3600 DRUM SCOPE SYSTEM ROUTINES FOR THE DD212 TERMINAL

Richard L. Venezky

30 July 1967

Technical Report #4

INTRODUCTION

The material presented here was developed at the University of Wisconsin as part of an on-line, natural language processing project, under support of the National Science Foundation. One immediate goal of this work is an on-line text editing system for natural language on the CDC3600 -- a system which could eventually be expanded into a complete publications process. This system is now being developed for a DD212 terminal and will be described in a forthcoming technical report. From the experience gained through the current work, a more complete editing scheme will be designed and implemented for a graphical terminal. In addition, an on-line information retrieval system has been planned, centered around Infol and will be implemented during the 1967-68 school year.

The enclosed reports cover three basic software packages: the 212 driver which is a non-resident routine operating under the Drum Scope monitor system on the 3600, a series of assembler language (Compass) macros for facilitating program communication with the 212 terminal, and a series of routines for facilitating 212 communication in Fortran programs.

Nicholas Brown, Michael Dorl, and Stanley Su developed significant portions of these routines.

TABLE OF CONTENTS

TABLE OF CONTENTS - (Continued)

SECTION I

DRTVD

A Driver for the DD212 Display
under 3600 Drum Scope

I. PURPOSE

DRTVD is a 3600 Drum Scope non-resident routine for driving the DD212 display through the 3291-A controller. It interprets function codes, initiates data transfer, and provides BCD code conversion.

II. FUNCTION CODES

The compass I/O functions listed below are accepted by DRTVD. All other functions are illegal and will be interpreted as status requests, except that bit 5 in the status will be set to one to indicate an illegal function.

MODE (u, ra, m)

m = BCD	Convert BCD codes on data transmission
m = BIN	Do not convert BCD codes on data transmission

The 3291-A does not convert from internal to external BCD (or from external to internal), therefore code conversion must be done by software. When a program assigns an I/O unit to the 212, mode is set to BIN. It remains set until changed by a Mode request. On read operations, mode is checked after the end of operation interrupt, and conversion - if requested - is performed. On write operations, conversion (if requested) is performed before the write is initiated. Converted BCD codes are stored in their original location. On completion of the write operation, the BCD codes are reconverted to their original form. Thus, the user does not have to switch conversion modes for repeated writing of the same data. (See Appendix A for conversion codes.)

READ (u, cwa, ra, ia)

WRITE (u, cwa, ra, ia)

Data are read from (written in) the 212 buffer as specified by control word at location cwa. Code conversion will be done if the current mode is BCD (See Mode, above).

On chain interrupt, the current control word address is entered in IUSTQ, and an exit to DRBSY is taken. On end of operation or abnormal end of operation interrupt, the status is updated and an exit to DRFIN is taken. If the user specified an interrupt address (ia) in the READ/WRITE call, that address will be entered at this time.

Data transmission from or to the 212 buffer is terminated either when the word count is reduced to zero or when an end-of-message (eom) character is detected. On either input or output, an eom character, if present in the data, will be the last character transmitted. On all write operations, the final word count will be zero, regardless of the actual number of words transmitted to the 212 buffer. If in a read operation under IOTW control an eom character is detected, that character is transmitted to core, followed by zeros until the word count is zero.

Read operations under IOTR control will terminate when an eom character is detected (or when the word count becomes zero). The final word count will always be a function of the actual number of words read from the 212 buffer.

If a read operation is the first read operation after the send key was depressed, the first twelve bits of the input data will be the station control word (A1).

SKIP (u, ra)

REWIND (u, ra)

Both of these functions reset the cursor to the first character position on the screen. After the function is performed, the status is updated and an exit to DRFIN is taken. Since the 212 will be busy for 20-40 milliseconds after receipt of a reset cursor function, entries to the driver during this period will cause the driver to cycle internally until the 212 is not busy. Rewind will be rejected by Scope if it is requested before the first forward motion request (or, for background routines, before an assign request).

Upon program termination, Scope performs a Rewind request on the 212.*/

READY (u, ra, ia)

Interrupt (go to address ia) on ready-not busy condition. Since the 212 does not interrupt on ready-not busy, this function is accomplished by testing the status and stacking on time if the unit is either not ready or busy. Under the current version of Drum Scope, the driver will be re-entered approximately 5 seconds after it stacks on time.

---

*/ Scope exhibits a pathological tendency to treat all peripheral units as tape units.

ERASE (u, ra, ia)

The 212 buffer (and face) are cleared and the cursor is reset to position one. (An IOSW control word in an output operation writes zeros which on the 212 are projected as blanks.)

MARKEF (u, ra, ia)

Interrupt (go to address ia) when the send interrupt is received. This function is accomplished by testing the status and stacking on time (app. 5 second cycle rate) if the send interrupt is not present.

DYSTAT (u)

Set the current status in IUSTQ.

EDITED STATUS BITS

Status bit	Name	Function
0	Ready	3291-A power is on.
1	Busy	Data transfer or cursor reset in operation.
5	Illegal function	An illegal request was attempted. (See page 5)
8	Send interrupt	Send button was pushed.
9	End of operation interrupt	Interrupt generated by the normal completion of an I/Ø operation.
10	Abnormal end of operation	Interrupt generated by the completion of a write operation in which a parity error occurred.

III. ERROR PROCESSING

Channel Parity Error

On entry to DRTV lower, with Q non-zero, the following are performed:

1. The contents of the upper 24 bits of IUPT are stored in IUSTQ lower. (This should be the address of the control word for the I/O operation which was in progress).
2. The channel is released.
3. DRTVD is re-entered at the upper address.

Illegal Function

The status is updated and bit 5 set to one to indicate an illegal function. Then, DRTV exits to DRFIN.

Illegal Control Word

If a control word error is detected by MOVCW, DRTV exists to DRBAD. This causes termination of the program which issued the I/Ø request.

Illegal Write-Read Sequences

On entry to DRTV upper, the read-write bits in IRHT are cleared. If this were not done, SCOPE would terminate a program abnormally for requesting a read operation after a write.

IV. INTEGRATION WITH DRUM SCOPE

DRTVD is included in Drum Scope as a non-resident driver. On the 3600 at the University of Wisconsin, the DD212 is equipment 0, unit 0, and is connected to channel 1 . Mnemonics TV have been assigned to the unit. To edit DRTVD into Drum Scope, the following must be done:

1. Enter TV, 1400, I, Ø into HTL
2. Enter TV, E, U, Ch into AER

   (E = equipment number, U = unit number,
   Ch = channel number)

3. Insert DRTVD into the library.

SECTION II

Compass Macros for DD212 Operations

I. PURPOSE

The Compass macros described here are for control of the following operations on the DD212 display unit:

-- Reading from the 212 (TVREAD)

-- Writing on the 212 (TVWRITE)

-- Clearing the 212 screen (and buffer) and resetting the cursor to position 1 (TVERASE)

-- Resetting the cursor to position 1 (TVRESET)

-- Setting interrupt on ready, no busy (TVREADY)

-- Setting interrupt on send (TVSEND)

-- Clearing interrupt on send (TVCLEAR)

-- Obtaining the current 212 status (TVSTATUS)

II. USE

All macros are on the Compass system tape and can be called from user programs. Besides the macro expansions performed by Compass, a library routine (TVCK) is loaded from the Drum Scope library when a user routine with any of these macros is loaded. The users only concern, however, is to write the macros properly.

III. GENERAL DESCRIPTION

If interrupt on send has been set, execution of any of these requests except TVSTATUS will clear it. End of operation interrupt will not be cleared, however. Because of this clearing, send interrupts cannot be stacked. A TVSEND request clears a previous, active TVSEND request.

MACRO PARAMETERS

u	unit
cwa	control word address
ra	reject address
ia	interrupt subroutine address
cv	I/O code conversion (NO => suppress conversion; anything else => conversion)

Any legal Compass form of u, cwa, ra, and ia can be used, including those with indexing.

IV. MACRO DESCRIPTIONS

TVREAD (u, cwa, ra, ia, cv)

Same as READ macro (see Drum Scope Reference Manual, CDC publication No. 60059200, Rev. A, p. 4-4), except that if cv equals NO, code conversion is suppressed. If cv is absent, or equal to any value except NO, codes are converted after the operation is completed. The code conversion table is given in Appendix A .

A read operation under IOTW or IOTR control will terminate transmitting 212 data when the word count is reduced to zero or when an to end-of-message (eom) character is detected in the buffer data. If an eom character is detected under IOTR control, it will be the last character transmitted from the 212 buffer. Zeros (converted to internal blanks) will fill out the last 3600 word if necessary. The word count at the end of the

read operation will reflect the actual number of words transmitted from the 212 buffer (words transmitted equals the original word count minus the final word count). If an eom character is detected under IOTW control, zeros will be transmitted to core from the 212 controller until the word count is zero. The 212 cursor will always be located at the character position following the last character transmitted from the 212, regardless of the control word type.

If a read request is the first read request following a send interrupt, then the first two characters transmitted to core will be the 212 station control word (^1). Data from the 212 buffer will follow, starting in character position three.

Under all other circumstances only data from the 212 buffer will be transmitted.

TVWRITE (u, cwa, ra, ia, cv)

Some as the Compass WRITE macro, except that if cv equals NO, code conversion is suppressed. If cv is absent, or equal to any value except NO, internal BCD codes are converted to external 212 BCD codes before the write is initiated, and then back to internal BCD codes when the write is completed. At the completion of a TVWRITE, therefore, the data in core will be the same as it was before the request was issued.[1/] The code conversion table is given in Appendix A .

[1/] Since the data are not reconverted until the end-of-chain interrupt, a channel parity error -- which would cause reinitiation of the write -- could result in faulty conversion.

Write operations under IOTW and IOTR control are identical.

Data will be transmitted to the 212 buffer until the word count is zero or an eom character is detected. In the latter case, the eom character will be the last character transmitted. However, the word count will always be zero on the termination of the write operation. IOSW control will write blanks on the screen.

TVERASE (u, ra)

The 212 screen (and buffer) are cleared and the cursor reset to position 1 .

TVRESET (u, ra)

The cursor is reset to position 1, but the data on the screen and in the buffer are not altered.

TVSEND (u, ra, ia)

An interrupt on send is set. When the interrupt is detected, control will go to ia . The user should perform a TVCLEAR request in his interrupt subroutine so that interrupts on end of I/O operations will not be accidentally cleared.

TVCLEAR (u)

If an interrupt on send has been set, it will be cleared. If no interrupt has been set, this instruction does nothing.

TVSTATUS (u)

Same as DYSTAT

Edited status bits as shown below are placed in bits 32-42 of the Q register.

Bit	Q-reg.	Function indicated if set
0	32	ready
1	33	busy
5	37	illegal function
8	40	send interrupt
9	41	end of operation interrupt
10	42	abnormal end of operation interrupt

V. IMPLEMENTATION

Each macro includes a BRTJ to TVCK (a library subroutine) where a check request is performed if interrupt on send is active. The unit number (including index if necessary) and conversion mode parameter are assembled into the unused twelve bits of the BRTJ.

TVCK also performs a mode request on data transmission requests.

VI. USAGE NOTES

A. Carrage returns

The carriage return (CR) character (internal 36_8) functions on both input and output. If a CR occurs in data output to the 212, the characters following the CR will be displayed starting in position one of the line following the one on which the CR is displayed.

On input, the next character position read after a CR is position one of the following line. Data between a CR and the end of a line cannot be read.

B. Parity error symbol

The parity error symbol (internal 75_8) can be written onto the 212 (and read back), but cannot be generated from the keyboard.

SECTION III

Fortran Subroutine Calls for DD212 Operation

I. INTRODUCTION

There are six commands available as subroutine calls to the Fortran user. These are:

TVREAD (u, wc, fwa, is)

TVWRITE (u, wc, fwa, is)

TVSEND (u, is)

TVERASE (u)

TVRESET (u)

TVCLEAR (u)

u..... unit number (specified as a Fortran variable or constant)

wc ... number of words to be transmitted (word count must be specified as a Fortran variable or constant)

fwa... first word address for I/O data (any Fortran variable name)

is .... interrupt subroutine name or subroutine entry point name (optional)

The interrupt subroutine name is optional in TVREAD, TVWRITE, and TVSEND. If it is included it must be the name of a parameterless subroutine or an entry point in a subroutine, declared by an ENTRY statement. When this name is included in a call, control returns immediately to the statement following the call. (The subroutine name must be declared as external if it is not located in the calling program.) Data transmission (or send interrupt) will not have been completed when control returns to the calling routine. If the name is not included, control will not return to the calling routine until the end of operation interrupt is received. That is, for read and write operations the operation will be complete when control is returned and for the send operation the send key will have been pushed and the

interrupt received. Note: The display must be assigned a unit number through the use of an equip card.

On input and output operations, the carriage return character (CR) moves the cursor to the beginning of the next line. The next character read after the CR is the first character on the next line. On a write operation, the next character written after a CR is written at the beginning of the next line. An end-of-message character will terminate transmission of data if encountered in either a read or write operation. (See list of character codes, Appendix A .)

II. COMMAND DESCRIPTIONS

TVREAD, TVWRITE

These commands are identical in operation except that TVREAD reads the display from the current cursor position and TVWRITE writes on the display from the current cursor position. Both reading and writing are done with internal-external character conversion (see page 2).

Example 1

```
CALL TVREAD (3, 40, READAREA)
```

Unit 3 will be read from the current cursor position. A maximum of 320 characters will be stored in memory starting at location READAREA.[1] Control will be returned to the calling routine after the read is completed.

---

[1] A read or write operation will terminate a) when the desired number of words are transmitted or b) when an end-of-message mark is sensed in the transmitted data (see page 3).

(The first two characters in READAREA (upper 12 bits of first word) would contain a blank and the number 1 if this is the first read following receipt of a send interrupt; see page 4.)

Example 2

CALL TVWRITE (2, 100, RITEAREA, INTSUB)

Unit 2 will be written on from the current cursor position. A maximum of 800 characters will be written on the screen from memory starting at location RITAREA. Control will return immediately to the calling routine after the write operation has been initiated. Upon completion of the write, the calling routine will be interrupted and control transferred to subroutine or entry point INTSUB. On return from INTSUB, control goes to the interrupted position.

The execution of TVWRITE or TVREAD will cancel a TVSEND if the interrupt has not been received.

Any read or write command whose word count exceeds the number of words remaining from the present cursor position to the last character on the screen completes the read or write by continuing the operation from the reset position of the cursor (upper left hand corner).

TVSEND

TVSEND causes the calling routine to be interrupted when the send key on the keyboard is depressed. If an interrupt name is given, program execution continues until the send key is depressed; then control is transferred to the interrupt subroutine or entry point specified by the user in the TVSEND call. If no interrupt name is given, program execution is suspended until the send key is depressed. TVSEND cancels a previous TVSEND if the interrupt has

not occurred previous to the execution of this TVSEND command. Note: Depressing the send key also resets the cursor.

Example

```
CALL TVSEND (1, SENDINT)
```

Control is transferred to the SENDINT subroutine or entry point when the send key is depressed. If the interrupt subroutine name or entry point is omitted, the command acts as a delay. This is, execution of the users routine is halted until the send key is depressed.

Example

```
CALL TVSEND (1)
```

Program execution is halted until the send key is depressed. Depressing the send key resets the cursor and continues execution of the user routine. (The user is charged for the delay time.)

TVERASE

TVERASE resets the cursor after clearing the screen of the selected unit. The execution of this command cancels a TVSEND if the interrupt has not occurred.

Example

```
CALL TVERASE (1)
```

Unit 1 is cleared and reset.

TVRESET

TVRESET resets the cursor to the upper left corner of the CRT without disturbing data on the screen as in the execution of this command cancels a TVSEND if the interrupt has not occurred.

Example

```
CALL TVRESET (1)
```

Unit 1 is reset.

TVCLEAR

TVCLEAR cancels a TVSEND if the interrupt has not occurred.

Example

```
CALL TVSEND (1, INT)
        :
CALL TVCLEAR (1)
```

The INT interrupt, if it has not occurred, will be cancelled.

APPENDIX A

Code Conversion

Symbol	Internal Code	External Code	Symbol	Internal Code	External Code	Symbol	Internal Code	External Code
A	21	61	W	66	26	(	74	32
B	22	62	X	67	27	,	73	33
C	23	63	Y	70	30	%	16	34
D	24	64	Z	71	31	¢	75	35
E	25	65	Space	60	00			
F	26	66	1	01	01	\	76	36
G	27	67	2	02	02	=	13	37
H	30	70	3	03	03	-	40	40
I	31	71	4	04	04	!	52	52
J	41	41	5	05	05	$	53	53
K	42	42	6	06	06	*	54	54
L	43	43	7	07	07	]	72	55
M	44	44	8	10	10	;	37	56
N	45	45	9	11	11	Δ	56	57
O	46	46	0	00	12	&	77	60
P	47	47	#	35	13	?	55	72
Q	50	50	@	15	14	.	33	73
R	51	51	:	12	15	)	34	74
S	62	22	>	57	16	[	17	75
T	63	23	Not used	14	17	<	32	76
U	64	24	+	20	20	— carriage return	36	77
V	65	25	/	61	21			

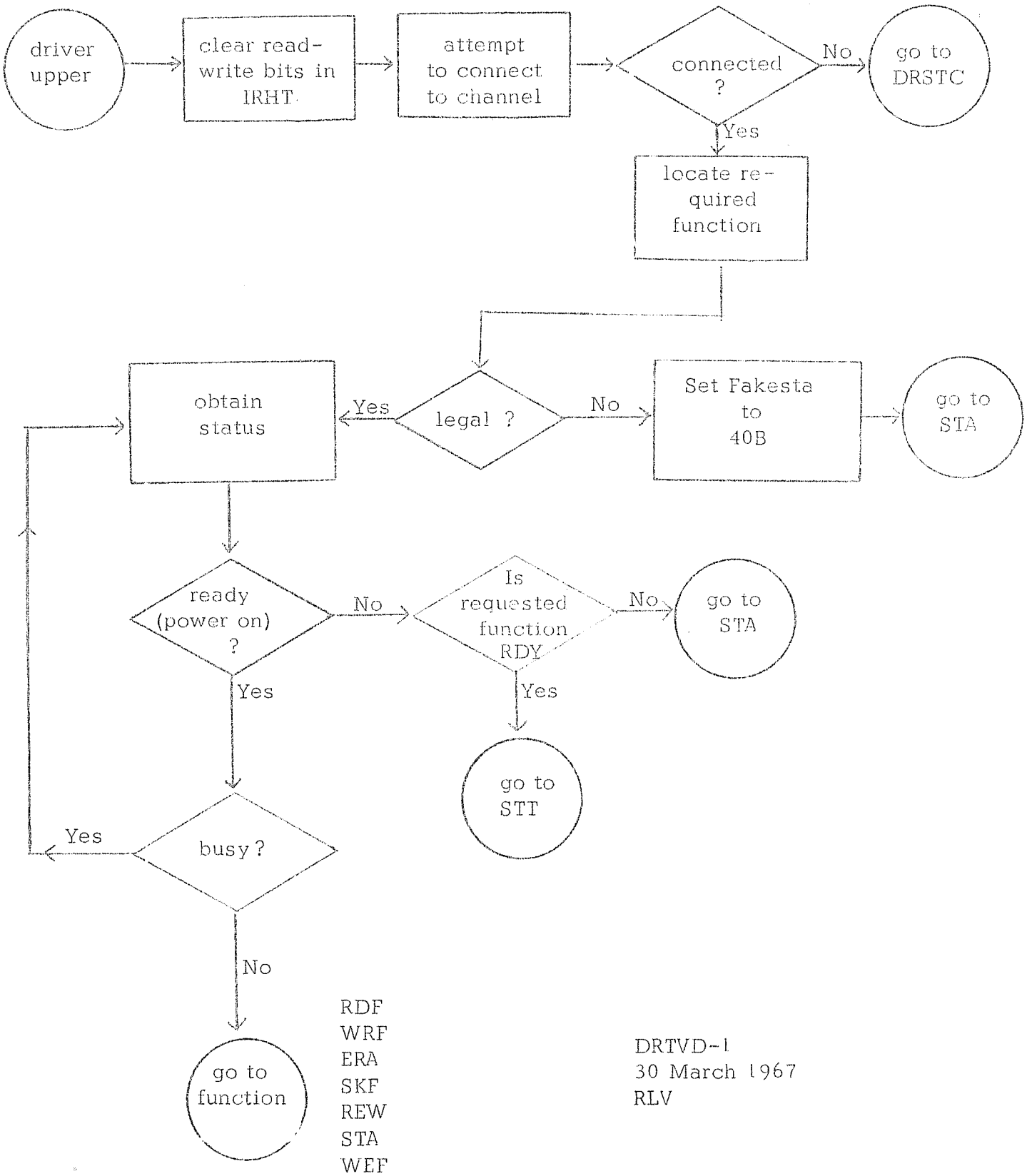
APPENDIX B

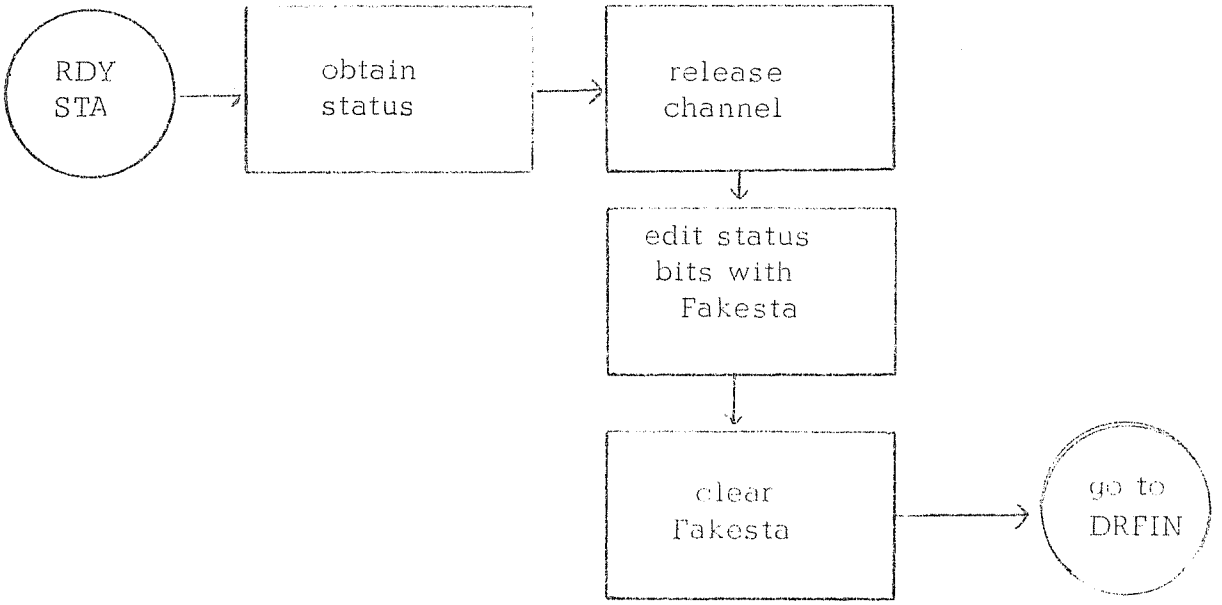
I/O Macros

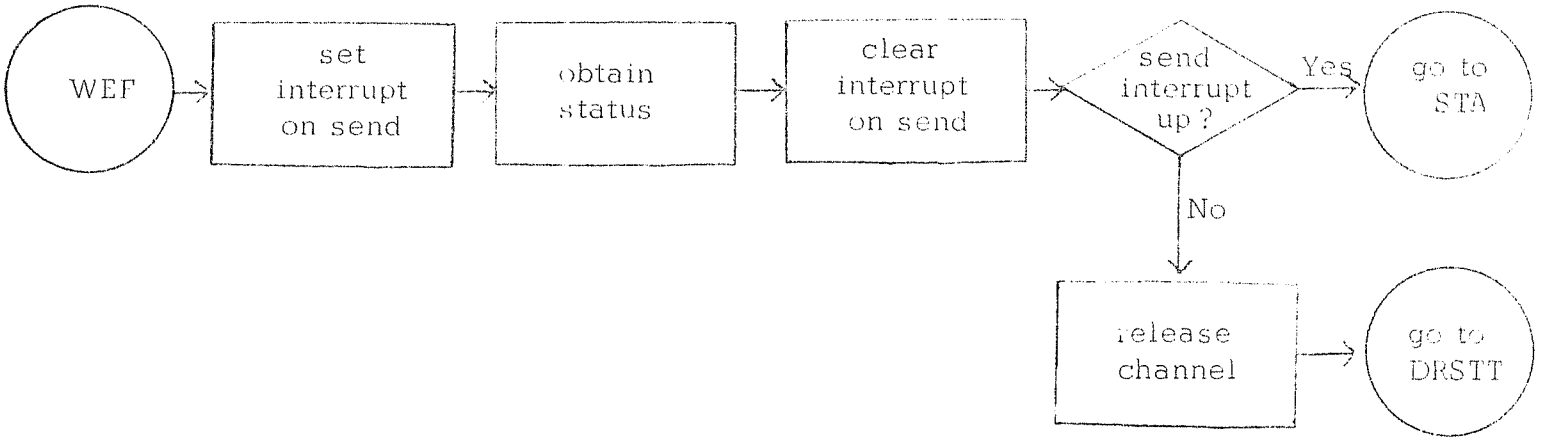
```
STUFF     MACRO     S, CV, U, I
          EXT       TVCK
TAG       VFD       06/63, 06/I, 06/U, 01/S, 02/CV, B/*, 05/1, 01/1, B/
                      $TVCK, A15/TVCK
          ENDM      STUFF
TVREAD    MACRO     U, CWA, RA, IA, CV
          IFT, EQ   CV, /NO/, 1
          STUFF     0, 2, U
          IFT,NE    CV, /NO/, 1
          STUFF     0, 3, U
          READ      ((U), (CWA), (RA), (IA))
          ENDM      TVREAD
TVWRITE   MACRO     U, CWA, RA, IA, CV
          IFT, EQ   CV, /NO/, 1
          STUFF     0, 2, U
          IFT, NE   CV, /NO/, 1
          STUFF     0, 3, U
          WRITE     ((U), (CWA), (RA), (IA))
          ENDM      TVWRITE
TVERASE   MACRO     U, RA
          STUFF     0, 0, U
          ERASE     ((U), (RA))
          ENDM      TVERASE
TVCLEAR   MACRO     U
          STUFF     0, 0, U
          ENDM      TVCLEAR
TVRESET   MACRO     U, RA
          STUFF     0, 0, U
          SKIP      ((U), (RA))
          ENDM      TVRESET
TVSEND    MACRO     U, RA, IA
          STUFF     1, 0, U
          MARKEF    ((U), (RA), (IA))
          ENDM      TVSEND
TVREADY   MACRO     U, RA, IA
          STUFF     0, 0, U
          READY     ((U), (RA), (IA))
          ENDM      TVREADY
TVSTATUS  MACRO     U
          DYSTAT    ((U))
          ENDM      TVSTATUS
```

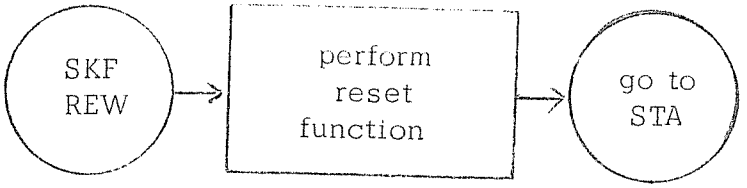
APPENDIX C

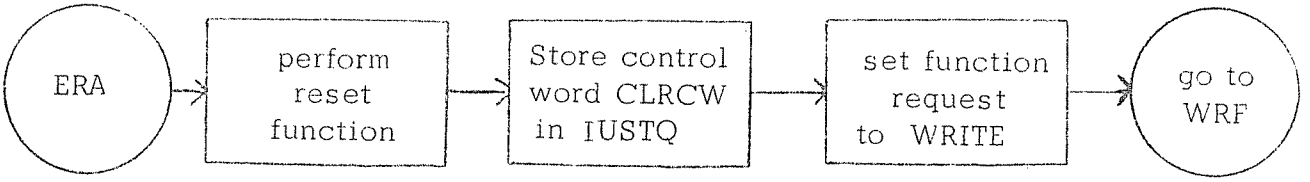
FLOW CHARTS FOR DRTVD



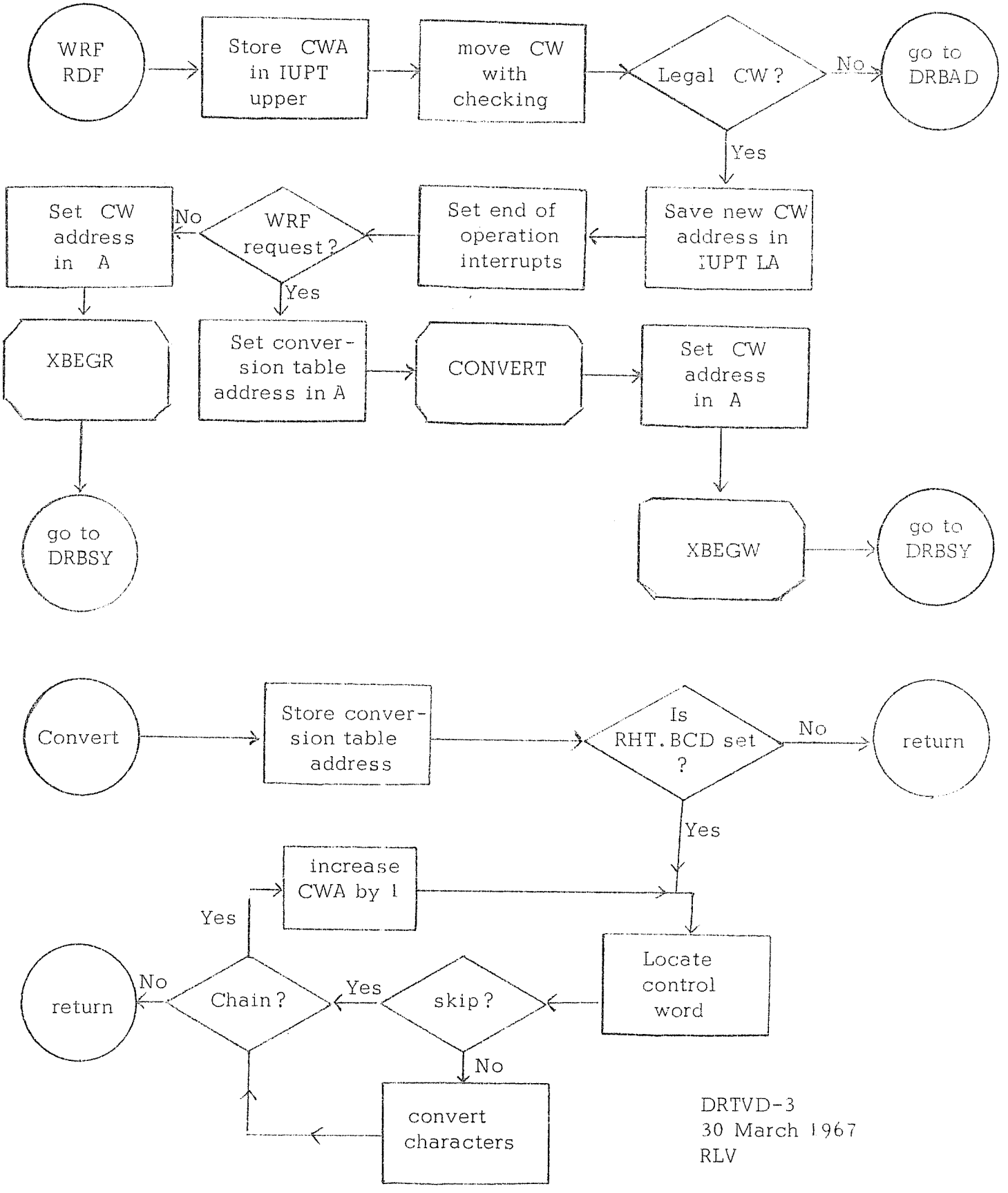


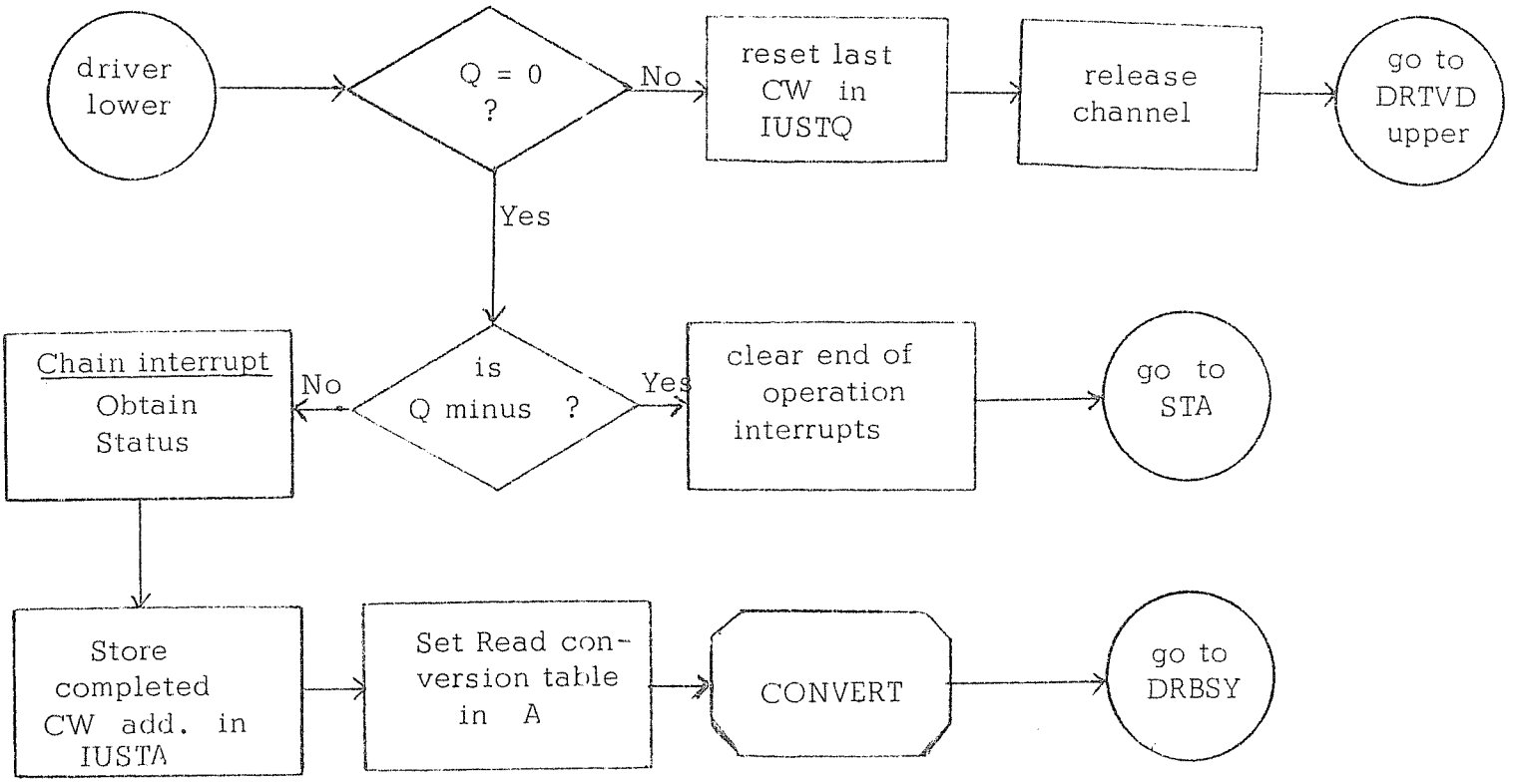






DRTVD-2
30 March 1967
RLV


WRF RDF
Store CWA in IUPT upper
move CW with checking
Legal CW?
No
go to DRBAD
Yes
Save new CW address in IUPT LA
Set end of operation interrupts
WRF request?
No
Yes
Set CW address in A
XBEGR
go to DRBSY
Set conversion table address in A
CONVERT
Set CW address in A
XBEGW
go to DRBSY
Convert
Store conversion table address
Is RHT.BCD set ?
No
return
Yes
increase CWA by 1
Yes
Locate control word
return
No
Chain?
Yes
skip?
No
convert characters
DRTVD-3
30 March 1967
RLV



DRTVD-4
30 March 1967
RLV