

U-CENT User Manual

'make it easy on yourself'

U-MICROCOMPUTERS

01.222

U-CENT USER MANUAL

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Manual issue A.

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Introduction

The U-Microcomputers Parallel Printer Interface is designed to connect Apple II+, //e and all Apple compatible computers to any printer that uses a "Centronics compatible" method of interfacing.

The interface card can be used by all Apple II languages eg BASIC, Pascal, CP/M machine code. It is an intelligent interface and requires no user written software drivers for normal operation.

The interface can be configured to suit differing control line logic levels required by various printer manufacturers. Additional features include the facility to change the number of columns in which listings are printed, the ability to suppress an automatic line feed needed by some printers. It is also possible to output all 8 bits of a byte to enable, for instance, graphical character output available on some printers.

Installation

1. Ensure computer is switched off.
2. Remove computer lid.
3. By referring to the printer manual determine what logic levels are required for the STROBE and ACKNOWLEDGE signals. These are usually referred to as:

STROBE or STB

and

ACKNOWLEDGE or ACK for normal logic

$\overline{\text{STROBE}}$ or $\overline{\text{STB}}$

and

$\overline{\text{ACKNOWLEDGE}}$ or $\overline{\text{ACK}}$ for inverse logic

There are two jumpers on the card, these are used to set the necessary logic levels. The card is marked with the function of each one. You should set these now.

4. Select the slot in which you wish to place interface. For BASIC systems this can be any slot from 1 to 7, for Pascal systems this MUST be slot 1. It will also normally be slot 1 for CP/M. On Apple //e systems avoid using slot 3.
5. Insert the interface card with its long overhang to the front of the computer.
6. Connect the cable from the interface card to the printer.
7. Replace the computer lid, using it to clear the cable in place to provide strain relief, or on the //e putting through a cut-out.
8. Switch on the computer and the printer.
9. The time has now come to try out the interface/printer combination!
10. In BASIC:
 - a. Load a sample program
 - b. Type in PR# n (n = slot number)
 - c. Type in LIST
 - d. You should get a program listing on both the monitor screen and the printer

11. In Pascal:

- a. Run FILER
- b. Check VOLUMES on line
- c. The printer interface should show up as PRINTER:
- d. TRANSFER a FILE to PRINTER:
- e. A listing of that FILE should be printed

12. If the listing does not appear then go back and check the following:

- a. Check correct STROBE and ACKNOWLEDGE Jumpers are correct.
- b. Check the interface card is pushed correctly into its slot
- c. Check all cables are connected correctly
- d. If there is double spacing between lines then the line feed supression option must be selected in BASIC, (CTRL IKreturn)

13. Back to BASIC, try typing in

```
PRINT "CTRL-I 80N"
```

then type in

```
LIST
```

The program should be listed in 80 columns on the printer only.

Now type in PR#0, this will reset the output to the video monitor only.

Use of Control Character Codes

When using BASIC programs, the following codes will select or alter various interface parameters.

PR#n selects output to printer interface in slot n. The video monitor will echo all data sent to the printer, program listings will be limited to 40 columns.

PR#0 deselects printer and returns data output to the video monitor.

CTRL I is the key I held down at the same time as CTRL.

CTRL InnN deselects the video monitor echo and cause program listings to be printed in nn columns. nn can range from 40 to 127.

CTRL II reslects video screen echo and 40 column listings.

CTRL I CTRL letter changes the control select character from CTRL I to CTRL letter. This is used to avoid conflict between data output and card control characters.

CTRL letter CTRL I changes control character to I.

CTRL IK suppresses the line feed character automatically added to any carriage return character received by some printers.

Example

To select printer only, with 80 column program listings. The printer generates its own line feed character.

```
10 PR#1           ! select printer
20 I$=CHR$(9)     ! CTRL I
30 PRINT I$+"80N" ! 80 columns
40 PRINT I$+"K"   ! suppress I/F
50 PRINT "----- text -----"
100 PR#0         ! deselect printer
```

How to output to the printer from machine code

The address of the output port is \$C080 + NO, where N is the slot number of the printer card.

Example to just output a character to slot 1:

```
LDA #$60
```

```
STA $C090
```

or

```
POKE 49196,96
```

The output byte is 8 bits wide, this is to enable graphics printer features to be accessed easily. If graphics features are not to be used then the most significant bit must be masked off.

Example

```
LDA $0300      ! get a character
AND #$7f      ! mask bit 7
STA $C090
```

or

```
50 IF BYTE > 127 THEN BYTE = BYTE - 126
```

```
60 POKE 49196, BYTE
```

The address of the acknowledge signal is \$C080 + NO or \$C0C1 + NO0, again where N = the slot number. The signal itself is the most significant bit of the byte (bit 7).

The acknowledge (ACK) line is polled to find out when the printer has accepted the character that has been sent out. Since it is the most significant bit of the byte then it is simple to find out the state of the ACK line using the fact that this bit signifies whether the byte is positive or negative.

Example to loop until an ACK signal has been received.

```
CHECK LDA $C090
```

```
BNE CHECK
```

or

```
50 ACK = PEEK (49196)
```

```
60 IF NOT ACK THEN GOTO 50
```

The program will stay in this loop until the ACK line goes low.

Technical Description

The U-CENT parallel printer interface consists basically of an 8 bit parallel output port to carry the data to the printer, a monostable to generate a signal to trigger the printer, a single bit input port to accept the acknowledgement from the printer, and a Read Only Memory that holds the 'driver' firmware.

If we assume that the interface is in Apple slot n, then the card operates as follows:

The output port is the 74LS 374, a tri-state buffer between the Apple databus and the Printer datalines. Whenever a Write command to the address \$C0(8+n)0 is received then the buffer is enabled and the data is transferred to the printer along with one microsecond strobe generated by the 74LS123 monostable.

Once the printer accepts the data, it is printed out and an Acknowledge signal is returned to the computer.

This signal is buffered through the 74LS125 and decoded at address \$C0(8+n)0 and also at \$CnCl to give PASCAL compatibility. To ensure sufficient time for this Acknowledge signal to be read it is stretched by the RS flip flop 74LS279 to keep it active until the next strobe is received.

The firmware is in 2716 Erasable Programmable Read Only Memory is Memory Mapped in the area Cn00 to CnFF. Address CnCl is decoded by the 74LS85s to disable the EPROM and enable the input buffer for PASCAL compatibility.

Table 1

Centronics standard Interface Connections

1.	Data Strobe	2	}	all ground
3.	Data bit 1	4		
5.	Data bit 2	6		
7.	Data bit 3	8		
9.	Data bit 4	10		
11.	Data bit 5	12		
13.	Data bit 6	14		
15.	Data bit 7	16		
17.	Data bit 8	18		
19.	Acknowledge	20		
21.		22		
	to			
35.	not used		36.	

Table 2

U-CENT		
Quantity	Description	Part number
1.	1	PCB U-CENT
2.	2	IC 74LS00
3.	1	IC 74LS04
4.	2	IC 74LS85
5.	1	IC 74LS123
6.	1	IC 74LS125
7.	1	IC 74LS279
8.	1	IC 74LS374
9.	1	EPROM 2716 5v only programmed
10.	1	Capacitor 22 uf,tantalum
12.	2	Capacitor 0.01 uf,ceramic
13.	2	Capacitor 22 pf,sub min, ceramic
14.	4	Resistor 1/4 watt 4K7
15.	2	Resistor 1/4 watt 33K
16.	1	IC Socket 24 way
17.	1	IC Socket 20 way
18.	4	IC Socket 16 way
19.	4	IC Socket 14 way
20.	2	Jumper system 3 way (RS 334 - 555)
21.	2	Jumper link (RS 334 - 561)
22.	1	Wire link
23.	1	Flat IDC ribbon cable 20 way
24.	1	IDC Amphenal connector 36 way plug
25.	1	Shell for connector (Farnell 609-036)

Options ::

1.		Cable fixed to interface card
26.	1	0.1" matrix solder transition connector
2.		Cable detachable from interface card
26.	1	IDC PCB mounting plug 20 way
27.	1	IDC free female connector

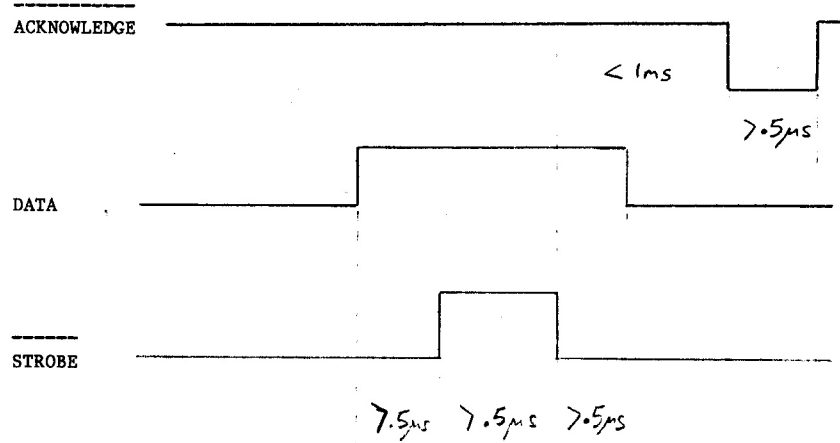


Fig 1 Interface Timing

```

SOURCE FILE: CD 19 MAR C
0000: 1 *****
0000: 2 *.....*
0000: 3 *.CENTRONICS INTERFACE DRIVER.*
0000: 4 *.....*
0000: 5 *.....*
0000: 6 *.....*
0000: 7 *...VERSION C...19 MAR 83...*
0000: 8 *...CD.19.MAR.C;OBJO.....*
0000: 9 *****
0000: 10 *
0000: 11 *.NUMBER.OF.LISTING.COLUMN..
0000: 12 *.CONTROLLED BY
0000: 13 *
0000: 14 *..CTRL.I(NUM)N(C/R)..-SCRN.OFF,N.COLS.OF PRINT
0000: 15 *
0000: 16 *
0000: 17 *
0000: 18 *
0000: 19 *..CTRL.I.I.(C/R).....-SCRN.ON
0000: 20 *
0000: 21 *..CTRL.I.K.(C/R).....-AUTO.L/F.OFF
0000: 22 *
0000: 23 *..CTRL.I.CTRL(LETTER)-ALTER CTRL CHAR
0000: 24 *
0000: 25 *..CTRL(LETTER).CTRL.I-CHANGE.BACK
0000: 26 *
0000: 27 *
0000: 28 *..PR#0.....-TURN.CARD.OFF
0000: 29 *
0000: 30 *..PR#(1-6).....-TURN.CARD.ON
0000: 31 *
0000: 32 *
0000: 33 *
0000: 34 *
FF4A: 35 IOSAVE EQU $FF4A
FF3F: 36 IOREST EQU $FF3F
FDF0: 37 COUT1 EQU $FDF0
FF58: 38 IORTS EQU $FF58
C080: 39 DEV EQU $C080
C080: 40 ACK EQU $C080
03B8: 41 CHAR EQU $03B8
0438: 42 SCRNRD EQU $0438
04B8: 43 FLTAB EQU $04B8
0538: 44 NCOL EQU $0538
05B8: 45 CTLFLAG EQU $05B8
0638: 46 CTLCHAR EQU $0638
06B8: 47 VLFLAG EQU $06B8
0738: 48 PRNCUR EQU $0738
0045: 49 ACCUM EQU $45
0036: 50 CSWL EQU $36
0037: 51 CSWH EQU $37
0024: 52 HCUR EQU $24
0000: 53 *
0000: 54 *
0000: 55 *
0000: 56 *
0000: 57 *
0000: 58 *
0000: 59 *
    
```

```

----- NEXT OBJECT FILE NAME IS CD 19 MAR C.OBJ0
C100:          61      ORG  #C100
C100:          62 *
C100:          63 *
C100:38       64      SEC          SET INITIALISATION FLAG
C101:B0 06    65      BCS  START
C103:00       66      BRK
C104:00       67      BRK
C105:         68 *
C105:         69 *
C105:48       70      PHA          ;
C106:98       71      TYA          ; PASCAL KEY
C107:48       72      PHA          ;
C108:         73 *
C108:         74 *
C108:18       75      CLC          SET NORMAL ENTRY FLAG
C109:20 4A FF 76 START JSR  IOSAVE  ;
C10C:78       77      SEI          ;
C10D:20 58 FF 78 JSR  IORTS   ;FIND SLOT NUMBER
C110:BA       79      TSX          ;
C111:BD 00 01 80      LDA  #0100,X ;
C114:         81 *
C114:AA       82      TAX          ;X HOLDS #CN
C115:A4 45    83      LDY  ACCUM
C117:90 16    84      BCC  INTDONE
C119:         85 *
C119:         86 *
C119:A9 89    87      LDA  ##89   ; 10001001 = CTL I
C11B:9D 38 06 88      STA  CTLCHAR,X
C11E:9D B8 06 89      STA  VLFLAG,X BIT7=VIDEO,BITO=L/F
C121:A9 28    90      LDA  #40
C123:9D 38 04 91      STA  SCRNDW,X ;SET TO 40 COLS
C126:8A       92      TXA
C127:85 37    93      STA  CSWH
C129:A9 08    94      LDA  ##0B
C12B:85 36    95      STA  CSWL   *
C12D:D0 05    96      BNE  SKIP1   FORCED BRANCH
C12F:         97 *
C12F:         98 *
C12F:BD B8 05 99 INTDONE LDA  CTLFLAG,X ;ALREADY IN CTL MODE?
C132:30 5E    100     BMI  CTLALRDY ;JUMP IF YES
C134:98       101     SKIP1 TYA          ;GET CHAR BACK IN ACC
C135:5D 38 06 102     EDR  CTLCHAR,X
C138:0A       103     ASL  A          ;DROP BIT7 INTO C
C139:F0 6C    104     BEQ  CTLCHECK ;IT'S AN CTL CHAR
C13B:5E B8 05 105     LSR  CTLFLAG,X ;OTHERWISE CLEAR FLAG
C13E:98       106     TYA
C13F:48       107     PHA          ;SAVE CHAR
C140:         108 *
C140:8A       109     TXA          ;GET #CN
C141:0A       110     ASL  A          ;
C142:0A       111     ASL  A          ;
C143:0A       112     ASL  A          ;FIND DEV SEL
C144:0A       113     ASL  A          ;
C145:AB       114     TAY          ; Y NOW HAS #NO
C146:BD 38 07 115 CHKTAB LDA  PRNCUR,X
C149:C5 24    116     CMP  HCUR
C14B:6A       117     ROR  A

```

```

C14C:9D B8 04 118     STA  FLTAB,X
C14F:0A       119     ASL  A
C150:68       120     PLA          ;GET CHAR
C151:B0 05    121     BCS  SKIP3   ;PRNTCUR>=HCUR
C153:         122 *
C153:48       123     PHA
C154:29 80    124     AND  ##80   ; 10000000
C156:09 20    125     ORA  ##20   ; 00000010 FORCE SPACE
C158:2C 58 FF 126 SKIP3 BIT  IORTS  ; 01100000
C15B:F0 03    127     BEQ  CHAROUT
C15D:FE 38 07 128     INC  PRNCUR,X
C160:         129 *
C160:         130 *
C160:         131 *DEV,Y...BIT.7=.ACK.LINE
C160:         132 *
C160:         133 *
C160:         134 *
C160:9D B8 03 135 CHAROUT STA  CHAR,X
C163:29 7F    136     AND  ##7F
C165:         137 *
C165:         138 *
C165:         139 *
C165:99 80 C0 140     STA  DEV,Y
C168:         141 *
C168:         142 *
C168:         143 *
C168:B9 80 C0 144 CHKRDY LDA  ACK,Y   ;READ ACK LINE
C16B:30 FB    145     BMI  CHKRDY
C16D:         146 *
C16D:         147 *
C16D:         148 *
C16D:BD B8 04 149     LDA  FLTAB,X
C170:10 D4    150     BPL  CHKTAB
C172:BD B8 03 151     LDA  CHAR,X
C175:49 0D    152     EOR  ##0D   ;IS IT C/R?
C177:0A       153     ASL  A
C178:D0 0D    154     BNE  NOTENDLN
C17A:9D 38 07 155     STA  PRNCUR,X
C17D:BD B8 06 156     LDA  VLFLAG,X
C180:6A       157     ROR  A          ;DROP BIT0 IN C,NO L/F?
C181:29 80    158     AND  ##80   ; 10000000
C183:09 0A    159     ORA  ##0A   ; 00001010 FORCE L/F
C185:B0 D9    160     BCS  CHAROUT
C187:BD B8 06 161 NOTENDLN LDA  VLFLAG,X
C18A:10 08    162     BPL  SKIPVID
C18C:20 3F FF 163     JSR  IOREST  ;RESTORE STATUS
C18F:4C F0 FD 164     JMP  COUT1   ;PRINT ON SCREEN
C192:         165 *
C192:30 15    166     CTLALRDY BMI  CTLBIT ;STEPPING STONE
C194:         167 *
C194:         168 *
C194:         169 *
C194:BD 38 07 170 SKIPVID LDA  PRNCUR,X
C197:F0 09    171     BEQ  SKIP7
C199:FD 38 04 172     SBC  SCRNDW,X
C19C:E9 F7    173     SBC  ##F7   ; -9
C19E:90 42    174     BCC  EX3
C1A0:69 1F    175     ADC  ##1F   ; 31

```

```

C1A2:18      176 SKIP7   CLC
C1A3:85 24   177         STA  HCUR
C1A5:90 3B   178         BCC  EX3
C1A7:        179 *
C1A7:        180 *
C1A7:F0 48   181 CTLCHECK BEQ INITNCOL ;STEPPING STONE
C1A9:        182 *
C1A9:        183 * FIND OUT WHAT CHARACTER FOLLOWS THE CTL CHARACTER
C1A9:        184 *
C1A9:98      185 CTLBIT  TYA
C1AA:29 7F   186         AND  ##7F      ; 01111111 MASK BIT 7
C1AC:49 30   187         EOR  ##30      ; 00110000 COMPLIMENT BITS 4 & 5
C1AE:C9 0A   188         CMP  ##0A
C1B0:90 34   189         BCC  WINDOW
C1B2:        190 *
C1B2:        191 * FIND OUT IF LETTER
C1B2:        192 *
C1B2:C9 78   193         CMP  ##78      ; 01111000 IS IT A LETTER?
C1B4:B0 0C   194         BCS  CTLLLETR
C1B6:        195 *
C1B6:        196 * MUST BE NEW CONTROL CHARACTER
C1B6:        197 *
C1B6:98      198         TYA
C1B7:9D 38 06 199         STA  CTLCHAR,X ;SAVE NEW CTL CHAR
C1BA:90 23   200         BCC  EX2
C1BC:        201 *
C1BC:        202 * MUST BE A LETTER H-O
C1BC:        203 *
C1BC:B0 04   204         BCS  CTLLLETR
C1BE:        205 *
C1BE:        206 *
C1BE:00      207         BRK
C1BF:00      208         BRK
C1C0:00      209         BRK
C1C1:00      210         BRK
C1C2:4A      211 CTLLLETR LSR  A
C1C3:6A      212         ROR  A
C1C4:B0 12   213         BCS  LETK      ;L/F SUPRESSION
C1C6:1D B8 06 214         ORA  VLFLAG,X
C1C9:10 11   215         BPL  EX1      ; LETTER N
C1CB:        216 *
C1CB:        217 * MUST BE LETTER I,RESET VIDEO MODE
C1CB:        218 *
C1CB:        219 *
C1CB:48      220         PHA
C1CC:A9 28   221         LDA  #40
C1CE:9D 38 04 222         STA  SCRNEW,X
C1D1:A9 00   223         LDA  #00
C1D3:85 24   224         STA  HCUR      ; SET VIDEO CURSOR TO 0
C1D5:68      225         PLA
C1D6:30 04   226         BMI  EX1
C1D8:        227 *
C1D8:        228 * MUST BE LETTER K, AUTO L/F ?
C1D8:        229 *
C1D8:3D B8 06 230 LETK   AND  VLFLAG,X
C1DB:18      231         CLC
C1DC:9D B8 06 232 EX1   STA  VLFLAG,X
C1DF:7E B8 05 233 EX2   ROR  CTLFLAG,X ;TOGGLE CTLFLAG

```

```

C1E2:        234 *
C1E2:        235 * REGULAR EXIT FROM ROUTINE
C1E2:        236 *
C1E2:20 3F FF 237 EX3   JSR      IOREST
C1E5:60      238         RTS
C1E6:        239 *
C1E6:        240 * SET NEW SCREEN WIDTH
C1E6:        241 *
C1E6:A0 0A   242 WINDOW LDY  ##0A      ; 00001010
C1E8:7D 38 05 243 LOOP   ADC  NCOL,X
C1EB:88      244         DEY
C1EC:D0 FA   245         BNE  LOOP
C1EE:9D 38 04 246         STA  SCRNEW,X
C1F1:9D 38 05 247 INITNCOL STA NCOL,X
C1F4:38      248         SEC
C1F5:B0 E8   249         BCS  EX2

```

*** SUCCESSFUL ASSEMBLY: NO ERRORS

45 ACCUM
 C168 CHKRDY
 36 CSWL
 C1A7 CTLCHECK
 C1DC EX1
 24 HCUR
 FF58 IORTS
 0538 NCOL
 C134 SKIP1
 C109 START

COB0 ACK
 C146 CHKTAB
 C192 CTLALRDY
 05B8 CTLFLAG
 C1DF EX2
 C1F1 INITNCOL
 FF4A IOSAVE
 C187 NOTENDLN
 C158 SKIP3
 06B8 VLFLAG

C160 CHAROUT
 FDF0 COUT1
 C1A9 CTLBIT
 C1C2 CTLETR
 C1E2 EX3
 C12F INTDONE
 C1D8 LETK
 0738 PRNCUR
 C1A2 SKIP7
 C1E6 WINDW

03B8 CHAR
 37 CSWH
 0638 CTLCHAR
 COB0 DEV
 04B8 FLTAB
 FF3F IOREST
 C1E8 LOOP
 0438 SCRNDW
 C194 SKIPVID

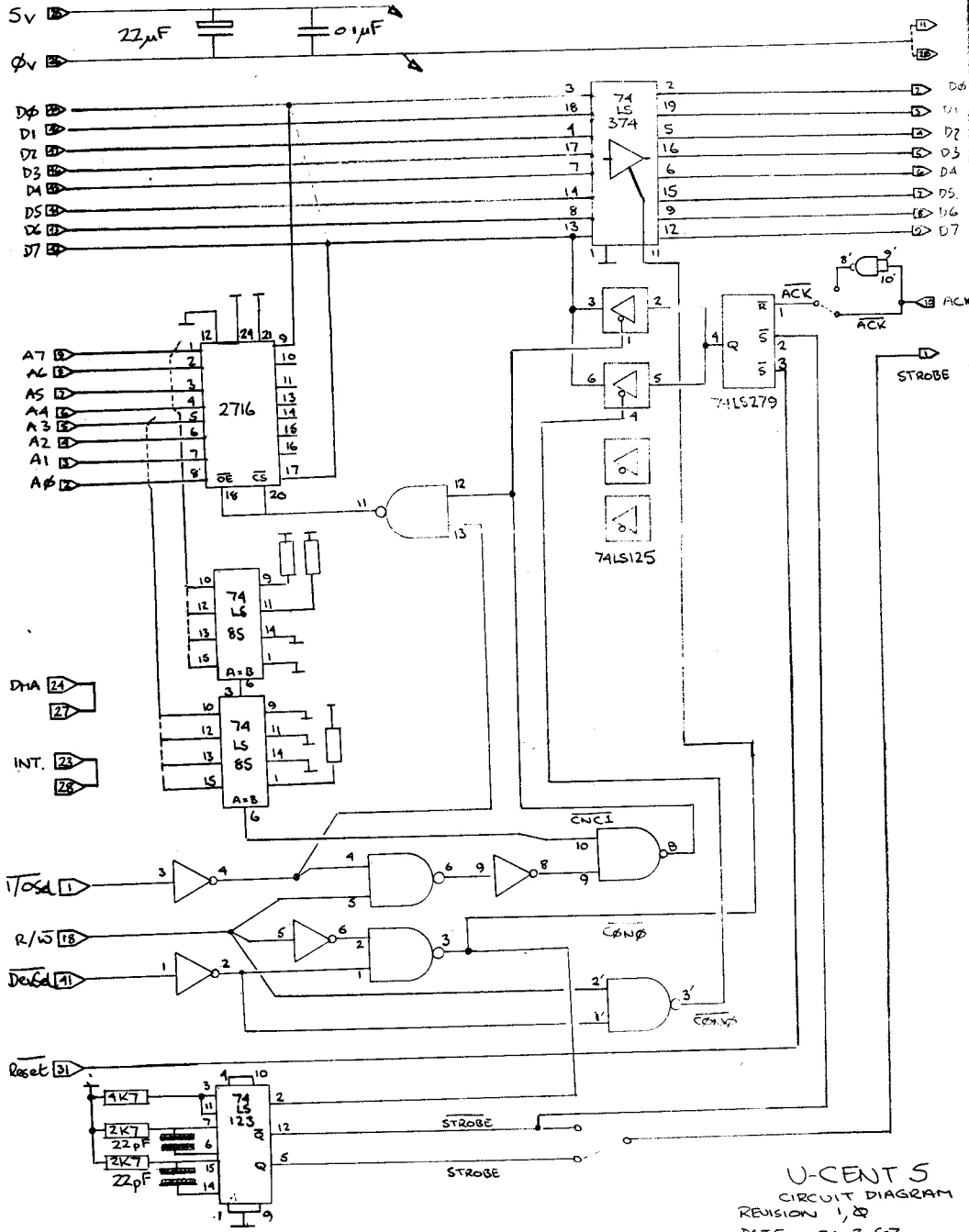
24 HCUR
 03B8 CHAR
 05B8 CTLFLAG
 COB0 ACK
 C134 SKIP1
 C168 CHKRDY
 C1A2 SKIP7
 C1D8 LETK
 C1E6 WINDW
 FF3F IOREST

36 CSWL
 0438 SCRNDW
 0638 CTLCHAR
 COB0 DEV
 C146 CHKTAB
 C187 NOTENDLN
 C1A7 CTLCHECK
 C1DC EX1
 C1E8 LOOP
 FF4A IOSAVE

37 CSWH
 04B8 FLTAB
 06B8 VLFLAG
 C109 START
 C158 SKIP3
 C192 CTLALRDY
 C1A9 CTLBIT
 C1DF EX2
 C1F1 INITNCOL
 FF58 IORTS

45 ACCUM
 0538 NCOL
 0738 PRNCUR
 C12F INTDONE
 C160 CHAROUT
 C194 SKIPVID
 C1C2 CTLETR
 C1E2 EX3
 FDF0 COUT1

Appendix 2 - Circuit Diagram



U-CENT 5
CIRCUIT DIAGRAM
REVISION 1, 8
DATE 20, 3, 83.

U-MICROCOMPUTERS

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