

# ELLIOTT

# 9000

Volume 2: PROGRAMMING INFORMATION  
Part 4: PERIPHERAL ROUTINES  
Section 4: QCARDIN and QCINCH (CARD INPUT ROUTINES)

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## Chapter 1: INTRODUCTION

### 1.1 Purpose

These programs are used to organise input from a Card Reader attached to the 900 computer. QCARDIN is used to read complete cards into buffers and decode them. QCINCH is used to get one character at a time from card buffers decoded by QCARDIN.

### 1.2 Method of Use

The programs are assembled and entered as SIR sub-routines, forming 2 blocks within the users program.

Issue 1 of the program is designed for use with the Elliott 4100 Card Reader fitted to Channel 1 of a 4100 Interface Matching Unit (IMU). Level 2 must be set to the on-line state.

### 1.3 Summary

Each entry to QCARDIN will normally read one card and store its image in one of two buffers which are filled alternately. QCARDIN then decodes the card image a column at a time, leaving the card image and the corresponding SIR internal code for each column in the buffer.

Each entry to QCINCH will take a character in SIR internal code from the next position in the buffer. QCINCH will enter QCARDIN automatically when required. The programs may be run on level 3 or level 4, in any store module.

### 1.4 Forms of Distribution

The programs are distributed on one SIR mnemonic tape, with title 903 CARDIN.

### 1.5 Subroutines Used

QCARDIN uses the Modular Interrupt Routine, QCINCH uses QCARDIN and QERROR.

## Chapter 2: FUNCTIONS

### 2.1 Initialising

Before any entry to QCARDIN, and therefore QCINCH, the following values must be entered. QCARDIN+2 must be set to -1 before the first entry to the subroutine. If two buffers (see 2.2.) are to be used the addresses of their first locations must be placed in QCARDIN+3 and QCARDIN+4, if only one buffer is to be used QCARDIN+4 must be set to -1. QCARDIN+5 must contain the address of the decode table (see 2.3.).

Before first entry to QCINCH; QCINCH+2 should be set to a high positive number (>80).

QCARDIN and QCINCH must be used on level 3 or level 4. They are normally used on level 4, so that the users program, if entered from the control panel, must program terminate. This should be done by storing the level 4 starting address in location 6 and obeying a 15 7168 instruction.

### 2.2 Input Buffers

QCARDIN may be used with one or two buffers, the program being faster with two. These buffers are 80 words each in length and must be specified by the user, their addresses must also be placed in locations QCARDIN+3 and QCARDIN+4 (see 2.1.).

### 2.3 Decode Table

A table must be supplied by the user for use in decoding cards and its address placed in QCARDIN+5 (see 2.1.). The table is 64 words long and each column contains a column image and its SIR internal code equivalent. The SIR internal code equivalent is contained in the least significant six bits and the column image in the remainder of the word, it should be noted that the image is inverted by the card reader when it is read. e.g. If A has internal code 41 (octal) and card code A1 its table entry would be (in binary):

$$\underbrace{000\ 000\ 001\ 001}_{\text{Card Image}} \quad \underbrace{100\ 001}_{\text{SIR equivalent of A}}$$

i.e. octal 001141.

The entries in the table must be in ascending numerical order (regarding the binary patterns as unsigned 18 bit numbers) as the program uses a binary search technique.

## 2.4 Card Input

To input a card enter:

```
11 QCARDIN
 8 QCARDIN+1
```

The decoded image will be entered in one of the buffers specified, which are used alternately. On exit from QCARDIN the A register will contain the address of the buffer which has just been decoded; unless an error has been detected in which case the A register will be negative and contain the card reader status in the eight least significant bits.

## 2.5 Character Input

To input a character enter:

```
11 QCINCH
 8 QCINCH+1
```

On exit from the subroutine the character will be in the A register in SIR internal code.

If it is required to skip the remainder of a card then set QCINCH+2 to >80, to skip n columns add +n to QCINCH+2. Note that if the addition of n to QCINCH+2 gives a result of >80, the program will only skip to the first column of the next card.

On exit the character obtained is held in the A register and location QCINCH+3 holds the address of the word containing the column image, this is of the same format as the decode table (see 2.3.). If the internal code equivalent is given as zero, either the whole column image will be zero, for blank column, or the most significant 12 bits will hold an image with no equivalent in the decode table of QCARDIN.

If errors occur in QCINCH entry to QERROR is automatic (see Chapter 3).

## 2.6 Exits

Exits from QCINCH and QCARDIN are standard, to location following entry. The contents of B and Q registers are undefined.

### Chapter 3: ERROR INDICATIONS

#### 3.1 Error Outputs

If an error occurs within QCARDIN the subroutine exit with the status word and bit 18 set in the A register.

Error output from QCINCH is displayed on the teleprinter in the form:

\*CRD <octal number> <address of entry>.

The octal number represents the state of the card reader status word. Various combinations of settings are possible, the meaning of each bit when set to 1 is given in the table below.

Status Bit	Octal Value	Meaning
1	00001	Card Reader Busy
2	00002	Card Reader in Manual
3	00004	Interrupts and attentions Inhibited (see Note 1)
4	00010	Missed Transfer (see Note 2)
5	00020	Recoverable Error (see Note 3)
6	00040	Non-Recoverable Error (see Note 4)
7	00100	Card in Transit

Note 1: This bit should always be set =0.

Note 2: This bit is set =1 if data held in a column is ready to enter the card reader buffer before data from the preceding column has been removed from the buffer.

Note 3: This bit is set =1 if the input hopper is full, the receiver is full or the drop lid on the receiver is open, cards in transit are read completely.

Note 4: This error should only occur if

- (a) The card is damaged.
- (b) There is a card jam.
- (c) There is a machine fault.

### 3.2 Continuation after an Error

Re-enter at 9 to continue after an error output. If the error has been cleared input will continue normally, otherwise same error will be output.

### 3.3 Error in QCARDIN

If QCARDIN is used separately the user must supply his own error routines.

#### Chapter 4: METHOD USED

Whenever QCARDIN is entered the program checks that the previous card has been read completely. A card feed instruction is given and the card reader interrupts on level 2 whenever a column enters its buffer. The Modular Interrupt Routine enters QCARDIN at QCARD2 whenever an Interrupt occurs on the Card Reader Channel. This entry causes the column image to be read and stored in the buffer.

The Modular Interrupt Routine enters QCARDIN at QCARD3 whenever an attention is received from the Card Reader Channel. This entry reads the card reader status and exits to QLEV2.

While a card is being read-in, QCARDIN on level 4 is decoding a buffer using a binary search technique.

Output of error messages is always from the base level on which QCARDIN runs, normally level 4.



Chapter 5: STORE USED

QCARDIN occupies approximately 161 locations not including the table and buffers.

QCINCH occupies approximately 34 locations. They also use the following routines:-

The Modular Interrupt Routine (Length depends on installation)

QERROR approx 80 locations.

QCHOP approx. 40 locations.