





## Chapter 1: INTRODUCTION

### 1.1 Purpose

This program is used to organise output to a lineprinter attached to the 900 computer. It receives output in the form of individual characters generated by a SIR code program.

### 1.2 Method of Use

The program is assembled and entered as a SIR subroutine, forming a block of the user's program.

Issue 1 of the program is designed for use with the Elliott 4100 buffered (Scientific) Lineprinter fitted to channel 2 of a 4100 Interface Matching Unit (IMU).

### 1.3 Summary

QLPOUT is entered as a subroutine with the internal code value of each character to be output. These characters are stored in a buffer until a newline character or a paper feed command is received, when the whole line is output. The program may be run on level 3 or level 4, in any store module.

### 1.4 Form of Distribution

The program is distributed as a SIR mnemonic tape.

### 1.5 Subroutines Used

QLPOUT uses the Modular Interrupt Routine (SSYS2) and subroutine QERROR (on SSYS1).

These programs must be incorporated as blocks in the user's SIR program.

## Chapter 2: FUNCTIONS

### 2.1 Initialising

Before any entry to QLPOUT the program must either set +1 in location QLPOUT+4 or output one newline character as in 2.2. QLPOUT must be entered on level 3 or level 4. It is 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. The level 2 address for the Modular Interrupt Routine must be set in location 2. This address must point to the global label QL2ENT.

### 2.2 Character Output

To output a character enter:

```
11 QLPOUT
 8 QLPOUT+1
```

with the internal code value (see Volume 2.1.1, Chapter 1.5) of the character held in the A register.

Characters for output are stored in a buffer within the program until newline character is received. When newline character (Code 1) is received the line is output, preceded by one paper throw. If no newline has been received by the time when the 122nd character is stored, the line will be output automatically. In this case the last 2 characters will be lost.

### 2.3 Vertical Format

The paper is normally thrown one line space for each line printed. However the user may override this with a special format entry.

Enter at:

```
11 QLPOUT
 8 QLPOUT+2
```

with a number +n in the A register. This entry will cause n lines to be thrown, and the existing contents of the internal buffer are then output. The value of n should be in the range  $0 \leq n \leq 15$ . The effect of values outside this range is undefined.

### 2.4 Exit

Exit is standard, to the location following entry. The content of the A, B and Q registers are undefined.

## 2.5 Clearing the Buffer

The programmer should note that the lineprinter routine requires that the last character output by a program must be newline, or a vertical format character. If this is not the case characters will be left in the buffer and never printed. Many number output routines precede their output with newline, but few follow it with newline.

Therefore it is advisable to insert a paper throw entry immediately before a temporary halt or final stop in any program using QLPOUT.

## 2.6 Example

The following program will output on a newline the characters A1, followed by 15 line throws.

```

4      +1
5      QLPOUT+4
4      L2A
5      2      (SET LEVEL 2 S-REG.)
11     6      (SET LEVEL 4 S-REG.)
15     7168   (TERMINATE)
4      +1
11     QLPOUT (NEWLINE)
8      QLPOUT+1
4      +33    (A)
11     QLPOUT
8      QLPOUT+1
4      +17    (1)
11     QLPOUT
8      QLPOUT+1
4      +15    (15 LINE FEEDS)
11     QLPOUT
8      QLPOUT+2
8      ;+0    (STOP)
L2A    0      QL2ENT

```

### Chapter 3: ERROR INDICATIONS

#### 3.1 Error Outputs

Error output is displayed on the teleprinter in the form:

\*LPT <octal number> <address of entry>

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

Status bit	Octal Value	Meaning
1	00001	Line Printer Busy
2	00002	Line Printer in Manual
3	00004	Interrupts and Attentions Inhibited (see Note 1)
4	00010	(Not Used)
5	00020	Paper Low
6	00040	Non-recoverable error state (see Note 2)
Special error	77777	Lineprinter channel invalid (see Note 3).

Note 1: This bit will normally be set =1 if the status is printed. It will only be zero if there is a line in the QLPOUT buffer waiting to be printed.

Note 2: Non-recoverable errors may be due to:

- (a) Paper broken or finished
- (b) Paper runaway
- (c) A Hammer fuse has blown
- (d) The Yoke is open
- (e) The hammers are disabled.

Note 3: Lineprinter invalid may mean that the lineprinter is not connected to the correct channel, or that power is not switched on to the printer.

### 3.2 Continuation after an Error

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

#### Chapter 4: METHOD USED

Characters are stored in a buffer within QLPOUT. When a newline or Vertical Format character is received output is initiated by permitting interrupts. The Modular Interrupt Routine enters QLPOUT at QLPT2 whenever an interrupt occurs on the lineprinter channel. This entry causes the contents of the buffer to be output, if the buffer is awaiting output. If the buffer is not awaiting output, (as may occur on the interrupt following output of the line) interrupts from the lineprinter are suppressed.

The Modular Interrupt Routine enters QLPOUT at QLPT3 wherever an Attention is received from the lineprinter channel. This entry merely reads the lineprinter status and exits to QLEV2.

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

The routine only holds up on the base level of the character following newline or Vertical Format is entered before the previous line has been output by the interrupt routine.



Chapter 5: STORE USED

QLPOUT occupies approximately 160 locations (including a 42 word buffer).

It also uses the following routines:-

The Modular Interrupt Routine (Length depends on installation)

QERROR	approx	80	locations
QPAUSE	approx	20	locations
QCHOP	approx	40	locations

Chapter 6: TIME TAKEN

QLPOUT is capable of driving the lineprinter at full nominal speed of 300 lines per minute. When outputting complete lines of varying characters the lineprinter speed may be reduced. Repeated outputs of newline alone may be faster than the nominal speed.