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RSX-11D SPEC

TO: RSX-11D Distribution
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Unless specified otherwise, the terms "RSX" and "RSX-11" imply "RSX-11D".

1.0 INTRODUCTION

1.1 This functional specification will cover both interior design considerations and outward appearance of I/O handler Task to support multiple teletype devices on RSX-11D. The Index is below.

- A. HANDLER SYSTEM INTERFACE [PARA
- B. INTERRUPT SERVICE ROUTINE: CONVENTIONS [PARA

2.0 HANDLER INTERFACE TO SYSTEM

2.1 HARDWARE INTERFACE

- A. Teletype devices standardly supported by Teletype Handler Task interrupt service routine are:
1. KSR33 - 10 char/sec
 2. KSR35 - 10 char/sec
 3. LA32 [DECRYPTER] - 30 char/sec [serial/parallel]
 4. VT05 - Variable rate
- B. All the above teletype devices (other than operator console) will be initially supported. If interfaced to the PDP-11 via the KL-11.
- C. It is currently envisioned that other, third-party teletype-class devices may appear, and provisions are made so that this should not cause any problems with the Handler. The KL-11A and KL-11C however will not support a low speed paper Reader/Punch.
- D. At present, a maximum of 17 devices will be able to be enabled for any PSX-11P machine system, to restrictions on the allocated vector space the KL-11.

* Full duplex 8-bit asynchronous line support will extend to the KL-11A, KL-11B, and KL-11C, implying a maximum rate of 300 for one Teletype Device.

2.2 USER TASK INTERFACE

- A. The Teletype Handler like any other RSX-1 Handler, receives its queued requests from an active task via either of the two QUEUE I/O System Directives. The user task provides the directive with a request node to the logical unit number [LUN], desired, as well as with the various parameters necessary for its execution. The system determines which physical device the LUN has been assigned to and after adding so linkage and user identifier information, queues the node to the appropriate handler's request list.
- B. The table below gives descriptions of the various I/O functions performed for the user task over Teletype Handler. These codes will be compatible with similar commands on a wide variety of devices, thus promoting device independence. The user may also specify an I/O status word, and/or event flag to the Handler for any I/O function through the request node. The Handler will call the user event flag to be set [if specified], when the I/O function is complete, and the user status word [if specified] to be set to an octal value determining the outcome of the I/O [success, or the type of failure incurred].

CODE #	COMMAND	DESCRIPTION OF HANDLER FUNCTION
0400	WRITE	Writes a line from a I/O buffer within the requesting task.
0602	WRITE TEXT FILE	Writes a text file specified in the request node, to user select teletype. This is the current Teletype Handler method of despooling [See section 2.3.]
1000	READ	Reads a line into a I/O buffer within the requesting task.
1002	READ NO ECHO	Same as READ, except input characters are not echoed on the teletype device.

1420 ATTACH

Dedicates the teletype device specified to a user task issuing an "ATTACH." Only the user's request nodes will be processed by the handler for that device regardless of the priority of other user nodes.

2000 DETACH

Detaches the user from the teletype device. Negates an ATTACH.

C; The format of the text line buffer specified in a user "READ" or "WRITE" function request nodes, will be compatible with the text line formats defined in the Files project. This format will be included in detail here, when it becomes available.

D; The status word location, if desired, is defined in the user task, within user core, from an address in the user request node. Possible values of the word upon completion of a Teletype operation are:

1;	+1	= Successful completion
2;	+2	= Successful completion of Read, by operator terminated line with ALTMODE, not CARRIAGE RETURN.
3;	+3	= Read completed because operator typed maximum number of characters. No terminator seen.
4;	+4	= +U typed by operator, terminated [if write operation]
5;	+5	= +S typed by operator [if write operation]

6;	-5	= Illegal function code
7;	-13	= Illegal buffer address
8;	-14	= Illegal buffer count
9;	-200	= Teletype Device incapable of desired I/O function
10;	-210	= Illegal characters
11;	-220	= Timeout occurred [if write operation]
12;	-999	= No node available for request

E; The general format of the request node that a user passes to the QUEUE I/O Directive is defined in the I/O Operations Specification. The detailed bit definitions of words 5-12 of the node however

are defined solely by the I/O Function. For functions available from the Teletype Handler three basic detailed formats of words 5-12 exist. Format A is for I/O functions "WRITE", "READ", "READ:NO ECHO"; Format B is for functions "ATTACH" and "DETACH"; Format C is for "WRITE:TEXT FILE."

1; FORMAT A

WD#	MEANING
05	The 16 bit address of the start of the text line buffer relative to user task
06	Spec[al] mode word [if set:] <ul style="list-style-type: none"> a, BITS 0-13=UNUSED B, BITS 14= pass all characters [RUBOUT, +U etc,] C, BIT 15=no byte count wanted [terminator will not end line]

2; FORMAT B

NO SPECIALIZED I/O FUNCTION WORDS NECESSARY

3; FORMAT C

THE FORMAT WILL BE IDENTICAL TO THE "OPEN FILE" REQUEST AS DEFINED BY THE FILES PROJECT

2.3 SPOOLER INTERFACE

A, Teletype spooling for RSX-11D will be performed as a separate handler task, for all user I/O "WRITE" functions assigned via LUN's, to a "SPOOLER" device. This "Spooler Handler" will operate throughout using its own disk manipulation,

Therefore it will enable the user task to funnel its Teletype output directly to disk and exit. This will both free core, and dramatically decrease runtime for Teletype I/O bound user tasks, two very desirable features.

B, Also, like the Teletype Handler, the function interface of the Teletype Spooler with the user task will be similar to other RSX-11D I/O handler promoting user task device independence. To spool simply change the user output LUN from teletype device to "Spooler" device.

C, The Teletype Handler itself will also provide facilities for a non-device independent form of spooling, here, the user task "spools" its output lines directly to a text file on the disk utilizing the I/O record handling capabilities provided by the Files project. Upon completion (either a terminating character, or user program exit or abort), a "WRITE TEXT FILE" request node will be queued for the Teletype handler. The entire unbroken text file will then be output on the user specified Teletype, under the user specified priority.

D, By the judicious use of multiple text files to break up long outputs, a user task should be able to "spool" at the level of effectiveness (if not sophistication) provided by the Teletype Spooler Handler Task. It is this form of spooling capability that will be provided initially.

3.0 INTERRUPT SERVICE ROUTINE: CONVENTIONS

3.1 Special Characters

- A. The typing of +C shall cause the Teletype Interrupt Service Routine to trigger the MCR sequence. Nothing will be echoed; it will be left to the user task to have set itself to key off this variable and perform legality checking. [Is this a console Teletype? What is its status?] There will be no effect on any TTY input or output operation.
- B. The typing of +X shall cause the Teletype Interrupt Service Routine to pass the time, date and device number, [via the Send System Directive] and start up [via the Request System Directive] a user task specified at System Generation [SGEN] time. This task could be used to, for example, allow the MCR to run on the teletype from which the +X is typed. The task may or may not be present depending on the installation's need for such a feature. In any case +X can be typed from any Teletype device, and there will be no effect on any TTY input or output operation.
- C. During write operations, the typing of +S shall cause a +5 to be returned in the status word, and the typing of +U shall cause a +4 to be returned as well as truncating the output in the middle of the line. The user task can use this information [for example] stop a long printout on that unit. In read mode, +U will clear the current line buffer, and echo as CRLF.
- D. The typing of +R shall cause the current line buffer [if in read mode] to be retyped up to the current input character. This allows a confused typist to examine exactly what he has typed into the system.
- E. The typing of +I shall cause a horizontal Tab to be echoed, regardless of whether the Teletype Device has a horizontal Tab hardware capability.
- F. The following characters always have special meanings,

1. ALTMODE [233, 375, 376] - ends line input; echo on output. Converted to 233; will allow further console input on the same output line.

2. CARRIAGE RETURN [215] - ends line input.
3. TAB [HORIZONTAL, VERTICAL, FORM FEED] - If provided by Teletype device, they will be simulated.
4. RUBOUT [377] - Deletes last character and ech as "\". If any previous characters in buffer,

3.2 TABLES

- A. The Teletype Interrupt Service Routine is that part of the handler task hooked directly into the interrupt chain. It is assembled with the Teletype Handler, but is run in Kernel Mode.
- B. The Interrupt Service Routine will be structured to be "LINEWARE". In other words, it will make the Teletype appear as a line device to the Teletype Handler.
- C. For each Teletype Device specified in the PUP (to a maximum of "N", where "N" < 16 is the number of teletype devices the Handler was assembled to control), 8 control words and 48 line buffer locations will be available in the Teletype Handler, set in the format:

WD 00 = STATUS OF TELETYPE, IF SET:

BIT 00 = CHAR OPERATION IN PROGRESS
 BIT 01 = LINE OPERATION IN PROGRESS
 BIT 02 = JOB IN PROGRESS [ATTACHED]
 BIT 03 = NO ECHO REQUIRED
 BIT 04 = SET IN POSITION FOR OVERPRINT
 BIT 05 = CONTROL CHARACTER BEING PROCESSED
 BIT 06 = LINE IS OVER
 BIT 07 = UNUSED

 BIT 08 = "WRITE" IN PROGRESS
 BIT 09 = "WRITE FILE" IN PROGRESS
 BIT 10 = "READ" IN PROGRESS
 BIT 11 = UNUSED
 BIT 12 = UNUSED

 BIT 13 = UNUSED
 BIT 14 = PASS ALL CHARACTERS [MODE]
 BIT 15 = WHOLE BYTE COUNT WANTED [MODE]

[NOTE: BITS 0-12 ARE SET INTERNAL TO THE HANDLER
 BITS 13-15 ARE PROVIDED BY THE USER I/O FUNCTION
 MODE WORD,]

WD 01 = STATUS OF TTY HARDWARE [SET VIA SGEN].*
 SET:

BIT 00 = DEVICE HAS NO KEYBOARD [READ DISABLE]
 BIT 01 = DEVICE HAS NO PRINTER [WRITE DISABLE]
 BIT 02 = NOT FULL DUPLEX [CHARACTER ECHO
 DISABLED]

BIT 03 = HORIZONTAL TAB ENABLED VIA HARDWARE
 BIT 04 = VERTICAL TAB ENABLED VIA HARDWARE
 BIT 05 = FORM FEED ENABLED VIA HARDWARE
 BIT 06 = PARITY REQUIRED FOR DEVICE
 BIT 07 = UNUSED

 BITS 28-15 = MAX NUMBER OF NULLS NEEDED
 FOLLOWING CARRIAGE RETURN FOR THE
 TELETYPE DEVICE, TO AVOID OVERPRINT.

WDS 02-05 = BUFFER POINTERS

WD 02 = CURRENT COUNT [NUMBER OF CHARACTERS TO
BEFORE MAXIMUM BYTE COUNT EXCEEDED]

WD 03 = ADDRESS OF CURRENT CHARACTER BYTE BEING
PROCESSED

WD 04 = POINTER TO USER NODE

WD 05 = PUD ENTRY POINTER FOR THIS DEVICE

WDS 06-08 = CHARACTER PROCESSING WORDS

WD 06

BYTE 0 = CHARACTER CODE BEING PROCESSED
 BYTE 1 = RELATIVE PROCESSOR LOCATION

WD 07 = POINTER TO CURRENT CHARACTER BEING ECHOED

WD 08

BYTE 0 = NUMBER OF CHARACTERS SINCE LAST CR
 BYTE 1 = NUMBER OF CR SINCE LAST PAGE

WDS 9-48 = TEXT BUFFER FOR CURRENT LINE; [THIS
 ALLOWS DOUBLE BUFFERING ON ALL TELETYPE LINE
 I/O FOR UP TO 80 CHARACTERS.]

* Some sample values are: KSR35=0, LA33=7479