3. I/O DRIVERS

3.1 Introduction

The various types of driver available with the TOSS Monitor are described briefly in Section 1.5. The present chapter describes in detail the function of the drivers and the interface rules which must be complied with.

Sections 3.2 to 3.4 describe general aspects of certain related groups of drivers. Section 3.5 describes the general interface rules for all drivers. And section 3.6 contains detailed reference information for each driver. The reference information is given in alphabetical driver name order (e.g. DRCG01, DRCD01).

3.2. Drivers for Teller Terminal Printer

The drivers used to control a Teller Terminal Printer are DRTP01 and DRTP02. Only one of these drivers can be incorporated into the TOSS Monitor. DRTP02 is a version of the driver which can accept CREDIT order codes for the Teller Terminal Printer.

3.3 Drivers for Data Communication

Data communication (DC) drivers control the reception and transmission of data between the Terminal Computer and the remote computers. There is one DC driver for each type of line procedure. However, only driver DRDC15 is described in this manual. More DC drivers will be included in future Manual updates. A single DC driver may only be connected to one remote computer.

The unit of information passed between a DC driver and an application task at a DC I/O request is called a message. This message may have any format, and need not contain any special DC information such as destination address, message length etc. The DC driver generates or discards such information automatically. It also performs blocking and de-blocking when necessary.

The main orders handled by DC drivers are write (order /06), read (order /02) and exchange (order /08). The write order is used to transmit a message from a task. The read order is used to obtain a message which has been sent to the task. The exchange order has the effect of a write followed immediately by a read.

DC drivers comprise the following functions:

- activation
- line procedure
- device simulation

The activation function handles the request and checks the validity of the parameters. The work areas are prepared with respect to queues and timers for the requests.

The line procedure function generates and checks the message framing characters such as STX, ETX, BCC etc. It also decodes the line procedure control characters such as EOT, ACK, polling, selection etc. This function also performs timeout supervision for the procedure and takes actions at timeout.

The device simulation function carries out actions that are related to the simulated terminal type of the remote computer e.g. status signalling.

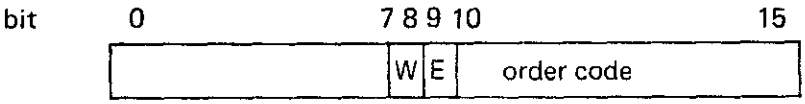
In each application program performing DC there should be a special task dedicated to the reception of random messages from the remote computer. This task is known as the "DC task". It is discussed in the TOSS User Specification (M17).

DC control characters must not appear in the body of a message. If such a character is detected during a write request (or the write part of an exchange request) it will be ignored and bit 13 "code check error" will be set in the return code.

3.4. General Interface Rules

Registers A7 and A8 are used for communication between drivers and application tasks (see LKM request types 1 and −1).

Register A7 has the following format:



where:

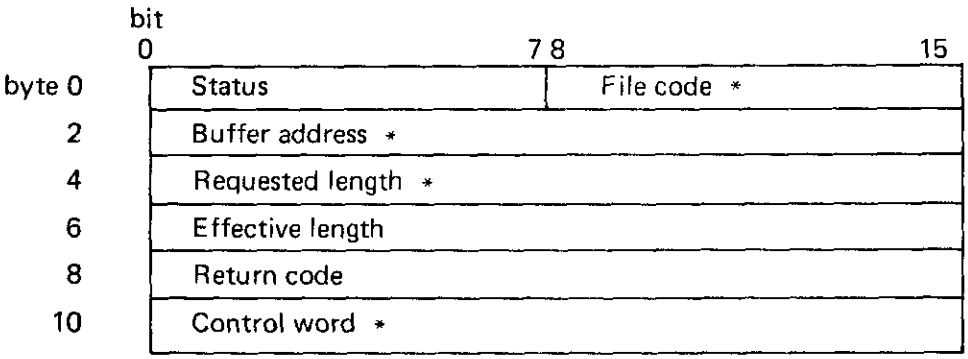
bits 0–7 are not significant.

bit 8 is the wait bit. Execution of the task will recommence at the start of the requested I/O operation if the wait bit is set to 0. If the wait bit is set to 1, execution will be suspended until the I/O operation is completed.

bit 9 is the echo bit. This bit may be set to 1 only for keyboard input operations. When set to 1, the driver automatically generates an echo of each input character on the display or printer device. The display device must have been declared as an echo device during system generation.

bits 10–15 is the order code specifying the I/O operation to be performed by the driver. Order codes have a different meaning for each driver. They are discussed in the Driver Reference section (3.6).

Register A8 points to the start of an "event control block" (ECB). The ECB has the following format:



The ECB must be reserved in the application program via the DATA and/or RES directives. The fields marked with an asterisk in the above diagram must be set by the user although the control word can be set by the driver on return e.g. order code /00, Test Status returns the current status of the device to the control word. The remaining fields are set by the drivers.

The significance of each field in the ECB is as follows:

Status — This field is used exclusively by the Monitor. The only bit of possible interest to the application programmer is the most significant (bit 0). This bit is set to 1 on completion of the I/O operation.

File code — The file code specifies the device to be used in the I/O operation and must always be present in the ECB. File codes are associated with devices during system generation. (See the list of recommended file codes below).

Buffer address — This word contains the address of the start of the buffer to be used for the I/O operation. Data is written to this memory area on input. Data is written from this memory area on output. For certain drivers and orders the buffer address is not significant and can take any value (see section 3.6).

Requested length — For an output operation, this word contains a binary number indicating the length of the output record in bytes. For an input operation this word contains a binary number indicating the **maximum** length of the input record in bytes. For certain drivers and orders the requested length is not significant and can take any value (see section 3.6).

Effective length — This word contains a binary number indicating the actual number of bytes, input or output.

Return code — This word contains a bit pattern indicating any exceptional conditions encountered during the I/O operation. The significance of some of these bits is device dependent (see section 3.6).
The significance of the remaining bits, when set to 1, is as follows:

Bit	Meaning
0	Illegal request
1–2	Not used/device dependent
3	End of file
4–8	Not used/device dependent
9	Time out/hardware error
10	End of device
11	Illegal order sequence
12	Incorrect length
13	Data fault (parity/CRC/LRC/code)
14	Throughput error
15	Not operable

Control word — This word contains device dependent control information. For certain driver and orders, the control word is not significant and can take any value (see section 3.6).

Note: The ECB is used by the Monitor during I/O. The contents of the ECB should not be changed until any associated I/O operation is completed.

The file codes which are recommended are listed below:

Recommended file code (hexadecimal)	Device
/10	System operator panel-in
/11	System operator panel-out
/12	Cassette recorder no. 1
/13	Cassette recorder no. 2
/15	Remote line test
/20	Keyboard
/25	Reserved for future use
/30 – /30,/31,/32	General printer – terminal printer TJ, TV, TR
/40	Signal display
/41	Numeric display
/50	Character display
/60	Data communication
/70	Magnetic tape
/80	Line printer
/90	Reserved for future use
/A0	Reserved for future use
/B0 – /B3	Reserved for future use
/B6	Reserved for future use
/C0 – /CF	Data management disk files
/D0	Intertask communication – input
/D1	Intertask communication – output
/F0	Fixed disk, drive 1
/F1	Cartridge disk, drive 1
/F2	Fixed disk, drive 2
/F3	Cartridge disk, drive 2
/F4 – /F7	Reserved for future use
/F8	Flexible disk, drive 0
/F9	Flexible disk, drive 1
/FA	Flexible disk, drive 2
/FB	Flexible disk, drive 3
/FC – FF	Reserved for future use

Note: File codes /F0–/FB are automatically assigned at system generation if data management is included.

3.5 Driver reference

This section contains detailed reference information for each driver. The information for each driver is given in alphabetical driver name order.

During system generation, certain parameters concerning the handling of I/O devices can be specified. These parameters are described for each driver in this section. The words "system generation" are printed in bold type throughout this section in order to highlight these parameters. Most parameters are specified during the "conditional assembly" specification for each driver. Where this is not the case the relevant part of system generation appears in brackets.

The table below shows which driver belongs to which peripheral device.

Peripheral device	Drivers
Card reader	DRCR01
Cassette recorder	DRTC01
Console typewriter	DRTW01
Data Communication – BSC multipoint	DRDC15
Data Communication – BSC point-to-point	DRDC17
Disk	DRDU01
Flexible disk	DRFD01
General terminal printer	DRGP01
Keyboards general: only 6236:	DRKB01 DRKB03
Line Printer	DRLP01
Magnetic tape recorder	DRMT01
Numeric display	DRDN01
Remote terminal	DRRT01
Signal displays, lamps on keyboards	DRDT01
SOP Panel	DRSOP1
Teller terminal printer	DRTP01, DRTP02
Video and plasma display	DRDY01

DRCR01 CARD READER **DRCR01**

General information : This driver handles one card reader PTS6885 connected to CPU via CHCD on a programmed channel only.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  -1
DATA  start address
```

Order code : /02 – standard read

Buffer address : Significant for this order

Requested length : The value must be within 0–80.

Effective length : The number of characters read up to the first space character. If there is a space in column 23, then the effective length will be 22.

Return code : The following bits may be set by this driver:

Bit	Meaning
0	Request error
3	EOF detected
10	Input hopper empty or output stacker full
12	Incorrect length – Requested length is too long (>80). Requested length is too short (there is more information on the card than has been transferred to user buffer).
13	Data fault – Received character cannot possibly be converted to ASCII. The erroneous character is replaced by a "?" (/3F).
14	Throughput error – The card reader offers a new character before the previous one has been handled by the driver.
15	Not operable – Requires an operator intervention.

DRCR01	Continued	DRCR01

Control word : Not significant.

Order : /02 – standard read.
The LKM request must be issued for each card to be read. The cards are read in Hollerith code on 12 bits, converted into ASCII code on 8 bits, and stored until requested length is reached.

Power failure : If there is a read request running when power failure occurs, the request is completed with bit 14 Throughput error set in the return code of ECB.

To be sure that no information from the actual card is lost, the card has to be read again (for instance, moved from output stacker to input hopper).

DRDC15

BSC MULTIPOINT DATA COMMUNICATIONS

DRDC15

General information : This description covers the standard Binary Synchronous Communication (BSC) Multipoint driver for PTS 6810. The driver is designed to fulfil different BSC requirements, mainly for IBM 3270 simulation.

The transmission speed should be 4800 bps or less. The driver can be used with dialled up (switched) or leased lines, two or four wire.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA 1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA-1
DATA  start address
```

Order codes : The following orders may be used:

/02 – read
/06 – write
/08 – exchange
/22 – release read buffer
/31 – get write buffer
/37 – transfer parameters

Buffer address : During **system generation** the transmit buffer length and receive buffer length must be specified.

If the length of the transmit buffer is specified as zero then the necessary buffer(s) must be reserved in the application program. In this case the application task must set the value of buffer address in the ECB before requesting order /06 (write) or /08 (exchange). These are the only orders for which the application task must set the buffer address.

Order /31 (get transmit buffer) cannot be requested if the transmit buffer length is specified as zero during **system generation**.

If the length of the transmit buffer is specified as **non** zero, two transmit buffers will be reserved within the driver. They will be allocated dynamically by the driver and need not be reserved in the application program. In this case the transmit buffer address is determined by the driver when order /31

DRDC15 — Continued — DRDC15

(get transmit buffer) is requested. A subsequent order /06 or /08 will use the buffer address set in the ECB by the get transmit buffer request. This buffer address must not be changed during the intervening period.

The first word of the transmit buffer must be reserved for use by the driver.

The length of the receive buffer must be specified as non zero during **system generation**. Two receive buffers will always be reserved within the driver. The buffer address in the ECB will be set by the driver when order /02 (read) or /08 (exchange) is requested. After an order /02 or /08 the receive buffer must be released as soon as possible by requesting an order /22 (release receive buffer).

The length of the receive buffer and transmit buffer specified during **system generation** must be equal to the length of the longest message in words.

Requested length : Only significant for orders /06 and /08. The requested length should be equal to the length of the message to be sent including the reserved word at the start of the buffer.

Effective length : Only significant for orders /02, /06, /08 and /31. For orders /02 and /08 the length will be the number of bytes of application data received. For order /06 the length will be the number of bytes of application data transmitted (including the first word). For order /31 the length will be the length of the buffer allocated.

Return code : The following bits may be set by this driver:

Bit	Meaning
0	Illegal request
2	Status change
5	Calling indicator
9	Time-out (poll time-out for DC task)
10	Carrier off
13	Code check error
14	Throughput error. Set at unsuccessful transmission
15	Not operable. Modem not ready.

DRDC15 Continued DRDC15

Control word : Only significant for orders /02, /06, /08, /31 and /37 (i.e. not order /22).

For orders /02, /06, /08 and /31 the control word contains the timeout value in multiples of 100 ms. A zero control word implies no time out function. After a request with timeout the control word will contain the timeout period remaining. After a read request performed by the "DC task" the control word contains the task address (see order /37).

For order /37 the control word holds the line address of the Terminal Computer and the logical device.

Order : /02 – read:

This order has a special function when used in a "DC task". For other tasks this order is used to receive a message addressed to a task. The control word holds the timeout value in multiples of 100 ms. Control word equal to zero means no timeout supervision. The request is completed when a message is correctly received, or because of timeout. The return code is zero if there is a message before timeout, otherwise bit 9 "timeout" will be set.

A message that is correctly received when there is no order /02 or /08 request outstanding for the addressed task is handed over to the "DC task". The DC driver will queue messages and DC status changes when there is no order /02 request outstanding from the DC task.

There is no timeout supervision on an order/02 request issued by the DC task. When a message is received the return code is zero and the task address (see order /37) is returned in the control word. On a status change bit 2 "status change" is set. At a status change one of the following bits is set in the return code:

Bit	Meaning
2	Status change
5	Calling indicator
9	Poll time out
10	Carrier off
15	Not operable. Modem not ready.

All status changes will complete the request for the DC task, e.g. "carrier off" will give return code /2020 and "carrier on" after that /2000.

When a message has been received, either by the DC task or any other task, a receive buffer in the driver has been allocated. This buffer has to be released as soon as possible using order /22 (release read buffer) in order to avoid busy situations due to lack of buffers.

Order : /06 – write

This order will queue a message for transmission on a poll. The control word holds the timeout value in multiples of 100 ms. Control word equal to zero means no timeout supervision.

All message framing characters such as STX, ETX, ... are added by the driver. The first word of the data buffer is reserved for control information. This word must be included in requested length.

The request is completed when the message has been transmitted and an acknowledgement has been received, or a time-out has occurred. If the message is successfully transmitted the return code is zero. If the transmission is unsuccessful due to procedure responses, bit 14 "throughput error" is set.
At timeout bit 9 "timeout" will be set.

If the DC driver contains write buffers, they are released on completion of the request.

This request may not be used by the DC task.

Order : /08 – exchange:

This order is a combination of orders /02 and /06. It gives the same return codes as orders /02 and /06 above. Besides, when there is a timeout before the write part has been completed bit 9 "timeout" and bit 14 "throughput error" will be set.

Order : /22 – release read buffer:

This order is used to release a receive buffer to the DC driver. The buffer address is given in the ECB. Return code is always zero.

Order : /31 – get write buffer:

This order is only included in the driver if the transmit buffer is given a non zero length during system generation.

It is used to get a write buffer from the DC driver. The request is completed when a buffer is allocated, or a time-out occurs. When a buffer is allocated the address is given in ECB and the return code is zero. Buffer length is given in ECB field effective length.

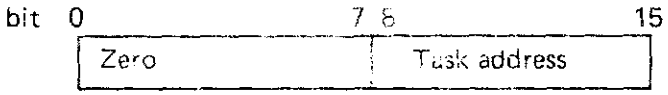
The control word holds the timeout value in multiples of 100 ms. Control word equal to zero means no timeout supervision.

At timeout bit 9 "timeout" will be set.

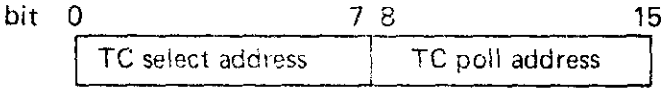
This request may not be used by the DC task.

Order : /37 – transfer parameters

For non-DC tasks this order is used to transfer the "task address" from the control word to the DC driver. The task address is an 8 bit code which uniquely identifies the task to the DC driver. It can have any binary value. The control word must have the following format:



For the DC task this order is used to transfer the terminal computer address from the control word to the DC driver. The control word must have the following format:



The request is completed immediately with return code zero.

When EBCDIC line code is used, the addresses will be transferred in EBCDIC code to the driver.

DC task file code : The file code of the DC device for the DC task is normally /60, but it may be given a different value during **system generation**.

Interrupt logging : Optionally an interrupt logger may be included in the driver. If so, all output, input and status interrupts will be logged in a circular buffer which is 200 words long and which it is possible to access with the debugging console. This facility must be requested during **system generation**.

Poll timeout value : The driver supports a poll timer which is started/restarted every time a poll sequence is received with recognizable address information. If the next poll sequence is not detected within a specified period of time, a poll timeout will occur and this event will be reported to the DC task by means of an order /02 or /08 request completion.

The timeout value in this case must be defined during **system generation** and should be given in multiples of 100 ms.

DRDC15 **Continued** DRDC15

IBM 3270 simulation : If IBM 3270 simulation is required the facilities "status and RVI handling" and possibly "read command handling" must be requested during **system generation.** These facilities are discussed in detail in the TOSS User Specification (M 17).

Transmit block length : The information exchange between the application program and the driver is always carried out on message level. For output messages the driver performs blocking if necessary. This is necessary if the message length is greater than the "transmit block length" specified during **system generation.**
The length does not include control characters such as STX, ETB or ETX.
Text blocking does not divide up the three-byte SBA order sequence, therefore the last characters of a block ending with a SBA sequence would be:
SBA, Address, Address, ETB (or ETX)

Code set : During **system generation** it is necessary to choose either an EBCDIC or ISO–7 DC code set.

This option enables the driver to communicate with ISO–7 or EBCDIC code. If ECBDIC code is chosen all incoming and outgoing characters are translated. The application program does not have to translate any information. The only thing that must be noted is that TC- and DV-addresses must be presented in EBCDIC-code by performing a "transfer parameters" request if EBCDIC code is used.

See appendix D and E for the ISO–7 and EBCDIC codes.

Recovery at power on : At power on the status of the line procedure is reset to neutral and no indication is given to the user program. No I/O requests to the DC driver are completed for this reason.

DRDC17	BSC POINT-TO-POINT DATA COMMUNICATION	DRDC17

General information : This driver enables point-to-point connection over 2 or 4-wire lines between two PTS 6810 or between PTS 6810 and any other equipment using BSC Contention or optionally Siemens MSV2, protocols. The protocols required must be specified at **system generation** time.

The driver handles traffic in both directions as controlled by the application program. Several lines can operate independently of each other in one PTS 6810. The number of lines must be specified at **system generation** time.

The transmission code can be ASCII as well as EBCDIC. The code conversion is performed by the driver. The code used must be specified at **system generation** time. EBCDIC can only be used with BSC protocols.

Optionally the driver can be adapted for EBCDIC Transparency at **system generation** time. When using this feature non-EBCDIC coding can be transmitted as transparent code. This can only be used with BSC protocols.

The driver will take care of all line control characters such as STX, ETX etc.

Blocking must be done by the application program.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

Order codes :
/02 – read
/06 – write
/22 – send RVI (reverse interrupt)
/31 – accept call
/37 – connect modem to line
/38 – disconnect line

Buffer address :
Requested length :
Effective length :
} Only significant for orders /02 and /06. For order /06 the first word of the buffer should contain control characters and these should be included in the requested length.

DRDC17 **Continued** **DRDC17**

Return code : The following bits may be set by this driver:

		Order in which bit is set					
Bit	Meaning	/02	/06	/22	/31	/37	/38
0	Always set for order /38						X
1							
2							
3							
4	WACK count out		X				
5							
6							
7	ETB received	X					
8	End of Transmission (EOT)	X	X	X			
9	Time out*	X	X	X	X		
10	RVI received		X				
11	*		X	X	X		
12	Incorrect length	X		X			
13							
14	Throughput error		X				
15	Modem not operable	X	X	X		X	

* The reason for setting these bits is different for each order, see below.

Bit 0 This bit is always set after order /38.
Bit 1 Not used.
Bit 2 Not used.
Bit 3 Not used.
Bit 4 WACK count out
Set after a reception of several WACKs on a message block. The number of WACKs is specified at **system generation** time.
Bit 5 Not used.
Bit 6 Not used.
Bit 7 ETB received
A message block terminated with ETB has been correctly received.
Bit 8 EOT
The EOT control character has been received.

DRDC17 Continued **DRDC17**

Bit 9 Order /02 Time-out
No message block has been received within the specified time.
Order /06 ENQ time-out
This bit is set at unsuccessful BID or when there has been no acknowledgement on a message block after several ENQs. The number of ENQs is specified at system generation time.
Order /22 Time out
No response to WACK within the specified time. Driver has transmitted WACK due to missing data request.
Order /31 Request time out

Bit 10 RVI received
RVI has been received as response to the message block. Another block ended by ETX should be sent to allow the other party to transmit.

Bit 11 Order /06 ENQ received
This bit is set at BID collision or when the driver is in receive mode.
Order /22 Sequence error
This bit is set when the driver is in write mode or block including ETX already received.
Order /31 Modem already connected.

Bit 12 Incorrect length
A message block has been received that is longer than the buffer.

Bit 13 Not used.
Bit 14 Throughput error
Bit 15 Modem not operable
Set when the modem has not been connected or is switched off.

Control word : Significant for orders /02, /22 and /31. The control word defines the request time-out value in multiples of 100ms. Control word equal to zero means no request time-out supervision.

Order : /02 – read block
This request enables the driver to receive one block into the user buffer.

Order : /06 – write block
The first word of the ECB-buffer contains a right-adjusted control character.

If the control character is **not NUL** the request will cause transmission of one message block terminated by ETB.

If the control character is **equal to NUL (/00)** the request will cause transmission of one message block terminated by ETX. After reception of acknowledgement the driver sends EOT and switches to control state.

If the driver is in control mode, that is neither receive nor transmit mode, a BID sequence is sent to set the receiver in receive mode.

Order : /22 – send RVI
This request is used when the reception of message blocks has to be interrupted. Send RVI request is executed instead of the normal Read request. This means that RVI is sent as a response instead of the normal ACK.

Another block has to be received normally terminated by ETX before the flow of messages is interrupted.

Order : /31 – accept call
This order will test the telephone line for a call signal. If there is a call present it will send a ringing signal back to the caller. It is recommended that this instruction is repeated a number of times to give the caller a definite acknowledgement. If a call signal is not present the order will time-out and bit 9 of the return code will be set. When a call is accepted, the modem should be connected to the line by the connect modem order (/37).

Order : /37 – connect modem to line
The modem is connected to the line, even if already connected.

Order : /38 – disconnect modem from line
The modem is disconnected and another call can be accepted. The return code is always zero.

System generation parameters : In addition to the parameters mentioned in General Information there are several other options that must be specified.

- Interrupt logging. A log routine and one circular buffer for each line are included in the driver. If included the parameter is equal to each buffer size.

- BID time-out. A station sends ENQ as a bid for the line. If two stations are connected, the time-out value should be different in case both stations bid for the line at the same time. This is known as 'line contention'.

  The standard is
  – 1 second for the primary station (Master)
  – 3 seconds for the secondary station (Slave).

- Device addresses. The device addresses are alterable as some addresses may already be defined in the system.

The driver is added to the monitor by including:

- driver
- all interrupt entries in the interrupt vector
- one File Code and one Device Work Table in each Task Table
- Power on entry in the PFTAB.

Recovery at power on : At power on any request is compited with return code bit 15, modem not operable, set. The modems are disconnected.

DRDI01

SIGNAL DISPLAYS, AND LAMPS ON KEYBOARDS

DRDI01

General information : This driver handles output to Signal Displays PTS 6241 and 6242, and lamps on Keyboards PTS 6232, 6233, 6234, 6236 and 6331. All devices must be connected to the CPU via a CHLT or CHRT.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ebc-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be used:

/05 – write lights on
/06 – write lights off
/06 – write program display–PTS 6241 only (CREDIT)
/07 – write program display–PTS 6241 only
/37 – write lights on (CREDIT)
/38 – write lights off (CREDIT)
/39 – write flashing lights.

Buffer address :
Requested length :
Effective length :
} Only significant for orders /07 and /06 when used with a program display on PTS 6241.

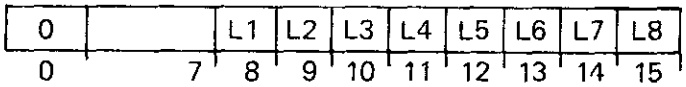
Return code : The following bits may be set by this driver:

Bit	Meaning
0	Illegal request
13	Code check error (only order/07)
15	Not operable. Power off

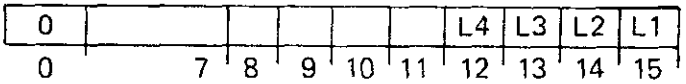
Control word : The control word specifies the lamps that will be affected at orders /05, /37, /06, /38 and /39. The bit pattern has a different meaning for different devices, and is specified below. Lamp L1 is the leftmost lamp on each device.

DRDI01 **Continued** **DRDI01**

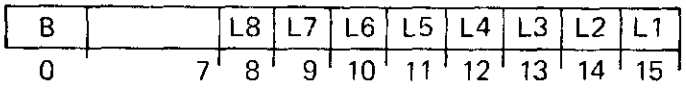
Control word for PTS 6241 and 6242.



Control word for PTS 6232 and 6234

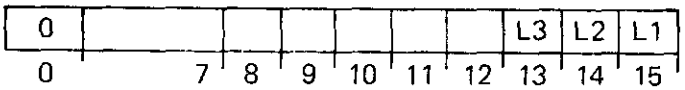


Control word for PTS 6233

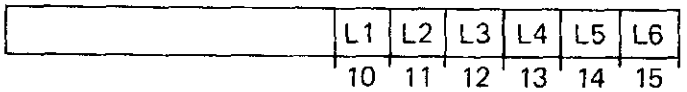


If B = 1, a buzzer is sounded at the keyboard.
This will be done for orders /05, /37, /06 and /38.

Control word for PTS 6331:



Control word for PTS 6236:



Order : /05 or /37 – write lights on:

Order /37 must be used if a CREDIT application is indicated during **system generation.**

Lights corresponding to "1" bits in the control word are turned on. Other lights are not altered.

Order /06 or /38 – write lights off:

Order /38 must be used if a CREDIT application is indicated during **system generation.**

Lights corresponding to "1" bits in the control word are turned off. Other lights are not altered.

DRDI01 Continued DRDI01

Order /07 or /06 – write program display-PTS 6241 only:

/06 must be used if a CREDIT application is indicated during **system generation.**

With these orders the program display on PTS 6241 can be controlled. 1 to 4 characters are sent to the display from the user buffer. Character codes must be in the range /30 to /6F, where:

/30–/3F are sent to the first position
/40–/4F are sent to the second position
/50–/5F are sent to the third position
/60–/6F are sent to the fourth position

The first position corresponds to the leftmost display tube on the indicator unit. Illegal character codes are ignored and bit 13 is set in the return code.

If order /07 or /06 for PTS 6241 is required it must be requested during **system generation.**

Order : /39 – write flashing lights:

Lights corresponding to "1" bits in the control word are lit up once a second. Other lights are not altered. If order /39 is required it must be requested during **system generation.**

Recovery at power on : At power on, all lights are fed with the value existent at power failure time. The information on the program display is also restored.

Note: If an attempt is made to send characters to a device that is not active (power off) the request is immediately completed with bit 15 set in the return code. Thus, to test a terminal line, order /05, /37 /06 or /38 with control word set to zero, can be used.

DRDN01 NUMERIC DISPLAY **DRDN01**

General information : This driver handles the numeric display on indicator unit PTS 6241 connected to the CPU via CHLT or CHRT.

The display may be used as an ordinary output device where numeric information is displayed from the user program.
It may also be used as an echo-device, to any keyboard that works under the keyboard driver DRKB01.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be used:

/05 – erase numeric display
/06 – write numeric display

Buffer address :
Requested length :
Effective length :
} Only significant for order /06.

Return code : The following bits may be set by this driver:

Bit	Meaning
0	Illegal request
13	Code check error (only order /06)
15	Not operable

Control word : Not significant

Order : /05 – erase numeric display:

The entire display is erased.

Order : /06 – write numeric display:

Characters in the user buffer are sent to the display.
Only digits (/30 – /39) and blank (/3F) are accepted.
All other codes are ignored and bit 13 is set in return code.
Order /06 can be excluded during **system generation** if the display is only to be used as an echo device.

DRDN01 **Continued** DRDN01

Echo function : The numeric display may be attached to a keyboard as an echo-device. Only numeric read should be used when echo is wanted at the display.

All received digits are echoed. Clear key (code /18 from the keyboard driver) erases the display. End of record key is echoed if it is a digit. However, the end of the record key will not erase the display. This should be done from user program with order /05.

Recovery at power on : At power on the display is erased. If the old information is to be restored, it has to be done from the application program.

Note: If an attempt is made to send information to a display that is not active (power off) the request is immediately completed with bit 15 set in the return code.

DRDU01 **DISK** **DRDU01**

General information : This driver handles up to two disk drives PTS 6875/PTS 6876 connected to the CPU via a MUX and CHDU on a multiplex channel. The number of disk drives should be specified during **system generation.**
Logically the cartridge disk and the fixed disk on one drive are independent of each other. However, only one disk can be operated at a time.

Each disk has its own file code.

Data is stored per sector with 205 words in each sector. The first word is reserved for a cylinder identifier, thus leaving 204 words on each sector for the user.

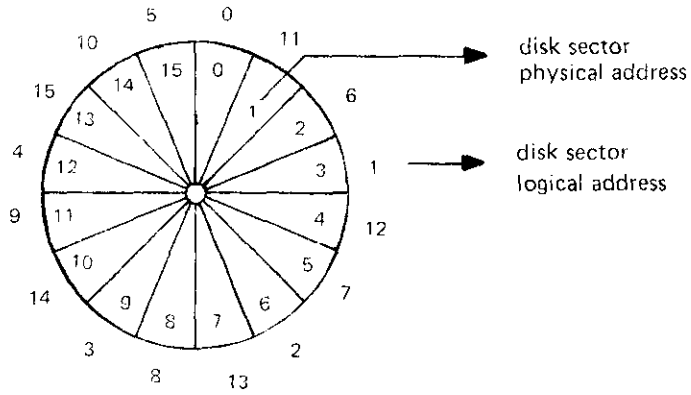
Each disk for PTS 6875 has 32 sectors per cylinder, and a total number of 204 cylinders. Thus, the total number of sectors on one disk is 6528.

Each disk for PTS 6876 has 32 sectors per cylinder and a total number of 408 cylinders. Thus, the total number of sectors on one disk is 13056.

When reading/writing a sector each sector is given a logical sector number from 0 – 6527/13055.

The physical and logical numbering systems are described briefly below and a full description is given in the manual DOS 6810 System Software M11.

There are two sector addressing systems used by the Monitor - physical addressing and logical addressing. Using physical addresses, sectors are numbered according to their physical sequence on the on the disk. Using logical addresses, sector numbers are interlaced on a "factor minus three" basis. This is done to give programs enough time to process the current sector before reading or writing the next sector. The following diagram illustrates this point:



16 sectors

DRDU01 **Continued** **DRDU01**

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be used:

/00 – test status
/01 – basic read
/05 – basic write
/11 – physical read
/15 – physical write

Buffer address : Only significant for orders /01, /05, /11 and /15. The first word in the buffer must be reserved for a cylinder identifier.

Requested length : } Only significant for orders /01, /05, /11 and /15. The value
Effective length : } of the length should always be 410.

Return code : The following bits may be set by this driver:

Bit	Meaning
0	Illegal request (e.g. illegal order, requested length or sector number)
6	Seek error. The seek operation is not correctly executed.
8	New volume loaded, request aborted. This bit will be set, at first request after the disk drive has become operable and the driver detects that a new volume has been loaded.
12	Incorrect length. End of sector is found before end of exchange.
13	Data fault. CRC-error is detected.
14	Throughput error.
15	Not operable.

Control word : Only significant for orders /01, /05, /11 and /15. It contains the logical sector number (0–6527) of the sector to be read/written.

Order : /00 – test status:

The disk drive status is checked and bit 15 in the return code is set if it is not operable.

At the completion of this request the control word holds an address pointing to a 6 character area in the Monitor where the volume name of the last loaded volume is stored.

Order : /01 – basic read:

One sector, defined in the control word is read into the user buffer. No recovery is carried out by the driver.

Order : /05 – basic write:

In the first word of the user buffer the driver will store the cylinder identifier before the sector is written. No recovery is carried out by the driver.

Order : /11 – physical read:

One sector, defined in the control word is read to the user buffer. The first word in buffer will contain a cylinder identifier, and is checked by the driver.

If a seek error, incorrect length, data fault or throughput error is detected a new read is carried out. If an error still remains after four attempts, the request is completed and the return code is set to the appropriate value.

Order : /15 – physical write:

Before the requested sector N is written the logical sector N–1 is read to check the cylinder identifier. In the first word of the user buffer the driver will store the cylinder identifier before the sector is written.

After the sector is written it will be read again to check the CRC character.

Read after write, if required, must be requested during **system generation.**

If a seek error, incorrect length, data fault or throughput error is detected the read-write-read sequence is repeated. If after four attempts an error still remains, the request is completed, and the return code is set to the appropriate value.

Recovery at power on : If there is a running request when power failure occurs, the request is immediately completed and bit 14 "throughput error" is set in the return code.
No recovery is carried out by the driver.

After power failure the disk drive will remain not operable until it is started manually.

DRDY01 **VIDEO AND PLASMA DISPLAYS** DRDY01

General information : This driver handles output to the Video Display PTS 6344 and to the Plasma Display PTS 6351. The displays to be handled must be specified during **system generation.** The display must be connected to the CPU via CHLT or CHRT. If a remote connection is made output is possible in block transmission. However, if a TFU is installed on the line, block transmission is not possible.

The driver includes device dependent echo-functions which makes it possible to use the display as an echo-device to any keyboard, that runs under the keyboard driver DRKB01.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be uses:

/00 – test status
/05 – basic write
/06 – standard write
/07 – graphic write
/0B – set cursor and write
/31 – erase

Buffer address : Only significant for orders /05, /06, /07 and /0B. For orders /06
Requested length : and /0B the first word in the buffer is used for a control code.
Effective length : This word is included in the length. For orders /05 and /07 the first word in the buffer is used for normal output data.

Return code : The following bits may be set by this driver:

		Orders in which bits are set					
Bit	Meaning	/00	/05	/06	/07	/0B	/31
0	Illegal request	X	X	X	X	X	X
13	Code check error	X		X			
14	Throughput error		X				
15	Not operable	X	X	X	X	X	X

Control word : Only significant for orders /0B and /31. It contains cursor position for order /0B or number of characters to erase for order /31.

DRDY01 Continued **DRDY01**

Order : /00 – test status:

A dummy character is sent to the display and bit 15 of the return code is set if the display is not operable (power off).

The actual cursor position is returned in the control word with the line number in the left byte and the column in the right byte.

Order : /05 – basic write:

The requested number of characters are sent to the display without any check. Trailing spaces are suppressed unless they are requested during **system generation.**

If LRC-error occurs for remotely connected displays the request is completed and bit 14 "throughput error" is set in the return code.

Note: the internal cursor position counter of the driver is not updated to correspond to the actual cursor position. Instead it is set to the home position (/0101) after each basic write request, and the value /0101 is returned in the control word when the request is completed.

This implies for display PTS 6351, that the cursor must be sent to the home position using order /0B, before orders /06 standard write or order /0B set cursor and write is used again after a basic write.

For display 6344 order /0B may be used directly since this display uses absolute cursor addressing.

Order : /06 – standard write:

First word in the user buffer is reserved for control information. It must contain one of the following codes in the right hand byte:

/2B: Cursor is not moved before the text is displayed.

/30: Cursor is sent to the leftmost position and advanced two lines before the text is displayed.

/31: The display is erased and the cursor is sent to its home position before the text is displayed.

All other codes will cause the cursor to be sent to the leftmost position and advanced one line before the text is displayed (CR/LF). Trailing spaces are suppressed unless they have been requested during **system generation.**

All alphanumeric characters within /20–/5F, in the user buffer, are accepted and sent to the display. Codes /60–/7F are reduced by /20 giving /40–/5F, if lower case is not requested at **system generation**.

DRDY01 **Continued** DRDY01

Certain special characters may appear in the buffer to control the output operation. A list of these characters is given at the end of this section. These characters, if used, should be counted in the requested length.

Illegal character codes in the user buffer are ignored and bit 13 is set in the return code.

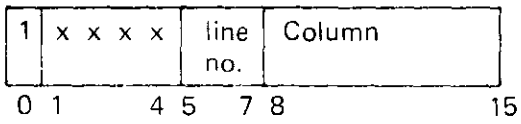
After the write request the actual cursor position is returned in the control word, with line number in left byte and column in right byte.

If LRC-error occurs for remotely connected terminals the message is retransmitted by the driver. No indication is given in the return code.

Order : /07 – graphic write:

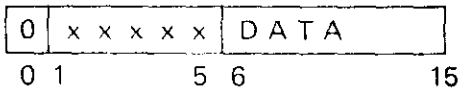
To control the graphic part of the plasma display PTS 6351 order /07 is used.
The display is switched to graphic mode and information in the user buffer is transmitted.
Two types of information may be present in the user buffer: "address" and "data".

- Address:



bit 0 = 1 : Indicating address
bit 1 – 4 : Not significant
bit 5– 7 : Line number (0 – 7) where next data word will be displayed
bit 8–15 : Column (0–255) where next data word will be displayed.

- Data:



bit 0 = 0 : Indicating data
bit 1– 5 : Not significant
bit 6–15 : 10 bits of information, where each bit set will light up a dot in the addressed line and column. Bit 15 corresponds to the lowest dot within a line.

Each address or data-word will result in output of two characters to the display.

It is not possible to rub out information from the screen, when the display is in graphic mode.

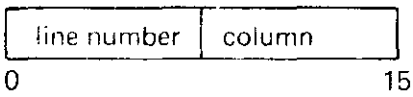
The display will be switched to alphanumeric mode if any of the orders /00, /05, /06 and 0B is given. The cursor will appear in home position when switching from graphic to alphanumeric mode.

After power fail the display will be in alphanumeric mode.

If graphic mode is required (order /07) it must be requested during **system generation.**

Order : /0B – set cursor and write:

By means of this order the cursor may be sent to any position on the screen before the text is displayed. No information on the display is erased. The cursor position is given in the control word as two binary values. The left byte contains a line number and the right byte contains the position within a li /0101 is the cursor home position. (PTS 6344 20 lines, 64 char/line · option 24 lines, 80 char/line . PTS 6351, 8 lines 36 char/line)
Control word:



After the cursor is positioned, the text in user buffer is displayed according to the same rules as for order /06 standard write. The first word in the buffer is not significant but should be included in the requested length. Requested length set to zero or two will cause cursor positioning only.

After the request the new cursor position is returned in the control word.

As for order /06 LRC-errors are handled by the driver.

Order : /31 – erase:

By means of this order a number of characters can be erased on one line. For PTS 6344 this is done in fast output mode. The order is executed on the line at which the cursor is positioned and erasing starts at the cursor position. The cursor remains in that position. The number of characters to be erased is given in binary form in the control word (1–64/80 characters for PTS 6344, 1–36 characters for PTS 6351).

DRDY01 **Continued** DRDY01

Echo function : The display may be attached to a keyboard as an echo-device. All alphanumeric characters within the range /20–5F are echoed. Echo of end of record key must be requested during **system generation** if required.

Backspace key (code /08 from the keyboard driver) will move the cursor one step to the left. The cursor cannot be moved further to the left than the position it had before the read with echo request. Cursor movement is destructive.

Clear key (code /18 from the keyboard driver) will erase the information that has been echoed for the running read request and the cursor is sent to the position it had before the read-with-echo request.

Recovery at power on : If there is a running request when power fail occurs the request is immediately completed and bit 15 "not operable" is set in the return code.

At power on the display is erased and the cursor is sent to its home position. Power on is also signalled to the application via the keyboard driver DRKB01.

If a write request is done to a display which has power off on the selector unit and/or the display itself, this request is immediately completed with bit 15 "not operable" set in the return code.

Control characters for Video and Plasma Displays : **General**

The following special characters may appear in the buffer to control the output operation.

Characters Valid for All Displays

/AE: Displayed as point (/E2)
/11: Tabulation character. This character should be followed by two ISO–7 digits giving the tabulation position.
/07: Bell is sent to the display.

Characters Valid for PTS 6344 and 6351 only

/0A: Cursor down (line feed).
/08: Cursor left, non-destructive (backspace)
/10: Cursor right, non-destructive.
/20: Cursor right, destructive.
/0B: Cursor home.
/0C: Clear and cursor home.
/0D: Carriage return.

Characters Valid for PTS 6344 only

/12: Underline start. Output of characters which follow this character are provided with underline.

DRDY01

Continued

DRDY01

/13: Underline stop. Output of characters which follow after this character are *not* provided with underline. Underline stop mode will also appear at request end.

/14: Fast output. First character following /14 will be transmitted in fast output mode up to requested length. Note that cursor will remain unchanged.

/1C: Data to keyboard.

/1D: Master clear to keyboard.

/1E: Low intensity start. Output of characters which follow after this character, are displayed at low intensity.

/1F: Low intensity stop. Output of characters which follow after this character are displayed at normal intensity. Normal intensity mode will also appear at request end.

DRFD01 **FLEXIBLE DISK** **DRFD01**

General information : This driver handles up to four chained flexible disk units connected to CPU via channel unit CHFD on multiplex or programmed channel, according to the option specified during system generation. For PTS 6805 only one or two flexible disk drives are included in the configuration.

Logically the disk drives are independent of each other. However, physically only one disk drive can be operated at a time.

Each disk drive has its own filecode.

On the physical level the Flexible Disk should be pre-formatted compatible to IBM 3740. Data is stored per sector with 128 bytes in each sector. Each disk has 26 sectors per track and a total number of 77 tracks. Thus, the total number of sectors in one disk is 2002.

In the text three different abbreviations are frequently used:

Standard: refers to TOSS-labelled disks when the standard type of driver is used.

DM: refers to TOSS-labelled disks when the Data Management type of driver is used.

IBM: refers to IBM-labelled disks.

Types of disk : Two different types of disks are handled by the driver, TOSS- and IBM-labelled disks.

TOSS-labelled disks
When physical reading/writing a sector, each sector is given a **standard** logical sector number from 0-2001. One to four sectors may be read/written at the same request.
Note: Different logical sector numbering may be used, according to the type of driver used, see below, "Types of Driver."

IBM-labelled disks
The driver provides means for sequential access to IBM-labelled disks. **One** Data Set per drive may be sequentially read from or written onto disk. However, it is the user's responsibility to ensure that track 00 contains a correct label before using the IBM-labelled disk. It is possible for the user to create a Data Set and write all necessary labels onto track 00 by means of TOSS utility program WRITE IBM LABELS.

The data fields of the IBM-labelled disk affecting the driver are:

- Volume ID-field
- Beginning of Extent (BOE) of specified Data Set Label
- End of Data (EOD) of Specified Data Set Label
- End of Extent (EOE) of specified Data Set Label

The driver can only affect the EOD-field of the disk.

Random access to an IBM-labelled disk is also supported by the driver. Up to four sectors at a time can be addressed and a **standard** logical number from 0—1923 should be given.

All data on IBM-labelled disks should be EBCDIC-coded and the conversion EBCDIC<—>ASCII is performed by the driver.

The driver keeps track of which type of disk is put into each drive by checking the volume label when load request is performed. Thus, any mixed combination of IBM/TOSS-labelled disks is permitted (if IBM-labelled disk handling is specified during **system generation**).

Types of driver : At system generation time it is possible to specify which of two types of driver is required, "Standard" or "Data Management" type. Each type uses the flexible disk in a different manner.

The Standard driver uses standard logical sector numbers from 0—2001. One standard logical sector corresponds to one physical sector of 128 bytes. IBM-labelled disk handling is not included. TOSS-labelled disks should be used, but any different labelled disk may be used, provided the IBM-labelled disk handling is not included. However, the driver will then always assume that the Volume Name is stored at the beginning of sector 0.

The Data Management driver uses DM logical sector numbers from 0—499. Four consecutive physical sectors are combined into one logical sector of 512 characters. However, only 410 of these are used. Thus, to convert a DM logical sector to a standard logical sector the former should be multiplied by four.

Only TOSS-labelled disks should be used.

During **system generation** IBM-labelled disk handling may be included in the Standard or DM-driver. If IBM-labelled disk handling is included, it will not affect the access to TOSS-labelled disks. Thus, for TOSS-labelled disks the logical sector numbering stated above is valid although Standard logical sectors from 0—1923 are used for IBM-labelled disks.

Calling sequence : Normal I/O only

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

DRFD01 **Continued** **DRFD01**

Order codes : The following orders may be used:

/00	test status
/01	basic read
/02	sequential read
/05	basic write
/06	sequential write
/0C	write deleted data
/11	physical read
/15	physical write
/1A	search key
/26	lock
/31	rewind
/37	load
/38	unload

Buffer address : Only significant for orders /01, /02, /05, /06, /0C, /11 and /15.

Requested length :
Effective length : When writing onto disk, requested length should be:

Standard: $\leq[(N+1) \times 128]$ where N = 0–3
DM: ≤ 410
IBM: $\leq[(N+1) \times 128]$ where N = 0–3

However, requested length at sequential read/write should always be 128.

Control word contains the logical sector number to be read/written.

Return code : The following bits may be set by this driver:

		Orders in which bit is set											
Bit	Meaning	/00	/01	/02	/05	/06	/0C	/15	/1A	/26	/31	/37	/38
0	Request error	X	X	Y	X	Y	X	X	X	X	Y	X	X
1	Key not found								X			Y	
2	Zero												
3	End of data			Y									
4	No data		X	Y					X				
5	End of extent					Y							
6	Write protected	X			X	Y	X	X					Y
7	Retries performed		X	Y	X	Y	X	X	X	X		X	Y
8	Zero												
9	Zero												
10	IBM label	Y								Y		Y	
11	Zero												
12	Incorrect length		X	Y	X	Y	X	X	X				
13	CRC-error		X	Y		Y	X	X	X	X		X	Y
14	Seek error		X	Y	X	Y	X	X	X	X		X	Y
15	Not operable	X	X	Y	X	Y	X	X	X	X	Y	X	X

X Standard/DM/IBM
Y IBM only

DRFD01

Continued

DRFD01

Bit	*Meaning*
0	*Request error* (e.g. illegal order, order not accepted, requested length or sector no.).
1	*Key not found* Search key request: This bit will be set if no record is found within the given limits or if the key has not been found and records could not possibly be read correctly within the limits of the search. Load request: This bit will be set if the contents of BOE/EOD/EOE-fields were impossible to transform to approved logical sector numbers.
3	*End of data* Sequential read request: This bit will be set if a record with a number greater/equal than EOD (end of data) is addressed. Request is aborted.
4	*No data* If any of the read sectors has a deleted data address mark this bit will be set.
5	*End of extent* Sequential write request: Set if an attempt is made to write outside physical space reserved for the data set at creation time.
6	*Write protection* This bit set indicates write protected flexible disk (hole in the envelope).
7	*Retries performed* Retries have been made by hardware due to CRC or seek errors.
10	The disk has an IBM label.
12	Incorrect requested length.
13	*CRC error (data fault)* This bit is set if CRC error still remains after recovery performed by hardware.
14	*Seek error* This bit is set if the requested track is not found after recovery performed.
15	*Not operable* If bits 0 and 15 are set, the request has been aborted due to unlocked drive.

Control word : The control word requirement can differ in each order depending upon which kind of disk is being handled. Refer to the notes of each order.

Order : /00 – Test status

The addressed disk drive is selected and its status is checked.

At return, control word holds an address pointing to a 6 character area in monitor where the volume name is stored. However, if at return bit 0 or 15 of return code is set, the volume name might not be significant.

Actual Return Code in ECB may be:

- Bit 0 Request error
- Bit 6 Write protected
- Bit 10 IBM-label
- Bit 15 Not operable

The read/write head is not moved by this order.

Order : /01 – Basic read

STD/IBM – One to four sectors are read into the user buffer. The requested length should be $\leq [(N+1) \times 128]$ where N = 0–3, the numbers of sectors.

DM – One DM-sector or part of one DM sector is read into the user buffer. The requested length should be ≤ 410.

The control word should contain the number of the first sector to be read. All recovery is performed by hardware.

Order : /02 – Sequential read

STD/DM – Not used.

IBM: The CRN is incremented by one and the record pointed to by CRN is read to the user buffer.

Requested length should be 128.

Control word will at return contain the standard logical sector number of the addressed sector.

If a record with a number greater than or equal to EOD is addressed, the request is aborted and bit 3 of return code is set.

This request is only accepted if the corresponding data set has been opened by a LOAD request.

DRFD01 **Continued** **DRFD01**

Order : /05 — Basic write

STD/IBM: One to four sectors are written from the user buffer. The number of sectors to be written is given in the requested length as ≤ [(N+1) x 128] where N = 0—3, the number of sectors.

DM: One DM sector is written from the user buffer. The requested length should be 410.

The control word should contain the logical sector number of the first sector to be written. All recovery is performed by the hardware.

DRFD01 **Continued** DRFD01

Order : /06 – Sequential write

STD/DM: Not used

IBM: One sector is written from the user buffer to the sector pointed to by the corresponding EOD number in the driver. The EOD number is incremented by one.

Requested length should be 128.

Control word will at return contain the standard logical sector number of the addressed sector.

If an attempt is made to address a sector behind the EOE, the request is aborted with bit 5 of return code set.

Order : /0C – Write deleted data

STD/IBM: One to four sectors are written from the user buffer. The requested length should be $\leq$[(N+1) x 128] where N = 0–3, the number of sectors.

DM: One DM sector is written from the user buffer. The requested length should be $\leq$410.

The addressed sectors are preceded by a 'write deleted data address mark'. The control word should contain the logical sector number of the first sector to be written. Read after write is performed by hardware as is all recovery after write/seek errors.

Order : /11 – Physical read

STD/IBM: One to four sectors are read to the user buffer. The number of sectors to be written is given in the requested length as $\leq$[(N+1) x 128] where N = 0–3, the number of sectors.

DM: One DM sector is read to the user buffer. The requested length should be $\leq$410.

The control word should contain the logical sector number of the first sector to be read. All recovery from read/seek errors is performed by hardware.

Order : /15 – Physical write

STD/IBM: One to four sectors are written from the user buffer. Number of sectors to be written is given in requested length of ECB. [(N+1) x 128], N = 0–3.

DM: One DM-sector is written from the user buffer. The requested length should be 410.

The control word should contain the logical sector number of the first sector to be written.

Read after write is performed by hardware and also all recovery from write/seek-errors.

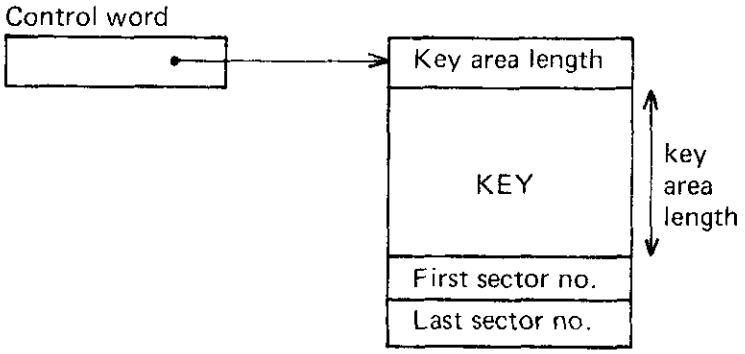
Order : /1A - Search key

DM/IBM: Not used.

STD: This order is used to find and read one particular record, of which the first data are identical to the key.

The key must be defined in an area pointed to by the control word. The first word of this area should contain the key area length.

The key must end with two words defining the first and the last record between which the search is to take place. The control word points to the key buffer area.



Requested length should be 130.

Note: If the key itself contains an odd number of characters, the last character is rejected as not significant.

The data buffer area pointed to by the ECB will contain the requested record preceded by a word containing the record number. Thus, the buffer length used should be 130 characters.

Recovery from read/seek errors is performed by hardware.

Order : /26 – Lock

The driver locks the door of the selected drive. If IBM-labelled disk handling is included in the driver, standard logical sector 0 is read to check whether this disk is TOSS-labelled. If it is not, the driver assumes the disk is IBM-labelled. The volume name is read by the driver and saved.

If an error occurs and the driver is unable to read the volume name, the disk drive will be unlocked at return.
This order must be successfully executed before any other order is accepted for this disk drive.

STD/DM: The control word is not significant.

IBM: The control word should contain the standard logical sector number of the data set label (between 8 and 25 inclusive). The data set is not opened.

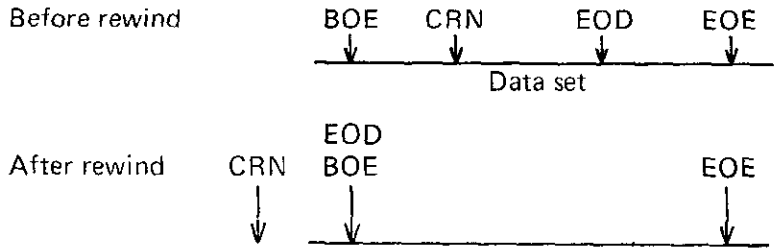
Order : /31 – Rewind

STD/DM: Not used.

IBM: The EOD-number of selected drive is set equal to the BOE number. The current record number is set equal to the BOE –1.

This order is only accepted if the corresponding data set has been opened by a Load request.

The read/write head is not moved by this request.



Order : /37 – Load

The driver locks the door of the selected drive. If IBM-labelled disk handling is included in the driver, standard logical sector 0 is read to check whether this disk is TOSS-labelled. If it is not, the driver assumes the disk is IBM-labelled. The volume name is read by the driver and saved.

If an error occurs and the driver is unable to read the volume name, the disk drive will be unlocked at return.

This order must be successfully executed before any other order is accepted for this disk drive.

STD/DM: The control word is not significant.

IBM: The control word should contain the standard logical sector number of the data set label (between 8 and 25 inclusive).

After the driver has taken the actions described above, the BOE, EOD and EOE fields of the specified data set label are read from the disk. The contents of these fields are transformed to standard logical sector numbers and saved in the driver. In the text these numbers saved in core are called BOE-no, EOD-no, and EOE-no respectively. If any of these numbers is not approved by the driver bit 1 of the return code is set and the drive is unlocked.

The current record no. (CRN) is set equal to the BOE −1.

Note: For a Sequential Read/Write request no data is affected of the data set label on disk. However, the CRN or the EOD-no in the driver is updated. Random access does not affect the data set handling.

Order : /38 – Unload

Door of selected drive is unlocked. Requested length, buffer address and control word are not significant.

IBM: Before unlocking, the driver checks if any data set was opened for this drive. If so the EOD-field of the data set label is updated to the last sector number addressed by a sequential write + 1.

Recovery at power on : All doors locked at the time of power failure will be locked during power off and after power on.

If there was a running request at the time of power failure, the driver will repeat this request. If not successful bit 13 of return code will be set.

DRGP01 **GENERAL TERMINAL PRINTER** **DRGP01**

General information : This driver handles General Terminal Printer PTS 6321 connected to the CPU via CHLT or CHRT.

The driver also includes a device dependent echo-function which makes it possible to use the general printer as an echo-device to any keyboard that runs under the general keyboard driver DRKB01.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be used:

/00 – test status
/05 – basic write
/06 – standard write

Buffer address : Only significant for orders /05 and /06. For order /06 the
Requested length : first word in the buffer should be reserved for a control code.
Effective length : This word is included in the length. For order /05 the first word in the buffer is used for normal output data.

Return code : The following bits may be set by this driver:

		Orders in which bits set		
Bit	Meaning	/00	/05	/06
0	Illegal request	X	X	X
13	Code check error			X
14	Throughput error		X	
15	Not operable, power off	X	X	X

Control word : Not significant.

Order : /00 – test status:

A dummy character is sent to the printer. If time-out is signalled by the channel unit bit 15 of the return code is set.

Common functions for orders /05 and /06:

Continuation of request when the selector unit or printer is inactive may be requested during system generation (bit 15 set in return code).

DRGP01 Continued DRGP01

Order : /05 – basic write:

The requested number of characters are sent to the printer without any check. Trailing spaces are suppressed unless they are requested during **system generation.**

Order : /06 – standard write:

First word in the user buffer is reserved for control information. It can contain one of the following codes in the right hand byte:

/2B: print the line without advancing the paper. The print-head is not moved before printing the text.
/30: advance the paper two lines before print-out and make carriage return.

All other codes will cause carriage return and line feed before print-out.

All alphanumeric characters within the range /20–/5F, in the buffer, are accepted and sent to the printer. Codes /60–/7F are reduced by /20 giving /40–/5F. Furthermore, the following special characters may appear in the buffer to control the output operation:

/AE: Point is printed as roomless. That is, the digit after /AE is code converted and printed as a roomless point digit (point is placed to the left of the digit).

If roomless point is excluded from the driver /AE is printed as an ordinary point.

/13: This code is sent directly to the printer. By hardware, this will cause a special symbol to be generated.
/14: Same as for code /13.
/11 Tabulation character. This character should be followed by two ISO–7 digits giving the tabulation position.
/09: Hardware tabulation. Note: hardware tabulation will reset the head position counter included in the driver. This may cause text to be overwritten in recovery situations.

The special characters and the tabulation position should be included in the requested length.

Illegal character codes in the user buffer are ignored, and bit 13 is set in the return code. A dot is printed in place of the illegal code and printing continues.

Trailing spaces are suppressed at print-out unless they are requested during **system generation.**

If special characters /13 and /14 are to be used they should be requested during **system generation.** Non standard character codes for roomless point digits can also be specified during **system generation.**Alternately the handling of roomless point codes can be suppressed.

Echo function : The General Printer may be attached to a keyboard as an echo-device. All alphanumeric characters within the range /20—/5F are echoed. Each character is echoed together with a space to get visibility of the last printed character. Space must be requested during **system generation** if it is required.

End of record character is echoed if it has a code within the range /20—/5F for standard read or /30—/39 for numeric read. This must be requested during **system generation** if it is required. Backspace key (code /08 from the keyboard driver) is echoed and will be represented by an underline character. After the echoed backspace, the print head advances to the next character position. Cancel key (code /18 from the keyboard driver) is echoed. The paper is then advanced one line and the print head is sent to the position it had before the read with echo-request. Head positioning is carried out with backspace.

The codes to be used for backspace key, cancel key, end of record key and multiple zero key must be specified for the associated keyboard during **system generation** (terminal device class/echo device class).

Recovery at power on : At power up the following actions are taken:

- If the order is /06, the print head is sent to the position it had before the write-request and the line is printed once more. No indication is given in the return code.
- If the order is /05, bit 14 is set in the return code and the request is completed.
- If the printer is in echo-mode no recovery is carried out.

DRKB01 **KEYBOARD** **DRKB01**

General information : This driver handles input from numeric and alphanumeric keyboards PTS 6231, 6232, 6233, 6234, 6331 and 6342 connected to CPU via CHLT or CHRT.

Only input data from depressed keys are handled by this driver. Output data to signal indicators are processed by a special Signal Display Driver (DRDI01).

For every keyboard in the system there is a circular input buffer, where depressed keys are stored if no read request is running. When a read request is set up the information in this buffer is transferred to user buffer.

An echo-device can be attached to every keyboard.

Calling sequence

Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be used:

/01 – basic read
/02 – standard read
/03 – numeric read
/04 – SKip circular input buffer
/31 – SKip circular input buffer (CREDIT).

Buffer address :
Requested length : } Significant for all order codes. The end of record key is included in the length.
Effective length :

Return code : The following bits may be set by this driver:

		Orders in which bits set				
Bit	Meaning	/01	/02	/03	/04	/31
0	Illegal request	X	X	X	X	X
9	Time-out	X	X	X		
12	Incorrect length		X	X		
13	Undefined key		X	X		
14	Throughput error	X	X	X		

DRKB01 — Continued — DRKB01

Control word : Significant for orders /02 and /03 only. For these orders the control word may contain a keytable address. The key table contains a list of end of record keys. If the keytable address is zero then no keytable will be used. The format of the keytable is as follows:

byte		
0	No. of EOR keys	key 1
2	key 2	key 3
4	key 4	key 5
	etc.	

Order : /01 – Basic read:

The requested number of characters are read and stored in the user buffer without any check. If overflow had occurred in the circular input buffer, at time of request the read request is completed with bit 14 set in the return code.

Common functions for orders /02 and /03 : The driver checks every received character in the following sequence:

- If overflow had occurred in the circular input buffer at the time of request, the request is completed with bit 14 set in the return code.
- Received characters are code converted, if this facility is included, before any further handling of the characters.
- If received character is found in keytable the key is stored in the user buffer and the request is immediately completed. The end of record key is also code converted and stored in the control word so that KEY 1 gives 0, KEY 2 gives 2, KEY 3 gives 4 and so on to enable indexing.

  If a CREDIT application is indicated during **system generation** KEY 1 will give 1, KEY 2 will give 2, KEY 3 will give 3 etc.

  If the keytable address is zero in the control word a standard key, KBEOR, is treated as end of record key.
- Special characters are checked (e.g. multiple zero, clear key etc.) and corresponding functions are carried out.
- Alphanumeric/Numeric characters are stored in the user buffer. If overflow occurs in the user buffer the request is completed with bit 12 set in the return code.

- If received character cannot be identified in the tests above, it is treated as undefined and the request is completed with bit 13 set in the return code. The undefined key is stored in the user buffer and the control word remains unchanged.

Order : /02 – Standard read:

Alphanumeric characters within the range /20–/5F or /20–/7F, depending upon the type of keyboard specified during **system generation** (device class definition) are accepted and stored in the user buffer. If standard read is required it must be requested during **system generation.**

Order : /03 – Numeric read:

Only digits within the range /30–/39 and /70–79 are accepted and stored in the buffer (/70–79 are converted to /30–/39 before storing in the user buffer). Characters within the range /70–/79 may be excluded depending upon the type of keyboard specified during **system generation** (device class definition).

Order : /04 or /31 – skip circular input buffer:

Code /31 must be used if a CREDIT application is indicated during **system generation.**

The information in the circular input buffer is deleted, and the request is completed.

Special characters : Some keys have a special meaning to the driver. The codes for these keys can be user defined. For keyboards 6231, 6233 and the numeric part of 6234 the special keys are independent of key switch position. Codes for key switch in position 1 should be used.
The special keys are:

KBEOR: Standard end of record key. Used by the driver when the keytable address is zero.

KBCLR: Cancel key. The user buffer is cleared. This does not cause completion of the request.

KBBSP: Backspace key. The last reported character is cleared in the user buffer. This does not cause completion of the request.

KBMZ: Multiple zero. Two or three zeros are stored in the user buffer, when this key is received. The number of zeros to be stored must be indicated during **system generation.**

DRKB01 — Continued — DRKB01

The codes to be used for backspace key, cancel key, end of record key and multiple zero key must be specified for the associated keyboard during **system generation**.

Echo function : Input characters are echoed if the E-bit is set in register A7 during the LKM-request. The read request is accepted only when the echo-device is free. Else the request is queued. The device-dependent echo-function is included in the driver for the output device, and is not described here.

If echo is required it must be requested during **system generation** and an echo device must be associated with the keyboard.

The following information is transferred to the echo-device from the keyboard driver:

- Standard read
  Characters within the range /20–/5F or /20–/7F depending upon the type of keyboard specified during **system generation** (device class definition).
- Numeric read
  Characters within the range /30–/39.
- Basic read
  Echo not allowed, for code check reasons.
- Special Characters
  (both standard and numeric read)
  /08 Backspace key
  /18 Cancel key

Time out : For each keyboard in a system it is possible to include a time-out function. That is, if a key has not been pressed within a certain time, the request will be ended with bit 9 set in the return code. The timer is restarted for each depressed key. The time before time-out is the same for all keyboards. If time-out is required it must be requested during **system generation.**

Double keyboard handling : If two keyboards, one alphanumeric and one numeric are used at the same work position or if keyboard PTS 6234 is used, these keyboards can be treated as one device, despite the fact that two device addresses are used. To avoid code interference the driver can be adapted to convert all function keys of the numeric part by setting the "8–bit" in the received code. Digits will give codes /30–/39 independent of keyswitch position.

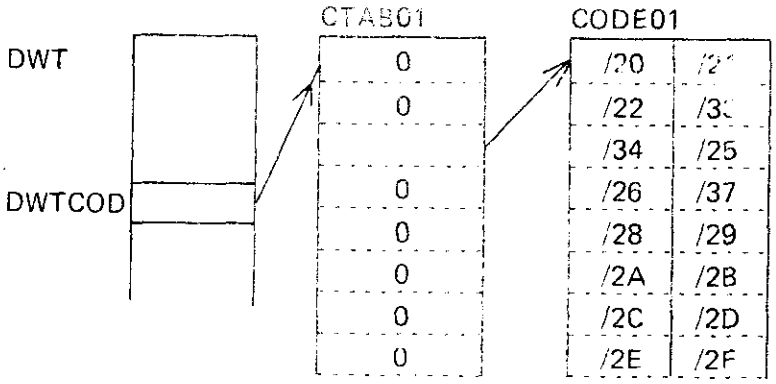
DRKB01 — Continued — DRKB01

Appendix B shows all codes generated as seen from the application program for keyboard PTS 6234.
Appendix C gives the same information for keyboard PTS 6231.

Note: If keyboard PTS 6231 will work within the same system in conjunction with PTS 6234, input from the 6231 can be code converted by "8–bit" setting to get full code compatibility with PTS 6234.

Code conversion : The driver can, optionally, code convert input characters. That is, the user can at **system generation** time, (device class definition) define one or more columns in the ISO–7 table to be converted for a specific keyboard in the system.

The conversion is achieved with the following table structure.



DWTCOD of the device work table holds an address of an 8–word table CTAB01, indicating the columns to be converted. (DWTCOD) = 0 means no conversion for this keyboard.

Each non-zero entry in CTAB01 gives the address of the code conversion table for the specific column. In the example above codes /23, /24 and /27 are converted to /33, /34 and /37 respectively. The conversion tables can be common for several keyboards.

Only codes between /00–/7F can be converted. So if "8–bit" setting is used (double keyboard handling) these codes cannot be code converted via conversion tables.

Code /FF is used by the driver and must not be used as a converted code.

Completion of read request at power on : If there is a read request this is completed with -2 set in the control word. If not, a power up flag is set causing the first read request after power on to be completed with control word set to -2.
If a CREDIT application is specified during **system generation** power fail indication will be zero instead of -2.

If completion of read request at power on is required it must be requested during **system generation**.

DRKB03 — KEYBOARD — DRKB03

General information : This driver handles input from alphanumeric keyboard PTS 6236 connected to CPU via SUM and CHLT/CHRT. Input from keyboards 6231, 6232, 6233, 6234, 6331 and 6342 should be handled by driver DRKB01.
Only input from depressed keys is handled by this driver. Output data to signal indicators are processed by a special Signal Display Driver (DRDI01).
For every keyboard in the system there is a circular input buffer, where depressed keys are stored if no read request is running. When a read request is set up the information in this buffer is transferred to the user buffer.
An echo-device can be attached to every keyboard. The echo function must be defined at system generation time.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LKM
DATA  -1
DATA  start address
```

Order codes : The following orders may be used:

/01 – basic read
/02 – standard read
/03 – numeric read
/31 – skip circular input buffer (CREDIT)

Buffer address :
Requested length :
Effective length :
} Significant for order codes /01, /02 and /03. The end of record key is included in the length.

Return code : The following bits may be set by this driver:

		Orders in which bits set			
Bit	Meaning	/01	/02	/03	/31
0	Illegal request	X	X	X	X
9	Time-out	X	X	X	
12	Incorrect length		X	X	
13	Undefined key		X	X	
14	Throughput error	X	X	X	

DRKB03 **Continued** DRKB03

Control word : Significant for orders /02 and /03 only. For these orders the control word may contain a keytable address. The keytable contains a list of end-of-record keys. If the keytable contains zero at the completion of the request, a power failure has occurred. If it contains a negative value, a key-lock code has been received. A key-lock code cannot be specified as an end-of-record key. The format of the key table is as follows:

byte		
0	No. of EOR keys	key 1
2	key 2	key 3
4	key 4	key 5

etc.

Order : /01 – Basic read

The requested number of characters are read and stored in the user buffer without any check. Code conversion is performed according to appropriate conversion table. If overflow has occurred in the circular input buffer at time of the request, the read request is completed with bit 14 "Throughput Error" set in the return code.

Received characters from the key-switch locks (codes /70 – /77) are stored in the user buffer. The internal status indicator of the key-switch position is also updated.

If a power failure occurs during the request no action is taken. (No completion of the request.)

Common functions for orders /02 and /03 : The driver checks every received character in the following sequence:

- If overflow has occurred in the circular input buffer, the request is completed with bit 14, "Throughput Error", set in the return code.
- If the received character derives from a key-lock (codes /70 – /77) the request is completed with a negative value set in the control word. Key-lock code is also stored in the user buffer.
- SHIFT and CTRL keys will only set internal status and are never transferred to the user buffer.
- Received characters are code converted according to the appropriate conversion table before any further handling of the characters.

DRKB03 Continued DRKB03

- If a converted character is found in the keytable that indicates an end-of-record key, the character is stored in the user buffer and the request is immediately completed.
- The EOR-key is also converted and stored in the control word of the ECB so that KEY 1 gives 1, KEY 2 gives 2, KEY 3 gives 3 and so on, to enable indexing.
- Special characters are checked (e.g. multiple zero, clear, etc.) and corresponding functions are carried out.
- If the converted character cannot be identified in the tests above, it is treated as undefined and the request is completed with bit 13 "Undefined Key" set in the return code. The undefined key is stored in the user buffer and the control word remains unchanged.

Order : /02 – Standard read

- Alphanumeric characters within the range of /20–/7F after conversion are accepted and stored in the user buffer. If overflow occurs in the user buffer the request is completed with bit 12, "Incorrect Length" set in the return code.

Order : /03 – Numeric read

The numeric read has the same functions as standard read except that only digits within the range of /30 – /39 after conversion are accepted and stored in the user buffer.

Order : /31 – Skip circular input buffer

The information in the circular input buffer is deleted, and the request is completed.

Special characters : Some keys have a special meaning to the driver. The codes for these keys are user-defined and the converted codes should always be used. The special keys are:

KBCLR: Clear key. The user buffer is cleared. This gives no completion of the request.

KBBSP: Backspace key. The last received character is cleared in the user buffer. This gives no completion of the request.

KBMZ2: Double zero key. Two zeroes are stored in the user buffer.

KBMZ3: Triple zero key. Three zeroes are stored in the user buffer.

DRKB03 **Continued** DRKB03

Echo function : Input characters are echoed if the E-bit is set in register A7 during the LKM-request and if an echo-device is attached to the keyboard at system generation time. Note that converted characters are echoed. The read request is accepted only when the echo-device is free, else the request is queued. The device-dependent echo function is included in the driver for the output device, and is not described here.

The following information is transferred to the echo-device driver from the keyboard driver:

- Basic read
  All characters but key-lock, SHIFT and CTRL information.
- Standard read
  Characters within the range /20 – /7F.
- Numeric read
  Characters within the range /30 – /39.
- Special characters
  (both standard and numeric read)

/18	Clear key
/08	Backspace key
/30, /30	Double zero key
/30, /30, /30	Triple zero key

Time-out : Each keyboard in a system includes a time-out function. That is, if a key has not been depressed within a certain time, the request will be ended with bit 9 "Time-out" set in the return code. The timer is restarted for each depressed key. The time before time-out is the same for all keyboards. If this facility is required it should be specified at **system generation** time.

Key-lock : Changed key-lock position will be received as input characters. This will always cause a completion of a running Standard or Numeric Read request with a negative value in the control word.

If such a request is not running the completion will be done on subsequent request. If more than one key-lock has been changed only one key-lock change will be reported at a time.

The negative value in control word has the following meaning:

–1	Key-lock no. 4 turned OFF
–2	Key-lock no. 3 turned OFF
–3	Key-lock no. 2 turned OFF
–4	Key-lock no. 1 turned OFF
–5	Key-lock no. 4 turned ON
–6	Key-lock no. 3 turned ON
–7	Key-lock no. 2 turned ON
–8	Key-lock no. 1 turned ON

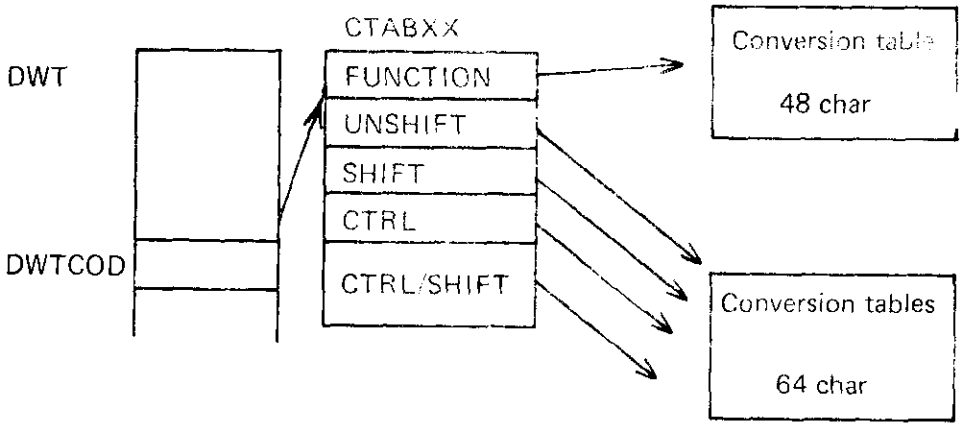
DRKB03 Continued **DRKB03**

For Basic Read only the received code is stored in the user buffer and the request is not completed. If all keys are in OFF, the keyboard is regarded as inactive.

Code conversion : To adapt the keyboards to different national keyboard-layouts the driver includes code conversion facilities. The conversion consists of five modes:

- Function/Numeric
- Unshift
- Shift
- CTRL
- CTRL/Shift

The conversion is achieved by means of the following table structure:



Each entry not zero in CTABXX gives the address to the code conversion table. The conversion tables may be used common for several keyboards. One or more conversion tables may be excluded by setting zero or UNSHIFT in corresponding entry in table CTABXX. Zero means no conversion and UNSHIFT conversion according to the UNSHIFT-table.

The code conversion is performed according to the following rules:

Received characters between /00 – /1F and /60 – /6F are converted according to the Function/Numeric conversion table.

DRKB03 Continued DRKB03

Received characters between /20 – /5F are converted according to:

- Unshift table if neither SHIFT nor CTRL-key has been depressed
- Shift table if SHIFT-key has been depressed
- CTRL table if CTRL-key has been depressed
- CTRL/Shift table if both shift and CTRL-key have been depressed.

The conversion tables are set up at **system generation** time.

For the conversion the following recommendations are given:

Function/Numeric – table
The numeric cluster is converted to /30 – /39. All other keys are converted to codes in the range of /80 – /AF.

Unshift – table
If necessary this table is used to adapt the keyboard to different national keyboard layouts. Converted codes should still be in the range of /20 – /5F.

Shift – table
The shift function is realized with this table. Converted codes should be within /20 – /7F or within /20 – /5F if only upper case is used for alpha-keys.

CTRL – table
The CTRL-functions are realized with this table. Converted codes should be within /00 – /1F. The CTRL-function may also be used for special purposes when the alpha-keys are also used as function keys. The converted code shall then be outside the range of /20 – /7F.

CTRL/Shift – table
Same indications as for the CTRL–table. (See above).

Conversion tables
A depressed key on keyboard PTS 6236 generates an internal code. This code is given from the key pad layout see appendix G, for example: Key in position D03 has the code /45 (not converted).
If a conversion table is defined, an index is calculated for every key, see appendix G, for example: Key in position D03 has the index 38 in the UNSHIFT, SHIFT, CTRL and SHIFT/CTRL cluster. If the conversion table in position 38 contains /88, the key in position D03 will give the code /45 without conversion and will give code /88 with conversion.

Index 1 is the first position in the conversion table.

DRKB03 Continued **DRKB03**

System generation parameters : The following parameters should be defined for the device work table (DWT):

DWTKEY: Codes for special keys
KBCLR, KBESP, KBMZ2, KBMZ3
Note that converted code should be used.

DWTECH: DWT-address of echo-device. Set to zero means no echo device.

DWTTP: Timer-indicator. Set to zero if no timing wanted on this keyboard.

DWTCOD: Address to conversion address table CTABXX

The circular input buffer is also placed in DWT. Its length should be the same in all DWTs, but may be changed between systems.

DRLP01 **LINE PRINTER** **DRLP01**

General information : This driver handles one line printer PTS 6881 on a multiplex or programmed channel. The type of channel should be specified during **system generation.**

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be used:

/00 – test status
/05 – basic write
/06 – standard write

Buffer address :
Requested length :
Effective length :

Only significant for orders /05 and /06. For order /06 the first word and the last character in the buffer are reserved for control information. For order /05 these parts of the buffer are occupied by normal data.

Return code : The following bits may be set by this driver:

Bit	Meaning
0	Request error
15	Not operable

Control word : Not significant

Order : /00 – test status:
The printer status is tested and bit 15 in the return code is set if not operable.

Order : /05 – basic write:
The requested number of characters are sent to the line printer without any check.
If the buffer of the line printer is full (132 char.), or if a format control character is received, the buffer is printed.
The following format control characters are available:

/0A: advances the paper one line and sets the device at the left-most print position (CR/LF)

DRLP01 **Continued** DRLP01

/0C: advances the paper to top of form and sets the device at the left-most print position (FF/CR)

/0D: sets the device at the left-most print position (CR)

Order : /06/ – standard write:

The first word in the user buffer is reserved for control information. It can contain one of the following codes in the right hand bytes:

/2B: print the line without advancing the paper (superposition).

/30: advance two lines before printing.

/31: skip to top of form before printing.

All other control codes will advance the paper one line before printing.

At the end of the user buffer one character must be reserved for the system, in which a print code is stored by the driver. This character should **not** be included in the requested length. All other characters in the user buffer should be within /20–/5F but this is not checked by the driver.

Recovery at power on : No recovery is carried out by the driver. If power failure occurs when there is a running print request, this request is completed with bit 15 "not operable" set in the return code.

DRMT01 **MAGNETIC TAPE** **DRMT01**

General information : This driver handles up to eight 1/2 inch magnetic tape recorders, PTS 6872 or 6164 connected to CPU on multiplex channel.

The recorders are operated independently of each other, each having its own file code. However, only one can be working at a time, except at unload.

Data is recorded in blocks with length from 2 to 4095 characters.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes The following orders may be used:

/00 – test status
/02 – read
/05 – write
/06 – write
/22 – write tape mark
/31 – rewind
/33 – step reverse
/34 – step forward
/37 – load

Buffer address :
Requested length :
Effective length :

Only significant for orders /02, /05 and /06. The last word in each buffer may be used as a block sequence counter. The length must be from 2 to 4095 bytes and must exclude the block sequence counter if this is used.

Return code : The following bits may be set by this driver, see the table on the next page.

DRMT01 **Continued** DRMT01

Bit	Meaning	Order in which bit is set									
		/00	/02	/05	/22	/31	/33	/34	/37	/38	/3F
0	Illegal request	X	X	X	X	X	X	X	X	X	X
1	Zero										
2	Rewinding	X	X	X	X	X	X	X	X		
3	Tape mark		X		X		X	X			
4	No data		X	X	X		X	X			
5	BOT	X				X	X		X		X
6	Write protected	X	X	X	X	X	X	X	X		X
7	Zero										
8	Zero										
9	Hardware error		X	X	X	X	X	X	X	X	X
10	EOT	X	X	X	X		X	X			X
11	Sequence error		X								
12	Incorrect length		X								
13	Data error		X	X			X	X			X
14	Throughput error		X	X							
15	Not operable	X	X	X	X	X	X	X	X	X	X

Control word : Only significant for orders /37, /02, /05, /06 and /3F.

The value of the least significant bit (rightmost) when requesting on order /37 determines whether a block sequence counter will be used:

0 – sequence counter is required
1 – no sequence counter required

The setting of the control word for order /37 will affect the operation of later orders /02, /05, /06 and/or /3F and the recovery procedures at power on.

After a read or write request the control word contains the number of read or write retries performed (orders /02, /05 or /06)

Order : /00 – test status:

The status of the selected recorder is indicated in the return code.

Order : /02 – read:

One block is read from the tape and stored in the buffer. If there is a "data error" or "throughput error" a retry is made. At most three retries are performed.

If used, the block sequence counter is checked and if not correct "sequence error" is set in the return code. Two characters must be reserved at the end of the block for this counter.

If the requested length was less than the actual length "incorrect length" is set in the return code.

When data is not found within two seconds "no data" is set in the return code.

Order : /05 and /06 – write:

One block from the user buffer is written on the tape. If there is a "data error" or "throughput error" a retry is made, after erasing the tape 10 cm from the beginning of the block just written. At most three retries are performed.

When a block sequence counter is used then, before writing the two characters at the end of the buffer are replaced by the counter. These characters are not included in the requested length.

If the tape is write protected the request terminates immediately with "write protected" set. The tape is not moved.

Order : /22 – write tape mark:

One tape mark is written on the tape. Recovery is carried out as in orders /05 and /06 (write).

If the order is successful "tape mark" is set in the return code.

Order : /31 – rewind:

The tape is rewound to beginning of tape (BOT). If BOT is not reached within 3 minutes "rewinding" is set in the return code.

Order : /33 – step reverse:

The tape is reversed one block

Order : /34 – step forward:

The tape is moved one block forward:

It is recommended that this order code is used (or step reverse) when searching for a tape mark since the transport does not delay the CPU.

Order : /37 – load:

The recorder is set on-line and the tape is rewound to BOT. The control word determines if a sequence counter will be used for subsequent orders.

DRMT01 **Continued** **DRMT01**

If BOT is not reached within 3 minutes "rewinding" is set in the return code.

Note: the PTS 6164 recorder cannot be set on-line from the program, so this must be done by the operator.

Order : /38 – unload:

The tape is rewound and the recorder is switched off-line.

Order : /3F – recover:

The recorder is set on-line and the tape is positioned before the block indicated by the block sequence counter.

If unsuccessful i.e. incorrect block sequence counters on the tape, the recorder is put off-line.

If sequence counters are not used no action is taken.

Recovery at power on : After power fail in the computer a recovery is performed for each recorder which was on-line when the trouble started.

The procedure is the same as in the order "recover".

If the recovery is not successful, due to incorrect block sequence counters the recorder is put off-line.

If sequence counters are not used no action is taken.

When a power fail occurs only in a formatter or recorder this is indicated by the status "not operable" in the return code. It is then possible to put it on-line and recover by using the order "recover".

DRRT01 REMOTE TERMINAL **DRRT01**

General information : The remote terminal driver controls data transfer from the device driver onto the channel units for local and remote terminals.
One special function is available in the remote terminal driver which function can be called by the application program. The test remote line function is valid only for remote connected terminals. The line which connects the channel unit with the selector unit can be tested.

Calling sequence : (LDKL A1, parameter)
LDK A7, code
LDKL A8, ecb-address
LKM
DATA (–)1
(DATA start-address)

Order code : The following order can be used:

/00 -- test remote line

File code : Recommended is file-code /15.

Buffer address :
Requested length : } These parameters are not used.
Effective length :

Return code : The following bits may be set by this driver in the return code word:

Bit	Meaning
0	Request error
9	Channel unit missing or erroneous
14	ACK missing
15	SYNC missing

Control word : The control word contains for this driver identification of the line to be tested.

1 = line of first channel on CHRT1
2 = line of second channel on CHRT1
3 = line of first channel on CHRT2
4 = line of second channel on CHRT2
5 = line of first channel on CHRT3
6 = line of second channel on CHRT3
7 = line of first channel on CHRT4
8 = line of second channel on CHRT4

The control word has to be filled by the application program.

DRRT01 **Continued** **DRRT01**

Order : /00 — test remote line:

This order will test the remote line, if loop connected, by sending a SYNC character each 500 msec. to device address = 7. On return of SYNC from the CHRT an ACK-character is sent and also returned by the loop-connection. A test on receiving ACK is also done.

Information about the state of the line, up to the loop-connection, is specified for this test in the return code word.

The return codes for this order differ as follows:

bit 14: bad line
bit 15: If the line is not loop connected, then the selector unit is inactive. If the line is loop connected, the line is probably broken.

If both bits 14 and 15 are set the line is probably broken.

Miscellaneous : A remote line can be loop-connected via a switch on a used TFU (transfer unit) and sometimes also on the modem. The remote line is tested in this way: the line from CHRT onto the loop-connection and the return from the loop-connection onto the CHRT is used to send a SYNC-character (155) over it and a check is done on receiving the SYNC. After the SYNC detection an ACK-character is sent over the same line and also the return of the ACK-character is checked.

A looped line is out of order for any workstation transaction connected to this line.

A test-remote line should be issued from a local-workstation, a separate task.

DRSOP1 — SYSTEM OPERATORS PANEL — DRSOP1

General information : The System Operator's Panel (SOP) is connected to the CPU through the channel unit for cassette recorder CHCR. The panel facilities include 10 switches and 11 lights. The switches may be read and the lamps written.

To facilitate simultaneous operations on the lights and switches, they are treated as independent devices, and are thus assigned different file codes.
Moreover, it is possible to have two independent read requests each with its own file code.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be used:

/02 – read switches
/05 – write lights on
/06 – write lights off
/37 – write lights on (CREDIT)
/38 – write lights off (CREDIT)
/39 – write flashing lights.

Buffer address :
Requested length :
Effective length :
} Not significant

Return code : Only bit zero of the return code is used. This is set if any error is detected.

Control word : The control word contains a SOP switch number after input or a bit pattern before output (lamps corresponding to the bits are illuminated).

Order : /02 – read switches:
When a switch is depressed the switch number is stored in the control word so that SWITCH 1 gives 0, SWITCH 2 gives 2, SWITCH 3 gives 4 and so on to enable indexing. If power failure occurs the read request is completed with the control word set to -2.

If a CREDIT application is indicated during **system generation** SWITCH 1 gives 1, SWITCH 2 gives 2, SWITCH 3 gives 3 and so on. Power failure will in this case give zero in the control word.

The rightmost switch corresponds to SWITCH 1.

Order : /05 or /37 – write lights on:
Code /05 must only be used only in an Assembler application.
Code /37 must be used only in a CREDIT application.
The control word bit pattern is transferred to the panel lights. The rightmost light corresponds to bit 15. Lights corresponding to "1" bits are turned on. Other lights are not altered.

Order : /06 or /38 – write lights off:

Code /38 must be used if a CREDIT application is indicated during **system generation.**

The control word bit pattern is transferred to the panel lights. The rightmost light corresponds to bit 15. Lights corresponding to "1" bits are turned off. Other lights are not altered.

Order : /39 – write flashing lights:

The control word bit pattern is transferred to the panel lights. The rightmost light corresponds to bit 15. Lights corresponding to "1" bits are flashed. Other lights are not altered. If order /39 is to be used it should be requested during **system generation.**

Recovery at power on : At power on the following actions are taken:

- Switches are activated
- Lights are fed with the value existent at power failure time
- If there is a read request, this is completed with -2 set in the control word. If not, a power up flag is set, causing the first read request after power on to be completed with the control word set to -2 (if adapted for CREDIT, power fail indication will be zero instead of -2).
  No indication is given in the return code.

  Note: recovery is always carried out after program loading.

DRTC01 **CASSETTE** **DRTC01**

General information : This driver handles one or two recorders connected to the CPU on a programmed channel. The number of recorders must be specified during **system generation.**

Logically the cassette recorders are independent of each other. However, only one can be operated at a time, except at rewind and unload.

Each cassette has its own file code.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order code : The following orders may be used:

/00 – test status
/02 – read
/05 – basic write
/06 – standard write
/22 – write tape mark
/24 – erase
/26 – lock
/31 – rewind
/33 – reverse
/37 – load
/38 – unload

Buffer address :
Requested length :
Effective length :

Only significant for orders /02, /05 and /06. The last byte in each block may be used as a block sequence counter. The length must be from 2 to 256 bytes and must exclude the block sequence counter if this is used.

Return code : The following bits may be set by this driver:

DRTC01 Continued **DRTC01**

Bit	Meaning	Order in which bit is set										
		/00	/02	/05	/06	/22	/24	/31	/33	/37	/38	/26
0	Illegal request	X	X	X	X	X	X	X	X	X	X	X
1	Leader	X	X	X	X	X	X		X		(X)	X
2	BOT missing							X		X		
3	Tape mark detected		X			X			X			
4	No data/erased		X	X	X	X	X		X			
5	BOT/EOT hole		X	X	X	X	X		X		(X)	(X)
6	Write protected	X	X	X	X	X	X	X	X	X	X	X
7	B-side	X	X	X	X	X	X	X	X	X	X	X
8	Zero											
9	Rewind time-out, 55 seconds							X		X		
10	Zero											
11	Sequence error	X	X	X	X	X	X	X	X	X	(X)	X
12	Incorrect length		X									
13	CRC error		X	X	X	X			(X)			
14	Throughput error		X	X	X	X						
15	Not operable	X	X	X	X	X	X	X	X	X	X	X

(X) Not relevant.

Leader - The tape is positioned at the transparent leader.
Throughput error - System overload and should never be set
Not operable - The cassette is not locked, there is no cassette, or it executes an unload command.

Control word : Only significant for orders /37, /02, /05 and /06.

The value of the least significant bit (rightmost) during order /37 determines whether a block sequence counter will be used:

0 - sequence counter is required
1 - no sequence counter required.

The setting of the control word during order /37 will affect the operation of later orders /02, /05 and/or /06 and the recovery procedure at power on.

During a write request (orders /05 and /06) the number of rewrite attempts is returned in the control word.

Order : /00 – test status:

The cassette is selected and the status is indicated in the return code.

Bit 15 is set "not operable" indicates that the cassette is not locked or it is rewinding.

DRTC01 **Continued** DRTC01

If bit 15 is set the other bits are not significant else the following are significant:

Bit 1 "leader"
Bit 6 "write protected"
Bit 7 "B-side"

Order : /02 – read:

One block is read from tape and stored in the buffer. If there is an "incorrect length", "CRC" or "throughput error", read recovery is carried out. At read recovery the tape is backspaced one block and the block is read again. If reading is still not successful there is another backspace and read.

If it is used the block sequence counter is checked and if the block is not in sequence bit 11 "sequence error" is set in the return code. The sequence counter is not included in the effective length, but is stored in the read buffer.

Bit 3 "tape mark" is set if a tape mark was read.

Bit 4 "no data" is set if no block is found within 400 mm.

Bit 11 "sequence error" is set if the block is not in sequence when a sequence counter is used or after power failure when a sequence counter is not used.

Bit 12 "incorrect length" is set if the block was longer than the requested length. In this case read recovery is always carried out.

Bit 13 "CRC error" is set if CRC-error remains after read recovery.

For normal applications the last byte is a block sequence character.

Order : /05 – basic write:

This order has the same function as order /06 standard write.

Order : /06 – standard write:

One block is written on tape. If the status after write is "incorrect length", "CRC" or "throughput error", write recovery is carried out.

At write recovery the tape is repositioned after the last correctly written block (or backspaced once if a sequence counter is not being used). The tape is erased, depending on the number of retries, and the block is written again. If it is still not successful the tape is positioned and erased.

Before writing the first block after BOT one block is erased to be compatible with ECMA 34 standard.

DRTC01 Continued DRTC01

If a sequence counter is used this should not be included in the requested length, but one byte must be reserved in the end of the write buffer, where the sequence counter is stored by the driver.

In the return code the following bits are significant for data:

Bit 4 "erased" should be set at successful write recovery.

Bit 5 "BOT/EOT" is set when end of tape hole is found.

Bit 11 "sequence error" is set if positioning of the tape is unsuccessful at write recovery or after power failure when a sequence counter is not used.

Bit 12 "incorrect length" only appears together with bit 0 "request error" indicating that the requested length is less than 2 or greater than 256.

Bit 13 "CRC error" is set after unsuccessful write recovery.

Order : /22 – write tape mark:

A tape mark is written on tape. Write recovery is carried out as for order /06. The bits in the return code are the same as for write. In addition bit 3 "tape mark" should be set.

Order : /24 – erase:

The tape is erased about 570 mm. Erase should be executed after last block written on tape.

Bit 4 "erased" should be set when successful.

Bit 5 "BOT/EOT hole" is set when end of tape hole is found.

If erase is required it must be requested during **system generation.**

Order : /26 – lock:

The cassette drive is locked only. The *tape is not moved.* If lock is required it must be requested during **system generation.**

Order : /31 – rewind:

The tape is rewound to BOT. The block sequence counter is set to zero.

Order : /33 – reverse:

The tape is reversed one block. The block sequence counter is decreased by one.

Bit 3 "tape mark" is set if the reversed block was a tape mark.

Bit 4 "no data/erased" is set if no block is found within 400 mm.

If reverse is required it must be requested during **system generation.**

Order : /37 – load:

The tape is locked and rewound to BOT. The block sequence counter is set to zero.

Order : /38 – unload:

The tape is positioned on the leader and unlocked. This operation is carried out by hardware so the other cassette recorder may be operated simultaneously.

Recovery at power on : After power fail on the CPU, recovery is executed for each recorder.

If the cassette is locked at power fail, it will remain locked.
If no blocks have been written or read BOT is searched for, else the tape is positioned. Four blocks are backspaced.
If no data is found, BOT is searched for. A block is read, and if it is a tape mark another block is backspaced. The number of blocks to go forward is calculated with help of the sequence counter. The tape is read forward the calculated number of blocks. The sequence number of the read block is checked. Then the running request, if any, is repeated.
No information about power fail is given in the return code.

When recovery is unsuccessful, bit 11 "sequence error" in the return code is set for the running request else at a subsequent request.

If there is no block sequence counter the cassette is locked and bit 11 "sequence error" in the return code is set for the running request else at a subsequent request.

DRTP01 TELLER TERMINAL PRINTER **DRTP01**

General information : This driver handles Teller Terminal Printer PTS 6221, 6222 or 6223 connected to the CPU via a CHLT or CHRT, and only for an Assembler application.

Alphanumeric characters are printed according to the user print buffer. Only one line is printed at each request, to get full control at recovery situations.

The user has to specify the movement of the print head and elevator in the control word. That is, no control characters are placed in print buffer.

Calling sequence : Normal I/O

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be used:

/00 – test status
/06 – write journal
/07 – write tally roll
/08 – write voucher/passbook

Buffer address :
Requested length :
Effective length :

Only significant for orders /06, /07 and /08. The first word in the buffer must be reserved for control information. This word is only used for order /08. It must be reserved for all orders though the contents are not significant for orders /06 and /07. This word is included in the length.

Return code : The following bits may be set by this driver:

Bit	Meaning
0	Illegal request
6	Voucher in (only order /00)
10	End of journal tape
13	Code check error
14	Throughput error (special feature see order /08)
15	Not operable, power off

DRTP01 Continued **DRTP01**

Control word : The control word specifies the elevator and printhead movement and has the following format:

H	P	R	D	U		C	P	TAB DECADE	TAB UNIT
0							78		15

where:

HP (bit 0–1) : Head positioning after printing
HP = 0 Standard (current station)
HP = 1 Inverted (other station)
HP = 2 No action

R (bit 2) : Voucher/passbook is released after printing.

D (bit 3) : If the D-bit is set the line number given in the first word of the buffer (see buffer address) is treated as a displacement from the last position. That is, the elevator is sent up/down (depending on U) the requested number of line steps before printing.
If the D-bit is zero the elevator is sent to the top position and waits for grasp. Then the elevator is sent down the requested number of line steps, counted from elevator top position.

U (bit 4) : Elevator is sent up (U = 1) /down (U = 0) the requested number of line steps (Only significant if D = 1).

(bit 5) : Not used.

C (bit 6) : Journal copy is cut off after printing (only significant for PTS 6223).

P (bit 7) : Journal copy is perforated after printing (only significant for PTS 6223).

TAB
(bit 8–15) : A tabulation position can be set as two BCD-digits. Bits 8 – 11 contain tens and bits 12 – 15 contain units.

HP (bit 0–1) is significant for all orders /06 – /08.
R-, D-, U-bit and TAB are only significant for order /08, and C- and P-bit only for order /06.

Order : /00 – test status:

A dummy character is sent to the printer and the return code is set to the appropriate value. (bit 6, 10 and/or 15).

DRTP01 Continued DRTP01

Common functions for orders /06, /07 and /08 : Alphanumeric characters within the range /20 – /5F, in the user buffer, are accepted and sent to the printer. Furthermore, the following special characters are processed:

/AE: Point is printed as roomless. That is, the digit prior to /AE is code converted and printed as roomless point digit (point is placed to the right of the digit).

/13: This code is sent directly to the printer. By hardware, this will cause a special symbol to be generated by the selector unit.

/14: Same function as for code /13.

/11: Tabulation character (only significant for order /08).

The special characters should be included in the requested length.

Leading spaces (/20) in the user buffer are ignored.

Illegal character codes in the user buffer are ignored and bit 13 is set in the return code.

If special characters /13 and /14 are to be used, they should be requested during **system generation.** Non standard character codes for roomless point digits can also be specified during **system generation.** Continuation of write request when the selector unit or printing is inactive may also be requested during **system generation.** (bit 15 set in return code).

Order : /06 – write journal:

Alphanumeric characters in the user buffer are printed on the journal tape. The following sequence is carried out:

- A dummy character is sent to initiate output.
- Carriage return CR1 is sent and the print head is attached.
- Characters according to the user buffer are sent.
- HP of the control word is checked.
  If HP = 0, carriage return is sent to the current station.
  If HP = 1 carriage return is sent to the other station.
  If HP = 2 the print head is not moved after print out.
- Line feed is sent to the journal tape.
- If C-bit is set the journal copy is cut off.
- If P-bit is set the journal copy is perforated.
- A dummy character is sent to end output.

If cut/perforate journal tape is to be used it must be requested during **system generation.**

Order : /07 – write tally roll:

Alphanumeric characters in the user buffer are printed on the tally roll.
The following sequence is carried out:

- A dummy character is sent to initiate output.
- The voucher/passbook status is checked. If the voucher/passbook is in, a release voucher/passbook command is sent to the printer and the driver waits until it is removed. If the voucher/passbook is out, carriage return CR2 is sent and the print head is attached.
- Characters according to the user buffer are sent.
- HP of control word is checked.
  If HP = 0, carriage return is sent to the current station
  If HP = 1, carriage return is sent to the other station.
  If HP = 2, the print head is not moved after print out.
- Line feed is sent to the tally roll,
- A dummy character is sent to end output. Order /07 can be excluded during **system generation** if it is not required.

Order : /08 – write voucher/passbook:

The elevator is positioned at the requested line and alphanumeric characters in the user buffer are printed on the voucher/passbook. The line feed should be given in the first word of the user buffer as two ISO–7 digits the number of line feed steps, that the elevator should be moved).
The following sequence is carried out:

- A dummy character is sent to initiate output.
- Carriage return is sent to the current station.
- If D = 0 in the control word, or if the voucher/passbook is not in, the elevator is sent to the top position and waits for grasp.
- Elevator is sent to the requested line.
  That is:
  If D = 0 the line feed is treated as an absolute number and is counted from the elevator top position.
  If D = 1 the line feed is treated as a relative number (up or down depending on U) and is counted from the last elevator position.
- Print head is attached.
- If PTS 6223 a space is sent.
- Characters according to user buffer are sent.
  If a tabulation character (/11) is found the print head is returned. Spaces are sent until the tabulation position is reached, and the print head is attached again.

DRTP01 Continued DRTP01

During printing, the voucher/passbook status is checked. If the voucher/passbook is not in, the elevator is sent to the top position and waits for grasp. The request is then repeated. No indication is given in the return code. As an alternative chosen at **system generation** the write request is completed at voucher/passbook out and bit 14 "throughput error" is set in the return code.

- R-bit in the control word is checked. If R = 1, the elevator is sent to the top position and waits until the voucher/passbook is removed. If R = 0, no elevator movement is carried out.
- HP of control word is checked.
  If HP = 0, carriage return CR2 is sent (standard).
  If HP = 1, carriage return CR1 is sent (inverse).
  If HP = 2, the print head is not moved.
- A dummy character is sent to end output.

Recovery at power on : After power failure on the CPU or printer the elevator is sent to the top position and any running request is repeated and the requested line is printed once more. No indication is given in the return code unless requested during **system generation**.

DRTP02 **TELLER TERMINAL PRINTER** **DRTP02**

General information : This driver handles Teller Terminal Printer PTS 6221, 6222 or 6223 connected to the CPU via a CHLT or CHRT, and can be used for both Assembler and CREDIT applications.

Alphanumeric characters are printed according to the user print buffer. Only one line is printed at each request, to get full control at recovery situations.

Journal, tally roll and voucher/passbook parts of the printer are regarded as three independent logical devices. Three different file codes are used: one for each type of printer.

This driver can be used instead of driver DRTP01 in every system, provided the different user interfaces are considered. However, this driver *must* be used in systems where the interpreter language CREDIT is used.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following order codes may be used:

- /00 – test status
- /06 – write
- /0B – position lift and write
- /22 – cut journal
- /26 – perforate journal
- /37 – grasp
- /38 – release voucher/passbook

Buffer address :
Requested length :
Effective length :
} Only significant for orders /06 and /0B. The first word of the buffer must be reserved for a control code and is included in the length.

Return code : The following bits may be set by this driver:

DRTP02 Continued DRTP02

Bit	Meaning
0	Illegal request
8	Recovery executed on request
10	End of journal tape/voucher out, depending on device
13	Code check error
15	Not operable, power off

Control word : Only significant for order /0B. The control word specifies the lift position. The lift position is given as a binary value in the right byte. Only absolute positioning is used, i.e. the control word gives the number of lift steps from home (lift in top position).

Order : /00 – test status:

A dummy character is sent to the printer and the return code is set to the appropriate value. Note that Bit 10 in the return code means "voucher out" or "end of journal paper" depending on the device used.

Common functions for orders /06, /0B, /22, /26. /37 and /38 : Continuation of request when the selector unit or printer is inactive may be requested during **system generation** (bit 15 set in return code).

Order : /06 – write:

Alphanumeric characters within the range /20–/5F, in the user buffer, are accepted and sent to the printer. Furthermore, the following special characters are processed:

/AE: Point is printed as roomless i.e. the digit prior to /AE is code converted and printed as a roomless point digit.

/13: This code is sent directly to the printer. By hardware, this will cause a special symbol to be generated by the selector unit.

/14: Same function as for code /13.

/09: The print head is moved to the rightmost print position of the voucher print station. This character should be present in the last buffer position.

/0D: The print head is moved to the rightmost journal print position. This character should be present in the last buffer position.

Leading spaces (/20) in the user buffer are ignored.

DRTP02 Continued DRTP02

Illegal character codes in the user buffer are ignored and bit 13 is set in the return code.
If special characters /13 and /14 are to be used, they should be requested during **system generation.** Non standard character codes for roomless point digits can also be specified during **system generation.**

A short summary of the sequence followed when a write request is executed is given below:

- A dummy character is sent to obtain the status of the printer.
  If voucher/passbook printing is being performed, the voucher/passbook must be in.
  If tally roll printing is being performed, the voucher/passbook must be out.
  If these conditions are not fulfilled, grasp is carried out in the first case and release in last case.
- Carriage return is sent and the print head is attached. (if req. length = 0 – 2 no attach).
- If PTS 6223 is being used and voucher/passbook printing is being carried out a leading space is sent.
- Characters according to the user buffer are sent.
- Voucher/passbook printing: If a tabulation character (/11) is found, the print head is returned. Spaces are sent until the tabulation position is reached and the print head is attached again. During printing, the voucher/passbook status is checked. If the voucher/passbook is not in, the elevator is sent to the top position and waits for grasp. Then the request is repeated. As an alternative, chosen at **system generation,** the write request is completed at voucher/passbook out and bit 10 is set in the return code.

  The control code in the first word of the buffer specifies the paper feed. This code has the following significance:

  /28: print with no advance.
  /30: advance two lift steps before printing.
  /31—/39: advance one to nine lift steps before printing.
  Other codes: advance one lift step before printing.
- Tally roll printing: During printing the voucher/passbook status is checked. If the voucher/passbook is in, a release command is sent to the printer and the request is repeated.
- After printing the print head is detached and carriage return is executed if one of the two characters /09 or /0D is present in the buffer.
- Line feed is executed (not voucher/passbook printing) and a dummy is sent to end output.

DRTP02 — Continued — DRTP02

Order : /0B -- position lift and write:

Elevator position should be given in the right byte of the control word as a binary value, and indicates the number of line feed steps that the elevator should be moved from home position.

Before positioning a check is made that the voucher/passbook is in. If not the command grasp is initially sent to printer. During positioning the voucher/passbook status is checked and, if the voucher/passbook is out, grasp is executed and the request is repeated. As an alternative, chosen at **system generation** the request is completed at voucher/passbook out and bit 10 in the return code is set.

After lift positioning write voucher/passbook is carried out (see order /06 write)

Order : /22 – cut journal:

Journal copy is cut off (PTS 6223) and one line feed is made. If the cut journal facilitiy is required it should be requested during **system generation.**

Order : /26 – perforated journal:

Journal copy is perforated (PTS 6223) and one line feed is made. If the perforate journal facility is required it should be requested during **system generation.**

Order : /37 – grasp:

The following sequence is carried out:

- a dummy character is sent to initiate output.
- the elevator is sent to the top position.
- a grasp command is sent to the printer.
- a dummy character is sent to the printer. When a data request is returned from the printer the grasp has been performed, i.e. the voucher/passbook is in and the next character can be sent to printer.
- lift to top position is executed.
- the request is completed.

Order : /38 – release voucher/passbook:

The lift is moved to the top position and a release command is executed. After that a dummy character is sent. When a data request is returned from the printer, the command is complete i.e. the voucher/passbook is out and the request is completed.

DRTP02 **Continued** **DRTP02**

Recovery at power on : After power failure on the CPU or printer, the elevator is sent to the top position and any running request is repeated. Normally no indication is given in the return code. There is a possibility, chosen at **system generation**, to get bit 8 set in the return code if recovery has been carried out on a write request (orders /06 or /0B).

DRTW01 **CONSOLE TYPEWRITER** **DRTW01**

General information : This driver handles input from and output to typewriter PTS 6862, connected to the CPU via the teletype-interface or V24 interface.

Input and output can not take place at the same time, since the connection only allows half duplex transmission.

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  – 1
DATA  start address
```

Order codes : The following orders may be used:

/01 – basic read
/02 – standard read
/03 – numeric read
/05 – basic write
/06 – standard write

Buffer address : Significant for all orders: For order /06 the first word in the buffer should be reserved for control information. This word is also included in the length. For orders /02 and /03 the length includes the end of record key.

Return code : The following bits may be set by this driver:

		Order in which bit is set				
Bit	Meaning	/01	/02	/03	/05	/06
0	Illegal request	X	X	X	X	X
9	Time out	X	X	X		
12	Incorrect length		X	X		
13	Code check error		X	X		X
14	Throughput error				X	

Control word : Only significant for orders /02 and /03. For these orders it may contain a keytable address. The keytable contains a list of end of record keys. If the keytable address is zero then no keytable will be used. The format of the keytable is as follows:

DRTW01 **Continued** DRTW01

No. of EOR keys	key 1
key 2	key 3
key 4	key 5

etc

Order : /01 – basic read:

The requested number of characters are read and stored in the user buffer without any check.

Common functions for orders /02 and /03 : The driver checks every received character in the following sequence:

- If the received character is found in the key table, the key is stored in the user buffer and the request is immediately completed. The end of record key is also code converted and stored in the control word so that for Assembler applications KEY 1 gives 0, KEY 2 gives 2, KEY 3 gives 4 and so on to enable indexing. For CREDIT applications KEY 1 gives 1, KEY 2 gives 2, KEY 3 gives 3 and so on. If the keytable address is zero in the control word a standard key TWEOR is used as end of record key.
- Special characters, clear and backspace, are checked and the corresponding functions are carried out.
- Alphanumeric/numeric characters are stored in the user buffer. If overflow occurs in the buffer the request is completed with bit 12 set in the return code. The requested length should include the end of record key.
- If the received character cannot be identified in the tests above, it is treated as undefined and the request is completed with bit 13 set in the return code. The undefined key is stored in the user buffer and the control word remains unchanged.

Order : /02 – standard read:

Alphanumeric characters within the range /20–/5F are accepted and stored in the user buffer.

Order : /03 – numeric read:

Only digits within the range /30–/39 are accepted and stored in the user buffer.

Order : /05 – basic write:

The requested number of characters are sent to the printer without any check.

DRTW01 Continued DRTW01

Order : /06 – standard write:

The first word in the user buffer is reserved for control information. It must contain one of the following codes in the right hand byte:

/2B : print the line without advancing the paper. The print head is not moved before printing the text.

/30 : advance the paper two lines before printing and perform carriage return.

/31 : skip to top of the page (form feed) and perform carriage return before printing.

All other codes cause carriage return and line feed before printing.

All alphanumeric characters within the range /20–/5F in the user buffer are accepted and sent to the printer.

Codes /60–/7F are reduced by /20 giving /40–/5F. Furthermore, the following special characters are processed:

/AE : Printed as point (/2E)

/11 : Tabulation character. This character should be followed by two ISO–7 digits giving the tabulation position. Tabulation character and position should be included in the requested length.

/07 : Bell is sent to the printer.

Time out function : For input it is possible to include a time-out function. If a key has not been pressed within a certain time, the request will be ended with bit 9 set in the return code. The timer is restarted for each depressed key.
If time out is required it must be requested during **system generation.**

Special characters : Some keys have a special meaning to the driver. These keys are:

TWEOR : Standard end of record key.
This is used by the system when keytable address is zero.

TWCLR : Clear key. The user buffer is cleared. This does not cause completion of the request.

TWBSP : Backspace key. The last reported character is cleared in the user buffer. This does not cause completion of the request.

DRTW01 **Continued** **DRTW01**

Recovery at power on : At power up the following actions are taken:

- If the order was /01, /02 or /03 the read request is completed with -2 set in the control word.
  If no read request is running a power up flag is set, causing the first read request after power on to be completed with the control word set to -2.
  Completion of read request, if required, must be requested during **system generation.**
- If the order was /05, bit 14 is set in the return code and the request is completed.
- If the order was /06, the print head is sent to the position it had before the write request and the line is printed once more. No indication is given in the return code.

TIODM DATA MANAGEMENT **TIODM**

General information : This driver provides data management facilities for the files held on upto two PTS 6875 disk drives. The disk drives are controlled via the disk driver DRDU01 (which is called by the data management task). The general information in the driver description for DRDU01 also applies to the data management driver.
For a full explanation of the facilities offered by the data management routines see the Data Management Manual (M07).

Calling sequence : Normal I/O:

```
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  1
```

I/O and Activate:

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  -1
DATA  start address
```

Order codes : The following orders may be used:

/02 – sequential read
/03 – read VTOC record
/06 – sequential write
/09 – release exclusive access
/0A – random read
/0B – random write
/0C – random delete
/1A – indexed random read
/1B – indexed rewrite
/1C – indexed delete
/1D – indexed insert
/1E – indexed read next
/22 – close
/23 – get current data record number
/24 – get current index record number

Buffer address : Only significant for orders /02, /03, /06, /0A, /0B, /1A, /1B, /1D, /1E.

Requested length :
Effective length : Only significant for orders /02, /03, /0A, /1A, /1D, /1E. If the requested length is smaller than the record length only the most significant part of the record will be moved to the user buffer.

Return code : The following bits may be set by this driver:

TIODM

Continued

TIODM

		Order code in which bit is set													
Bit	Meaning	/02	/03	/06	/09	/0A	/0B	/0C	/1A	/1B	/1C	/1D	/1E	/22	/23	/24
0	Request error	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1	Key not found								X		X					
2	Record protected	X		X		X	X	X	X	X	X	X	X			
3	End of file	X				X	X	X	X		X	X	X			
4	No data	X				X			X		X		X			
5																
6	Next key same								X		X	X	X			
7	Retries performed	X	X	X		X	X	X	X	X	X	X	X			
8	New volume loaded	X	X	X		X	X	X	X	X	X	X	X			
9																
10	End of medium			X		X	X	X	X	X	X	X	X			
11																
12	Incorrect length	X	X			X			X				X			
13																
14	Disk I/O error	X	X	X		X	X	X	X	X	X	X	X	X		
15	Disk not operable	X	X	X		X	X	X	X	X	X	X	X	X		

Bit 0 Request error
Set for request errors such as illegal order, unknown file code etc.

Bit 1 Key not found
Set if the symbolic key required for indexed random instructions was not found in the index file.

Bit 2 Record protected
Set if the accessed record is under "exclusive access" at the time of the read request, or the record is not under "exclusive access" and the record status indicates "USED" at the time of a write request.

Bit 3 End of file
Set if the accessed record has a logical record number greater than the "last record No." updated by sequential write.

Bit 4 No data
Set if the record status character indicates "free" at a read-request.

Bit 5 Not used.

Bit 6 Next key same
Set if the symbolic key in the next used index record is the same as in the current index record.

Bit 7 Retries performed
The driver has retried an I/O action that was in error.

Bit 8 New volume loaded
Set at the first request after a new volume has been loaded.

Bit 9 Not used.

Bit 10 End of medium
Set if the requested record is outside the physical space reserved for the file at creation time.

Bit 11 Not used.

Bit 12 Incorrect length
Set if the requested length is less than the record length at read request.

Bit 13 Not used.

Bit 14 Disk I/O error
Set for hardware errors e.g. seek error, CRC-error, throughput error.

Bit 15 Disk not operable.

Control word : Significant for orders /02, /03, /06, /0A, /0B, /1A, /1B, /1D, /1E. At the time the request is made the control word should contain a logical record number in CW1 and CW2, or the address of a symbolic key in CW1 and key length in CW2. The logical record number starts with 1 and is a 23 bit (right justified) integer. The first characters should contain hexadecimal zero and the sign bit of the third character is not used.

Order : /02 – sequential read:

A record will be read into the user buffer according to the rules for sequential read, described in the Data Management Manual (M07).

The requested length must be filled in by the user and will define the length of the user buffer.

The effective length will, at return, contain the record length (the part of the block moved to the user record area). If the requested length is smaller than the record length defined at file creation time, only the most significant part of the record will be moved.

The control word will be set by data management to the current logical record number.
If a correct return is made the record read is set to exclusive access for the calling task.

Order : /03 – read VTOC:

This order is used to read the volume table of contents (VTOC) for the assigned file into the user buffer. If the requested length is less than the length of the VTOC, only the most significant part of the VTOC is moved to the user buffer.

Order : /06 – sequential write:

A record will be written from the user buffer according to the rules for sequential write, described in the Data Management Manual (M07).

The control word will be set by data management to the logical record number written by this instruction. To check the record status the record space is read before it may be overwritten. If the record is "free" it will be changed to "used" and the record will be put into the sector buffer and the record is immediately written on disk. If the status is "used" the sequential write is not allowed.

Order : /09 – release exclusive access:

The current record in the file specified by the file code in the ECB will no longer be under "exclusive access". This order does not result in any physical I/O.

Order : /0A – random read:

A record will be read into the user buffer according to the rules for random read described in the Data Management Manual (M07).

The requested length and effective length are used in the same way as for order /02 (sequential read).

The control word must be set by the user to the logical record number of the record to be read.

Order : /0B – random write:

A record will be written from the user buffer according to the rules for random write described in the Data Management Manual (M07).

The control word must be set by the user to the logical record number of the record to be written.

To check the record status, the record space is read before it may be overwritten. If the record is "free" it will be changed to "used" and the record is written. The record is written if the record is "used" and under exclusive access. If a "used" record is not under exclusive access the return condition "record protected" is set.

After this order the record written will no longer be under exclusive access.

If the exclusive access check is required it must be requested during **system generation.**

Order : /0C – random delete:

The status of the specified record will be set to "free". This order is only allowed for a record which is under exclusive access. After the order the free record space will no longer be under exclusive access. There is no check that the record was already "free".

If the exclusive access check is required it must be requested during **system generation.**

The control word must be set by the user to the logical record number of the record to be deleted.

Order : /1A – indexed random read

A record will be read into the buffer according to the rules for indexed random read described in the Data Management Manual (M07).

The requested length and effective length are used in the same way as for order /02 (sequential read), that is, they apply to the data record. The control word must contain the symbolic key and key length of the data record to be read.

The current record number of both the index file and the data file will be updated to the index record and data record accessed by this order.

Order : /1B – indexed rewrite

A record will be written from the user buffer and replace the record on the disk that has just been read according to the rules for indexed rewrite described in the Data Management Manual (M07).

Before the record is written, the record that it is replacing must have been read with exclusive access set. Exclusive access is released after this order.

The current record number will be set to the record just rewritten.

If the exclusive access check is required, it must be requested at **system generation** time.

Order : /1C – indexed delete

The status of the referenced data record is set to "free". When this has been done successfully, the index record that refers to the deleted data record is also set to "free".

This order is only allowed for a record that is under exclusive access. There is no check that the record was already "free".

If the exclusive access check is required, it must be requested during **system generation.**

The control word must contain the symbolic key and key length of the data record to be deleted.

The current record number is unaffected by this order.

Order : /1D – indexed insert

A record will be written from the user buffer to the data file after the last record in the file. The last record number will be updated. A new index record, with the logical record number of the new data record, is placed in the correct position in the index file. If an index record exists with the same symbolic key, the new index record will be placed in front of the old one.

The current record numbers for both the data file and index file are set to the new records.

Exclusive access is not set with this order.

Order : /1E – indexed read next

A record will be read into the user buffer from the data file as indicated by the next index record after the current index record number.

The current record numbers in both the data file and the index file will be updated.

The control word is empty at the time the request is made. Exclusive access can be set for this record in the same way as for indexed random read.

Order : /22 – close file:

This order indicates to data management that the file specified by the file code on the ECB is no longer required by any task. It may not be used again by any task until a file code is re-assigned to the file.

Order : /23 – get current record number of the data file:

The current record number of the data file is put into the control word. No I/O operation occurs and only the file code is required as a parameter.

Order : /24 – get current record number of the index file:

The current record number of the index file is put into the control word. No I/O operation occurs and only the file code is required as a parameter.

TIODM **Continued** TIODM

System generation parameters : In addition to the parameter mentioned above (exclusive access handling) the following parameters must be supplied during **system generation.**

- Number of disk files. This is the maximum number of data management files which can be assigned at the same time.
- Number of file codes. This is the maximum number of file codes which can be used for data management files.
- Number of buffers. This is the number of sector buffers to be used by data management.

Recovery at power on : If there is a running disk I/O-request when power fail occurs, this request is immediately completed at power up and bit 14 "disk I/O error" is set in the return code.

After power fail the disk drive will remain not operable until it is started manually. When the disk drive becomes ready again the volume label is read by the disk driver. If a new volume name is entered the next data management request will be aborted and bit 8 "new volume loaded" is set in the return code.

3.6 Special calls

This section contains detailed reference information about two functions which are called by the LKM, DATA 1, the ATTACH/DETACH function and the INTERTASK COMMUNICATION function.

During system generation, certain parameters concerning the handling of the functions can be specified. The parameters are described for each function in this section. The words "system generation" are printed in bold type throughout this section in order to highlight these parameters. Most parameters are specified during the "conditional assembly" specification. Where this is not the case the relevant part of system generation appears in brackets.

ATTACH/DETACH

ATTACH/DETACH

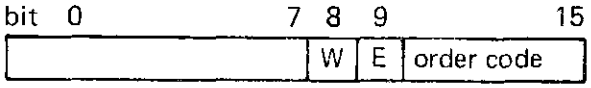
General information : The ATTACH request is used when a task wants to have exclusive access to a device. The other tasks are locked out from I/O on this device.

When a device has been attached to the task all I/O requests from other tasks are put into the device queue and will not be executed until the device is detached.

The DETACH request is used for releasing the attached device. The detach request must be performed by the task that made the attach request.

Calling sequence : LDK A7, code
LDKL A8, ecb-address
LKM
DATA 1

"Code" has the following layout:



bits 0–7 – are not significant.
bit 8 – wait bit, must be set (1).
bit 9 – echo bit, must be reset (0).
bits 10–15 – are the order bits specifying the function.

Order codes : The following order codes are available:

/3B : attach
/3C : detach

ecb-address : The ecb-address is the pointer to the event control block which has the following layout:

byte address

0	status	file code*
2	not used	
4	not used	
6	not used	
8	return code	
10	control word*	

"status" – This field is used exclusively by the monitor. Bit 0 (most significant) is set to 1 on completion of the I/O operation.

"file code" – specifies the device to be attached to or detached from the requesting task. File codes are associated with devices during **system generation** (see list in section 3.4 of recommended file codes).
File code has to be specified by the user.

ATTACH/DETACH **Continued** **ATTACH/DETACH**

"return code" — In the word return code two bits indicate how the event is completed.

bit 0 — request error
bit 9 — device not available (only order /3B).

"control word"— The control word is only significant for order /3B. The control word contains the specified time-out value in multiples of 100 ms. That specified time the attach-request stays on and after that time the request is aborted and that is indicated in the return code (bit 9).

A time-out setting of zero implies a test on device for availability. The control is immediately given back to the task which issued the request, with in the return code the information whether the device is attached or not.

Control word has to be specified by the user with order /3B.

Order : /3B — attach

The specified device is attached to the requesting task and stays under control of that task until a detach request is issued by the controlling task. If the device is not available after some time (time-out specified in control word) the request is aborted with bit 9 set in the return code.
I/O requests for the device from other tasks are queued in the device queue. The requests are executed after the device is detached. The attach and I/O requests are queued in the device queue which is organized first in first out within priority.

Order : /3C — detach

The specified device is detached from the task issuing this detach request.
After the detach the device can be used by any other task as specified by the device queue or program.

INTERTASK COMMUNICATION

INTERTASK COMMUNICATION

General information : This intertask communication processor which handles the communication between tasks can be included at **system generation** time. With the intertask communication processor it is possible to transfer data from one task to another task. However, the sending task has to issue a write request and the receiving task has to issue a read request.

A write request is always addressed to a specific task in contrast to a read request which is used for receiving data from any task.

It is strongly recommended to assign the same file codes for intertask communication to all tasks (/D0 – input, /D1 – output) at **system generation.**

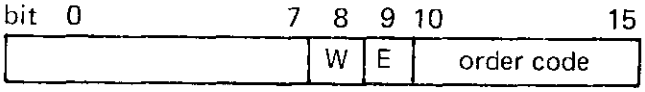
Calling sequence : Intertask communication

```
LDK   A7, code
LDKL  A9, ecb-address
LKM
DATA  1
```

Intertask communication with activation

```
LDK   A1, parameter
LDK   A7, code
LDKL  A8, ecb-address
LKM
DATA  -1
DATA  start-address
```

"Code" has the following layout:



bits 0–7 – not significant
bit 8 – wait bit
bit 9 – echo bit must be reset (0)
Bits 10–15 – are the order bits specifying the function.

Order codes : The following order codes are available:

/02 : read
/06 : write
/39 : set time-out

ecb-address : The ecb-address is the pointer to the event control block which has the following layout:

INTERTASK COMMUNICATION **Continued** **INTERTASK COMMUNICATION**

byte address

0	status	file code*
2	buffer address*	
4	requested length*	
6	effective length	
8	return code	
10	control word*	

"status" – This field is used exclusively by the monitor. Bit 0 (most significant) is set to 1 on completion of the I/O operation.

"file code" – Specifies the file code for input or output in accordance with the order code (input-read, output-write).

"buffer address" – Points to the buffer address used with the intertask communication. (Used with orders /02 and /03.)

"requested length" – Length of the data to be transferred inclusive of the control word in buffer. (Only used with orders /02 and /03.)

"effective length" – In this word the number of transferred characters are administrated. (Not significant with order /39.)

"return code" – The return code gives information about the status of the I/O request after completion.

bit 0 – request error
bit 9 – time-out
bit 12 – Incorrect length (Requested length of read request less than requested length of attached write request.)

"control word" – Only used with order /39 and will contain a time-out value (marked in multiples of 100 msec) or if no time-out is wanted, the value should be –1.

* has to be supplied by the user.

Order : /02 – read

With the order read the task is prepared to receive data from another task, which has issued a write for this task.

The first word of the buffer is reserved and should be included in the requested length. After completion of the read the first word in the buffer contains the task identification (TID) of the task from which the data were transferred.

The words buffer address, requested length, effective length and the return code have the normal meaning.

Order : /03 – write

The write order prepares a data transfer from this task to another task which is addressed by the first word in the buffer.

The write is accepted by the addressed task if that task has issued a read. If no read is issued, the write is put into an input queue (first in–first out) attached to the addressed task.

The words buffer address, requested length, effective length and the return code have the normal meaning.

Order : /39 – set time-out

The set time-out request is issued by the monitor to supervise the read and write request within the intertask communication. If the issued read or write request is not completed within the specified time, bit 9 of the return code word will be set. For read and write different time out values can be set. The time-out value is specified in multiples of 100 msec. in the control word of the ECB. A time-out request for read uses the input file code (recommended /D0).
A time-out request for write uses the output file code (recommended /D1).

A time-out value is valid until changed by a new set-time-out request. If no time supervision is wanted (for a non-expired time-out value) the control word of the set time request should be set to –1.

A set-time-out request should be issued without wait on event before the read or write request is issued which needs the time supervision.

Buffer address, requested length and effective length are not significant.