SAG

Element 22.2 : Cassette Type Unit Controller

Baseline 2 : Element Performance Specification

TYPE OF PAGE : SURVEY OF DOCUMENTS

SECTION OR TYPE OF PAGE											SIGNATURE			First issue = O Changed = X Cancelled = V Not applicable = N	
											Author	Responsible	Approval		
0	1 scope	2 Applicable documents	3	4	5 Extend logic interface	6 Functional Performance	7	8	9 special circuit requirements	10	Robert	Labrator	Catlet / Van der Loot	N° of Change	Date of Document
TOTAL NUMBER OF SHEETS	1	1			2	33			14						
	0	0			0	0			0		R.			0	14.9.71

TC

CONTROLLER

The digit which possibly follows modification sign X, indicates the changed page number.

AUTHOR:	SIGNATURE:	RESPONSIBLE:	APPROVAL:

Philips Data Systems

IGSC - Centre Technique et Industriel - Fontenay aux Roses - France

Date of créations

Page :

PHILIPS

SAG Element 22.2 Cassette Tape Unit Controller
Baseline 2 : Element Performance specifications
Type y page : Mailing list (Destinataires)

Direction: Technique: M. Van der Sloot Commerciale: M. Groosman

Head Office Apeldoorn: MM.	Astles	Debyl	Krigsman	Visser
	Arends	De Munck	Van der Veen	
	Balder	De Meijere	Van der Vlught	
	Berghuis	Delange	Van Veen	
Direction C. T. I	MM. Chové	Froliger	Morvan	Prades
Chefs de Projets	MM. Cottet	Dandrel	Dias Gama	Serpoul
Responsable				
Auteur				

Administration	Chef de service			
C. A. D.	Chef de service	MM. BERTAUX	SHAYER	
Electronic	Chef de service			
	MM. DEUFFIC		Melle FERNANDES	
	GIMOND	HAMON	ROUSSET	MOUGENEL
Test management	Chef de services			
	MM. CHARAU	DURANTON	DURIEU	
	FROISSART	GODARD		
	Melle RADOJKOVIC	ROUSSEAU		
Quality assurance	Chef de service	ROURE	TASSIE	CHAIGNEAU
Bureau de Construction	Chef de Service	MM.MUTEL	FOURNERIE	
Logic	Chef de Service			
		MM.LEBRETON	POTTIER	RICHECOEUR
		ROBERT	VU TIEN	
Material Management	Chef de Service			
Planning	M. DUBOURVIEUX			
Software	Chef de Service			
	MME ANAMELICHI	MM. BALOCHE	BRACQUART	
	M. CRUBEZY	DUCASSE	DUC LAM	
	M. FAULLE	LACOUR	LUX	
	M. MAILLET			
	Melle THIBULT	MM. VAST	TAILLADE	
TEO	Chef de Service	MM. BARTHEZ	CANAL	
Technical Document.	Chef de Service			
Commercial Document.	Chef de Service			
Montparnasse	MM. LE MARCHANT	RAIMOND		
Field Service Internat.	M. LAILLIER			
Rambouillet	M. LOYER			
	MM BARLOW	PARREIRA		

AUTHOR :	SIGNATURE	RESPONSIBLE	APPROVAL

Philips Data Systems
IGSC - Centre Technique et Industriel - Fontenay-aux-Roses - France

Date :
Page :

5111 991 00441

1 - SCOPE

The cassette tape unit used on Sagittaire is the Philips professional cassette unit or the Ampex one.

The control unit will allow to connect up to 4 cassettes tape units according to the size of the hardware which should be three Sagittaire cards.

2 : APPLICABLE DOCUMENTS

Philips professional cassette system (29.1.71)

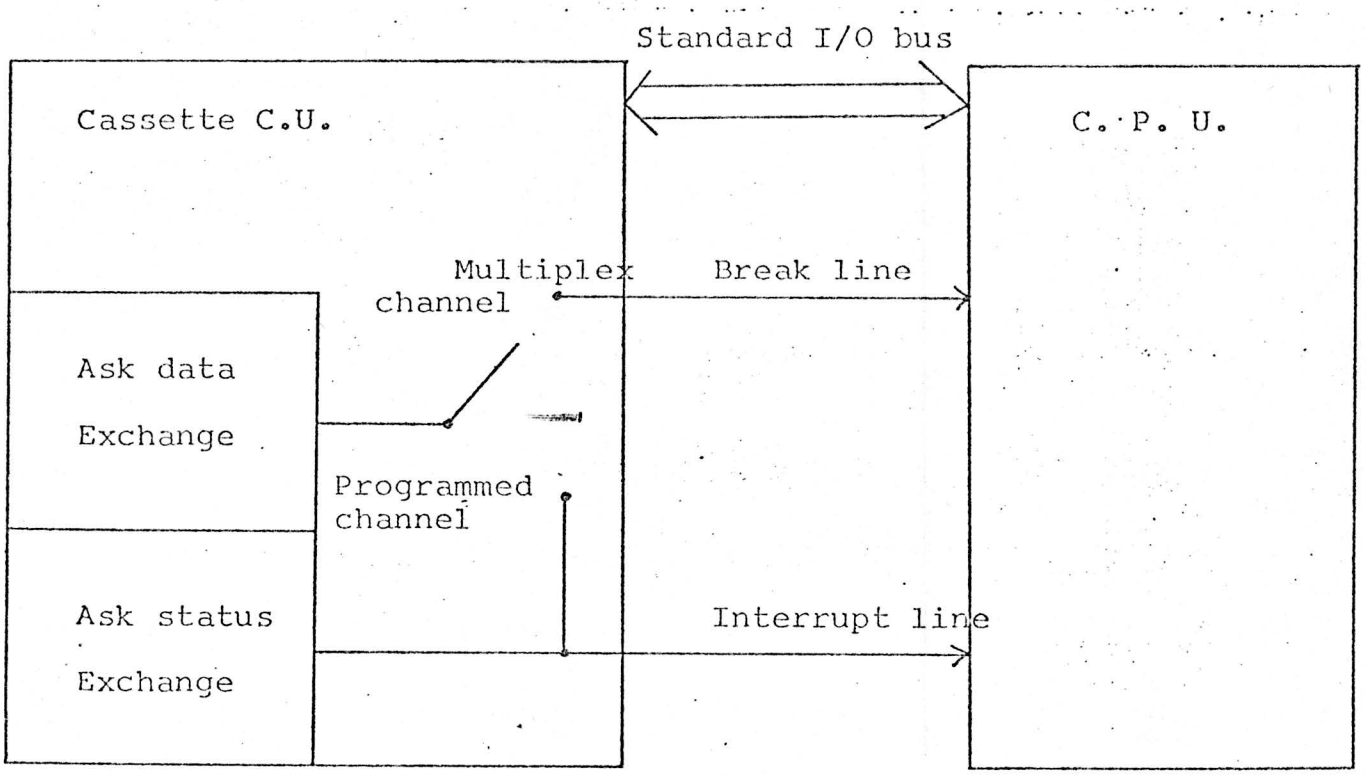
Draft commercial specifications for
Philips Professional Cassette type LG 6003. (4.2.71)

Draft standard for Data Interchange
on Magnetic Tape Cassette 800 bpi, PE, (25.5.70)

Ampex cassette TMC specifications

1.5.1. Computer Interface

It is the standard I/O bus interface. Depending on the channel to which the control unit is connected, the following connections are done :



1.5.2. Device interface

Signals from the controller to the device

SIGNAL NUMBER	NAME	ACTIVE / INACTIVE LEVEL PHILIPS	AMPEX
0		0 Volt	0 Volt
1	SLT/ select	———	0/5
2	FWD Forward	5	———
3	REV Reverse	5	5
4	FAST Fast	5	5
5	WCD Write command	5/0	———
6	WCD/ Write command	———	0/5
7	RCD Read command	5/0	
8	RCD/ Read command	———	0/5
9	WDA Write data	5/0	———
10	WDA/Write data	———	0/5
11	LCK Lock	5/0	———
	SIGNALS FROM THE DEVICE TO THE CONTROLLER		
12	WEN/ Write enable	0	0
13	RDY/ Ready	0	0
14	BET/ Beginning or end of tape	0	0
15	A/ A or B side	0/5	0/12
16	RDA/ Read data	0	0
17	CIP/ Cassette in place	0	0

1 : Basic information

1.1. Tape unit characteristics

1.1.1. Tape unit specifications

Model	Philips	Ampex
Type of encoding	Phase encoded	Phase encoded
Tape speed	7.5 ips	7.5 ips
Number of track per side	1	1
Number of cassette side	2 (A or B)	2 (A or B)
Type of head	Read after write	Read after write
Data rate	750 ch/s at 7.5 ips	750 Ch/s at 7.5 ips
Start time	20 ms max.	40 ms max
Stop time	20 ms max	40 ms max
Maximum time to rewind a 282 feet tape	45 s	45 s
Error rate	1 recoverable in 10^6 bits 1 unrecoverable in 10^7 bits	1 recoverable in 5.10^6 bits
Density	800 bpi	800 bpi

1.1.2. Cassette tape specifications

Cassette type : Twin hub, coplanar

Tape type : Magnetic tape certified for 1600 fcpi

Tape size : 282 ft long
0.15 i wide
750 ui thick

Data capacity : 2.8 million bits on each track

File protect : Two replaceable write enable plug in cut-outs at rear edge of cassette frame

Tape side identification : Asymetrically positioned cut-out in rear edge of cassette frame.

Number of head passes before drop outs occurs : > 2000

Tape markers : two oblong holes as beginning of tape and End of Tape for optical indication

Location : 3.94 i from the physical beginning of magnetic tape.

1.1.3. Record format

The information on the tape is arranged in characters of 8 bits.
The characters are arranged in blocks. A block shall consist of a preamble, data and a postamble. The data portion of a block is 1 to 256 characters long.

Preamble

When running in the forward direction, the preamble pattern "Ø10101010" is the first character of each block.

Postamble

When running in the forward direction, the postamble pattern "Ø10101010" is the last character of each block.

The preamble and postamble characters are generated by the C. U. They are never sent to the CPU when reading a block, as first and last character, except the postamble can be sent as last character if the programmed length of the block is greater than the physical length of the record.

LRC character

When reading or reading after writing a block, the same weigted bits of all the characters are X ored by the cassette control unit. The status word of the ended operation will indicate a data fault if the character sum in the C. U. is different from zero.

For this purpose the program has to generate a LRC character in the data portion of a block when writing.

1.2. Control unit characteristics

Up to four tape units can be connected to the control unit.

The tape control unit is connected either to the multiplex channel or to the programmed channel (with or without interrupt handling).

The correspondence between the BIN/BOU lines and the character's bits is the following :

Bit number	bo	b1	b2	b3	b4	b5	b6	b7
BIN/BOU lines	08	09	10	11	12	13	14	15

The least significant bit of a character, b7, is first recorded.

2 - INPUT/OUTPUT COMMANDS

2.0. Summary

The control unit has to recognize the following commands :

2.1. TST
2.2. Commands I/O start
- 2.2.1. Erase forward
- 2.2.2. Forward space block
- 2.2.3. Backward space block
- 2.2.4. Write a block forward
- 2.2.5. Read a block forward
- 2.2.6. Search tape mark forward
- 2.2.7. Search tape mark backward
- 2.2.8. Rewind
- 2.2.9. CIO lock/unlock

2.3. CIO stop
2.4. INR
2.5. OTR
2.6. SST

In a general way a refused I/O command sets the condition register to "1" and an accepted one resets it to "0".

During the execution of any I/O command a non recognized device address sets the condition register to "3".

The control unit does not accept invalid command, except for any invalid CIO start command which generates an interrupt and program error indication in the status word.

The control unit performs any CIO commands whatever the side A or B of the cassette is up.

Caution on tape handling

Any I/O operation on a raw cassette or previously rewound cassette must begin by a forward space block on order to reach the logical beginning at the tape. The tape motion stops after an ending hole during any operation without data transfert.

2.1. TST Test status command

0 1	4	5 7	8	9 10	11 12	15
0 1 0 0 1		R1	10	DN	C U A	

C.U.A. : Control unit address

D.N : Device number (00 to 11)

R1 : Indicates the register into which status bits are exchanged during this instruction.

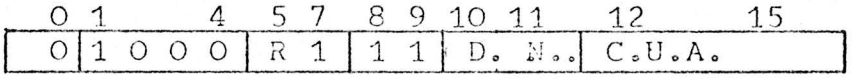
This command must be used before starting any I/O operation, to test if the control unit is in ready state

This command is always accepted by the control unit and does not disturb the eventual running operation of the control unit.

During the execution of TST the BIN contents are sent into R1 register, with the following meaning :

bit value	1	0
bit n° 15	C.U. busy (not ready)	C.U. ready

2.2 CIO Starting commands



0	1	4	5	7	8	9	10	11	12	15
0	1 0 0 0		R 1		1 1		D. N..		C.U.A.	

C.U.A. : Control Unit Address

D.N. : Device Number

R1 : The bits number 12, 13, 14, 15 of this register specify the command sent via the BOU lines

R1 Contents

bit number	12	13	14	15	command
	0	0	0	0	Lock/Unlock
bits value	0	0	0	1	Erase forward
	0	0	1	0	Backward space block
	0	0	1	1	Forward space block
	0	1	0	1	Write a block forward
	0	1	1	1	Read a block forward
	1	0	0	0	Rewind at fast speed
	1	0	1	0	Search Tape Mark backward
	1	0	1	1	Search Tape Marck forward

2.2.1. Erase forward

Execution time : 380msec

This command is used to erase the tape for a distance of approximately 2.5 inches, on the track according to the side being up, on the addressed tape unit. (The length of a 256 characters block is 2.5.inches)

This command is accepted if the Control Unit is in the inactive state and if the tape unit is not in a rewind operation -

The Condition Register is set to "1" if the command is not accepted. When this command is accepted :

- The condition register is reset to zero,
- The controller switches to the "Execute" state,
- The selected tape unit moves the tape forward, erases a part of the tape and stops, if the device is operable and if the working track is not file protected.
- If the track is file protected, the device does not start, the Control Unit switches to the "wait status" state . The bit n°6 of the status word is set.
- If the device is not ready, the C.U. switches to the "wait status" state and the bit n°15 of the status word is set.

When an erase operation is performed in the end of tape area, the tape will stop as soon as the end of tape hole is detected and the bit 10 of the status word is set.

2.2.2. Forward space block

This command is used to move the working track forward to the next interblock gap on the addressed unit.
This command is accepted if the control unit is in the inactive state and if the tape unit is not in a rewind operation.
The condition register is set to "1" if the command is not accepted and nothing else happens.
When this command is accepted :

- the condition register is reset to zero
- the controller switches to the "Execute state"
- the selected tape unit moves the tape forward

There is no data exchange, and no parity check.

- When the next interblock gap is reached, the tape stops. If an End of Tape is encountered, the the tape stops after the ending hole, and the bit n° 10 of the status word is set.

Even following a write block or erase gap command an accepted forward space command is performed, and the tape moves until the end of a previously recorded block is found. If the tape is raw, it moves until the ending hole detection, the tape stops, and the bit N° 10 of the status word is set.

2.2.3. Backward Space Block

This command is used to move the working track backward of the addressed unit to the next interblock gap.
This command is accepted if the C.U. is in the inactive state and if the tape unit is not in a rewind operation.
The Condition Register is set to "1" if the command is not accepted and nothing else happens.
When this command is accepted :

- The Condition Register is reset to zero,
- The Controller switches to the "Execute" state,
- The selected tape unit moves the tape backward. There is no data exchange, and no parity check.

- When the next interblock gap is reached, the tape stops. If the space is performed in the End or Beginning of tape area, the tape stops after the hole detection and the n° 10 of the Status word is set. If the track is raw the tape moves until the beginning of tape area, the tape stops after an ending hole and the bit n° 10 of the status word is set.

2.2.4. Write a Block Forward

This command is used to write a block fetched from the main storage, on the working track of the addressed tape unit.
This command is accepted if the Control Unit is in the inactive state and if the tape is not in a rewind operation.

The Condition Register is set to "1" if the command is refused, and nothing else happens.

When this command is accepted :

- The Condition Register is reset to zero,
- The C.U. switches to the "Execute" state.
- The selected tape unit moves the tape forward and writes characters taken on the BOU lines. At the end of the Multiplex transfer or if a STOP command is received, the C.U. realizes the Interblock Gap and stops the tape.

A write command assigned to a file protected track is accepted but not performed. In this case the C.U. switches to the "Wait Status" state ; the bit n°6 of the Status Word is set.

(2.2.4)

If a parity error is detected during a write command the C.U. realizes the Inter block gap and stops the tape. The bit N° 13 of the Status Word is set.

If a throughput error occurs during a write operation, the data transfer is interrupted, the C.U. realizes the Interblock Gap and stops the tape. The bit N° 14 of the Status word will be set.

After the first write operation performed in the End of Tape area, the bit N° 10 of the Status Word is set. The tape will be long enough to allow another block with the maximal length to be written, but the bit n° 10 of the status word will be not set.

2.2.5. Read a block forward

This command is used to read forward a block of data on the working track of the addressed tape unit.
This command is accepted if the Control Unit is in the inactive state and if the tape is not in a rewind operation.

The Condition Register is set to "1" if the command is refused and nothing else happens.

When this command is accepted :

- The Condition Register is reset to zero,
- The Control Unit switches to the "Execute" state,
- The selected tape unit moves the tape forward and sends the data characters read on the track to the BIN lines,
- When the Interblock Gap is reached the tape stops and the C.U. switches to the "Wait Status" state.

If the block is finished before or after the End of Range signal of the Multiplex or the Stop command occurs, the bit 12 of the Status Word will be set. The postamble is sent as the last character of a block if the programmed length is greater than the physical length.

(2.2.5.)

The data transfer stops as soon as the EOR signal or Stop command or Interblock Gap occur.

If a throughput error occurs during a read command the data transfer is interrupted. The C.U. switches to the "Wait Status" state after the tape is stopped in the Interblock Gap and the bit 14 of the Status Word is set.

If a parity error is detected during a read command the operation is ended like for a throughput error, but the bit 13 instead of the bit 14 of the Status Word will be set.

As soon as an ending hole is detected, the bit n° 10 of the status word is set.

Even following a write block or erase gap command, an accepted Read forward command is performed ant the tape moves until the end of a previously recorded block is found.
The tape moves until the end of tape if the tape is raw and there will be no interrupt.

2.2.6. Search Tape Mark Forward

This command is used to search forward a block of 2 data characters, on the working track of the addressed tape unit

This command is accepted if the C.U. is in the inactive state and if the tape is not in a rewind operation.

The conditionregister is set to "1" if the command is refused and nothing else happens.

When this command is accepted :

- The condition register is reset to zero ;
- The C.U. switches to the Execute State,
- The selected tape unit moves the tape forward and the C.U. stops the tape after the next tape mark block, it switches to the wait status state and the bit n° 3 of the status word is set.

2.2.7. Search Tape Mark Backward

See 2.2.6 with the tape moving in the backward direction.

2.2.8. Rewind

This command is used to rewind the working track on the addressed tape unit to the nearer ending hole.

This command must be programmed when starting a job on a new track if this track is not at the beginning of tape hole.

This command is accepted if the control unit is in inactive state and if the tape is not already in a rewind operation.

The condition register is set to "1" if the command is refused and nothing else happens.

When this command is accepted :

- the condition register is reset to zero
- the C. U. switches to the "Execute" state and initiates the tape rewind
- the selected tape unit moves the tape backward and stops after the first encountered ending hole.

After the C. U. has initiated the tape movement it switches in the inactive state.

When the tape stops and if the CU is inactive, it switches to the "Wait status" state and the bit 10 of the status word is set.

Execution time : 45 sec. max. for a 282 feet tape

2.2.9. CIO lock/unlock

This command is used to lock/unlock the cassette in the addressed tape unit and to put the heads in the end position (tape contact), for the PHILIPS drives.

For the AMPEX units this command is don't care. This command is accepted if the control unit is in inactive state and if the tape is not in a rewind operation. The condition register is set to "1" if the command is refused and nothing else happens.

- When this command is accepted :
  - the condition register is reset to zero
  - the C. U. switches to the "Execute State" and :

    Lock the cassette if it is unlocked
    Unlock the cassette if it is locked

  After 80 ms the C. U. switches in the inactive state.

Nota : After a Master clear all the units become unlocked.

2.3. STOP Command

0	1	4	5	7	8	9	10	11	12	15
0	1 0 0 0		R 1		1	0	X	X	C.U.A.	

C.U.A. : Control Unit address
D.N. : Device Number is don't care
R1 : The contents of the Register R1 is not significant.

This command is used to stop data transfer between the C.U. and the C.P.U.

The execution of the following commands :

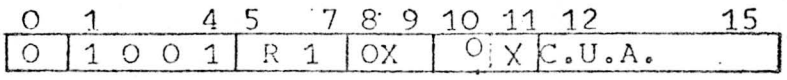
- Forward and Backward space block
- Erase gap
- Rewind

is not disturbed by a stop command.

This command is always accepted and the condition register is reset to zero.

This command must be programmed after the last character to be exchanged.

2.4. INR Command



C.U.A. : Control Unit Address
D.N. : Device Number is don't care
X : don't care
R1 : indicates the register into which data are exchanged during this instruction.

This command is used when the control unit is connected to the programmed channel. It is simulated by the Multiplex when using this channel.

The INR command is used to transfer one character read on the working track of the selected tape unit.
This command is accepted if the C.U. is in the exchange state.
The condition register is set to "1" if the command is refused and nothing else happens.
When this command is accepted :

- The condition register is reset to zero,
- The 8 bits contents of the C.U. buffer is sent to the right half of R1 via the BIN lines,
- The ask for exchange line is desactivated,
- The C.U. switches to the "Execute" state,
- The C.U. serializes the next character.

2.5. OTR Command

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	1	0	0	0	R	1	C	X	0	X		C. U. A.			

C.U.A. : Control Unit Address
D.N. : Device number is don't care
X : don't care
R1 : indicates the register from which the right half contents is exchanged during this instruction.

This command is used when the C.U. is connected to the programmed channel. It is simulated by the Multiplex when using this channel.

The OTR command is used to transfer one character to be written on the working track of the selected tape unit.

This command is accepted if the C.U. is in the exchange state.

The condition register is set to "1" if the command is refused.

(2.5.)

When this command is accepted :

- The Condition Register is reset to zero,

- The right half of the R1 register is sent into the C.U. buffer via the BOU lines,

- The ask for exchange line is desactivated,

- The C.U. switches to the "Execute" state and serializes the character.

2.6. SST Command

0	1 4	5 7	8 9	10 11	12 15
0	1 0 0 1	R 1	11	0 x	C.U.A.

C.U.A. : Control Unit Address

D.N. : Device Number is don't care

R1 : indicates the register into which the status word of the C.U. is sent during this instruction.

This command is used to get the status word from the control unit. It is always programmed at the end of any I/O operation.

A SST command is accepted if the control unit is in the "Wait Status" state.

The condition register is set to "1" if the command is refused.

When this command is accepted :

- The condition register is reset to zero,
- The Status Word is sent into R1 via the BIN lines.

The C.U. switches to the "Wait Status" state and generates an interrupt if the device is not operable during the "Execute", "Exchange" states or for the set conditions enounced with the preceding commands.

3. Status Configuration

During an accepted SST or TST, the R1 contents get the the following meaning :

Bit n°15		Not operable or C.U. busy
-	14	Throughput error
-	13	Parity error
-	12	Incorrect length
-	11	Program error
-	10	End of Tape or beginning of tape
-	09 08	Device address in binary value
-	07	A or B side
-	06	Write unable
-	05/04/	Reserved
-	03	Tape mark has been read
-	02	Reserved
-	01	Has been unready

3.1. Not operable or C.U. busy

During a SST command the meaning is :

- Cassette not inserted when the tape unit is selected.
- Power is not supplied

During a TST command this bit is set if the C.U. is busy.

3.2. Throughput error

The serialization of a character is ended before the preceding is taken by the C.P.U. when reading or before the next to be written is sent by the C.P.U.

When a throughput error occurs :

- The data exchange requests are inhibited when reading and the C.U. switches to the "Wait Status" state in the interblock gap.
- The data exchange requests are stopped when writing and the C.U. accomplishes the interblock gap, stops the tape and switches to the "Wait Status" state.

3.3 Parity error

This bit is set when a longitudinal parity error is detected during a read or write command.

When a parity error occurs, the Exchange requests are interrupted only when reading.

3.4. Incorrect length

This bit is set when reading whenever the tape block length is different from the channel block length.

3.5. Program error

This bit is set whenever the C.U. receives from the Multiplex channel an invalid code, or if an invalid CIO starting command is attempted.
A program error stops any data exchange.

3.6. End of tape :

This bit is set when an End of tape area is reached.or when a rewind operation is ended.

3.7. Device address

Bits 09, 08 give the device number concerned by the status word. Bit N° 8 is the most weighted bit

3.8. A or B side

This bit is set during a SST command if the A side was up.

3.9. Write unable

This bit is set whenever the C.U. receives a write or erase command while the working track is file protected.
A write unable declaration stops any data exchange

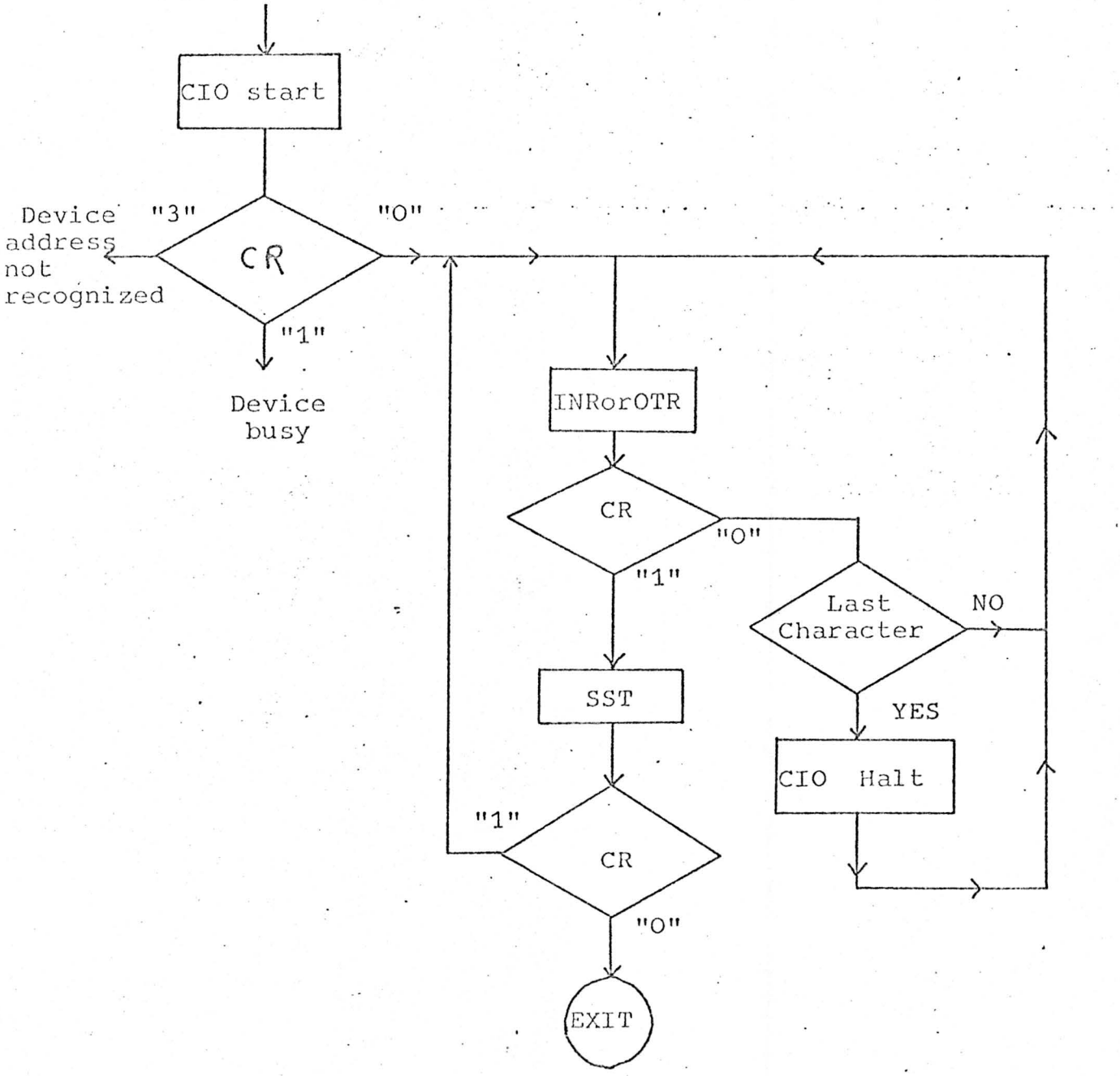
3.11. Has been unready

The C.U. switches to the "Wait Status" state when the state of a tape unit has changed from not ready to ready and the bit n°1 is set.

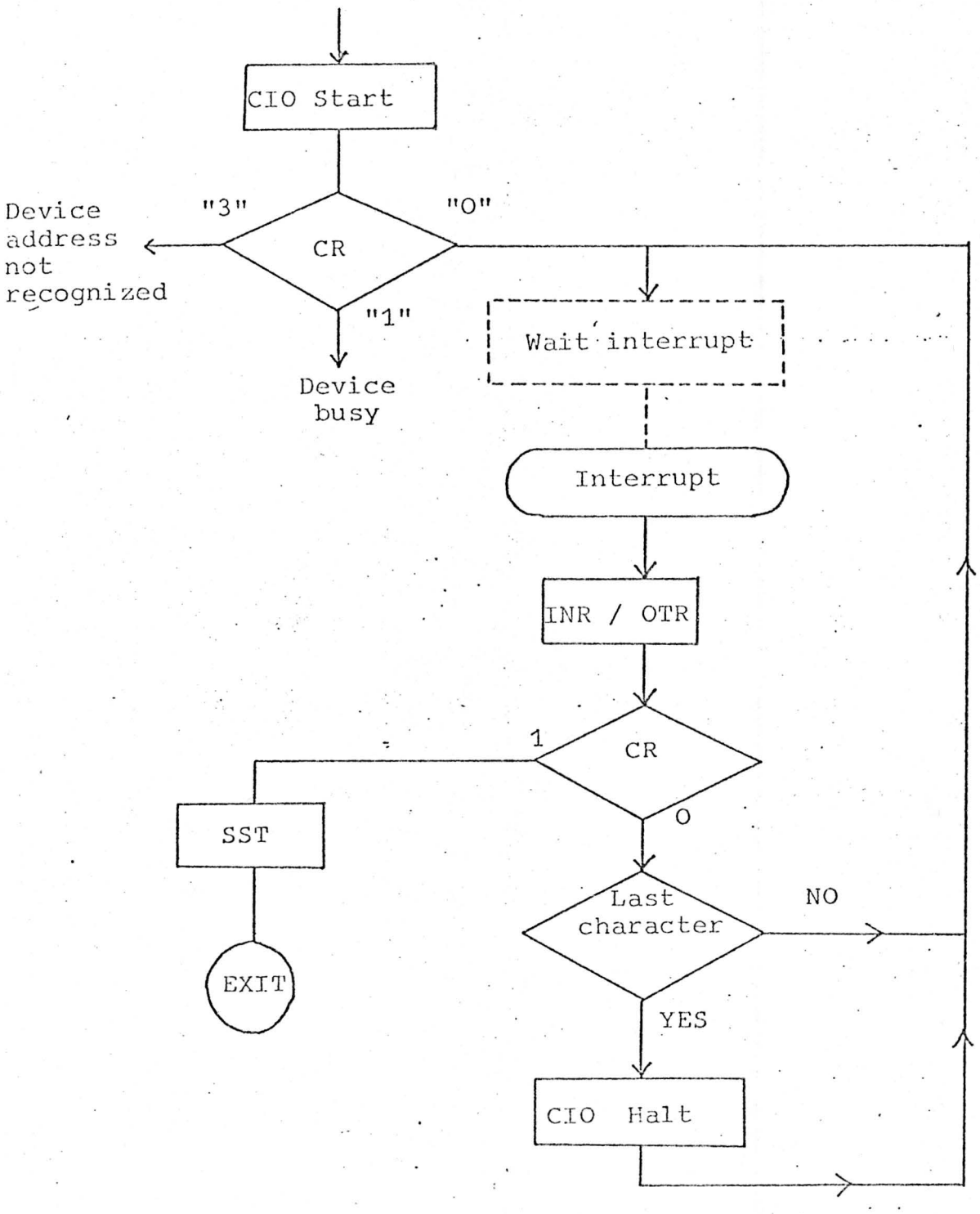
(e. g.) When inserting a new cassette or when switching the side of a cassette.

4. PROGRAMMING RULES

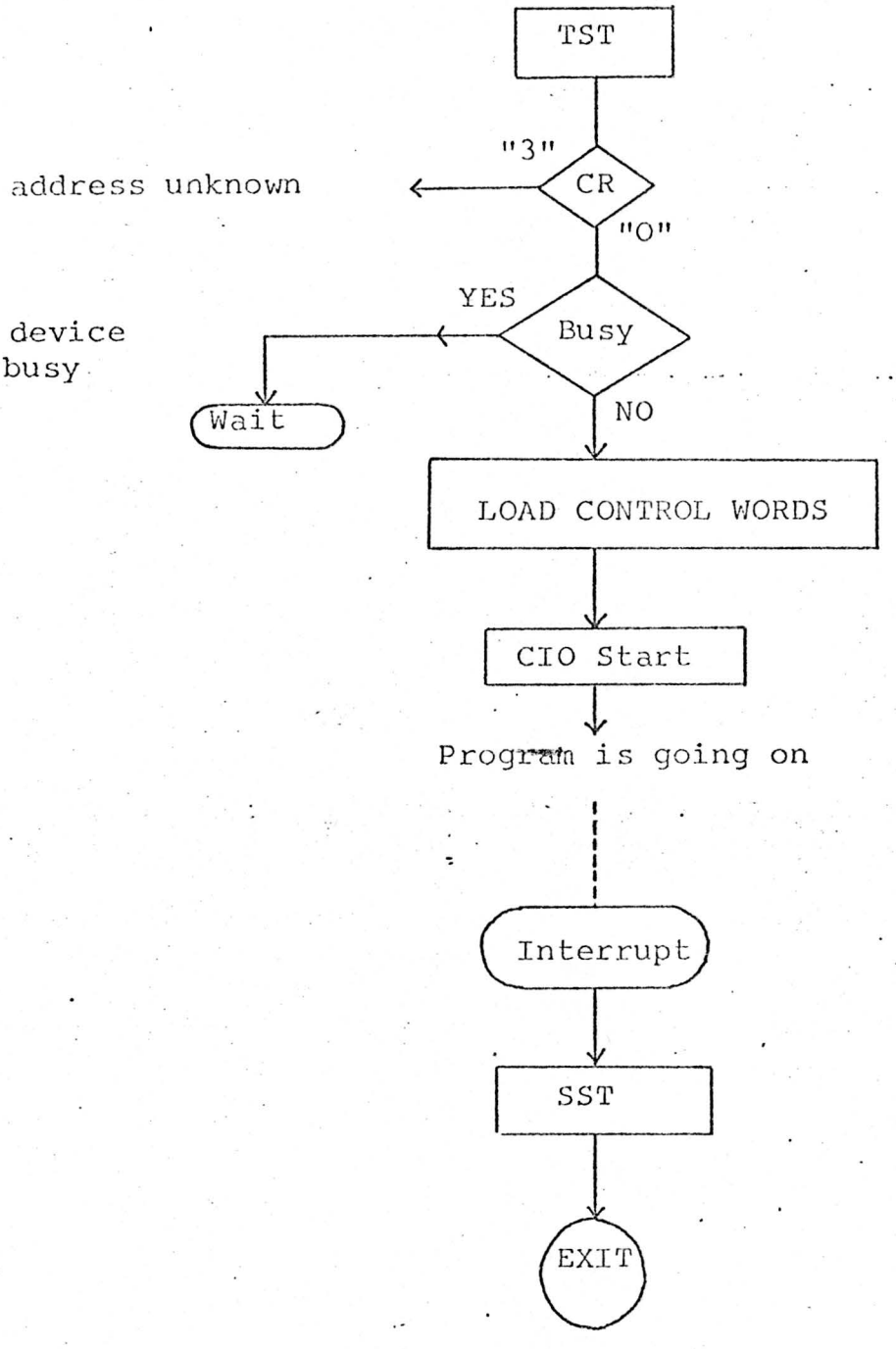
4.1. Programmed channel without interrupt handling



4.2. Programmed channel with interrupt handling



4.3. Multiplex channel



4.4. Interrupt activation

4.4.1. Control unit connected on the I/O bus with interrupt handling

The interrupt line is activated only when a CIO start command has been accepted by the control unit.

An interrupt activation appears when the control unit asks for a data exchange or for an SST command.

4.4.2. Control unit on multiplex channel

In this mode of connection the interrupt line is only used to ask for a status exchange. For the data exchange requests, the break line is activated.

1 - GENERAL

The circuits, which have to be developped are clock circuits, interface circuits between the C. U. and the peripherals and power supply for the cassette models :

- Philips Digital Cassette Deck

- Ampex TMC 200

2 - FUNCTIONAL REQUIREMENTS

2.1. General wiring diagram

2.1.1. Interface circuits

The circuits must not invert the signals.
The correspondance between the AMPEX and PHILIPS is the following.

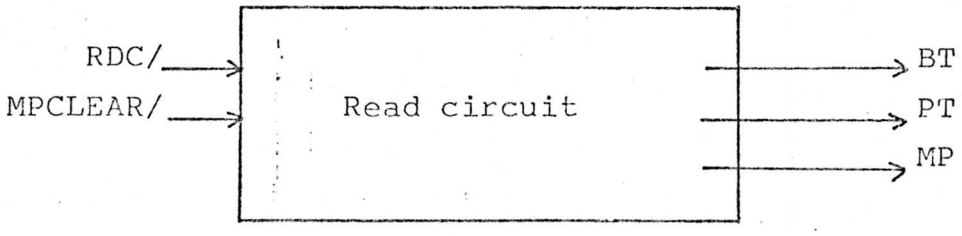
Circuit number	AMPEX	PHILIPS
CSO C.U.→Cassette drive		
1	FAST → [ ] → FAST*	FAST → [ ] → FAST*
2		FWD → [ ] → FWD* (forward)
3		LOCK → [ ] → LOCK*
4	RCD/ → [ ] → RCD/* (read command)	
5		RCD → [ ] → RCD* (read command)
6	REV → [ ] → REV* (reverse)	REV → [ ] → REV*
7	SEL/ → [ ] → SEL/* (run)	
8	WCD/ → [ ] → WCD/* (write command)	
9		WCD → [ ] → WCD* (write command)
10	WDL/ → [ ] → WDL/* (write data)	
11		WDL → [ ] → WDL* (write data)

Circuit number	AMPEX	PHILIPS
CSI CASSETTEC.U.		
12	A/* → ▭ → A/	A/* → ▭ → A/
13	BET/* → ▭ → BET/	BET/* → ▭ → BET/
14	CIP/* → ▭ → CIP/ (cassette not in place)	CIP/* → ▭ → CIP/
	→ ▭ → RDY/ (not ready)	RDY/* → ▭ → RDY/
16	RDA/* → ▭ → RDA/ (read data)	RDA/* → ▭ → RDA/
17	WUN* → ▭ → WUN (write unable)	WUN* → ▭ → WUN

All the interface circuits and signals are indexed by 0, 1, 2, 3 according to the cassette drive number 0, 1, 2, 3.

2.1.2. Writing oscillator

2.1.3. Read circuit



2.1.4. Cassette power supply

AMPEX : + 12 V ; 3A for control and electronics
+ 24 V ; 1A for motor drive

PHILIPS : + 6 V ; 1,8 A for control
+ 24 V ; 1A for motor drive
(1.4A during the power on)

3 - ELECTRICAL REQUIREMENTS

3.1. Special circuits power supply

Vcc = + 5 V ∓ 5 %

3.2. Interface circuits

3.2.1. Wiring

The transmission lines are 120 ohms twisted lines
Max length : 3 m.
All the special circuits outputs not connected to an interface line must be terminated on the C. U. cards.

3.2.2. Timing requirements

t rise ⩽ 500 ns
t fall ⩽ 500 ns

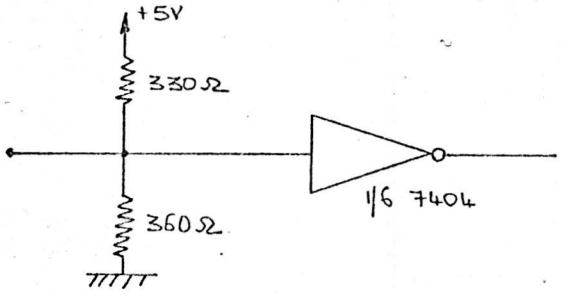
3.2.3. Loading

3.2.3.1. Output circuits

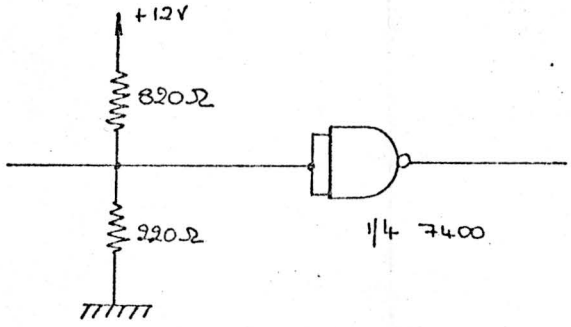
The driving circuits of the logic signal number 1 to 11 are standard TTL output ; fan out 10.

3.2.3.1. a - Ampex loading circuits

Circuit number : 1, 6, 7

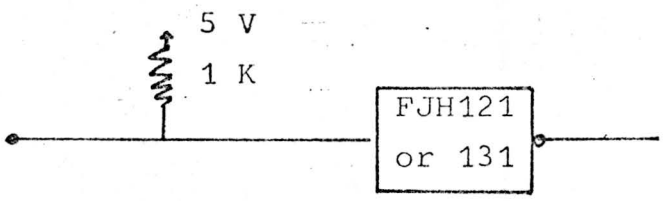


Circuit number : 4, 8, 10



3.2.3.1. b - Philips loading circuits

Circuit number 1, 2, 3, 4, 5, 6, 9, 11

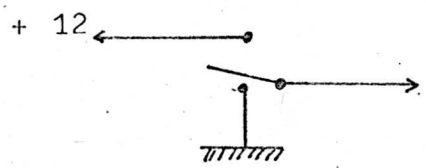


3.2.3.2. Input circuits

The loading circuits of the logic signals number 12 to 17 are standard TTL input ; fan In 1

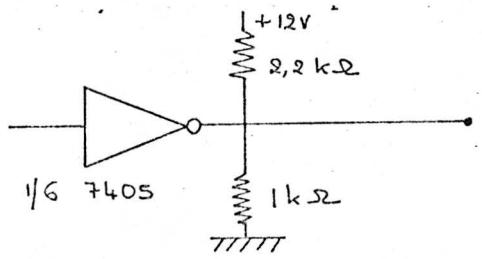
3.2.3.2. a - Ampex driving circuits

Circuit number 1

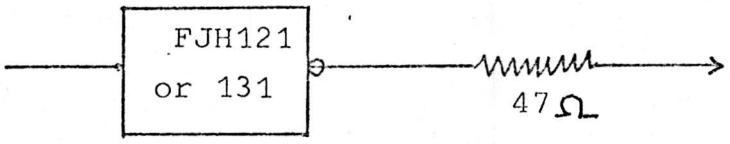


Circuit number 13, 14, 17 : one 7404 output

Circuit number 16 :



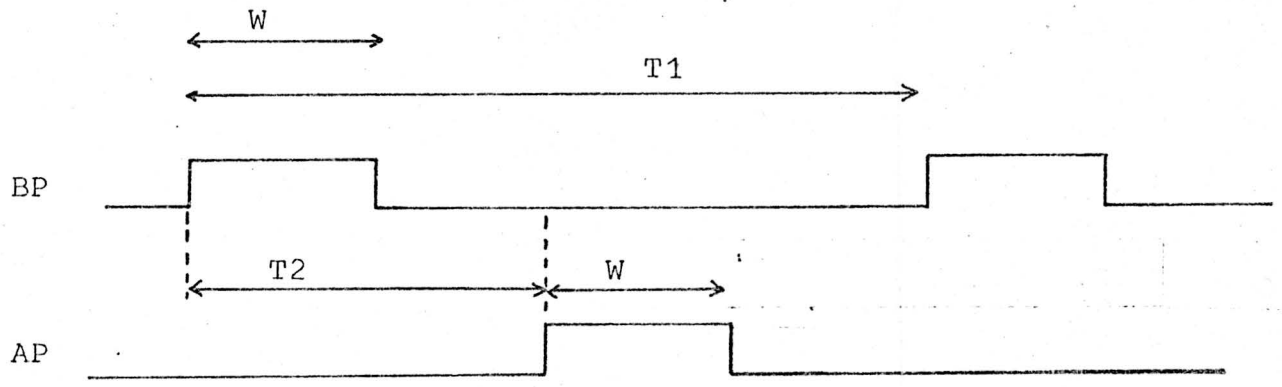
3.2.3.2. b-Philips driving circuits



3.3. Writing oscillator

3.3.1. Timing requirements

The writing oscillator delivers a biphased clock BP and AP.



T1 = 83,33 us ± 1 % long term ; ± 6 % short term (0.15 % per cell)
T2 = 41,66 us ± 1 % " " " " "
W = 135 ns min ; 30 us max.

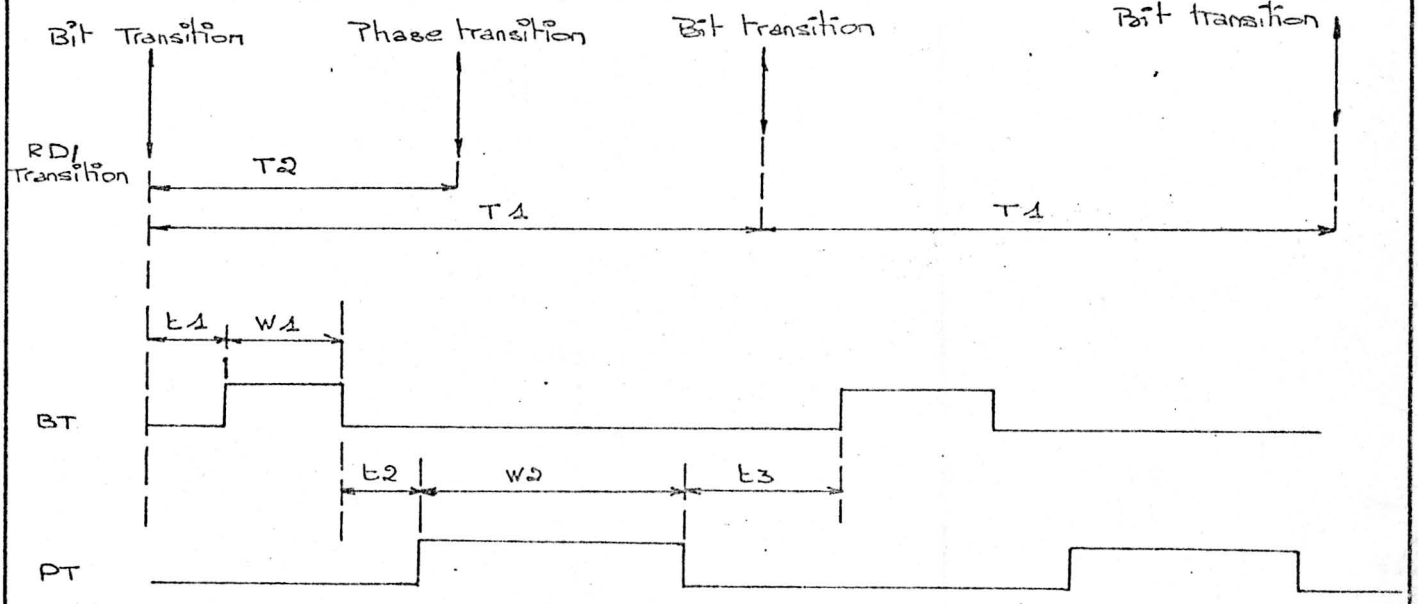
3.3.2. Fan out requirements

BP : 8
AP : 4

3.4. Read circuit

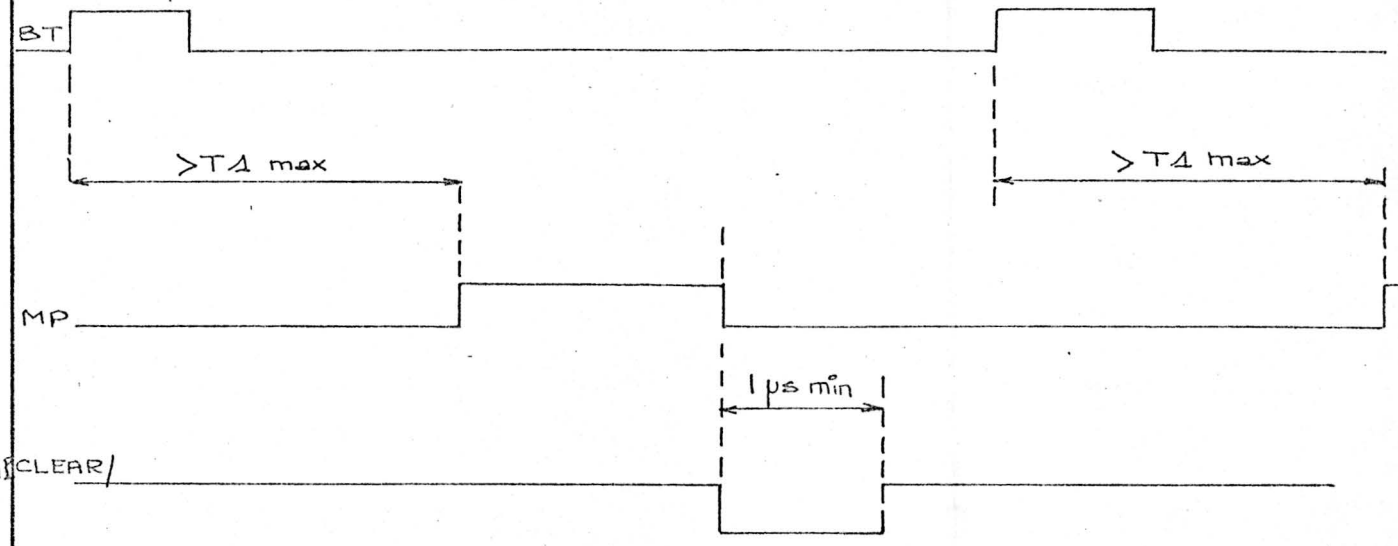
3.4.1. Timing requirements

The generator delivers a biphased clock BT and PT according to the transition on the RDC/ signal (the first transition is a phase transition followed by a positive bit transition).



T1 = 166,66 us ∓ 11 % long term ; ∓ 12 % short term
T2 = 83,33 us ∓ 11 % long term ; " " "
W1 = 200 ns min ; 70 us max.
W2 = 200 ns min ;
t1 = 35 ns min ; 70 us max.
t2 ≥ 100 ns
t3 ≥ 35 ns

When the reading is ended, no more transition occurs, so the read circuit must indicate a missing BT pulse by a MP signal high until the reset of this signal by the logic signal MP CLEAR/



3.4.2. Loading requirements

BT	F.O.	12
PT	F.O.	1
MP	F.O.	5
RDC/	F.I.	9
MPCLEAR/	F.I.	3

4 - MECHANICAL REQUIREMENTS

See document :

5 - ENVIRONMENTAL REQUIREMENTS

See document : SAG Specs. Section 3.2.2.1.

6 - RELIABILITY REQUIREMENTS

MTBF : T.B.F.