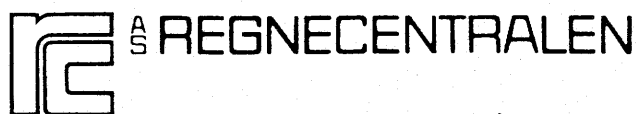

Title:

TECHNICAL MANUAL

LPC 308



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RCSL No:

44-RT 1738

Edition:

October 1978

Author:

Lars Myrup Jacobsen.

Keywords: Printer Controller and Printers.

Abstract: This manual contains a description of the LPC 308 printer controller, which allows different printers to be interfaced to the RC3600 system.

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1. INTRODUCTION.

1.

1.1 Description.

The LPC 308 printer controller is prepared for use with different printer types. Some of the printers are identical, from a controller point of view, and some differs in details. A number of switches has been introduced in the controller, to make the use of different printer types possible.

The LPC 308 is based on the controllers LPC 301-307 and is able to run all the different kinds of printers.

1.2 Printer Types.

1.2

LPC 308 printer controller may be used with three printer types, of which the first exists in different versions. These printers are described on the next page.

1.3 Type 1 Printers.

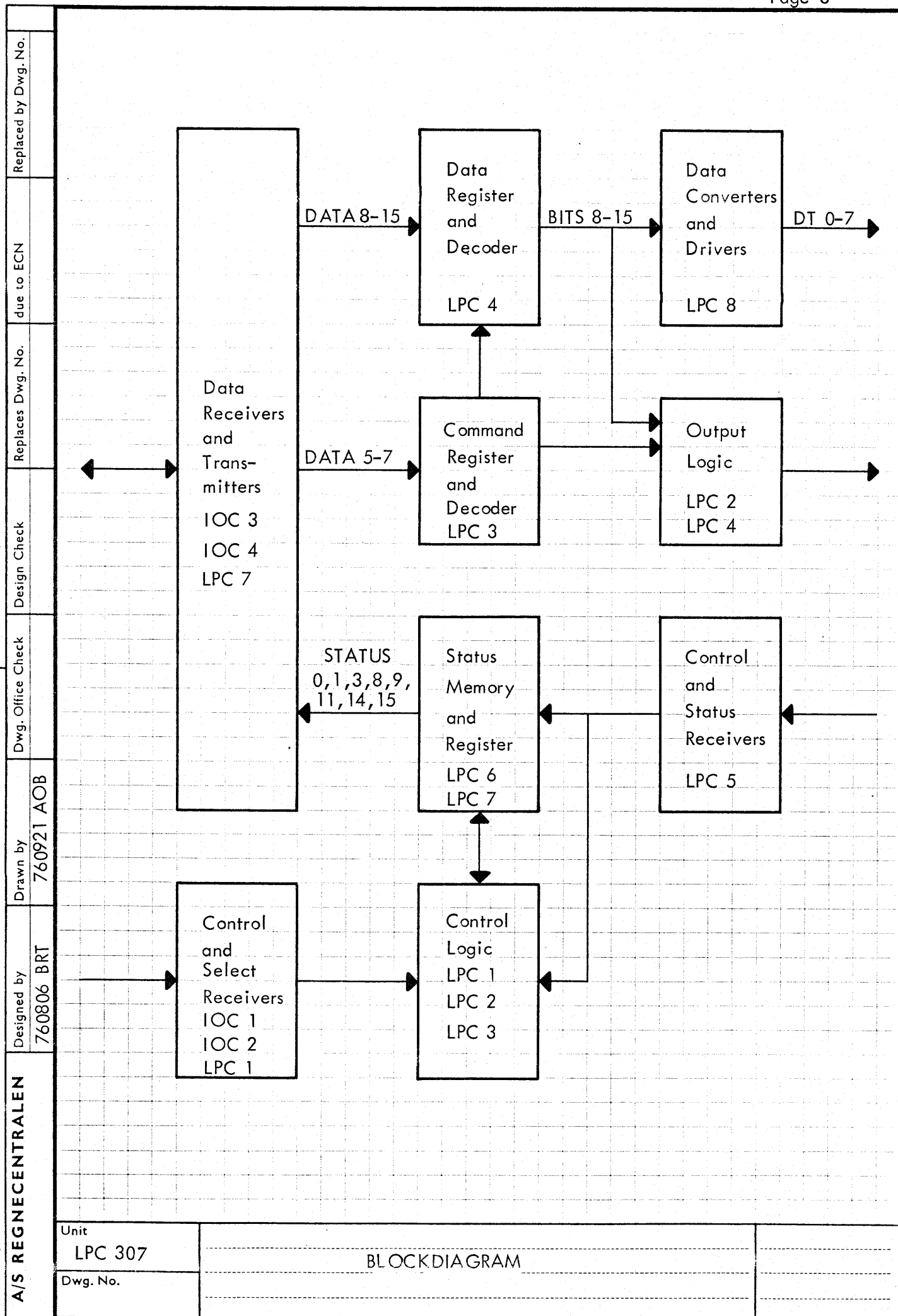
A: Sales number	Technical number	Producer and Model	
RC3632	LPT 703	Data Products	2470
RC3632	LPT 704	- -	2470
RC3633	LPT 704	- -	2470
RC3634	LPT 702	- -	2440
RC3635	LPT 702	- -	2440
RC3636	LPT 701	- -	2420
RC3641	LPT 705	- -	2230
RC3641	LPT 709	- -	2230 DI
RC3642	LPT 718	- -	2260
B: RC3641	LPT 724	- -	2230
RC3642	LPT 725	- -	2260
RC3643	LPT 722	- -	2290
C: RC3641	LPT 726	- -	2230
RC3642	LPT 727	- -	2260
RC3643	LPT 728	- -	2290
RC3641	LPT 729	- -	2230
RC3642	LPT 730	- -	2260
RC3643	LPT 731	- -	2290

1.4 Type 2 Printers.

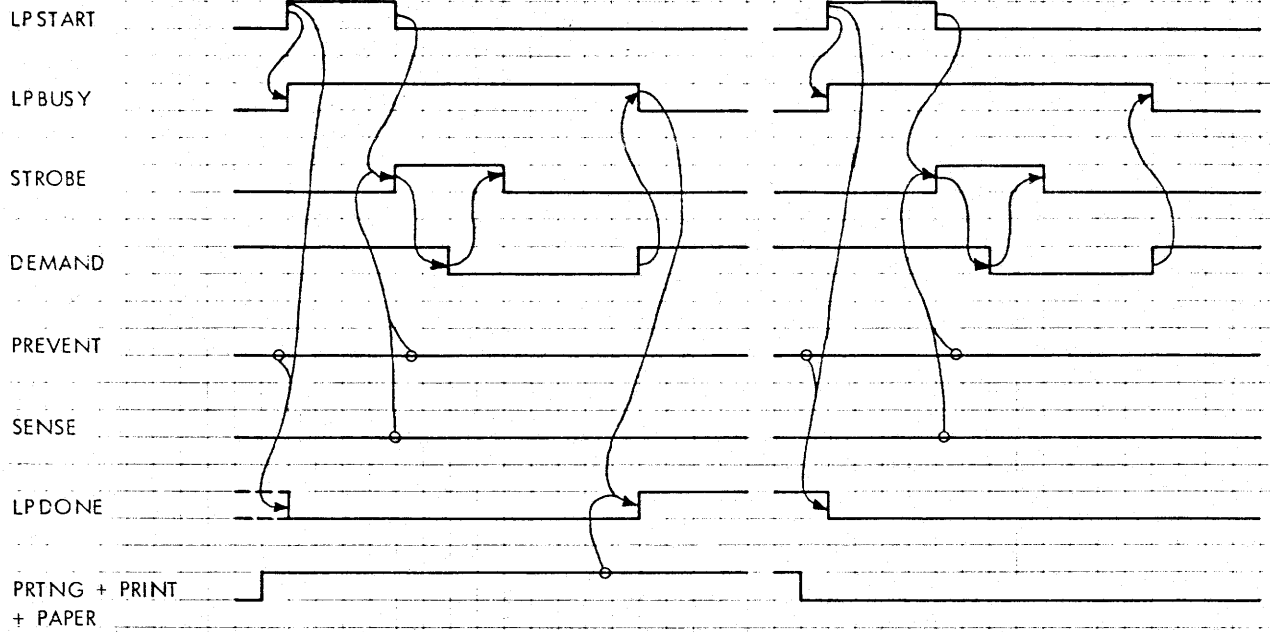
Sales number	Technical number	Producer and Model	
RC3638	LPT 706	Centronics	101A
RC3638	LPT 708	Centronics	101AL
RC3639	LPT 707	Centronics	102

1.5 Type 3 Printers.

Sales number	Technical number	Producer and Model	
RC3637	LPT 719	Mera-Blon	DZM-180

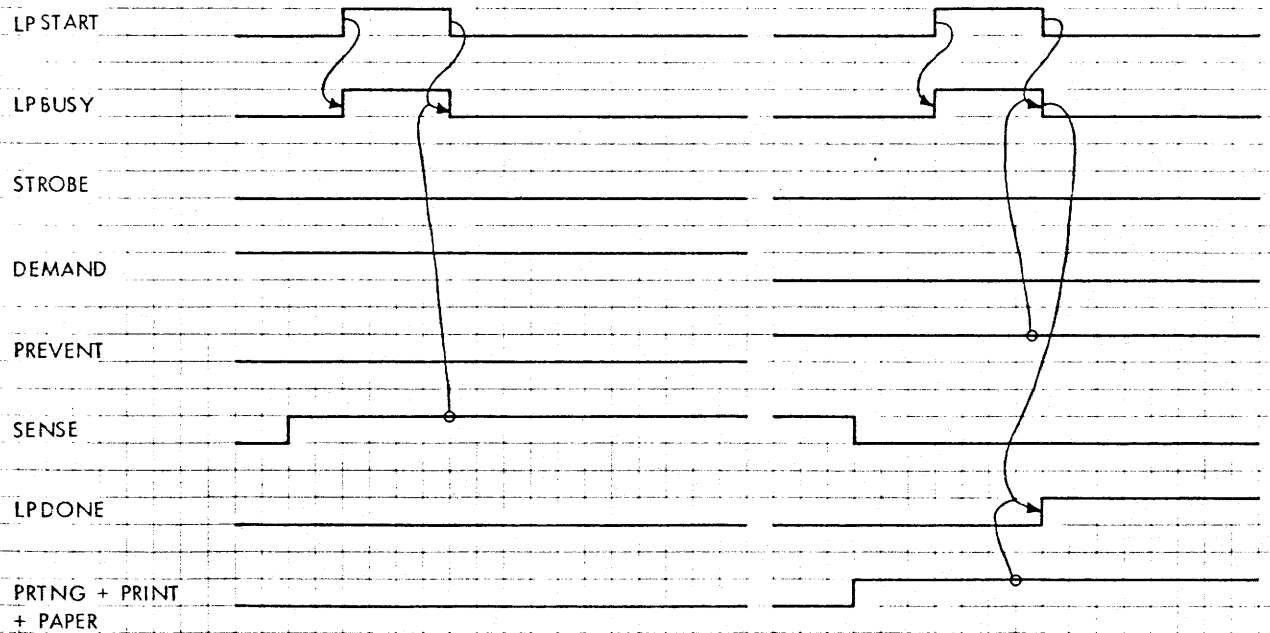


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PRINT OR PAPER COMMAND

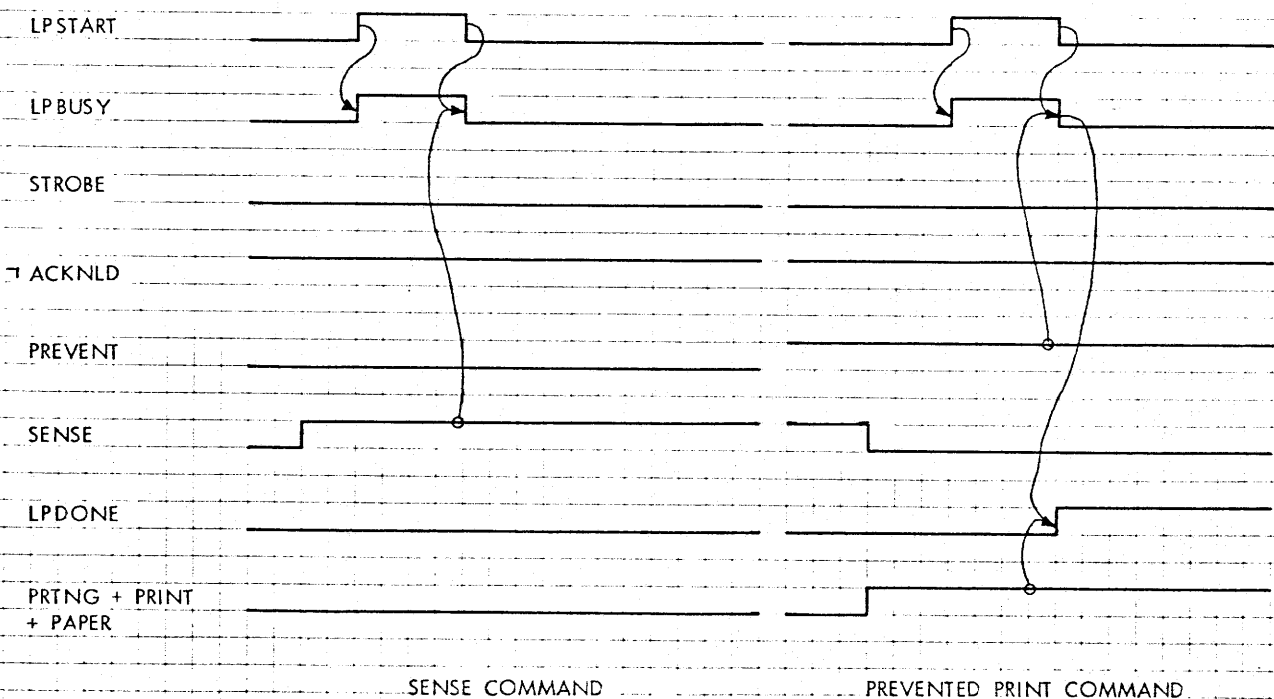
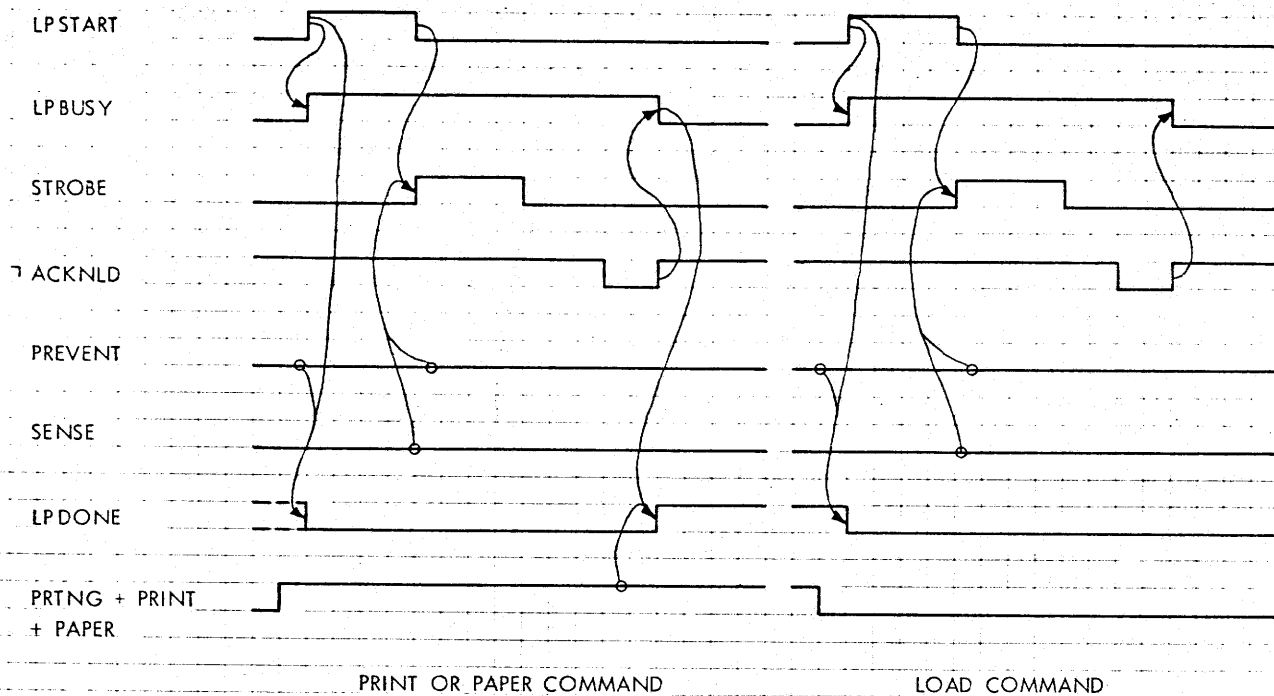
LOAD COMMAND



SENSE COMMAND

PREVENTED PRINT COMMAND

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Ref. by Dwy. Ho

due to 11

Ref. by Dwy. Ho

Design Check

Dwg. Office

Drawn by 741001 SMN 760511 AOB

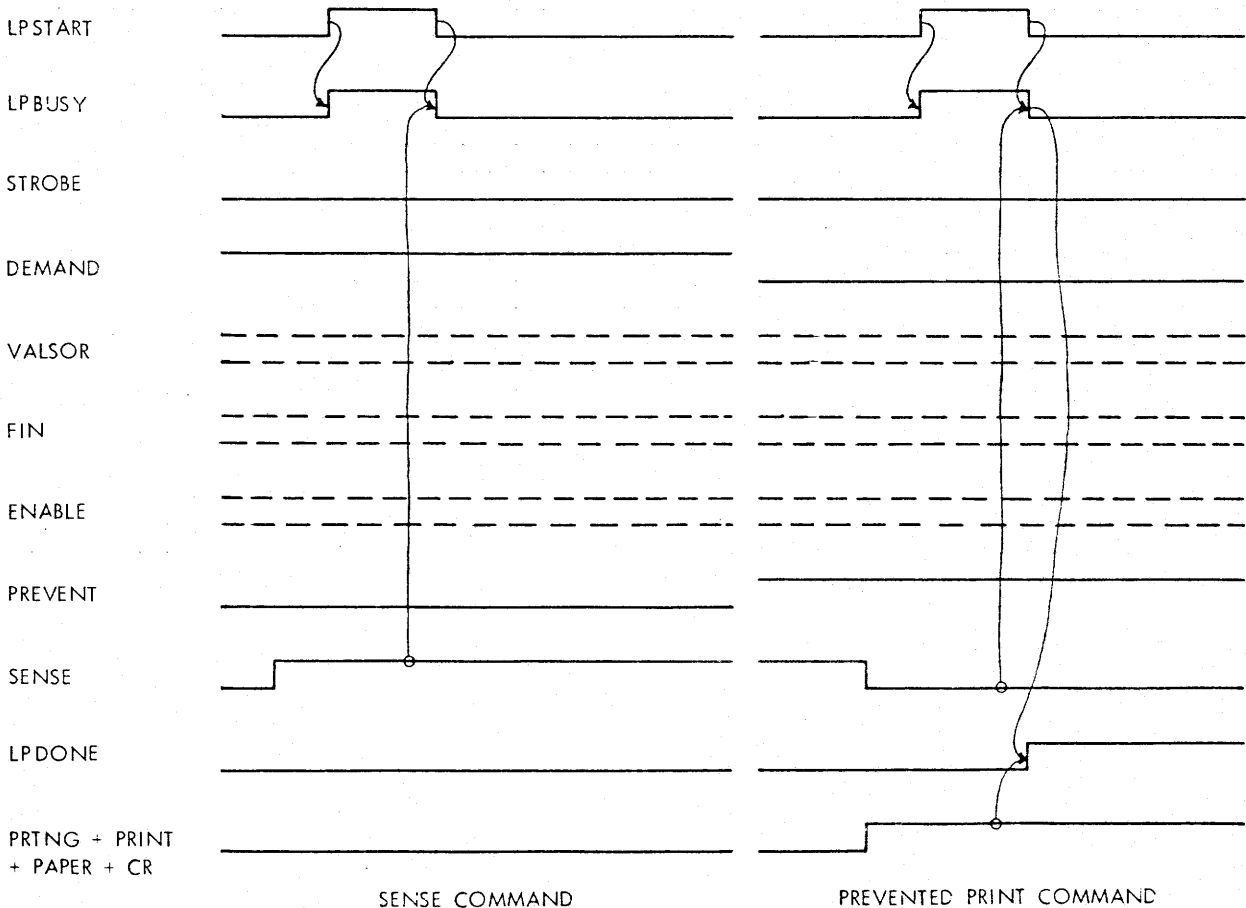
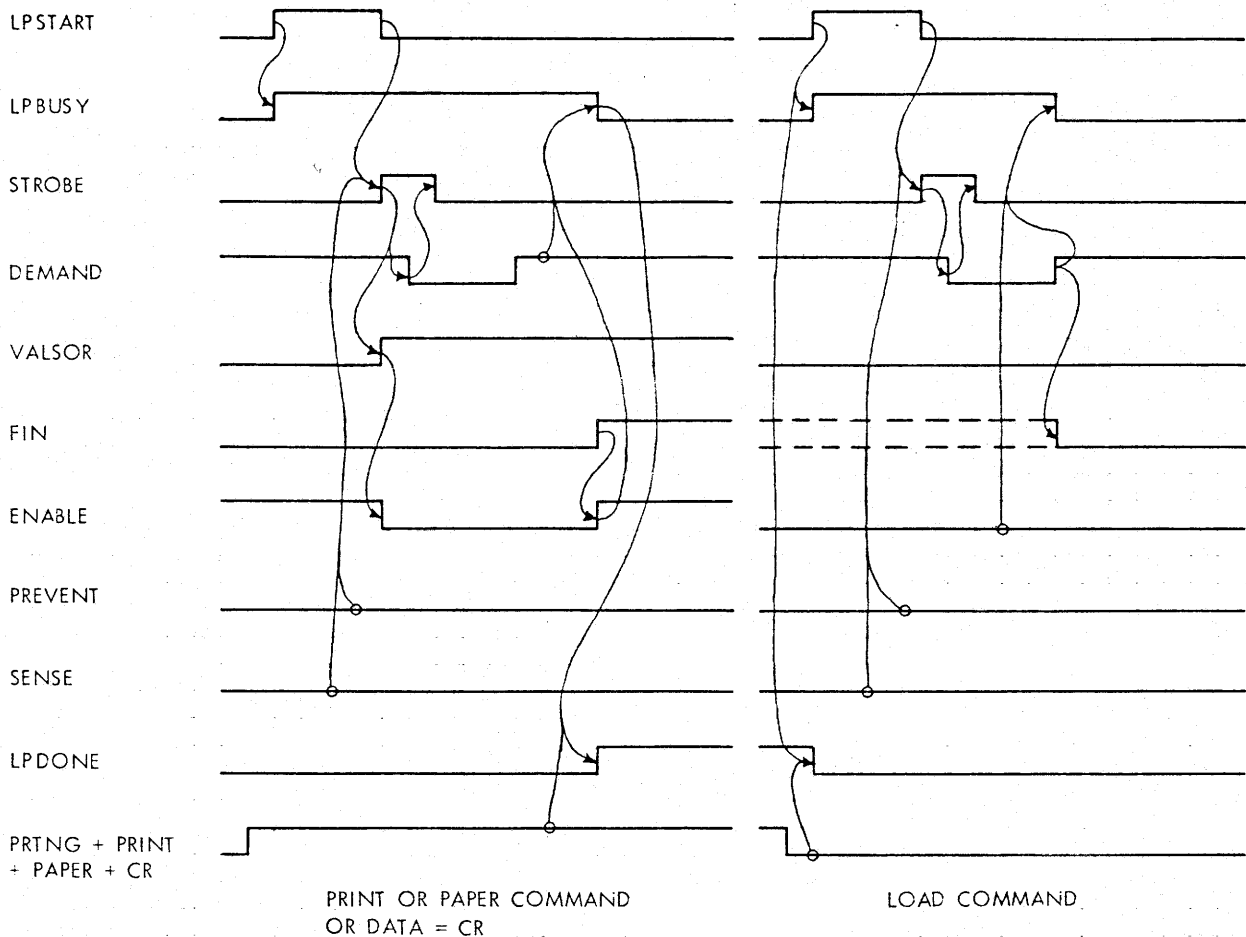
Designed by 741001 SMN

A/S RECENTRALEN

Unit
LPC 306/307
Dwg. No.
R11597

TIMING OF BUSY, DONE AND STROBE
WITH STRAPPINGS FOR PRINTER TYPES II

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760721 BRT 760811 AOB

LPC 306/307

R 11593

TIMING OF BUSY, DONE AND STROBE
WITH STRAPPINGS FOR PRINTER TYPES III

4. FUNCTIONAL DESCRIPTION.

4.1 Device Selection.

The device selection logic is of an RC standard type. The device code is selected by a number of switches. A logic one is obtained by turning on the belonging switch (red dot visible).

4.2 Commands and Data.

Any DOA instruction to the controller will load the command field (bits 5-7) into the command register, and the data field (bits 8-15) into the data register. The commands are decoded directly from the command register.

Data in the data register is decoded in a Read Only Memory (ROM). The ROM has a four bits output, and the first indicates data is to be rejected. This is not used at the moment. The second bit indicates data is Carriage Return to enable print out on type 3 printers. The third bit indicates data has a value greater than any of the characters used. These are converted to a Space (SP) when type 2 printers are used. The last bit indicates one of four data: CR, LF, VT, or FF (Carriage return, Line feed, Vertical tab, or Form feed, octal 12-15). This bit is used to set done when the operation is finished, when type 1B and 1C printers are used.

Data in the data register is sent directly to a 4 to 1 multiplexer. One input for type 3 printers. One input for converting to space, and two inputs for type 1 and type 2 printers. One of these for paper commands and the other for load and print commands. The output from the data multiplexer is sent to a printer via the output drivers.

4.3

Status.

4.3

The status receivers have hysteresis on the input (Schmitt-triggers). Type 1A and 1B uses all status bits, while type 1C, type 2, and type 3 only use a part of the status bits. The output connector of the controller has a number of low and high level outputs, so any status input not used may be connected properly via the external cabling.

Status signals: disconnected, on line, ready, and printing, are latched as soon as they arrive. The status bits are updated into status register on the falling edge of busy. The VFU status memory bit is cleared as soon as it has been updated into status register. All the other status memory bits are cleared on the falling of busy, if the belonging status bit has disappeared.

The difference between the type 1 printers lies in the status signals. Type 1A and 1B have paper fault status on two different pins, and type 1B is missing the status printing. Type 1C is missing status signals paper fault, paper low (exhausted), tape 11, and printing. With type 1C printer status signal disconnected also generates paper fault and paper low.

4.4

Strobe - Demand/Acknowledge.

4.4

A DOAS-instruction to the controller with a load, print, or paper command will set the strobe flip-flop, unless the operation is prevented by a status bit. When type 1 and type 3 printers are used, the output from the strobe flip-flop is sent to the printer. When type 2 printers are used, the output from the strobe flip-flop starts a one-shot, and the one-shot output is sent to the printer. This strobe signal tells the printer that data is available on the data lines. When the printer has accepted the data, it sends a demand/acknowledge to the controller. Demand/acknowledge will clear the strobe flip-flop.

4.5 Enable Printout.

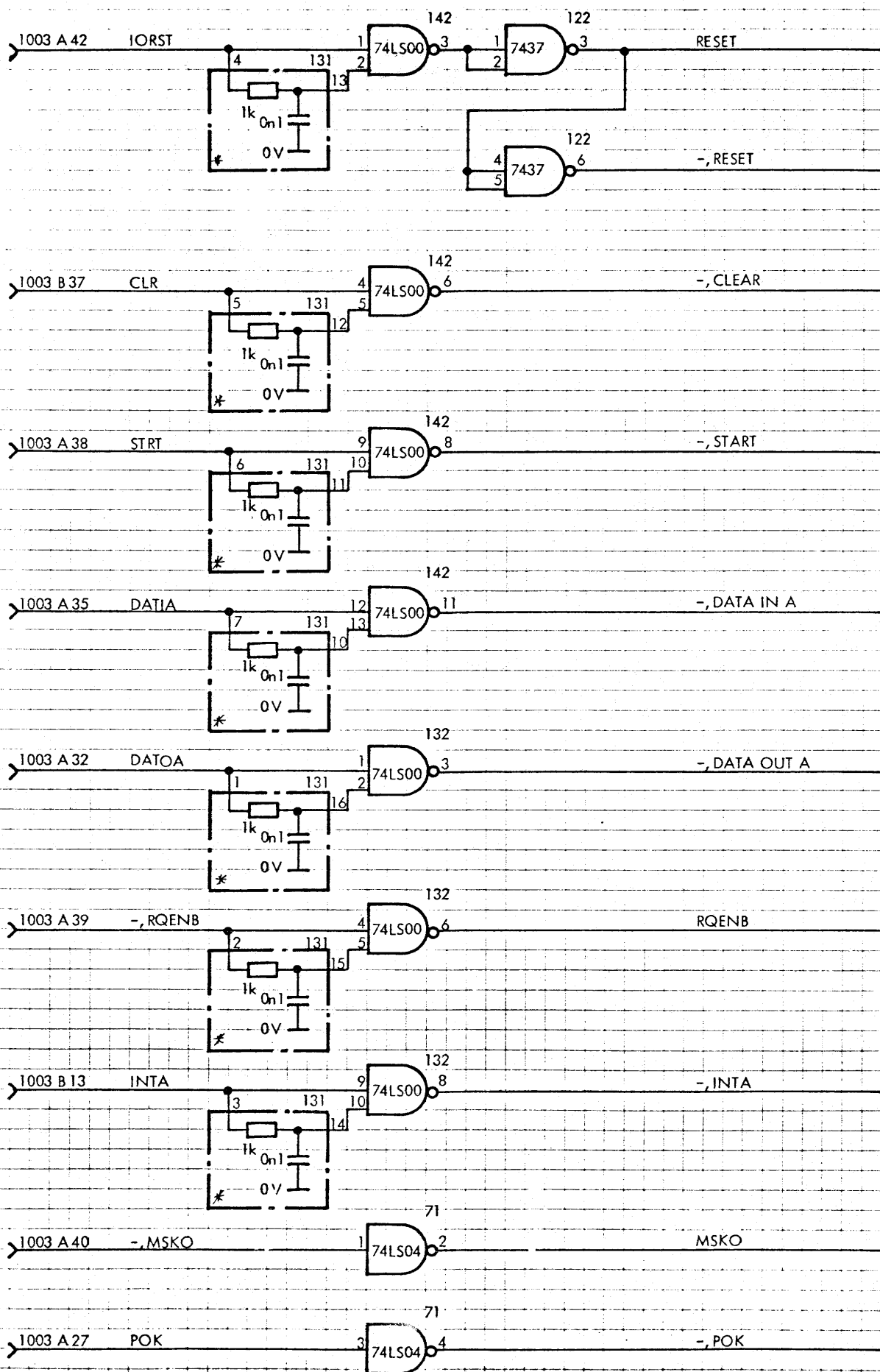
This circuit is used by type 3 printers. The strobe flip-flop will set enable flip-flop, if output is a print or paper command or a CR data. When the enable flip-flop is set, data is sent from the printer buffer to the printer control logic.

4.6 Busy, Done, and Interrupt.

Busy, done, and interrupt control logic are of standard type. Demand will clear busy immediately. Only when type 3 printers are used the clearing is delayed until the printer has ended printing.

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SIGNAL	DESTI- NATION	DESCRIPTION
IORST CLR STRT DATIA DATOA -, RQENB INTA -, MSKO POK	1003 1003 1003 1003 1003 1003 1003 1003	I/O Reset Clear device Start device DIA instruction DOA instruction Request Enable Interrupts Acknowledge Mask Out Power OK
RESET -, RESET -, CLEAR -, START -, DATA IN A -, DATA OUT A RQENB -, INTA MSKO	IOC1 LPC1 LPC6 OPC LPC3 LPC4 LPC6 LPC7 OPC LPC1 OPC LPC1 OPC LPC7 OPC LPC4 OPC LPC3 OPC LPC1 OPC LPC3 OPC	Received CPU control signals
Unit		



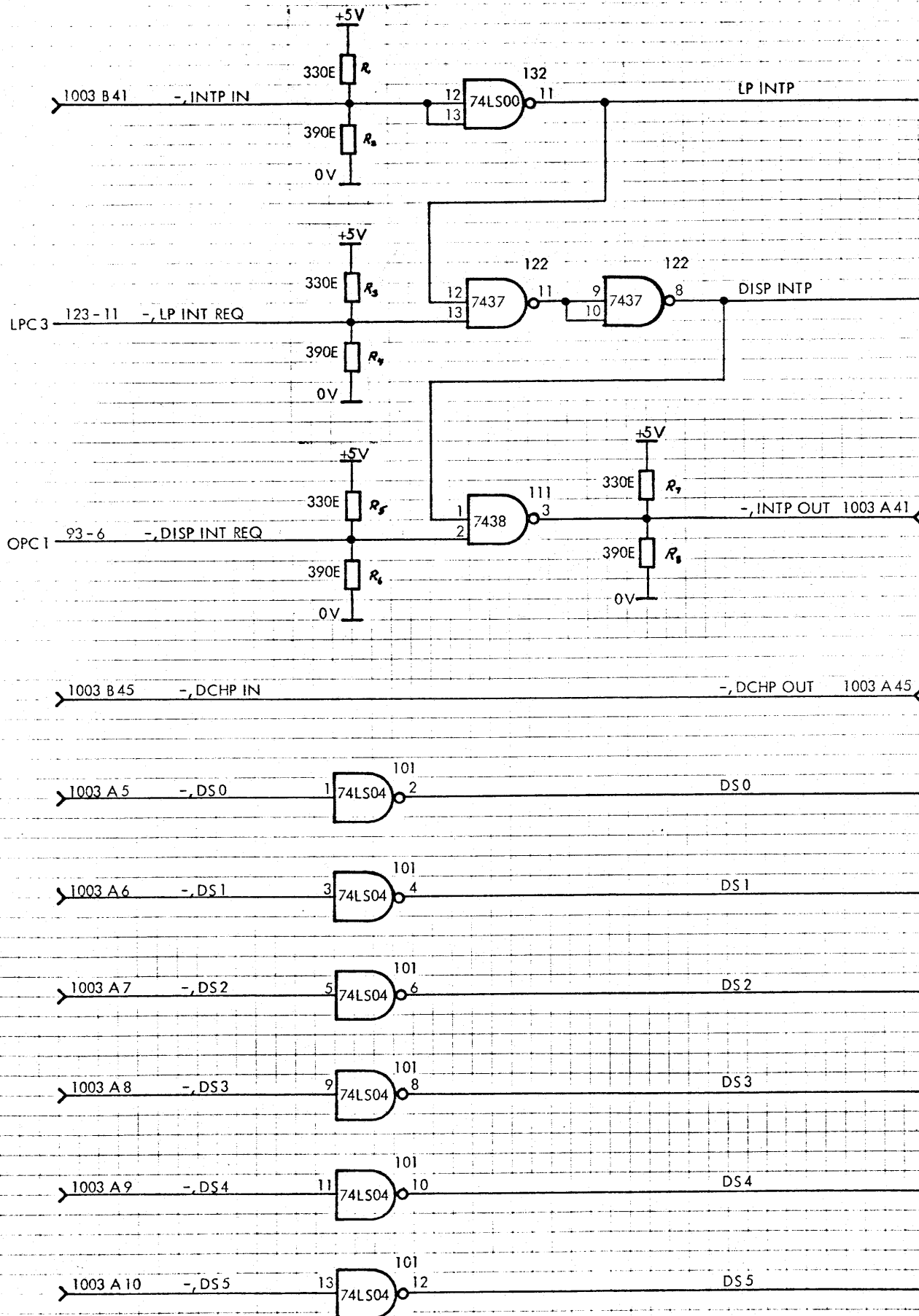
* IC SPRAGUE 90LC102X5V6

Unit
UC 301
Dwg. No
R12115

CONTROL SIGNAL RECEIVERS
LOGIC DIAGRAM

IOC
1

SIGNAL	DESTI- NATION	DESCRIPTION
-, INTP IN	1003	Interrupt priority chain received
LP INTP	LPC1	
DISP INTP	OPC	Not used
-, INTP OUT	1003	Interrupt priority chain passed through
-, DCHP IN	1003	Data channel priority chain received
-, DCHP OUT	1003	Data channel priority chain passed through
-, DS 0 - -, DS 5	1003	Device selection
DS 0 - DS 5	LPC1	Received device selection
	OPC	
Unit		



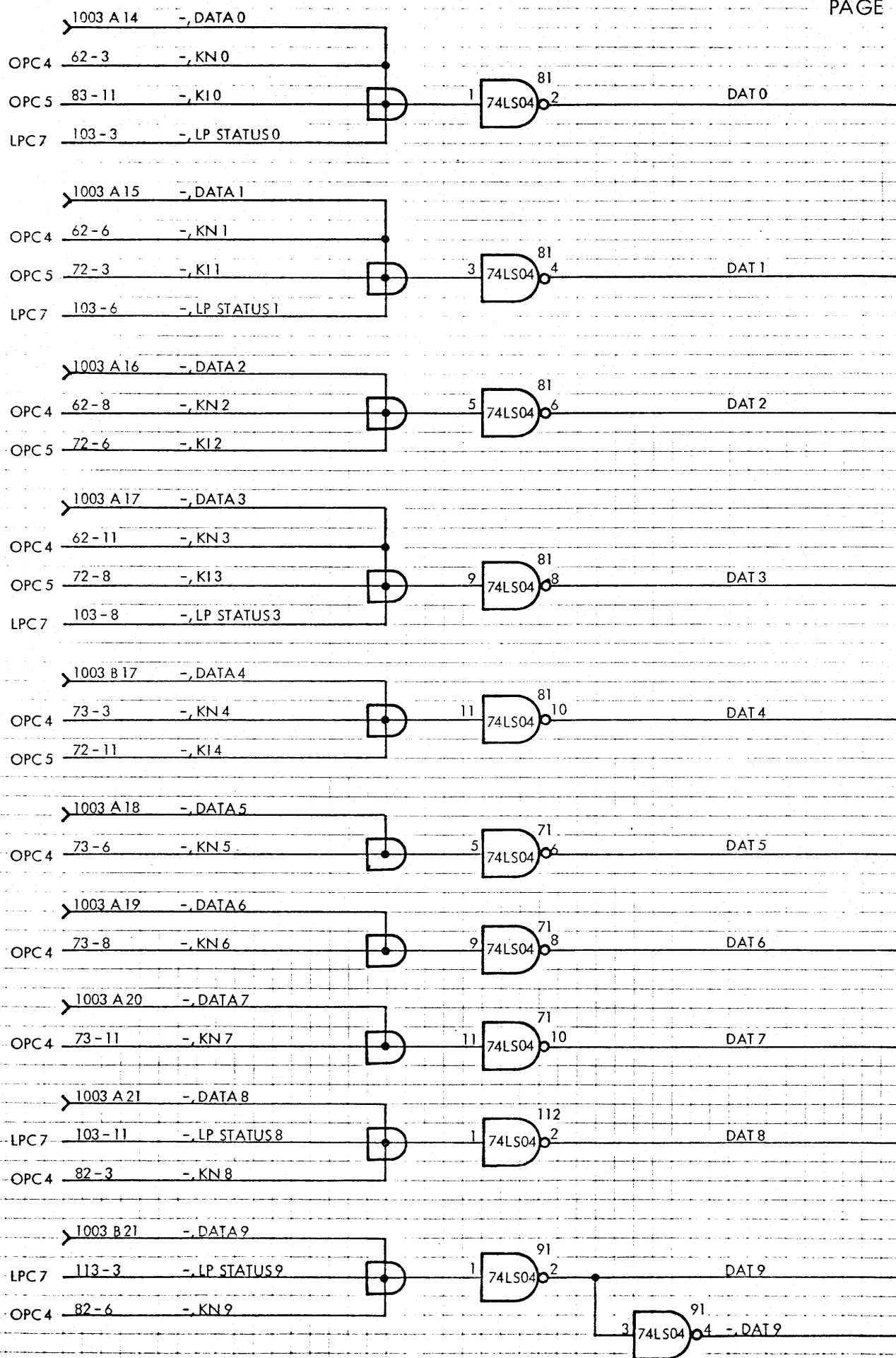
Unit: LPC 307

Dwg. No. R 12/16

PRIORITY AND SELECT RECEIVERS LOGIC DIAGRAM

IOC
2

SIGNAL	DESTI- NATION	DESCRIPTION
-, DATA 0 - -, DATA 9 DAT 0 - DAT 9 -, DAT 9	1003 LPC3 LPC4 OPC OPC	CPU Databus Received Databus
Unit		



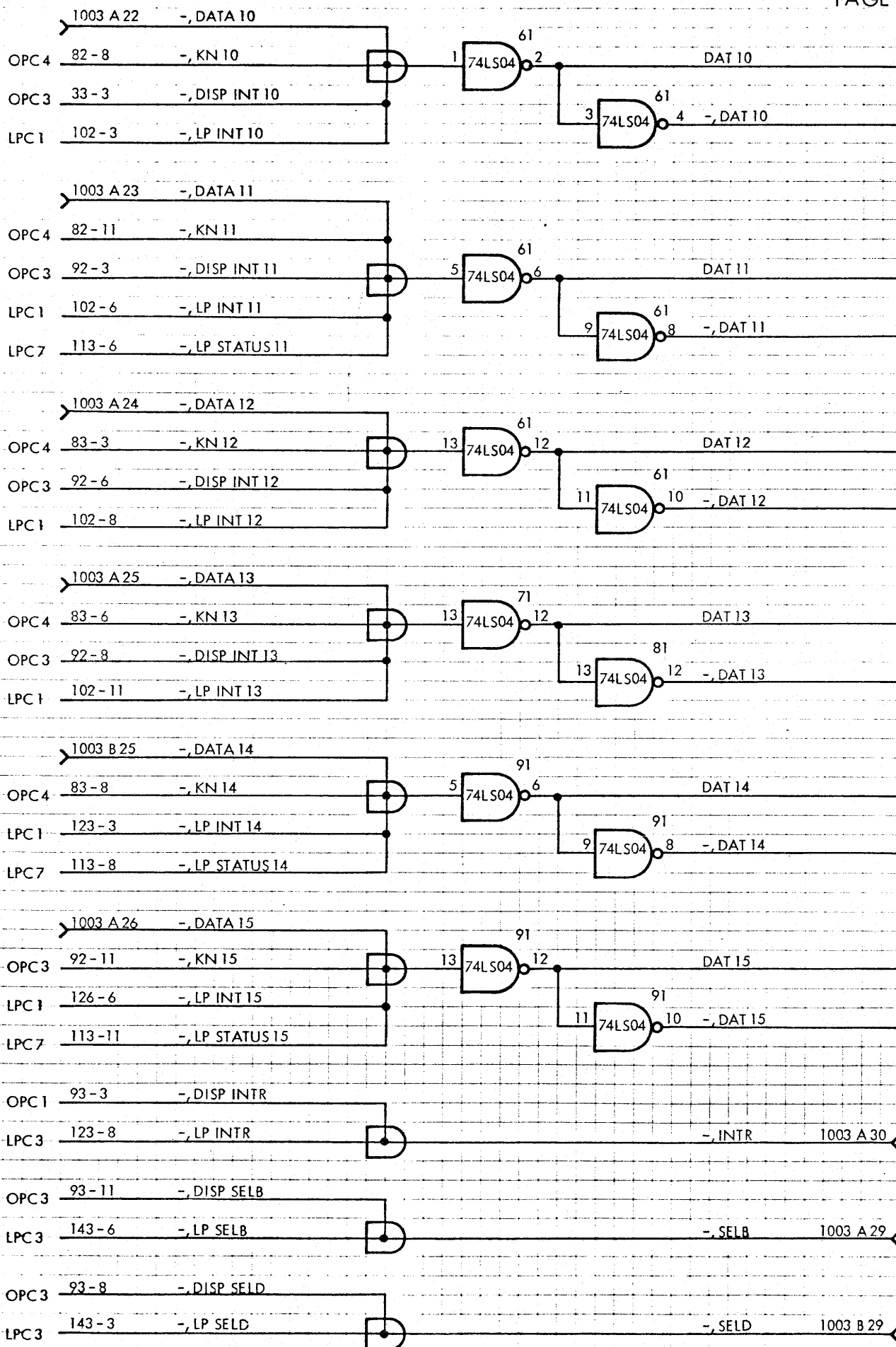
Unit
LP 307

Dwg. No.
R 12 H 7.

DATA BUS LOGIC DIAGRAM

IOC
3

SIGNAL	DESTI- NATION	DESCRIPTION
-, DATA 10 - -, DATA 15	1003	CPU Databus
DAT 10 - DAT 15	LPC3 LPC4 OPC	Received Databus
-, DAT 10 - -, DAT 15	OPC	
-, INTR	1003	Interrupt Request
-, SELB	1003	Selected Busy
-, SELD	1003	Selected Done
Unit		



Unit
LPC 307
Dwg. No.
R12/11

DATA BUS
LOGIC DIAGRAM

IOC
4

Replaces Dwg. No.

due to ECU

Replaces Dwg. No.

Design Check

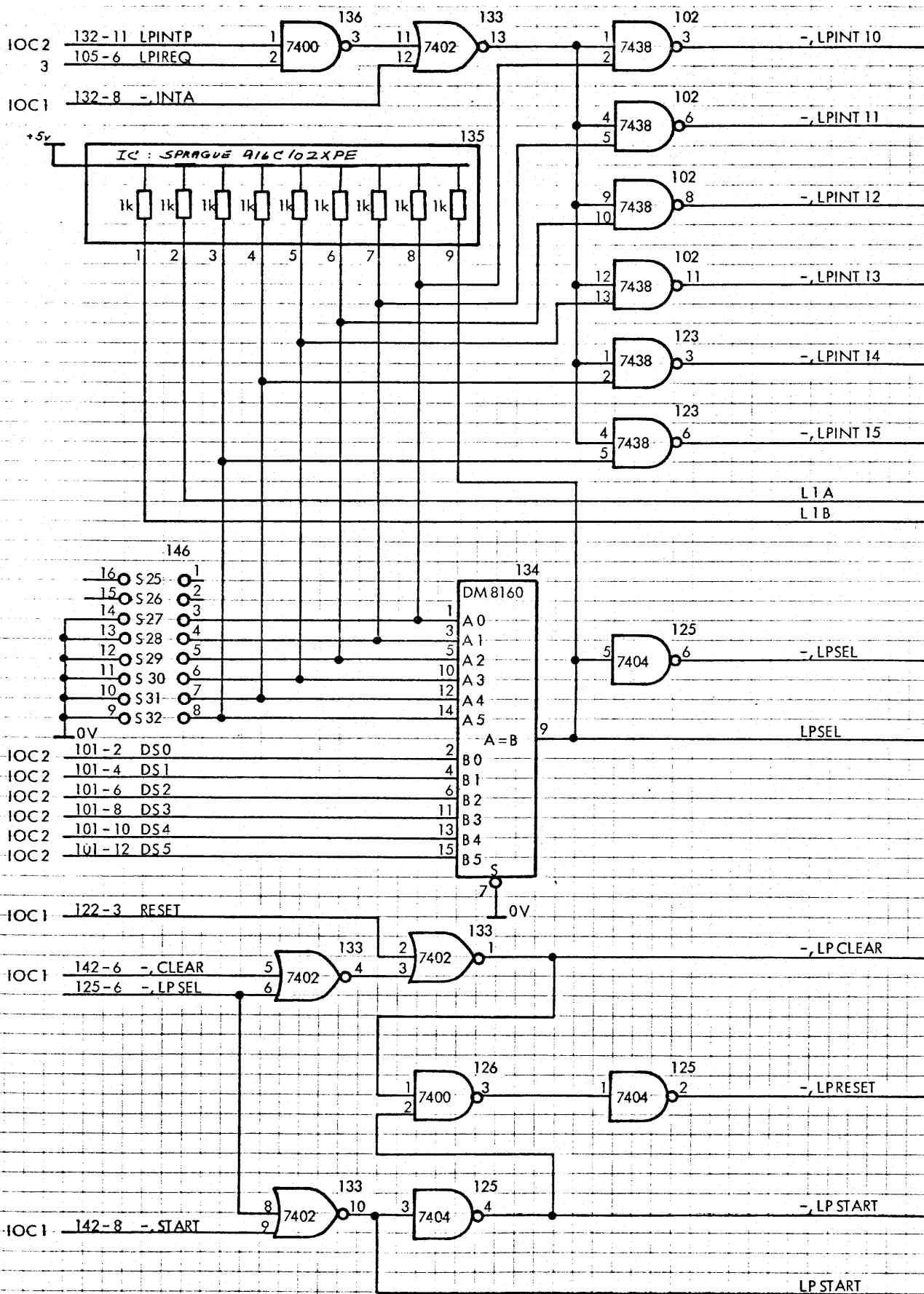
Dwg. Office Check

Drawn by
080376 ERC

Designed by
230174 JFA

A/S REGENTRALEN

SIGNAL	DESTI- NATION	DESCRIPTION
-, LPINT 10 - -, LPINT 15	IOC 4	Transmitted Databus
L 1 A	LPC2 LPC6	Logic '1' Generator
L 1 B	LPC3 LPC7	
LPSEL	LPC1 LPC3	Device Selected
-, LPSEL	LPC1 LPC4 LPC7	
-, LPCLEAR	LPC1 LPC2 LPC3 LPC4	Received Device Clear
-, LPSTART	LPC1 LPC2	Received Device Start
LPSTART	LPC1 LPC3 LPC6	
-, LPRESET	LPC3 LPC6	Received Device Clear or Device Start
Unit		



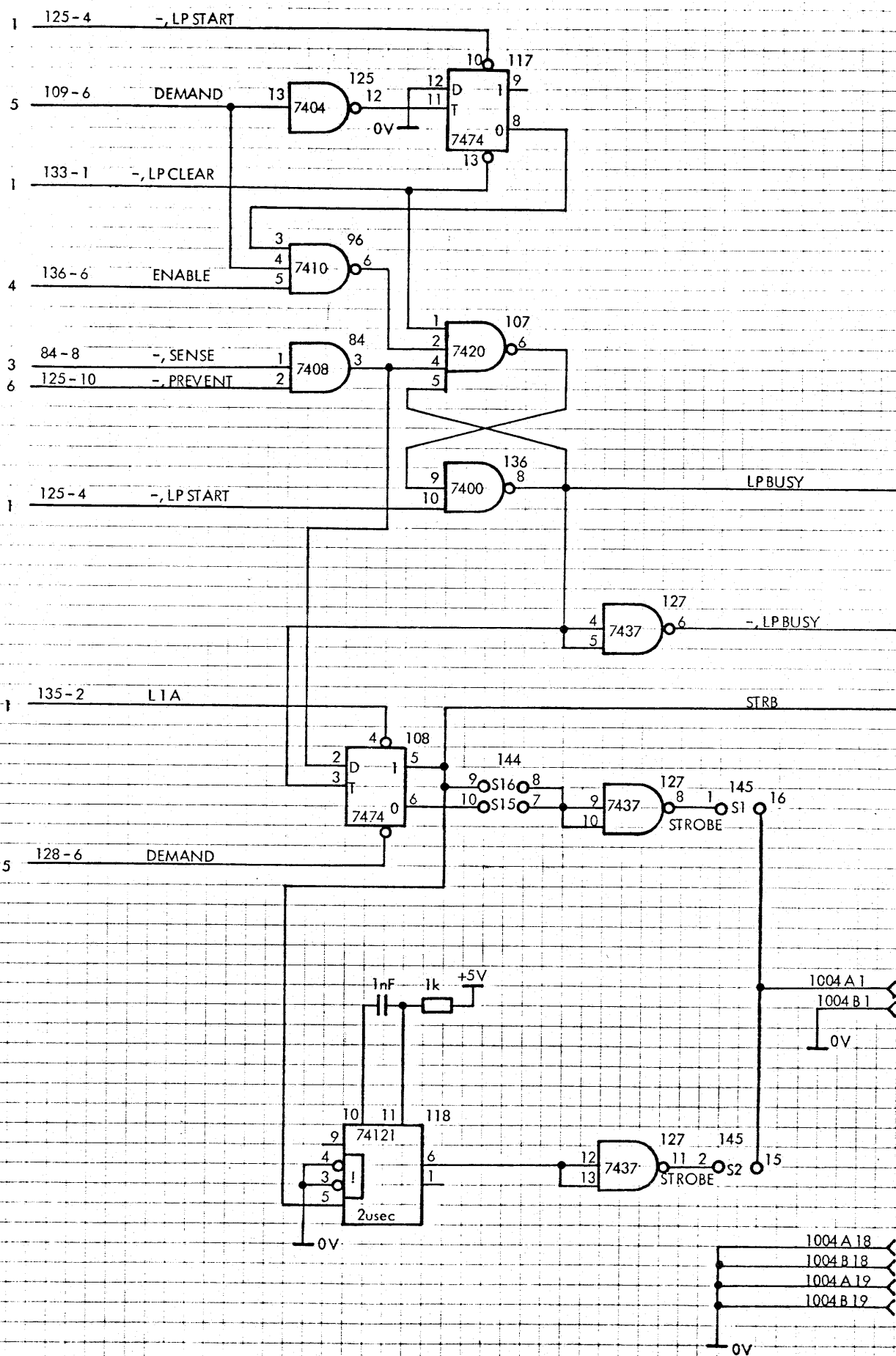
Unit
LPC 307

Dwg. No.
R12/119 -

SELECT LOGIC
LOGIC DIAGRAM

LPC
1

SIGNAL	DESTI- NATION	DESCRIPTION
LPBUSY	LPC2 LPC3	Device Busy
-, LPBUSY	LPC2 LPC3 LPC6 LPC7	
STRB	LPC2 LPC3 LPC4	Send Strobe
STROBE/S1	1004 A1	Transmitted Strobe Handshake Type
STROBE/S2	1004 A1	Transmitted Strobe Pulse Type
Unit		



Replaces Dwg. No.

due to E.C.14

Replaces Dwg. No.

Design Check

Dwg. Office Check

Drawn by 100576 ERC

Designed by 030475 JFA

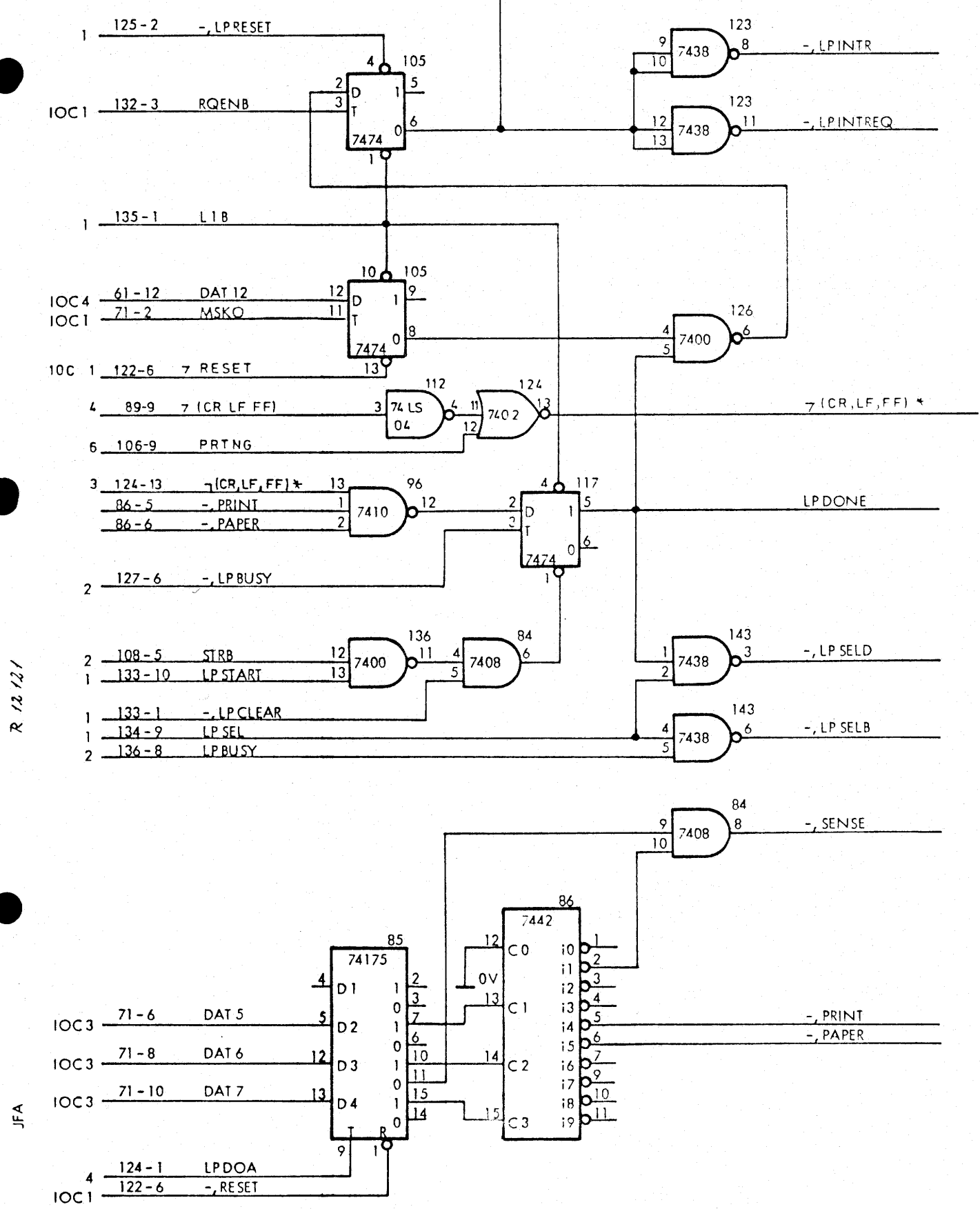
REGNECENTRALEN

Unit
IPC 307
A/S
12/120

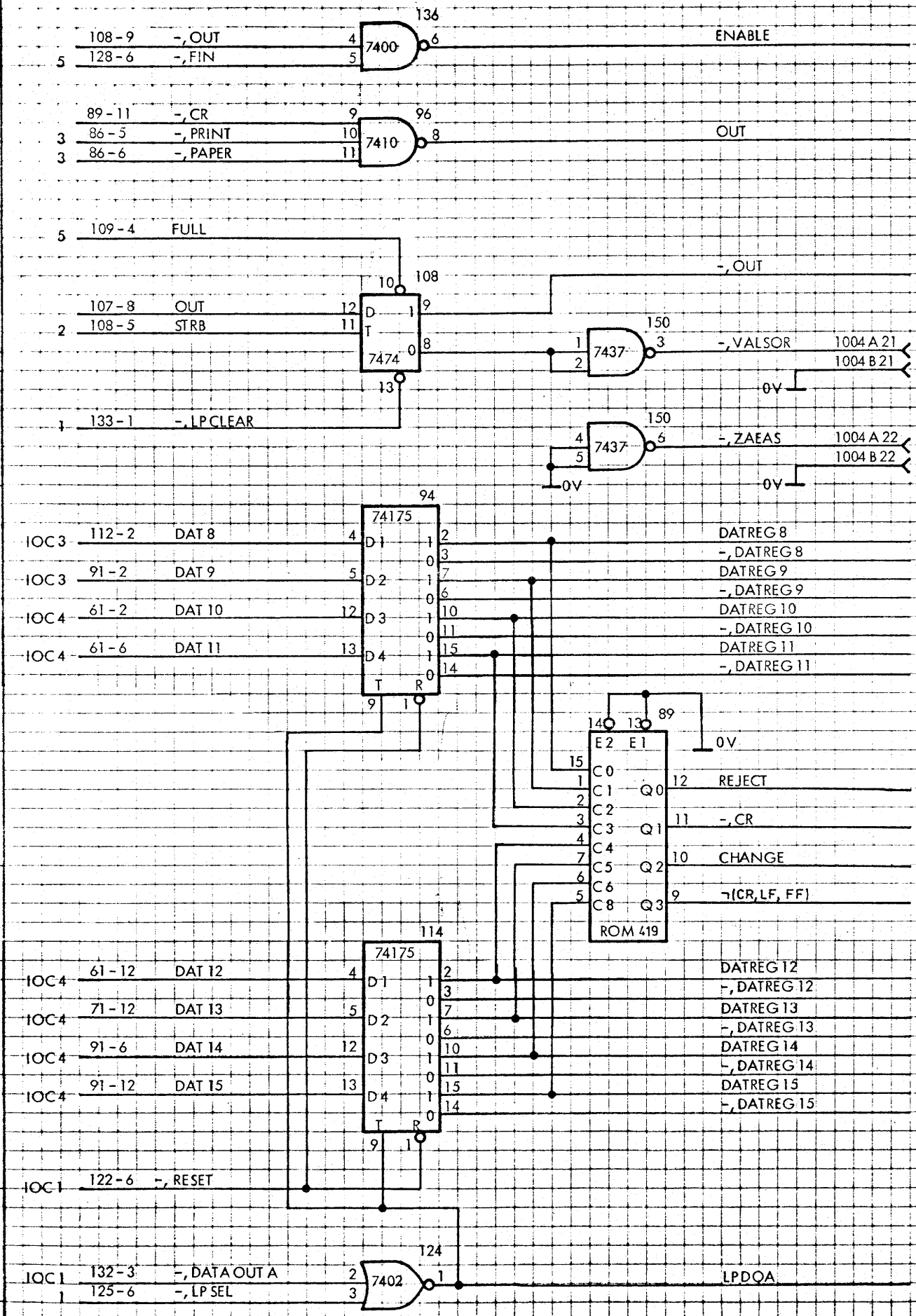
BUSY AND STROBE LOGIC
LOGIC DIAGRAM

LPC
2

SIGNAL	DESTINATION	DESCRIPTION
LPIREQ	LPC1 LPC3	Device Interrupt Request
-, LPINTR	IOC4	Transmitted Interrupt Request
-, LPINTREQ	IOC2	Interrupt Priority Chain Transmitted
LPDONE	LPC3	Device Done
-, LPSELD	IOC4	Transmitted Device Done
-, LPSELB	IOC4	Transmitted Device Busy
-, SENSE	LPC2 LPC3	Sense/Load Command
-, PRINT	LPC3 LPC4	Print Command
-, PAPER	LPC3 LPC4 LPC8	Paper Command
-, (CR, LF, FF) *	LPC3	Set done if a CR, LF, FF or UT is executed
Unit		



SIGNAL		DESTI- NATION	DESCRIPTION
ENABLE		LPC2	Enable Demand to Busy
OUT		LPC4	Make Print Out Possible
-, OUT		LPC4	Synchronized Output Enable
-, VALSOR		1004 A21	Transmitted Output Enable
-, ZAEAS		1004 A22	Transmitted Logic '1'
DATREG 8 - DATREG 15		LPC4 LPC8	Data Register
-, DATREG 8 - -, DATREG 15		LPC8	
REJECT		LPC6	Data Value to be Rejected
-, CR		LPC4	Data Value to Start Print Out
CHANGE		LPC8	Data Value to be Changed to Hardwired Value
-, (CR, LF, FF)		LPC3	Decoding of CR, LF, FF in order to set done when busy goes low.
LPDOA		LPC3 LPC4	Received Device DATOA
Unit			



LPC 307

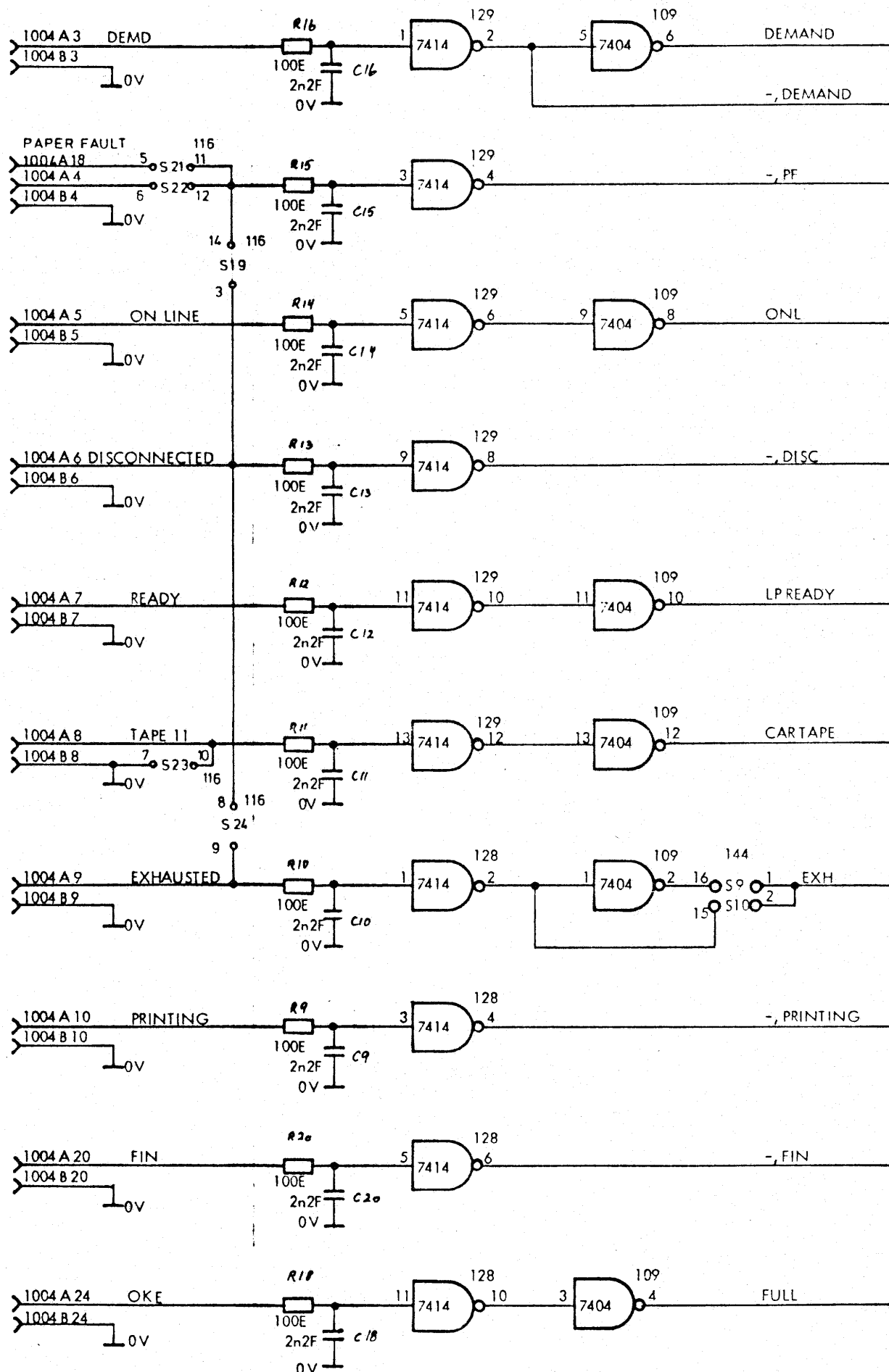
Dwg. No.

R12/22

DATA REGISTER
LOGIC DIAGRAM

LPC
4

SIGNAL	DESTI- NATION	DESCRIPTION
DEMD	1004 A3	Demand/Acknowledge
DEMAND	LPC2	Received Demand/Acknowledge
-, DEMAND	LPC5 LPC6	
PAPER FAULT	1004 A4	Paper Fault Status
-, PF	LPC7	Received Paper Fault Status
ON LINE	1004 A5	On Line Status
ONL	LPC6	Received On Line Status
DISCONNECTED	1004 A6	Disconnected Status
-, DISC	LPC6	Received Disconnected Status
READY	1004 A7	Ready Status
LREADY	LPC6	Received Ready Status
TAPE 11	1004 A8	VFU Channel 11 Status
CAR TAPE	LPC6	Received VFU Channel 11 Status
EXHAUSTED	1004 A9	Exhausted/Paper Out Status
EXH	LPC7	Received Exhausted/Paper Out Status
PRINTING	1004 A10	Printing Status
-, PRINTING	LPC6	Received Printing Status
FIN	1004 A20	Print Out Ended Status
-, FIN	LPC4	Received Print Out Ended Status
OKE	1004 A24	Buffer Full Status
FULL	LPC4	Received Buffer Full Status
Unit		

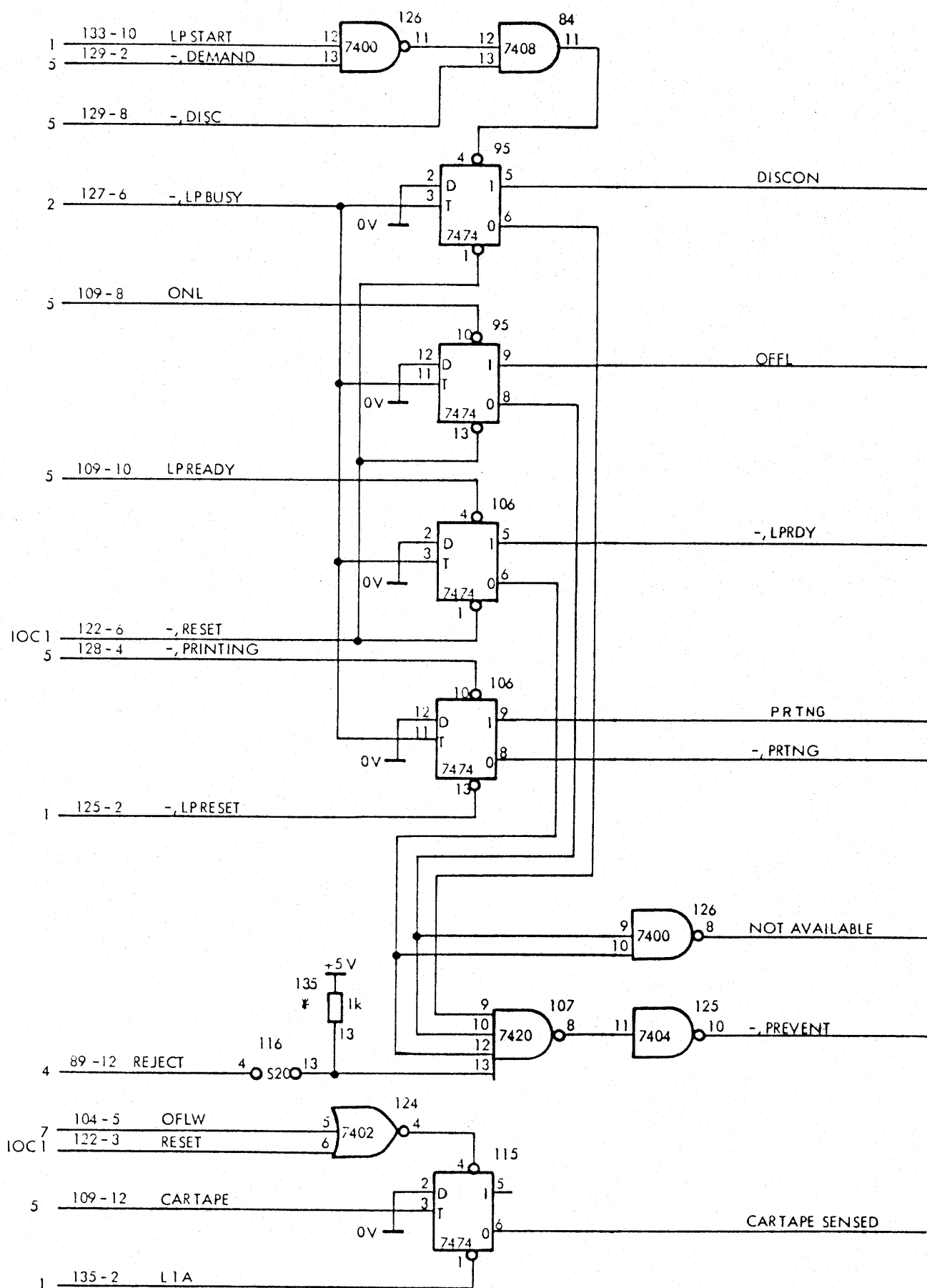


LPC 308

R 12514

STATUS RECEIVERS
LOGIC DIAGRAMLPC
5

SIGNAL	DESTI- NATION	DESCRIPTION
DISCON	LPC7	Disconnected Status Memory
OFFL	LPC7	Off line Status Memory
-, LPRDY	LPC7	Ready Status Memory
PRTNG	LPC3	Printing Status Memory
NOT AVAILABLE	LPC7	Printer Hard Error Status
-, PREVENT	LPC2	Print Out Rejected
CAR TAPE SENSED	LPC7	VFU Tape Memory
Unit		



* IC: SPRAGUE 916 C102X5PE

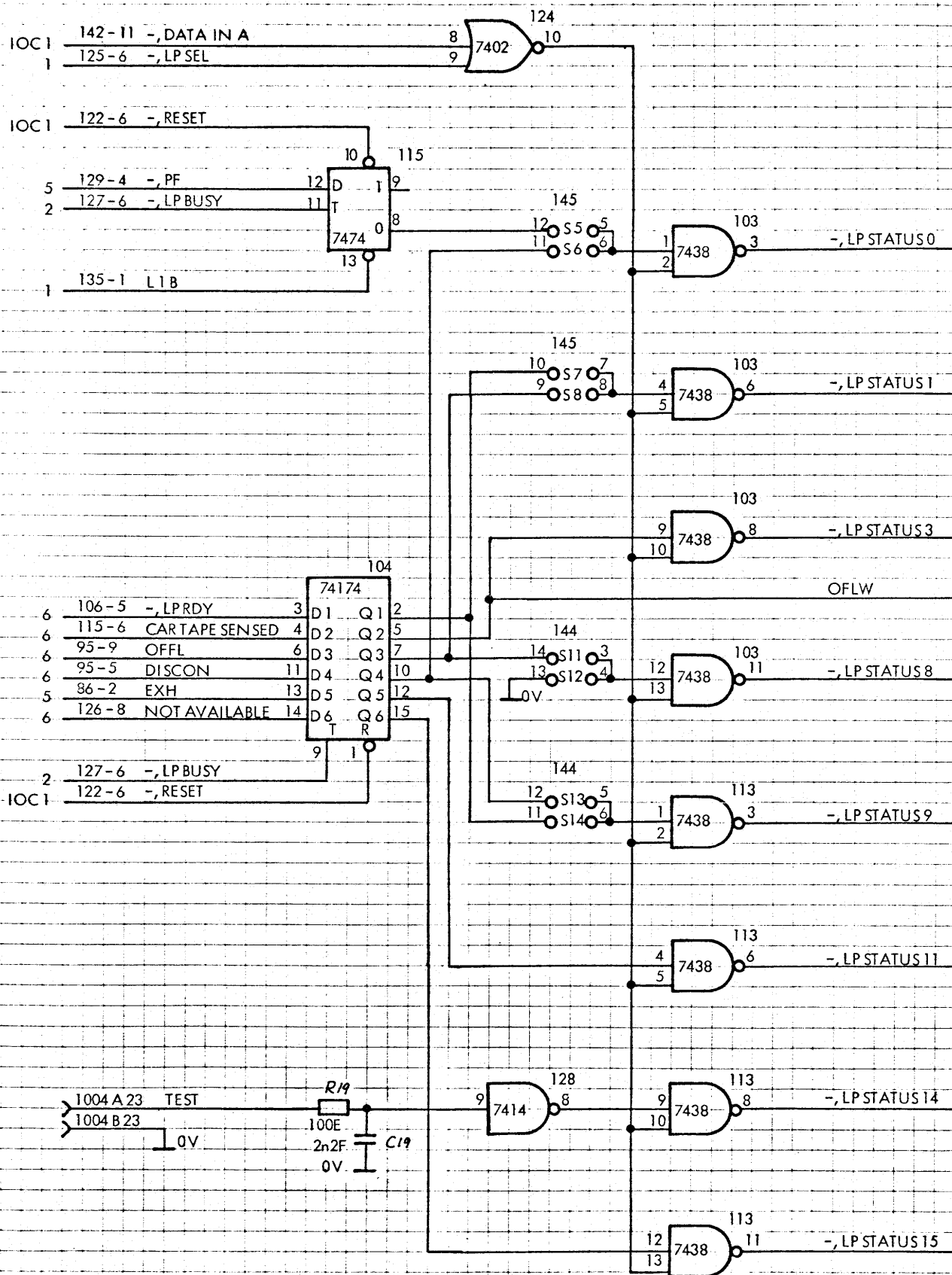
LPC 308

R 12515

STATUS PREBUFFER LOGIC LOGIC DIAGRAM

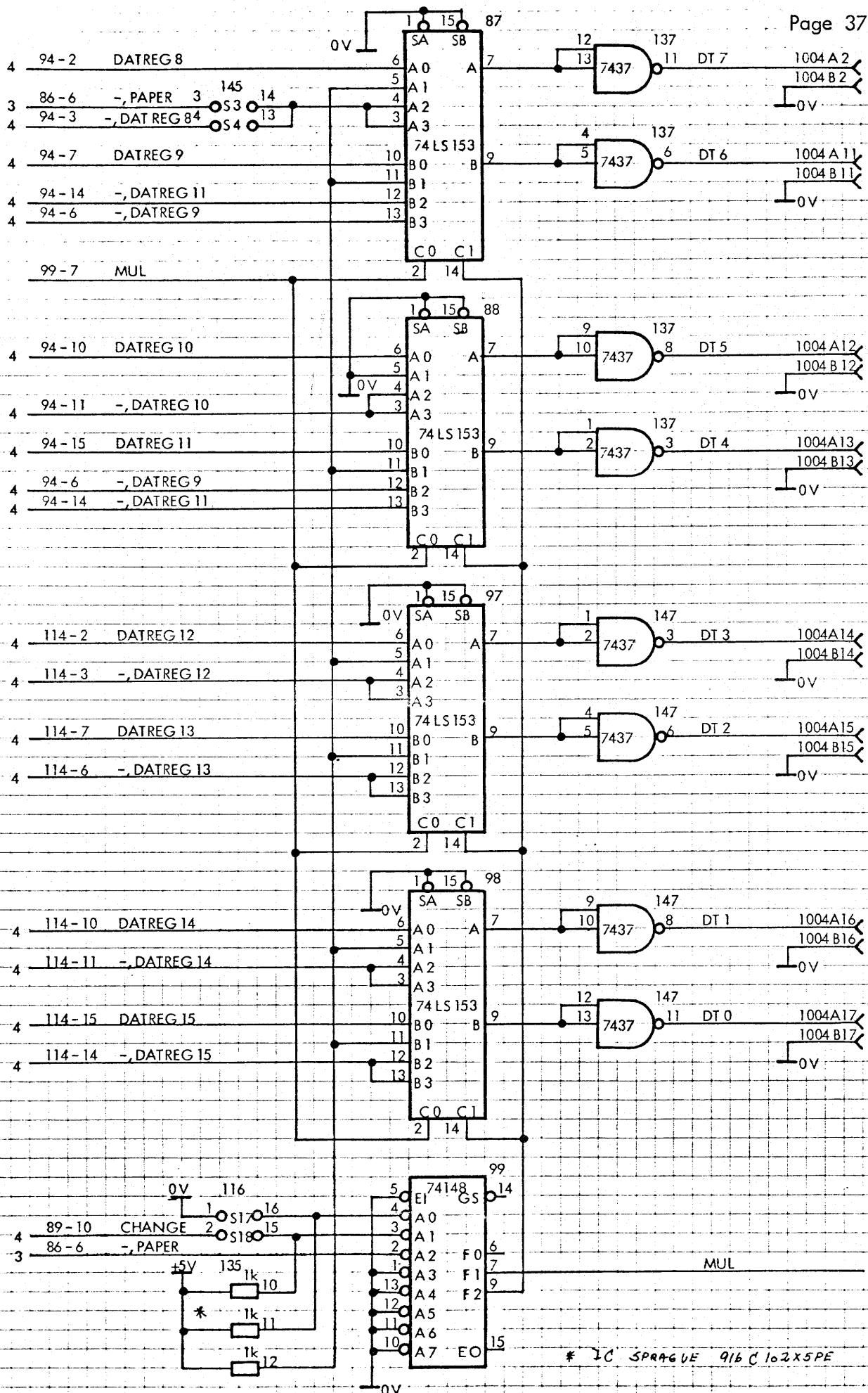
LPC
6

SIGNAL	DESTI- NATION	DESCRIPTION
-, LPSTATUS 0 - -, LPSTATUS 15		Transmitted Databus
-, LPSTATUS 0	IOC3	Paper Fault or Disconnected Status
-, LPSTATUS 1	IOC3	Ready or Off Line Status
-, LPSTATUS 3	IOC3	VFU Channel 11 Status
-, LPSTATUS 8	IOC3	Off Line or Logic '0' Status
-, LPSTATUS 9	IOC3	Disconnected or Ready Status
-, LPSTATUS 11	IOC4	Exhausted/Paper Out Status
-, LPSTATUS 14	IOC4	Test Status
-, LPSTATUS 15	IOC4	Not Available Status
Unit		

STATUS REGISTER
LOGIC DIAGRAMLPC
7Unit
LPC 307
Dwg. No.
R12/25Designed by
060476 JFA
Drawn by
100576 ERCDwg. Office Check
Design CheckReplaces Dwg. No.
due to ECU

Replaces Dwg. No.

SIGNAL	DESTI- NATION	DESCRIPTION
DT 0 - DT 7	1004	Transmitted Data
MUL	LPC8	Most Significant Bit to Data Multiplexer
Unit		



* IC SPRAGUE 916C 102X5PE

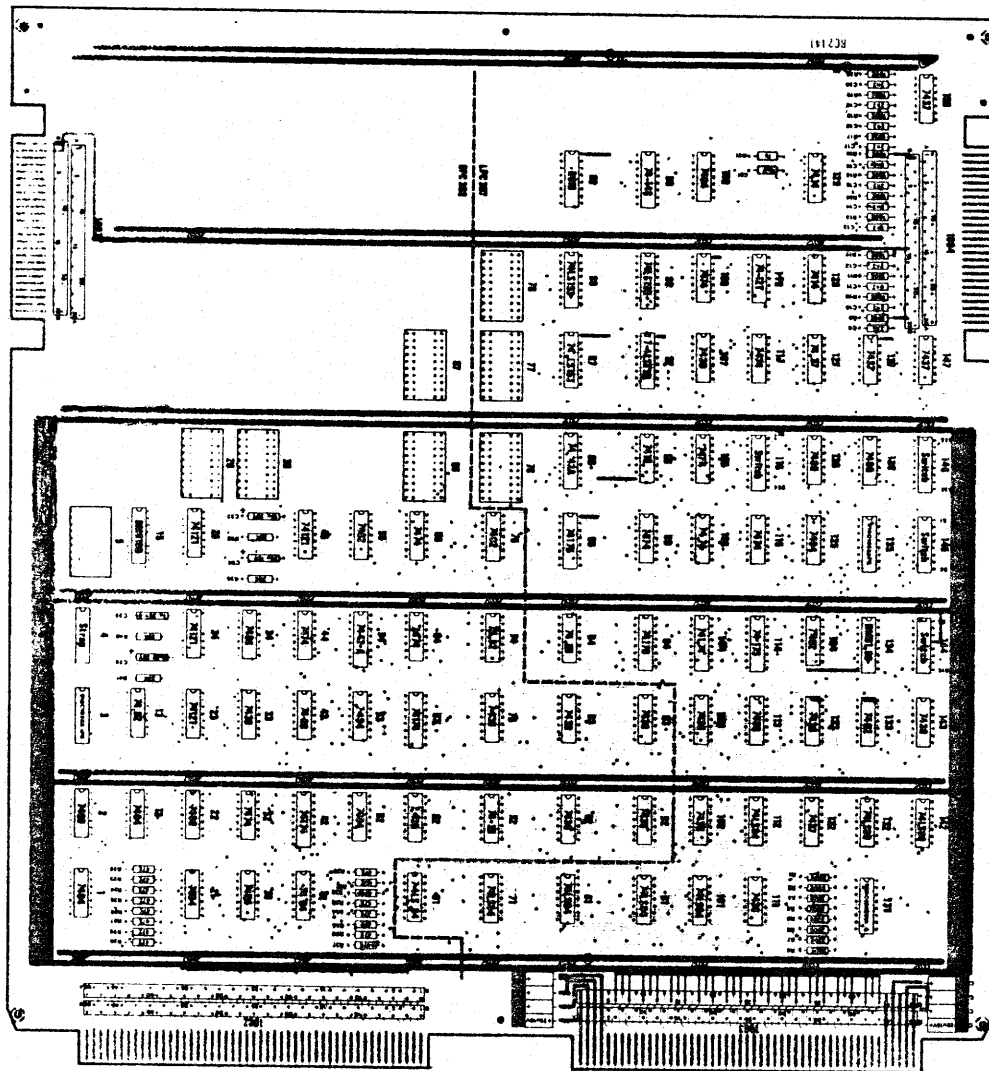
Unit
LPC 307

Dwg. No.
R 12126-

OUTPUT SELECTOR AND DRIVER
LOGIC DIAGRAM

LPC
8

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LPC 308
1004

CBL 022

LPC 308
J1

7. SWITCH SET THINGS.

7.1 Description.

The LPC 308 printer controller is prepared for use with different printer types. Some of the printers are identically, from a controller point of view, and some differs in details. A number of switches has been introduced in the controller, to make the use of different printer types possible. The switches are divided into two groups, one group covering the printer type used, and the other group covering the device code. The switches physically location on the printed circuit board are outlined on the Assembly Drawing page 39. A switch is closed when the red dot is visible, and a switch is open when the white dot is visible.

7.2 Printer Type Switch Settings.

Pos 145

Switch	Printer Type		
	I	II	III
S1	closed	open	closed
S2	open	closed	open
S3	closed	open	open
S4	open	closed	closed
S5	closed	open	open
S6	open	closed	closed
S7	closed	open	open
S8	open	closed	closed

Pos 144

S9	closed	closed	open
S10	open	open	closed
S11	closed	open	open
S12	open	closed	closed
S13	closed	open	open
S14	open	closed	closed
S15	closed	open	open
S16	open	open	closed

Pos 116

Switch	Printer Type				
	1A	1B	1C	II	III
S17	open	open	open	open	closed
S18	open	open	open	closed	open
S19	open	open	closed	open	open
S20	open	open	open	open	closed
S21	open	closed	closed	open	open
S22	closed	open	open	closed	closed
S23	open	open	closed	open	open
S24	open	open	closed	open	open

7.3

Device Code Switch Settings.

7.3

The device codes used are (octal values):

	Printer Type		
	I	II	III
First controller	17	37	37
Second controller	57	67	67

Pos 146

Switch	Device Code			
	17	37	57	67
S25		not used		
S26		not used		
S27	closed	closed	open	open
S28	closed	open	closed	open
S29	open	open	open	closed
S30	open	open	open	open
S31	open	open	open	open
S32	open	open	open	open

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CASE STUDY

Dr. C. C. C. C.

Drawn by

Designed by

TRALEN

4/25/68

RCSL 44-RT 417

Dwg. No.

Printer Type 1

1) type 1A 2) type 1B

CBL 022

Connector	Gen. addr.	Signal Name	Connector LPC 307-J1	Connector	Gen. addr.	Signal Name	Connector 1004
A 1		STROBE	1	A14		DT3	
B 1		OV	2	B14		OV	
A 2		PAPER INST	3	A15		DT2	
B 2		OV	4	B15		OV	
A 3		DEMAND	5	A16		DT1	
B 3		OV	6	B16		OV	
A 4		PAPER FAULT 1)	7	A17		DT0	
B 4		OV	8	B17		OV	
A 5		ON LINE	9	A18		PAPER FAULT 2)	
B 5		OV	10	B18		OV	
A 6		DISCONNECTED	11	A19		OV	
B 6		OV	12	B19		OV	
A 7		READY	13	A20	- , TEST		
B 7		OV	14	B20	OV		
A 8		TAPE (7: 1) 1) 2)	15	A21			
B 8		OV	16	B21			
A 9		EXHAUSTED 1) 2)	17	A22			
B 9		OV	35	B22			
A10		PRINTING 1)	34	A23			
B10		OV	33	B23			
A11		DT6	32	A24			
B11		OV	31	B24			
A12		DT5	30	A25			
B12		OV	29	B25			
A13		DT4	28			Chassis	
B13		OV	27			Chassis	

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Connector	Gen. addr.	Signal Name	Connector	Gen. addr.	Signal Name	Connector
A 1	127-8	LPC 307 - LPT 719	1	147-3	LPC 307 - LPT 719	26
B 1		STROBE - -, SE	2		DT3 - -, ENT4	25
A 2	137-11	DT7 - -, ENT8	3	147-6	DT - -, ENT3	24
B 2		0V	4		0V	23
A 3		DEMAND - -, ACK	5	147-8	DT1 - -, ENT2	22
B 3		0V	6		0V	21
A 4		PAPER FAULT - -, ZAEAS	7 #	147-11	DT0 - -, ENT1	20
B 4		NOT USED	8		0V	19
A 5		ON LINE - RESEL	9		0V	18
B 5		0V	10		0V	36
A 6		DISCONNECTED - 0V	11		0V	37
B 6		0V	12		0V	38
A 7		READY - -, ZAEAS	13 #		FIN - FIN	39
B 7		NOT USED	14		0V	40
A 8		TAPE 11 - -, ZAEAS	15 #	150-3	-, VALSOR - -, VALSOR	41 *
B 8		NOT USED	16		0V	42
A 9		EXHAUSTED - -, FINPAP	17	150-6	-, ZAEAS - -, ZAEAS/-ZAS	43 #
B 9		0V	35		0V	44
A 10		PRINTING - -, VALSOR	34 *		TEST - -, ZAEAS	45 #
B 10		0V	33		0V	46
A 11	137-6	DT6 - -, ENT7	32		FULL - OKE	47
B 11		0V	31		0V	48
A 12	137-8	DT5 - -, ENT6	30		NOT USED	49
B 12		0V	29		NOT USED	50
A 13	137-3	DT4 - -, ENT5	28		Chassis	51
B 13		0V	27		Chassis	52

9. ROM CONTENTS.

ROM 422	P I N			
Address (octal)	9	10	11	12
0 - 11	1	1	1	1
12	0	1	1	1
13	0	1	1	1
14	0	1	1	1
15	0	1	0	1
16 - 137	1	1	1	1
140 - 176	1	0	1	1
177	1	1	1	1
200 - 377	1	0	1	1

LPC307:

Pos 89. ROM419

RESISTORS:R1 to R8
2% 0.4W MetallfilmR9 to R40
5% 1/8W Carbonresistors

Pos 146 (S25 - S32):

LPC Device Code Selection
(Red dot = logic 1)Pos 145 (S1 - S8) and
Pos 146 (S9 - S16) and
Pos 116 (S17 - S24):

Printer Type Selection

Pos 76, 77 and 78:

Spare

OPC303:

Pos 4 STRAP:

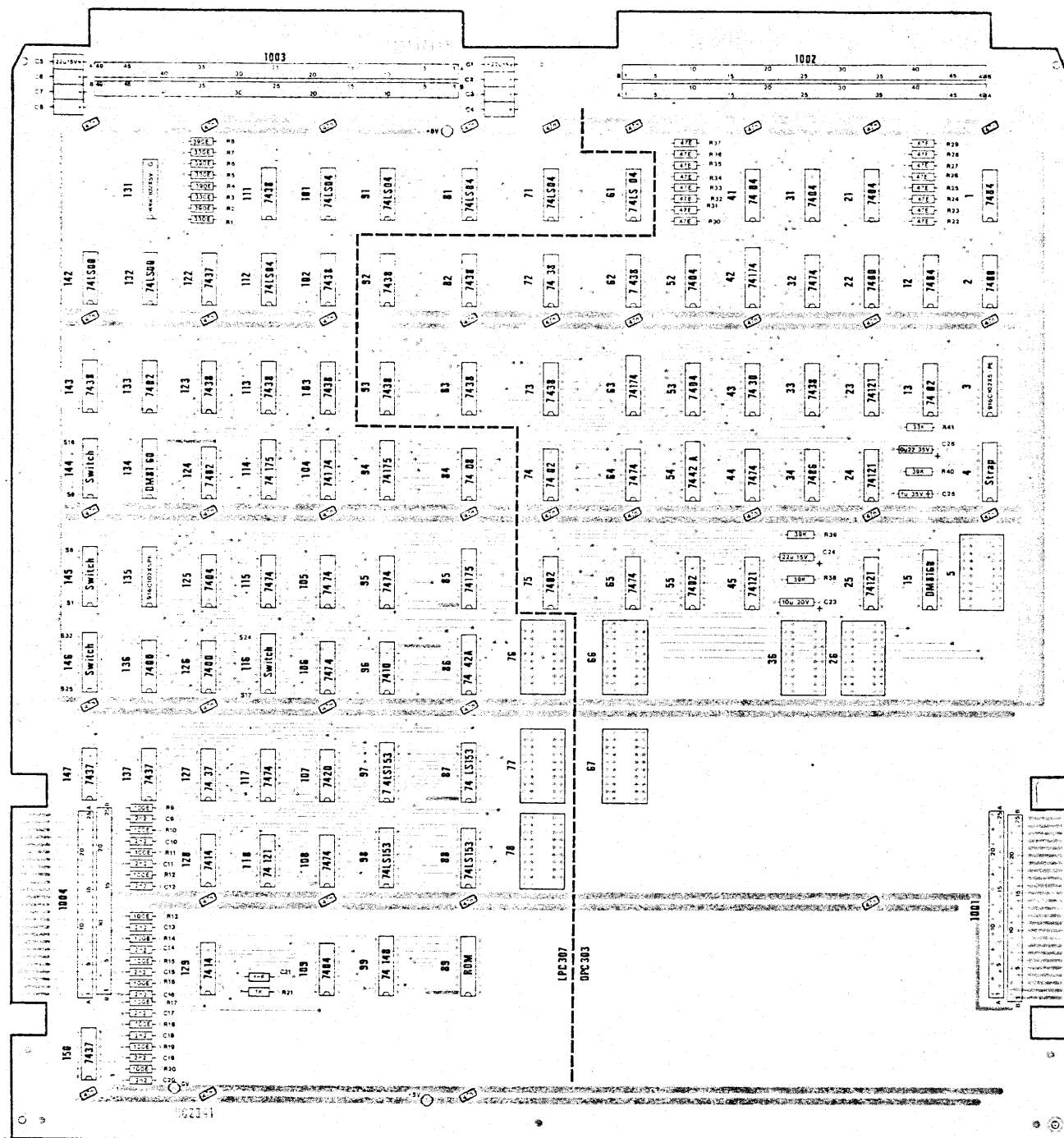
OPC Device Code Selection

(Strap = logic 0

No Strap = logic 1)

Pos 5, 26, 36, 66 and 67:

Spare



LPC307:

Pos 89: ROM419

RESISTORS:

R 1 to R 8

2% 0,4W Metafilm

R 9 to R 40

5% 1/8W Carbonresistors

Pos 146 (S25 - S32):

LPC Device Code Selection (Red dot = logic 1)

Pos 145 (S1 - S8) and

Pos 146 (S9 - S16) and

Pos 116 (S17 - S24):

Printer Type Selection

Pos 76, 77 and 78:

Spare

OPC303:

Pos 4 STRAP:

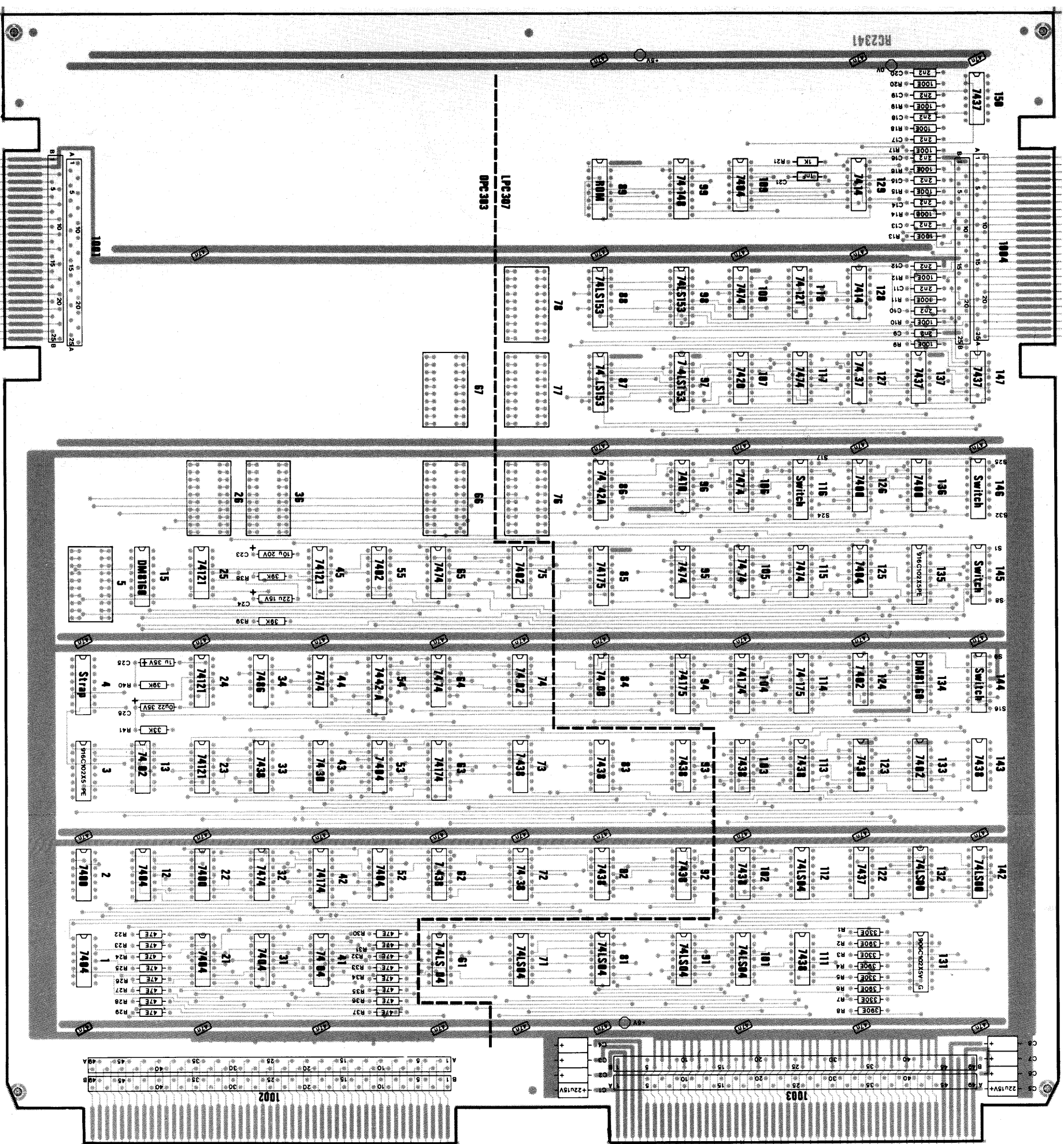
OPC Device Code Selection

(Strap = logic 0

No Strap = logic 1)

Pos 5, 26, 36, 66 and 67:

Spare



PCB ASSEMBLY DRAWING RC2341