TITLE: FORTRAN CALLABLE CAMAC STANDARD SUBROUTINES

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FORTRAN CALLABLE CAMAC STANDARD SUBROUTINES*

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ABSTRACT

This paper presents an implementation of the COMPUTER AUTO-MATED MEASUREMENTS AND CONTROL (CAMAC) Standard Subroutines. CAMAC is a hardware protocol for designing devices in a standard format and lay-out. The standard subroutines represent an effort to carry the standardization of CAMAC over to the programming to facilitate the generation of unambiguous and portable programs.

The routines are written in Macro-11 and are designed to be callable from the FORTRAN languages supported on the RSX systems, that is, 11/M and 11/D. Four levels of subroutines are defined--Levels A, B, C, and system dependent. Level A, the simplist, consists of the primary subroutines. They provide the ability to define the CAMAC address of a CAMAC entity and the desired access to it. Level B provide single-action routines. Level C allows block transfers, multiple actions, and inverse declarations. The system dependent routines allow the programmer the flexibility to take advantage of the particular computer system that is being used. Segregating the computer specific routines allows the programmer, when necessary, to write truly portable programs that will be usable on any computer system that adheres to the standard.

The FORTRAN callable routines are an implementation of the CAMAC standard subroutines prepared and adopted by the United States NIM committee and ESONE committee of European Laboratories published in June 1978 (1).

The implementation presented here is designed to be compatible with the DIGITAL EQUIPMENT CORPORATION family of PDP-11 computing hardware running RSX-11/M or RSX-11/D executive systems. The CAMAC hardware is assumed to be connected to the MICRO-PROGRAMMABLE BRANCH DRIVER, a programmable CAMAC interface (2).

Naming conventions are adopted in order to make it simpler for a user to avoid name conflicts. The name of each recommended routine begins with the character "C" to indicate a CAMAC routine. The second character indicates the general function of the routine:

"C" indicates a control function;
"D" indicates a declaration of a CAMAC entity;
"F" indicates a full-word data transfer (24 bits);
"G" indicates a routine to analyze a CAMAC entity into its component parts, the complement of the "D" type;
"S" indicates a short-word data transfer (less than 24 bits);
"T" indicates a test of the state of a signal or status.

The remaining characters of the routine name are chosen for their mnemonic value in delineating the function that the routine performs.

The routines are grouped into four sections to provide different levels of implementation. The lowest level contains routines that give access to most of the facilities of CAMAC. In the next two higher levels of implementation, routines are added to allow for a more mnemonic terminology, provide better handling of LAMs and provide block-transfer capability. The standard strives for system independence when possible. In the fourth level consists of all the system dependent routined that are unavoidable.

Level A consists of two routines which are:

CDREG Declare CAMAC register;
CFSA   Perform single CAMAC action, e.g. read a register

Level B consists of twelve routines which are:

CCCC   Generate crate clear;
CCCD   Enable/disable crate demand;
CCCI   Set/clear dataway inhibit;
CCCZ   Generate dataway initialize;
CCLC   Clear LAM;
CCLM   Enable/disable LAM;
CCLNK* Link LAM to a service procedure;
CDLAM   Declare LAM;
CTCD   Test crate demand enabled;
CTCI   Test dataway inhibit;
CTGL   Test crate demand present;
CTLM   Test LAM.

*Under development

Level C consists of seven routines which are:

CFGA	General Multiple Action;
CFMAD	Address scan;
CFUBC	Controller synchronized block transfer;
CFUBL	LAM synchronized block transfer;
CFUBR	Repeat mode block transfer;
CGLAM	Analyze LAM identifier;
CGREG	Analyze register identifier.

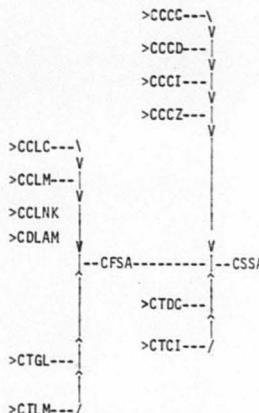System dependent routines are eleven in number:

CCINIT	Branch initialize;
CDCHN	Declare CAMAC channel identifier;
CDCRT	Declare CAMAC crate identifier;
CGCHN	Analyze CAMAC channel identifier;
CSGA	General multiple action, short words;
CSMAD	Address scan, short words;
CSSA	Perform single CAMAC action;
CSUBC	Controller synchronized block transfer, short words;
CSUBL	LAM synchronized block transfer, short words;
CSUBR	Repeat mode block transfer, short words;
CTSTAT	Test status of preceding action.

The interdependence of the subroutines are represented schematically below. The entry points to the subroutines are represented by the angle bracket ">." Control flow from one routine to another is represented by dashed lines. The direction of flow is from left to right and up or down.
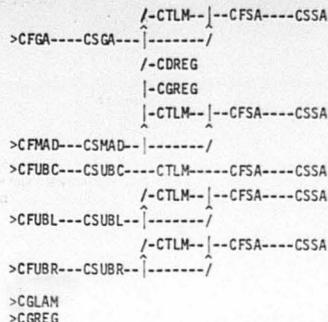
LEVEL-A SUBROUTINE INTERDEPENDENCE

```
    >CDREG
    >CFSA---CSSA
```

LEVEL-B SUBROUTINE INTERDEPENDENCE

```
                        >CCCC---\
                              V
                        >CCCD---|
                              V
                        >CCCI---|
                              V
                        >CCCZ---|
                              V
    >CCLC---\
          V
    >CCLM---|
          V
    >CCLNK
    >CDLAM  V                  V
            |--CFSA---------|--CSSA
                           ^
                        >CTDC---|
                           ^
                        >CTCI---/
    >CTGL---|
            |
    >CTLM---/
```

LEVEL-C SUBROUTINE INTERDEPENDENCE

```
                /-CTLM--|--CFSA----CSSA
    >CFGA----CSGA---|-------/

                /-CDREG
                |-CGREG
                |-CTLM--|--CFSA----CSSA
    >CFMAD---CSMAD--|-------/
    >CFUBC---CSUBC----CTLM-----CFSA----CSSA
                /-CTLM--|--CFSA----CSSA
    >CFUBL---CSUBL--|-------/
                /-CTLM--|--CFSA----CSSA
    >CFUBR---CSUBR--|-------/
    >CGLAM
    >CGREG
```

SYSTEM DEPENDENT SUBROUTINES INTERDEPENDENCE

```
                /-CDREG
                ^
    >CCINIT-|-CCCZ-----CSSA
    >CDCHN
    >CDCRT
    >CGCHN
                /-CTLM-----CFSA-|--CSSA
                ^
    >CSGA---|---------------/
                /-CDREG
                |-CGREG
                |-CTLM-----CFSA-|--CSSA
    >CSMAD--|---------------/
    >CSUBC----CTLM-----CFSA-|--CSSA
                /-CTLM-----CFSA-|--CSSA
    >CSUBL--|---------------/
                /-CTLM-----CFSA-|--CSSA
    >CSUBR--|---------------/
    >CTSTAT
```

REFERENCES

1. Subroutines for CAMAC, prepared and adopted by U. S. NIM Committee and ESONE Committe of European Laboratories, June 1978, U. S. Department of Energy, Assistant Secretary of Environment, Devision of Biomedical and Environmental Research.

2. MICRO-PROGRAMMABLE BRANCH DRIVER, A Product of BI-RA SYSTEMS, Albuquerque, New Mexico.