Beam Switchyard Control Computer System Language

The following pages are a description of the SDS 925 computer system language, which is used to monitor and control Beam Switchyard variables.
BSY Computer Instruction List

An instruction is a series of words, separated by one or more spaces or carriage returns, terminated by a semicolon word,

The instruction list is given below. In case of confusion, e.g., two instructions before the semicolon, the computer takes the last (or rightmost) one. If there is no meaningful instruction between semicolons, the computer types out

ERR

and is ready for another try.

The instructions may be typed from the typewriter or read in from the card reader (see CARD instruction below). In either case the format is the same.

1. Repeatable Instructions

   **STEP** <elt> BY <no.> ;
   - causes specified magnet power supply to increase its current by the specified fraction of its present value.

   **STEP** FLO ;
   - starts the flip coil on a single flip, which takes about 10 seconds to complete.

   **CARDS** ;
   - causes the input source to be the card reader. i.e., the program now takes its input from the card reader until an 'end of file' character is sensed. This character is the 'v' (8-7 punch on cards).

   **OUTPUT** <elt> ;
   - causes current of specified magnet (or width of specified slit) to be packaged as output.

   **RECORD** <elt> ;
   - causes current of specified magnet (or width of specified slit) to be packaged as output in a format which is readable. i.e., the format is in the 027 system language.
SEND <string> ;  - causes specified string (note - a space is the delimiter and hence the string contains no spaces) to be packaged as output.

TIME ;  - causes the time to be packaged as output.

CLOCK (<time>) ;  - sets the computer clock to specified time of day.

Examples:

STEP B1 BY .01 ;
OUTPUT B1 ;
RECORD B1 ;
CARDS ;
SEND THIS.IS.A.TEST ;
TIME ;
CLOCK (9:00MIN) ;

Clauses

Clauses may be added to these instructions to give them flexibility. The types of clauses are given below. In case of confusion, e.g., two clauses of same kind in a single instruction, the computer takes the last (or rightmost) one.

Time Clauses

Each of the above instructions causes a single action to take place. This action may be taken at a specific time, repeated at periodic intervals, and stopped at another specific time by adding the following time clauses (in any order appearing anywhere before the final semicolon).

EVERY (<time>)

AT (<time>)

UNTIL (<time>)
Examples:

AT (9:05MIN) EVERY (15SEC) UNTIL (9:20MIN) STEP B1 BY .01;
causes the current to be increased (by 1 percent of its value) every
15 seconds until 9:20.

AT (T+30SEC) EVERY (15SEC) UNTIL (T+10:30SEC) STEP RL0;
will cause the flip coil to begin a flip every 15 seconds for 10 minutes.

Time may be expressed in either HR, MIN, or SEC. So

(9HR)
(9:00MIN)
(9:00:00SEC)

all express the same time.
Destination Clause

TO <integer>

This clause is used with any of the digital output instructions. That is, with:

OUTPUT
RECORD
SEND
TIME

and directs the output to the specified destination. If there is no destination clause, the program assumes typewriter output. The destinations currently available are:

<table>
<thead>
<tr>
<th>integer</th>
<th>destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>no dest (i.e., ignore the output)</td>
</tr>
<tr>
<td>2</td>
<td>TWR</td>
</tr>
<tr>
<td>3</td>
<td>card punch</td>
</tr>
</tbody>
</table>

Example:

AT (9:05:20 SEC) EVERY (15 SEC) UNTIL (9:20:20 SEC) OUTPUT B1 TO 3 ;

causes the current in B1 to be punched on cards every 15 seconds, but 20 seconds behind the execution time of the previous example.

Label Clause

Each of the above instructions may be given a label by the user, so that it may be singled out by the computer later (to be deleted, or related to the output produced). Instructions without a label clause are implicitly given the label 'XX'. The label clause

<label> :

may appear anywhere before the final semicolon.
Example:

```
LABL : EVERY (1 MIN) OUTPUT Bl ;
```

causes Bl current to be printed on the typewriter every minute indefinitely.

2. 'Once only' instructions

The instructions below ignore any clauses and will be executed just once.

```
KILL <label> ;
```

- kills the instruction having the specified label.

```
SET <elt> = <no.> ;
```

- sets magnet current (or slit width) to specified value.

```
TUNE <elt> = <no.> ;
TUNE ALL = <no.> ;
```

- loads scale factor for specified magnet (or for all magnets) connected to the tune box into the computer. Then each time the lever on the 'tune box' is pushed, the current in magnets selected on the tune box panel are increased by (new current) ← (1 + (scale factor))(old current)

Examples:

```
KILL LABEL ;
```

- kills the instruction given in examples in label clause section.

```
SET Bl = 4.5 ;
```

- sets the current in magnet Bl so that the design momentum of beam through the switchyard is 4.5 GeV/c.

```
SET SL10 = 2.0 ;
```

- sets slit width of SL10 to 2cm.

```
TUNE ALL BY 0.01 ;
```

- loads scale factor of 1 percent for all elements connected to TUNE box.
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM1A</td>
<td>PM1, PM2A, PM3A, PM4A, PM5A, APJ, Q10, Q11, Q12, Q13, Q14, Q20, Q21, B23, B1, B29, Q100, Q101, ABEN, PIC, R10, B10, B17, B100 (kilovolt magnets)</td>
</tr>
<tr>
<td>SL10</td>
<td>SL10 (rear only)</td>
</tr>
<tr>
<td>SL11</td>
<td></td>
</tr>
<tr>
<td>COH</td>
<td>CO (horizontal)</td>
</tr>
<tr>
<td>COW</td>
<td>CO (vertical)</td>
</tr>
<tr>
<td>C1H</td>
<td>C1 (horizontal)</td>
</tr>
<tr>
<td>C1HR</td>
<td>C1 (horizontal, rear only)</td>
</tr>
<tr>
<td>C1V</td>
<td>C1 (vertical)</td>
</tr>
<tr>
<td>C1VR</td>
<td>C1 (vertical, rear only)</td>
</tr>
<tr>
<td>C10H</td>
<td>C10 (horizontal)</td>
</tr>
<tr>
<td>C10V</td>
<td>C10 (vertical)</td>
</tr>
<tr>
<td>T10H</td>
<td>Tank of C10 (horizontal)</td>
</tr>
<tr>
<td>T10V</td>
<td>Tank of C10 (vertical)</td>
</tr>
<tr>
<td>SL30</td>
<td>SL30 (rear only)</td>
</tr>
<tr>
<td>SL31</td>
<td></td>
</tr>
</tbody>
</table>
Repeatable Instructions - clauses may be added

STEP <elt> BY <no.> ;
STEP FLC ;
CARDS ;
OUTPUT <elt> ;
OUTPUT BOX1 ;
OUTPUT BOX2 ;
RECORD <elt> ;
SEND <string> ;
TIME ;
CLOCK ;
DATE <string> ;

Clauses
EVERY <time> } - time clauses
AT <time> ]
UNTIL <time>
TO <destination> - destination clause
<label> : - label clause

'Once only' instructions - clauses are ignored
KILL <label> ;
SET <elt> = <no.> ;
TUNE <elt> = <no.> ;
TUNE ALL = <no.> ;

<time> format examples

((9H0))
(9:00MIN)
(9:00:00SEC)
(2+5MIN)
(2+5:00SEC)  - refers to 9 o'clock, or 9 hours

<label>
<no.>
<elt>
<string>

<destination> list
2 - Typewriter output
3 - Card output
4 - Link output
anything else - typewriter output
no destination clause - typewriter output

<string> definition - any sequence of characters, not spaces or carriage
returns, the first of which is a letter or the character '#'

<label> definition - any string

<no.> definition - any sequence of digits with one decimal point somewhere
in it. The sequence may be preceded by a minus sign '-'

<elt> list

PM1A Q10 Q21 ADEN COY TOW
PM2A Q11 Q22 FLC CHR TOH
PM3A Q12 Q11 SL10 CHH TOW
PM4A Q13 Q20 S10R CHV SL30
PM5A Q14 Q100 SL01 CHVR S30R
AP5 Q20 Q101 COH CTW SL41

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