SCL

ELAN E/C SERIES
MAINTENANCE &
CALIBRATION MANUAL

CONTENTS

Scope

Introduction

This manual covers the overall circuit operation of the Elan E and C Series programmers. The range has evolved through several significant levels of hardware and software as briefly described in the history notes below. The range is as follows:

Copiers: 1 master socket and 8 copy sockets

E8
E8A
E8B

Programmers: 1 master socket with RAM editing and communication ports & 8 copy sockets (E9 range) or 1 copy socket (E2 range)

E9, E2
E9A, E2A
E9B, E2B
E9C

Set Programmers: Capable of programming different data to each copy socket in one operation, enabling 16 bit & 32 bit programming and sequencial block programming.

E12
E12B
E12C

C41 as E12 range but 2 programmable sockets allowing 16 bit & sequential block programming.

Circuit Diagrams

The circuit references in the text apply to drawing numbers as follows.

Model	Serial Number Range	Drawing Numbers
E2, E8, E9	400,000 onwards	285/1 & 285/3 to 285/7
	500,000 onwards	285/1 & 285/3 to 285/7
E2A, E8A, E9A	5---(A) $600,000 onwards	296/1 to 296/6
E2B, E8B, E9B	700,000 onwards	326/1 to 326/6
E9C	701,000 onwards	20230 to 20237
E12	702,000 onwards	20230 to 20237
E12B	800,000 onwards	20240 to 20246
E12C	801,000 onwards	332/1,332/2 & 332/5 to 332/7
C41	802,000 onwards	332/1,332/2 & 332/5 to 332/7
	C01000 onwards	311/1 to 311/7 & 331/9 to 332/13

History

The original E Series programmers were designed in 1982.
The E8 copier had a master socket and 8 copy sockets, the power supply, control board and case formed the basis of the whole range. An interface board added the facility of user RAM, editing and serial/parallel I/O ports in the E9. The E2 had the same facilities for 1 master socket and 1 copy socket. The first units supported 2508 to 27128 with the 50ms programming algorithms.

Fast programming algorithms were introduced almost immediately with switched Vcc supplies.

The introduction of the 27256 necessatated the addition of the 12.5v Vpp selection which also served for the later 2764A and 27128A devices. Intel approval was first granted in November 1983.

The 27512 was heralded by the introduction of the EA Series with 64K/128K byte dynamic RAM and 27512 programming in socket 1 only on the E8A and E9A. The E12 was one of the earliest set programmers supporting 16 and 32 bit configurations.

Further improvements were seen with the introduction of the C41 incorporating all the best features of the range in a compact 2 socket set programmer with LCD display.

The EB Series also incorporated an LCD, further improvements were seen with Quick-Pulse algorithms across the range and the membrane keypad on E9C and E12C.

General Circuit Description

Clock, Micro-Processor & Buffers

ICI 74HC14 (IC3 Z8581 C41) and associated circuitry generates a 4.0 MHZ crystal controlled clock signal which is used to clock the micro-processor and the baud rate generator on the interface board (not E8B). The micro-processor IC2 (IC5 in C41) is a Z80A. The data bus is buffered by IC6 (IC9 in C41) a bi-directional buffer. The data direction is controlled by BRD. IC3, 4 & 5 (IC's 6, 7 & 8 in C41) uni-directional buffers buffer the Address Bus and BWR, BRD signals.

Address decoder, Internal EPROM and Scratchpad RAM

IC7 (ICI in C41) decodes the available 64K of addressing into sections:-

0000 to 3FFF	First EPROM
4000 to 7FFF	Second EPROM
8000 to BFFF	Scratchpad RAM *
C000 to FFFF	User RAM

* Only 2K of Scratchpad RAM fitted address 6000 to 67FF supported by Nickel Cadmium battery on PSU board.

The outputs of the address decoder control the chip enable of EPROM and Scratchpad RAM selecting one device for a read or write operation in conjunction with BRD or BWR signals.

Port Decoder & Latches

IORQ, BRD, BRW signals are gated to produce an I/O write or an I/O read signal which enables pin 1 or 15 of IC12 the port sector decoder. IC12 decodes the I/O port address into four input sections (pins 4, 5, 6, 7) or four output sections (pins 12, 11, 10,9) all active low. These sections are further decoded where necessary by IC13 (chip select decoder), IC14 (various input ports), IC15 and IC16 (various output ports). (IC23, 18, 19, 20 in C41).

Where data outputed to a port has to be stored it is held in latches (IC17, 18, 19, 20). (IC16, 17, 21 & 22 in C41)

Chip Select decoder

IC13 (IC23 in C41) selects one of the copy sockets during a copy socket read. IC32 selects the Master Socket during a master socket read, (E Series only.

Address Latch

IC26, 27 latch the port 00 and port 01 data which is the socket address LSB and MSB respectively. A common 00 read signal or a latched Address/Data control enables the tri-state outputs of IC26, 27.

Variable Access Time Control

The tACC or access time of the EPROM is defined as the time taken for the EPROM to output correct data after the selected address is stable. The read strobe is used to enable the Address latch (see above) and from this period of valid address a timing 'window' is generated by a monostable IC34. The period of the pulse generated by the monostable is determined by an R.C time constant. The C content is fixed in C9, (C16 & C17 in C41) but the resistance can be selected via multiplexer IC33. One of eight resistors is selected by the ABC inputs.

It is therefore possible with software control to start off with a wide open 'window', check that the data is read correctly and progressively close the 'window' until the EPROM gives incorrect data.

For E-Series models the output of the monostable enables a transparent latch IC35 on the common Socket Data Bus. IC31A permits the automatic overiding of the Access Time facility when reading the master socket. On the C41 model the transparant latches are IC40 and IC42.

Data Latch

IC36 latches the data to be programmed into the EPROMs, (IC39 & IC41 on C41). The tri-state outputs are controlled by the Latched Address/Data Control signal.

Interface Circuits

Various gates, transistors and relays perform multiplexing or level shifting functions for the multi-use pins on copy and master sockets.

For E-Series models an EEPROM wave shaper circuit centred around IC37 conditions the rise and fall times of Vpp.

Relays 2 and 3 each 4 pole change over contacts switch the pin 22's of the copy sockets between output enable function or Vpp (Intel 2732, 2732A & 27512). On the E9C, E12C & C41 the relays are replaced by switching transistors BC327 & BC337 on pin 22's.

Display and Peizo Sounder

IC45 latches selection of code B or Hex display formats on the display and also drives the piezo sounder, (IC21 in C41).

On E and EA Series models the 8 digit L.E.D display is driven by IC44 a multiplexed diplay driven with internal RAM. IC42 latches the digit blanking (which is not available from IC44 with Hex display format). IC40, 41 gate digit blanking to Common Cathode drive transisitors Q48 to Q55. The L.E.D display consists of two 4 digit 7 segment Litronix DL4770 displays.

C41 & B Series models introduced an L.C.D display driven direct from the buffered data bus.

Keyboard

IC43 inputs the eight push button switches onto the data bus when port 10 receives input, (IC37 in C41).

Intelligent Indentifier

Relay 5 and associated components permit intelligent interrogation of EPROMs by switching address 9 to +12v in accordance with Intel specification.

P.S.U Monitor

On E series models before serial numbers begining with 6 a quad voltage comparitor IC48 is used to check the switched +5v level, 21v and 24v. IC50 outputs this data on to the data bus when PORT 12 is inputed.

Later E-Series models added further comparitors IC47 & IC52 .

C41 models use a multiplexer IC47 to select a voltage reference which is increased by a precision amplifier IC44 for comparison with pin 22 voltages at comparitor IC48.

P.S.U Circuit

Mains Transformer

Toroidal mains transformer specification:

Input	Colour Code	Outputs	Colour Code
0v	Blue	0v	Red +
110v	Violet	8v 25mps	Red
120v	Brown		
0v	Blue *	0v	Orange +
110v	Violet *	24v 21mps	Orange
120v	Brown *		
Screen	Green/Yellow		

*Small yellow sleeve at transformer end identified this group of windings.

+Small white sleeve at transformer end indentifies phase of secondary windings.

NOTE that later models have a different Primary Colour Code:-

Ov Blue, 110V Violet, 120V White, Ov Black, 110V Grey, 120V Brown.

+5v Supply

A conventional circuit using a bridge rectifier and series regulator. A switched +5v output is controlled by software to supply the EPROM sockets.

+25v/21v/12v Supplies

Vpp supplies are provided by IC2, (REG3 in C41). The +12v supply is fixed regulated by ICI. Q13, 14 provide Vpp current limiting at 400mA.

Pins 22 Supply

Pins 22 of the EPROM sockets require a wide variety of supply voltages. Q2, Q4, and associated circuitry select 0v, 12v, 21v or 25v under software control.

L.E.D indicators monitor:-

L.E.D 3 (1 in C41) Regulated +21/25v etc
L.E.D 4 (2 in C41) Regulated +5v

Interface and Memory Board

This board has four functions-

1. Hex-Keypad.
2. Serial RS232 Input/Output
3. Random Access Memory RAM
4. Parallel Input/Output.

On the C41 the RAM and Hex-Keypad control is on the main board, the serial and parallel I/O is on the PSU board.

1. Hex-Keypad

IC15 (IC23 on later models, IC36 on C41) an LSI Keyboard decoder chip enables the reading of the 16 hex keys and 4 function keys.

2. Serial RS232 Input/Output

The heart of the Serial I/O is the 6402 U.A.R.T IC18, (IC27 on later models IC6 on C41). IC13 (IC28 on later models, IC9 on C41), an eight bit latch holds the baud rate selection (Bits 0, 1, 2, 3) and the remaining bits are used to control parity, stop bits and clear the data ready flag. IC11 is a four bit latch used to select 7 or 8 data bits and handshaking output flags. (IC26 on later models IC8 on C41). IC10 accepts the master clock and converts this to the required U.A.R.T clocking speed. Later models use a board rate generator IC24, (IC10 in C41).

IC16 (IC29 on later models) converts the CMOS signal levels to RS232 levels (approx. + -9v). Converter IC19 (IC3 on C41) converts the RS232 input levels to CMOS levels. The Clear To Send and Data Set Ready handshaking inputs are buffered through IC14, (IC28 on later models, IC11 on C41).
IC17 converts the +12v supply to -9v to provide the negative bias on the RS232 output lines, (IC30 on later models, IC5 on C41).

3. RAM

(E Series models before serial numbers beginning with 7)
The first E-Series models accomodated 16K bytes of RAM on the I/O board (IC2, 3, 4, 5, 6, 7, 8, 9). A minimum of 8K bytes is fitted (IC2, 3, 4, 5). IC12 enabled by RAM selects one of eight 4016 RAM chips.

An added RAM board enabled a total of 32K Bytes on E Series models in the 600,000 serial number range.

EA, EB EC and C41 models have up to 128K Bytes of dynamic RAM.

4. Parallel Input/Output

IC1 a Z80A P.I.O chip provides two 8 bit parallel I/O ports at T.T.L levels with handshaking control. (IC12 on C41).

Calibration

Equipment Required:

A digital voltmeter with a d.c range greater than 25v with resolution to 1mV.

Procedure

Allow 10 minutes warm-up.

These adjustments must be carried out in the following order:-

PSU +5v Logic supply for 5.15v.

	C41	EA EB EC	E	E	Model
	all	7	5 & 6	4	Serial No 1st Digit
Adjust (A)	RV6	RV3	RV3	RV3	
measure at (B)	REG4	IC3	IC3		
Adjust	-	RV7	-	IC3	
measure at	-	IC7	-	-	
Main board voltage ref.					
Adjust for (C)	RV1	RV3	RV3	RV3	
measure at	2.90 IC46 pin4	2.90 IC48 pin 4	2.90 IC48 pin 4	2.35 IC48 pin 4	

procedure continued over-leaf

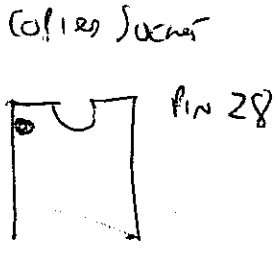
TEST C VERSION 5 NO ADJ.

Calibration continued

In order to activate the following switched voltages the programmer must be put into "System Mode" (note C41-C14A firmware cartridge does not support "System Mode"); - switch programmer off, hold down the two cursor/arrow keys and switch on. 'SYS' will now appear on the right of the display. Select 2564 device, press & hold the 'Program' key for 2 'beeps '(lower 'Program' key in E-Series models), press enter, if display shows 'copy not blank' press enter.
Vpp & Vcc voltages will now be present at the ZIF sokects pins.

	C41	EA EB EC	E	E	Model
	all	7	5(A)&6	4&5	Serial No. 1st digit
Select 2564 measure 25.15v at ZIF pin Adjust	1 RV5	1 RV1	1 RV1	1 RV1	
Select 2784-1 or 2764 Int Measure 21.15v at Adjust	1 RV4	1 RV2	1 RV2	1 RV2	
Measure 6.15v at Adjust	28 RV2	28 RV4	28 RV4	28 RV4	
Select 2764A Measure 12.66v at Adjust	1 RV3	1 RV6	1 RV6	- -	
Select 2564 Measure 5.15v at Adjust	28 RV1	28 RV5	28 RV5	28 RV5	

Note: Models with Quick-Pulse hardware will automatically select higher Vpp & Vcc programming voltages by switching precision resistors, these voltages are not separately adjustable but can be checked at display selections showing the QP devices. Vpp will be nominally 12.8v & Vcc nominally 6.3v



After Sales Support and Service

In case of operating difficulties (and before making any returns) please contact:-

UK and rest of the world (excluding U.S.A.):

I. Your Distributor *or*
II. Customer Support Engineering at
Elan Digital Systems Ltd.
Elan House,
Little Park Farm Road,
Segensworth West,
Fareham,
Hampshire,
PO15 5SJ.

Tel: (0489) 579799
Fax: (0489) 577516

For U.S.A.

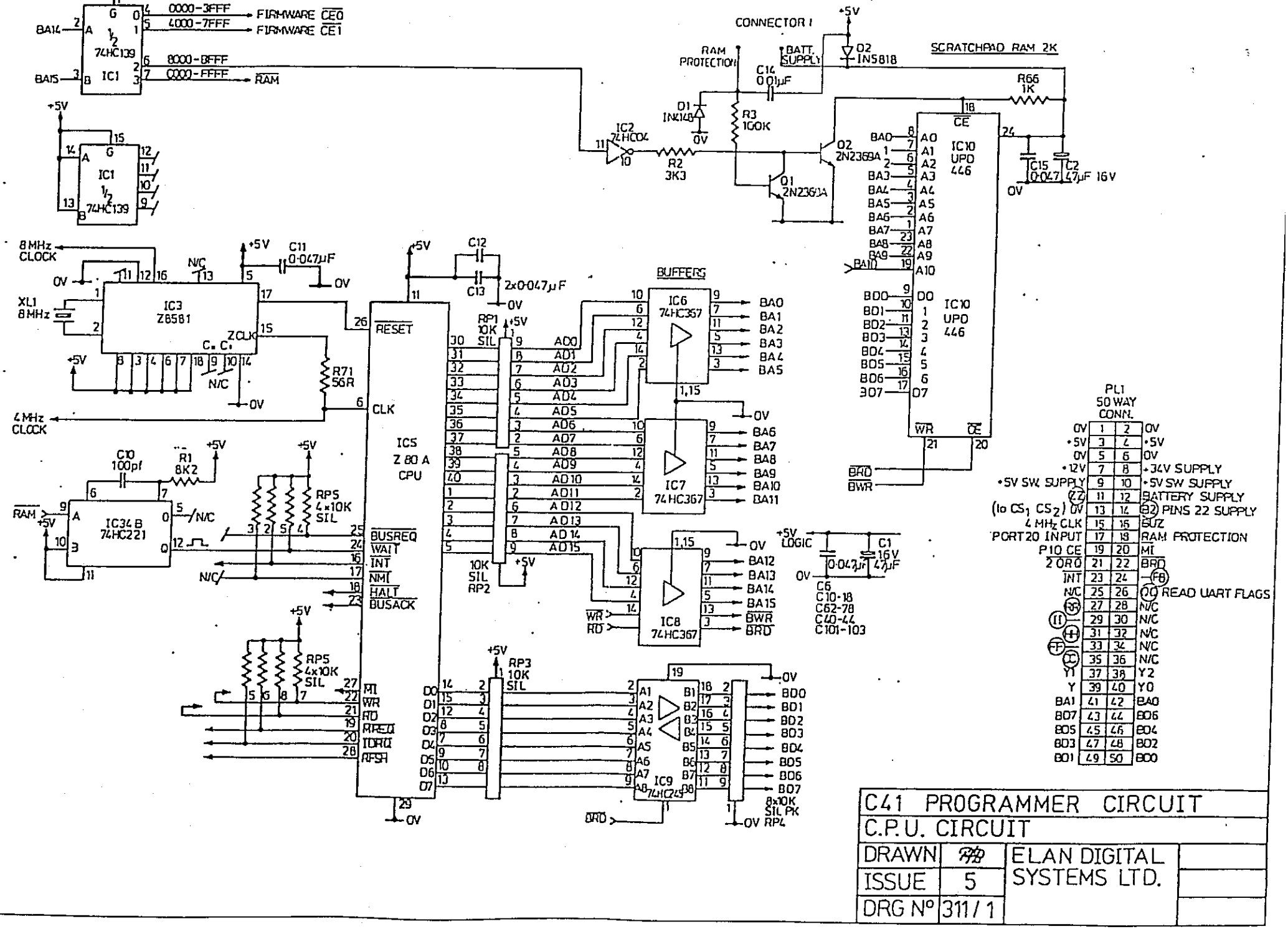
The Technical Support Representative,
Elan Digital Systems
538 Valley Way
Milpitas
California 95035

Tel: (408) 946-3864
(800) 541-ELAN
Fax: (408) 946-0351

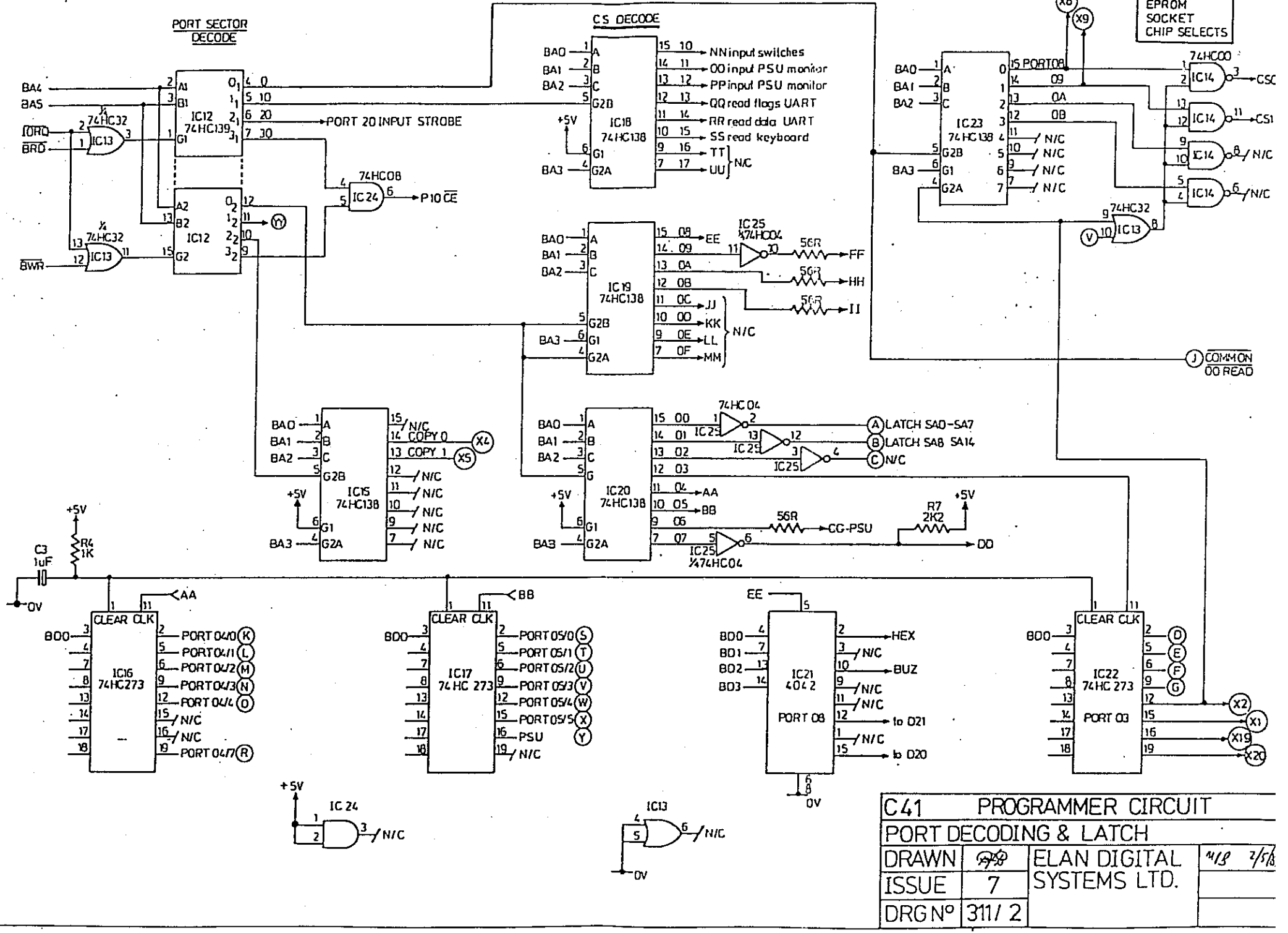
Advice can be given on all aspects of the programmer's operation and the problems encountered when interfacing with other sytems.

In the event of a return being necessary please use the original packing material or pack very carefully to minimise damage in transit. Equipment received in inadequate packing will be returned in new packing which will be charged for.

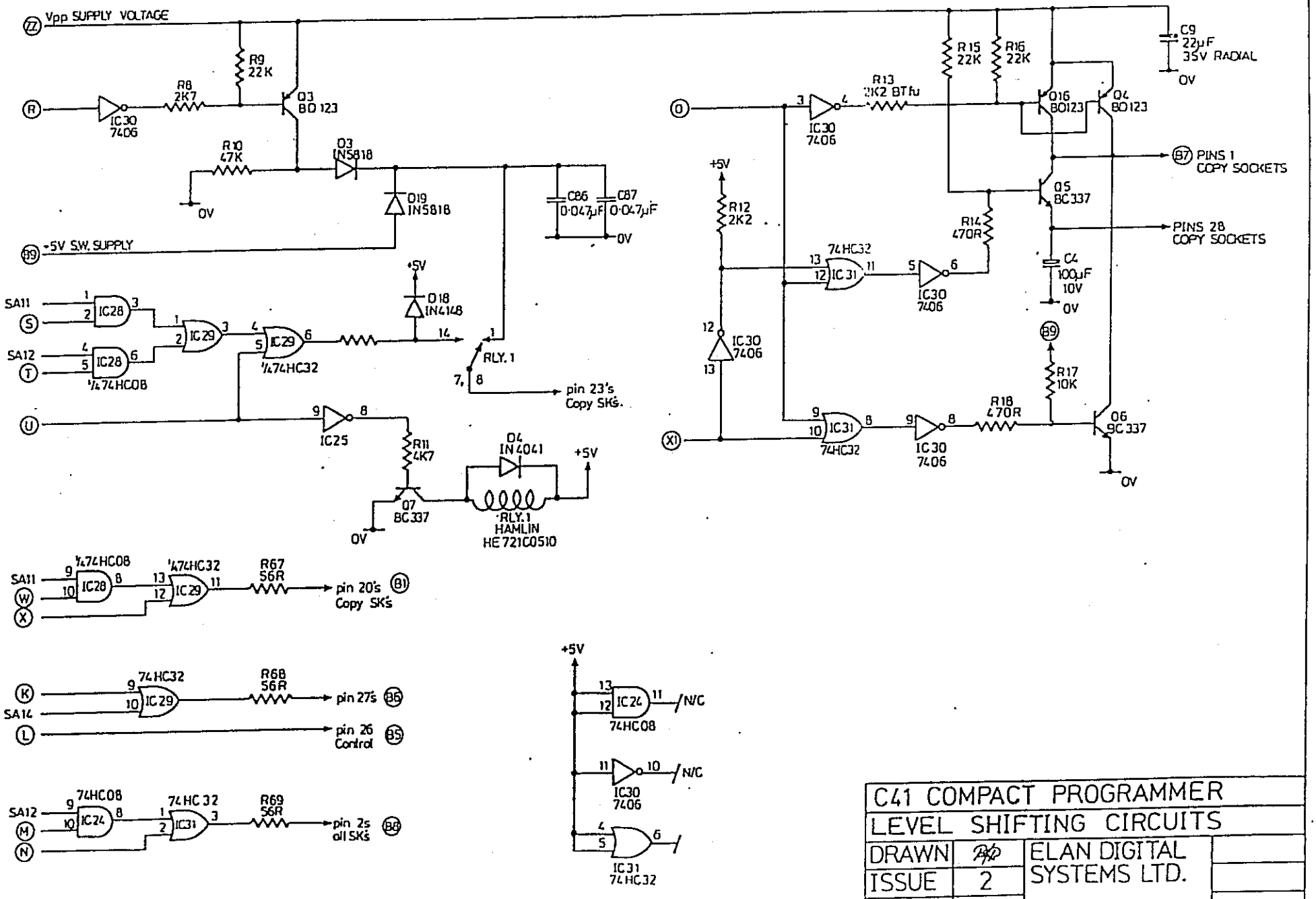
Please note: All "returns" to Elan are made at the sender's risk and expense.



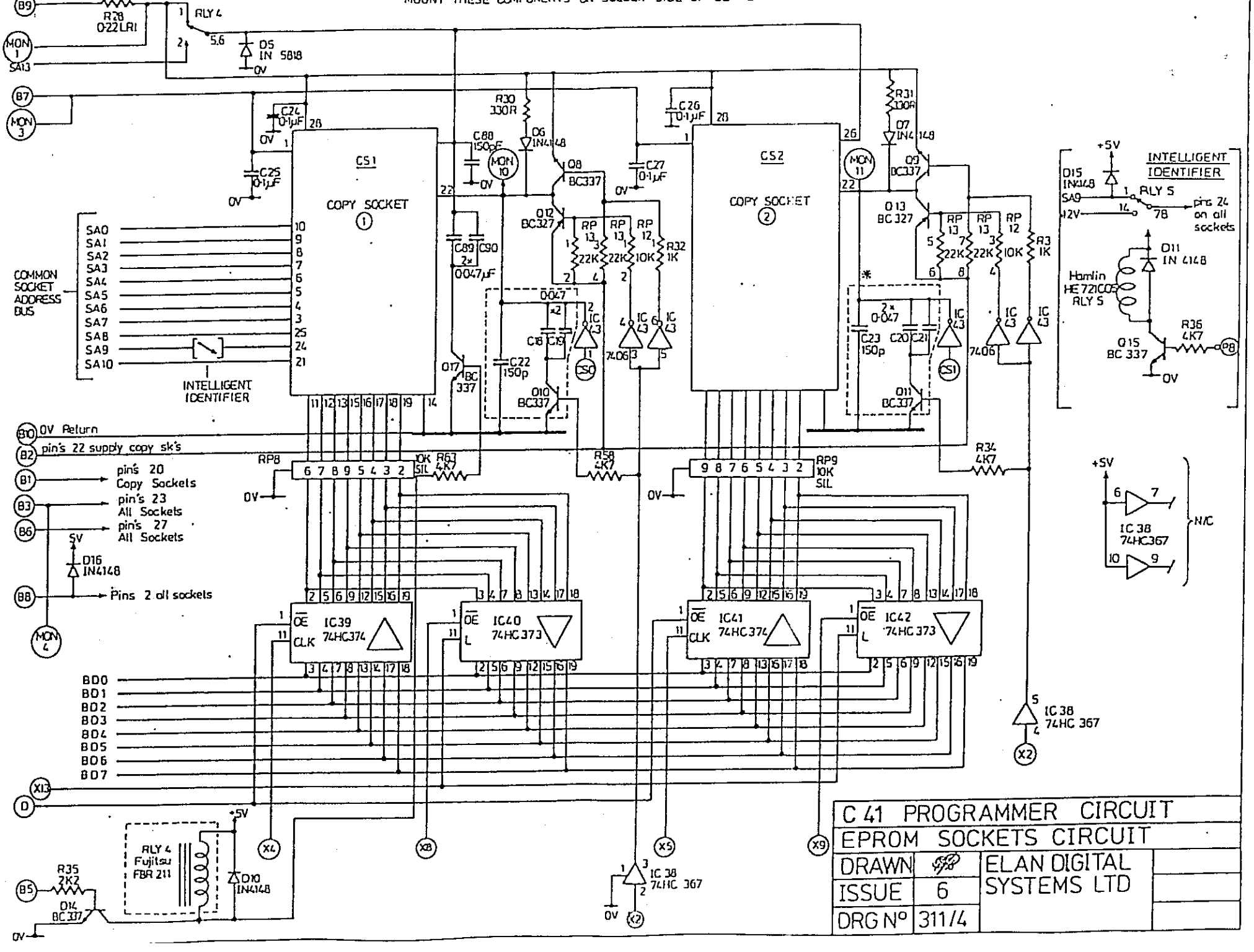
C41 PROGRAMMER CIRCUIT	
C.P.U. CIRCUIT	
DRAWN	RJB
ISSUE	5
DRG N°	311/1
ELAN DIGITAL SYSTEMS LTD.	

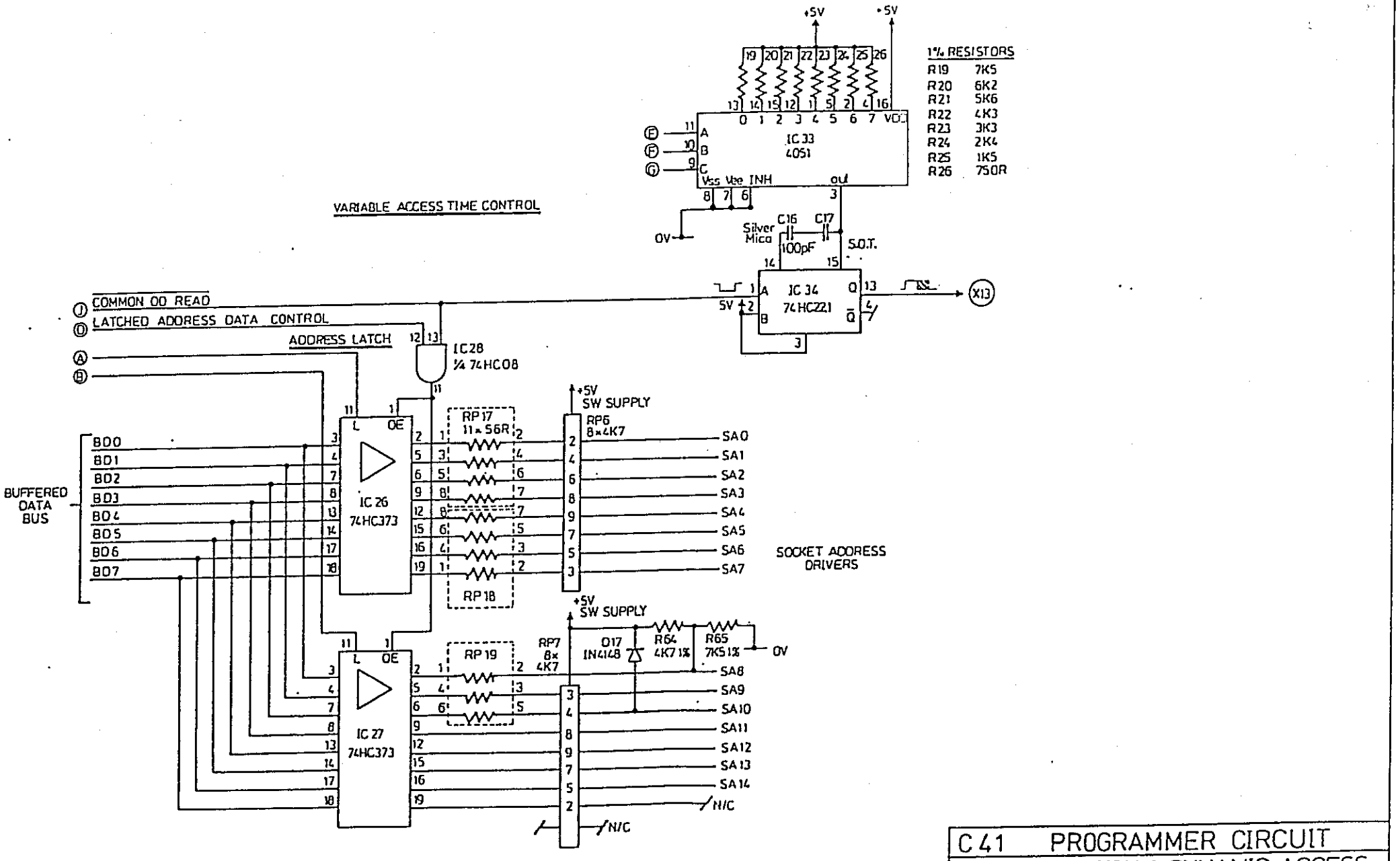


C41 PROGRAMMER CIRCUIT			
PORT DECODING & LATCH			
DRAWN	[illegible]	ELAN DIGITAL SYSTEMS LTD.	4/18 2/5/18
ISSUE	7		
DRG N°	311/2		

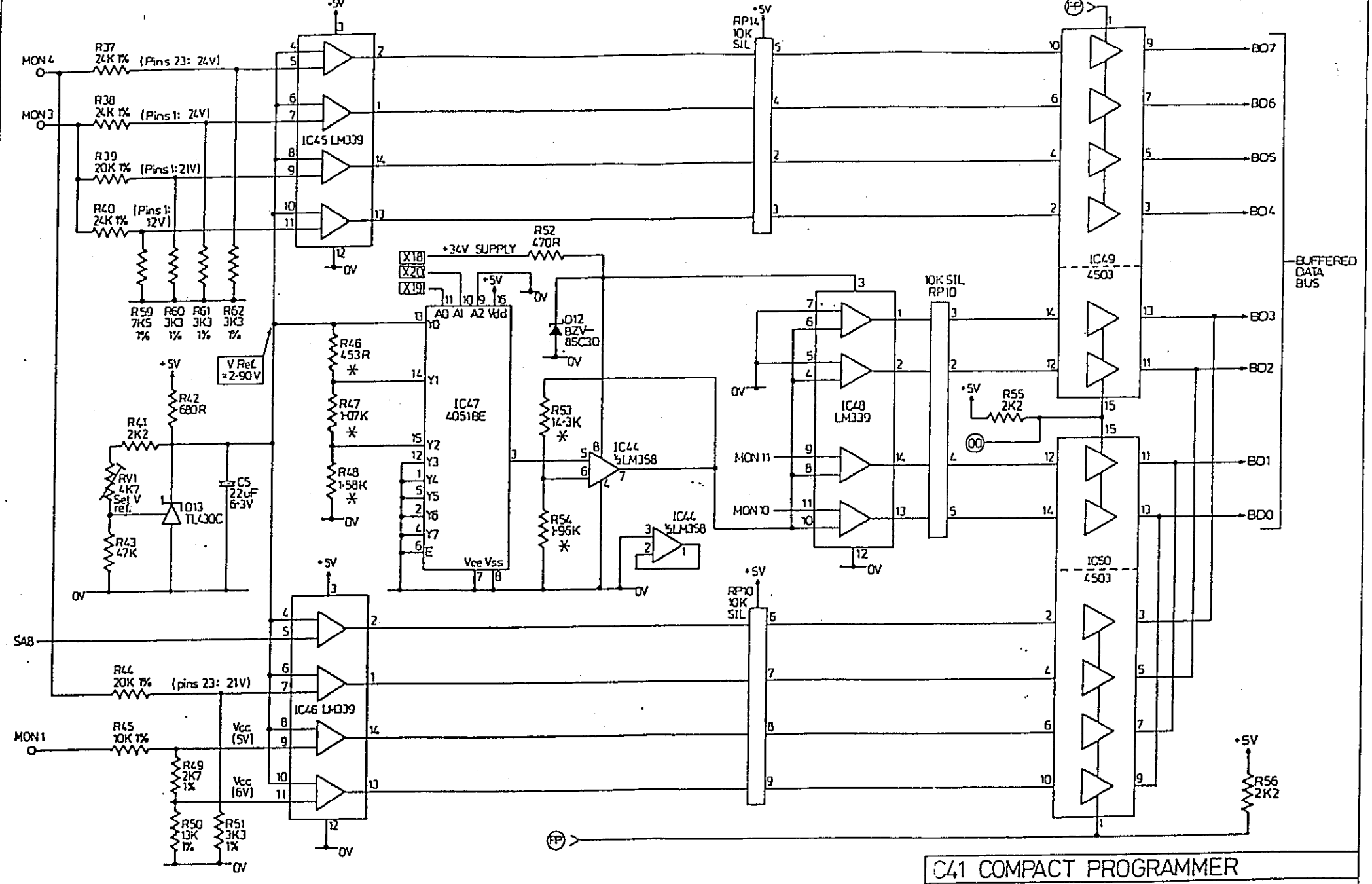


C41 COMPACT PROGRAMMER			
LEVEL SHIFTING CIRCUITS			
DRAWN	AJD	ELAN DIGITAL SYSTEMS LTD.	
ISSUE	2		
DRG Nº	311/3		


COPY SOCKET (1)
COPY SOCKET (2)
COMMON SOCKET ADDRESS BUS
SA0
SA1
SA2
SA3
SA4
SA5
SA6
SA7
SA8
SA9
SA10
INTELLIGENT IDENTIFIER
0V Return
pin's 22 supply copy sk's
pin's 20 Copy Sockets
pin's 23 All Sockets
pin's 27 All Sockets
Pins 2 all sockets
IC39 74HC374
IC40 74HC373
IC41 74HC374
IC42 74HC373
IC 38 74HC367
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
RLY 4 Fujitsu FBR 211
INTELLIGENT IDENTIFIER
Hamlin HE721C05 RLY 5
pins 24 on all sockets
C 41 PROGRAMMER CIRCUIT
EPROM SOCKETS CIRCUIT
DRAWN
ISSUE 6
DRG Nº 311/4
ELAN DIGITAL SYSTEMS LTD



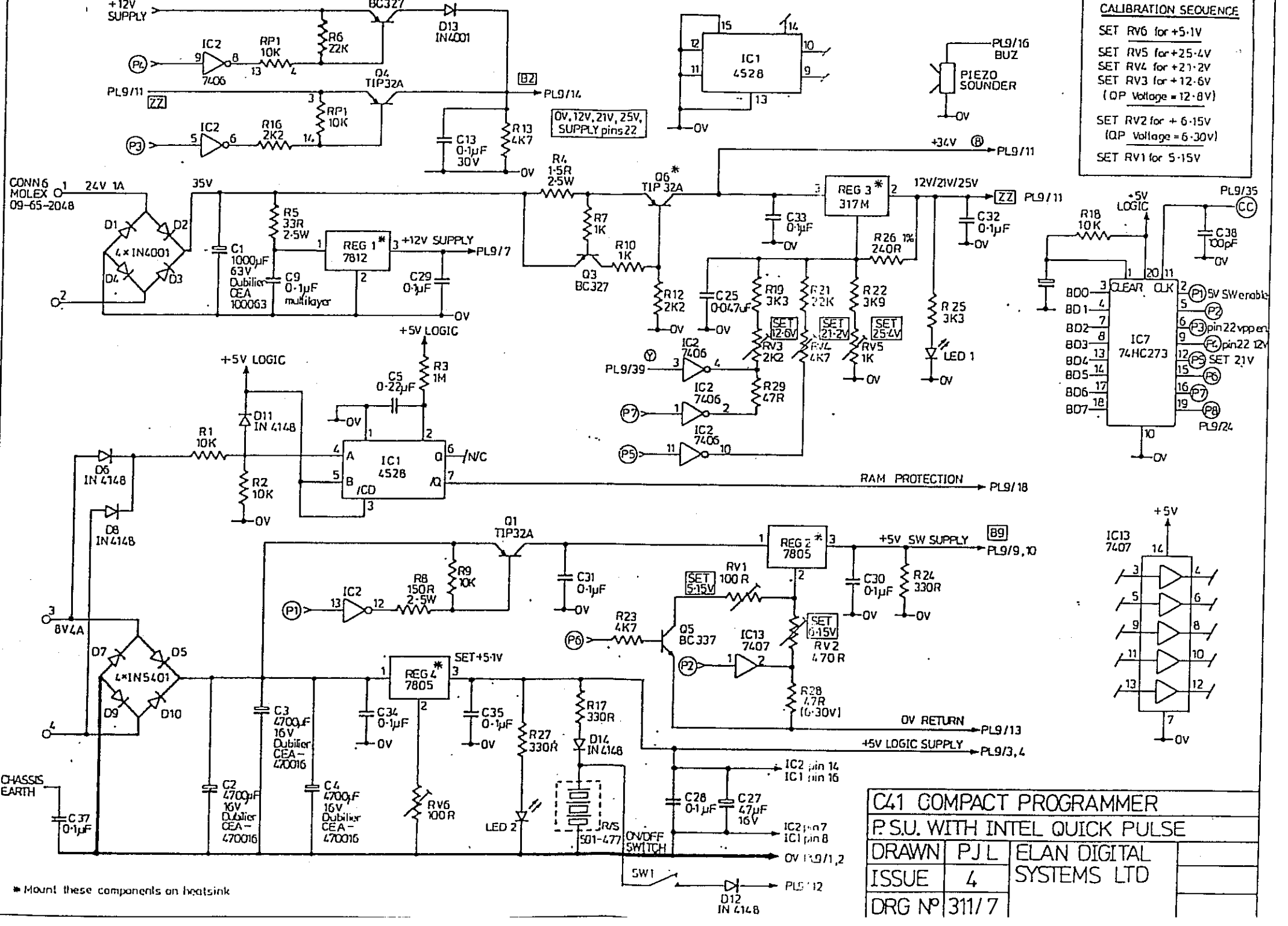
C41 PROGRAMMER CIRCUIT		
ADDRESS LATCH & DYNAMIC ACCESS		
DRAWN	JHB	ELAN DIGITAL SYSTEMS LTD.
ISSUE	7	
DRG N°	311/5	

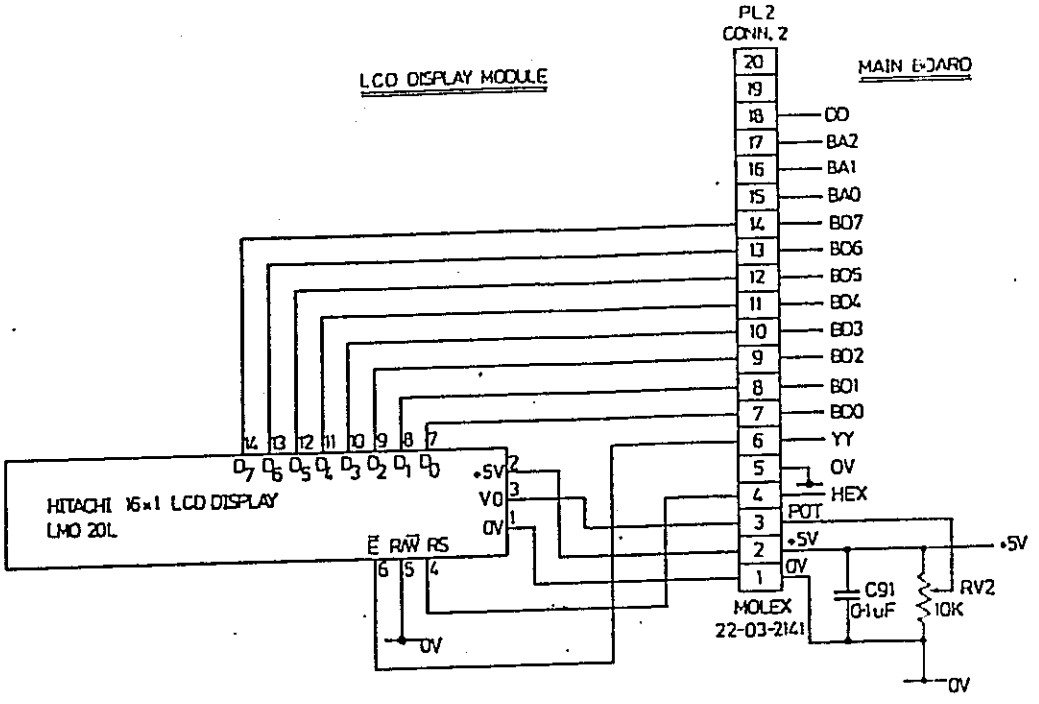


* Resistors RC55 ± 0·1%, ¼ W

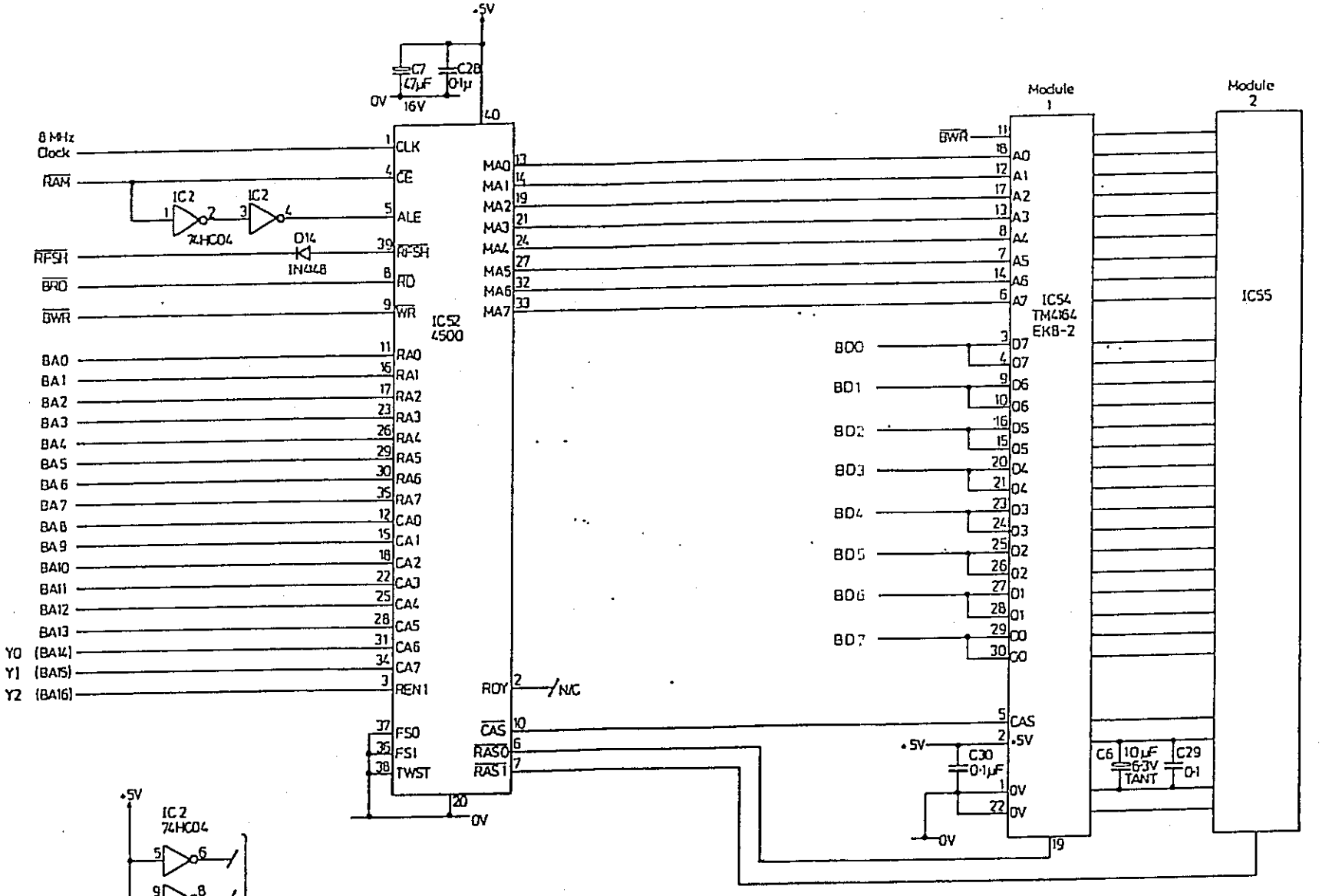
C41 COMPACT PROGRAMMER		
VOLTAGE MONITORING CIRCUIT		
DRAWN	PJ L	ELAN DIGITAL SYSTEMS LTD
ISSUE	5	
DRG Nº	311/6	

MBB 4/5/85

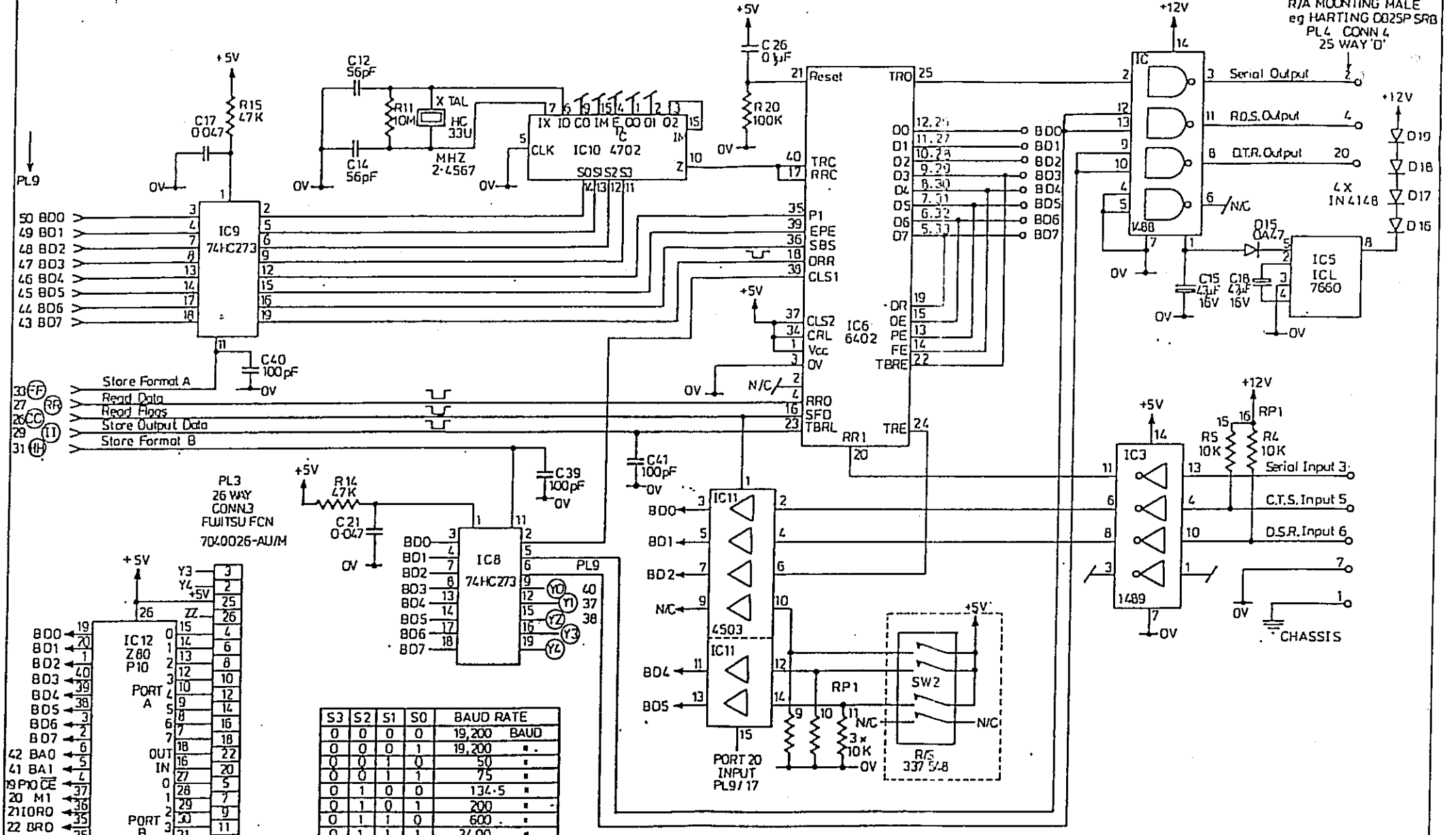

CALIBRATION SEQUENCE
SET RV6 for +5·1V
SET RV5 for +25·4V
SET RV4 for +21·2V
SET RV3 for +12·6V
(O/P Voltage = 12·8V)
SET RV2 for + 6·15V
(O/P Voltage = 6·30V)
SET RV1 for 5·15V
+12V SUPPLY
IC2 7406
RP1 10K
R6 22K
BC327
D13 IN4001
Q4 TIP32A
PL9/11
ZZ
R16 2K2
C13 0·1µF 30V
R13 4K7
0V, 12V, 21V, 25V, SUPPLY pins 22
PL9/14
IC1 4528
PL9/16 BUZ
PIEZO SOUNDER
+34V
PL9/11
CONN6 MOLEX 09-65-2048
24V 1A
35V
D1 D2 D3 D4 4×IN4001
C1 1000µF 63V Dubilier CEA 100063
C9 0·1µF multilayer
R5 33R 2·5W
REG 1* 7812
+12V SUPPLY
PL9/7
C29 0·1µF
R4 1·5R 2·5W
Q6* TIP 32A
R7 1K
R10 1K
Q3 BC327
REG 3* 317M
12V/21V/25V
C33 0·1µF
C32 0·1µF
R26 1% 240R
R12 2K2
C25 0·047µF
R19 3K3
R21 22K
R22 3K9
R25 3K3
SET 12·6V
SET 21·2V
SET 25·4V
RV3 2K2
RV4 4K7
RV5 1K
LED 1
+5V LOGIC
R18 10K
C38 100pF
PL9/35
IC7 74HC273
BD0 BD1 BD2 BD3 BD4 BD5 BD6 BD7
5V SW enable
pin 22 vpp en
pin 22 12V
SET 21V
PL9/24
+5V LOGIC
C5 0·22µF
R3 1M
D11 IN 4148
R1 10K
R2 10K
D6 IN 4148
D8 IN4148
IC1 4528
/CD
N/C
RAM PROTECTION
PL9/18
IC2 7406
PL9/39
R29 47R
Q1 TIP32A
REG 2* 7805
+5V SW SUPPLY
PL9/9,10
R8 150R 2·5W
R9 10K
C31 0·1µF
C30 0·1µF
R24 330R
RV1 100R
SET 5·15V
SET 0·15V
RV2 470R
R23 4K7
Q5 BC337
IC13 7407
R28 47R (6·30V)
8V4A
D7 D5 D9 D10 4×IN5401
REG 4* 7805
SET+5·1V
C3 4700µF 16V Dubilier CEA-470016
C34 0·1µF
C35 0·1µF
R27 330R
R17 330R
D14 IN4148
OV RETURN
PL9/13
+5V LOGIC SUPPLY
PL9/3,4
IC13 7407
+5V
C2 4700µF 16V Dubilier CEA-470016
C4 4700µF 16V Dubilier CEA-470016
RV6 100R
LED 2
IR/S 501-477
ON/OFF SWITCH
SW1
D12 IN 4148
C28 0·1µF
C27 47µF 16V
IC2 pin 14
IC1 pin 16
IC2 pin 7
IC1 pin 8
0V PL9/1,2
CHASSIS EARTH
C37 0·1µF
* Mount these components on heatsink
C41 COMPACT PROGRAMMER
P.S.U. WITH INTEL QUICK PULSE
DRAWN PJL
ISSUE 4
DRG Nº 311/7
ELAN DIGITAL SYSTEMS LTD



C41 PROGRAMMER CIRCUIT		
LCD DISPLAY		
DRAWN	PJL	ELAN DIGITAL SYSTEMS LTD
ISSUE	4	
DRG N°	311/9	

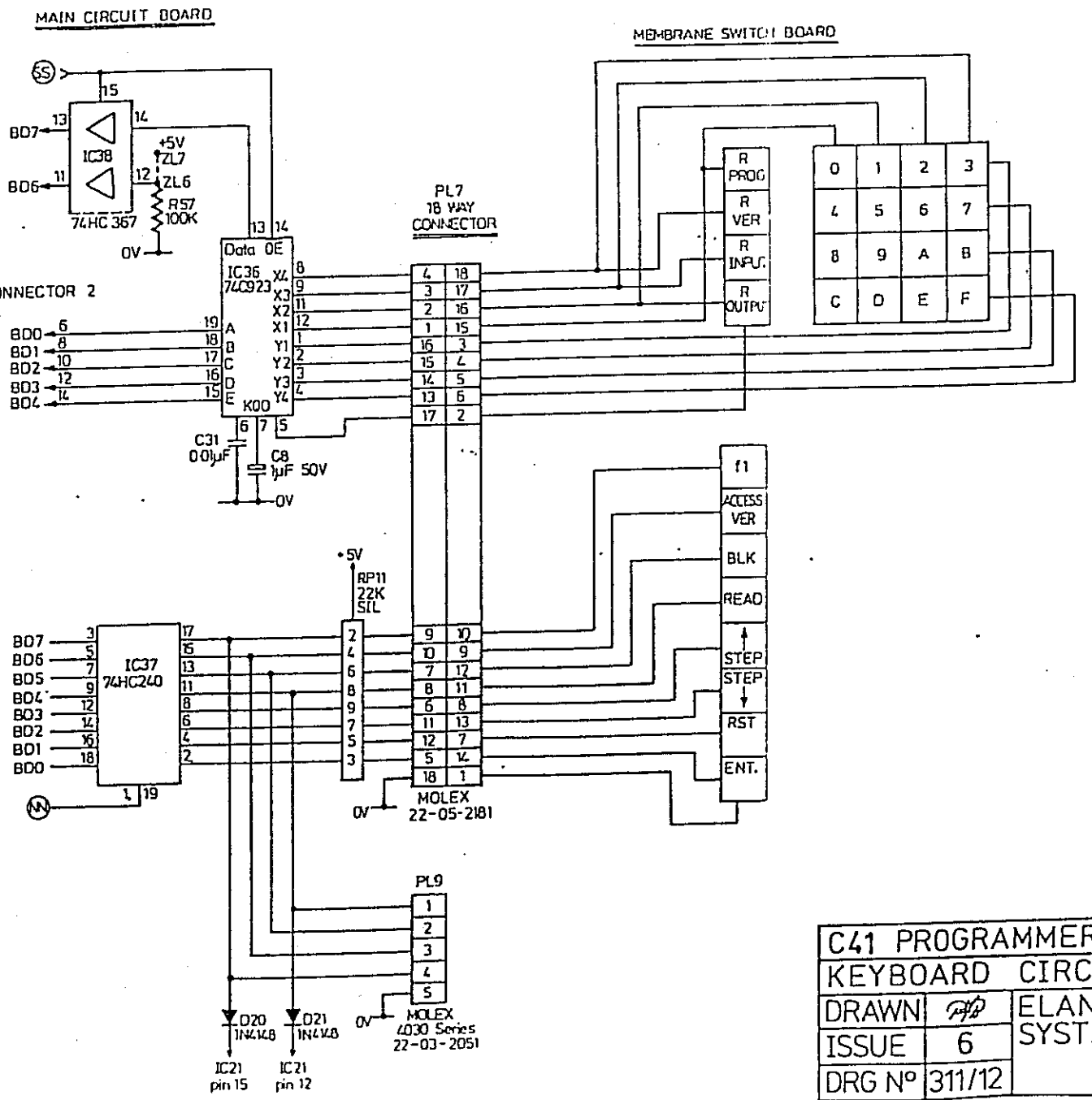


C41 COMPACT PROGRAMMER			
DRAM PSU. MEMORY, I/O, BOARD			
DRAWN	PJL	ELAN DIGITAL SYSTEMS LTD	MGG 7/5/85
ISSUE	7		

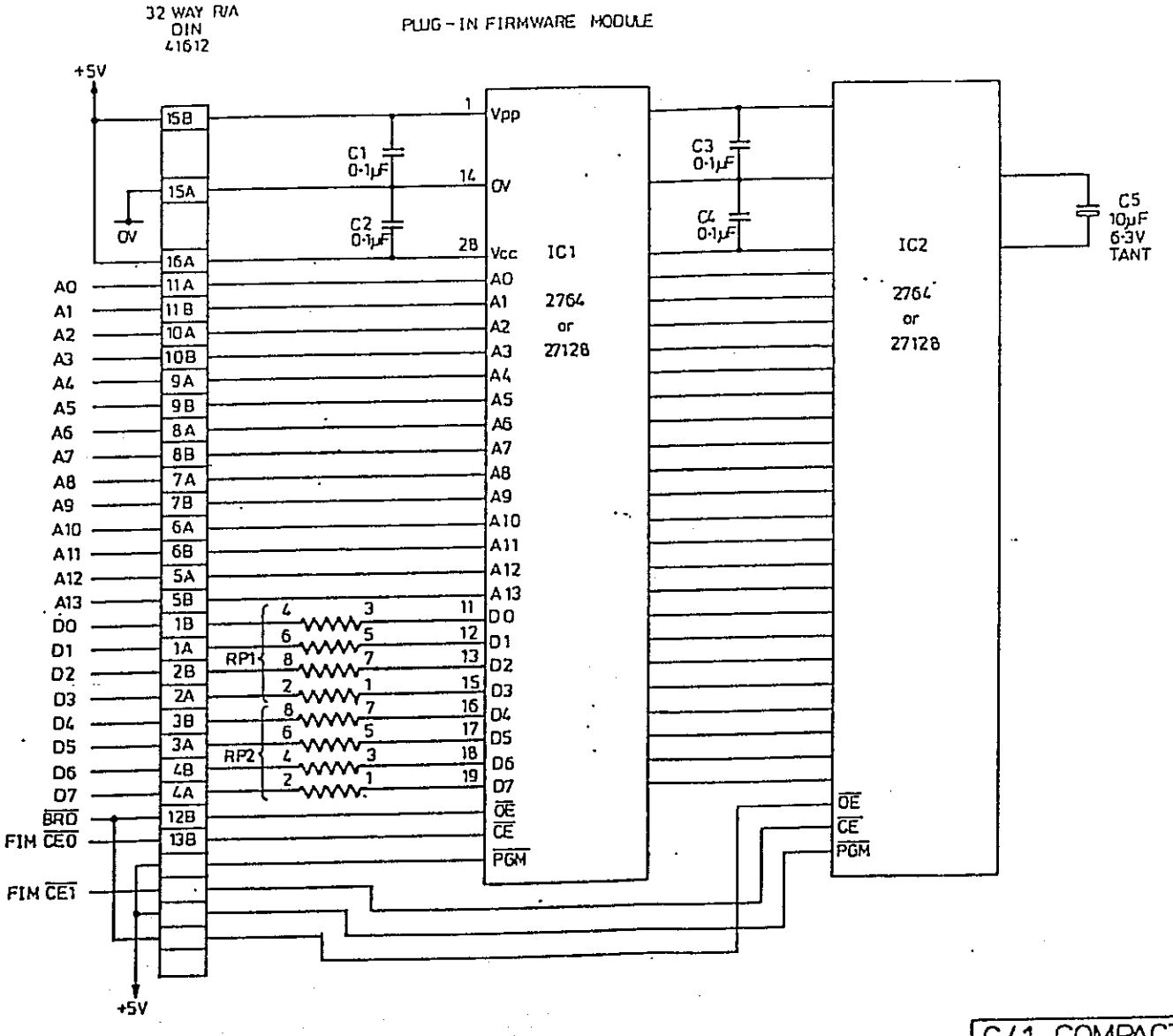


S3	S2	S1	S0	BAUD RATE	BAUD
0	0	0	0	19,200	BAUD
0	0	0	1	19,200	"
0	0	1	0	50	"
0	0	1	1	75	"
0	1	0	0	134·5	"
0	1	0	1	200	"
0	1	1	0	600	"
0	1	1	1	2400	"
1	0	0	0	9600	"
1	0	0	1	4800	"
1	0	1	0	1800	"
1	0	1	1	1200	"
1	1	0	0	2400	"
1	1	0	1	300	"
1	1	1	0	150	"
1	1	1	1	110	"

C41 PROGRAMMER CIRCUIT			
INTERFACE			
DRAWN	[illegible]	ELAN DIGITAL SYSTEMS LTD	
ISSUE	4		
DRG N°	311/11		



C41 PROGRAMMER CIRCUIT	
KEYBOARD CIRCUIT	
DRAWN	ELAN DIGITAL SYSTEMS LTD
ISSUE 6	
DRG Nº 311/12	



C41 COMPACT PROGRAMMER			
FIRMWARE CIRCUIT BOARD			
DRAWN	PJL	ELAN DIGITAL SYSTEMS LTD	
ISSUE	4		
DRG Nº	311/13		