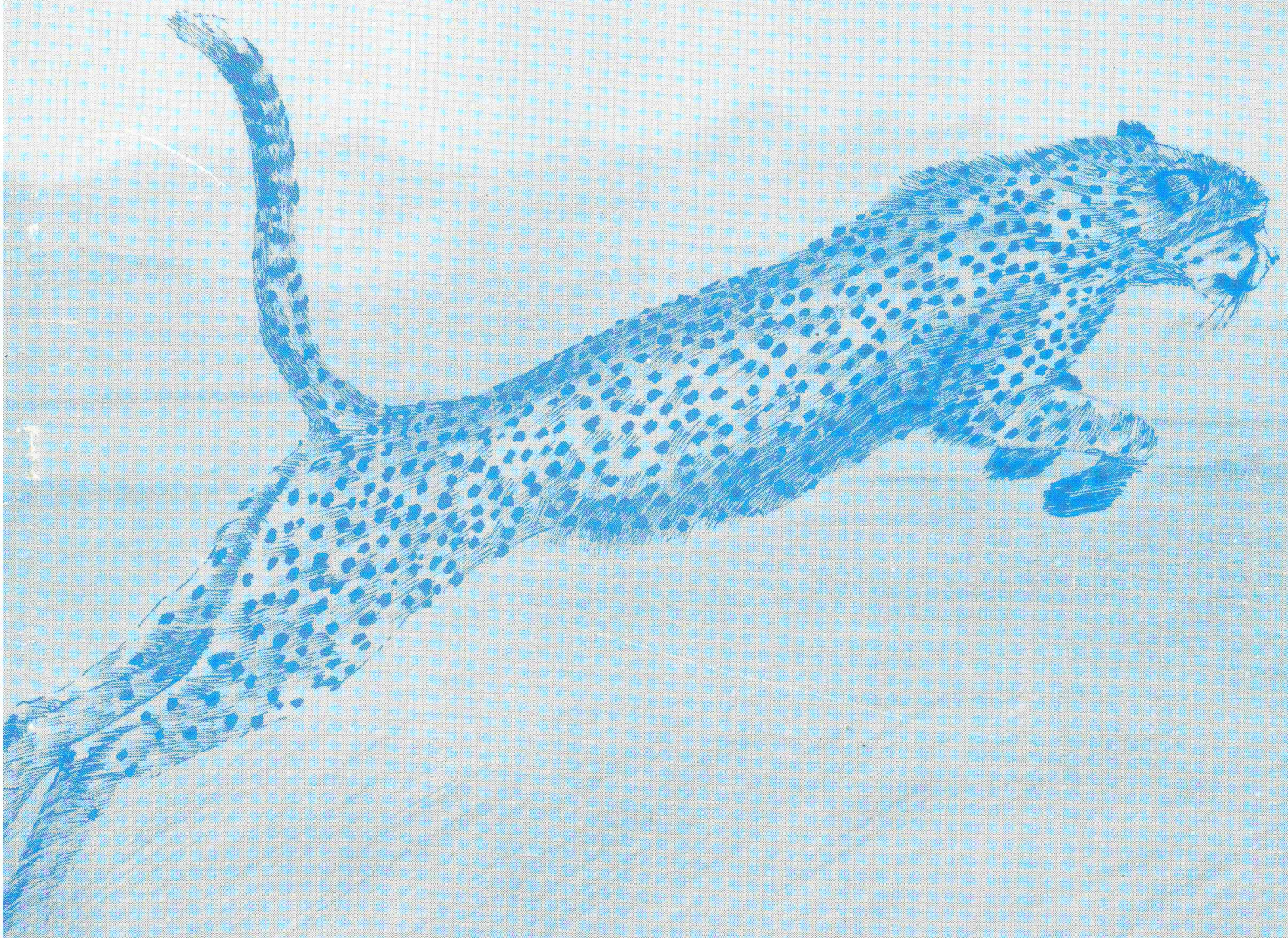
elan digital systems ltd.



E Series

Maintenance Manual

Development and Programming Aids

'E' Series Circuit Description

Clock, Micro-processor & Buffers

IC1 and associated circuitry generates a 2.4 576 MHz crystal controlled clock signal which is used to clock the micro-processor and the baud rate generator on the interface board (where fitted). The micro-processor IC2 is a Z80. The data bus is buffered by IC6 a bi-directional buffer. The data direction is controlled by BRD. IC3,4 & 5 uni-directional buffers buffer the Address Bus and BWR, BRD signals.

Address Decoder, Internal EPROM and Scratchpad RAM.

One section of IC7 decodes the available 64K of addressing into two 32K sections:-

0000 to 7FFF	EPROM & Scratchpad RAM	
000 TO FFFF	External RAM Enable	(RAM)

The other section of IC7 decodes the first 32K address section into four 8K sections:-

0000 to 1FFF	First EPROM	IC8
2000 to 3FFF	Second EPROM	IC9
4000 to 5FFF	Third EPROM	IC10
6000 to 7FFF	Scratchpad RAM	IC11 *

* Only 1K of Scratchpad RAM fitted address 6000 to 63FF.

The outputs of IC7 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).

Where data outputed to a port has to be stored it is held in latches (IC17,18,19,20).

Chip select decoder

IC13 selects one of the eight Copy sockets during a copy socket read. IC 21C,D selects the Master Socket during a master socket read.

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 signal 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. In the 'E' Series programmers 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 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.

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.

Data Latch

IC36 latches the data to be programmed into the EPROMS. This has tri-state outputs 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 EEPROMS a ware shaper circuit centred around IC37 conditions the rise and fall times of Upp.

Relays 2 and 3 each 4 pole change over contacts swtich the pin 20's of the Copy sockets between Chip Select function or Upp (Intel 2732, 2732A and Mostek MK2764).

Display and Piezo Sounder

IC45 latches selection of Code B or Hex display formats on the Display and also drives the piezo sounder.

The 8 digit L.E.D. display is driven by IC44 a multiplexed display 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 transistors Q48 to Q55. The L.E.D. display consists of two 4 digit 7 segment Litronix DL4770 displays.

Keyboard

IC43 inputs the eight push button switches onto the data bus when Port 10 is inputed.

P.S.U. Monitor

A quad voltage comparitor IC48 is used to check the swtiched +5V level, 21V and 24V. IC50 outputs this data on to the data bus when PORT 12 is inputed.

P.S.U. Circuit

Mains Transformer

A toroidal mains transformer of the following specification is used in 'E' Series programmers :-

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

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

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

+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

The 25v/21v supply is swtiched by Q1. The +12v supply is Fixed regulated by IC1.

Pins 22 Supply

Pins 22 of the EPROM sockets require a wide variety of supply voltages. Q2,3,4,5,6,7 and associated circuitry select 0v,5v,12v, 21v or 25v under software control.

L.E.D. indicators monitor:-

L.E.D.	Unregulated +24v
L.E.D.2	regulated +12v
L.E.D.3	" " +21/25v
L.E.D.4	" " + 5v

Interface and Memory Board

This board has three functions:-

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

1. Hex-Keypad

IC15 an LSI Keyboard decoder chip enables the reading of the 16 hex keys and 4 function Key 5.

2. Serial RS232 Input/Output

The heart of the Serial I/O is the 6402 U.A.R.T IC18. IC13 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. IC10 accepts the master 2.4576 MHz clock and converts this to the required U.A.R.T clocking speed set by IC13. An external clock may also be selected e.g. the external clock generated by the cassette interface unit. This permits accurate tracking of the cassette unit increasing the integrity of operation.

IC16 converts the CMOS signal levels to RS232 levels (approx. +9v). Conversely IC19 converts the RS232 input levels to CMOS levels. The Clear to send and data set ready handshaking inputs are buffered through IC14.

IC17 converts the +12v supply to -9v to provide the negative bias on the RS232 Output lines.

3. Random Access Memory

A maximum of 16K bytes of RAM may be accomodated on the 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.

4. Parallel Input/Output

IC1 a Z80 P.I.O chip provides two 8 bit parallel I/O ports at T.T.L levels with handshaking control.

Equipment needed:- Digital multimeter accuracy better than +/- 0.1%
Dual beam oscilloscope of high quality ; at least 50 Mhz bandwidth .

1. Inspect P.S.U. Board , check for component errors , short circuits etc. Check connections from 26 Way transition connector to 26W socket ensuring that there are no shorts between cables.

2. Set up mains voltage to 240v or 220v :-

   240v blue lead male bullet crimp connector to brown lead female bullet crimp connector.
   purple lead female bullet crimp connector - disconnected.
   brown lead 1/4" shrouded crimp connector to switch.

   purple lead 1/4" shrouded connector - disconnected.

   220v blue lead male bullet crimp connector to purple lead female bullet crimp connector.
   brown lead female bullet crimp connector - disconnected.
   purple lead 1/4" shrouded crimp connector to switch.
   brown lead 1/4" shrouded crimp connector - disconnected.

3. Briefly apply mains voltage and check that LED 3 , 4 illuminate.

4. If all is well apply mains voltage and adjust RV3 to give +5v on the output of IC3 (labelled U3).

5. Adjust RV1 to give +25.5v on the output of IC2 (labelled U2).

6. Check that the output of IC1 is +12v (+ 0.5v)

7. Check voltage across :-

   C4 = +10.6v (+0.3v)
   C1 = +34.0v (+1.0v)

8. Connect + lead of multimeter to cathode of D10 and - lead to 0v. Using a flying lead (with 1K resistor in series) from +5v supply. Check that voltage goes from 0v to +24.3v when flying lead is touched on P3 (right hand side of R10).

9. Similarly check voltage goes from 0v to +11.3v when flying lead is touched on P4 (right hand side of R13).

10. Move multimeter + lead to output of IC2 (labelled U2). Check that voltage falls from +25.5v to approx.+21v when flying lead is touched on P5 (right hand side of R4). Using RV2 set output voltage to +21.3v.

11. Move multimeter + lead to output of IC4 (labelled U4). Check that voltage goes from 0v to approx.+10.0v when flying lead is touched on P1 (right hand side of R21). Note that until the PSU board is connected to the main board there is no ground reference for IC4. The output voltage will therefore not be +5v but the supply voltage less any drop across the IC. Connect a flying lead from 0v to the L.H leg of RV4 . Using RV4 set output voltage to + 5.1v.

This completes the provisional calibration of the P.S.U.

12. Inspect main board. Check for component errors, short circuits etc.

13. New boards straight from production - do not insert any IC's at this point. Connect board to PSU via 26 Way ribbon socket. Turn on PSU and check that +5v appears across U14 pin 8 = 0v pin 16 = +5v. Switch off PSU and carefully insert all IC's.

14. Switch on and re-check +5v supply, re-adjust RV3 (on PSU Board) if necessary to give +5.0v across U14. When programme is switched on it should "beep" and display [88888888] for 2 seconds before displaying:-
[2732]

15. Connect multimeter + lead to pin 8 of IC48 (LM339). Adjust RV3 on main board for a reading of +2.35v.

Check pin 7 approx. + 2.5v (when Vpp is + 5v)
" pin 9 " + 2.9v (" " " ")
" pin 5 " + 5v (0v for E2)
" " 11 " + 2.5v (this will only be present when sockets are powered up e.g. in static read)

If any of these pins fall below +2.35v (the reference level) the PSU fail error code will be displayed (E9).

16. Press reset and select 2716 type.
Press read, display should be:-

[/F800]

Press read again, display should be:-

[0000/FF]

Connect multimeter across Master Eprom socket - lead pin 14 + lead pin 28. Re-adjust RV4 (on PSU) if necessary to give +5.10v.

17. Insert a 39R 7 Watt resistor in Master Eprom socket and each copy socket (9 resistors) from pin 14 to pin 26. Connect multimeter negative lead to pin 14 + lead to pin 26 on MASTER socket. Press read, display should be:-

[/ F000]

then press read again, display should be:-

[0000/FF]

Multimeter should read 4.80v; if less than 4.75v suspect an error and check circuit.

18. Reset and select 2716. Remove load resistors. Select read and press twice as above to achieve a static power up situation to sockets.
Read voltage on pin 23 Master Socket = + 5v.
" " " " " Copy Socket = + 5v.

19. Reset. Using oscilloscope to check waveforms on pins 3, 4, 5, 6, 7, 8, 9, 10, 21, 24, 25 check that address lines have a rapid series of pulses during program. Note you will need to keep re-entering programme mode as the address lines will be low unless driven.

20. Similarly check pin 22 of the Master and each copy socket for rapid pulses. On the copy sockets the pulses will only be present when that socket is selected.

21. Check that pin 20 (on all sockets) remains low.

22. Insert a 2716 Master EPROM in master socket. Read EPROM and make sure that check sum is correct.

23. Connect multimeter + lead to pin 23 of first copy socket and enter into programme mode. (If copier stops on an empty socket step on). Re-adjust RV1 (on PSU board) if necessary to give a reading of 25.2v. Connect 75R 7W Resistor from pin 14 to pin 23 on Copy SK1 - voltage should fall to approx.24.4v. If less than 24v suspect a fault. Using oscilloscope examine programming pulse on each pin 20 of Copy sockets. This hould be high for 50mSec and low for approximately 0.5mSec.

24. Reset and select 2532. (Remove 2716 master Eprom). Check on all sockets that A11 is present on pin 20, chip select on pin 22 and during programming (again very important to check all sockets) the programme pulse which low for 50mSec. Note that to enter programme mode you will need a master Eprom with data in the master socket.

25. Reset and select 2732. Check that pin 20 is at 0v.
Check that A11 is present on pin 23 of all sockets. Check each chip select pin 22. With Master Eprom in master socket enter programme mode. When the programmer has checked each socket for programability you will hear the sound of RL2 & 3 turn on. Check each pin 22 with a multimeter the voltage should be +24.9v.
Using oscilloscope examine the programme pulse on each pin 20 - it should be low for 50mSec

26. Reset and select 2732A. Enter programme mode and measure the voltage on pin 22 copy socket 1. This should be approx. 21v. Re-adjust RV2 (on PSU board) if necessary to give a reading of 21.2v.

27. Reset and select 2564. Enter programme mode. Check:-

    a. pin 2 and pin 27 stay low.
    b. pin 1 is at +25.2v.
    c. pin 23 has AD12
    d. pin 22 has prog.pulse - 50mSec.low.
    e. pin 20 has AD11.

28. Reset and select 2764. Enter programme mode. Check:-

    a. pin 2 has AD12.
    b. pin 1 is at +21.2v.
    c. pin 27 has prog.pulse - 50mSec.low.
    d. pin 23 has AD11.
    e. pin 22 is high.
    f. pin 20 is low.

29. Reset and select 2764H. Enter programme mode. Check:-

    a. pin 2 had AD12.
    b. pin 23 has AD11.
    c. pin 22 has 25.2v.
    d. pin 20 had programme pulse - 50mSec.low.

30. Reset and select 68764. Enter programme mode. Check:-

    a. pin 23 has AD12.
    b. pin 22 has Vpp pulse (approx. 4v to 25v for 50mSec)
    c. pin 20 has AD11.

31. Reset and select 27128. Enter programme mode. Check:-

    a. pin 26 has AD13.
    b. Pin 1 has +21.2v.

32. Reset and select 2815. Enter programme mode. Check:-

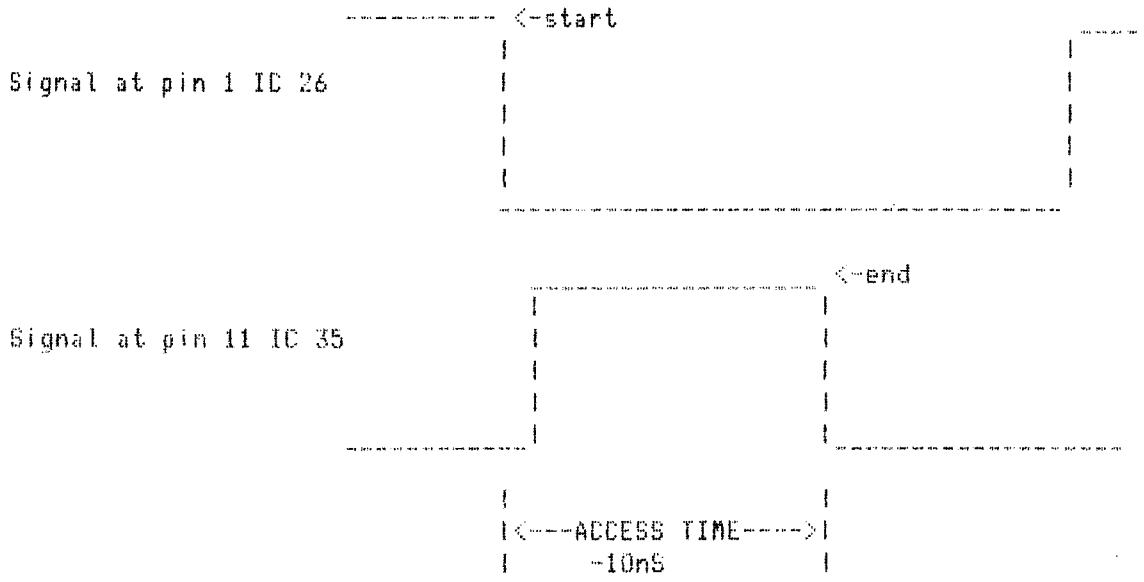
    a. pin 23 copy sockets has pulsed waveform in accordance with Intel specification (See Fig.2a page 3 of 2815 data sheet). To set the peak Vpp Voltage at +21.4v connect multimeter to pin 23 and temporarily ground (take to 0v) the base of Q9 with a flying lead. The voltage will now be static and can be adjusted by RV1 on the main board. Note that Prog pulse is nominally 50mSec high.

33. Reset and select 2816. Enter programme mode. Check:-

    Check that the pulse waveform on pin 23 copy sockets is in accordance with Intel spec. Note that Prog pulse is nominally 10mSec high.

34. Connect one channel of oscilloscope to pin 1 of IC26 enter Debug mode and trigger scope on the signal . The falling edge of the signal marks the start of the dynamic access time period. With the other scope channel observe the signal on pin 11 of IC35. This should be a high going pulse. The end of this pulse marks the end of the dynamic access time minus 10nS. Select each access speed and check that it is correct.

WAVEFORM DIAGRAM



elan — "vigorous spirit or enthusiasm typically revealed by poise, verve or liveliness of imagination" — Webster's

The company was formed in 1976 by Alex G. Bible, B.Eng., with the support of Alan E. Negrin, B.Sc. to provide advanced design and development services in the field of applied microelectronics. T. Peter Hadingham joined later as a director. The combined experience of the directors spans more than 25 years each in various aspects of computer systems design, the development of industrial controls and instrumentation, technical support, financial control, marketing and publicity.

Current capabilities include hardware and software design, development and production of micro-processor-based equipment. In every product strong emphasis has been given to simplicity of operation with a very high degree of reliability. By imaginatively applying state of the art microprocessor technology to each product a reputation for performance value, reliability and quality has been maintained.

Elan Digital Systems Limited
16-20 Kelvin Way, Crawley, W. Sussex, RH10 2TS, England

Telephone: Crawley (0293) 510448