



**JPM Micro-Processor
Service Manual**



JPM

JPM (Automatic Machines) Ltd.

Hadfield Road, Leckwith Trading Estate, Cardiff,

South Glamorgan, CF1 8AQ.

Telephone 0222-39538/9.

HIGH VOLTAGE WARNING

High voltage is used on parts of this machine. Personnel other than skilled Service Engineers must ensure that the machine is disconnected from the mains electrical supply before attempting any service or cleaning operations on the internal workings of the equipment.

Three Reel - 5p game - AWP

Lite-a-Nudge

Part No: 140267

£2.50

Lite-a-Nudge Introduction

The purpose of this Service Manual is to enable the Service Engineer to ensure that the equipment is installed and working properly initially, and also to help him locate and in many cases correct, any fault that occurs. The text and accompanying photographs and drawings are intended to be easily understood and as straightforward as possible without involving the Engineer in detailed explanations of the various sophisticated electronic circuitry that is contained in the machine. This basic approach in no way reflects on the ability of the Service Engineer but ensures that the repair, when necessary, can be carried out in the shortest possible time so that the machine may be back in service quickly. Where component failure is diagnosed or indeed, merely suspected, an exchange board may be obtained from the Factory if indeed it is not carried as an operating spare.

A great deal has been written about the potential benefits of Solid State machines and indeed the reliability of the individual components is beyond doubt, however, a machine that is improperly installed and serviced will inevitably break down and, by doing so, destroy any credibility it once had. The Service Engineer can have a considerable effect on the success of microprocessors in Fruit Machines and there are those who, being used to relays and switches, may be sceptical about such machines. This Manual will be of as much help to those Engineers as it will to Engineers with a greater depth of electronic experience.

THE CONCEPT OF THE J.P.M. SYSTEM

The concept of the J.P.M. Stepper Reel Unit System differs from the conventional system in that the game is played within the computer and the reel unit displays the results of this game. The programme is continually altering the values of three counters. These values are used when the start button is pressed to determine how many symbols each non-held reel will advance. Thus the final position of any reel is not known until the start button is pressed because the advance valve is not decided until that time.

NOTE

The information contained in this Manual, which remains the property of J.P.M. (Automatic Machines) Limited, is loaned solely for the purpose of operating, maintaining and repairing J.P.M. equipment and may not be used, or loaned to, any person for any other reason. Neither may it, or any part thereof, be copied or reproduced by any means or for any purpose, other than with the express permission of J.P.M. (Automatic Machines) Limited. J.P.M. (Automatic Machines) Limited reserve the right to make any alterations to components and/or component values where necessary to conform to their policy of continuous product improvement and to keep pace with technological advancement.

Contents

Introduction	2
Description Of Game	4
Instalation Procedure	5
Basic Description Of System	6
Self Test Routine	7
Reel Band Positioning	8
System Capability	9
The Stepper Reel Unit Controller	10
Triac Packs	11
Servicing Hints	12
Do's & Dont's	13
Fault Finding	14 & 15
Operation Of Test Box's	16
Hexadecimal To Binary To Decimal Conversion	17
Output And Input Charts	18 & 20
Mini Logic Output	21
Reel Drive System	22
Main Board Power Supplies	23
Plug 1 Wiring Diagram	24
Power Pack Wiring Diagram	25
Parts List	26
Main Board Layout	27
Main Board Drawing	28
Glossary Of Terms	29
Warranty	30
Notes	31

IN

④ Lite-a-Nudge 3 Reel AWP Machine

The Lite-A- Nudge is J.P.M.'s new 3 Reel A.W.P. Machine housed in the new 80's style cabinet with improved coin handling which includes 'Coin Controls Series 10' coin acceptors.

A feature of the Cabinet is a glass fibre - Double Skin Front - with steel inserts for maximum strength.

FEATURE

This new Each Way Nudge Feature incorporates a reverse button allowing the player independent direction control of each reel.

The Nudge Feature can be played for; When the reels stop, overprinted numbers on pay-line advance. The Nudge panel, in steps coinciding with the numbers, a total of five, will illuminate the panel completely, giving a Nudge without the numbered symbols.

Nudges available are indicated by an attractive Plaque Display which flashes at random when the feature is presented. The Player stops the flash by pressing a feature stop button and the available Nudges are indicated.

An attractive Gamble Feature is available giving Double or Nothing on the Wins of 10p, 20p and 40p to a maximum of 80p.

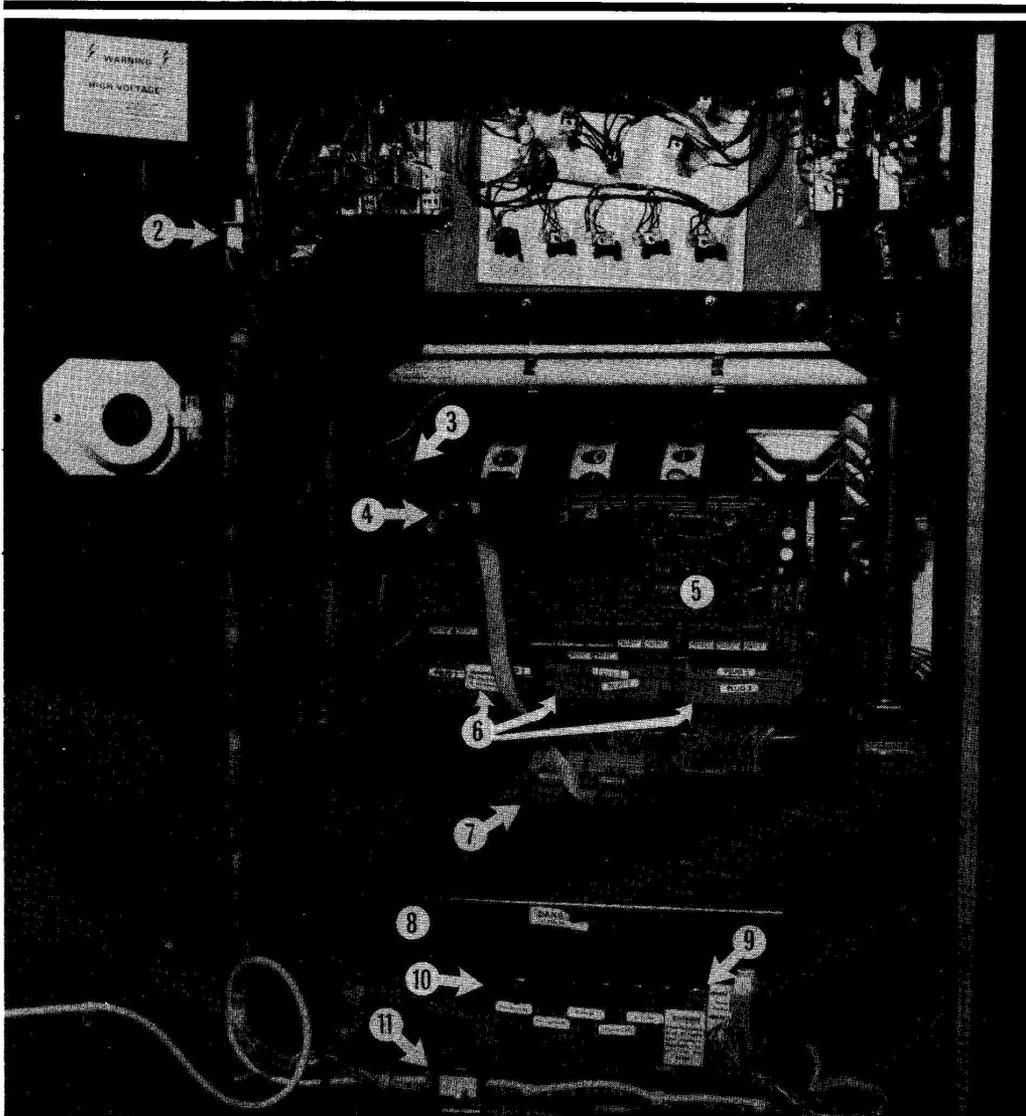
The J.P.M. Microprocessor controlled stepper motor reel is standard unit giving the Bonus that interference with reel spin gives no advantage whatsoever.



Contents

Introduction	2
Description Of Game	4
Instalation Procedure	5
Basic Description Of System	6
Self Test Routine	7
Reel Band Positioning	8
System Capability	9
The Stepper Reel Unit Controller	10
Triac Packs	11
Servicing Hints	12
Do's & Dont's	13
Fault Finding	14 & 15
Operation Of Test Box's	16
Hexadecimal To Binary To Decimal Conversion	17
Output And Input Charts	18 & 20
Mini Logic Output	21
Reel Drive System	22
Main Board Power Supplies	23
Plug 1 Wiring Diagram	24
Power Pack Wiring Diagram	25
Parts List	26
Main Board Layout	27
Main Board Drawing	28
Glossary Of Terms	29
Warranty	30
Notes	31

Installation Procedure



Before switching on machine:

1. Check that mains socket and plug top are earthed.
2. Check that the Main Board is secure.
3. Check that Main Board, Plugs and Sockets are married together.
4. Check that the Program Board is in position.
5. Check that Triac Packs are connected.
6. Switch on Machine, wait for reels to initialise them proceed with test routine.

- 
- | |
|--|
| <ol style="list-style-type: none">1. Lockout Triac Pack.2. Self Test Switch.3. Credit Display4. Main Board.5. Main PCB.6. PCB Plugs 1, 2, 37. Output Extension8. Power Unit9. Main Switch.10. Mains Fuse.11. Isolation Switch. |
|--|

6 Lite~a~Nudge

Basic Description of System

S.R.U. REEL UNIT

The J.P.M. processor controlled reel unit is a new concept in gaming machine design. This new concept is achieved by utilising a D.C. stepping motor to drive each reel. This motor is driven by the S.R.U. controller whose C.P.U. is the Texas Instruments TMS 9980 microprocessor.

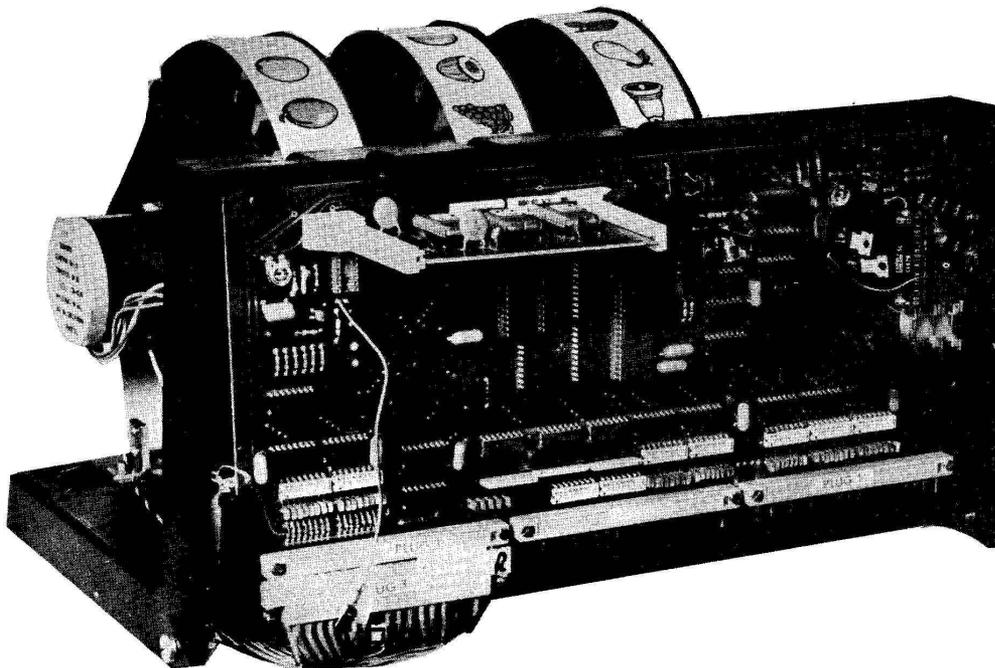
It does not take an electronics expert to realise that a system that positions a reel accurately, having information on its position derived within the C.P.U., has a tremendous advantage over traditional systems. The most significant advantage is that no data is taken from the reel itself thus doing away with the need for contacts and wipers.

Stepping Motor - Basic Description

The Stepping Motor is controlled by a DC (24V) power supply and the drive logic

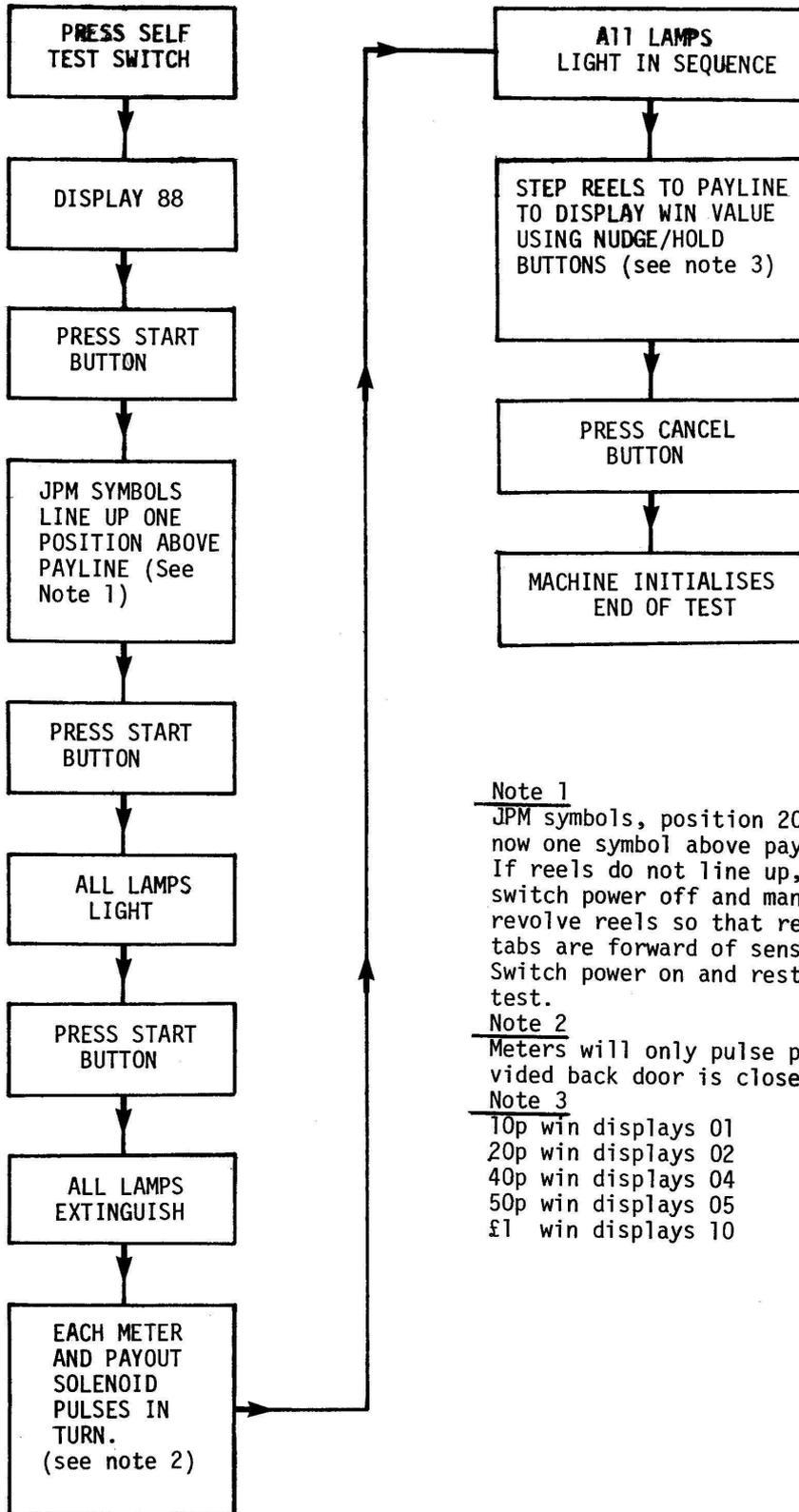
within the controller. Unlike a conventional motor which has a free running shaft the stepper shaft rotation is in fixed repeatable known increments (1.8° or 200 steps per revolution). These steps are achieved for each incoming pulse from the drive circuitry; thus a train of 200 pulses will result in shaft rotation of exactly 360° or 1 revolution. The step angle error is less than 5% of 1 step and is not cumulative no matter how many steps are taken. On the reel unit positional correction for the C.P.U. is given by a sensor unit and information is taken from the reel during the first spin on switch-on.

This first spin is an initialisation spin of 200 steps (360°), from then on all movements are controlled by the processor and it knows its exact position at all times.



The Stepper Reel Unit & Main Board Assembly

Lite-a-Nudge Self Test Routine 7



Note 1

JPM symbols, position 20, are now one symbol above payline. If reels do not line up, switch power off and manually revolve reels so that reel tabs are forward of sensors. Switch power on and restart test.

Note 2

Meters will only pulse provided back door is closed.

Note 3

10p win displays 01
20p win displays 02
40p win displays 04
50p win displays 05
£1 win displays 10

8 Lite-a-Nudge Reel Band Positioning

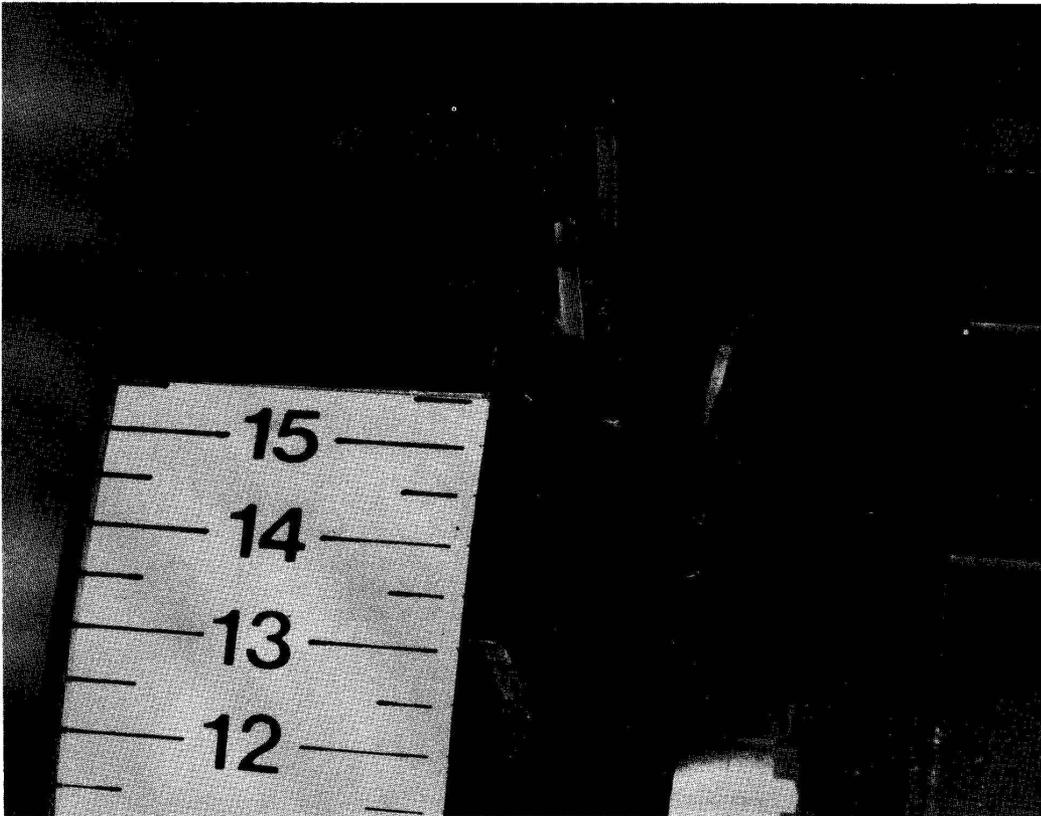
To check or re-align the Reel Band Positions, proceed as follows:

1. Set each reel tab to a position forward of Sensor, (as illustrated).
2. Switch ON machine.
3. Press Self-Test Button (Display 88).
4. Press Start Button.
5. Reels will spin and position themselves with tabs just before sensors. In this position J.P.M rosettes on the Reel Bands should line up one step above pay-line. Adjust Reel Bands if necessary using fruit symbols on the pay-line as a guide to alignment. Temporarily secure bands to reels with tape.
6. Switch machine OFF and ON, reels will initialise. Check if alignment is still correct, if so secure Reel Bands to reels with double sided tape.

Later type reel bands will be seen to have a series of steps numbered at the beginning of the band. These steps are to ensure accurate positioning of the band.

Place reel band on reel with step marker $15\frac{1}{2}$ exactly to the bottom of the reel spoke which incorporates the sensor tab (as illustrated). Secure with double sided tape. The band is now secured accurately.

N.B. - STEP $15\frac{1}{2}$ APPLIES TO LITE A NUDGE ONLY.



Position of Reel Tab and Sensor

System Capability

1. Outputs

The system has 56 transistor outputs each one capable of sinking up to 800 MA of DC current. As an S.R.U. controller 16 of these outputs are dedicated to driving the stepper motors on the reels. The balance of 40 outputs are available to drive.

- a) Lamps.
- b) Meters.
- c) Triac for heavy AC loads such as payouts or lamp banks.
- d) Display units.
- e) External output expansion systems.

2. Inputs

The system has 24 inputs available to input data to the system. As an S.R.U. controller 5 of the inputs are allocated for reel index data input to the system. Three of the remaining inputs are available as TTL level inputs. The remaining 16 inputs are configured for current drive (20 MA) for data input from switches (buttons, coins, etc.) This form of drive minimises interference from noise.

3. Timing

A second interrupt is obtained from the CPU crystal oscillator to provide a drive signal for the stepper motors to ensure an accurate 60 r.p.m. of rotation.

4. Tones

The basic tone generation system is a voltage controlled oscillator driven by a 6 bit D/A convertor.

5. Memory

The system is fitted with 256 bytes of RAM for working storage and up to 3K bytes of PROM for program and data storage.

6. Operation

At power on, the supply failure and power on detection circuit forces the CPU into RESET which forces the processor to start execution of the application (game) program from its start point.

The CPU then performs a series of sequential operations as defined by the program stored in the PROM. This sequence of operations will contain input operations where the CPU reads the state of selected inputs to determine if a switch is open or closed. It will also contain output operations which will cause the reels to rotate and lamps to light as determined by the game sequence and switch inputs.

During the normal execution of the program 2 levels of interrupt occur where the CPU suspends the operation of the normal program and branches to carry out a separate concurrent program for a few milliseconds. It is these interrupt programs that drive the reels and flash lamps and refresh the credit displays automatically without direct intervention of the main game program.

Spark detection circuitry is incorporated to force the CPU to REST should someone try to interfere with the system with a spark generator.

Two extension PCB's can be provided to expand the system:

a) Bus Extension

This provides non-volatile data storage for powerdown situations and 24 DIL switch inputs to enable the system to be parameterised.

b) Logic Output

The PCB provides a further 52 outputs each capable of sinking 800 MA. To interface this PCB to the system, 6 of the main PCB's outputs are lost for normal usage.

c) Output Extension

This PCB provides a further 16 outputs each capable of sinking 800 MA. To interface this PCB to the system, we use ribbon cable connections to SKT 2.

10 Lite-a-Nudge The S.R.U Controller

The Controller is connected to the reel unit assembly via three 35 way Varelco connectors. No.1 connector contains the reel drive circuitry. No. 2 connector contains 16 inputs and motors supply. No. 3 connector contains outputs and power supply inputs for the main board. The right hand section of the control board has the power supply section. Next to the power supply are circuits providing various safety functions, i.e. spark and missing pulse detection, the 6MH XTAL controlled clock. Zero crossing detector which also gives a 10m sec. reference for the processor. On the centre section of the board is the C.P.U. (TMS 9980) and its associated buffers and two 256 x 4 bit rams and a SN 74138 decoder (3 to 8 lines). Top left of the controller is a 35 way edge connector to accommodate the memory card, below this is a 14 way dil socket which is a test or input extension. The extreme upper left is the tone generation circuit.

The lower section of the board from right to left are five output ports each of 8 bits (74LS259N) with the resistors packs and ZTX450 transistors for the 40 outputs. To the left of the output section are three 8 bit input ports (74LS251N). The two LS138's are 3 lines binary to 8 separate output decoder chips used to select the input and output ports which themselves have integral 3 to 8 decoders. Thus with six lines any individual input or

output line may be selected and then enabled by a seventh line.

The extreme lower left section contains the output ports (259's) for the reel drive circuits, resistor packs and BCX 38A transistors.

Memory Board

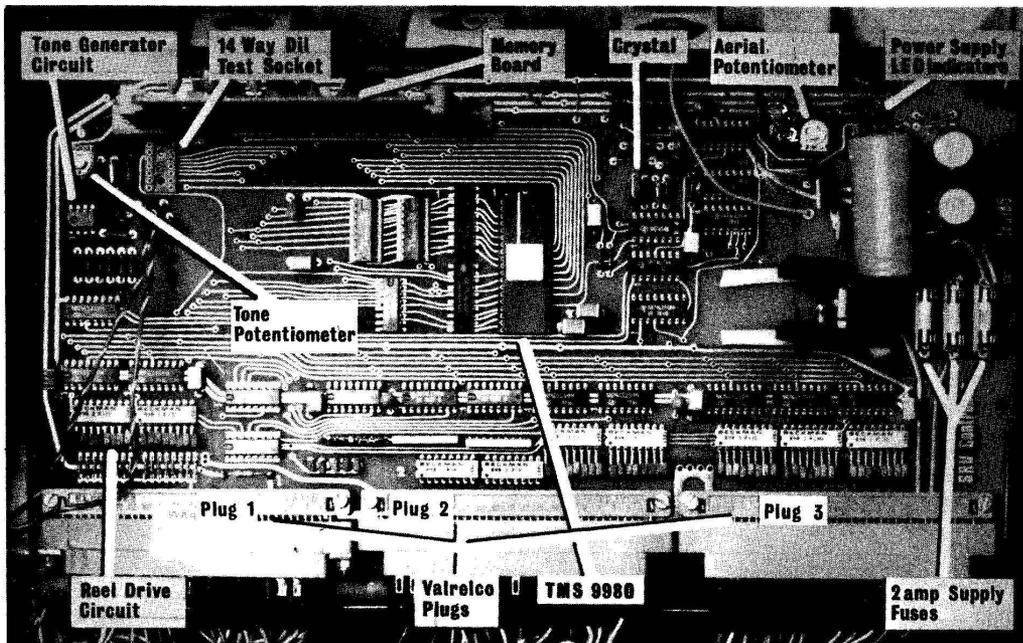
This board contains up to three TMS 2708 eproms each containing 1,000 words of program. This board gives the control unit its identity and the eproms contain the program for the individual game.

To cater for the needs of more complex games such as on export models, two further boards may be used as an extension to the system. These boards are:

1. A bus-extension which is an input extension and also provides non-volatile (switch off) memory and means of adjusting various factors of the games.
2. Logic extension to provide extra outputs such as lamp/solenoid drives over and above those provided on the main board.

Display

Credit display is achieved by use of 2 to 4 digit 7 segment led unit.



Because the Triac (DC controlled AC switch) is a more susceptible component to break down in the control circuit, this component and its associated resistor has been incorporated in an external Triac Pack and is situated on, or near the device that has to be switched, i.e. at payout solenoids lock-out solenoids and lamps where applicable (e.g. continental machines).

These are three connectors on the Pack.

1. Female $\frac{1}{4}$ " AMP tag which is connected to the solenoids or lamps where applicable.

2. Male $\frac{1}{4}$ " AMP tag which is the 12C Raw DC line (Purple).
3. Male $\frac{3}{16}$ " AMP tag which is the signal (switch line) from the controller.

Note: Should more than one device be switched from one signal line, the extra solenoids are linked to the female $\frac{1}{4}$ " AMP tag (1 above).

The 50 volt line (Yellow) is connected directly to the Solenoid(s)



Triac Pack. Coin Lockout location

12 Lite-a-Nudge Servicing Hints

Removal of Main Board from S.R.U. Chassis

1. Disconnect wires to speaker
2. Remove Plugs 2 and 3 (plugs should be pulled vertically downwards to prevent damage to pins).
3. Grip both sides of the Main Board with fingers and release spring catches by using thumb pressure against top of SRU Chassis.
4. Hinge top of board slightly towards you to clear SRU Chassis.
5. Place thumbs under base of memory card guides and fingers on top of SRU Chassis. Exert pressure with thumbs to remove board from Plug Socket 1.

Replacement of Main Board in S.R.U. Chassis

1. Offer board into board guides and ensure locating pins in plug and socket 1 are aligned.
2. Press board firmly into position and locate board retaining clips.
3. Fit plug sockets 2 and 3 to board taking care to ensure correct alignment.
4. Reconnect speaker wires.

Tone Adjustment

To reduce tone pitch, adjust potentiometer in an anti-clockwise direction. To raise pitch, adjust in a clockwise direction.

Type of Interference	Mains-Borne	Electrostatic	Electromagnetic
Typical Environmental Associations	Motors Fluorescent lights. Arcade surroundings.	Nylons carpets sparks from electrical devices	Radar installations Radio-Taxis
Aerial	No	Yes	Yes
Capacitor Back of Board	Yes	No	No
Sensitivity Potentiometer	Yes	Yes	Yes

Under no Circumstances Should:

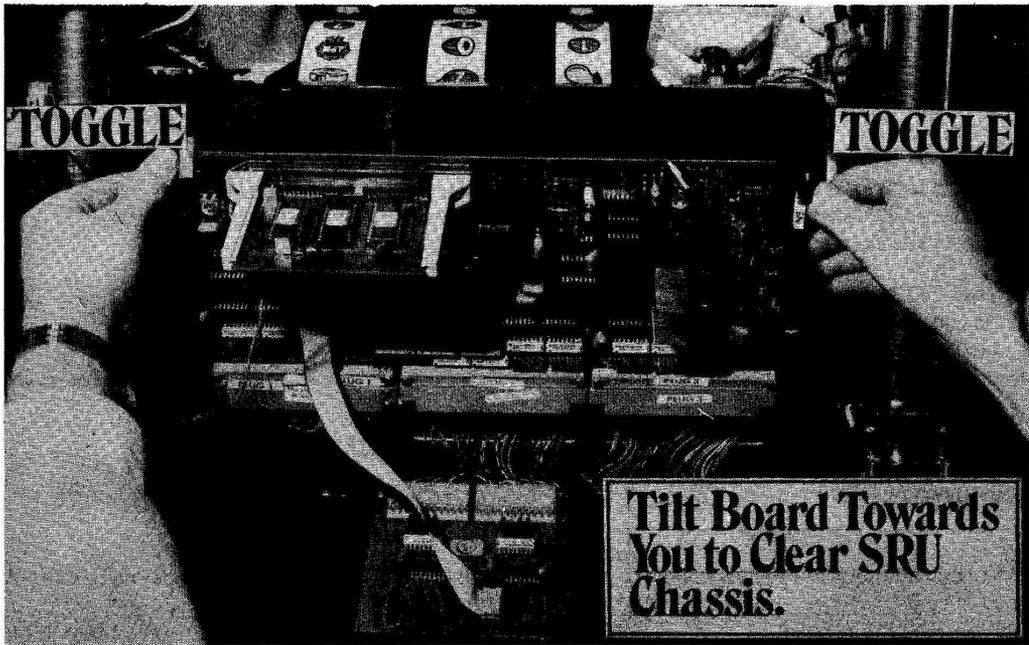
- a) The capacitor be removed
- b) the aerial shortened
- c) the pot. be turned fully anticlockwise since this disables the reset circuit.

Potentiometer Setting

The pot. should be turned clockwise to the highest level consistent with normal operation with few, if any, unwarranted resets occurring over an extended period. At this setting the circuit will be sensitive to surges in interference over and above the normal background level.

The pot. correctly set for normal operation as above it will be quite common for more than one reset to occur on start-up due to repeated striking of the internal fluorescent lamps.

Note: If the reset circuit is incorrectly tuned the machine may lock up sounding the tone which normally accompanies reset but without reset actually taking place.



Some Do's & Don'ts

Do's:

1. Always use a low wattage precision soldering iron when working on the Logic Board. Excessive heat and large soldering bits can damage Printed Circuit.
2. Always ensure that earth connections are re-connected if removed to replace parts or units.
3. It is recommended that faulty or flashing fluorscent tubes be replaced to prevent interference.
4. Always check earth connections are made in power points.
5. Always make sure that Plugs and Sockets make good connections as these can cause intermittant faults.
6. Always use a de-soldering tool to clear printed circuit track when replacing components.
7. Do ring our After Sales Department if you have a problem.

Don'ts:

1. Never remove the label from an Eprom as this could destroy the programme.
2. Never remove a component or plug before ensuring that the power is switched off.
3. Never exert excessive pressure on the Varelco Plugs and Sockets as this may cause the pins to open resulting in poor contact.
4. Never use excessive heat on Varelco Pin when removing wires as this can displace the Pin.
5. Never attempt to set up a winning combination by turning the reels. (N.B. This can be achieved by using the test procedure).
6. Do not fit any fuse other than an anti-surge fuse on the main board.
7. Do not replace a coin meter before checking whether an internal or external diode is required.
8. Do not attempt to dis-mantle a stepper motor.

14 Lite-a-Nudge Fault Finding

CAUTION

Sub standard or non-approved electronic components must not be used as replacements. This could lead to subsequent breakdowns and may invalidate warranty.

The following table of faults and possible causes is intended only as a guide to the Engineer and should not be regarded as the sole cause of a particular fault.

<u>Fault</u>	<u>Possible Cause</u>
Lamp continuously lit	Suspect relevant transistor short circuit.
Coil continuously energised	Check Triac Pack. Suspect relevant transistor short circuit.
Lamp not lighting	Check lamp, check wiring on plug and socket, or transistor failure O/C.
Coils not energising	Check coil, check Triac Pack, check plug and socket connections, check transistor failure O/C
1, 2 or 3 reel not revolving	Check plug and socket connection, check for broken wire in plug socket 1. Check transistors and diodes.
Intermittent payout and coin lockout chattering	Bad connections under insulated cover on 3/16" tag to relevant triac pack.
Main board fuse repeatedly blowing through no obvious fault.	Wrong fuse fitted. Fit anti-surge fuse.
Machine will not start with credit displayed.	Check coin acceptor microswitches.
No Initialisation On Switch On. Continuous Tone.	Check that power supply LED are on. Check board fuses. Check plugs and sockets on 1 2 and 3. Check aerial adjustments. Check 1022/4528 clobber chip Check O/C capacitor C11. Check programme board dirty contact on edge connector. Check connections transformer terminal strip.
Extended inialisation Tone	1C22 MC 14528 faulty. Check internal lighting system by removing light fuse. Check for external static.
Continual Tone.	Coin switch jammed (later models) Bad connection on memory board. Faulty 1C22 (Mc 14528)

NOTE'.

Full details and specifications of components may be obtained from the After Sales Department together with spares.

<u>Fault</u>	<u>Possible Cause</u>
Double Nudging of Symbols	Tight spot on motor. Loose reel Reel out of SYNC through interference by plastic or other materials. Obsolete programme. Bad connection on varelco plug 1.
Reels strobing.	Incorrect value of resistor on reel unit. Recommended value should be 10 OHM 50W rating (see TSB 6).
Reel Oscillating	Tight spot on motor
Reel Revolving in Opposite Direction to Other Reels.	Plug 1 bad pin connection Faulty transistor.
Reels Out of Alignment	Short circuit light source.
Incorrect Payouts.	Short circuit light source (Reels out of alignment). Open circuit light source (Paying out on criss cross position with incorrect symbol). Processor thinks tag is in the sensor.
No Payout (Cash)	Check if M/C will payout on 50p change if so check sensors.
No Payout	Payout commences then solenoid remains energised until M/C is switched off. Check for short on triac. Check for leaky transistor. Check for incorrect solenoid drive Transistor fitted should be ZTX450.
Machine Initialises During Payout.	Check triac. Check payout solenoid for radiation by disconnecting solenoid feed when paying out. Aerial too sensitive.

16 Operation of Hexadecimal Engineers Test Box

To allow a Service Engineer to Check the static operation of the S.R.U. Main Board and any sub boards, switches buttons, lamps, etc. connected to it without removal from the machine.

The main S.R.U. boards has 24 input and 56 output drive lines numbered 00 to 23 and 00 to 55 respectively.

Use of Engineers Test Box For Lite A Nudge

Switch machine OFF and remove programme card. Insert plug from Engineers Test Box into socket on main board ensuring that RED trace wire is at top left hand corner, i.e. Pin 1. Disconnect speaker.

Set Test Box digital switches to 00.

Switch ON power to machine.

To Test Inputs and Outputs

1. Inputs

Dial up relevant input Port No. using digital switches and referring to conversion table on page 17. for hexadecimal equivalent. L.E.D. on test box will change state when relevant input

is operated e.g. to test start switch input, (port no. 14) set digital switches to 0.E. (see conversion table), RED L.E.D. is now lit, operate start switch, RED. L.E.D. will extinguish. All other Inputs may be checked in a similar manner by referring to Input-Output chart.

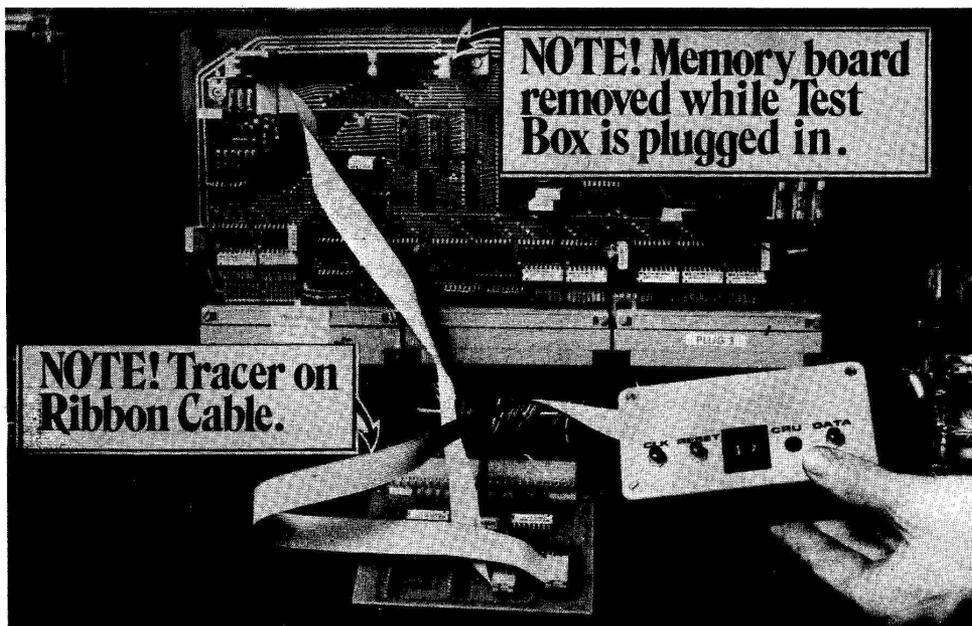
2. Outputs

Dial up relevant output port no. using digital switches and referring to conversion table on page 17 for hexadecimal equivalent. Press and hold clock button, press data button to operate output. E.G. to test token payout solenoid, (port no.54) set digital switches to 36 (see conversion table), press and hold clock button, press data button to operate token payout solenoid Other outputs may be tested in a similar manner.

Reminder

Switch Power Off.

1. Remove Test Box Plug.
2. Reconnect Speaker.
3. Insert Programme Card.



Conversion Table

Hexadecimal Binary

PORT	HEXA-DECIMAL	BINARY	PORT	HEXA-DECIMAL	BINARY
0	0000	00000000	51	0033	00110011
1	0001	00000001	52	0034	00110100
2	0002	00000010	53	0035	00110101
3	0003	00000011	54	0036	00110111
4	0004	00000100	55	0037	00110111
5	0005	00000101	56	0038	00111000
6	0006	00000110	57	0039	00111001
7	0007	00000111	58	003A	00111010
8	0008	00001000	59	003B	00111011
9	0009	00001001	60	003C	00111100
10	000A	00001010	61	003D	00111101
11	000B	00001011	62	003E	00111110
12	000C	00001100	63	003F	00111111
13	000D	00001101	64	0040	01000000
14	000E	00001110	65	0041	01000001
15	000F	00001111	66	0042	01000010
16	0010	00010000	67	0043	01000011
17	0011	00010001	68	0044	01000100
18	0012	00010010	69	0045	01000101
19	0013	00010011	70	0046	01000110
20	0014	00010100	71	0047	01000111
21	0015	00010101	72	0048	01001000
22	0016	00010110	73	0049	01001001
23	0017	00010111	74	004A	01001010
24	0018	00011000	75	004B	01001011
25	0019	00011001	76	004C	01001100
26	001A	00011010	77	004D	01001101
27	001B	00011011	78	004E	01001110
28	001C	00011100	79	004F	01001111
29	001D	00011101	80	0050	01010000
30	001E	00011110	81	0051	01010001
31	001F	00011111	82	0052	01010010
32	0020	00100000	83	0053	01010011
33	0021	00100001	84	0054	01010100
34	0022	00100010	85	0055	01010101
35	0023	00100011	86	0056	01010110
36	0024	00100100	87	0057	01010111
37	0025	00100101	88	0058	01011000
38	0026	00100110	89	0059	01011001
39	0027	00100111	90	005A	01011010
40	0028	00101000	91	005B	01011011
41	0029	00101001	92	005C	01011100
42	002A	00101010	93	005D	01011101
43	002B	00101011	94	005E	01011110
44	002C	00101100	95	005F	01011111
45	002D	00101101	96	0060	01100000
46	002E	00101110	97	0061	01100001
47	002F	00101111	98	0062	01100010
48	0030	00110000	99	0063	01100011
49	0031	00110001	100	0064	01100100
50	0032	00110010			

LMI

18 Lite-a-Nudge Out Puts

PORT	PLUG	PIN	TRANS	WIRE COLOUR	FUNCTION
0	1	35	Q1	WHT/RED (BLUE SLEEVE)	1st REEL MOTOR
1	1	34	Q2	GREEN (BLUE SLEEVE)	1st REEL MOTOR
2	1	32	Q4	RED (BLUE SLEEVE)	1st REEL MOTOR
3	1	30	Q6	WHT/GREEN (BLUE SLEEVE)	1st REEL MOTOR
4	1	28	Q8	WHT/RED (GREY SLEEVE)	2nd REEL MOTOR
5	1	29	Q7	GREEN (GREY SLEEVE)	2nd REEL MOTOR
6	1	31	Q5	RED (GREY SLEEVE)	2nd REEL MOTOR
7	1	33	Q3	WHT/GRN (GREY SLEEVE)	2nd REEL MOTOR
8	1	27	Q9	WHT/RED (PINK SLEEVE)	3rd REEL MOTOR
9	1	26	Q10	GREEN (PINK SLEEVE)	3rd REEL MOTOR
10	1	24	Q12	RED (PINK SLEEVE)	3rd REEL MOTOR
11	1	22	Q14	WHT/GRN (PINK SLEEVE)	3rd REEL MOTOR
16	2	14	Q17	GREY/BLK	1st REEL MOTOR
17	2	13	Q18	PUR/BLK	2nd REEL MOTOR
18	2	11	Q20	YEL/BLK	3rd REEL MOTOR
19	2	9	Q22	GRN/BLK	NUDGE REVERSE LAMP
22	2	10	Q21	GRN/GREY	1st HOLD LAMP
23	2	12	Q19	YEL/PUR	2nd HOLD LAMP
24	2	6	Q25	BRN/YEL	3rd HOLD LAMP
25	2	5	Q26	RED/BRN	START LAMP
28	3	32	Q32	PINK/GRN	TOTAL CASH IN METER

Lite-a-Nudge 19

Out Puts

PORT	PLUG	PIN	TRANS	WIRE COLOUR	FUNCTION
29	3	34	Q31	BLUE/GREY	TOKENS OUT METER
30	2	2	Q29	WHT/YEL	TOKEN REFILL METER
31	2	4	Q27	GRY/ORG	TOTAL PLAYS METER
32	3	31	Q33	ORG/RED	TOKENS IN METER
33	3	30	Q34	YEL/PINK	CREDIT DISPLAY 1
34	3	28	Q36	PUR/WHT	CREDIT DISPLAY 2
35	3	26	Q38	RED/BLK	CREDIT DISPLAY 3
36	3	24	Q40	BLK/WHT	CREDIT DISPLAY 4
37	3	25	Q39	BRN/ORG	DISPLAY STROBE 1
38	3	27	Q37	ORG/GRN	DISPLAY STROBE 2
39	3	29	Q35	RED/YEL	10p OUT METER
40	3	23	Q41	BLU/BLK	50p IN METER
41	3	22	Q42	WHT/BRN	GAMBLE LAMP
46	3	19	Q45	BLK/BLU	10p GAMBLE LAMP
47	3	21	Q43	RED/BLU	20p GAMBLE LAMP
48	3	15	Q49	PUR/BRN	40p GAMBLE LAMP
49	3	14	Q50	GRN/RED	80p GAMBLE LAMP
50	3	12	Q52	BLUE/PINK	DOUBLE LAMP
51	3	10	Q54	BLUE/ORG	NOTHING LAMP
52	3	8	Q56	WHT/GREY	TAKE WIN LAMP
53	3	9	Q55	BRN/BLUE	10p PAYOUT SOLENOID
54	3	11	Q53	ORG/GREY	10p TOKEN SOLENOID
55	3	13	Q51	GRN/PINK	LOCKOUTS

20 Lite-a-Nudge In Puts

INPUTS

PORT	PLUG	PIN	IC	PIN	WIRE COLOUR	FUNCTION
0	2	2	8	4	BLU/WHT	Opto Sensor No 1
1	2	3	8	3	GRY/WHT	Opto Sensor No 2
2	2	5	8	2	PINK/WHT	Opto Sensor No 3
3	2	6	8	1		N/A
4	2	4	8	15		N/A
5	2	34	8	14		N/A
6	2	32	8	13		N/A
7	2	31	8	12		N/A
8	2	24	9	4	BRN/WHT	Nudge/Hold M/S No 1
9	2	26	9	3	RED/WHT	Nudge/Hold M/S No 2
10	2	20	9	2	BLU/WHT	Nudge/Hold M/S No 3
11	2	30	9	1		N/A
12	2	29	9	15	GREY/WHT	Nudge Reverse M/S
13	2	27	9	14		N/A
14	2	25	9	13	YEL/GREY	Start M/S
15	2	23	9	12	BLU/YEL	Cancel M/S
16	2	16	10	4	YEL/BRN	Feature Stop M/S
17	2	18	10	3		N/A
18	2	20	10	2	PINK/YEL	Test M/S
19	2	22	10	1	BRN/GRN	Token Refill M/S
20	2	21	10	15	BLK/GREY	5p Coin M/S
21	2	19	10	14	WHT/RED	10p Token M/S
22	2	17	10	13	GREY/YEL	10p Token M/S
23	2	15	10	12	BLU/RED	50p Coin S/W

Lite-a-Nudge 21

Mini Logic Outputs

PORT	PLUG	PIN	TRANS	WIRE COLOUR	FUNCTION
64	A	10	Q1	GRN/BRN	NUDGE LAMP 1
65	A	9	Q2	BLU/GRN	NUDGE LAMP 2
66	A	7	Q4	WHT/ORG	NUDGE LAMP 3
67	A	5	Q6	RED/ORG	NUDGE LAMP 4
68	A	3	Q8	YEL/ORG	NUDGE LAMP 5
69	A	4	Q7	ORG/WHT	NUDGE LAMP 6
70	A	6	Q5	BRN/PUR	NUDGE LAMP 7
71	A	8	Q3	PINK/BLUE	NUDGE LAMP 8
72	B	10	Q9	GREY/GRN	NUDGE LAMP 9
73	B	9	Q10	WHT/PUR	NUDGE LAMP 10
74	B	7	Q12	ORG/PUR	'N' LAMP
75	B	5	Q14	GRN/PUR	'U' LAMP
76	B	3	Q16	YEL/BLUE	'D' LAMP
77	B	4	Q15	PUR/BLUE	'G' LAMP
78	B	6	Q13	PINK/ORG	'E' LAMP
79	B	8	Q11	GRN/ORG	FEATURE STOP LAMP

22 Lite~a~Nudge Reel Drive System

SOURCE SENSOR PACK - 1ST REEL

	Plug No.	Pin No.	Transistor No.	Wire Colour	
Anode	1	8		Blue/Yel)	Light Source
Cathode	1	9		Blue/Blk)	
Collector	1	16		Blue/Grn)	Light Sensor
Emitter	1	2	Q57	Blue/Wht)	

SOURCE SENSOR PACK - 2ND REEL

	Plug No.	Pin No.	Transistor No.	Wire Colour	
Anode	1	10		Gry/Yel)	Light Source
Cathode	1	11		Gry/Blk)	
Collector	1	17		Gry/Grn)	Light Sensor
Emitter	1	3	058	Gry/Wht)	

SOURCE SENSOR PACK - 3RD REEL

	Plug No.	Pin No.	Transistor No.	Wire Colour	
Anode	1	12		Pnk/Yel)	Light Source
Cathode	1	13		Pnk/Blk)	
Collector	1	18		Pnk/Grn)	Light Sensor
Emitter	1	5	059	Pnk/Wht)	

Lite-a-Nudge 23

Main Board Power Supplies

Plug No.	Pin No.	Supply Voltage	Colour	Function
3	1	12 volts AC	Gry/Blue)	Main Board Power Supplies
3	2	9 volts AC	Gry/Red)	
3	3	12 volts AC	Wht/Blk)	
3	4	9 volts Ac	Wht/Pnk)	
3	5	- 17 volts DC*	Pink	Switch Input Supply
3	6	Digital zero volt	Blue	Zero Volt Line
3	7	8 volts DC*	Grn	Feed to Display
3	35	Ground	Grn/Yel	
3				
2	35	34 volts DC	Brn/Blk	Stepper Motor Supply
2	1	Ground	Grn/Yel	

* All DC voltages are nominal.

<u>To Test Credit Display using Port No's 33 - 38</u>	<u>Display Shows</u>
Turn on Outputs 33 to 38	00
Turn off Output 33 to 38	11
Turn off Output 34	33
Turn on Output 33	22
Turn Off Output 35	66
Turn on Output 34	44
Turn on Output 35	00
Turn off Output 36	88
Turn on Output 36	00
Turn off Output 37	00
Turn off Output 36	80
Turn on Output 36	00
Turn on Output 37	00
Turn off Output 38	00
Turn off Output 36	08

Each drive line to the display has now been checked and the ability of the display to latch in data has been verified.

Faults:

If, when there is zero credit on machine the display shows 11, 22, 44 or 88, then there is a fault associated with output, 33, 34, 35 or 36 respectively.

LNI

NOTE: REEL 1 MOTOR WIRES HAVE BLUE SLEEVE
 REEL 2 MOTOR WIRES HAVE GREY SLEEVE
 REEL 3 MOTOR WIRES HAVE PINK SLEEVE

NO.	DESCRIPTION	CHKD	DATE

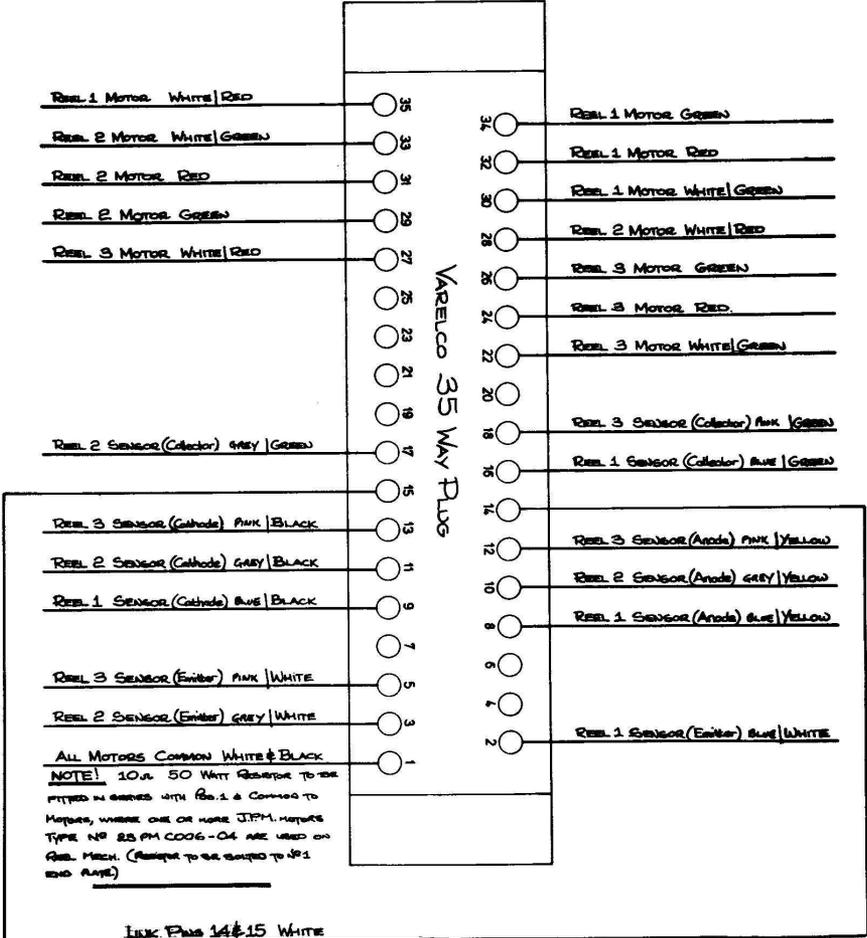
THIS PRINT IS THE PROPERTY OF JPM (AUTOMATIC MACHINES) LTD. AND IS LOANED TO THE RECIENT SUBJECT TO RETURN ON DEMAND. ITS CONTENTS ARE CONFIDENTIAL AND MUST NOT BE COPIED OR SUBMITTED TO OUTSIDE PARTIES FOR USE OR EXAMINATION WITHOUT OUR PERMISSION.



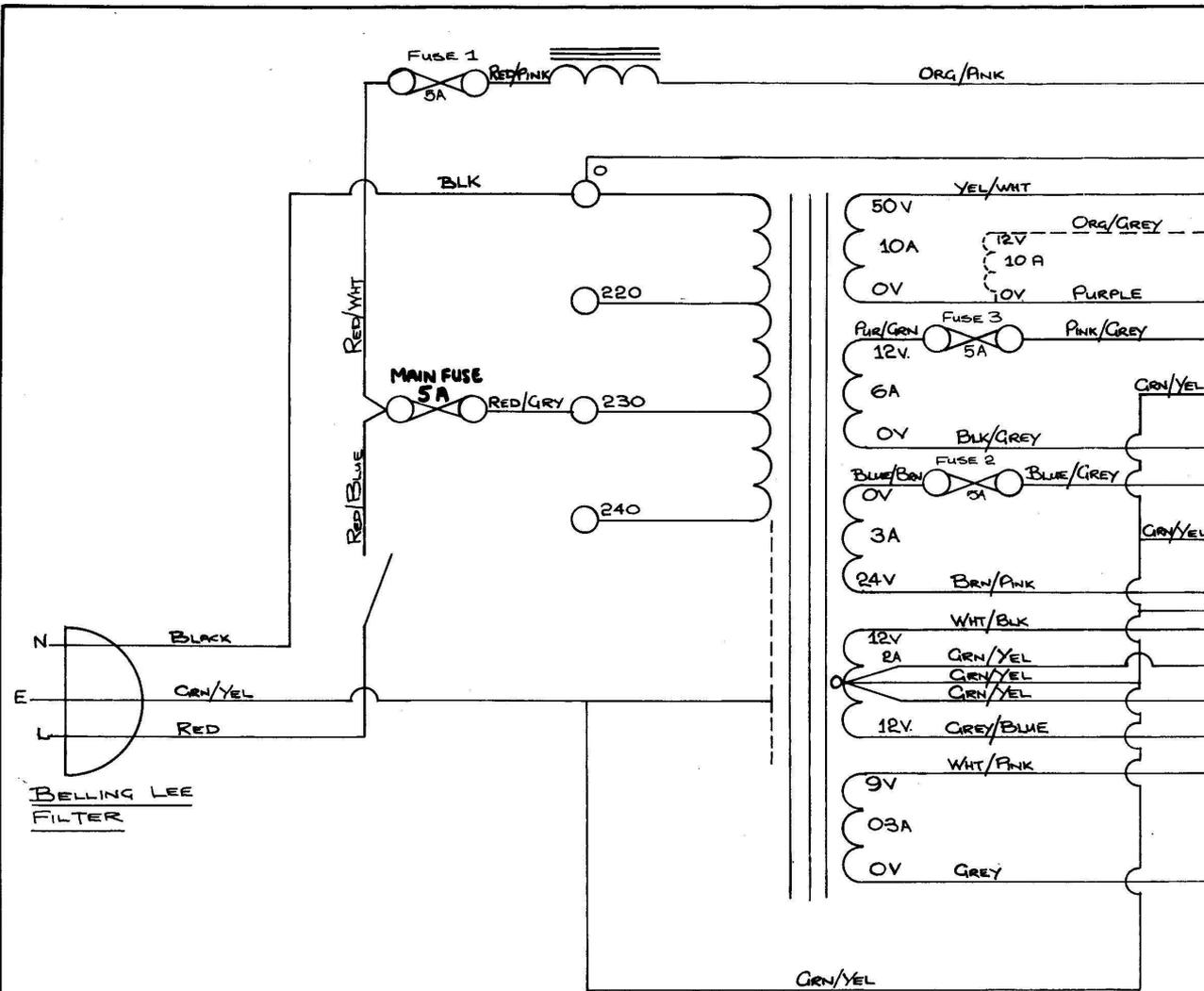
TITLE: WIRING FOR PLUS 1
 MATERIAL: ANY 3 REEL MACHINE
 FINISH:

DRAWN: 2/1
 APPROVED:
 DATE: 9.12.76
 SCALE:
 DRAWING No. M0067

DO NOT SCALE DRAWING



Item	Stk/Drg.No.	Qty	Unit	Description	MANUF.		TYPE	Remarks (CCT Ref etc)
					MAT'L	FINISH		
49								Brown, Green, Red, Gold
50	I80307	6	ea	Res carbon Film IK5 5% 0.25W	Mullard		CP25	RL-6 Alt I80307A
51	I80077	5	ea	Res Carbon Film 470R 5% 0.25W	Mullard		CR25	R7,12,13,22,24 Alt I80077A Yellow, Violet, Brown, Gold
52	I80040	1	ea	Res Carbon Film 6K8 5% 0.25W	Mullard		CR25	R9 Alt I80040A Blue, Violet, Brown, Gold
53	I80095	1	ea	Res Carbon Film 270R 5% 0.25W	Mullard		CR25	R10 Alt I80095A Red, Violet, Brown, Gold
54	I80176	1	ea	Res Carbon Film 47R 5% 0.25W	Mullard		CR25	R11 Alt I80176A Yellow, Violet, Black, Gold
55	I80300	4	ea	Res Carbon Film IK 5% 0.25W	Mullard		CP25	R14,15,17,23 Alt I80300A Brown, Black, Red, Gold
56	I80037	4	ea	Res Carbon Film 10K 5% 0.25W	Mullard		CR25	R16,19,20,26, Alt I80037A Brown, Black, Orange, Gold
57	I80274	1	ea	Res Carbon Film 22K 5% 0.25W	Mullard		CP25	R21 Alt I80274A Red, Red, Yellow, Gold
58	I80179	1	ea	Res Carbon Film 360R 5% 0.5W	Mullard		CR37	R25 Orange, Blue, Brown, Gold
59	I80178	2	ea	Res Carbon Film 100K 5% 0.25W	Mullard		CP25	R27 Brown, Black, Yellow, Gold Alt I80178A
60	I80113	1	ea	Res Metal Oxide 160K 2% 0.25W	Electrosil		TR4	R28 Brown, Blue, Yellow, Red Alt I80336
61								
62	I80175	1	ea	Res Preset Skeletal 4K7 5% W				R8 R8
63	I80275	1	ea	Res Preset Skeletal 100K 5% W				R30
64								
65	I80244	5	ea	Thick Film Network 16 Pin DIL 8 x 330R	AB Micro Electronics		761-3-330R	TFN 3-7
66	I80181	1	ea	Thick Film Network 9 Pin SIL 8 x 10K to Common	AB Micro Electronics		850-01-1K	TFN 8
67	I00182	2	ea	Thick Film Network 9 Pin SIL 8 x 1K to Common	AB Micro Electronics		850-91-1K	TFN 9, 10
68	I80340	4	ea	Thick Film Network 16 Pin DIL 8 x 2K7	AB Micro Electronics		761-3-2K7	TFN 11, 12, 1 & 2
69								
70	I20019	3	ea	Connector PCB Mnto 35W Rt Anode Pins	Varelco		7023-35-000-001	PL 1-3
71	I20020	1	ea	Connector PCB Mnto 35W Edge Contact	Varelco		001-9040-6072-00-00	PL 4
72	I20026	2	ea	PCB Guide Moulded	Varelco		6072-3218	PL 1 & 2
73	I80166	1	4a	Polarising Key	Varelco		6072-3618	Fitted to PL 4 Pos'n 15
74								
75	I60097	1	ea	Fuseholder 3 section	Bellinos Lee		L2222	PH 1
76	I60050	3	ea	Fuselink Antisurge 5mm Ø x 20mm, 2.5A 250V	Beswick		I23	FI, 2 & 3
77								
78	I80171A	1	ea	Crystal 6 MHz	Interface Quartz Devices		HC 16/U	X 1
79								
80	I80168	1	ea	Heatsink 10.5°C/W	Similar to RS Comp		401-964	HS 1
81								
82	040022	8	ea	Screw CH HD Slotted #3 x 16	M.S.		ZN & PASS	
83	040082	11	ea	Nut Full #3	M.S.		ZN & PASS	
84	040083	11	ea	Washer Int Tooth #3	B.M.S.			
85	040095	3	ea	Bolt Hex Hd #6 x 10	M.S.		ZN & PASS	Use with items 29 & 80, 87
86								
87	I00153	2	ea	Retaining Spring				To Drg. H0012
88								
89	200129	2	ea	Flying Lead Ass'y				Complete to P/L 200129
90	200140	1	ea	Aerial Lead Ass'y				Complete to P/L 200140
91								
92		A/P		Tape Insulating				Use for insulating tracks under DL 1 & 2 and under HS
93								
94		A/P		Heatsink Compound				Use between items 29 & 80
95								
96		A/P		Resin Single Part			RIV 1	Use between C11, I2 & I3



POWER UNIT FUSE RATING

<u>MAIN FUSE</u>	5 AMPS	240 VOLTS
<u>FUSE 1</u>	5 AMPS	240 VOLTS (LIGHTING)
<u>FUSE 2</u>	5 AMPS	37 VOLTS MOTOR FUSE
<u>FUSE 3</u>	5 AMPS	12 VOLTS TRAW D.C. (LAMPS)
<u>FUSE 4</u>	5 AMPS	50 VOLTS (SOLENOID & LOCKOUT)

No.	DESCRIPTION	CHK'D	APP'D	DATE
REVISIONS				

THIS PRINT IS THE PROPERTY OF JPM (AUTOMATIC MACHINES) LTD. AND IS LOANED TO THE RECIPIENT SUBJECT TO RETURN ON DEMAND. ITS CONTENTS ARE CONFIDENTIAL AND MUST NOT BE COPIED OR SUBMITTED TO OUTSIDE PARTIES FOR USE OR EXAMINATION WITHOUT OUR PERMISSION.



1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32

LMI

T
S
R
Q
P
O
N
W
L
K
J
I
H
G
F
E
D
C
B
A

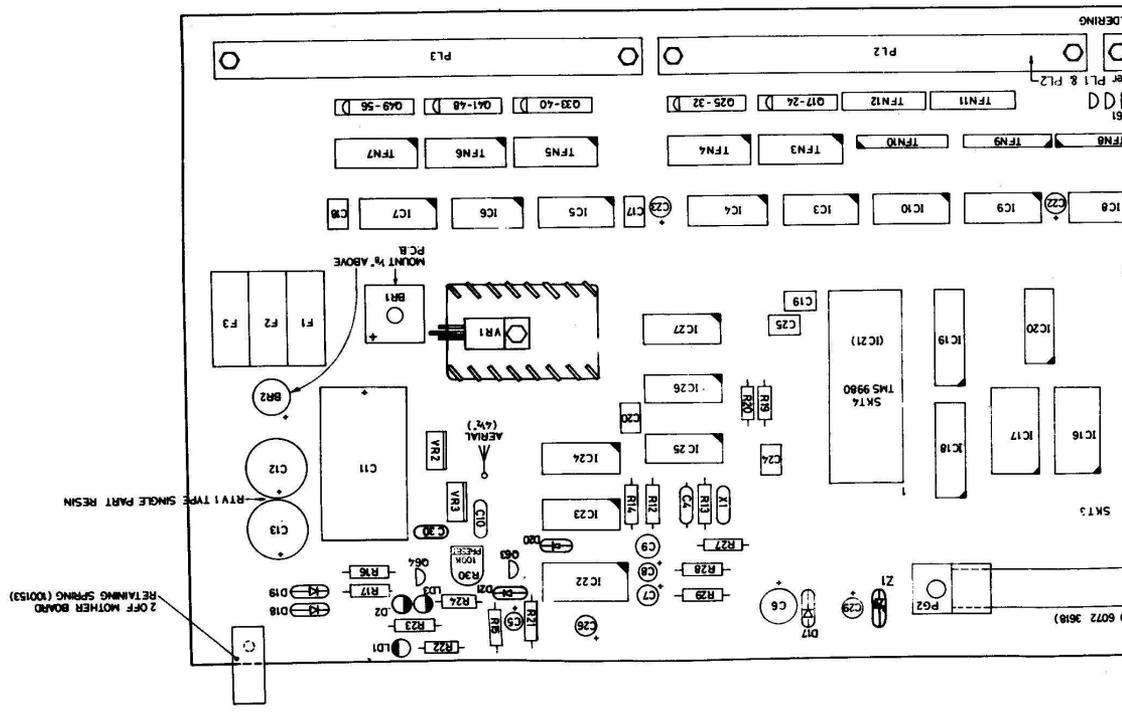
INTEGRATED CIRCUIT LIST

- 74393 Dual 4-bit Binary Ripple Counter with individual reset.
- TMS 4042-2 256 x 4-bit Static Random Access Memory.
- 154238 Cmos Dual Retriggerable Monostable.
- TMS 9980 Nmos 16-bit Microprocessor with Multiplexed 8-bit Data Buss and 14-bit Address Buss.
- NE 566 Voltage Controlled Oscillator.
- 7414 Hex Inverter with Hysteresis.
- 7474 Dual positive Edge-Triggered 'D' Type Bistable with Individua Clock, Data, Set and Reset Inputs.
- 74138 High Speed 1 of 8 Decoder/Demultiplexer.
- 74148 8 Input Priority Encoder with active 'Low' Inputs.
- 74244 Octal High Current Non-Inverting Buffer/Driver.
- 74251 8 Input Digital Multiplexer with True and Complimentary Outputs.
- 74259 8-bit Addressable Latch with Common Data Input.

Note: Further information may be obtained by reference to the relevant Manufacturers Data Sheets.

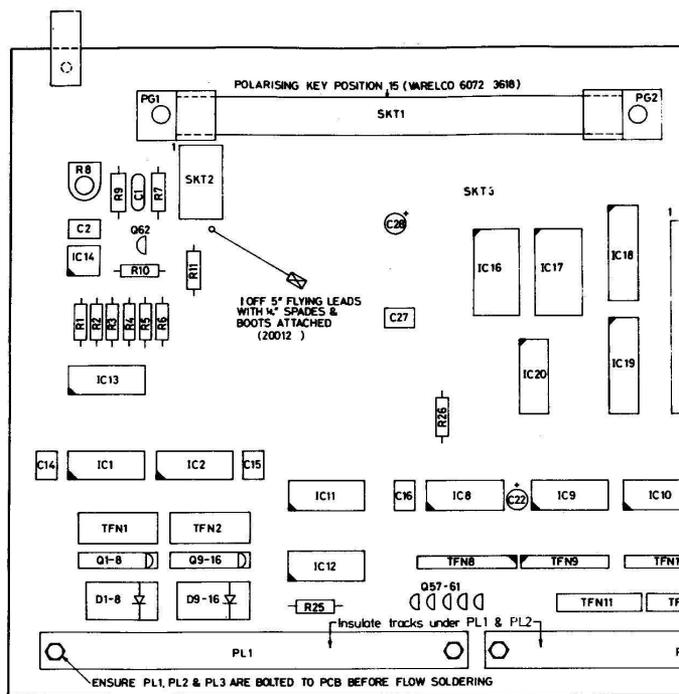
DRAWING NO. M 0287		FINISH		MATERIAL		JPM (Automatic Machines) Ltd		PROPERTY OF JPM (AUTOMATIC MACHINES) LOANED TO THE RECIENT SUBJECT TO CONDITIONS ARE CONFIDENTIAL OR EXAMINATION WITHOUT OUR CONSENT ON SUBMITTED TO OUTSIDE	
SCALE	DATE 5/12/79	APPROVED	CHECKED	TRACED	DRAWN	TITLE SRU CONTROL BOARD COMPONENT DESIGNATION			

T
S
R
O
4
O
N
W
L
K
J
I
H
G
F
E
D
C
B
A



DRG. No.

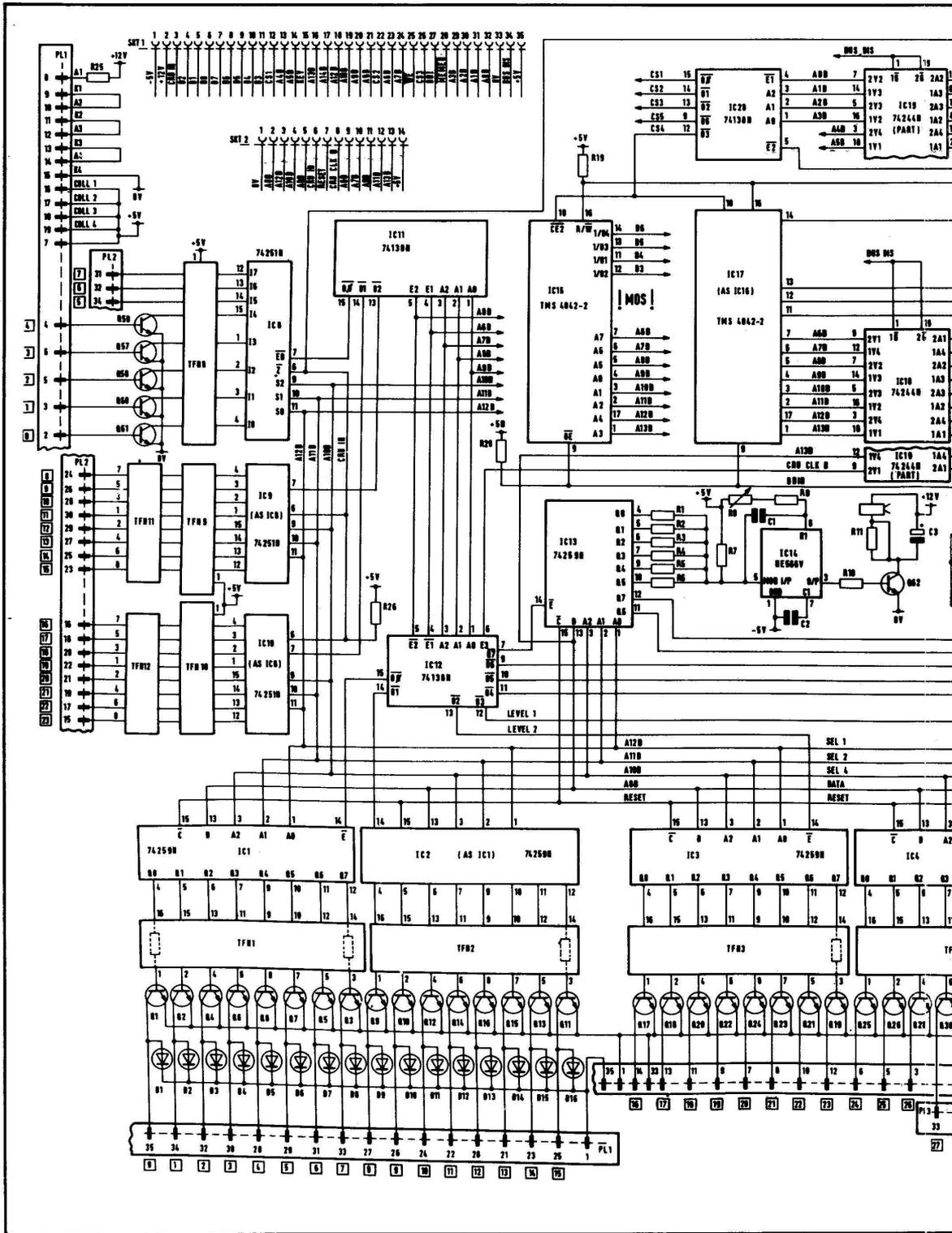
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T



C Change Note 0030		CHK'D	APP'D	DATE	TOLERANCE ON HOLES +.1 -0 mm	THIS PRINT IS THE PROPERTY OF JPM (AUTOMATIC MACHINES) LTD. AND IS LOANED TO THE RECIPIENT SUBJECT TO RETURN ON DEMAND. ITS CONTENTS ARE CONFIDENTIAL AND MUST NOT BE COPIED OR SUBMITTED TO OUTSIDE PARTIES FOR USE OR EXAMINATION WITHOUT OUR PERMISSION.
B Change Note N° 0103		CHK'D	APP'D	DATE		
REVISIONS					DO NOT SCALE DRAWING	

REPRODUCTION (WALES) LTD 1 2 3 4 5 6 7 8 9 10 11 12 13 14

LNI



29 Lite-a-Nudge

Glossary of Terms

Address - A number that designates a specific location in a storage or memory device.

B.C.D. - An isolating circuit used to avoid reaction of a driven circuit on its driver circuit.

Bus - One or more conductors used to transmit logic or power.

C.P.U. - Central Processor Unit. The heart of a computer system contains main storage, and arithmetic units and thus controls instruction processing.

Clock - A device that generates periodic signals used for synchronization.

Chip - Often used in reference to an integrated circuit. A piece of silicon or similar material containing an integrated circuit.

Flip-Flop (storage element) - A circuit having two stable states and can change from one state to another by application of a control signal and will remain in that state after removal of signal.

Flow-Chart - A map of a solution to a problem, symbols are used to represent operations, data, flow, etc.

Gate - A device having one output channel and one or more input channels where the output channel state is determined by the input channel states.

Hardware - The electronics and circuitry of any computer system which are "hard" i.e. physical objects.

Interrupt - To stop a process in such a way that it can be resumed.

Interface - A shared boundary, i.e. a hardware component linking two circuits or devices.

Multiplex - Simultaneous transmissions of two or more messages on a single channel.

Program - A sequence of instructions that controls a computer or micro-processor routine or behaviour.

Port - An input or output route for transferring data to or from a system.

P.R.O.M. - Programmable read only memory. A ROM into which information can be written by means of special equipment.

R.A.M. - Random Access Memory. A memory device that can be written to and read from under programme control.

R.O.M. - Read Only Memory. A memory device that can read only and contains information that is fixed.

E.P.R.O.M. - Erasable P.R.O.M.

E.A.R.O.M. - Electrically Alterable Read Only Memory.

S.R.U. - Stepper Motor Reel Unit.

T.T.L. - Transistor Transistor coupled logic circuits.

Warranty

Seller warrants that its Stepper Reel Unit system and printed circuit boards and parts thereon are free from defects in material and workmanship under normal use and service for a period of ninety (90) days from date of shipment. None of the Seller's other products or parts thereof are warranted.

If the products described in this manual fail to conform to this warranty, Seller's sole liability shall be, at its option, to repair, replace or credit Buyer's account for such products which are returned to Seller during said warranty period, provided:

- a) Seller is promptly notified in writing upon discovery by Buyer that said products are defective
- b) Such products are returned prepaid to Seller's plant and
- c) Seller's examination of said products discloses to Seller's satisfaction that such alleged defects existed and were not caused by accident misuse, neglect, alteration, improper repair installation or improper testing.
- d) Only seller's recommended or approved electronic components are used as service replacements.

In no event shall Seller be liable for loss of profits, loss of use, incidental or consequential damages.

Except for any express warranty set forth in a written contract between Seller and Buyer which contract supercedes the terms of this order, this warranty is expressed in lieu of all other warranties expressed or implied including the implied warranties of merchantability and fitness for a particular purpose and of all other obligations or liabilities on the Seller's part and it neither assumes nor authorises any other person to assume for the Seller any other liabilities in connection with the sale of products under this order.

