Transrack	F-TR
Blank Module Kit (1/25)	BM1	GEC-Elliott	GB-EL
Blank Module Kit (2/25)	BM2	GEC-Elliott	GB-EL
Blank Module Kit (3/25)	BM3	GEC-Elliott	GB-EL
Blank Module Kit (4/25)	BM4	GEC-Elliott	GB-EL
Empty Modules 1/25 to 4/25	BCK/5CAM/CM1-4	Imhof-Bedco	GB-IM
Empty Enclosed Modules 2/25 to 4/25	BCK/5CAM/BM2-4	Imhof-Bedco	GB-IM
Module Kits	9005	Nuclear Enterprises	GB-NE
Empty Modules		Willsher + Quick	GB-WI
Empty Module, 1/25	CCA/1	RDT/DEL TURCO	I-RD
Empty Module, 2/25	CCA/2	RDT/DEL TURCO	I-RD
Empty Module, 3/25	CCA/3	RDT/DEL TURCO	I-RD
Empty Module, 4/25	CCA/4	RDT/DEL TURCO	I-RD
CAMAC Compatible Modules 1/25	NSI875DM	Nuclear Specialities	US-NS
CAMAC Compatible Modules 2/25	NSI875DM	Nuclear Specialities	US-NS
CAMAC Compatible Modules 3/25	NSI875DM	Nuclear Specialities	US-NS
Module Printed Circuit Board	40000020	Knürr	D-KN
Printed Circuit Board CAMAC (5U)		Transrack	F-TR
CAMAC Test Board (PCB)	10	Jorway	US-JO
DATAWAY CONNECTORS AND ASSEMBLIES			
Dataway Connector, Miniwrap	40000000	Knürr	D-KN
Dataway Connector, Solder	40000010	Knürr	D-KN
Dataway Connector, Straight	K/47995	FRB Connectron	F-FR
Dataway Connector, Wrapping	K/48326	FRB Connectron	F-FR
Dataway Connector, Solder	K/49016	FRB Connectron	F-FR
Dataway Connector, Miniwrap	254DF43AWV	Socapex	F-SO
Dataway Connector, Boardsolder	254DF43AYV	Socapex	F-SO
Dataway Connector, Wire-Solder	254DF43AZV	Socapex	F-SO
Dataway	Dataway	Saphymo	F-SS
Dataway Connector, Solder	R50 0....	Carr Fastener	GB-CA
Dataway Connector, Miniwrap	R50 0....	Carr Fastener	GB-CA
Dataway Connector		UECL	GB-UL
Dataway	CDW	RDT/DEL TURCO	I-RD
Dataway Connector		AMP-Holland	NL-AM
Coaxial Connector	RA 00 C50	Lemo	CH-LE

BRANCH HIGHWAY COMPONENTS

Branch Highway Connector (F)	WSS0132...	SABCA (ECC Market)	B-SA
Branch Highway Connector (M)	WSS0132...	SABCA (ECC Market)	B-SA
Connector Hood	WAC0132...	SABCA (ECC Market)	B-SA
Branch Highway Cables		Precicable Bour	F-PR
Branch Highway Cable, 27CM	CD18067-27	Emihus	GB-EM
Branch Highway, XX CM Long	CD18067XX7	Emihus	GB-EM
Branch Highway Connector (F)	WSS0132...	Emihus	GB-EM
Branch Highway Connector (M)	WSS0132...	Emihus	GB-EM
Connector Hood	WAC0132...	Emihus	GB-EM

CORRECTIONS TO PRODUCTS GUIDE The information given in this Products Guide has been checked against data sheets wherever possible, but manufacturers are urged to check the entries relating to their products and send any corrections to: Dr. H. Meyer, CBNM Euratom, Steinweg naar Retie, Geel, Belgium. Please send detailed data sheets, if possible, and state the date of first delivery of each piece of equipment.

INDEX OF MANUFACTURERS

In addition to the following manufacturers, whose products have been included in the index of products, there are undoubtedly other manufacturers and agents.

REF.	MANUFACTURER'S NAME AND ADDRESS
B-SA	SABCA (S.A. Belge de Construction Aeronautique) Chaussee de Haecht, 1470 B-1130 Bruxelles Belgium/Belgique/Belgien Tel. 02-168010 Telex DEI 24042 (SABCA BRU)
CH-BO	Borer Electronics Co. Solothurnstrasse 65 Biberist CH-4500 Solothurn 22 Switzerland/Suisse/Schweiz Tel. 065-48822 Telex 34228
CH-HP	Hewlett-Packard (Schweiz) AG 7 rue du Bois-du-Lan 1217 Meyrin-Genève Switzerland/Suisse/Schweiz Tel. (022) 415200 Telex 22486
CH-LE	LEMO SA 1110 Morges Switzerland/Suisse/Schweiz Tel. (021) 711341 Telex 24683
CH-SA	SAPEG S.A. Societe Anonyme Pour Electronique Geneve 7, Avenue Krieg 1208 Geneve Switzerland/Suisse/Schweiz Tel. (022) 367047
CH-SE	SEN Electronique 31, Avenue Ernest-Pictet 1211 Geneve 13 Switzerland/Suisse/Schweiz Tel. (022) 442940 Telex 23359 SENEL CH

REF.	MANUFACTURER'S NAME AND ADDRESS
D-AE	AEG-Telefunken Elisabethenstrasse 3 Postfach 830 79 ULM Germany/Allemagne/Deutschland Tel. (0731) 1921 Telex 712723
D-FH	Frieseke und Hoepfner GMBH 852 Erlangen-Bruck Postfach NR.72 Germany/Allemagne/Deutschland Tel. Erlangen (09131) 171 Telex 06/29894
D-KN	Hans Knürr KG Ampfingstrasse 27 8 München 80 Germany/Allemagne/Deutschland Tel. (0811) 403045 Telex 05 29608 Hanse D
D-SI	Siemens AG Wernerwerk F. Messtechnik Rheinbrueckenstrasse 50 75 Karlsruhe—West Germany/Allemagne/Deutschland Tel. (0721) 5951 Telex 7826851 SH D
D-WI	Hans Wiener KG Neuenhaus, 106 D-5675 Hilgen/RHLD Germany/Allemagne/Deutschland

REF.	MANUFACTURER'S NAME AND ADDRESS
D-WQ	Willsher and Quick GMBH 4054 Nettetal 2 Postfach 2192 Sieylerstrasse 27 Germany/Allemagne/Deutschland Tel. (02157) 6836 Telex 854816
F-FR	FRB Connectron 30 Avenue Gabriel Peri 92 Gennevilliers France/Frankreich Tel. 793 69-69 Telex 78038
F-FC	FRB Connectron Service Etranger B.P.8 76 Saint-Aubin-les-Elboeuf France/Frankreich Tel. 35-670356 Telex 78038
F-PR	Precicable Bour 151, Rue Michel-Carre 95-Argenteuil France/Frankreich Tel. 96177-01 Telex 69-919 PRECICAB
F-SA	SAIP-CRC/SCHLUMBERGER Schlumberger Instruments et Systèmes Centre d'Instrumentation Nucléaire 38, Rue Gabriel-Crié, 92-Malakoff France/Frankreich Tel. 253-87-20, 735-99-10 Telex Sapex 25075F
F-SO	Socapex (Thomson-CSF) 9 Rue Edouard Nieuport 92 Suresnes France/Frankreich Tel. 506-20-40, 506-65-45
F-SS	Saphymo-Srat 51, Rue de l'amiral-Mouchez 75, Paris-13ème France/Frankreich Tel. 588-16-39
F-TR	Transrack B.P.12 22, Avenue Raspail 94 Saint-Maur France/Frankreich Tel. 283-87-58 Telex TRANSRACK Saint-Maur 22493

REF.	MANUFACTURER'S NAME AND ADDRESS
GB-CA	Carr Fastener Co. Ltd. Nottingham Road Stapleford Nottingham England/Angleterre Tel. Sandiacre 2661 Telex 37637
GB-EK	EKCO Instruments Ltd. Southend-on-Sea Essex England/Angleterre SS2 6PS Tel. Southend-on-Sea 49491 Telex 99167 *See also GB-EN*
GB-EL	GEC-Elliott Process Instruments Ltd. Century Works Lewisham London, S.E.13 England/Angleterre Tel. 01-692-1271 Telex 22469 (Ellautolew LDN)
GB-EN	Harwell 7000-Series Units Manufactured by: EKCO Instruments Ltd. *See also GB-EK* and Nuclear Enterprises Ltd. *See also GB-NE*
GB-EM	Emihus Microcomponents Ltd. Heathrow House Bath Road Cranford Hounslow Middlesex England/Angleterre Tel. 759-9584/5, 759-9961/2 Telex 23613
GB-GR	Grenson Electronics Ltd. High March Road Long March Industrial Estate Daventry Northants NN11 4HQ England/Angleterre Tel. 03272 3811 2
GB-IM	Imhof-Bedco Ashley Works Cowley Mill Road Uxbridge Middlesex England/Angleterre Tel. Uxbridge 37123 Telex 24177

REF.	MANUFACTURER'S NAME AND ADDRESS
GB-NE	Nuclear Enterprises Ltd. Bath Road Beenham Reading Berkshire RG7 5PR England/Angleterre Tel. Woolhampton 2121 Telex 84475 *See also GB-EN*
GB-NM	Nuclear Measurements A Division of EG+G Nuclear Ltd. Dalroad Industrial Estate Dallow Road Luton Bedfordshire England/Angleterre Tel. Luton 27557
GB-UL	Ultra Electronics (Components) Ltd. (UECL) Fassetts Road Loudwater Buckinghamshire England/Angleterre Tel. High Wycombe 26233 Telex 83173
GB-WI	Willsher and Quick Ltd. Walrow Highbridge Somerset England/Angleterre Tel. Burnham-on-Sea 3371/2/3 Telex 46145
I-RD	ING. Roselli Del Turco Rossello S.R.L. Via di tor Cervara, 261 00155 Roma Italy/Italie/Italien Tel. 220104, 221393

REF.	MANUFACTURER'S NAME AND ADDRESS
NL-AM	AMP-Holland Papierstraat 2-4 Postbus 288 S-Hertogenbosch Netherland/Pay Bas/Nederland Tel. (04100) 25221 Telex 50150
US-DE	Digital Equipment Corporation 146 Main Street Maynard Massachusetts U.S.A. 01754
US-JO	Jorway Corporation 27 Bond Street Westbury New York 11590 U.S.A. Tel. (516) 997-8120
US-LS	Le Croy Research Systems Corp. 126 North Route 303 West Nyack New York 10994 U.S.A. Tel. (914) 358-7900 Telex
US-PR	Nuclear Specialities Inc. (Precision Metal Fabricators) 540 Lewelling Blvd. San Leandro California 94579 U.S.A. Tel. (415) 483-2804
US-RO	RO Associates Incorporated 3705 Haven Avenue Wenlo Park California 94025 U.S.A. Tel. (415) 322-5321 TWX 910-378-5929

AGENTS FOR CAMAC PRODUCTS *Please send details of agents for CAMAC products. In this issue of CAMAC Bulletin we have listed those firms known to manufacture equipment or components, but in a future issue we may be able to list also the main agents in other countries.*

CAMAC BIBLIOGRAPHY

Specifications

CAMAC: A modular instrumentation system for data handling. Description and Specification. EURATOM EUR4100e, March 1969.

and authorised translations

EURATOM, EUR4100d (German), EUR4100f (French), EUR4100i (Italian).

EUR4100 d, e, f, i are available from the ESONE Secretary, Ispra.

CAMAC: Organisation of multi-crate systems. Specification of the Branch Highway and CAMAC Crate Controller Type A. EURATOM, EUR4600e. (To be published).

and

Preliminary Issue, November, 1970. ESONE Committee. Available from the ESONE Secretary, Ispra.

Other Documents

This section is a selected list of papers whose main topic is CAMAC, arranged in date order, by date of presentation for conference papers and date of publication for others. The ESONE Committee does not necessarily agree with any interpretations of the CAMAC specifications contained in these papers. It is hoped to publish in a future issue of CAMAC Bulletin a comprehensive bibliography, including review papers and descriptions of computer systems, in which CAMAC is a secondary but significant topic.

HOOTON, I.N. *and* **BARNES, R.C.M.** A standardised data highway for on-line computer applications. (Presented at 1968 Fall Joint Computer Conf.) *AFIPS Conf. Proc.* vol. 33, part 2. pp. 1077–1087.

BISBY, H. An advanced modular system of electronic equipment for on-line computer applications. *Proc. International Symposium on Nuclear Electronics, Versailles,* September, 1968. vol. 2, paper 108-1-27.

BECKER, W. An advanced modular system of nuclear electronics for on-line computer applications. *Nucl. Inst. & Methods,* vol. 64. September, 1968. pp. 197–200.

HOOTON, I.N. A modular instrumentation system for computer aided measurement and control. *Proc. Skytop Conference on Computer Systems in Experimental Nuclear Physics,* March, 1969. CONF.-690301, EANDC(US) 121U. pp. 466–471.

CAMAC: A European standard specification for modular interface units between nuclear experiments and data processing equipment. *Nucl. Eng. Int.,* vol. 14. April 1969. pp. 345–347.

ATTWENGER, W., EGL, W., MAY, F., PATZELT, R. *and others.* CAMAC crate control for a PDP-8 and a CAMAC 24-bit counter. *Proc. Ispra Nuclear Electronics Symposium,* May, 1969. EURATOM, EUR4289e, pp. 391–394.

BARNES, R.C.M. *and* **HOOTON, I.N.** The CAMAC system of modular instrumentation. *Proc. Ispra Nuclear Electronics Symposium,* May, 1969. EURATOM, EUR4289e. pp. 379–383.

and

IEEE Trans. Nucl. Sci., vol. NS-16, no. 5. October, 1969. pp. 76–80.

BISBY, H. The CAMAC scheme of electronic modules. *Physics Bulletin,* vol. 20. September, 1969. pp. 366–369.

BARNES, R.C.M., HOOTON, I.N. *and* **RICHARDS, J.M.** Data transfers and demand handling in multicrate CAMAC systems. (Presented at IEEE Nucl. Sci. Symposium, San Fransisco, October, 1969) *IEEE Trans. Nucl. Sci.,* vol. NS-17, no. 1. February, 1970. pp. 463–466.

HALLING, H. *and* **EGL, W.** Handeinstellbare Programmsteuerung für CAMAC system. *Nucl. Inst. and Methods,* vol. 80. April, 1970. pp. 122–124.

(Special edition on CAMAC) Nuclear Instrumentation no. 40, supplement to: *Bulletin d'Informations Scientifiques et Techniques,* no. 149, June, 1970. (Also available in French, German and Italian).

MACK, D.A. CAMAC, a standard for digital data handling. (Presented at CAP-APS-SMF Meeting, University of Manitoba, Winnipeg. June 24th, 1970). Lawrence Radiation Lab., University of California, *UCRL-20034,* July, 1970.

TRADOWSKY, K. CAMAC–Ein System rechnergeführter Elektronik, Prinzip und Andwendungen. *Kernforschungszentrum Karlsruhe, Report KFK 1241.* July 1970.

ISELIN, F., *et al.* Introduction to CAMAC. *CERN-NP CAMAC Note 25-00.* January 1971.

COSTRELL, L. CAMAC instrumentation system—introduction and general description. *IEEE Trans. Nucl. Sci.,* vol. NS-18, no. 2. April 1971.