fremstehebel 8m.

SOUNDCRAFT MAGNETICS LTD

SATURN MULTITRACK RECORDER

SECTION 1

GUIDE TO OPERATION

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1. Unpacking and Installation.

1.1 The delivery carton of your Soundcraft Saturn Recorder should contain:

1 x Recorder

1 x Power cable

1 x Reel of tape

1 x Empty reel

1 x Tool Set

1 x "Total Remote" unit

1 x Remote cable

1 x Remote meter cable

1 x Service and operation manual

1.2 The A.C. mains supply is connected to the recorder via a 3-core cable colour coded as follows:

BROWN - LIVE

BLUE - NEUTRAL

GREEN/YELLOW - EARTH

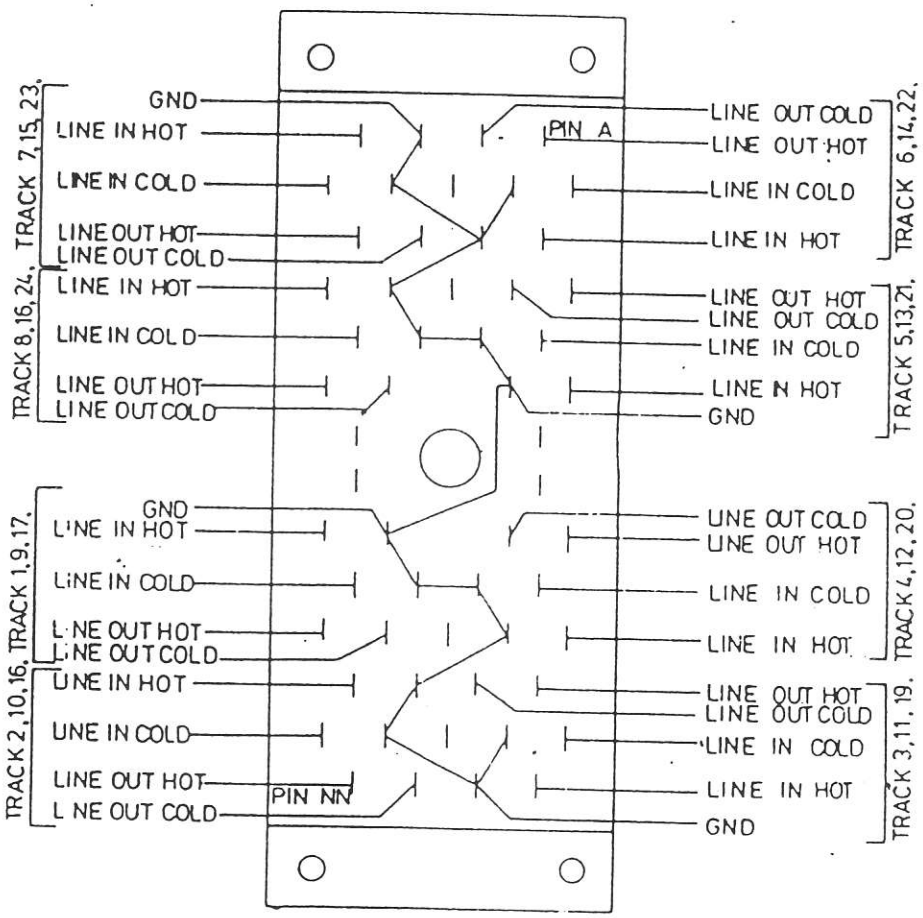
A suitable connector for the country of use should be attached to the cable and fitted with a 5A fuse for 200 - 240 volt operation or a 10A fuse for 100 - 120 volt operation.

CHECK THE ORIENTATION OF THE INPUT VOLTAGE SELECTOR ON THE POWER SUPPLY FRONT PANEL.

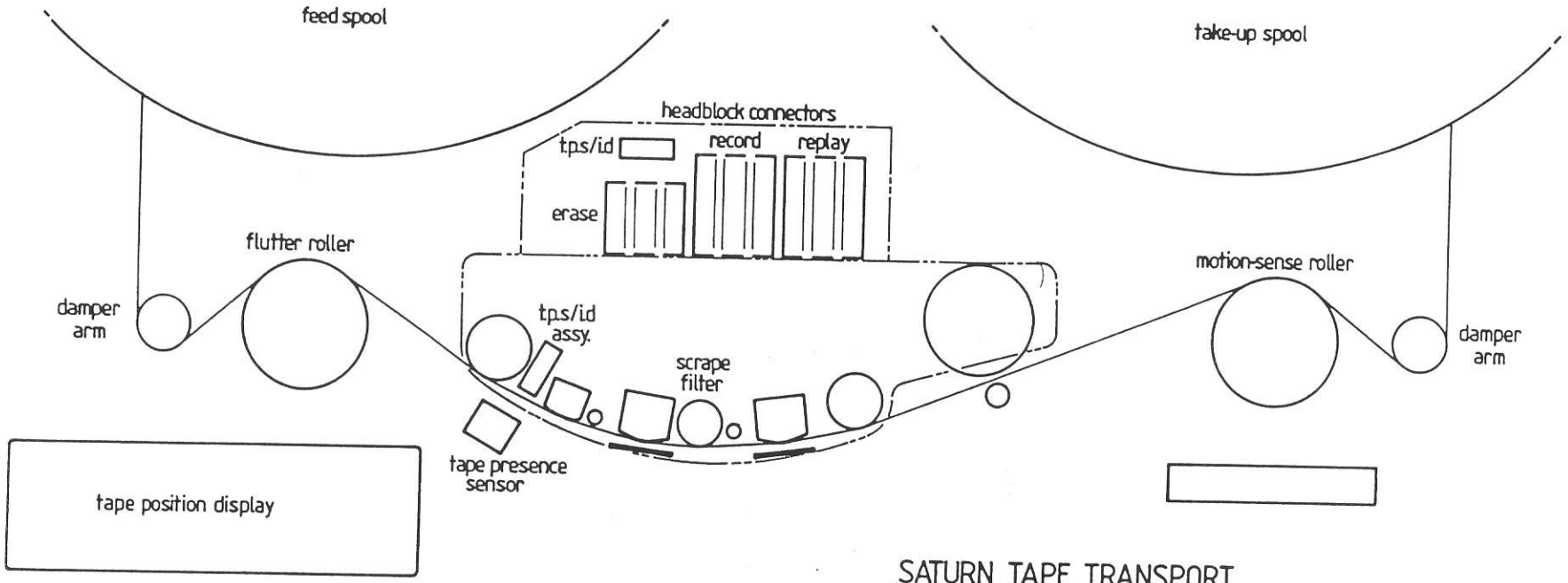
This is located behind a cover plate at the right hand side of the unit.

The mains switch is located on the Power Supply front panel at the right hand end. Only turn on the power after checking the fuses and voltage selector.

VIEWED FROM SOLDER PIN SIDE OF
FREE CONNECTOR



VARELCO WIRING
BALANCED IN-OUT



SATURN TAPE TRANSPORT

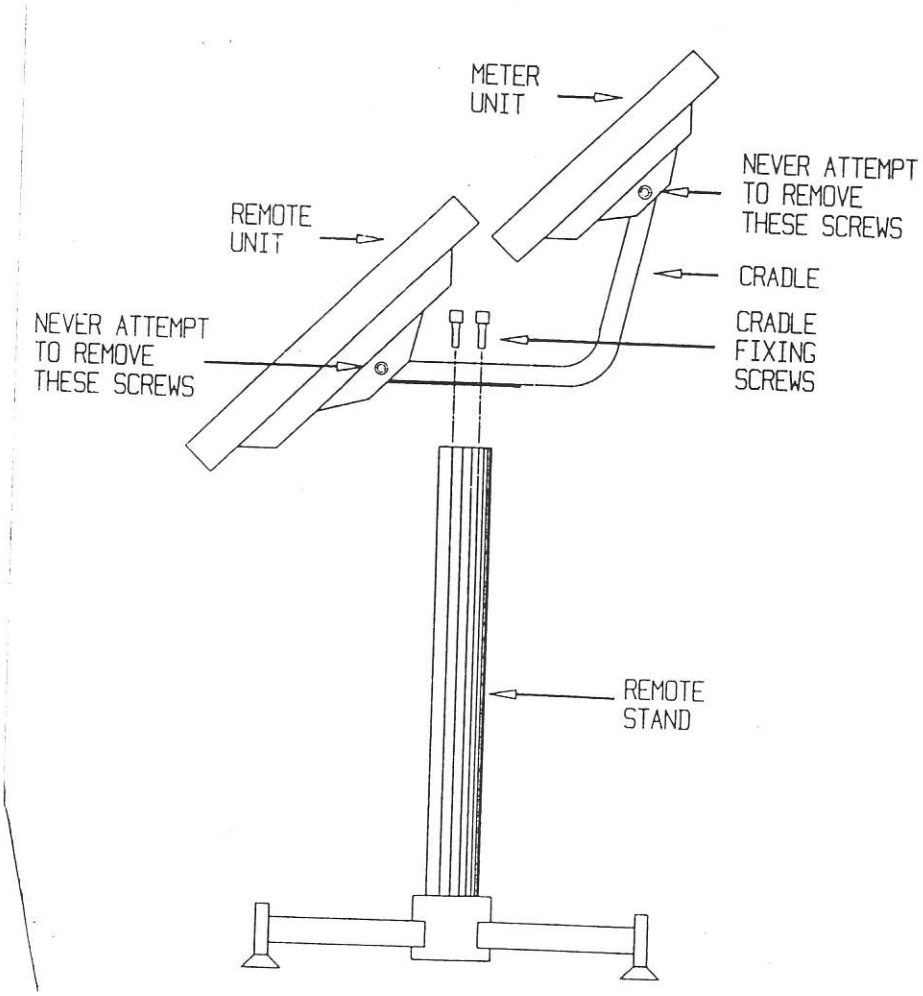
1.3 Connecting the Equipment together

a) The remote control unit connects to the recorder via one of the slots in the "auxilliary rack" at the rear of the recorder. The correct socket is marked 'remote' and is readily identified by the large terminal fitted next to the multiway connector. Attach the ground wire of the remote cable to this terminal and to the 'spade' terminal on the remote unit itself.

b) The remote metering module is separately connected to the machine via a 37 way cable to the "auxilliary rack". make sure that this cable is connected to the socket marked "Remote meters".

c) If the recorder is fitted with a meter overbridge, remove the unit from the mounting struts by undoing the four bolts. The unit is then re-assembled the correct way up by the same four bolts. Connect the male flying lead to the socket marked "local meters" and the female flying lead to the socket marked "meter LE.s".

d) If the recorder is fitted with any other modules in the "auxilliary rack" then refer to the appropriate section of the manual for connection details.



1.4 Audio

All audio ins and outs are available on the rear panel. Both 3-pin XLR and Elco muticore connectors are provided.

The connections are the same with or without the transformer balancing option fitted.

PIN 1 - 0V

PIN 2 - Line out (cold)

PIN 3 - Line out (hot)

The connections for the Audio multicore system are shown opposite.

1.5 Earthing

A series of links are fitted to the recorder to allow you to select whether the XLR pin 1's are connected to audio 0v. or to chassis earth. These are factory set to audio 0v. You can access these links by removing the four screws holding the rear panel closed and swinging open the rear door. The links are located on the connector mounting PCB's fitted to the rear door itself. Each link affects two audio tracks.

A switch is also provided on the power supply front panel (behind a cover plate) which connects/disconnects the Saturn's main "star point" to chassis ground.

The chassis is always connected to the mains earth via the power cable.

2. Tape Loading and Unloading

2.1 Lacing the machine.

Make sure when handling the tape away from the recorder that 'LOAD' mode is selected. This is indicated by the STOP switch and the LOAD switch being illuminated.

Note that the Saturn is not able to distinguish the difference between spool hubs. If you are using a 14" reel of tape, you must use a 14" empty as well, so that the tension control system stays in balance

a) Locate the spools on the reel hubs and ensure they are properly seated by rotating the hub caps counter-clockwise until the spools drop into place. Lock in place by tightening the hub caps in a clockwise direction.

b) Lace the tape. A diagram of the correct tape path is shown opposite.

c) Pressing 'STOP' or 'LOAD' keys will now apply tension to the tape.

d) If you are loading a tape which has been stored 'tail out', and the last reel was spooled off 'tail in' then some creeping of the tape will occur when tension is applied. This will stop when the tension control system has aquired enough information to update itself.

e) If the message 'TENSION ERROR' appears in the alignment panel display then pull the tape, at fairly constant speed, through the correct tape path enough to provide at least five turns of the motion sense roller. This gives the microprocessor sufficient information to apply correct tape tension.

After a short delay the 'TENSION ERROR' message will clear and be replaced by '** Ready! **'. If the message is not removed at the first attempt repeat the procedure. If the 'TENSION ERROR' message has still not been cleared consult qualified service personnel.

2.2 Unloading the tape.

a) To remove tape from the recorder, press 'LOAD' to cancel tape tension.

b) To unlock the retainers, rotate them in a counter - clockwise direction until the spools can be lifted off the recorder.

3. Description of Machine controls.

This section explains the functions of the machine's controls and keys:-

3.1 Local keys:

- 3.1.1 Transport functions.
- 3.1.2 Seven segment display.

3.2 Remote Control Unit:

- 3.2.1 Monitoring controls - monitor switching and muting.
- 3.2.2 Safe/ready/record control
- 3.2.3 Tape position and locator displays
- 3.2.4 Autolocator.
- 3.2.5 Programmeable function keys.
- 3.2.6 Varispool and Varispeed.

3.3 Alignment Panel:

- 3.3.1 Housekeeping display
- 3.3.2 Test oscillator controls.
- 3.3.3 Tape speed, EQ and tape type controls.
- 3.3.4 Alignment and bias controls.
- 3.3.5 Function key editing.
- 3.3.6 Mode control
- 3.3.7 Unlocking the keyboard.

For ease of use certain key sequences are considered in more than one section. Some of the keys have more than one function. To access these functions special key actions are required :-

(a) Double key routines (KEY1+KEY2)

Some machine features require two keys to be held down together.

(b) Repeated press routines (KEY//KEY)

Some keys, when pressed twice within about half a second, will activate a 'repeated press' function. Features initiated by a 'double press' will be shown by (KEY//KEY).

(c) Shifted key routines ^(KEY)....(Alignment panel only)

Pressing the alignment panel SHIFT key turns the SHIFT LED on and off. When the SHIFT LED is on all other keys have a second function. A shifted key function will be denoted as ^(KEY).

3.1.1 Transport control functions.

<< SPOOL LEFT

Activates fast rewind. Machine will go into STOP when close to the end of tape. Continuously holding the key will cause the tape to run off at full wind speed. Pressing the spool key after the machine has stopped near the end of tape will cause the tape to run off at low speed.
Operational in all modes except 'Load' and 'Dump'. Speed limited to 300 ips (or user selected speed up to 400 ips, see Varispool).

REWIND to STOP mode is indicated by the illumination of the REWIND key.

<< (SPOOL LEFT//SPOOL LEFT)

Repeating the << SPOOL LEFT key activates fast rewind as above. However when nearing the end of the tape the machine will slow down to 50 ips and wind off, instead of stopping.
REWIND OFF mode is indicated by a flashing REWIND key.

>> SPOOL RIGHT

Activates fast forward and stops near the end of the tape. Otherwise as SPOOL LEFT above.
FAST FORWARD to STOP mode is indicated by the illumination of the FAST FORWARD key.

>> (SPOOL RIGHT//SPOOL RIGHT)

Activates fast forward wind and winds off at 50 ips. Otherwise the same as repeated SPOOL LEFT above.
FAST FORWARD OFF mode is indicated by a flashing FAST FORWARD key.

> PLAY

The pinch roller is not engaged until the tape is at the correct speed.
The PLAY key will cancel RECORD mode
If the machine is in EDIT mode then DUMP EDIT is entered.

[] STOP

Tape brought to rest and held under tension.
If previously in LOAD mode, pressing the STOP key will cause the machine to take in a small amount of slack tape. Pressing the STOP key again will pull more tape in until there is no slack tape left and the machine will hold the tape under tension.
STOP mode is indicated by the illumination of the STOP key.

O RECORD

When the machine is in EDIT mode (see below) the record key activates a spot erase function. As long as the key is held down, any tracks selected to 'ready' will have the erase head energised.

(O+>) (PLAY+RECORD)

Puts those channels selected to 'ready' into record. RECORD mode is entered. The lamp will flash until pinch roller is engaged.
RECORD mode is indicated by the continuous illumination of both the PLAY and RECORD keys.
When not in RECORD mode, rapid flashing of the record lamp indicates that tracks have been selected to 'ready'

LOAD

Bistable action key:-

1) When tape has tension on it, pressing LOAD key will put the machine into LOAD mode and remove all tension from the tape.

2) When the machine is in LOAD mode, pressing the key will pulse the motors. If the machine succeeds in winding in all of the slack tape, it will hold the tape under tension and go into STOP mode.

LOAD mode is indicated by the illumination of both the STOP and LOAD switches.

EDIT

a) EDIT mode is the same as STOP mode except that lifters are defeated and extra tension is applied to the tape.
All tracks are made "Safe" on entry to edit mode.

EDIT mode is indicated by the illumination of the EDI key and a flashing STOP key.

EDIT mode 'inching' is possible using the varispool left and right keys on the remote. These allow the user to move tape in either direction at speeds of up to 100 ips.

(b) "Spot Erase" is enabled in EDIT mode. Channels can be selected to "ready" and will provide erase current as long as the RECORD button is held. Note that the tape should continue moving as you release the RECORD button in order to avoid clicks on the tape.

(c) If the machine is spooling, the EDIT key acts as a lift defeat facility. Tape speed is reduced to three times play speed, tape lifters are dropped and muting cancelled.

(d) DUMP EDIT

Pressing the PLAY key while in EDIT mode immediately engages pinch roller and back tension. Take up motor remains unpowered.

(e) When the Saturn is in PLAY mode, the EDIT key acts as a head screen defeat facility. This can be used to examine the tape path.

RTZ

Return to zero. Self explanatory.

If local zero (see remote conrol unit) is active, then RTZ will return to the local zero position.

Selecting play whilst in RTZ causes play mode to be entered after the zero point is reached. Any other mode overrides RTZ.

RTZ mode is indicated by the illumination of the RTZ key and flashing wind keys.

(RTZ//RTZ)

A double press of the RTZ key instigates the 'return to play' (RTP) mode and causes the machine to return to the last position where the pinch roller engaged.

Selecting PLAY whilst the machine is in RTP (return to play mode) causes the machine to enter PLAY on reaching the last known PLAY position.

Pressing the RTZ key when the machine is in RTP causes it to revert to RTZ.

RTP mode is indicated by the illumination and flashing of the RTZ key.

NOTES ON TRANSPORT OPERATION

1. With two exceptions LOAD mode (i.e. no tension) is automatically entered when either there is no tape in front of the tape sensor on the headblock or either of the damper arms indicates too much or too little tension.

The two exceptions are EDIT mode (where the machine will only exert (editing) tension if it believes the tape to be correctly laced across the headblock) and DUMP mode (where the tension arm sensors have no function). Tension can be reapplied by selecting STOP or LOAD controls until the tape is correctly laced.

2. Tape tension is continuously calculated from reel diameter. Loss of valid information to perform this calculation causes removal of all tension and LOAD mode to be entered. STOP mode is entered when valid reel diameter is calculated. This can be achieved by passing enough tape to cause at least five revolutions of the motion sense (right hand) roller.

3.1.2 SEVEN SEGMENT DISPLAY

The eight character display mounted on the transport above the transport control switches is an exact copy of the tape position display on the remote control unit. Current tape position is always displayed in hours, minutes and seconds. The 'CLEAR' button adjacent to the display resets the tape position to either master or local zero dependent on current selection.

The 'frames' digits are only available when the time code reader option is fitted.

3.2 REMOTE CONTROL UNIT

3.2.1 Monitor control section

LINE

Monitor select. Selects input monitoring. No muting occurs on input monitoring.

SYNC

Monitor select. Selects sync monitor. The automatic muting system will select input monitor whenever the recorder is not in PLAY or when a channel is selected to "ready". If mute defeat is selected then only selecting a channel to "ready" will provide this facility.

REPLAY

Monitor select. Selects replay monitoring. When the recorder is not in PLAY all tracks selected to replay are muted. If mute defeat is selected then this facility is disabled.

SOLO

Monitor control. Enables selected tracks for monitoring with all other tracks muted. This control has a bistable action (push on / push off).

MUTE DEFEAT

Monitor control. This control has a bistable action and enables / disables the automatic muting functions (see above).

ALL

Monitor control. This control has a bistable action. When ALL is active (led on) then all tracks will follow the monitor selection keys above. When ALL is not active then the monitor track select ke, become active.

MONITOR TRACK SELECT (1-24)

Monitor select. If SOLO is selected then these controls will select / deselect tracks for solo operation. If neither ALL nor SOLO are active (leds off) then these controls put the appropriate track into the condition indicated by the monitor select keys above.

MONITOR LED DISPLAY (1-24)

The led matrix shows the monitor condition of every track.

Green - replay monitor
Flashing green - muted replay monitor
Orange - sync monitor
Orange + flashing red - sync monitor selected - muted to input monitor
Red - input monitor

N.B. When a 16 track headblock is fitted to the recorder, tracks 17-24 are not displayed and their control buttons are disabled.

MONITOR SELECT MEMORIES (1-4)

Monitor select. To the right of the monitor condition display leds are four monitor setup memories. These are controlled by the store and recall buttons (see below). The led for each switch indicates:

led off - memory empty
led on - memory contains a valid setup
led flashing - this memory is currently being used.

STORE

Followed by a memory number will save the current monitor status in a memory.

1 - 4

Pressing one of the memory select keys by itself will bring back the saved monitor status from memory.

3.2.2 Safe/ready/record control

READY SELECT (1-24)

Arm/disarm the channels for recording.
When a track is "safe", the ready control toggles the track between "safe" and "ready".
When a track is in "record", the ready control toggles the track between "record" and "unready" (ready to punch out).

RECORD UPDATE

Provided that the recorder is selected to record mode, a single hit on the RECORD transport switch will transfer all tracks selected "ready" to punch in, and all tracks selected "unready" to punch out.

ALL SAFE

Cancels all record or ready selections.
On some recorders this button is marked "RECALL" or "CLEAR"

3.2.3 Tape positon and locator displays

The tape position display always shows the current tape position.

LOCAL

Changes the displayed position to show the distance from the last selected local zero. The actual tape positon of locator memories are unaffected. Pressing this control again reconverts the display to show master tape position.

POS(ITION) CLEAR

Sets the current tape positon to zero. If LOCAL zero is currently selected then the present tape position is defined as the local zero and master tape position is not changed.

The locator display shows tape positions entered from the number keys, recalled from memory or transferred from the position display.

LOC(ATOR) CLEAR

Clears the locator display to zero

TRANSFER KEYS

Copy the contents of one display to the other in the direction of the arrows. When capturing tape positions from the position display to the locator display for subsequent storage, up to three transfers can be made without storing each time. (see also STORE control below)

3.2.4 Autolocator

a) **Number entry**

If no locator function is active, numbers can be entered from the number keys directly into the Locator display. Numbers are left shifted calculator style into the display. If no number key is entered for several minutes then key entry will re-start at the least significant digit.

b) **CLEAR LOC(ATOR)**

Clears the locator display to zero.

c) **STORE n**

Stores the current contents of the locator display into the selected (one of ten) memory location.

If the number had been transferred from the tape position display and other tape positions had been transferred without being stored then the STORE led stays on and the next location is brought up into the locator display. This can be stored by simply pressing a new memory number. The STORE led is extinguished when all positions have been stored or the STORE button is pressed again.

The led's associated with the number keys indicate:
led off - memory contains master zero. This memory is considered "empty".
led on - memory contains a valid tape position.
led flashing - memory is currently being acted on by the autolocator.

d) **DISPLAY n**

Displays the current contents of the selected memory location in the locator display.

e) **DISPLAY//DISPLAY**

Recalls the latest locator target if it has been overwritten by number entry or position transfers.

f) **+ (PLUS)**

When entering numbers into the locator display, this key converts the display to a positive value
When used with a LOCATE command (see below) an offset to the target location can be entered.

g) **- (MINUS)**

When entering numbers into the locator display, this key converts the display to a negative value
When used with a LOCATE command (see below) an offset to the target location can be entered.

h) **UNTIL**

Allows the autolocator memories to be used in conjunction with play and record modes. 'Play' 'Until' '7' will stop the tape when it reaches the position stored in memory 7.

i) LOCATE

Prepares the autolocator to do a locate function. Used in conjunction with the number keys and the 'GO' button (see below).
A typical operation might be:

'locate' '4' 'GO'.....or
'locate' '3' '-' '1' '0' 'GO'....or
'locate' 'display' 'GO'

to move the tape to memory 4 or 10 seconds ahead of memory 3 or to the position currently in the locator display.

If the locate button is pressed in error then it is cancelled by a second press.

j) CYCLE

Prepares the autolocator to do a cycle function. Used in conjunction with the number keys and the 'GO' button (see below).
A typical operation might be:

'cycle' '3' '4' 'GO'

to repeatedly play over the section of tape between memories 3 and 4.

If the cycle button is pressed in error then it is cancelled by a second press.

Two of the illuminated switches are associated with the autolocator.

k) GO

All locator commands are executed using the 'GO' button. No tape motion will occur until this button is hit.

If the 'GO' button is used without any other locator command, then a locate - display operation will occur.

l) (GO//GO)

A double press of the GO key instigates "SHUTTLE" mode. The machine locates to the number in the locator window and plays up to the point where GO//GO was pressed. This cycle is repeated until cancelled

m) RTZ

Return to zero. Self explanatory.

If local zero (see above) is active, then RTZ will return to the local zero position.
Selecting play whilst in RTZ causes play mode to be entered after the zero point is reached. Any other mode overrides RTZ.

RTZ mode is indicated by the illumination of the RTZ key and flashing wind keys.

n) (RTZ//RTZ)

A double press of the RTZ key instigates the 'return to play' (RTP) mode and causes the machine to return to the last position where the pinch roller engaged.

Pressing the RTZ key when the machine is in RTP causes it to revert to RTZ.

RTP mode is indicated by the illumination and flashing of the RTZ key.

3.2.5 Programmeable function keys

This powerful facility allows you to store in memory sequences of up to 32 keypresses for automatic execution. Any key on the recorder can be programmed into these keys.

There are three such keys available. Each one has four operations associated with it; programming, editing, displaying and execution.

PROG f

Starts/stops the programming operation. One of f1,f2,f3 should be pressed to select which key to program. If 'prog f' is pressed again immediately then the selected function key is cleared.

Once 'prog f' is selected then any key pressed is stored in the appropriate buffer. Whilst in this mode the recorder does not repond to any key except 'STOP' which automatically cancels the programming operation.

When you have finished entering keys into the buffer, pressing 'prog f' again terminates programming.

EDIT f

Starts/stops the editing operation. One of f1,f2,f3 should be pressed to select which key to edit. While editing the function keys any key pressed is stored in the appropriate buffer at the current function key cursor position. (see Alignment panel 'function key editing').

Whilst in this mode the recorder does not repond to any key except 'STOP' which automatically cancels the editing operation.

When you have finished altering the buffer, pressing 'edit f' again terminates editing.

Display - f1/f2/f3

Using the autolocate 'display' key followed by one of the f-keys will allow you to view the contents of the buffer without risk of changing its contents. (See Alignment panel 'function key editing').

f1/f2/f3

Pressing one of the function keys without preselecting any of the above operations will cause the recorder to execute the keys contained in its buffer.

A typical session might consist of:

[prog f] [f1]	start programming f-key 1
[ready 1] [ready 2] [ready 3]	with three ready buttons
[prog f]	finish programming f1
[prog f] [f2]	start programming f-key 2
[locate] [1] [go]	go to memory 1
[play] [until] [2]	
[f1]	put record ready's on
[record] [until] [3]	
[f1]	turn ready's off
[f2]	go back and do it again
[prog f]	finish programming f2
[f2]	execute all of the above

See also section 3.3.5 - Function key editing

3.2.6 Varispeed and Varispool

VARISPOOL IN/OUT

(a) Normal operation - variable speed wind.
When selected, operates tape lifters, disengages pinch and maintains current tape speed. Left/right buttons can then accelerate/decelerate the tape.
VARISPOOL mode is indicated by the illumination of the IN/OUT LED and the flashing of both wind lamps.
When exiting varispool mode by pressing this button again the transport returns to its previous mode.

(b) Selecting USER WIND SPEEDS
Pressing the locator '[STORE]' button twice while in varispool mode allows the user to change the spooling speed from the default value of 300 ips.

(c) In EDIT mode the varispool left and right keys move tape in the appropriate direction at three times play speed until left/right key released. The tape will remain in contact with the heads. This is referred to as 'inching'.

VARISPEED

Enables/disables the variable play speed control at the right hand end of the remote unit.
Varispeed is overridden by an EXTERNAL SERVO REQUEST from any device connected to the (optional) synchroniser interface.
Varispeed is deselected by going into LOAD mode.
Varispeed is allowed in reverse play mode.

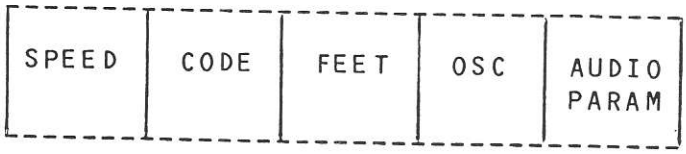
3.3 ALIGNMENT PANEL

3.3.1 Housekeeping display

A sixteen digit LCD display is provided on this unit to give the user information about machine status. Various messages will appear in this display to warn you about error conditions and incorrect operations.

Otherwise the display is controlled by the....

Display control keys.



SPEED Pressing the speed key converts the digital readout to show tape speed in ips. In PLAY mode the display normally shows selected speed, in varispeed and all other modes true tape speed is displayed.

The left hand side of the display indicates the current capstan status.

e.g.

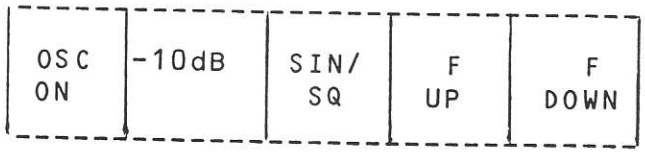
L INT/F indicates - servo phase locked and on internal frequency control.
? EX/V indicates - servo out of lock and on external voltage control.

N.B. if the capstan servo is not in phase lock then the machine will refuse to enter PLAY mode

3.3.2 Oscillator control

The Test oscillator is designed for use in checking and aligning the machine. Although the signal levels are accurate it does not provide a high quality sine wave.

When connected the test oscillator disables the normal inputs from LINE IN. Since this can be dangerous, the operation of the test oscillator requires the alignment panel keyboard to be unlocked (see below).



OSC ON

Turns on the built in test oscillator and connects its output to all audio channel inputs. If an external test oscillator has been connected, you must use this key to connect it to the audio channels. Normal line inputs are disconnected.

-10dB

LED on indicates that oscillator output is attenuated by 10dB. The switch has bistable action and operates on sine and square wave signals. When the oscillator output is in the low level condition the meter amplifier gains are boosted by 10dB.

This control can be used in normal recorder operation to raise the meter indications by this amount.

SIN/SQUARE

Converts the internal oscillator to provide a square wave output.

F UP / F DOWN

Selects one of sixteen frequencies from 20Hz to 25kHz. Note that only the 10kHz output has an accurate frequency (for bias adjustment). The remainder are only guaranteed to be within 10%. An external generator should be used if other accurate frquencies are required. This can be connected via a 1/4 inch jack socket on the audio control card located at the left hand end of the audio rack.

CODE

Sets the display to show the value being seen by the (optional) time code reader card

FEET

Displays the current tape position as a physical length of tape from the current zero point

OSC

Sets the display to show the current status of the built-in test oscillator. Information is given about frequency, waveform and signal level. (See 3.3.2 - oscillator controls below.)

AUDIO PARAM

Allows the value of the current channel adjustment parameter to be held in display. This value is a hex(adecimal) digit between 00 and FF and is only used as a rough guide to the relative settings of the audio system. The value displayed relates to the currently selected tape speed, equalisation standard and tape type. Typical displays might be...

Ch01 REP HF 76 ... channel 1 - replay HF setting
ALL PHASE 8A ... all tracks - phase compensation.

Value shown is only applicable to the last track viewed.

See Section 3.3.4. and section 4 - audio adjustment - below

3.3.3 Speed and EQ. selection.

REV PLAY	7.5	15	30	TAPE 1	TAPE 2
	IEC	NAB	AES	TAPE 3	TAPE 4

REVERSE PLAY

Reverses the direction of capstan rotation. All transport controls (except record) remain fully operational (including CYCLE).

7.5/15/30

Transport speed select. Automatically brings in a new set of audio parameters and switches the headpeaking capacitors. When changing speed, the eq. last used at that speed is selected automatically:-

N.B.
(a) Speed selection cannot be changed in PLAY or RECORD
(b) Changing speed automatically deselects varispeed).

To select other eq's use -

NAB/IEC/AES

Equalisation standard select. Brings in a new set of audio parameters. Switch labelling is arbitrary and each combination of speed and eq. can be adjusted as required.

OBS!

TAPE 1 - TAPE 4

Allows one of four different record amp / bias settings for each combination of speed / eq., facilitating the interchange of tapes between sessions.
N.B. Replay / sync alignment is unaffected.

3.3.4 EQ. & bias adjustment

Each set of speed/EQ selections can be aligned independently by the operator. None of these keys are normally active, but must be 'unlocked' to allow adjustment (see below).

The procedures for alignment are covered in detail, with examples, in chapter 5, here we will deal only with the function of the keys themselves.

CHAN UP	CHAN DN	AUTO	MASTER	REP	SYNC	REC	BIAS
UP	DOWN	STORE		LF	GAIN	HF	PHASE

[CHAN UP]/[CHAN DOWN]

Selects which channel to adjust.
When stepping 'up', channel 24 steps to channel 1 and vice versa for stepping down.

[MASTER]

Selects / deselects all tracks to be adjusted together.
When 'master' is selected, 'auto' is automatically deselected.

[AUTO]

Enables / disables automatic stepping between channels.
When 'auto' is selected, 'master' is automatically deselected.
When 'auto' is selected, each press of the 'store' button (see below) moves the adjustment on to the next channel as if 'chan up' had been pressed.

[REP]/[SYNC]/[REC]

Selects which one of selected channel's three amplifiers to adjust.

[LF]/[GAIN]/[HF]

Selects one of the three parameters to adjust for the selected amplifier.

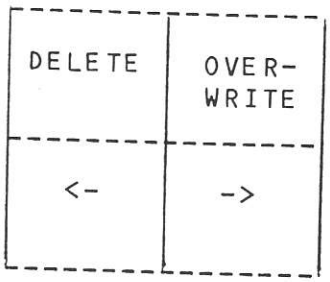
3.3.5 Function_key_editing

These keys become active when one of 'display'- fkey or 'edit'- fkey has been selected from the remote control keyboard.
In these circumstances the "housekeeping" display will show the current contents of one of the programmeable function keys. If 'edit - fkey' has been selected then the contents of the function key buffer may be changed.
A typical display might be .....

[Record f1/15]
....step 15 of function key 1 is "record"

OR

[f3 f2/10]
....step 10 of function key 2 is "do function key 3"



<- (move down)
Moves the display towards the beginning of the function key buffer.

-> (move up)
Moves the display towards the end of the function key buffer.

DELETE
Removes the currently displayed command from the function key buffer.

OVERWRITE
Toggles between 'insert' and 'overwrite' editing mode. The normal editing process inserts new commands into the function key buffer. When 'overwrite' is selected, the currently displayed command is replaced by a new keypress.

[BIAS]

Automatically cancels REP/SYNC/LF/HF/GAIN and selects the channel's bias preset for adjustment.

[PHASE]

Automatically cancels [REP]/[SYNC]/[LF]/[HF]/[GAIN] and sets REC LED. This parameter can only sensibly be adjusted with the aid of an oscilloscope, to produce best symmetry on the rising and falling edges of a square wave.

[UP]

Increments the selected parameter towards FF hex. This key has a key repeat feature (i.e. it will continue incrementing whilst the key is held).

Attempting to adjust a parameter which is not being monitored at the time is not allowed and will activate a warning beep.

[^(UP)]

Sets the selected parameter to maximum (i.e. FF hex).

[DOWN]

Decrements the selected parameter towards 00 hex. Otherwise the same as [UP] above.

[^(DOWN)]

Sets the selected parameter to minimum (i.e. 00 hex).

[STORE]

Puts the current setting of the currently selected parameter into memory.

The value is stored under the current selection of speed, eq and tape type.

3.3.6 Mode_control

RESET	TIMING DEFEAT
MODE	SHIFT

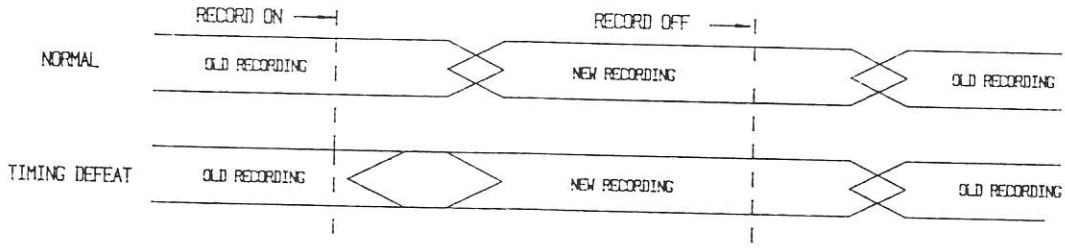
MODE

Switches the remote control unit's position and locator displays to show their current values in 24 hour or +/- conventions. This allows the recorder's internal displays to conform to SMPTE time code standards.

e.g. -00:00:10 (hrs/mins/secs) is converted to.....
23:59:50
(frames digits are only displayed if the recorder is fitted with a code reader.)

TIMING DEFEAT

Enables / disables the punch in timing of the bias and erase ramps. When timing defeat is active, these ramps are not separately timed when punching in. This permits a fast punch in response at the expense of a section of twice recorded tape. Punch out timing is not affected, so gapless operation is always assured.



SHIFT

Enables a second function on keys where this has been defined. e.g. SHIFT-UP as above.

If the shift key is pressed accidentally, it can be deselected with a second press.

^ RESET

This key is only defined as a 'shifted' function. It has no effect when pressed by itself.

'Shift reset' should only be used as a weapon of last resort after a software crash. It provides a complete re-initialisation of the system memory.
Noticeable effects include

All locator memories cleared
All monitor memories cleared
All function key definitions cleared
Wind speed reset to default (300ips)
15 ips / NAB / tape type 1 selected
Spool motor tension reset. No transport operation is permitted until the motion sensing system has provided enough information to recalculate the spool sizes.
Line input monitoring is selected.

Audio channel data is not affected.

3.3.7 Unlocking the keyboard

All of the keys on this keyboard (with the exception of the speed / eq / and display selection keys can be locked out by a simple key sequence. The lock is there to protect the operator's audio parameter settings from accidental alteration.

Most of the key routines above require the keyboard to be unlocked. Locking/unlocking the keyboard is achieved by using:-

PHASE/SHIFT

The key sequence is:

Press (and release) - SHIFT	-shift led comes on
Press (and hold) - PHASE	
Press (and release) - SHIFT	-shift led goes off
Release - PHASE	

After initial powering up, the keyboard is always in the "locked" condition.

4. Audio Alignment

4.1 Overview

The Saturn multitrack is capable of running at any of three tape speeds whilst operating to any of three EQ standards. Obviously it would be unreasonable to expect the user to readjust the machine every time the speed or EQ were changed. A separate preset for each of the above combinations would overcome this drawback but a large number of them would be needed. Arranging these ergonomically, without compromising performance is not an easy task. Clearly a new approach was needed.

The Saturn in effect has one set of preset adjustments but controlled digitally and the settings required for all possible combinations are saved in the computer's memory. This has several advantages.

A) Since access to presets is not required the signal path can be optimised for performance.

B) The replay signal path can be simplified by using a common amplifier and readjusting its characteristics for replay or sync.

C) It is now practical to store record/bias settings for several tape formulations.

D) It is far easier to align the recorder sitting comfortably in a chair pressing a few buttons than crouching on the floor with a screwdriver straining to see the meters.

E) It is now possible to install automatic alignment features.

4.2 Line Level Adjustment

Presets are retained for this adjustment and are located on the front of each audio channel.

Note that the Saturn line levels are factory set to

+4dBm in = OVU = +4dBm out

However if adjustment is needed - proceed as follows;

LINE INPUT LEVEL adjust

A) Ensure that the recorder is correctly connected to the mixing console, see section 1.3 if in any doubt, and that recorder power is on.

B) Slate a 1kHz tone to the group outputs of the mixing console at your reference level, eg +4dbm, make sure to Dim or Mute the studio monitoring just in case.

C) Using the Saturn Remote, select ALL LINE(INPUT) monitoring and ensure that the internal oscillator is OFF. Signal should appear on all recorder level meters. If the meter overbridge option is fitted it is better to refer to them for the rest of this operation.

D) Open the front doors on the recorder. The top rack of printed circuit boards are the audio channels. Locate the preset marked IN, (VR2) on track one and, using a suitable trimming tool, adjust it so that track one level meter shows OVU. Repeat for all remaining tracks.

Then for LINE OUT adjust ;

E) Set the mixing console to show multitrack return level on the console meters.

F) Locate the preset marked OUT, (VR3) on the front of track one and, using a trimming tool, adjust it so that the appropriate console level meter shows OVU. Repeat for all remaining tracks.

G) If the input level controls have been changed from the factory settings then the internal oscillator may also need adjustment (see section 4.6 below)

4.3 Replay/Sync adjustments

The replay/sync chain should normally be adjusted with reference to a commercially produced audio alignment tape. It is also common studio practice to align to the tones at the head of an imported master tape (which already has tracks laid down by another recorder).

4.3.1 Using an alignment tape -

A) With the recorder power turned off, demagnetise the tape heads and tape path components. This should already be part of daily studio practice.

B) With recorder power turned on check that NO tracks are in RECORD READY. Then load the alignment tape onto the recorder and select audio monitoring to ALL REPLAY (or SYNC). Remember it is not possible to adjust an audio parameter if the monitoring is inappropriate.

C) Select the correct tape SPEED and EQ for the alignment tape in use (e.g 30ips AES). It helps if you are familiar with the test tape and can store useful tone positions into the autolocator memories.

D) Check that the replay/sync heads are correctly aligned for AZIMUTH. Using a dual beam oscilloscope, replay the AZIMUTH alignment section of the tape and compare the phase difference between tracks 1 and 24, then 1 and 23,22,21 etc. Phase errors should be equally scattered about zero. If not, adjust the appropriate azimuth set screw until the best phase scatter is obtained.
If you have had to make any adjustment here then the phase difference should be checked at a number of (lower) frequencies.

E) Unlock the alignment keys, see section 3.3.15, and select REP (or SYNC) then GAIN. Select the housekeeping display to AUDIO PARAM. Replay the reference level section of the alignment tape and adjust for correct replay level using the "Adjustment Method" of section 4.4.
The table below shows the correct Saturn meter reading for various test tape signal levels.

		Test tape reference fluxivity (nWb/m)				
		180	200	250	320	510
Desired Operating fluxivity	180	0VU	+1VU	+3VU	+5VU	-
	200	-1VU	0VU	+2VU	+4VU	-
	250	-3VU	-2VU	0VU	+2VU	+6VU
	320	-5VU	-4VU	-2VU	0VU	+4VU
	510	-9VU	-8VU	-6VU	-4VU	0VU

F) From the alignment panel select REP (or SYNC) then HF. Replay the frequency response section of the alignment tape.
Whilst replaying tones between the highest available and about 4kHz adjust all tracks for optimum flatness using the adjustment techniques of section 4.4.
If this section is not at a suitable level (some tapes have a low level frequency response section) it might help to select -10db on the oscillator section of the alignment panel as this boosts the gain of the meters by 10db. In extreme cases, you will have to use external or mixing console metering.

G) From the alignment panel select REP/SYNC then LF. Whilst replaying tones between 500HZ and the lowest available adjust all tracks for optimum flatness using the techniques described in section 4.4.

4.3.2 Alignment to programme tones

When aligning replay/sync using the tones on a master tape, only spot frequencies are available. These are often at frequencies of 10kHz, 1kHz and 100Hz and at the required reference fluxivity.

Use the 1kHZ section to set GAIN as described above.

Use 10kHz to set azimuth and HF as described above.

The 100Hz section could be used to set LF but this is not good practice, particularly if the tones were made on another recorder. All recorders of this type have amplitude ripples at the low frequency end of the spectrum known as the "contour effect". This is a function of the replay head itself and is more significant with higher tape speeds. Therefore one can see that adjusting at one spot frequency could easily produce larger errors than leaving the recorder set to optimum flatness as derived from an alignment tape.

4.4. Adjustment Method

The principles of adjusting the audio system are the same whatever parameter is currently selected.

If the meter readings are completely random then select MASTER then SHIFT DOWN. This will set all tracks to minimum

If the meter readings on all tracks are the same as each other then select MASTER before adjusting. Now all tracks can be adjusted together.

If the meter readings on all tracks are fairly close to the correct setting, select AUTO then use CHAN/UP CHAN/DOWN keys to move to track 1. When the correct setting for a track has been found, by using the UP/DOWN keys, STORE it and the next track will be selected automatically.

If only one or two channels are out of alignment, cancel AUTO and MASTER then use the CHAN/UP CHAN/DOWN keys to get to any track of special interest.

When a setting has been changed, it must be saved in memory by pressing the STORE key. The UP and DOWN leds will remain on until the new setting is stored. If you attempt to move on without storing the new setting a warning "**** STORE ****" message will be displayed. You may ignore this and reselect, but the old value will be restored and the new one discarded.

Notes on the display -

The Alignment Panel housekeeping display, when selected to "audio param" shows the current setting of your adjustment.

The value at the right hand end is only provided to give you an indication of where you are in the range of adjustment available. This is a hex number in the range 00 to FF.

When MASTER is selected the value displayed is that of the last individual track selected and does not necessarily mean that all tracks have that value. If CHAN/UP CHAN/DOWN keys are used "ALL" will be replaced, temporarily, with the new track number. The UP and DOWN keys are still adjusting all tracks.

4.5 Erase/Bias adjustments

The Erasure system is aligned prior to despatch and it is not considered user adjustable. The procedure is complex and should only be performed by qualified service personnel.

The correct bias point for any given type of tape is always a compromise. Maximum sensitivity does not coincide exactly with minimum distortion. For optimum results consult the manufacturer's data sheets. Bias level is usually specified by its effect on the recording of a 10KHz signal. So to set bias for a given tape .....

A) From the alignment panel select the desired SPEED, EQ & TAPE TYPE. Then load a sample of the tape to be biased.

B) Select all tracks to RECORD READY, select REPLAY MONITOR and enter RECORD.

C) Unlock the alignment keys, (see section 3.3.7), select OSC ON, -10db, 10KHz, then AUDIO PARAM and BIAS.

D) Set bias to min ("00"), then increase the bias until a maximum replay signal is reached. Note this value and carry on increasing bias until the reading has dropped by (say) 1.0db. Press the "store" button and repeat for all tracks. The tape is now said to be overbiased by 1db (a typical value for AMPEX 456 at 30ips). Of course make full use of ^UP, ^DOWN, MASTER and AUTO as described in section 4.4.

E) Qualified service personnel may refer to the technical manual for further notes on bias adjustment.

4.6 Record adjustments

A) After setting bias, keep all tracks in record, cancel -10db and select 1KHz & REC GAIN.

B) Whilst monitoring the replay signal of the selected track adjust REC GAIN to give 0VU. Store when correct and repeat for all tracks.

C) Select REC HF and whilst sweeping the oscillator frequency, between 4KHz and maximum, adjust for optimum flatness. Store when correct and repeat for all tracks.

D) Select REC LF and whilst sweeping the oscillator frequency, between 500Hz and minimum, adjust for optimum flatness. Store when correct and repeat for all tracks.

Of course make full use of ^UP, ^DOWN, MASTER and AUTO as described in section 4.4.

4.7 Internal Oscillator

The internal oscillator is located on the AUDIO CONTROL card adjacent to track 1 and should only need adjusting if the audio channel line level adjustments have been changed from their factory settings.

An external signal source may be used if preferred via a standard 1/4 inch jack socket on the front of the card. As adjusted in the factory, an input level of +4dbm is required for OVU.

When the internal oscillator is switched on, a signal plugged into the external input socket will be sent to all tracks simultaneously.

The adjustment procedure is as follows:

a) Check Line in / Line out adjustment as in section 4.2 above.

b) Select OSC ON, OdB and input monitoring

c) Inject a signal of 1kHz at +4dBm (or studio reference level if different) into the external input socket. Adjust "Output Level" for OVU on the recorder meters.

d) Physically disconnect the external signal and check internal oscillator is set for 1kHz SIN OdB. Adjust "Int Level" for OVU on the recorder meters.

e) Select -10db and adjust the "-10dB" preset for OVU on the recorder meters.

f) The other adjustments on the Audio Control Board should only be performed by qualified service personnel.

5. EXTERNAL_INTERFACES.

5.1 Noise reduction control.

The Saturn noise reduction interface consists of a 25 way D-type female connector fitted to an option panel in the rear "auxilliary rack" of the recorder. A standard 25 way D-type plug is required to connect to this port.

The pins are assigned as follows:-

PIN No.	Function.
1.	Channel 1 NR select (ACTIVE LOW).
14.	Channel 2 NR select (ACTIVE LOW).
2.	Channel 3 NR select (ACTIVE LOW).
15.	Channel 4 NR select (ACTIVE LOW).
3.	Channel 5 NR select (ACTIVE LOW).
16.	Channel 6 NR select (ACTIVE LOW).
4.	Channel 7 NR select (ACTIVE LOW).
17.	Channel 8 NR select (ACTIVE LOW).
5.	Channel 9 NR select (ACTIVE LOW).
18.	Channel 10 NR select (ACTIVE LOW).
6.	Channel 11 NR select (ACTIVE LOW).
19.	Channel 12 NR select (ACTIVE LOW).
7.	Channel 13 NR select (ACTIVE LOW).
20.	Channel 14 NR select (ACTIVE LOW).
8.	Channel 15 NR select (ACTIVE LOW).
21.	Channel 16 NR select (ACTIVE LOW).
9.	Channel 17 NR select (ACTIVE LOW).
22.	Channel 18 NR select (ACTIVE LOW).
10.	Channel 19 NR select (ACTIVE LOW).
23.	Channel 20 NR select (ACTIVE LOW).
11.	Channel 21 NR select (ACTIVE LOW).
24.	Channel 22 NR select (ACTIVE LOW).
12.	Channel 23 NR select (ACTIVE LOW).
25.	Channel 24 NR select (ACTIVE LOW).
13.	+24v reference.

An output is active whenever:-

a) The channel is in RECORD or
b) it is selected to 'input monitor'
(ie LINE or SYNC in record).

This module is suitable for switching all non- simultaneous noise reduction systems, and for the new DOLBY SR system.

5.2 Synchroniser Interface.

The parallel synchroniser interface consists of a 25 way D-type male connector fitted to an option panel in the rear "auxilliary rack" of the recorder. A standard 25 way D-type socket is required to connect to this port.

The connections available are listed below. Inputs in section 5.2.1 and outputs in section 5.2.2. The number in brackets refers to the wire number if a flat cable insulation displacement connector is used.

5.2.1 Command inputs require a pull down to ground of 20mS minimum duration. A 4k7 pull up resistor to +5v is fitted to each line inside the recorder. A ground reference is provided.

PIN		
13	GROUND	(25)
10	RECORD	(19)
12	EXT SERVO REQUEST	(23)
14	REWIND	(2)
15	FAST FORWARD	(4)
16	PLAY	(6)
17	STOP	(8)
18	LIFT DEFEAT	(10)
19	UNMUTE	(12)
11	SERVO CONTROL IN	(21)
21	SERVO REF	(16)

EXT. SERVO REQUEST (Pin 12) must be held active whilst external control over the capstan servo is required. When Ext. servo request is released and returns to the high state, control of capstan servo reverts to lower priority (internal) control.

The capstan servo circuitry is able to detect the presence of either external voltage or external frequency signals and will select the appropriate control signal path for itself.

The control voltage / frequency is injected on SERVO CONTROL IN (Pin 11) and referenced to SERVO REF. (Pin 21).

When used with external frequency control the capstan servo will run at selected speed with a frequency of 9.6kHz. A speed variation of +100% and -50% is permissible about this reference using frequencies at TTL voltage levels. Note that voltage swings of less than 4.5v may not operate the servo system correctly.

When used with external voltage control the capstan servo requires a voltage between -12 and +24 for maximum speed range. The input circuit of the servo has 3k6 between the selected control source and +24v.

UNMUTE and LIFT DEFEAT (Pins 18 & 19) unlike the transport commands are not momentary inputs, the required status is only held while the input is active.

UNMUTE will cancel the automatic muting of the audio channel selected for time code (see TEST MODE 15 - section 9.3).

LIFT DEFEAT will slow the tape to 3 times play speed before lowering the tape onto the heads. When the LIFT DEFEAT command is removed, the tape will accelerate back to full wind speed.

The other transport controls are initiated by an active pulse of at least 20 ms on the relevant input. When the input has been accepted it will be acknowledged by a low voltage on the corresponding output line.

It is possible, although not necessary, to assert both PLAY and REC in order to enter record. A 20ms active pulse on REC. will suffice

FAST FORWARD and REWIND will not allow the tape to run at high speed near the ends of the reels. If high speed operation is required in this region then the control input must be held low.

If the FAST FORWARD and STOP inputs are taken low together then the recorder will perform an RTZ operation (to its own zero point). If this operation is repeated within about 0.5 secs, then the recorder will return to the last point in the tape that the pinch roller was engaged.

If the RECORD and STOP inputs are taken low together then the recorder will zero its own position counter at the present tape position.

If the PLAY and REWIND inputs are taken low together then the direction of capstan rotation will be reversed.

5.2.2 Tally outputs are standard TTL output signals, and follow the active low convention. A 5v reference is provided.

2	TACH (30Hz=15ips)	(3)
3	DIRECTION (logic 1=fwds)	(5)
4	EOT	(7)
5	REWIND	(9)
6	FAST FORWARD	(11)
7	PLAY	(13)
8	STOP	(15)
9	RECORD	(17)
20	SPEED1 (not 30 ips)	(14)
22	PINCH (logic 0 = engaged)	(18)
23	SPEED2 (not 15ips)	(20)
24	REPLAY MONITOR	(22)
25	CODE READY	(24)
1	+5 VOLTS	(1)

EOT active indicates that either the tape presence sensor or the tension limit sensors have operated. A STOP command will attempt to re-lace the tape.

If none of STOP, REWIND, FAST FORWARD, PLAY or RECORD tallies are active the recorder is in "LOAD" mode, i.e. no tension. A STOP command will attempt to re-lace the tape.

While the machine is in record mode both the PLAY and RECORD tallies are active.

Nominal capstan speed is indicated as follows:

SPEED1	SPEED2	selected speed
1	1	7.5ips
1	0	15 ips
0	1	30 ips
0	0	invalid

The Saturn maintains a record of the track currently in use for time code. (see TEST MODE 15). The current condition of this channel is indicated to an external device by two additional tallies:
Active REPLAY MONITOR indicates time code is coming from the replay head. Otherwise input or sync monitor is selected.
CODE READY indicates that the time code track is selected to either "record" or "ready to record".

The default time code track is the highest track number in the headblock fitted to the recorder.

5.3 Ready Control Interface

Some modern mixing consoles provide the facility to switch the multitrack recorder between safe and ready (to record).

The Saturn ready control interface provides such a console with all the connections necessary to implement this facility.

For each track on the recorder there is :-

Ready input - active low

If this wire is connected to 0v reference for a minimum of 50 mS, the ready status of the track is toggled. The effect is exactly as if a ready button on the Remote Control had been pressed - see section 3.2.2

Ready output - active low

This wire is connected to an open collector output which is active when a track is either recording or ready to record. A protection diode is provided in the unit, connected to Vref.
Vref is link selectable on the module between +5v and unregulated 12v

ready / not solo - mode select

The function of the above input and output wires can be changed to "solo select" by connecting this line to 0v. A link is provided on the PCB to permanently make this selection if required.

Also provided are three inputs and three outputs to control the monitor condition of the Saturn audio system. One pair of wires is provided for each of input, sync and replay monitor

Monitor input - active low

If this wire is connected to 0v reference for a minimum of 50 mS, all tracks are set to the appropriate monitor state.

Monitor output - active low

This wire is connected to an open collector output which is active when all tracks are selected to the appropriate monitor state.

All the command inputs can be converted to non - momentary action by removing link LK3 on the PCB.

In this case the channel is "ready" (or solo'ed) while the input is active and "safe" (or not solo'ed) when the input is released.

The connector is a 64 way DIN41612 row A&C type and the mating socket is provided with the option card.

The connections are as follows

A32		C32	
A31		C31	replay mon tally
A30	sync mon tally	C30	line mon tally
A29	channel 24 tally	C29	channel 23 tally
A28	channel 22 tally	C28	channel 21 tally
A27	channel 20 tally	C27	channel 19 tally
A26	channel 18 tally	C26	channel 17 tally
A25	channel 16 tally	C25	channel 15 tally
A24	channel 14 tally	C24	channel 13 tally
A23	channel 12 tally	C23	channel 11 tally
A22	channel 10 tally	C22	channel 9 tally
A21	channel 8 tally	C21	channel 7 tally
A20	channel 6 tally	C20	channel 5 tally
A19	channel 4 tally	C19	channel 3 tally
A18	channel 2 tally	C18	channel 1 tally
A17	ready / not solo	C17	
A16		C16	replay monitor select
A15	sync monitor select	C15	line monitor select
A14	channel 24 input	C14	channel 23 input
A13	channel 22 input	C13	channel 21 input
A12	channel 20 input	C12	channel 19 input
A11	channel 18 input	C11	channel 17 input
A10	channel 16 input	C10	channel 15 input
A9	channel 14 input	C9	channel 13 input
A8	channel 12 input	C8	channel 11 input
A7	channel 10 input	C7	channel 9 input
A6	channel 8 input	C6	channel 7 input
A5	channel 6 input	C5	channel 5 input
A4	channel 4 input	C4	channel 3 input
A3	channel 2 input	C3	channel 1 input
A2	Vref	C2	Vref
A1	0v	C1	0v

Note that there are inconsistencies in the numbering of pins in the DIN41612 range of connectors. The above numbers should be correct for the free connector but are reversed on the rear connector of the option module.

SOUNDCRAFT MAGNETICS LTD

SATURN MULTITRACK RECORDER

SECTION 2

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OPERATIONAL FEATURES

9. Operational Features:-

This section deals with the extra control and information facilities which the Saturn provides you with. They are not included in the Operation Guide because of their technical nature or because they will not be encountered in normal operation. You should NOT use these facilities unless you have read about and UNDERSTOOD their purpose and mode of operation.

9.1 More audio adjustments

9.1.1 Audio parameter switches

There are four switches on each channel which can be changed by the user from the alignment panel controls. These cannot be set independently for each channel, pressing UP or DOWN to make an adjustment always affects all channels regardless of the status of MASTER or AUTO.

Only two settings are available, HI and LO, for these parameters. They have been factory set to match the expected use of the various speed/eq settings. AVOID ALTERING them if possible.

The four parameters are replay-LF, replay-HF, record-LF and record-HF.

[(REP+HF)]

Pressing REP & HF together (REP first) allows the UP/DOWN keys to select either REP-HF Hi or REP-HF Lo ranges.

Store when correct

Selection indicated by flashing replay and HF LED's.
Selection is cancelled by pressing one of the other alignment keys.

[(REP+LF)])
[(REC+HF)]) are selected as above.
[(REC+LF)])

The replay selections alter both the replay and sync time constants and cannot be set separately. .

The replay and record HF switches act as range changing switches. They provide you with a wide range of possible HF time constant settings.

The replay and record LF switches are designed to switch in and out a 3180uS time constant and not to extend the range of LF adjustment. They should be set BEFORE adjusting the normal LF settings.

To select a 3180uS time constant, the settings are REP/LF Lo and REC/LF Hi.

Note that because of the filter characteristic the effect of the REC/LF switch appears to be wrong when observing the VU's with a 100Hz tone.

The switches are correct.

Use a lower frequency if you wish to verify this.

9.1.2 Master bias

The range of bias adjustment should be sufficient to cater for all current tape types without being too coarse for accurate setting. There is however a MASTER-BIAS setting that can be adjusted (with caution) to optimise the range. This sets the drive level sent to all tracks and hence alters the bias for all tracks. It does not alter the individual track stored value. To select MASTER-BIAS press MASTER & BIAS together. Flashing MASTER & BIAS leds indicate correct selection. Use UP & DOWN to adjust as usual (in the range "00" to "FF") and store when correct.

****

NOTE:

Adjusting MASTER-BIAS in this way will affect all stored values for all speed / eq / tape type combinations

****

Master Bias has been factory set to provide the best range of adjustment in the individual channels.

If Master Bias is adjusted upwards it may be possible for the user to overdrive the channels and produce severe distortion in the bias waveform.

If Master Bias is adjusted downwards there may not be enough adjustment range for high bias tape formulations.

If you simply require to adjust all tracks together then you should use the ALL BIAS control. See section 3.3.4

9.2 Error Messages

The Saturn software has a number of self-diagnostic routines, which generate messages to attract your attention when something is wrong. Most of these are accompanied by a gentle "beep" from the Total Remote Unit. The messages are given in the Alignment Panel "housekeeping display"

9.2.1 'FAIL' messages-

These are accompanied by a number indicating the nature of the machine's problem.

Fail messages can only be removed by hitting the CPU 'reset' button and will re-appear unless the fault has been remedied.

Under certain conditions (e.g. severe line transients) it is possible for the Saturn to incorrectly diagnose a system fault. In such circumstances the message will not return after the reset and it is therefore always worth trying this first.

Always refer to qualified service personnel if a FAIL message returns after a reset.

FAIL_01- ROM checksum failure. Produced if the ROM code is not self-consistent.

FAIL_02- No valid software version string.

On initialisation the machine looks for a software number as part of its warm-up checks. If no software number is found the machine displays 'FAIL 02'. 'FAIL 02' usually indicates corrupted system ROM's and this could result in permanent damage if the machine is not switched off immediately.

FAIL_03- Test remote handshaking failure.

This refers to a factory system for connecting a microcomputer to the Saturn.

If no such interface is fitted, the machine has an internal hardware fault, probably on the interface board.

FAIL_04- Synchroniser read failure.

If a synchroniser interface is fitted to the machine then the message probably indicates a hardware fault in the synchroniser wiring or the interface.

If no such interface or synchroniser is fitted the machine has an internal hardware fault, probably on the machine's interface board.

FAIL_05- Can't read remote keys

If the machine is connected to a compatible remote unit the message probably indicates a hardware failure in the remote.

If no such remote is fitted the machine has an internal hardware fault, probably on the machine's interface board.

FAIL_06- Position counter overflow.

The machine can calculate tape positions of up to 350000 ft. If a tape position of more than 349525 ft is encountered the FAIL 06 message is displayed.

Although it is not impossible to achieve such large tape displacements, it is much more likely that the overflow is due to counter failure.

Reset will only remove this message if the problem is related to the counter hardware.

FAIL_07- Can't read local keys.

This refers to the main transport switches on the machine itself and the counter reset switch in the transport display module

The fault is most likely to be found in the wiring to the keyboards although the effects of extraneous noise cannot be ruled out.

LAST DIGIT

1ST 2 NOS	1	2	3	4	5	6	7	8
REMOTE CONTROL UNIT								
00	MONITOR 1	CHANNEL 23	CHANNEL 17	CHANNEL 12	CHANNEL 6	CHANNEL 1		LINE MONITOR
01	MONITOR 2	CHANNEL 24	CHANNEL 18	READY 12	CHANNEL 7	READY 1	PROG F	SYNC MONITOR
02	MONITOR 3	READY 24	READY 18	CHANNEL 13	READY 7	CHANNEL 2	F1	REPLAY MONITOR
03	MONITOR 4	NO. 7	CHANNEL 19	READY 13	CHANNEL 8	READY 2	F2	SOLO
04	MONITOR STORE	NO. 4	READY 19	CHANNEL 14	READY 8	CHANNEL 3	F3	ALL
05	MONITOR RECALL	NO.. 1	CHANNEL 20	READY 14	CHANNEL 9	READY 3		MUTE DEFEAT
06	NO. 9	DISPLAY	READY 20	CHANNEL 15	READY 9	CHANNEL 4		LOCAL
07	NO.. 6	CLEAR LOC	CHANNEL 21	READY 15	CHANNEL 10	READY 4	LOCATE	CLEAR POS
08	NO...3	STORE	READY 21	CHANNEL 16	READY 10	CHANNEL 5	CYCLE	VARISPOOL
09	MINUS (-)	NO. 8	CHANNEL 22	READY 16	CHANNEL 11	READY 5		<<
10	NO...0	NO. 5	READY 22	READY 17	READY 11	READY 6	UNTIL	>>
11	PLUS (+)	NO.. 2	READY 23	LOC > POS	POS > LOC			
12								
13								
14				RTZ	VARISPEED		GO	
15				STOP	RECORD	REWIND	PLAY	WIND
ALIGNMENT PANEL (LOCAL)								
16	IEC			F DOWN	F UP	SQUARE	-10DB	OSC ON
17		STORE	DOWN	UP	TYPE 4	TYPE 3	AES	NAB
18	SHIFT	MODE	EDIT >	EDIT <	PHASE	HF	GAIN	LF
19	TIMING DEFEAT	RESET	OVERWRITE	DELETE	BIAS	REC	SYNC	REP
20	MASTER	AUTO	CHANNEL DOWN	CHANNEL UP	TYPE 2	TYPE 1	30 IPS	15 IPS
21	7.5 IPS	CAPSTAN REVERSE		DISPLAY PARAM	DISPLAY OSC	DISPLAY FEET	DISPLAY CODE	DISPLAY SPEED
ALIGNMENT PANEL (REMOTE)								
22	IEC			F DOWN	F UP	SQUARE	-10DB	OSC ON
23		STORE	DOWN	UP	TYPE 4	TYPE 3	AES	NAB
24	SHIFT	MODE	EDIT >	EDIT <	PHASE	HF	GAIN	LF
25	TIMING DEFEAT	RESET	OVERWRITE	DELETE	BIAS	REC	SYNC	REP
26	MASTER	AUTO	CHANNEL DOWN	CHANNEL UP	TYPE 2	TYPE 1	30 IPS	15 IPS
27	7.5 IPS	CAPSTAN REVERSE		DISPLAY PARAM	DISPLAY OSC	DISPLAY FEET	DISPLAY CODE	DISPLAY SPEED
LOCAL TRANSPORT KEYS								
28				RECORD	STOP	PLAY	WIND	REWIND
29	COUNTER RESET			RTZ	EDIT	LOAD		
SYNCHRONISER INPUTS								
30			STOP	PLAY	WIND	REWIND		RECORD
31								
EXTERNAL READY CONTROL								
32	CHANNEL 8	CHANNEL 7	CHANNEL 6	CHANNEL 5	CHANNEL 4	CHANNEL 3	CHANNEL 2	CHANNEL 1
33	CHANNEL 16	CHANNEL 15	CHANNEL 14	CHANNEL 13	CHANNEL 12	CHANNEL 11	CHANNEL 10	CHANNEL 9
34	CHANNEL 24	CHANNEL 23	CHANNEL 22	CHANNEL 21	CHANNEL 20	CHANNEL 19	CHANNEL 18	CHANNEL 17
35						REPLAY MON	SYNC MON	LINE MON

STUCK KEY TABLE

FAIL 08- Stuck key.

If any command input including the external interfaces is held on for more than about 65 seconds the FAIL 08 message will be displayed together with a three digit number indicating which key is at fault. The table shows the meaning of key numbers. For example 'No 027' is Function key 1 on the Remote Control Unit and 'No 285' the STOP key on the machine itself.

If a key is found to be stuck, the Saturn will take no action except to display the key number and you may continue to use the machine. If a FAIL 08 message does occur it can sometimes be cured by pressing the stuck key a few times. If it becomes unstuck the fail message will not be removed until a reset.

FAIL 09- Can't read remote alignment panel.

This refers to an alignment panel when fitted as part of the Total Remote unit and probably indicates a hardware failure.

If no such panel is fitted, the machine has an internal hardware fault, probably on the machine's interface board.

FAIL 10- Can't read local alignment panel

As above but with reference to an alignment panel fitted to the front of the recorder.

FAIL 11- Can't read test remote.

This refers to a factory system for connecting a microcomputer to the Saturn.

If no such interface is fitted, the machine has an internal hardware fault, probably on the interface board.

FAIL 12- Can't read transport info.

This message is serious and power should be removed from the machine as soon as possible if qualified help is not available.

If the Saturn is unable to get consistent readings from the motion and tension limit sensors this message will be produced.

Check interface board IC28 and all associated hardware.

FAIL 13- Can't read external ready control module.

If an external ready control option module is fitted in the auxilliary rack then the message probably indicates a hardware failure in this unit.

If no such interface is fitted, the machine has an internal hardware fault, probably on the interface board.

9.2.2 'HOT' -

To protect the machine from overheating there are temperature sensors bolted to the heatsinks in the power supply unit. These are regularly checked, and if the Saturn finds itself overheating it will display the 'HOT' message. It then waits until it is no longer in PLAY or RECORD before going into LOAD mode and removing tension from the tape. If the 'HOT' message is displayed and the machine is not in PLAY or RECORD the machine will go into LOAD mode and not respond to any keypress.

Once in LOAD mode you can do nothing with the machine except wait for it to cool down and the 'HOT' message to be removed.

There a several reasons why the machine may become overheated:-

i) First and most obvious, the studio itself may be too hot or the ambient temperature in the area around the machine may be too high. If the ambient temperature in the studio is above 30 degrees Centigrade (86 degrees Fahrenheit) then you may find that the machine regularly comes up with the 'HOT' message particularly at the end of long sessions.

ii) Secondly the cooling fans may be faulty or the fan inlets blocked. Check the fan inlet filter on the front panel of the PSU by opening the front doors of the machine. The fan filter material may be cleaned with a vacuum cleaner.

iii) To check for a defective sensor, allow the machine to cool down and with the power on measure the voltage across R23 on the PSU main board. If more than 0.6 volts are present either one of the temperature sensors or the wiring to it is faulty. Otherwise IC28 on the Interface board is probably defective.

9.2.3 'TENSION ERROR' -

The Saturn maintains constant tape tension by constantly recalculating the amount of tape on each reel. A safety feature of this system is that if an impossible or illogical stack height is calculated, it stops the tape, goes into LOAD mode and displays the TENSION ERROR message indicating its dilemma.

NOTE this message is always produced by a software reset (see section 3.3.6), since stack height information is cleared from memory.

To regain normal operation you must manually wind the tape through the correctly laced path for at least five revolutions of the motion roller. After a few seconds the message will disappear.

If the message occurs repeatedly either the CTC (Interface board IC21) is at fault or one of the motor pick-up boards (section 12.2.1) is generating spurious signals.

If there is a fault with the CTC then it is quite likely that the machine will demonstrate other difficulties (such as inconsistent speed and position readings and perhaps even 'FAIL 06' messages).

The motor pick-up boards sense the movement of the spool motors by optical sensors. If a wide bandwidth oscilloscope (>40MHz) is available the tach pulses can be monitored on the inputs to IC38 (RRT and LRT) on the interface board.

If tach signals are not reaching the interface board then check for the signals at pins 1 and 2 of J9 and J15 on the Deck Distribution Board. If the signal is absent here then the motor pick-up boards themselves are probably faulty.

If the motor pick-up boards are removed take GREAT CARE not to damage the sensing discs attached to the motor shafts.

9.3 Test Mode :-

The Saturn software contains sixteen test routines to aid you in setting up various parameters and checking the electrical systems.

If you plan to use any of the test routines relating to the motor drive system then certain precautions must be taken :-

1. Turn the power off
2. Undo the deck retaining catches and raise the deck plate to its fully open position.
3. Disconnect the spooling motors from the 'Deck distribution board' (J10 and J14)
4. Turn the power back on

To enter 'Test mode' :-

1. Select 'load' mode.
2. Press (and hold) the CPU reset button on the processor board.
3. Press (and hold) the STOP key on the transport
4. Release the CPU reset button
5. Release the STOP button

The Saturn will enter test mode 1 at this point. While in test mode you may use the transport wind and rewind buttons to step around the test modes.

Wind - steps up one (16 goes to 1)
Rewind - steps down one (1 goes to 16)

Note that the remote keys cannot be used for this purpose.

DO NOT TURN OFF THE POWER OR HIT THE RESET BUTTON WHILE IN TEST MODE 1

'Test mode' will immediately be cancelled if any motion is detected in the tape path or the spooling motors.

To exit Test Mode :-
press any STOP key.

Test mode 1 - all lamps and leds are set flashing. Any faulty LEDs can be quickly identified. At the same time the software version number is displayed in the housekeeping display.

Test mode 2 - Defeats the tape lifters and raises the head screens.

Test mode 3 - Displays the time in hours that the recorder has had power applied

Test mode 4 - Displays the time in hours that the recorder has been in play or record modes.

In test modes 1 to 4 the tension control A/D converters are set to 00 (minimum). Adjust "T1 - zero" and "T2 - zero" for readings of -20 mV DC on T1 and T2 test points respectively. These test points and adjustment presets can be found on the front of the interface board. See section 12.1.5

Test mode 5 - Outputs FF hex (full scale) to the tension control A/D converters on the interface board. Adjust "T1 - gain" and "T2 - gain" for readings of 2.7 VDC on T1 and T2 respectively.

Test mode 6 - Outputs a sequence of tension values and direction reversals to the spool motor control system. This is used as part of the factory burn in procedure and is not intended for the user.

Test mode 7 - Outputs 20 hex to the tension control A/D converters on the interface board. This is used to confirm the operation of the D/A's and should produce approx. 0.3 VDC on T1 and T2

Test mode 8 - Lynn wheel counter reading

Test mode 9 - 13 unallocated

Test mode 14 - Displays the currently selected maximum wind speed. The transport EDIT key switches between 600ips (15m/s) and 400ips (10m/s)

Test mode 15 - Displays the channel currently allocated to time code. The selection can be changed by pressing the desired channel select key on the Remote Control Unit. The effect of changing the selection is :
a) to feed the monitor output of the selected channel to the Time Code Reader option (when fitted)
b) to send monitor and ready status information about this channel to the synchroniser interface (when fitted)
c) this track unmuted by synchroniser unmute command

Using the transport EDIT key will switch this facility on or off

Test mode 16 - Displays the currently selected record start method.
a) "One key record" allows record to be entered on pressing the record key by itself
b) "Two key record" means that the record and play keys must be pressed together.
In both cases the record update function works from the record key alone. (see section 3.2.2)
The transport EDIT key can be used to select the required mode.

9.4 Additional Commands

The Saturn has a number of further facilities available which can be initiated from the keyboard.

9.4.1 Exhibition mode :-

This is initiated in a similar fashion to the keyboard unlock procedure, and in fact requires the alignment panel keys to be unlocked. (See section 3.3.7).

To turn exhibition mode on/off use:-

MODE/SHIFT

Press (and release) - SHIFT -shift led comes on
Press (and hold) - MODE
Press (and release) - SHIFT -shift led goes off
Release - MODE

In normal operation the Saturn does not reduce its wind speed when performing "locate" operations near the ends of the reels. The experienced user would find such an automatic slow-down frustrating when using the autolocator on the first and last sections of a reel of tape. This means that locating to a point off the end of the reel will result in the tape spinning off at high speed.

In situations (such as exhibitions) where the Saturn is exposed to inexperienced users, setting "exhibition" mode on will provide the automatic slow-down during locate operations.

Exhibition mode also activates a record safe protection so that the Saturn will not enter RECORD mode even though the LEDs and monitoring apparently behave correctly. This is similar to REHEARSE mode.

After initial powering up, exhibition mode is always "off".

9.4.2 True tape speed:-

The Saturn's normal speed display shows "selected" capstan speed whilst in 'PLAY' mode, unless varispeed is required. You may change this to show true tape speed by -

SHIFT-SPEED

This converts the tape speed display to show real speed under all conditions. Pressing shift - speed again converts back to normal readout.

The "true speed" readout is subject to small variations in such factors as CPU clock rate, motion sense roller diameter, tape thickness, capstan shaft diameter etc. and thus is only guaranteed to 0.1% accuracy. This can be disconcerting to the non-technical, and so the Saturn always powers up with true speed switched off.

9.4.3 Stop mode options

Some users may require the head screens to be raised in stop mode. This can be selected by using

SHIFT - REV PLAY

Edit mode still lowers the screens

9.4.4 Last message recall

Pressing the key of the currently selected alignment panel display will re-display the last message output by the system (e.g TENSION ERROR, Entry terminated etc.). This is to allow you to see what caused that "beep" while you weren't looking.

Note that "No code present" is treated as a message by the system

10. Microprocessor System.

10.1. Physical Layout

The operation of the SATURN is controlled by a Z80B CPU running at 6MHz. The CPU in the minimum configuration has access to 16k bytes of RAM and 32k bytes of ROM.

Additionally by way of decoding PROMs the CPU has access to up to 64 input and 64 output ports in the fully expanded system.

The microprocessor control unit takes up two boards. These are located in the digital rack. The upper of the two boards is the CPU and the lower is the Interface.

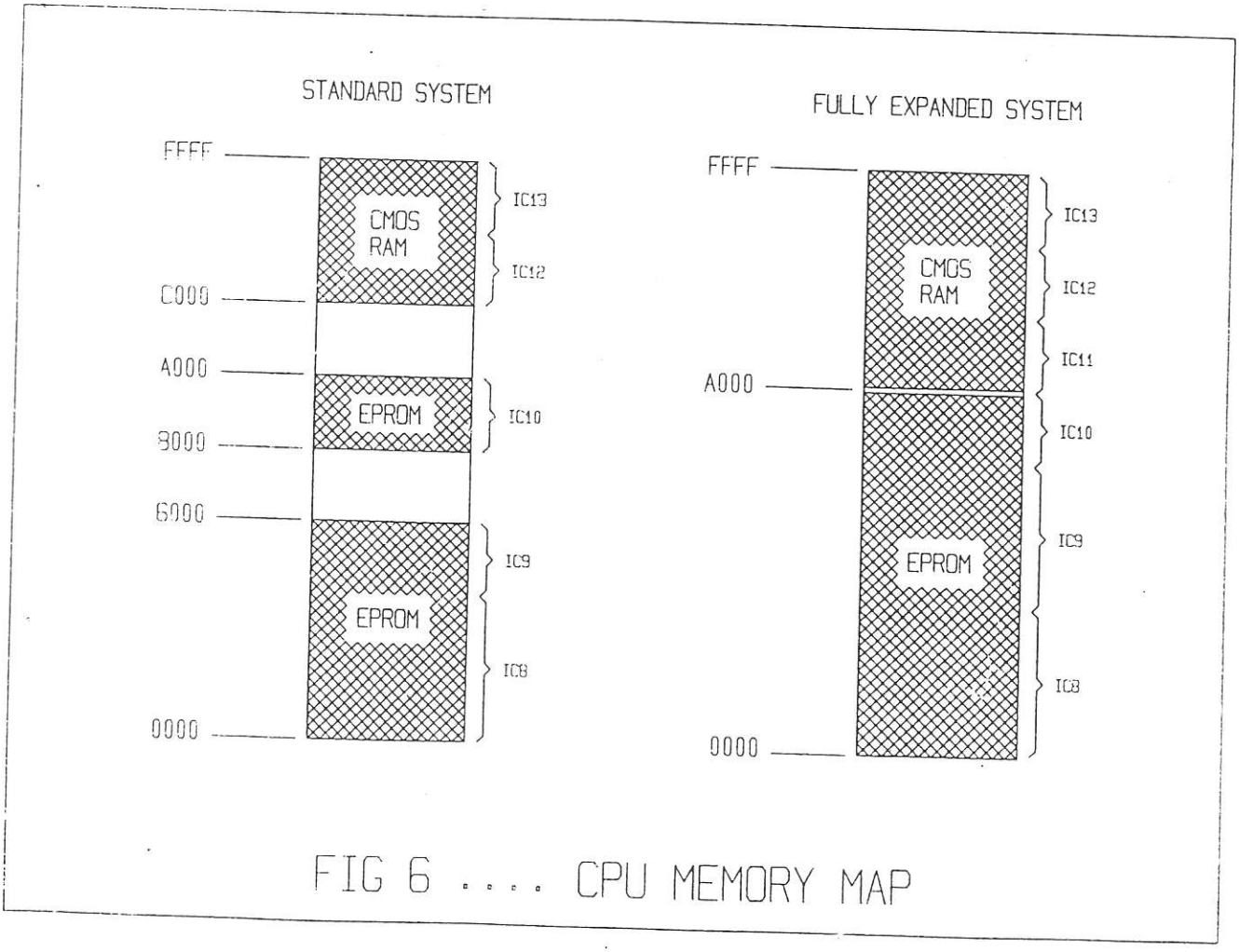


FIG 6 .... CPU MEMORY MAP

10.2. The Processor board

This consists of a Z80B microprocessor (CPU) running at 6MHZ, a minimum of 16K bytes of battery backed CMOS RAM (6264LP), a minimum of 32K bytes of EPROM containing the operating software (27128/64).
In addition to the Z80B and its memory the Processor board contains various control circuitry and input/output buffers.

The main CPU clock is formed around IC6-F and a 24MHZ crystal. The divider chain (IC20 & IC21) provide output frequencies in the range 2MHZ to 8MHZ one of which is link selected to feed the final clock drive stage (IC6-A & Q1). A further output of the divider chain (REFCK at 250KHZ) is sent to the real time circuitry on the Interface board.

The Z80's control of the processor board is routed through three external buses:-

10.2.1 Address bus

The 16-bit address bus runs from the processor to the EPROMs, the RAM and the buffers IC2 and IC3. The top 5 address lines (A11-A15) also run to a decoder PROM (IC15) and are used to select the appropriate memory chip.
The PROM also controls the I/O data latch (IC1) allowing expansion systems external to the processor board to have access to the system data bus.
The contents of the address bus cannot be easily analysed, without suitable equipment, while the machine is running, but no individual bit on the bus should remain continuously in either state (high or low).

10.2.2 Data bus

The 'internal' 8-bit data bus (XD0-XD7) runs from the processor to the EPROMs, the RAM, and the buffer (IC1) to the 'system' data bus (D0-D7).
As with the address bus all the data lines should be seen to be constantly in use and should never remain in one state.

10.2.3 Control bus

The control bus is the name given to all the other lines (input or output) to which the CPU refers in normal operation. Only three inputs on the control bus effect the normal operation of the processor, they are:-

1) 'RESET' (pin 26). Active low

This is an input used to restart the CPU. See 10.2.4 below

2) 'NMI' (pin 17). Negative edge triggered

This is the control line used to initiate a 'non-maskable interrupt'. On the SATURN the 'NMI' control line is driven from PH1 of the motion sense board.

3) 'INT' (pin 16)- Active low.

A low level on the 'INT' line causes a 'maskable' interrupt if interrupts are enabled. On the SATURN the 'INT' line is driven from a timer on the interface board at a 1kHz rate. The CPU acknowledges an 'INT' command by asserting 'IORQ' and 'M1' simultaneously.

The outputs from the control bus are automatically asserted during normal Z80 operation, some of these are used by the CPU and interface circuitry. If further information is required on control bus operation, reference should be made to a Z80 handbook.

10.2.4 Reset circuit.

Three signals are associated with this function:

RESET - machine bus physically shorted to 0v. to initiate a reset.

XRESET - Buffered output from the RESET bus sent to the microprocessor.

SYSRESET - Buffered output from XRESET sent to all devices needing a reset input.

The reset system is used by the SATURN to restart CPU operation. The reset circuit is a simple RC integrator made up from R1 and C17. The integrator drives into a dual invertor buffer (IC6-B/C) to produce the correct switching levels. R2 prevents high peak currents flowing through the reset switch as C17 is discharged. The time constant of the circuit is about 100ms.
RESET is asserted for 100ms after:-

1) Turning the power on.

2) The +5v rail falls below 4.5 volts.

3) An autoreset (see section 10.3.3).

The reset pulse should be of sufficient length to allow the power rails to recover before the CPU begins to run the software.

If the input is going low regularly (every 1-2 seconds) but then recovering after a short pulse, the autoreset system is not operating correctly. If however the 'RESET' line is stuck permanently low there is probably a fault within the reset circuit itself.

10.2.5 Battery backup.

The Processor board has an integral battery backup circuit which powers the RAM chip when the power from the 5v rail is not present. Current flows from the battery when the voltage on the VCMOS line (TP3) falls to approx 4.5 volts. When the voltage across the zener diode D3 is less than 4.7 volts the diode begins to turn off as do the two transistors Q4 and Q5. In turn Q5 switches off the series element Q2 and prevents current from the battery from supplying the whole +5v rail. The collector of Q4 rises which causes Q3 to turn on, pulling the 'RESET' line low and halting the CPU operation.

The protection trigger voltage has been factory set by varying the values of D3 & R10 and therefore they may differ slightly from the circuit values.

The NOR gates of IC17 form a Bistable latch which holds the 'CS2' line off, disabling the RAM chip and protecting its contents. If a memory write cycle is in operation at this time then it is allowed to complete its cycle before disabling RAM.

The 6264LP was chosen for its low stand-by power requirements, allowing the battery to power the memory for up to 10 years. The battery can be disabled by removing LK8, however all stored eq alignment settings will be lost if the power is removed for longer than a few minutes. Should this situation ever arise take careful note of the following

BEFORE RECONNECTING LK8:-

1) Always power up the SATURN as soon as LK8 is replaced.

2) NEVER leave the CPU board unpowered after LK8 has been replaced. The memory protection latch will be set incorrectly and the battery will discharge in days rather than years.

10.2.6 Wait States.

To allow interfacing with a variety of I/O and memory devices a wait state generator is incorporated. This circuit is formed by IC18, IC19-A, IC16-C & IC16-D. Links LK6 & LK7 are used to select the conditions under which a Wait State is generated.

1) None

No wait states are generated when reading program data from memory. This is the default setting for LK7 when EPROMs with access times of 200ns or faster are used.

2) Op-code-fetch

Wait states will be generated whenever program data is read from memory. This must be used whenever EPROMs with access times of 250ns or slower are used.

3) EX-I/O

A Wait state will be generated for slow I/O devices only. This is the default setting. The signal 'EXWAIT' is produced by the interface board whenever an attempt is made to access slow I/O devices and is used to trigger a wait state.

4) All-I/O

A Wait state is generated every time an attempt is made to access any I/O device.

5) LK6 removed

No Wait states will be generated for I/O operations.

10.3 Interface board

As the name suggests this board interfaces the CPU board with the rest of the machine. The Address and Data buses are buffered on entry to the interface board (IC1 &IC6). From this point these buses become the Machine Operating Bus (MOB) and are routed throughout the SATURN, see section 10.4 for a full description. The MOB addresses required by the interface board itself are decoded by PROMs (IC3/4/5).

10.3.1 Interrupt generator

Maskable CPU interrupts are generated on the interface board. A 555 timer (IC9) gives a 1kHz square wave output which is routed to a D-type latch (IC8-A). Each rising edge of the square wave forces the 'INT' line to the processor low until the interrupt is acknowledged, by the CPU asserting (low) both the 'M1' and 'IORQ' lines simultaneously. This resets the D-type. Thus an interrupt is generated every 1ms by the timer and automatically held until acknowledged. This signal can be seen on TP6 as a series of narrow pulses. If this circuit fails to operate there will be no response from any keypress anywhere on the SATURN and the multiplexing of the leds and flourescent displays will cease. Quite serious!!!

Although it is not critical, the rate of this clock affects many timing functions in the Saturn and can be adjusted by VR5 for 1kHz.

10.3.2 Capstan speed measurement

A signal is taken from one of the capstan motor Hall elements (TACH) and routed to the speed measuring circuit on the Interface board. There are two possible inputs to this circuit TACH and WHT1. The processor selects which one is required and asserts the control line, CAPSPD, accordingly. CAPSPD is high during PLAY mode and low at all other times.

A 555 timer (IC19) gives a 1024Hz square wave which is used to clock an 8 bit counter. The rising edge of the input signal (TACH) generates two short pulses, the first latches the count into the input port whilst the second resets the counter. The value read by the processor via the port is used to calculate capstan RPM.

The additional circuitry in this system ensures that the count will be zero should the counter overflow, indicating an invalid reading to the processor.

The operating software makes use of this speed reading when the capstan is in one of its external modes of operation (ie varispeed or synchroniser has taken control) to ensure that the Pinch is engaged only when the correct tape speed is reached.

10.3.3 Autoreset

During normal operation the software sends a constant stream of pulses to the Autoreset circuit. If at any time there is a software crash these pulses will not be produced and after a short delay the CPU will be reset. The most likely causes of a crash are:-

1) Severe AC power noise.

2) Plugging/unplugging boards with the power ON.

3) A fault on the Processor board itself.

A free runing oscillator / divider (IC20) will, unless reset, produce an output that will turn on Q1 causing a 'RESET' to be sent to the processor.

During normal operation the processor will toggle pin 9 of IC25 and for each transition IC33-a will produce a short pulse. After inversion by IC33-b the pulse is gated with 'SYSRESET' and routed to the reset pin of the counter. If the counter is reset often enough a 'RESET' will never be produced.

'SYSRESET' clears the counter when power is first applied or any other CPU reset occurs (see also section 10.2.4.)

10.3.4 More on the Interface board

A description of the D/A converters and tension control can be found in section 12.1

A description of the CTC, motion and direction circuits can be found in section 12.2

A description of the transport switch and display drivers can be found in section 12.6

10.4. The Machine Operating Bus. (MOB)

The 'MOB' runs throughout the SATURN via a 25 way screened ribbon cable and all the digital systems requiring communication with the processor are connected to it. The table below shows how the signals have been allocated.

Note that the following pin nos. refer to those in an IDC system. The remote control unit is driven from a buffered version of the MOB via a 25 way D-type connector. These pin numbers are NOT APPLICABLE to a D-type connector.

Pin No:-	Description:-
1	Data Bit 0
2	Data Bit 1
3	Data Bit 2
4	Data Bit 3
5	Data Bit 4
6	Data Bit 5
7	Data Bit 6
8	Data Bit 7
9	Address Bit 0
10	Address Bit 1
11	Address Bit 2
12	Address Bit 3
13	Address Bit 4
14	WRITE
15	READ
16	Varispeed ground (VS1)
17	Varispeed control (VS2)
18	+5 volts
19	+5 volts
20	0 volts
21	0 volts
22	+24 volts
23	Address Bit 5
24	+12 volts unregulated
25	+12 volts unregulated

The data bus signals on the 'MOB' are only active when an input or output is requested by the processor (IORQ active). The cable screen is connected to ground at the Digital Motherboard only.

10.4.1 Standard MOB interface

All systems connected to the MOB have a standard MOB interface. This provides the necessary outputs to control the 8 bit I/O ports used in the SATURN. This consists of 3 chips:

Address buffer (LS244) - buffers the 6 bit address bus and the RD and WR signals.

PROM - decodes the MOB addresses required by the particular system and provides latch enable signals.

Data buffer (LS245) - Bidirectional bus buffer. Data direction is controlled by the PROM outputs and the RD line. The data buffer is usually 'tri-stated' when the particular system is not being addressed.

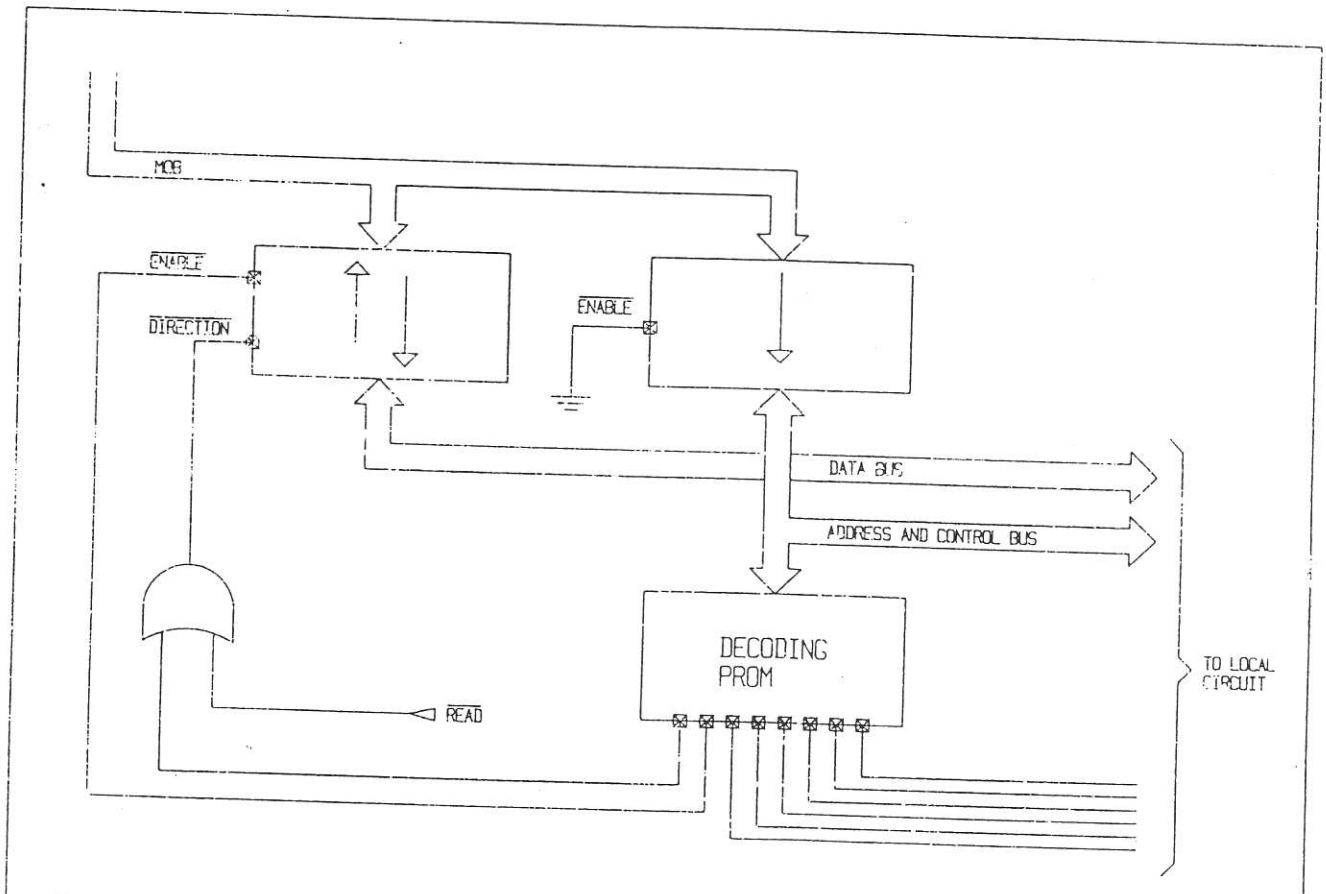


FIG 5 TYPICAL MOB INTERFACE...BLOCK DIAGRAM

AUDIO SYSTEM

11. Audio systems -

Introduction :- (See circuit diagram B001K)

The Saturn's audio system is digitally controlled. All the main parameters of the record and playback amplifiers are aligned by the microprocessor when the machine is switched on and are updated when equalization or monitor status is changed.

The audio system consists of:-

i) The audio channels,
ii) the heads,
iii) the master erase and bias oscillators,
iv) the metering circuitry,
v) the Line in/out circuits,
vi) the internal test oscillator and
vi) the audio motherboard.

A block diagram of the audio system is shown opposite.

11.1 The Audio Channels :-

The audio channels contain full record, sync and replay amplifiers with electronically balanced line inputs and outputs. The boards include all of the digital decoding and control circuitry for the hybrid circuits, monitor selection, headpeaking capacitors, bias and erase control relays and equalisation range switches.

11.1.1 Line inputs:-

The balanced input signal is taken to buffer amplifier stage IC1. The gain of the stage is about -14dB. FET switch Q21 routes this signal to buffer amplifier IC20 via input level preset VR2 and an insert point which can be bypassed by link LK1. Q26 enables the oscillator input. From the output of IC20 the signal is fed to the Record amplifier and to the monitor select system.

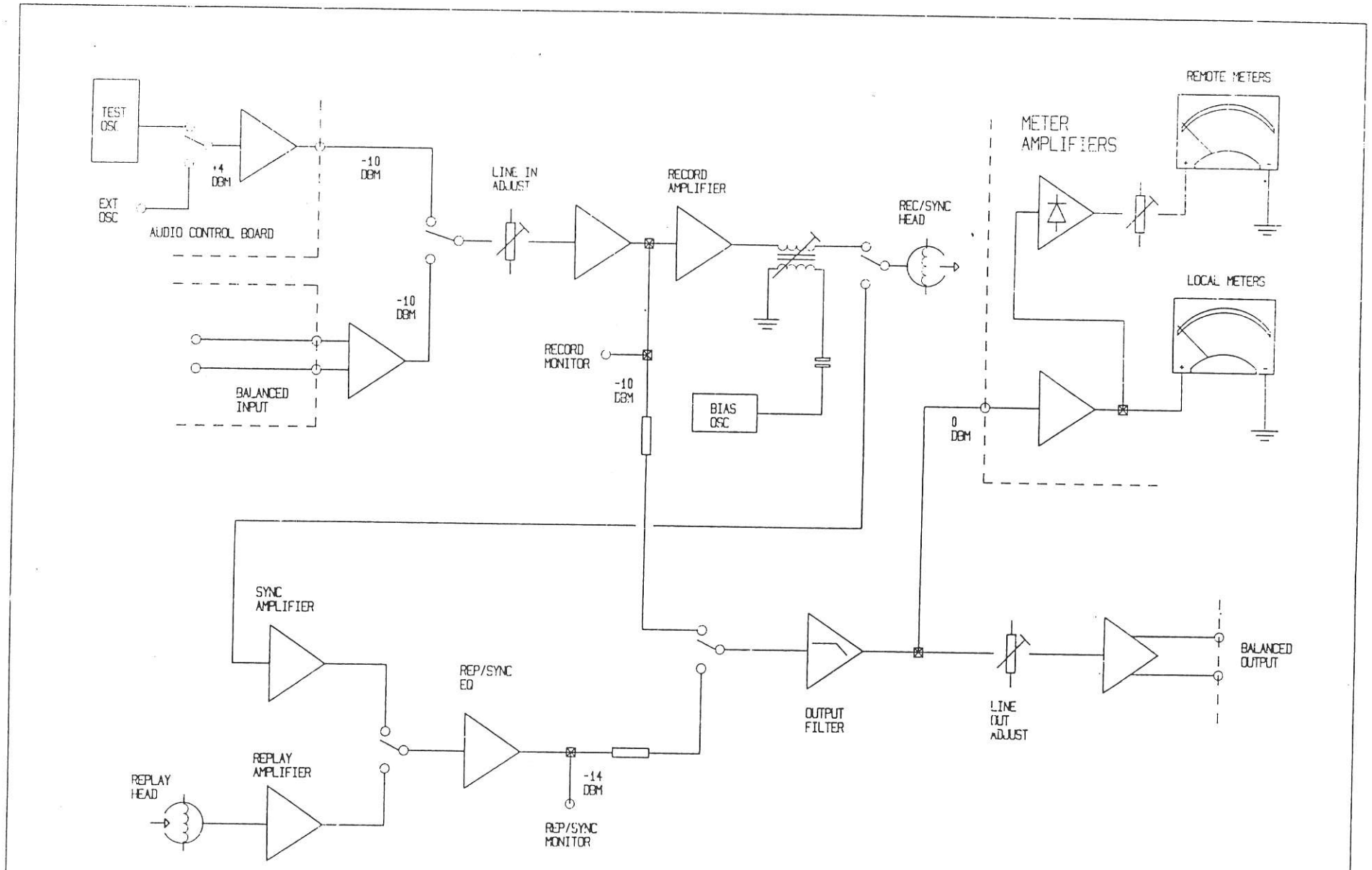


FIG 4 AUDIO SYSTEM BLOCK DIAGRAM

11.1.2 Record amplifier:-

The Record amplifier is a three stage amplifier.
The first stage (IC3a) is the gain stage. The gain is adjusted by hybrid circuit (DR1).
The phase compensation stage (IC3b) has a gain of 0dB at all passband frequencies. The phase response is adjusted by hybrid circuit DR2.
The final, frequency compensation, stage has two hybrid circuits (REC LF and REC HF) and two range switches (RECLF and RECHF).
The RECLF switch adjusts the low frequency level by approx 6dB at 20Hz by switching in and out a time constant of 3180us. The RECHF range switch adjusts by approx 4.5dB at 20kHz.
The REC LF and REC HF hybrid circuits (DR3 and 4) adjust the LOW and HIGH frequency time constants.
The effect of the record amplifier's switches and resistors at the given frequencies is as follows:-

	adjusment range	at FREQUENCY.
REC GAIN DR	17 dB	1kHz
REC HF DR	14 dB	20kHz
REC HF switch	4.5 dB	20kHz
REC LF DR	14 dB	20Hz
REC LF switch	6 dB	20Hz
PHASE COMP. DR	100 degrees	10kHz.

The signal from the output of the Record amplifier is summed with the bias signal by transformer (TX1) and routed to the record head switching relay (RL1).

11.1.3 Bias and Erase amplifiers:-

Square wave signals with their fundamentals at the BIAS and ERASE frequencies are supplied by the 'audio control board' (see section 11.3 below).
The bias signal (227.5kHz) is routed to the base of Q14. This stage is an emitter follower, with its collector connected to the output of the ramp generator circuit (see 11.1.9). The bias signal is passed to a parallel LC circuit (L3 & C64) tuned to the fundamental frequency. The bias sine wave is then buffered by IC16b, the signal level being adjusted by hybrid DR5. Finally the signal is passed to the output driver stage and to the transformer (TX1). Tuning of the bias and erase circuits is covered in section 11.1.10.
The erase signal (113.75kHz) is fed to Q17 and then onto the erase driver circuit. A series trimmer capacitor is used to tune the erase head. When not in use, the erase head is disconnected from the circuit by RL2.

11.1.4 Playback pre-amplifiers:-

The SYNC and REPLAY heads have switched tuning capacitors to obtain optimum high frequency performance. The capacitors are switched automatically with tape speed selection.

The SYNC pre-amplifier is transformer coupled to improve input sensitivity and noise performance across the full bandwidth.

The two pre-amplifiers are similar in design. The front end is a differential discrete amplifier feeding into an integrated output stage (IC's 5 and 7).

The second stage is fitted with a fixed 6dB/octave roll off.

The two pre-amp outputs are sent via FET switches Q28 - Q31 to the input of the equalisation amplifier.

11.1.5 Equalisation amplifier:-

The e.q. amplifier has three stages IC7b and IC18. IC7b provides a switchable LF time constant of approx 3180uS. IC18a and DR6 are used for GAIN control, feeding the LF adjustment C41 & DR7. IC18b contains HF adjustment via DR8 & C71. Q35 switches the HF time constant between two ranges. The effect of these adjustments at the given frequencies is as follows:-

	adjustment range	at FREQUENCY.
REP GAIN DR	16dB	1kHz
REP HF DR	14dB	20kHz
REP HF switch	6dB	20kHz
REP LF DR	16dB	20Hz
REP LF switch	13dB	20Hz

The output of the e.q. amplifier (labelled REP/SYN) feeds the monitor select switching (JFET's (Q36-39)). See section 11.1.8 below

11.1.6 Output stages:-

From the monitor select point the signal is fed to a low pass filter.

The amplifier has an attenuation of 23dB at 113.75kHz (Erase) and 40dB at 227.5kHz (Bias).

From the filter output, signals are fed to the metering system (see 11.4 below) and to the line out preset. The output of the preset is buffered and then routed to the balanced line output stage. The balance null can be adjusted using VR1. The gain of the balanced output stage is 4dB.

11.1.7 Digital control circuitry:-

The digital control circuitry for each channel is contained on the channel board. The 8 bit 'Audio Data Bus' (see 11.7 below) can be routed to any one of 10 data latches. The 5 bit 'Audio Address Bus' (decoded by IC9) determines which data latch is required.

The ten address codes currently defined are as follows:-

Address (bit) 3 2 1 0	Data (bit no.) 7 6 5 4 3 2 1 0	Selects.
0 0 0 0	Any	Bias hybrid circuit.
0 0 0 1	Any	Record LF hybrid circuit.
0 0 1 0	Any	Record HF hybrid circuit.
0 0 1 1	Any	Record gain hybrid circuit.
0 1 0 0	Any	Replay LF hybrid circuit.
0 1 0 1	Any	Replay HF hybrid circuit.
0 1 1 0	Any	Replay gain hybrid circuit.
0 1 1 1	Any	Phase compensation hybrid circuit.
1 0 0 0	0 0 0 0 0 0 0 1	Replay LF range switch.
	0 0 0 0 0 0 1 0	Headpeaking capacitor 1.
	0 0 0 0 0 1 0 0	Headpeaking capacitor 2.
	0 0 0 0 1 0 0 0	Replay HF range switch.
	0 0 0 1 0 0 0 0	Line input.
	0 0 1 0 0 0 0 0	Test oscillator input.
	0 1 0 0 0 0 0 0	Record HF range switch.
	1 0 0 0 0 0 0 0	Record LF range switch.
1 0 0 1	0 0 0 0 0 0 0 1	Record on.
	0 0 0 0 0 0 1 0	Sync/replay pre-amp select.
	0 0 0 0 0 1 0 0	Mute.
	0 0 0 0 1 0 0 0	Input/ output monitor.

The 'Audio Data' and 'Audio address' busses on the motherboards are protected from channel shorts by a set of 22k series resistors.

The digital control elements connected to the 'audio data bus' are hybrid thick film packages designed especially for Saturn audio channels. The adjustment steps represent approximately 1 degree of movement in the rotation of a typical preset.

11.1.8 Signal path switching:-

The switching sections of the Saturn audio channel have been designed to reduce switching noise to a minimum. The devices used (J112s) are depletion mode n-channel JFETs, and require gate source voltages of between -1 and -5 volts to turn them off. They have an 'on' resistance of less than 50 ohms and a drain leakage current of less than 1nA.

There are three types of switch circuit used in the Saturn.

(a) Single element (input selector).
Each FET (Q20 and Q21) is directly in the series path from the input, the gate being driven from the anode of a diode (D9 and D10). The switching stages are driven from the '$\overline{Q1}$' and the 'Q0' outputs (respectively) of IC12. When the input to the latch is low (-8v) the output is high and the transistor (Q22 or Q23) connected to the output is 'on'. This pulls the cathode of the diodes (D9 and D10) down turning off the FETs (Q20 and Q21). When the inputs to the latch (IC12) are high the transistors (Q22 and Q23) are off and the diodes float high turning on the FETs (Q22 and Q23). The same type of switching circuit is also used for switching in the record and replay LF range elements.

(b) Two element (Replay/sync pre-amp selection).
This circuit uses four FETs for switching, two series elements and two parallel. The two series FETs pass the selected signal, whereas the two parallel elements short the signal not selected to ground. This ensures very high levels of isolation, around 90dB. On the REP/SYNC switch, the FETs are configured with their gates cross connected in pairs, the gate of the replay pass FET in common with the gate of the sync grounding element and vice versa, thus providing simple changeover operation.
'Q1' of latch IC11 is connected to the sync pass pair, '$\overline{Q1}$' to the replay pass pair. The latches drive the gates of the switching elements via RC networks which control the timing of the FETs.
A 'break before make' action is provided by diodes included in these networks (RC [on] = 100ms, RC [off] = 4.7ms).

(c) Two element (Monitor select switching).

The configuration is similar to the REP/SYNC switch but the four FETs are individually controlled, allowing both inputs to be switched off together.

The associated logic circuitry controls channel muting, and selects monitoring according to the truth table below :-

Q0 of IC11 is - record on
Q2 of IC11 is - mute
Q3 of IC11 is - input mon select

1=selected, 0=deselected, X=don't care

SYNC SELECT	REC ON	INPUT MONITOR	MUTE	MONIN	MONOUT
X	X	X	1	0	0
0	1	0	0	0	1
1	0	0	0	0	1
1	1	0	0	0	1
0	0	0	0	1	0
0	0	1	0	1	0
0	1	1	0	1	0
1	0	1	0	1	0
1	1	1	0	1	0

The inverse states of MONIN and MONOUT are also generated.
The four logic outputs are connected via dual RC networks (RC [on] = 100ms, RC [off] = 4.7ms) to the gates of the FETs. This provides "break-before-make" action as in type b) above. However when muting is required both series elements are turned off a short time before both the parallel FETs come on.

In addition to series switching there are two types of circuit used to switch components in parallel with the main signal path.

(d) The first of these types is used to switch the headpeaking capacitors using a single FET. The gate of the FET is connected through a diode and a single RC network (RC=22ms) to the latches (IC10, Q1 and Q2).
(e) The final type of switching circuit is used to control the record and replay HF range switches. In these the switching element is a bipolar transistor, the base of which is connected to the latch (IC12 Q2 and IC10 Q3) via a single RC network (RC=1ms).

11.1.9 Relay switching and bias/erase ramp generation:-

The bias and erase inputs from the Audio Control Board are ramped during punch in/out to reduce switching noise to a minimum.

The timing of the bias and erase ramps, on entry to and exit from recording, is important. In addition the record and erase heads must be correctly connected before the erase and bias ramps begin. Finally, since the heads are mounted separately, it is also necessary to start the rise in the erase signal first so that start of the ramp (as recorded on the tape) reaches the record head as the bias ramp begins.

The tape motion 'TACH' and MOTION signals from the audio control board are used to synchronise the ramps and signal switching system.

RECORD START SEQUENCE :-

(i) On the REC-ON command the Q0 output of IC11 (pin 2) is asserted high ('1'). This connects to shift register IC14 (pin 7) and relay control NOR gate IC13 (pin 13).
The data on IC14 is now available for clocking through the latch
The output of the relay control NOR gate IC13 (pin 11) goes low and relay by-pass transistor (Q11) is turned off. This causes Q10 to be pulled on operating the erase (RL2) and record (RL1) relays.

(ii) If there is no tape motion (MOTION='1') shift register (IC14) is reset, preventing any operation of the recording system

(iii) 'TACH' pulses, after the assertion of REC-ON, arrive at the clock inputs to IC14 (pins 9 and 1) and the data ('1') is clocked into the register.

(iv) On the second 'TACH' pulse the Q2 output operates the integrator circuit R83, C61 and IC15b.
The output of IC15b (pin 7) ramps from +8 to -8 volts.
The ramp is of 73ms duration. This is buffered by Q13 to provide Q17 with a ramped collector current.
'TACH' pulses occur approximately every 1/4" of tape movement. This represents a delay of at least 8ms (at 30 ips) between relay contact closure and erase ramp start.

N.B. The Q2 output is also routed to IC23 (pin 8). If pin 9 is also high then the bias ramp is also started now.

(v) On the seventh 'TACH' pulse, the Q7 is asserted. This is fed via OR gate (IC8) to the input of the integrator (R82 and C60) around IC15a.
This ramp is buffered by Q12 and provides collector current to Q14 in the bias circuit.

RECORD OFF SEQUENCE :-

(i) The REC-ON signal is removed from the Q0 output (pin 2) of IC11. IC14 pin 7 and IC13 pin 13 both go low ('0'). The other input of IC13 (pin 12) is held high by the bias ramp control so the relays are left in the 'on' state.

(ii) On the second 'TACH' pulse after the removal of the REC-ON command the Q2 output of IC14 goes low and the erase signal begins to ramp off.

(iii) On the seventh 'TACH' pulse the Q7 output goes low and the bias signal starts to ramp off.
The output of the OP-AMP (IC4 pin 7) stays high as the ramp voltage rises until the emitter of Q12 reaches +8v volts. At this point the NOR gate output (IC13 pin 11) will turn on and the relays will turn off.

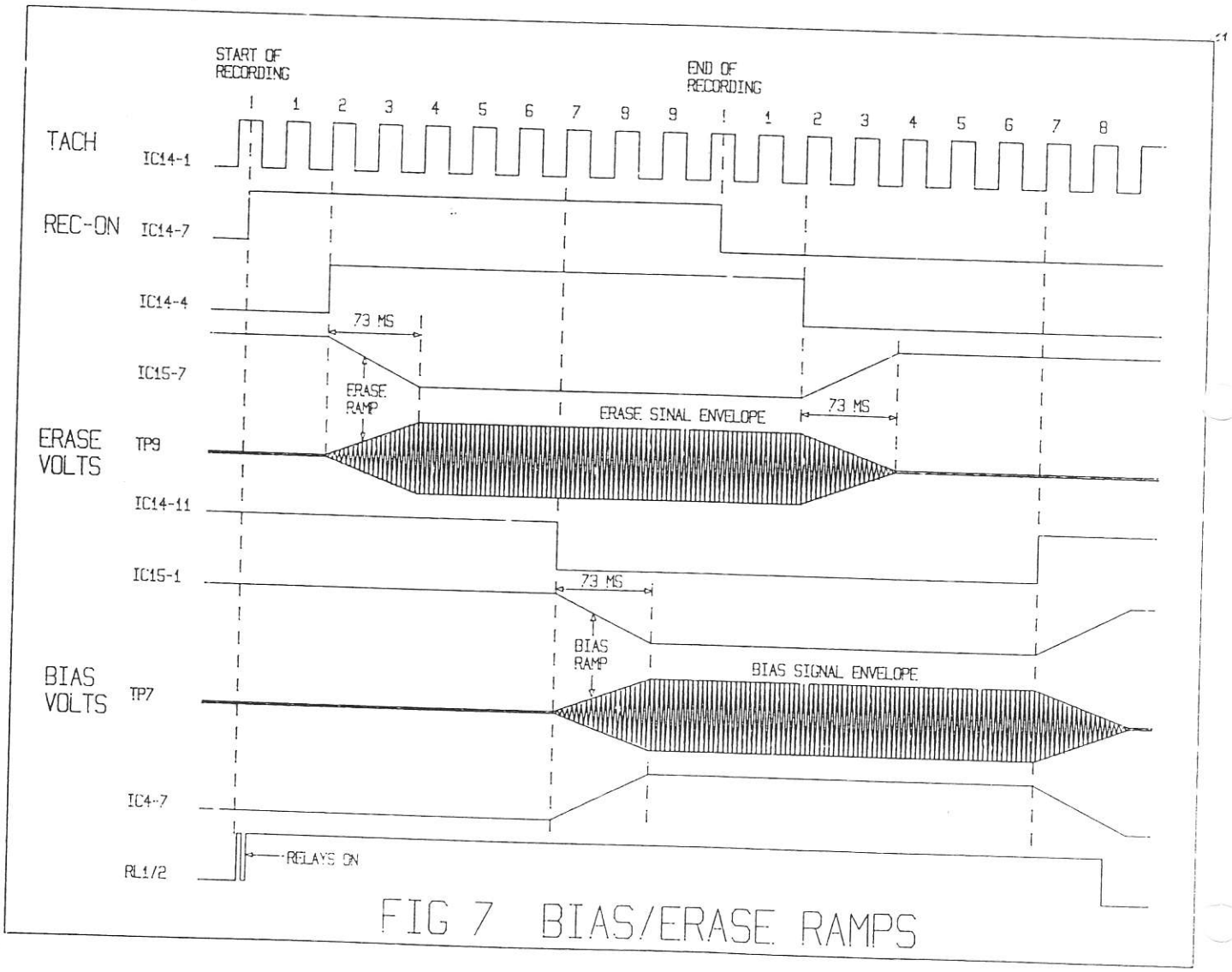


FIG 7 BIAS/ERASE RAMPS

11.1.10 Bias and erase tuning:-

To adjust the bias and erase currents the following equipment is required:-

i) Wideband millivoltmeter (minimum 1MHz),
ii) Oscilloscope.

1) Erase Current

a) Turn off machine power.
b) Place channel on extender board.
c) Turn the power on.
d) Probe TP10 (ER.I), using TP6 (ER.GND) as ground.
e) Put channel into record
f) Turn the erase preset (VR4) to minimum.
g) Adjust the tuning capacitor C68 for maximum current.
h) Turn up VR4 until the current waveform shows signs of distortion. Then back off VR4 to obtain a reasonable sine wave
i) Re-check tuning of C68 for maximum output. If the current suddenly jumps then go back to step f)
j) TP10 should show a reading of not less than 50mv RMS on the millivoltmeter (= 50mA erase current).

2) Bias Current

a) Probe TP8 (BIAS I) using R21 as a ground reference.
b) Using the keyboard, set "Bias" adjustment to max (FF) for this channel. Do NOT store this setting.
c) Tune L3 for a peak on MVM.
d) Tune TX1 for a peak on MVM.
e) Repeat steps 2c and 2d for maximum Bias current. This should be not less than 35mV on MVM (= 3.5mA bias current).
f) Recover your bias alignment on the alignment panel.

See section 11.3 for adjustment of the master bias level.

[N.B. Physical adjustment of bias circuitry will affect <u>all</u> stored bias settings]

11.2 The tape heads:-

The Saturn is available with both 16 and 24 track headblocks. The inductance and head gaps are as follows:-

Head	Inductance	Head gap (microns (um))
Erase	1.6mH	2*200(um)
Record	7mH	10-20(um)
Replay	80mH	3-5(um)

[N.B. Head alignment is covered in section 17.6]

11.3 The master bias and erase oscillator:-

The master bias oscillator is situated on the audio control board (see circuit diagram C117K). IC13c is connected as a 455kHz crystal controlled oscillator. Link LK1 is provided to allow the master oscillators to be disabled.
Divide-by-two circuits of IC14 provide bias (227.5kHz) and erase (113.75kHz) frequencies.
The erase output is buffered by IC16, Q3 & Q4 and from there is fed to the audio channels. The master erase output level is about 4.5 volts rms (as measured on TP9).

The master bias oscillator has a similar buffer amplifier (IC15, Q1, Q2) and the output voltage is adjusted by hybrid circuit DR1 under processor control. The bias output level (measured at TP8) with the hybrid set to maximum is approx 4.5 volts rms.

[N.B. Adjustment of master bias level will affect all stored bias settings.]

11.4 Metering system:- (See circuit diagrams SM3732, and SM3733)

11.4.1 Physical layout

The monitor outputs from the audio channels are used for metering purposes. The audio mother boards combine the signals into a 26 way cable which is routed to the "auxilliary rack" on the rear of the machine. Amplifiers for both types of meter used in the Saturn are contained in a double width module which plugs into this rack. The meters themselves are plugged into the external sockets on this module.

The large meters used in the machine overbridge can be either standard or "Bell Spec" types and are referred to as Local meters. The small meters used in the Total Remote are referred to as Remote meters.

11.4.2 Circuit configuration

a) Local meter amps

The signal recieved from the audio channels is first passed through a switchable 10dB attenuator. The control line for this is generated on the audio control board, and is common to all channels. This stage is followed by an amplifier with a fixed 10 dB gain. A series resistor is provided in the meter output signal which can be shorted out if the Local meters have internal ballast.

The Local meters require no calibration.

The outputs of the Local meter amplifiers are also routed via a cable to the Remote meter amplifiers on the other PCB in the module.

b) Remote meter amps

The input signal recieved from the local meter amps is applied to a precision rectifier circuit, which is followed by a gain stage. Approximate VU characteristics for the remote meters are obtained from an RC network on the output of this amplifier. The cable feeding the remote meters is connected to the output of this network.

11.4.3 Meter calibration

If Local meters are not fitted to the machine then no calibration is required.

The remote meters themselves are fitted with a variable resistor in series with the signal. These presets are inside the "remote metering module" which must be lifted from its cradle to gain access for adjustment.

a) Turn off the power at the machine
b) Refer to the sketch in section 14.2.1
c) Undo the four (two each side) screws marked 'A'
d) The metering module can now be lifted up to reveal the presets

If both sets of meters are in use then the presets can be used to match the readings between meters. If the factory calibration has changed and the meters do not agree with each other then use the following procedure...

1. Select input monitor
2. Send a studio reference level signal (mixer OVU) to all tracks.
3. Adjust audio channel "line in" preset for OVU on Local meters.
4. Adjust remote meter preset to read OVU on Remote meters.
5. If necessary adjust audio channel "line out" preset for a studio reference level (mixer OVU) return signal.

11.5 Audio input/output (see circuit diagram C122K)

11.5.1 Physical layout

Electronically balanced inputs and outputs are fitted to the audio channels, and these signals appear on 10 way IDC connectors on the audio mother boards. One connector per pair of tracks.

The signals are connected to the Audio Interface boards by 40-way ribbon cable. One cable per 8 tracks.

The three Audio Interface boards are mounted on the rear door of the Saturn. Each contains 3-pin XLR line connectors

The pin out of the XLR connectors is as follows:-

PIN 1 Ov (ground).
PIN 2 Line in/out (cold).
PIN 3 Line in/out (hot).

The line in / line out signals are also provided on a Varelco 56 way multicore connector (1 per 8 tracks). See section 1.4 for pinout details.

The XLR and Varelco connectors are wired directly in parallel.

11.5.2 Transformer balancing (option):-

Also available is the transformer balancing option. This is a mechanical assembly which fits in the rear of the machine and inserts transformers (Sowter 3276 (i/p) and 5130 (o/p)) between the I/O connectors and the audio channels. The pin-outs of the line connectors are unchanged.

11.6 The internal test oscillator:- (See circuit diagram SM3714)

The Saturn built in test oscillator is provided for testing and alignment of the audio system. Sinusoidal or square wave signals can be generated at 0 VU (+4dBm) or -10 VU (-6dBm) at 16 frequencies from 20Hz to 25kHz. The test oscillator signals are generated on the audio control board.

The oscillator is based around an integrated waveform generator (IC9 - 8038).

Oscillation is disabled by asserting (high) IC10 pin 13 via analogue switch (IC10A).

The frequency of oscillation is determined by the resistance to +8v on IC9 pin 8 and the capacitance to -8v on IC9 pin 10. Bits 0 to 3 on IC6 select the required values via the analogue switches of IC7 and IC8, under processor control.

bit 3 2 1 0	IC7	IC8	components selected	nominal frequency	
0 0 0 0	X1,Y1	X1,Y1	C7,R2	20 Hz	
0 0 0 1	X2,Y2	X1,Y1	C7,R3	35 Hz	
0 0 1 0	X3,Y3	X1,Y1	C7,R4	60 Hz	
0 0 1 1	X4,Y4	X1,Y1	C7,R5	90 Hz	
0 1 0 0	X1,Y1	X2,Y2	C8,R2	250 Hz	
0 1 0 1	X2,Y2	X2,Y2	C8,R3	450 Hz	
0 1 1 0	X3,Y3	X2,Y2	C8,R4	750 Hz	
0 1 1 1	X4,Y4	X2,Y2	C8,R5	1 kHz	
1 0 0 0	X1,Y1	X3,Y3	C9,R2	2.5 kHz	
1 0 0 1	X2,Y2	X3,Y3	C9,R3	4.5 kHz	
1 0 1 0	X3,Y3	X3,Y3	C9,R4	7.5 kHz	
1 0 1 1	X4,Y4	X3,Y3	C9,R5	10 kHz	**
1 1 0 0	X1,Y1	X4,Y4	C10,R6	15 kHz	
1 1 0 1	X2,Y2	X4,Y4	C10,R8	18 kHz	
1 1 1 0	X3,Y3	X4,Y4	C10,R10	21 kHz	
1 1 1 1	X4,Y4	X4,Y4	C10,R12	25 kHz	

** Note that preset (VR1) is wired in series with R5 in order to accurately trim the frequency of the 10kHz selection as this is most commonly used for bias adjustments.

11.7 Audio Control:- (See circuit diagram SM3714)

The Audio Control board contains the circuitry for generating the 'Audio Data Bus', the 'Audio Address Bus' and the 'Channel select' lines. These signals are the means by which the CPU passes instructions to the audio channels.

11.7.1 Channel Select

A 5 bit code is produced on the output of IC18 when the CPU wishes to send data to a particular channel. This is decoded by IC17,19,21 and 23 into one of 24 output wires. The signal at this point is a negative going pulse of about 5uS duration. This TTL signal is level shifted by IC20,22,24 to the +/- 8v logic required by the audio system. The channel select pulses are distributed to the channels by the audio mother boards (SM3716 & SM3717).

11.7.2 Audio address bus

The CPU can select one of 32 different functions (e.g. replay gain setting, monitor status etc.) on each channel by means of the 5 bit address bus. This is generated at IC25 (bits 0-4), and level shifted to +/- 8v logic by IC27.

The channel board only decodes the first 16 of these 'functions' and only the first 10 are actually used (see section 11.1.7). If a function address greater than 16 is generated then IC17 inhibits the channel select pulse. This allows channel functions not to be physically on the audio channel.

11.7.3 Audio data bus

The information required by any function (selected on the audio address bus) is sent to the channels on the Audio data bus. This is 8 bits wide giving 256 settings per function.

The bus is generated by IC28 and level shifted by op-amps IC29,30. Since the op-amps are connected as inverting integrators, the CPU sends inverse logic to IC28.

11.7.4 Audio control

Three additional signals are sent to the audio channels by the CPU. These are generated a IC25 bits 5-7 and level shifted by IC27. See also section 11.1.7.

'motion' used to switch off the bias and erase systems when lack of tape motion is detected.

'tach' used to time the bias and erase ramp starts according to current tape speed.

'timing' is used to disable the separate timing of bias and erase ramps (see section 3.3.6).

VR2 is used to set equal mark-space ratio on the square wave output.

VR3 and VR4 adjust the sine waveform. By successively adjusting these presets the sine wave output can be set for a distortion of <0.1%. These presets should only be used after the mark-space ratio has been set.

IC10B and IC10C select either sine or square wave signals to the buffer amplifier IC12A, under the control of bits 5 & 6 of IC6 (via IC11). The sine wave amplitude is set by VR5.

The gain of this stage is reduced by 10dB by switching in R23 and its calibration preset (VR6) via IC6 bit 4 and IC10D. Note that bit 4 control signal is also sent to the meter amplifers (see section 11.4 above) so that meter gain is raised when t oscillator signal is reduced.

From here the signal is routed via a break jack where an external signal can be inserted to replace the internal oscillator. The sensitivity of this input can be adjusted by VR7 (Output Level). A buffer amplifier IC12B drives the feed to the audio channels.

The test oscillator is factory set, but if adjustment is required the following procedure should be followed:-

1. Ensure that the line levels have been correctly set as described in section 4.2
2. Connect a millivoltmeter and oscilloscope to TP10 (TST OSC).
3. Connect a studio reference level signal (factory set to +4dBm) to the external input socket.
4. Select input monitor for all channels, unlock the alignment panel keys (see section 3.3.7), and turn o the test oscillator. Ensure the 10dB led is off. Check that all the VU meters give the same reading. If the meter readings are different, go back to step 1.
5. Adjust VR7 (Output Level) to achieve 0VU on the meters
6. Disconnect the external signal from the socket.
7. Set the oscillator to 1kHz square wave
8. Adjust VR2 (mark-space) for a 50% duty cycle
9. Select 1kHz sine wave.
10. Adjust VR3 and VR4 (SIN-ADJ) to obtain the best sine waveform. 0.1% distortion is achievable.
11. If a frequency counter is available, select 10kHz sine and trim VR1 to obtain 10kHz.
12. Select 1kHz sine wave
13. Adjust VR5 (OSC LEV) to obtain 0VU on the meters
14. Select-10dB.
15. Adjust VR6 (-10DB) to give a meter reading of 0VU.

12. Transport Electronics

12.1. Motor drive system

The microprocessor system calculates the drive requirements for the spooling motors taking into account the following factors.

A) The amount of tape on each reel.(effective reel diameter)

B) The tape tension required.

C) The acceleration required.

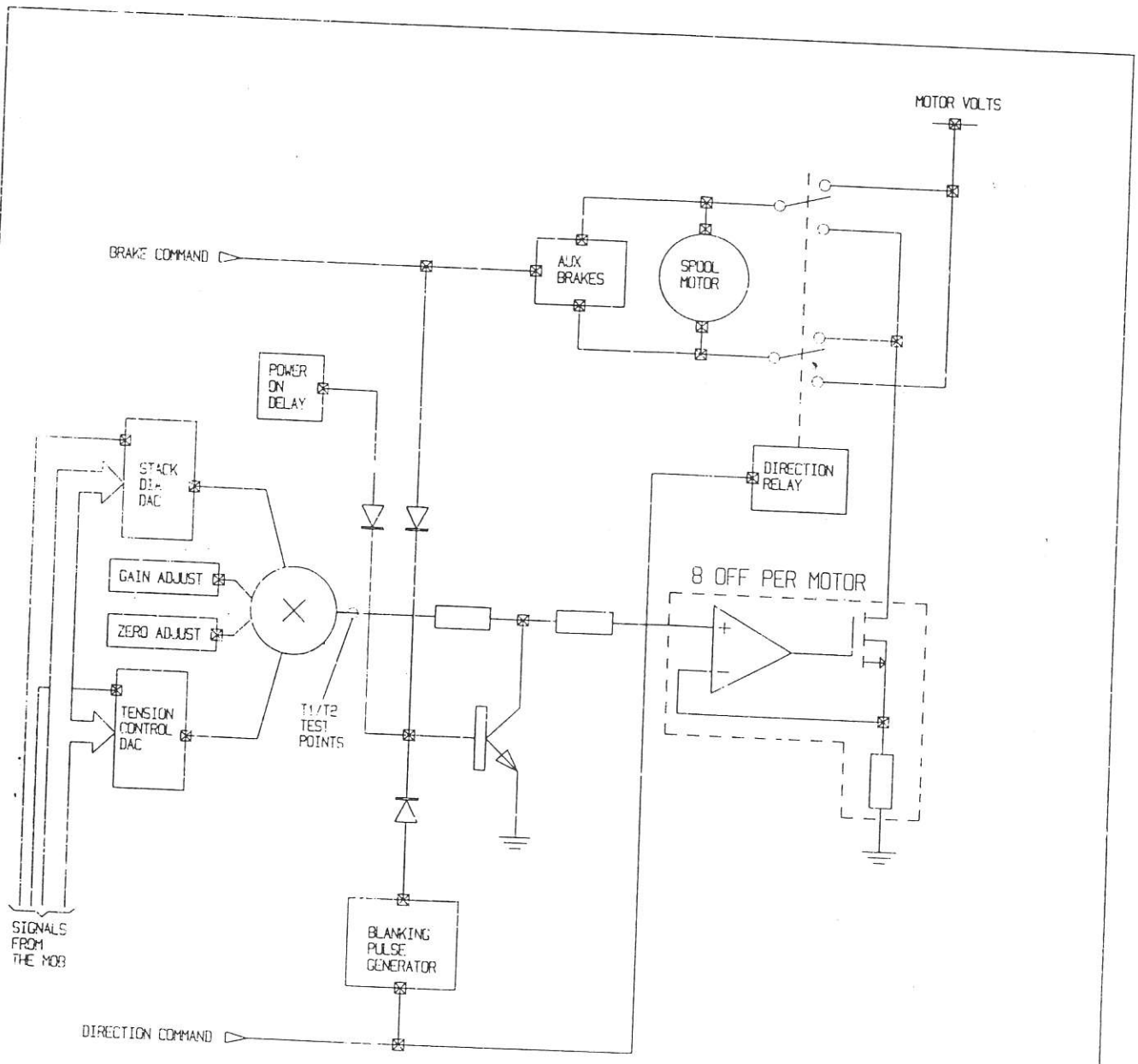


FIG 3 SPOOL MOTOR CONTROL...BLOCK DIAGRAM

Each motor is driven via a dual D to A converter on the interface board (IC12 & IC13). The output of one half is relative to the amount of tape on the spool and the output of the other represents the tension required. These outputs are multiplied together to form the torque command voltage (T1 Rewind motor & T2=Wind motor).

These signals are fed via the PSU main board to the .ET boards on the heatsink blocks. Each FE[illegible] board drives four MOSFET devices and each motor uses two of these boards (8 FET's per motor). Together each pair of boards act as a voltage to current converter with 1 Volt input producing approx 2 Amps of motor current. Each FET is driven by it's own op-amp and is individually fused with a 1 Amp fuse. Metal Oxide Varistors limit the absolute maximum voltage apearing across the MOSFET devices to about 600 volts.

An important point to note is the relationship between motor current and motor torque. The motors used in the SATURN are of an ironless rotor type and have a linear current torque relationship regardless of motor RPM.

12.1.1 Bi-directional drive.

In order to maintain constant tape tension under high acceleration conditions the drive system is able to reverse the direction of motor currents. Under these conditions the leading motor will be pulling the tape and the trailing motor pushing. The reversal of motor current is done on the PSU main board using a pair of relays (RL8 rewind, RL9 wind). The relays are controlled by signals from the interface board (LRD & RRD).

12.1.2 Current blanking. (see PSU circuit diagram C137K)

Whenever a direction reversal is requested by LRD or RRD, IC2 & IC3 generate a 40ms blanking pulse which via Q5/Q3 (T1) and Q6/Q4 (T2) remove motor current while the relays switch over.

12.1.3 Braking.

In most circumstances braking is done dynamically. This means that when the tape is spooling fast in one direction and stop is requested, fast spooling in the opposite direction is used until the tape comes to rest.

There is however a secondary braking system used under power fail and some other conditions. These brakes use the energy stored in the rotating spool mass to bring the tape to rest. They are activated in one of two ways.

A) Simultaneously if mains power fails.
B) Individually under processor control.

In either case the action is the same. If we consider the rewind motor. When the current through Q1 on the PSU main board is interrupted either through loss of +24 volts or on request from the processor (LRB), RL3 drops out first putting RL2 coil + R18 across the motor. If the motor RPM is high enough RL2 will pull in thus removing the short across D37+R20. After a short period .20 will discharge and RL4 contacts close. If the motor RPM was high enough and turning in the trailing direction , which is anticlockwise for this motor, current will flow through the motor via D37+R20 so reducing it's RPM. No current will flow if the motor was turning in the leading direction. Eventually the RPM will be low enough for RL2 to drop out, placing a direct short across the motor. Obviously if the initial ..PM was low the motor will be shorted as soon as RL4 drops out.

The wind motor operates in exactly the same way except that the lead/trail directions are reversed. The effect of this is to give smooth, safe lead/trail action braking if power dies at high spooling speeds. Full motor shorting comes in when tape speed has dropped below about 2 ips.

If the processor commands these secondary brakes (signals LRB & RRB from the interface board) then current blanking is forced via D46 & D47. C29 & 31 ensure that when a processor brake command is released, the current blanking is maintained long enough for the relays to disengage before power is fed to the motors.

12.1.4 Safety points

The motors are protected by fuses F7 & F8 on the PSU main board but remember these facts.

****

A) The DC motor supply voltage (+160vdc) takes several minutes to die away after power goes off.

B) Over 400 Volts can exist across parts of the motor drive circuit.

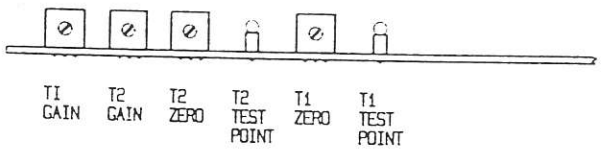
****

12.1.5 Adjustments

The only adjustments required for the motor drive system are the calibration presets on the to . converters.

Facilities are provided to allow these adjustments to be made quickly and accurately.. (see Test Mode - section 9.3)
Four adjustment presets are located on the interface board together with test points for T1 and T2.

VR1 - T1 gain
VR2 - T2 gain
VR3 - T1 zero
VR4 - T2 zero



NOTE THAT SOME PCBS HAVE INCORRECT LABELS ON THESE COMPONENTS.

THIS SKETCH IS CORRECT FOR ALL BOARDS.

FIG 9 INTERFACE BOARD PRESETS

In test modes 0 to 4, zero tension values are output to all D to A's. Adjust VR3 & VR4 for -20mV DC on the test points.
In test mode 5, full scale is output to all D to A's. Adjust R1 & VR2 for +2.7V DC on both test points.

Note that the motors should be disconnected from the deck distribution board before entering test mode 5.

12.1.6 Emergency fault finding.

A fault in the motor drive system will usually first show itself by the machine being unable to run for long without dropping into "Load". This almost certainly indicates an unbalanced tension control system. Most faults can be located with the aid of a simple DC voltmeter.

First check the adjustments as in 12.1.5 above. If these check out OK then follow the procedure below:

(See circuit diagrams C126K and C127K Saturn power supply.)

1. Turn the power off.

2. Pull out the power supply on its runners and remove both the top covers.

3. Lift up the two heatsink assemblies on their hinges. Captive nuts are provided to secure them in the up position.

4. Note that high voltages are present in these assemblies.

********** BE CAREFUL **********
DO NOT TOUCH ANYTHING WITH THE POWER ON

5. Turn the power on

6. Using the power supply star point for the negative lead, check the voltage on all 16 FET cans. This should be about +160v DC.

7. Any not present indicates a blown fuse on the FET board.

8. If a replacement fuse also blows, then the FET is probably short circuit. Go to step 15 below.

9. Put the recorder into "Stop".

10. Check the voltage on the interface board test points for T1 and T2. The actual value measured here will depend on the amount of tape on each reel.

11. Measure the voltage on the large 3.9 ohm resistors on the FET boards. (The leg nearest you). Each one of the eight in the left hand heatsink assembly should read the same as T1, and those in the right hand assembly the same as T2. These voltages indicate the current through each FET.

12. If just one resistor fails this test then either a blown FET or a faulty op-amp is indicated. Go to step 15 below

13. If all the resistors in a block fail this test then the path of the T1 or T2 signal must be traced through. Taking T1:
From Interface board J2C pin 7
via Digital mother board
to PSU J8 pin 7
via R9 and R10 to J18 pin 5
to left hand heatsink FET boards
to pin 3 and pin 5 on four op-amps

14. If both voltage and current are correct for all FETs then the fault will lie elsewhere e.g. motion sensing or mechanical misalignment

15. If a failed FET or op-amp is discovered and replacement parts are not available, then the recorder can be made to function as an emergency measure by removing one FET from the other motor to bring the system back into balance. This is easily done by removing a fuse from the FET board.

16. Recheck the adjustment as in 12.1.5 and then try machine operation.

17. If the reduced tape tension now provided is insufficient to operate the machine satisfactorily then repeat the adjustment of 12.1.5 but setting "gain" to read 3.1v DC. This will restore the original tensions.

18. THIS SHOULD ONLY BE DONE IN ORDER TO FINISH AN IMPORTANT SESSION.

As a safety precaution it is advisable to limit the wind speed to 300 ips if this action is taken. See Varispool section 3.2.6

Since 7 FETs are now doing the work of eight, a proper repair should be carried out AT THE EARLIEST OPPORTUNITY.

12.1.7 Replacing FEts

The Saturn will run with different types of FET fitted to the drive board. The recommended type is Motorola MTM6N85. This is an 850 volt device.

Lower voltage devices such as MTM6N55 can be used providing they are protected from voltage transients.

This can be provided by the use of two Motorola P6KE200A (or 1.5KE200A) MOSORB devices connected in series with each other across the drain and source terminals of each device.

The bar on the MOSORBs goes to the drain terminal.

12.2 Optical tachometers.

Three optical tachometers are used on the SATURN. One on each spool motor and one on the motion roller. Outputs from these sensors are processed on the Interface board.

The most important information derived from the tachometers are;

A) Tape speed. (section 12.2.3)

B) Amount of tape on each reel. (section 12.2.4)

For circuit references in this section see Interface Board circuit diagram

12.2.1 Spool Motor Tachometers.

Attached to the ends of the spool motor shafts are thin stainless steel slotted disks. A dual infra-red optical interrupter is mounted so that its beams are broken by the outer ring of 141 slots as the motor shaft rotates. This produces phase quadrature outputs from each sensor (LRT1 & LRT2 for the supply motor, RRT1 & RRT2 for the take-up motor). If we look at one pair of signals, say RRT1 & RRT2. IC38-A compares the relative phases to produce an output representing the direction of rotation. This is then input to the processor via IC29. RRT1 is also sent....

A) To a frequency detecting circuit (IC34-B & IC36-B). The output of this circuit will be high if the spool is moving and low if not. This is then input to the processor via IC29.

B) To one of the inputs of a counter/timer (IC21) where the pulses are counted.

12.2.2. Motion Sensing Tachometers

Mounted on the end of the Motion roller shaft is an aluminium disk which has 24 holes spaced equally around its circumference. A pair of infra-red optical interrupters are mounted so that their beams are broken as the roller rotates. This produces phase quadrature signals PH1 & PH2 . Motion and direction information is generated on the interface board as for the spool tachometers (IC35,37-A,39-A). Each positive edge of PH1 sets latch IC23-B the output of which causes a non maskable interrupt (NMI) of the microprocessor. The latch is cleared after the the interrupt service has been completed. This prevents interference causing self interrupts and possibly a software crash.

12.2.3. Tape speed

The Motion roller in the tape path is of known diameter and the tacho output interrupts the microprocessor 24 times every revolution, as described above (12.2.2). The CTC (IC21) on the Interface board is fed with a 250KHZ reference frequency (REFCK) derived from the crystal controlled oscillator on the Processor board. At each NMI the number of reference clock pulses counted by the CTC is stored. From each reading the tape speed can be calculated but for greater accuracy they are averaged over the latest 24. If the tape speed is very slow (<2ips) the the CTC may overflow. This is latched by IC23-A and signals to the processor that the reading will be incorrect.

12.2.4. Calculating the tape on each reel

After every complete revolution of the motion roller (i.e. 24 NMI's) the number of reel tach pulses (LRT1 & RRT1) are input from the CTC. Using this ratio the processor calculates the "effective reel diameter" for each spool. The value found for diameter is checked for errors before it is used to generate tape tension information.

A) The diameter cannot be smaller than the centre of a NAB hub (approx 4.6 ins) or greater than the stack on a full 14 inch reel of tape (approx 13.75 ins)

B) Three consecutive diameter calculations must not differ by more than a small amount.

After a "tension error" message (section 9.2.3) or a software reset (section 3.3.6) both the above conditions must be satisfied before proper operation is restored.

12.3 Tension limit and tape presence sensing

These systems are used to prevent tension being applied to the tape when conditions are unsuitable.

12.3.1. Tension limit sensors

Attached to the underside of each damper arm is a small aluminium vane. The position of the vane is sensed using an infra-red optical sensor of the same type used on the motion roller tachometer. The outputs are sent to the Deck Distribution Board where they are OR'ed together by IC1 to produce the signal 'EOT'. This signal is sent to the Interface Board and input to the processor via IC28. The EOT signal goes high if either damper arm moves too far forwards (tension too high) or too far backwards (tension too low).

12.3.2. Tape presence sensor

To detect the presence of tape, an infra-red beam is sent across the tape path and detected by a sensor on the Headblock board. This board is situated next to the erase head. A high power infra-red diode is mounted in a small housing on the deck opposite the erase head. Power is continuously supplied to it from the Deck distribution board via current limit resistor R6. Without tape, the beam is sensed by light activated switch (S1) whose output (TPS), on Pin 4, will be high and LED1 will be on.

The sensitivity is controlled by VR1 (clockwise = less sensitive).
For correct adjustment ;

A) Remove tape.
B) Reduce sensitivity until the LED goes out.
C) Increase sensitivity until LED just comes on.
D) Continue to increase sensitvity by half a turn.

12.3.3. When is TPS used?

A) Going into STOP from LOAD. to check for successful lacing
B) EDIT mode. to remove tension if tape is pulled away from the heads
C) Tension going out of limits. to ensure safe handling of the tape

The absence of a Headblock board is detected using the ID system (LK1-4 - see section 12.5.1) and appropriate alternative action is taken in the above circumstances.

12.4. Head screens and tape lifter control

Control signals HS & TL are used to operate these mechanisms. These are generated on the Interface board and sent to the Deck distribution board for buffering and interlocking.

12.4.1. Head screens.

A small DC motor, gearbox, friction clutch combination drives a pair of MU-METAL screens up through the deck plate in front of the Record and Playback heads to prevent hum pickup. On command from the processor Q2 turns on and current flows through the motor via R21 and the normally closed contacts of a microswitch. The screens are driven up at a rate controlled by R21. When the screens are fully up the microswitch contacts open, adding an extra resistor in series with the motor. This limits the stall current to a safe continuous value. If the screens are pushed down manually the friction clutch operates causing no damage. When released, the motor drives the screens back up.
When the screens are commanded to drop, a resistor / diode combination across the motor terminals causes them to fall smoothly using the back EMF effect.
A micro-switch fitted to the tape lifter assembly prevents the the head screens from operating unless the lifters are fully retracted.

12.4.2. Tape lifters

A pair of stainless steel pins lift the tape away from the heads when playback is not required. These pins are moved by a solenoid / slide combination. When the machine is unpowered, the rest position is with tape against the heads.
On command from the processor Q3 turns on causing current to flow through the solenoid via a microswitch. The microswitch is arranged so that the lifters can only be operated when the screens are fully down. This prevents any possibilty of the tape coming into contact with screens. When it is turned off, the back EMF spike is supressed by diode D3.

12.5. Headblock identity.

It is posible to fit the SATURN with headblocks using various different tape head combinations. Heads may vary both in the number of tracks and in tape width. The processor can identify the type fitted by reading a 4 bit code from the headblock. The code is set by links on the Headblock board (link not made = 1, link made = 0) and have the following meaning.

	0	1
ID0	1"	2"
ID1	8T,1" or 16T,2"	16T,1" or 24,2"
ID2	Undefined	Undefined
ID3	Headblock present	headblock not present

The SATURN stores in memory two complete sets of audio alignment data.
The setting of ID1 decides which block of memory is to be used. This allows two headblocks to be interchanged without the need to realign the audio system.

The headblock present bit, ID3, is used in conjunction with the TPS system described in 12.3.2. When no headblock ID is detected the the system defaults to 24 tracks on 2 inch tape.
When 8 or 16 track headblocks are in use the unused monitor status leds are blanked and the invalid keys will not respond.

12.6. Transport switches and Display

These are connected by ribbon cable directly to the sockets located on the front edge of the Interface board.

12.6.1. Transport switches

These are housed in the extrusion in front of the transport and are arranged in two banks, of five and three. The switches are input via IC46 & IC47. Pull up resistors on the inputs mean that a switch not pressed = 5 volts and switch pressed = 0 volts. The switch illumination is provided by a parallel pair of bulbs under each switch. The commands to turn on the bulbs are output via IC44 & IC45 and turn on the current drivers IC50 & IC51. Current (about 70mA) is provided from the 24 volt supply. To maximise the life of the bulbs, resistors (R30 to R37) are connected across the drivers to provide a "warm" current to the bulbs when switched off.

Switches:-

IC46	bit 0 -	rewind	IC47	bit 0 -	
	bit 1 -	fast forward		bit 1 -	
	bit 2 -	play		bit 2 -	load
	bit 3 -	stop		bit 3 -	edit
	bit 4 -	record		bit 4 -	RTZ
				bit 5 -	
				bit 6 -	
				bit 7 -	counter reset

Lamps:-

IC45,51	bit 0 -	rewind	IC44,50	bit 0 -	
	bit 1 -	fast forward		bit 1 -	
	bit 2 -	play		bit 2 -	load
	bit 3 -	stop		bit 3 -	edit
	bit 4 -	record		bit 4 -	RTZ

12.6.2 Transport display

A Fluorescent Display Module is fitted to the deck plate just behind the Transport switches. This provides the user with a copy of whatever is displayed on the Tape Position Counter on the Total Remote unit. Like all the fluorescent displays it is multiplexed directly by the processor. The module also contains a clear button which has the same function as POS(ition) CLEAR on the Total Remote. The digits are driven by IC43 via IC49 (+5v to +24v level shifter). The segments are driven by a similar combination (IC42/48).

	segments			digits	
IC42/48	bit 0 -	segment a	IC43/49	bit 0 -	frames
	bit 1 -	segment b		bit 1 -	10's frames
	bit 2 -	segment c		bit 2 -	secs
	bit 3 -	segment d		bit 3 -	10's secs
	bit 4 -	segment e		bit 4 -	mins
	bit 5 -	segment f		bit 5 -	10's mins
	bit 6 -	segment g		bit 6 -	hrs
	bit 7 -	decimal point		bit 7 -	10's hrs

Filament current for the module is derived from +5v via resistors on the Transport Display board.

To make any given segment illuminate the following conditions must be met.

A) Approx 50ma of filament (cathode) current must be flowing.

B) The selected digit (Grid) must be at +24v.

C) The selected segment (anode) must be at +24v.

To turn off a given segment either the selected grid or the selected anode must be at least 3v below the average filament voltage

12.6.3 Transport switch or Lamp replacement

It is inevitable, despite the best efforts of designers and lamp manufacturers, that filament bulbs will occasionally expire.

To replace a bulb in the Saturn Transport switch bank :-

a) Remove the five self tapping screws "A" securing the front facia.
b) Remove the two screws "B" securing each side panel to the frame
c) Slide the side panels forward to remove them from the machine. Take care that any washers used in some units are retained on the side panel pillars.
d) Remove the screws "C" from the upper side of the front extrusion.
e) The front extrusion can now be twisted gently forwards, pivoting on screws "D".
f) The switch caps can now be lifted out to reveal the switches and lamps.
g) The lamps can be replaced from the top of the PCB, without any further disassembly.

To replace a switch

h) Remove screws "D" and remove the front extrusion completely to release the switch bank PCB's.
j) When re-assembling the unit make sure that the switch bank PCB's engage in the lower slot in the extrusion
k) Reading from left to right the front extrusion contains -

10mm facia
5 switch bank:
- rewind
- fast forward
- play
- stop
- record

65mm facia
3 switch bank:
- load
- edit
- RTZ

Long facia (or local alignment panel)

m) Fit the parts into the rear extrusion and offer up the front extrusion
n) Refit screws "D" then follow steps e) to a) in reverse.

13 P.L.L Capstan servo:-

INTRODUCTION

The PAPST capstan servo motor is driven by the phase locked loop (PLL) capstan servo board (SM3683). A 120 pole tachometer is used to sense the rotational speed of the motor and the output is used to adjust the input frequency to achieve an exactly calculated tape speed. The HALL effect switches were included to ensure optimum commutation. The PLL capstan servo can be frequency or voltage driven from a external source or be left to lock to its own internal oscillator.

CIRCUIT DESCRIPTION:-

13.1 Power requirements

24v @ 3A
5v @ 100ma
0v logic
0v Motor Ground

13.2 Input section

This section monitors the varispeed bus (VS2 relative to VS1) and depending on the state of the bus selects one of three modes of operation:-

a) Internal frequency control (INT/F).
This mode is selected when the bus is open circuit. The capstan speed is then controlled by internal reference oscillator.

b) External frequency control (EX/F).
This mode is selected when an AC signal is present on the bus with an amplitude of 5V PP (ie TTL level square wave) and in the frequency range 4.8 to 19.2kHz.

c) External voltage control (EX/V).
This mode is selected when the impedance of the bus is less than 13k. In this mode capstan speed can be controlled by a variable resistor (Max value 11K), or by a variable voltage in the range 0 to +3V, (low volts/resistance = high speed)

When controlling the capstan from external source the speed range available is:

HI Speed	13ips to 45ips
LO Speed	6ips to 22ips

Operation outside this range is not recommended, however speeds of 60ips and above are possible by altering the value of R21 upwards. (R22 controls minimum speed).

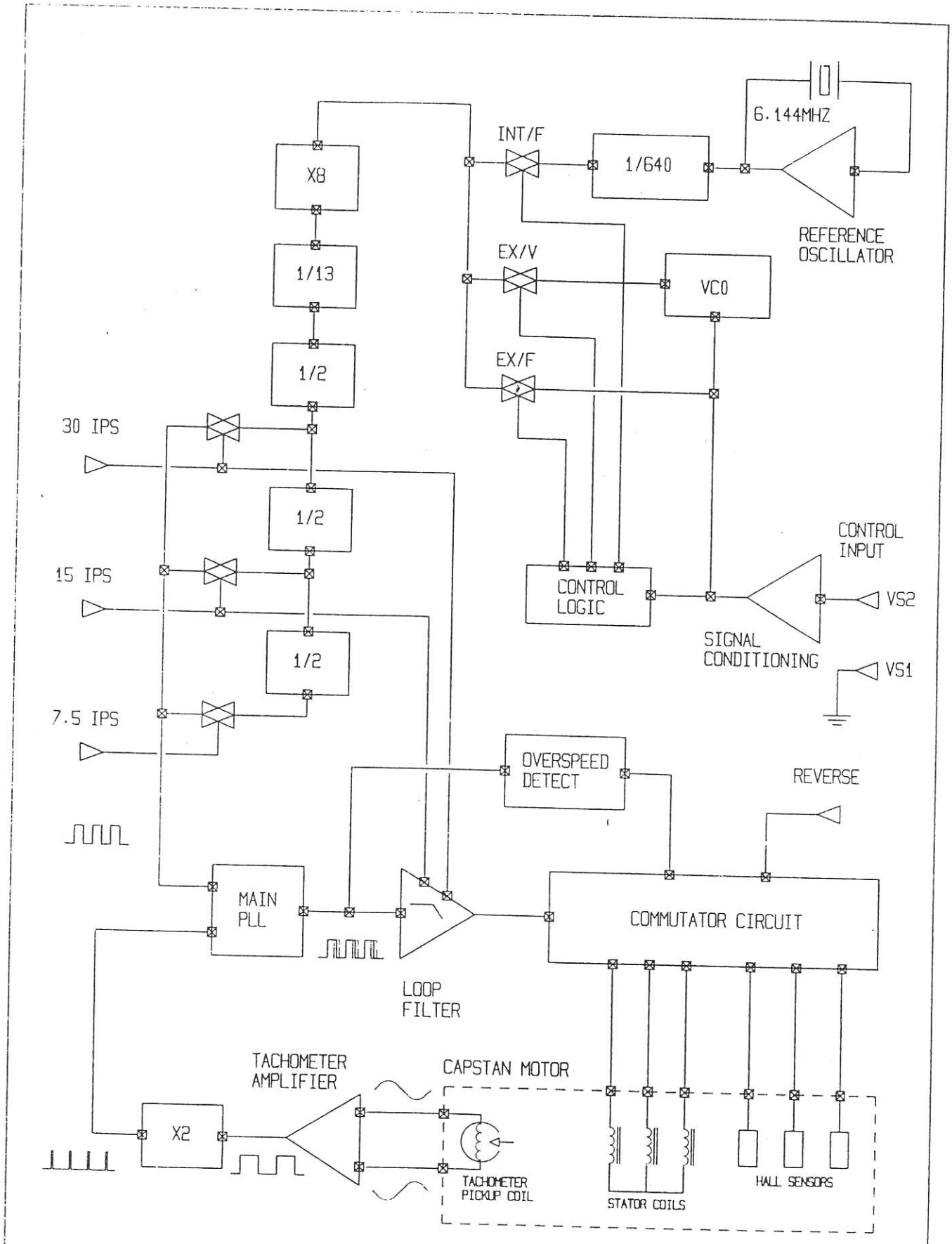


FIG 8 CAPSTAN SERVO...BLOCK DIAGRAM

Any input signal appearing on the bus is split into two directions:-

i) Any DC components are inverted and buffered by IC2-A plus associated components R5-R8, C5 and fed via R23 to the input of the VCO section of IC10.

ii) The output of comparator IC1-A (TP1) will be low for INT/F mode. The outputs of IC3-A & IC3-B will both be low.
When in EX/V mode TP1 and IC3-B will go high. IC3-A will remain low.
When in EX/F mode TP1 will be a square wave. This passes through C2 and sends the output of IC3-A high. The outputs of IC3-A & IC3-B are then decoded by IC11-A/B & IC3-C/D.

IC3-A	IC3-B	MODE
0	0	INT/F
1	0	EX/F
0	1	EX/V
1	1	EX/F

The selected mode is then passed through the transistor driver stage and displayed by the appropriate LED.

13.3 Internal reference oscillator

This is a standard two inverter crystal controlled squarewave oscillator formed by IC12-A, IC12-B, R26, R27, C14 and a 6.144MHZ Quartz crystal. After buffering, the signal passes through a frequency dividing network, (IC13-A, IC14) appearing as 9.6kHz. This signal is referred to as F/INT.

13.4 Voltage controlled oscillator (VCO)

When EX/V mode is selected, an internal VCO (part of IC10) is enabled by IC9-C and begins to oscillate. This produces a square wave on IC10 pin 4 (F/VEX). The frequency of oscillation is proportional to the voltage on TP6 and rate of change limited by C12. For a fixed value of C11 the max frequency of oscillation is controlled by R21 whilst the min frequency is controlled by R22. The centre frequency is chosen to be 9.6kHz

13.5 Capstan tachometer signal conditioning

The capstan motor produces this signal by means of a 120 pole magnetic wheel and pickup coil. The signal is sinusoidal and is passed to IC1-B for amplification and squaring and can be seen on TP4 as good square wave with equal mark space ratio. The frequency depends on motor RPM and bears the following relationship to tape speed:-

7.5ips = 738HZ
15ips = 1476HZ
30ips = 2953HZ

The signal is buffered by IC9-A. Then IC9-B, R20 and C10 multiply the signal frequency by 2. This signal can be seen as a series of narrow pulses on TP5 the input to the main PLL circuit.

13.6 Frequency changer

The purpose of this circuit is to convert the standard frequency of 9.6kHz into a frequency suitable for phase locking with the signal obtained from the capstan tachometer. To do this the reference frequency must be multiplied by 8/13 before entering the final divide by two chain.
The input to this section, one of F/INT, F/EX or F/VEX, is selected by three analogue switches (IC4-A/B/C) and is fed to the input of a PLL (IC5). A divide by eight network (IC6-A) is placed in the digital feedback path causing the output frequency to be eight times that of the input. IC7 divides this frequency by 13 and passes it to the final divider chain whose outputs are divide by 2, 4 or 8 corresponding to 30, 15 and 7.5ips. The correct output is chosen by the speed select inputs (J2 9,10,11), high equals speed selected (+5V or +24V), and forms the reference input for the main PLL section.

13.7 Main PLL section

The main PLL is provided in IC10 and this circuit drives the capstan motor until the reference frequency (TP3) is equal in phase and frequency with the tachometer (TP5) and attempts to maintain this "locked" condition.

a) Reference frequency higher than tacho.

PLL output (IC10 13) will be high. This passes through the filter (IC2-B) and causes maximum current to flow through the motor.

b) Reference frequency lower than tacho.

PLL output will be low and no current will flow through the motor. If this situation persists the input voltage on comparator IC1-C pin 9 will fall low enough to send the output high causing the motor to reverse direction. Max current flows until correct speed is reached. This greatly reduces the motor lockup time for large reductions in speed.
NB. When the capstan is being controlled by a system which does not moderate the rate of change of speed it is quite possible for the machine to enter autostop when in the play mode. It may be prudent to remove R42 on the capstan board which will disable the above auto reverse effect.

c) Reference frequency equal to tacho.

The PLL output will be a series of pulses the frequency of which will be equal to the reference frequency and the width of pulse will be equal to the difference in phase between reference frequency and tacho frequency. This signal passes through the filter where the reference frequency is removed leaving only the DC component. This DC component is proportional to the width of the above pulse and represents the drive required to maintain "lock". Under normal conditions at 15ips this will produce 150 to 200mA of motor current when in stop mode, rising when a load is placed on the motor.
Note that the output of the filter (TP7) is inverted ie, lower voltage equals higher current. In order to keep phase jitter between the above two signals to a minimum it is necessary to alter the value of C18 in the filter circuit to suit the selected speed.

7.5ips = C18 only
15ips = C18+C19
30ips = C18+C19+C30

13.8 Commutation section

The motor itself is a brushless DC outer rotor type consisting of three field coils, three HALL effect position sensors and a tachometer pickup coil. In order for the motor to rotate it is necessary to pass current through the field coils in the correct sequence and at the correct time relative to the position of the rotor. The information on rotor position is passed from the HALL sensors to the address inputs of a PROM (IC15) which is pre-programmed with the information required to produce optimum commutation. The data outputs of this commutation PROM drive three sets of tristate coil drivers. The current flowing through the coils being proportional to the filter output.
The direction of rotation can be selected using LK1. Link in place equals clockwise direction (viewed from top).
Resistor / capacitor networks connected between each phase are used for suppression purposes.
The bulk of the motor current returns to earth via the current sensing resistor (R53, 0.33ohms). A link (LK2) is provided to enable the motor current to return via a different route if required.

13.9 Phase lock indicator

When the PLL is in lock, the output of phase comparator 1 (IC10-2) is low except for some very short pulses that result from the inherent phase difference between the signal and the and the comparator inputs. The phase pulse output (IC10-1) is high except for some very short pulses resulting from the same phase difference. This low condition of phase comparator 1 is detected by the lock detection circuit IC11-C/D and associated components D6,R24,C13 and R25.

14. Remote control System.

14.1. Total Remote Unit

The Total Remote gives you all the functions of the recorder in a compact stylish assembly with its own roll-around stand. There are two main modules in the Total Remote which are connected together by a short flat cable and to the Saturn Recorder by two multicore cables.

The main module is the remote control unit (see 14.2 below)

The other module contains the alignment panel (14.3) and the remote metering assembly (14.4).

14.2. Remote Control Unit

This unit is the main user interface and contains all of the most important functions. It is connected to the Remote Buffer board (section 15.4) at the machine via a shielded 25 way round cable. Inside the remote unit there is :-

1) The Remote main board

2) The Display holder board

3) Membrane switch panel

4) Varispeed potentiometer

5) Two transport switch banks

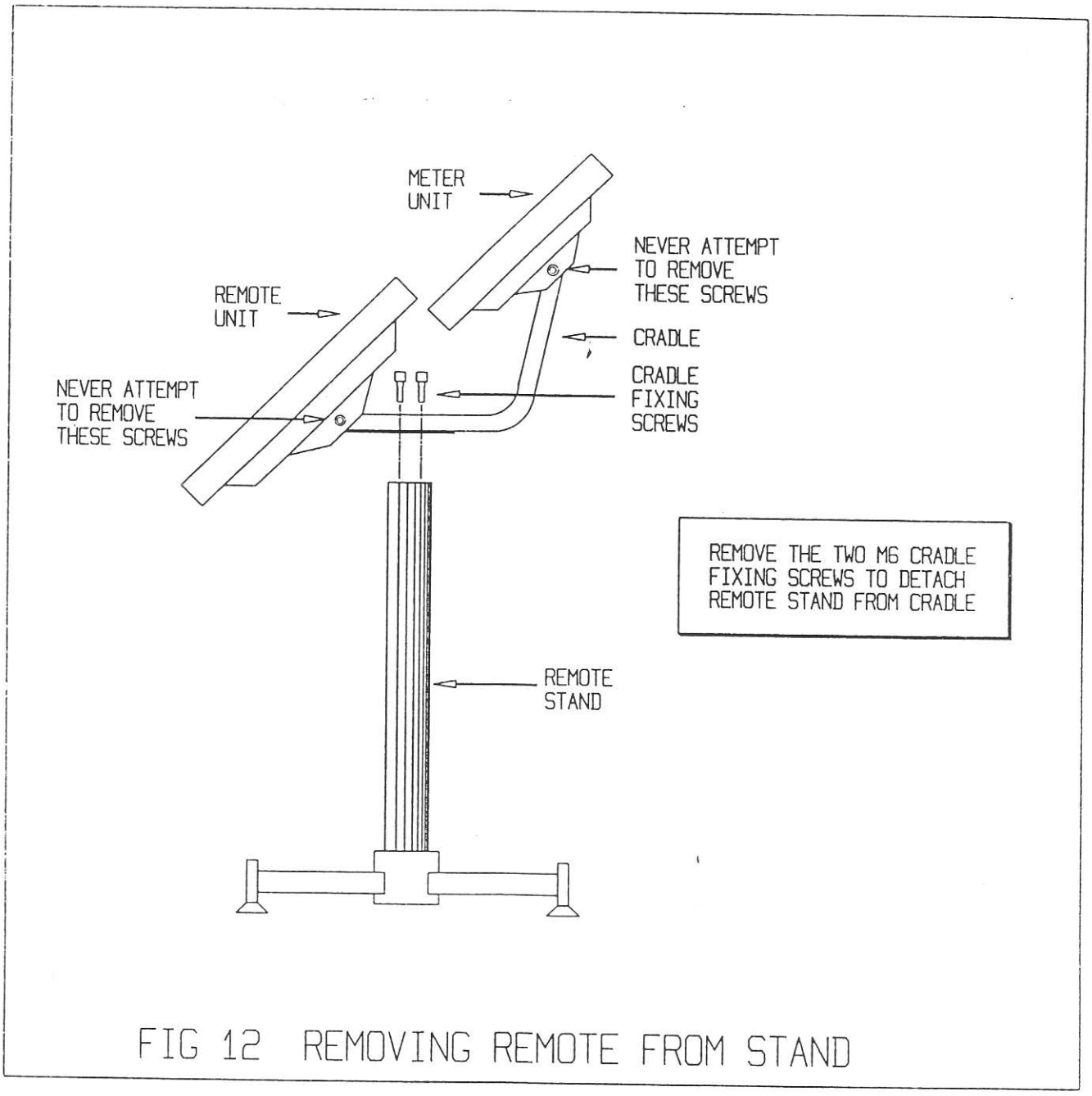


FIG 12 REMOVING REMOTE FROM STAND

14.2.1. How to disassemble the Remote Control Unit.

Read the whole of section 14.2.1 before starting work.

To remove the remote unit from its cradle:

A. Turn off the power at the machine
B. Disconnect the 25 way remote cable and earth strap from the unit.
C. Disconnect the 26 way flat cable to the alignment panel.
D. Undo the four (two each side) countersunk screws marked "A" in the sketch.
E. The remote unit can now be lifted out of its cradle.

To view the component side of the main board:

F. Using flat blade pliers unclip the 9 plastic PCB spacers at the front and rear of the board.
G. Gently lift the front (near the transport switches) of the board as far as cable length will permit.
H. Take care not to dislodge the "flextrips" at the rear of the board.

To remove the main board:

I. Disconnect the two 16 way cables from the transport switches and the 4 way connector to the varispeed pot.
J. Gently lift the board further and disconnect the 40 way connector to the flourescent displays.
K. Gently remove the 5 "flexstrips" from their sockets on the main board
L. The main board can now be lifted from the unit.

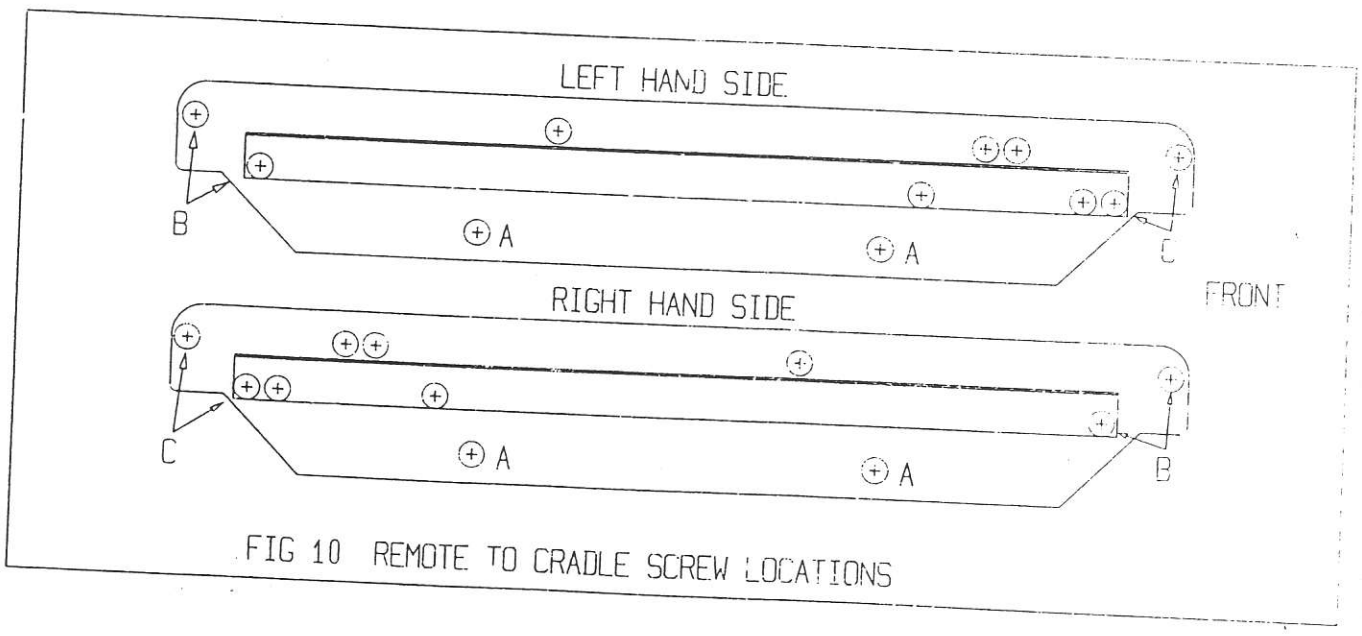


FIG 10 REMOTE TO CRADLE SCREW LOCATIONS

To remove the display board:

M. Undo the 5 screws securing the display board to the membrane panel. Note the position of the screw which is not fitted.

To remove the membrane panel:

N. Undo the screws marked "B" in the sketch.

O. Remove the rear extrusion and mounting bracket as one piece, by sliding it out from between the side panels

P. The membrane panel can now be removed from its location slot in the front extrusion.

Q. On reassembly check that no LEDs are touching the central support bar

To remove the transport switch assemblies:

A. Remove the remote control unit from its cradle as in steps A-E above.

B. Disconnect the two 16 way cables from the transport switches and the 4 way connector to the varispeed pot.

C. Undo the screws marked "C" in the sketch.

D. Turn the unit the correct way up.

E. Gently pull away the front extrusion from the unit.

To reassemble the transport switches:

A. Locate the switch bank PCBs, the switch caps and the infill panels in their correct slots on the centre extrusion.

B. Offer up the front extrusion and locate these parts in their correct slots

C. Reassemble screws "C"

D. Check that all the mechanical switches are seated correctly and are free to travel without binding in the extrusion.

To replace a faulty LED:

A. Follow steps A - H above to view the underside of the membrane panel.

B. Some LEDs are accessible without further disassembly by propping up the main board.

C. If the faulty LED is still obscured then remove the main board and display board as in steps I - M.

D. CHECK THE ORIENTATION OF THE LED BEFORE REMOVAL.

E. The LED can be removed from the rear of the membrane panel.

F. Bend and cut the legs of the new LED so that the front face of the LED touches the membrane surface and the legs fit approximately half way down the PCB hole.

14.2.2. Main board. General

All the active electronics are on this board the main function of which is to scan the switches and drive the LEDs.

The board is driven by the processor via a standard 'MOB' interface (see section 10.4.1), only active when remote functions are being accessed. The logic supply is derived from a regulator (IC0) attached to the +12 volt unregulated supply. The ground return makes use of the outer screen of the 25 way cable to ensure a low impedance path back to the power supply star point. An additional +5 volt regulator (IC50) supplies power to the Alignment panel if one is fitted.

The standard 'MOB' interface circuit is used here and operates as outlined in section 10.4 with PROMs IC3 & IC42 decoding adresses local to this board.

In order for the remote to function at all, its presence in the system must be recognized by the processor at switch on. This is done by attempting to read from IC11

14.2.3. Keyboard scanning

The keys are arranged in a matrix of 8 by 14. The membrane keys make up 96 of this matrix and the transport switches make up 16. Not all matrix positions have switches fitted. In operation all the columns are selected at the same time (via current sinks IC13 & IC14). At 2mS intervals the input port (IC10) is read by the processor. If no keys are being pressed the input will be all 1's (FF hex) and no further action is taken. If however a non-FF value is found, a key must be pressed and a complete scan of the keyboard is made to find out which one it is.

14.2.4. LED Multiplexing

The LEDs are arranged in a 24 by 8 matrix and as with the keyboard not all matrix positions have LEDs fitted. A map of the status of each LED is maintained in memory. The data for the first row is output via IC27 (1=LED on,0=LED off). This data is routed through current sink IC26 and to the row driver transistors (Q1-Q8). At the same time column select data for column 1 is sent out through IC21, decoded into 1 of 24 lines, and routed to current sinks IC19, IC22 & IC24. Current then flows from +5V through the transistors, current limit resistors (R5-R12), LEDs and then to ground via the selected column. After each maskable interrupt of the CPU the next row/column combination is output until all 24 have been output and the process is constantly repeated. A scan is completed every 24ms resulting in a continuous, flicker free display.

14.2.5. Replacing the membrane panel

This should only be necessary if a switch has become "stuck" (see FAIL 08 section 9.2.1) or is open circuit. Faulty LEDs can be replaced as in section 14.2.1

A. Remove the membrane panel as in 14.2.1 above
B. Insert the new panel in its slot in the centre extrusion and refit the rear extrusion.
C. Carefully insert the "flexstrips" in their sockets and retrace the disassembly procedure in reverse order.
D. When refitting the main board to its PCB clips ensure that the "flexstrips" do not become dislodged.

14.2.6. Fluorescent Displays

The fluorescent displays are multiplexed in a similar way to the LEDs. LED columns 1 to 16 are used, via level shifters, to drive the digit select pins. The segment drive is provided by IC12 and level shifter IC8. See section 12.6.2 for further information on fluorescent displays.
While LED columns 1to 8 are being output the segment data for the Tape Position display is sent. For LED columns 9 to 16, segment data for the Locate Position display is sent. For the remainder of the LED columns the displays are blanked.

The filament current is supplied by IC28 and associated components. This circuit provides an AC drive to the filaments resulting in a brighter and more even illumination than would be possible with a DC system.

14.2.7. Replacing the Fluorescent displays

A. Follow the disassembly procedure of 14.2.1 to remove the display board from the Remote Unit
B. Before removing the faulty display it may help to draw an outline round the old display module before unsoldering.
C. Carefully preform the display module pins to avoid stress at the glass envelope before fitting the new module.
D. It is good practice to only solder two pins of the new module and check the mechanical alignment before completing the solder joints.

14.2.8. Varispeed control

A 555 timer (IC29) is wired for astable operation. The frequency of the squarewave it produces is controlled by the setting of the 10-turn varispeed potentiometer (Min = 4.8kHz,Max = 19.2kHz). When Varispeed has been selected an analogue switch (IC36-D) is enabled, connecting the 555 output to VS2, the capstan speed control line. On detecting this the capstan servo will automatically select EX/F mode (See chapter 13 for further information on the servo board). The capstan speed will now be dependant on the setting of the Varispeed pot which will give a speed adjustment range of +/- one octave from selected speed.

A frequency detecting circuit, formed around counter IC33, operates in exactly the same way as the capstan speed measuring system on the interface board (section 10.3.2). This circuit is able to measure.

A) The capstan speed as requested by the Varispeed pot.
B) The capstan speed as requested by any external equipment connected to the SATURN. (a synchroniser for example)

The software can make use of this information to adjust tape speed/tension before engaging the pinch roller and to detect any variations between actual and requested capstan speeds.

14.2.9. Setting the varispeed range.

The varispeed control is designed to provide at least +/- 1 octave variation from nominal play speed. If this range of adjustment is not available then proceed as follows.

Note that, although it is possible to set the system to give a greater range of adjustment, this should not be done as the resolution of the control will be degraded.

A. Lift remote control unit from the cradle (see 14.2.1 above)
B. Ensuring that the remote control electronics is not shorting on any metal parts, turn the power on, select 30ips, select minimum varispeed and put the machine into play.
C. Select speed reading on the alignment panel display. This should be in the region of 13 - 14 ips.
D. Locate C41A on the main board (nom. 220pF). If necessary this can be increased to reduce minimum speed or vice versa.
E. Select maximum varispeed. The speed reading should be 60.5 - 62 ips. If necessary this can be adjusted using VR1.
F. Recheck minimum varispeed reading.
G. Check that the capstan lock indication ("L" in the display) is achieved at all varispeed settings.
H. Turn the power off at the machine before reassembling the remote.

14.3. Alignment Panel.

14.3.1 General

This unit can be fitted :-

A) In the Total remote unit (remote alignment panel)

B) In the extrusion in front of the SATURN transport (local alignment panel)

C) One in each of the above positions at the same time.

The alignment panel is identical in both cases except for the decoding PROM (IC3).

When fitting a second panel to the system ensure that it is of the correct type for the location. A "local" panel will not work in the Total Remote, and a "remote" panel fitted to the machine will cause unpredictable software errors.

If two panels are fitted then outputs from the processor are sent in parallel to each, but inputs from them are treated separately. As standard an Alignment panel is fitted to the Total Remote.

Connection is via a 26 way ribbon cable which contain all the usual 'MOB' signals. These are routed through the standard 'MOB' interface circuit (see chapter 10.4). As with the remote, an ID system (IC8) indicates its presence to the processor during initalising.

14.3.2 Disassembly

Read the whole of section 14.3.2 before starting work.

To remove the remote metering from its cradle:

A. Turn off the power at the machine
B. Disconnect the 37 way cable from the unit.
C. Disconnect the 26 way flat cable to the remote control unit.
D. Undo the four (two each side) countersunk screws marked "A" in the sketch.
E. The metering unit can now be lifted out of its cradle.

To remove the alignment panel:

F. Undo the screws marked "C" in the sketch.
G. Remove the front extrusion and carefully slide out the alignment panel assembly from between the side panels

To replace a faulty LED:

H. Undo the four screws attaching the board assembly to the membrane switch panel
I. CHECK THE ORIENTATION OF THE LED BEFORE REMOVAL.
J. The LED can be removed from the rear of the membrane panel.
K. Bend and cut the legs of the new LED so that the front face of the LED touches the membrane surface and the legs fit approximately half way down the PCB hole.

To reassemble the unit:

A. Follow the steps A-H above in reverse order
B. Ensure that the "flexstrips" are securely located in their sockets.
C. Ensure that all insulating materials are replaced in their original positions.

14.3.3 Keyboard Scanning

This is arranged in a 6 by 8 matrix and is very similar in operation to the main keyboard (chapter 14.2.3).

14.3.4 LED multiplexing

The LEDs are also arranged in a 6 by 8 matrix and is very similar in operation to the multiplexing of the main LEDs (chapter 14.2.4). The current sink IC is however not included in this arrangement. Instead the data outputs are inverted, in software, to drive the transistor bases via current limit resistors.

14.3.5 Housekeeping Display

This is a self contained module which sits on pillars attached to the Alignment panel board and connected to it by wire links. The module is a complete 16 digit X 1 line dot matrix alphanumeric display and because it consists mainly of surface mounted devices it must be considered unservicable. Should this module ever become faulty a replacement unit must be obtained from your dealer.

Apart from control information all communication with the module is in standard ASCII form. Vital information is sent to this module during initialising and if for any reason this is incorrectly received the display will not function and appear blank. Try pressing the RESET button on the Interface board or turning power OFF then ON again as this will re-initialise the module.

An adjustment of the display viewing angle is provided by VR1. This preset is located behind the display module on the track side of the main board, and is accessible without removing the alignment panel assembly from its extrusions. The wider the viewing angle the poorer the contrast ratio.

If, with the power off, the housekeeping display appears a dark blue/black in colour then the LCD is of the negative transmissive type and will have an electroluminescent (EL) backlighting panel fitted. This is a thin flexible panel placed directly behind the LCD and is powered by a small inverter module located next to VR1. The inverter takes its power from +5V and delivers about 70VAC RMS to the EL panel. In time the light output of the EL panel will begin to diminish and will need to be replaced.

14.3.6. Replacing an EL panel.

A. Disassemble the alignment panel as in 14.3.2 steps A-H.
B. Sit the main board assembly with the front of the display module uppermost and on your left.
C. Carefully unsolder the two tags on the right hand side of the display module PCB.
D. The EL panel can mow be slid out from underneath the metal envelope of the display module.
E. Carefully slide in the new EL panel and re-solder.
F. The module can be tested by reconnecting the flat cable to the remote unit without reconnecting the membrane panel.

To reassemble the unit:

A. Follow the steps 14.3.2 (A-H) above in reverse order
B. Ensure that the "flexstrips" are securely located in their sockets.
C. Ensure that all insulating materials are replaced in their original positions.

14.3.7. Replacing the Housekeeping display.

A. Disassemble the alignment panel as in 14.3.2 steps A-H.
B. Using good quality wire cutters, carefully cut the 14 tinned copper wire links joining the display module to the main circuit board.
C. Remove the display module by undoing the four nuts securing it to the main board.
D. Remove the cut pieces of wire from the main board
E. Assemble the new display module to the main board and fit new tinned copper wire links
F. The module can be tested by reconnecting the flat cable to the remote unit without reconnecting the membrane panel.

To reassemble the unit:

A. Follow the steps 14.3.2 (A-H) above in reverse order
B. Ensure that the "flexstrips" are securely located in their sockets.
C. Ensure that all insulating materials are replaced in their original positions.

14.4. Remote Meter Assembly.

14.4.1 Dissasembly

To remove the unit from its cradle :-

a) Turn off the power
b) Disconnect the 37 way cable to the meter amplifiers in the machine.
c) Disconnect the 26 way flat cable to the remote control unit.
d) Undo the screws marked 'A' in the sketch of section 14.2.1
e) The unit can now be lifted from its cradle

Take care of the resistors in series with the illumination bulbs. These are HOT!!!

By reconnecting the 37 way signal cable, meter calibration adjustments can now be performed. (see section 11.4.2 and 11.4.3)

To remove the meter mounting board

f) Undo the screws holding the rear support bar to the end plates. The bar will lift clear of the unit.
g) Undo the three screws holding the main PCB to the centre extrusion
h) The board can now be lifted away from the front panel.

Reassembly

i) It may be easier to locate the meters in the front panel cutouts if the rear extrusion is removed from the unit.
j) In this case, position the PCB by loosly assembling to the centre extrusion.
k) replace the rear extrusion if necessary and retrace the disassembly procedure.

To remove the alignment panel

a) Remove the remote metering module from its cradle as in steps a) to e) above
b) Undo screws marked 'C' in the sketch.
c) Remove the front extrusion
d) Ensure that all insulating materials are preserved.

14.4.2 Replacing a bulb

Disassemble the unit as above. The bulbs are 28 volt wire ended types soldered to the main PCB.

14.4.3 Replacing a meter

Disassemble the unit as above. The meters are soldered to the main PCB. The meter calibration should be checked (see section 11.4.2 and 11.4.3) before refitting the unit to the cradle.

15. Auxillary (AUX) Rack.

15.1. General

This is attached to the rear door of the SATURN and can house up to a maximum of 8 single eurocard size modules. These modules all have access to the 'MOB' (section 10.4) and to the monitor output points of all audio tracks. Here is a list of current and (*) soon to be available AUX rack modules:-

Remote Meter Amplifiers

Local Meter Amplifiers

Meter Overbridge LED driver

Remote Buffer

Parallel Interface

Noise Reduction Control.

Time Code Reader *

Synchroniser/Chaser *

Serial Interface *

Ready control Interface

The Meter Amplifiers and Remote Buffer are fitted as standard. The Meter amplifier is a double width module that houses both the Local and Remote Meter Amplifers and is always the first in the rack (furthest from the door hinges). Apart from this module, all the other interfaces can fit into ANY spare slot.

15.2. Remote/Local Meter Amplifiers

This module consists of two PCB's attached to a single facia panel.

The main PCB connects to the AUX rack mother board via a 64 way DIN connector and recieves the monitor output signals of all channels from the audio rack. The outputs from this card (the "local" meter amplifiers) are routed to a rear panel connector for feeding the meter overbridge.

The sub-board contains the "remote" meter amplifiers and takes its inputs via a 40 way flat cable from the outputs of the local meter amps. The outputs from this sub-card are routed to a rear panel connector for feeding the remote meters.

Taking channel 1:
R2,R3,Q1 form a switchable 10dB attenuator on command from the Audio control board (section 11.7).
Amplifier IC1-A has 10dB gain with a low-pass characteristic.
Resistor R8 is only fitted when the meters in the overbridge do not have internal ballast resistors.

The amplifier output is also fed via J2 to IC1-A on the Remote meter amplifier board. This is connected as a half-wave precision rectifier. The output of this is mixed with the input signal by IC1-B to give a full wave rectified signal on the output test point. The gain of this circuit can be adjusted by R1. R2 and C1 are used to give an approximate VU characteristic to the signal fed to the remote meters.

15.3. Meter Overbridge LED driver.

This module is fitted whenever the SATURN is supplied with a meter overbridge. Its function is to drive the RECORD status LEDs above the level meters. In fact the whole of the remote LED matrix is decoded by an identical circuit to that on the remote main board (see section 14.2.4) but only one row is made use of.

IC11 is contains an ID word, used by the processor to detect the presence of the board during the power up sequence.

15.4. Remote Buffer

This board takes the 'MOB', buffers it, and sends it down the remote cable. The buffers are only activated for address locations belonging to the Total Remote Unit.

Connection to the remote cable is via a 25 way D type connector and earth post. The earth post connects to the outer screen of the cable and provides an effective ground for the remote. It is important for correct operation that this connection is clean and tight.

15.5. Parallel (Synchroniser) Interface

This module provides all the I/O signals required to enable external equipment, such as a synchroniser, to take control of the SATURN. See section 5.2 for interfacing details.

A standard 'MOB' interface circuit is used to control four ports one of which (IC6) is an ID word used to indicate the presence of the board to the processor during the power on sequence.

All the usual inputs (and outputs) are directly read (and written to) by the processor under software control.

The TACH output (J2-2) is indirectly derived from the motion roller tachometer. Each pulse from this tachometer causes a non-maskable interrupt of the CPU, as described in section 12.2. The service routine for this interrupt pulses a pin of an output port (IC9-2). To make this short pulse more suitable for use by a synchroniser it is routed through a flip-flop. Thus the pulse rate is halved and a good square wave is assured. The output frequency is related to tape speed in a 2:1 ratio (2HZ = 1ips).

When external capstan control is required the processor connects the external source to the speed control system by activating RL1

RL2 can be used to drive an external warning lamp. J3 sees a closed contact when the SATURN is in Record Mode.

15.6. Noise Reduction Control

See section 5.1 for interfacing details.

This module uses a standard 'MOB' interface to drive a single input/output port. IC6 provides an ID word used to indicate the boards presence to the processor during the power on sequence.

Output port IC7 is used to drive three 8 bit addressable latches. Bits 0 to 4 select the channel to be written to, bit 5 clears all channels, bit 6 strobes the data into the latches and bit 7 is the data itself.

The outputs of these latches are routed to individual transistors which provide open collector outputs for the noise reduction equipment.

15.10. Ready control interface

See section 5.3 for interfacing details.

This module uses a standard 'MOB' interface to drive a number of input/output ports. IC6 provides an ID word used to indicate the board's presence to the processor during the power on sequence.

Record tally outputs

Output port IC11 is used to drive three 8 bit addressable latches (IC14,15,16). Bits 0 to 4 select the channel to be written to, bit 5 clears all channels, bit 6 strobes the data into the latches and bit 7 is the data itself.

The outputs of these latches are routed to buffer / drivers (IC17,18,19) which provide open collector outputs for external equipment. Series resistors are fitted to each output to limit current.
Each output also has a diode to Vref inside the driver IC's.

Vref on the external connector is link selectable between unregulated +12 volts and +5v.

Record / ready inputs

Input ports (IC7,8,9,10) directly read the 24 record ready control input wires and the 3 monitor select input wires.

Pull up resistors are provided on each input to Vref.

Two links are provided for hardware selection of different functions for the board. One of these is wired in parallel with an input line so that the selection can be made externally. This is currently defined to select between record / ready control and external solo control.

16. Power Supply Unit.

16.1. Physical Layout

The Saturn power supply is built into a pull out unit in the base of the recorder. See section 16.4 for details of how to access the unit.

Refer to PSU block diagram and wiring diagram C137

The unit is semi-modular, dividing into three main sections containing the following items :-

Main chassis -
- power transformers
- tap change switch
- power line fuse
- power switch
- motor supply rectifier
- motor supply capacitor
- surge suppressor assembly - (see section 16.1.1)

Main board assembly - refer to circuit diagram C137K
- dc supply rectifiers
- dc supply capacitors
- motor control relays - (see section 12.1)
- motor current blanking - (" " ")

Heatsink assemblies - circuit diagrams C110K and C126K
- dc regulators - (see section 16.1.2 & 3)
- motor drive FET boards - (see section 12.1)

16.1.1 Surge Suppressor Board

This assembly is fitted in the mains input wiring to prevent large surge currents when the Saturn is turned on.

R2 is a high power resistor wired in series with the neutral input wire. RL1, in parallel with R2, is normally open circuit.

When power is applied, RL2 turns on after a short time delay. The voltage on C1 is applied to RL1 coil. After approximately 0.5sec, RL1 operates and shorts out R2.

When power is removed, RL2 turns off allowing C1 to discharge quickly via R4. This allows the circuit to operate correctly if power returns quickly.

16.1.2 DC supplies

The PSU provides the following d.c rails to the Saturn recorder

+12v unregulated. This is taken from the input to the main 5v regulator. It is used to drive local low power regulators elsewhere in the system. It is also used to power the LEDs in the remote unit. It is also present on the MOB.

+5v. This rail is generated by an integrated IC regulator on the heatsink assembly. It is used mainly to power the digital systems within the Saturn frame. It is also present on the MOB.

+24v. This rail is generated by an integrated IC regulator on the heatsink assembly. It is used mainly to drive transport systems and the flourescent displays. It is also present on the MOB.

+/-18v. These rails are generated by a dual regulator board (see section 16.1.3) on the heatsink assembly. This is the main audio HT. A delay relay, RL1 on the PSU main board, is fitted to the input of the regulators to give the transport system time to settle before the audio system becomes active.

+/-8v. These rails are generated by a dual regulator board (see section 16.1.3) on the heatsink assembly. These lines are used to power the bias amplifiers in the audio channels and also as logic HT for the audio control system.

16.1.3 +/- Regulator Assy

See circuit diagram C110K

This board contains two separate voltage regulator circuits which are completely symmetrical. Considering the positive regulator :-

A low current (1.5A) regulator, IC1 controls a high current series transistor (Q2). For load currents under 1A, Q2 does not conduct.

IC1 is connected as a standard voltage regulator circuit.

The voltage across R2 becomes sufficient to turn on Q2 (i.e. approx 1.2v) at a load current of 0.8A. As the load current increases the series transistor Q2 supplies the extra requirement. IC1 current is limited to approx 0.8A max

R1 is a current sensing resistor allowing Q1 to switch off Q2 if input current rises above 6A.

R6 (and R12) are only fitted to the +/- 8v regulator assy. Fitting or removing these resistors converts the board between +/-18v and +/-8v assemblies.

16.1.4 Motor drive disable

RL8 coil is wired directly across the AC input to the 24 v rectifier. The contacts are wired to the motor drive signal at the same point as the current blanking system.

The relay ensures that when mains power is interrupted there are no spurious currents in the motors due to power rail fluctuations.

16.2 Earthing System

The Saturn uses a Star Point earthing system which requires that all references to Ov or earth are kept separate from each other. This avoids any wire or PCB track carrying earth currents which could interfere with each other.

The Star point is located on the PSU main board and consists of a metal bolt attached to a large copper area on the PCB. All rectifiers ,smoothing caps, regulators and loads have their own path to the star point.

Many of the electrical systems are connected to the power supply by cables containing both a "clean" earth and a "dirty" earth. This allows a true Ov reference for signals even when high earth currents are present.

Some systems, notably the digital rack, use copper braiding to bolster the dirty earth connection to the star point.

The chassis, deckplate, and headblock of the Saturn are permanently connected to the mains earth terminal on the power input socket.

The Star point can be connected to mains earth by the "earth break switch" located behind the small panel at the front of the PSU.

16.3 Switch on sequence

When power is applied to the Saturn a specific sequence of events is followed in order to ensure that no part of the system is put under undue stress and that the machine is in a known condition when audio HT is applied.

a) A reduced primary current is used to provide an initial charge in the main smoothing caps before full mains input is applied. (see Surge suppressor board - section 16.1.1)

b) The software starts running when the 5v line is up and the power on reset pulse has been removed.

c) All audio switches, transport and motor conditions are initialised by the software before RL1 on the PSU main board allows current to the +/- 18v regulators.

d) Approximately 3 seconds after power on the software will re-initialise the audio system as a double check.

16.4 Dismantling and servicing

a) To access the front panel of the PSU containing all the dc rail fuses, open the front doors of the Saturn.

b) The rear of the PSU can be accessed by opening the Saturn rear door. This is secured by four thumbscrews and swings open from the left.

c) To access the mains tap change and earth break switches undo the two screws securing the cover panel at the right hand end of the main front panel.

d) To access the internal subassemblies undo the four bolts securing the PSU to the main frame. Slide the whole unit forwards on its runners as far as it will go. The two covers can be removed by undoing the self tapping screws securing them to the PSU chassis. The left hand cover is over the heatsink assemblies and the right hand half covers the main board assembly.

e) The DC regulators are in the upper sections of the heatsink assemblies. No further dissassembly is required.

f) To gain access to the FET motor drive transistors, undo the two self tapping screws securing the front of the heatsink block to the PSU frame. The heatsink assembly can now be raised by the finger hole at the front. When the block is almost vertical, a clip engages to hold the raised block upright.

The left hand block contains the left motor drive and the right hand block the right motor drive.

Refer to section 12.1. when replacing FETs

DANGER!!!
THE FET CASES HAVE HIGH VOLTAGES PRESENT

g) To gain access to the power transformer and other main chassis components undo the three self tapping screws securing the main board frame to the PSU chassis. The main board assembly will now slide backwards about 2 cm. and then hinge up to the vertical. Sliding the board assembly forwards will locate the spigot in a hole in the PSU frame to hold the board upright.

SOUNDCRAFT MAGNETICS LTD

SATURN MULTITRACK RECORDER

SECTION 3

TRANSPORT MECHANICS

17. Transport Mechanics:

17.1 Transport alignment

- 17.1.1 Front deck mask removal
- 17.1.2 Roller height setting
- 17.1.3 Spool carrier adjustment
- 17.1.4 Verticality of rollers
- 17.1.5 Verticality of pinch/capstan
- 17.1.6 Pinch pressure

17.2 Removal of assemblies

- 17.2.1 Roller assemblies
- 17.2.2 Headblock assembly
- 17.2.3 Rear deck mask
- 17.2.4 Spool motor
- 17.2.5 Tape-lift module
- 17.2.6 Head-screen module
- 17.2.7 Capstan motor
- 17.2.8 Capstan/pinch module

17.3 Drawings

17.1 Transport alignment:

The following procedures should be followed in the order as read.

The Saturn Transport utilises a precision machined area on the upper surface of the deck plate as a reference for height and verticality of its critical components. To access this area the front section of the sheet metal deck mask has to be removed.

17.1.1 To remove the front deck mask:

a) Remove the headblock assembly - see section 17.2.2

b) Remove the pinch roller - Release the screw retaining the cap, and take out the sleeve from above the central bearing. Carefully lift the roller from its shaft. Ensure that any shims under the bearing (some may be stuck to the underside) are kept safe, to be replaced upon re-assembly.

c) Remove the six small screws securing the front section of the mask to the deck plate.

d) Holding both damper arms back, away from the front mask area, lift the front mask directly upwards, taking care not to damage the damper arm rollers. This is more easily achieved with the assistance of a friend!

e) The capstan motor dress cap, the flutter roller dress ring and the motion sense roller dress ring are all part of the front deck mask assembly, and should be retained with it.

f) The tape presence sensor LED may either be mounted on to the front deck mask or directly onto the main deck plate. If it is mounted on to the mask, the LED may be gently removed from its housing to allow the mask to be released from the machine.

g) Replace pinch roller, spacer and cap.

h) Replace the headblock assembly, ensuring that the mating surface is clean and the assembly is correctly located, before attempting to tighten the retainer bolt.

Use a reel of tape that is in good condition for all of the following checks, as misleading results may be obtained from tape that has become stretched or damaged due to excessive use.

17.1.2 Roller height setting:

** This procedure should only be attempted by an experienced engineer **

- You will require the following:

1; A "Calibrated Head-Square", part no.1799053.
2; A good source of light.
3; 2mm, 2.5mm, 3mm and 4mm hex Allen keys, kit part no.1603013.
4; 6.5mm diameter shims in 0.001" and 0.003" thickness, part nos.1803076 & 1803051.
5; 8.0mm diameter shims in 0.003" and 0.005" thickness, part nos.1803030 & 1803031.
6; 10.0mm diameter shims in 0.008" thickness, part no.1803058.
7; A headblock spanner (10mm AF nut-spinner), part no.1603013.

The two main roller assemblies are almost identical and can be adjusted in the same manner.
The FLUTTER ROLLER has a high mass in order to decouple the tape path through the headblock from any flutter induced by the feed spool assembly during play and record modes. It is smooth to enable it to float during high spooling speeds.
The MOTION SENSE ROLLER has an extremely low mass together with a grooved surface in order to maintain intimate contact with the tape, and hence negligible slippage, under all motion conditions. This roller is connected to a 24-hole disc underneath the deck plate to provide motion and direction sensing information. (Refer to section 12.2.2)

a) Check the current height setting using the head-square on the machined reference area (slightly lower than the top surface of the deck plate). The lower roller flange should be aligned with the lower edge of the square, and no light should be visible between the roller and head-square. If light is visible, please refer to section 17.1.3. If the lower flange is not correctly aligned, then continue.

b) Lift the cap from the top of the roller. This is merely a push fit, retained via an "o-ring".

c) Relax the screw in the centre of the roller shaft by approximately one half turn. This is a compression ring securing the roller to the shaft, and need not be removed entirely.

d) The roller can now be removed from the shaft, noting any shims that may be fitted underneath (some may stick to the bottom of the roller).

e) Add or remove shims one at a time, replacing the roller and re-checking height until correct. On replacing the roller each time, ensure that it is pressed down fully whilst gently tightening the central locking screw.

The damper arm assemblies are provided to reduce peaks in dynamic tape tension and to eliminate the lower frequency speed variations originating from the spool stacks. They also inform the system of excessive tension variations, (e.g: no tape laced!).
Three types of DAMPER ARM ROLLER assembly have been used, early machines having unflanged rollers. Subsequently flanged rollers have been fitted, referred to as Type 1 or Type 2, (Refer to the assembly drawings, section 3). The unflanged rollers do not require any height setting.

Type 1 - This procedure is not recommended unless access to replacement ballraces is available, as they are easily damaged.

a) Check height, as for main rollers, previous section. Access to the reference surface is quite restricted on earlier deck plates.

b) Remove cap, by releasing CSK screw in end of shaft.

c) Remove coil spring.

d) Remove roller from shaft, taking great care to ensure that minimal strain is put on the ballraces. If the lower ballrace remains on the shaft, remove it gently and place it on a clean surface.
Take note of any shims that may be sticking to the underneath of this ballrace, and replace them on to the shaft.

e) Add or remove shims one at a time, replacing the roller, spring and cap each time to re-check height.

Type 2 -

a) Check height, as for main rollers, previous section.

b) Remove cap, by releasing CSK screw in end of shaft.

c) Shims are located under the cap, adding a shim moves the roller lower, and vice versa.

d) Replace cap to re-check height setting each time.

As with the damper arm assemblies, both Type 1 and Type 2 HEADBLOCK GUIDE ROLLER assemblies have been used. The same warnings apply to the setting of type 1 guide rollers. The guide roller assemblies are very similar to the damper arm roller assemblies, the main difference being that they are inverted. (Refer to the assembly drawings, section 3). Extra precision is required on the headblock rollers - use 0.001" shims!

Type 1 - This procedure is not recommended unless access to replacement ballraces is available, as they are easily damaged.

a) Check height, as for main rollers.

b) Remove assembly by releasing CSK screw in top surface of headblock directly above shaft. This screw will have to be completely removed.

c) Invert assembly.

d) Remove end "cap", by releasing CSK screw in end of shaft.

e) Remove coil spring.

f) Remove roller from shaft, taking great care to ensure that minimal strain is put on the ballraces. If the lower ballrace remains on the shaft, remove it gently and place it on a clean surface.
Take note of any shims that may be sticking to the underneath of this ballrace, and replace them on to the shaft.

g) Add or remove shims one at a time, replacing the roller, spring and cap each time to re-check height. Ensure that the flat machined on the end cap is correctly located to clear the headblock support.

Type 2 -

a) Check height, as for main rollers.

b) Remove assembly by releasing CSK screw in top surface of headblock directly above shaft. This screw will have to be completely removed.

c) Invert assembly.

d) Remove end "cap", taking care not to lose any shims.

e) Shims are located under the cap, adding a shim moves the roller higher (when in situ), and vice versa.

f) Replace cap to re-check height setting each time. Ensure that the flat machined on the end cap is correctly located to clear the headblock support.

At this stage the roller guidance should be checked using a simple method:

a) Defeat the tape lifters, this can be done by unplugging the relevant connector (J3) on the transport distribution board (underneath the deck plate).

b) Put the machine into "Play" mode, preferably at 15ips.

c) Select "Varispool" on the remote control unit.

This allows the tape to follow its natural path without being biased by either the capstan/pinch mechanism or the tape lifters. The tape should ideally be centralised between all of the roller flanges.

Ensure that the tape lifters are enabled before returning to high spooling speeds.

Pinch roller height:

This should be checked before proceeding any further. The pinch roller should be centrally disposed about the tape. Add or remove shims underneath the roller as necessary.

17.1.3 Spool carrier adjustment:

Spool carrier height:

Incorrect spool height can adversely affect the tape path and Wow+Flutter performance of the machine. The height can be adjusted as follows -

a) Remove CSK screw in top of retainer (Screw "A").

b) Remove retainer by unscrewing fully.

c) Slacken locking screw, accessed via one of the holes in the side of the carrier bottom flange. Do not slacken this more than a half turn or the location onto the drive shaft may be lost. (Refer to drg.no.C.931.A/01)

d) Clockwise rotation of the large slotted screw, accessed from the top centre hole will raise the spool carrier, and vice versa. Only turn this screw 1/8th of a turn at a time. Note that the carrier may have to be pushed down to lower it.

e) Ensure that the locking screw is firmly re-tightened.

f) Gently tighten retainer with spool in place on carrier before replacing CSK screw again.

Spool retainer adjustment:

a) Remove screw "A", as above. (Refer to Drg.no.C.931.A/01)

b) Remove retainer, as above.

c) To increase the effective diameter of the carrier, move screw "B" from position 1 to position 3. This will enable the carrier to grip spools with larger diameter centres.

d) To decrease the effective diameter of the carrier, move screw "C" from position 2 to position 4. This will allow spools with smaller diameter centres to fit over the carrier.

e) Replace the spool retainer with the correct spool in place, and tighten the retainer until the carrier gently grips the spool.

f) Replace screw "A", ensuring that the spool retainer can rotate through approximately 180 degrees.

If required, this adjustment may be repeated to accommodate oversize or undersized spools.

17.1.4 Verticality of roller assemblies:

The main roller assemblies cannot be adjusted in this respect. If the flutter or motion sense rollers are suspect then it is probably due to a faulty roller, necessitating replacement. Refer to the previous section to remove these items.

The headblock guide rollers are also nonadjustable. In this case it is preferable to replace a complete guide roller assembly. Refer to section 17.9 to remove these assemblies.

The damper arm rollers may be shimmed to correct for undue slackness in tension at one or other edge of the tape. This should only be carried out as a "last resort" after all other transport alignment has been carried out, and only when felt strictly necessary by an experienced engineer. Shims should be placed between the damper assembly mounting plate and the damper (rotary dashpot) body, specifically under two of the (four) retaining screws only.

The scrape filter assembly (mounted between the record and replay heads) is correctly set for zenith at the factory, and should not require further attention. However, if this assembly has been dismantled and re-assembled, it may be necessary to reset its zenith. You will need a small "engineers" try-square (not a head-square) before attempting this adjustment.

a) Remove the assembly from headblock, by releasing the two M3 socket screws from the top.

b) Check for squareness between the roller and the mounting surface (uppermost) of the assembly. If light is visible between the roller and square, then slacken the two screws in the underside of the assembly very slightly. This will allow a small amount of movement between the two parts.

c) Re-tighten the two screws when correct, and re-check for squareness.

d) After replacing the assembly onto the headblock, check the verticality of the roller with the head-square. This should be at least as accurate as the head zenith.

17.1.5 Pinch / Capstan verticality:

Provision has been made to trim the verticality of the capstan and pinch wheel together via their mounting plate.
This is primarily to stabilise the tape path across the heads.

** This procedure should only be attempted by an experienced engineer **

a) All previous steps in section 17.1 must have been taken prior to this adjustment.

b) Locate the "set" (grub) screw "B" to the left and in front of the capstan shaft, this is adjacent to one of the capstan module retaining screws but accessed from the top of the deck plate. (Refer to drg.no.C.919.A/01)

c) Whilst the machine is in "Play" mode, alternately loosen the module retaining screw "A" (from underneath the deck plate) and tighten the set screw "B" a fraction at a time, until the tape path centralises between the exit guide flanges. If this adjustment aggravates the situation, then adjust the similar screws "C" & "D" to the right front of the capstan shaft, ensuring that the module screw is locked after each adjustment.
Extreme care should be taken, as this adjustment is very sensitive.

d) Re-check at each fixed play speed. It is acceptable for there to be a small variation in the tape path at the highest and lowest play speeds.

17.1.6 Pinch pressure setting:

Incorrect pinch pressure can influence the tape path in the following ways -

Too low a pressure can cause inaccurate fixed speeds, or long term speed drift.

Too high a pressure may cause the tape to ride up or down as it passes the capstan, or even cause wrinkling of the tape in extreme cases.

It is essential that the solenoid plunger "locks on" correctly. This can be verified by putting the machine into "Play" and checking that the plunger is fully home in the solenoid.

Pinch pressure is adjusted via the two nuts located on the end of the pinch solenoid control rod. If the plunger is not fully home whilst in Play mode, decrease the pressure slightly by slackening the two nuts and recheck.

17.2 Removal of subassemblies:

17.2.1 Roller assemblies:

All of the roller assemblies can easily be removed without first removing the deck mask, but note that the height settings may be incorrect if replaced with different assemblies. Please refer to section 17.1 if this is the case.

Main rollers:

a) Remove the motion sense disc where fitted, by releasing the M3 screw from lower end of shaft.

b) Remove the three M4 screws retaining the bearing housing from the underside of the deck plate.

c) The roller assembly can now be removed from above the deck plate.

The damper arm roller assemblies may be removed by releasing the M4 screw from underneath of the damper arm. This is accessed via the hole in the tension limit vane, mounted onto the arm, from the underside of the deck plate.

The headblock guide roller assemblies may be removed by removing the CSK screw in the top of the headblock, directly above each assembly.

17.2.2 Removal of headblock assembly:

This is a pre-aligned unit containing the tape heads, guidance rollers, a scrape filter roller and an optical tape presence sensor. The PCB that contains the sensor also has links to identify the type of headblock to the microprocessor. (Refer to sections 12.3.2 and 12.5)

a) Remove the dress plate covering the head adjustments (two screws).

b) Remove the rear headblock cover (two screws).

c) Disconnect all of the cables from the tape heads to the head connector plate, also the "ID/sensor" cable. Make note of the order that these connectors were inserted before removing them.

d) Remove the large (M6) central bolt using the special tool provided with the machine. The headblock can now be removed from the machine, taking care not to allow the tape heads to come into contact with the tape-lift pins.

17.2.3 To remove the rear deck mask:

a) Remove the front deck mask - refer to section 17.1.1

b) Remove the seven small screws securing the rear deck mask to the deck plate.

c) The rear mask can now be removed by lifting upwards to clear the spool hubs.

17.2.4 To remove a spool motor:

a) Remove the rear deck mask - refer to previous section.

b) Remove the spool carrier, after releasing the locking screw approximately one half turn - accessed via the carrier bottom flange (Refer to drg.no.C.931.A/01).

c) Lift the deck plate.

d) Remove eight 'pozidrive' screws retaining the two black motor cover plates.

e) Unplug the motor sensor cables (4-way ribbon) from transport distribution board. (J9 & J15)

f) Unplug the motor power cables from transport distribution board. (J10 & J14)

g) Release the transport distribution board by removing the four pillars and two pozidrive screws retaining it to the support tray.

g) Remove the support tray by releasing four further pillars retaining it to the motors.

h) Each Spool motor assembly (complete with its sensor) can now be carefully released from the deck, by removing the four M6 socket head screws accessed from above the deck plate.
WARNING: These motors are quite heavy, and the slotted sensor discs very delicate.

17.2.5 To remove the Tape-lift assembly:

a) Unplug any electrical connections to the module. (J3 on Transport Distribution board and the two in-line connectors in cable from microswitch.) Note the polarisation of these connectors upon re-connection.

b) Remove the four M5 Socket head screws retaining the module plate. The module can be carefully extricated by lowering the front until the tape-lift pins clear the deck, before withdrawing the assembly forwards.

17.2.6 To remove the Head-screen assembly:

a) Unplug any electrical connections to the module. (J2 & J20 on the Transport Distribution board, and two in-line connectors.)

b) Remove the two M5 Socket head screws located in the front of the support bar underneath the front edge of the deck plate.

c) The module should now be free to move downwards from the deck plate.

17.2.7 To remove the Capstan motor:

a) Remove the front deck mask - refer to section 17.1.1

b) Unplug in-line connector in the cable to the capstan motor.

c) Remove three socket head screws retaining the capstan motor. These are labelled "E" on drg.no.C.919.A/01. Each can only be slackened a little at a time until the motor is released.

d) The motor can now be withdrawn from its cylindrical screen, taking care that the cable and connector are fed through the cutout at the top of the screen.

17.2.8 To remove the Capstan/Pinch module:

a) Remove the front deck mask - refer to section 17.1.1

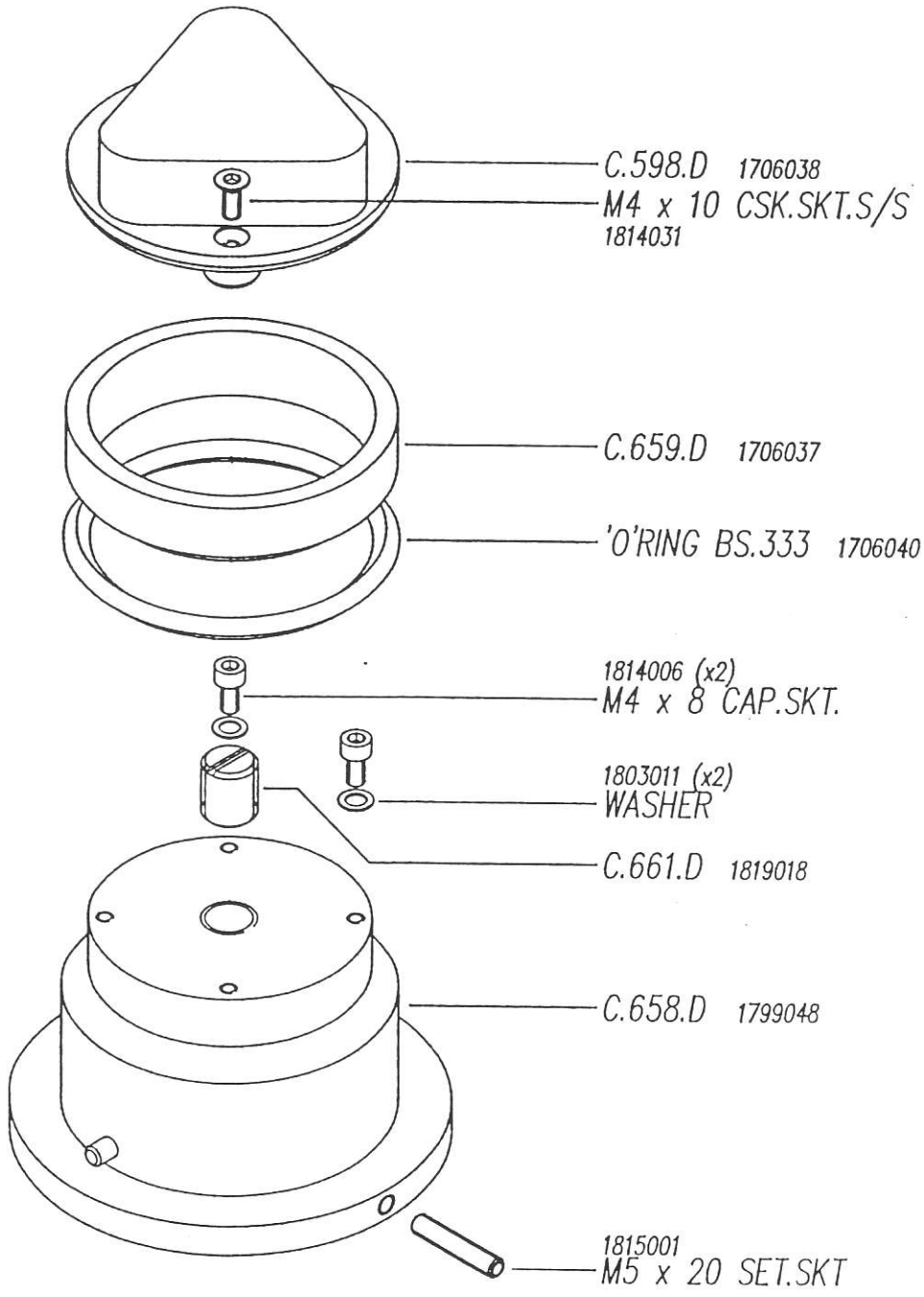
b) Unplug in-line connector in the cable to the capstan motor, and connector J4 on the Transport Distribution board.

c) Remove the three M5 socket head screws retaining the module plate. These screws are accessed from underneath of the deck plate and also contain a coil spring each to preload the module plate.

d) The complete assembly may now be removed, taking care not to damage the capstan shaft.

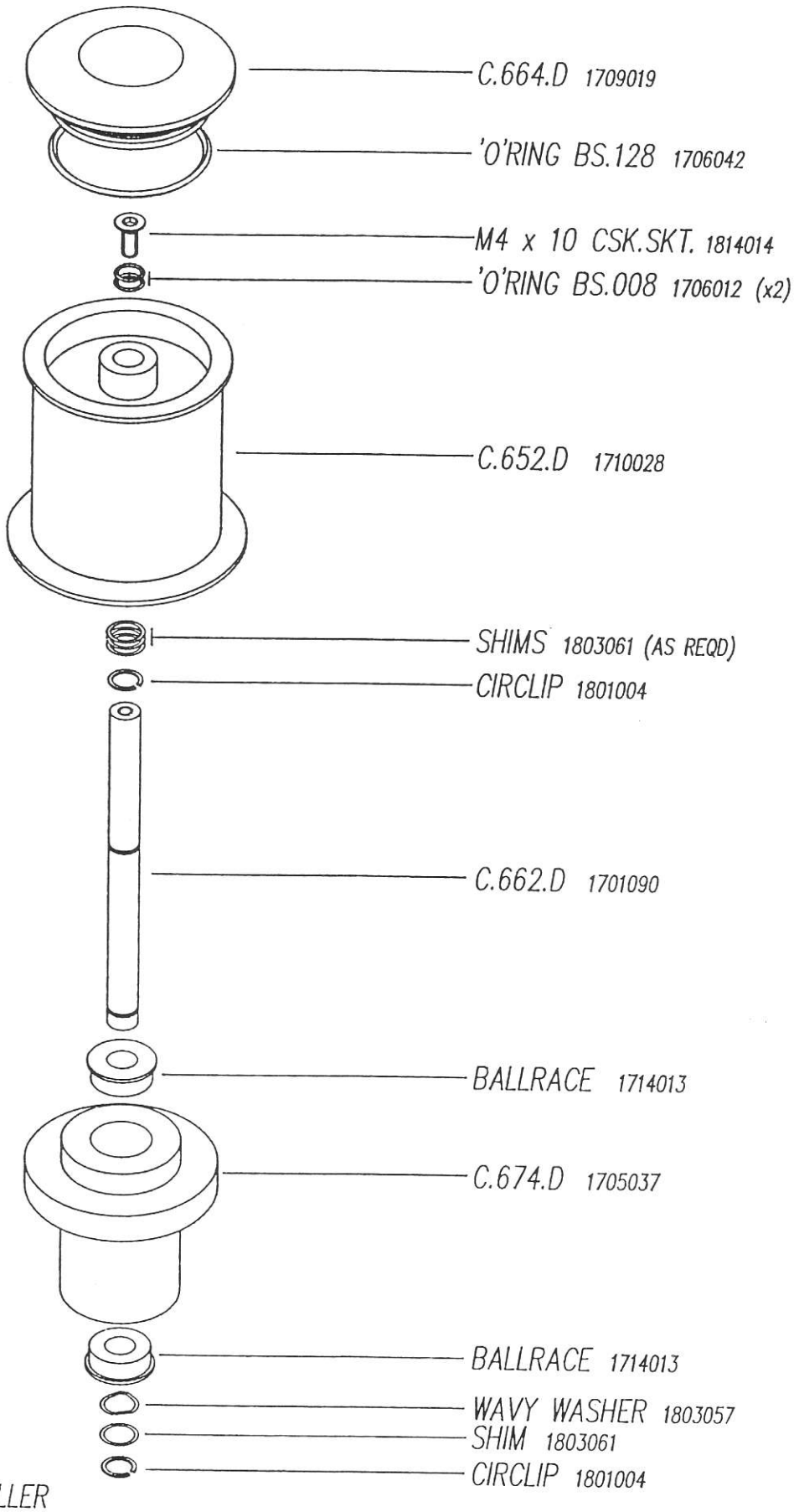
Drawing list:

C901A/02	Spool carrier assembly, 4-hole type.
C902A/03	Flutter roller assembly, Type 2.
C903A/03	Damper arm roller assembly, Type 2.
C904A/02	Scrape filter assembly.
C905A/03	Entry guide roller assembly, Type 2.
C906A/01	Feed Damper arm module assembly.
C907A/01	Head screen module assembly.
C908A/01	Headblock assembly.
C909A/01	Capstan module assembly.
C910A/01	Pinch arm pivot assembly, Type 2.
C912A/01	Tape-lift module assembly.
C914A/02	Motion sense roller assembly, Type 2.
C915A/02	Exit guide roller assembly, Type 2.
C916A/01	Take-up Damper arm module assembly.
C919A/01	Location of capstan motor screws.
C921A/01	Spool retainer adjustment, 3-hole type.
C922A/01	Tape-lift module adjustment.
C931A/01	Spool carrier adjustments.



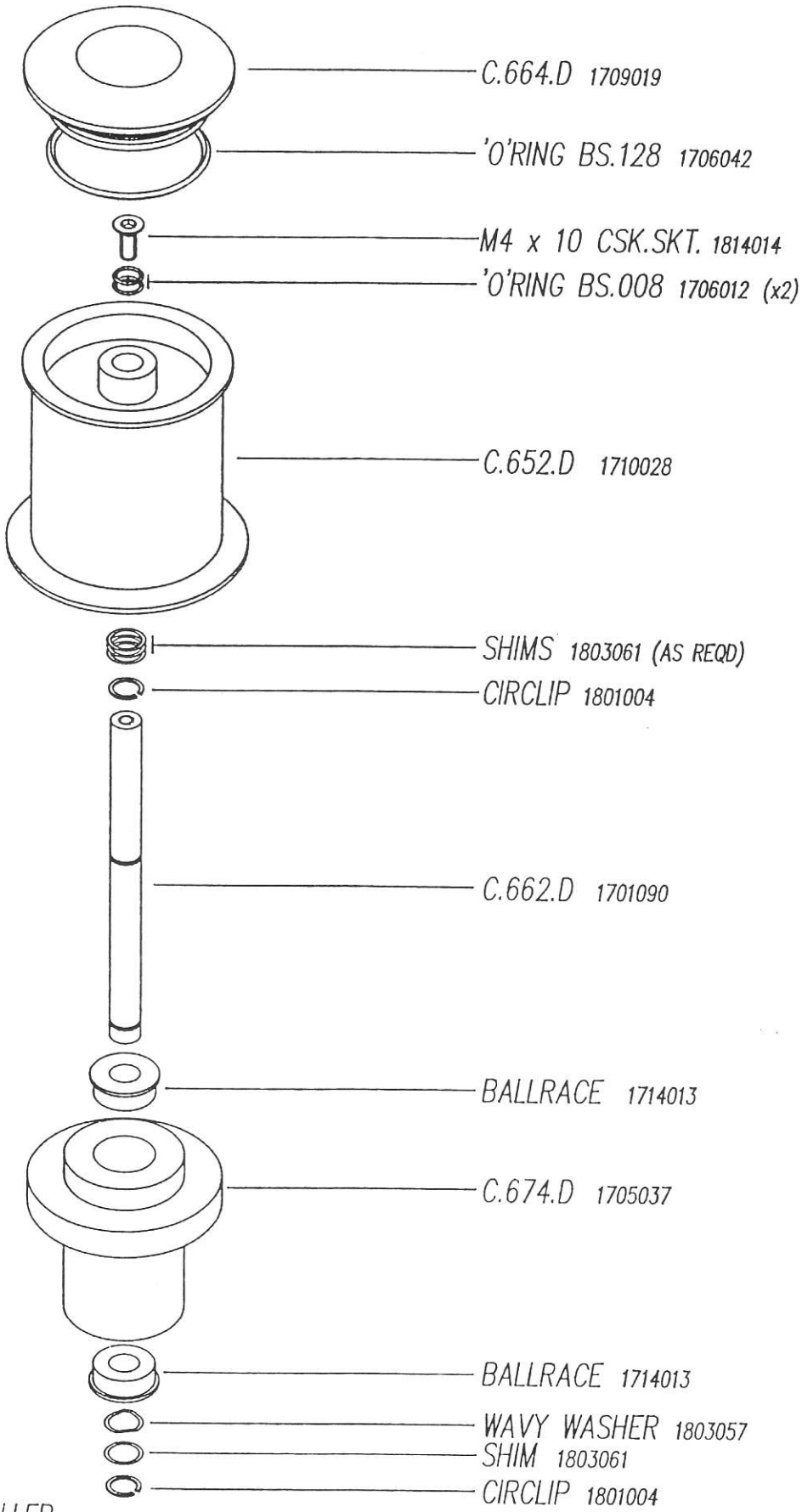
SATURN SPOOL CARRIER
ASSEMBLY, 4-HOLE TYPE
Assy.No.1303002
Drg.No.C.901.A/02 Soundcraft Magnetics Ltd

Soundcraft



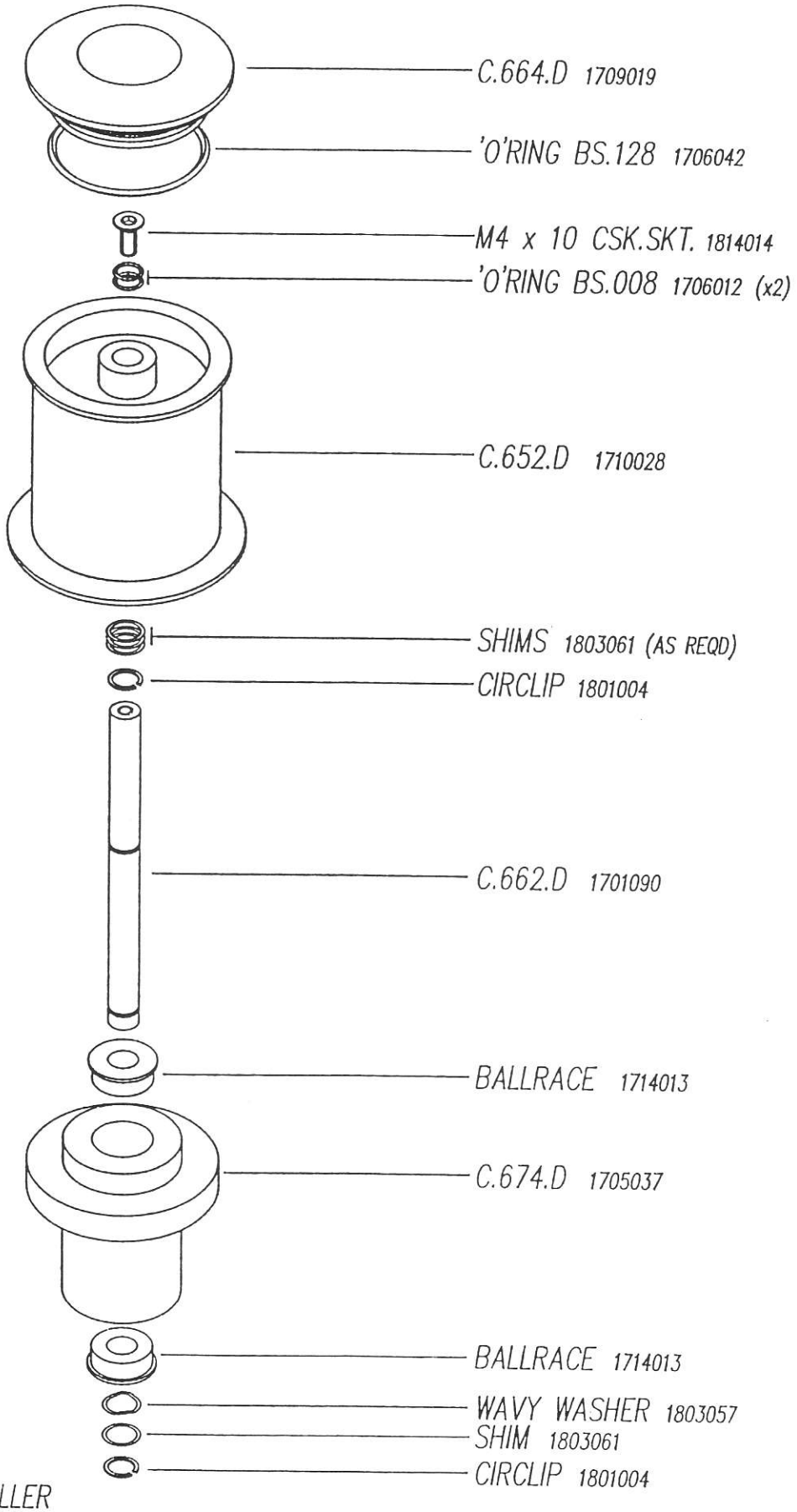
SATURN FLUTTER ROLLER
TYPE 2 ASSEMBLY.
Assy.No.1303016
Drg.No.C.902.A/03 Soundcraft Magnetics Ltd

Soundcraft



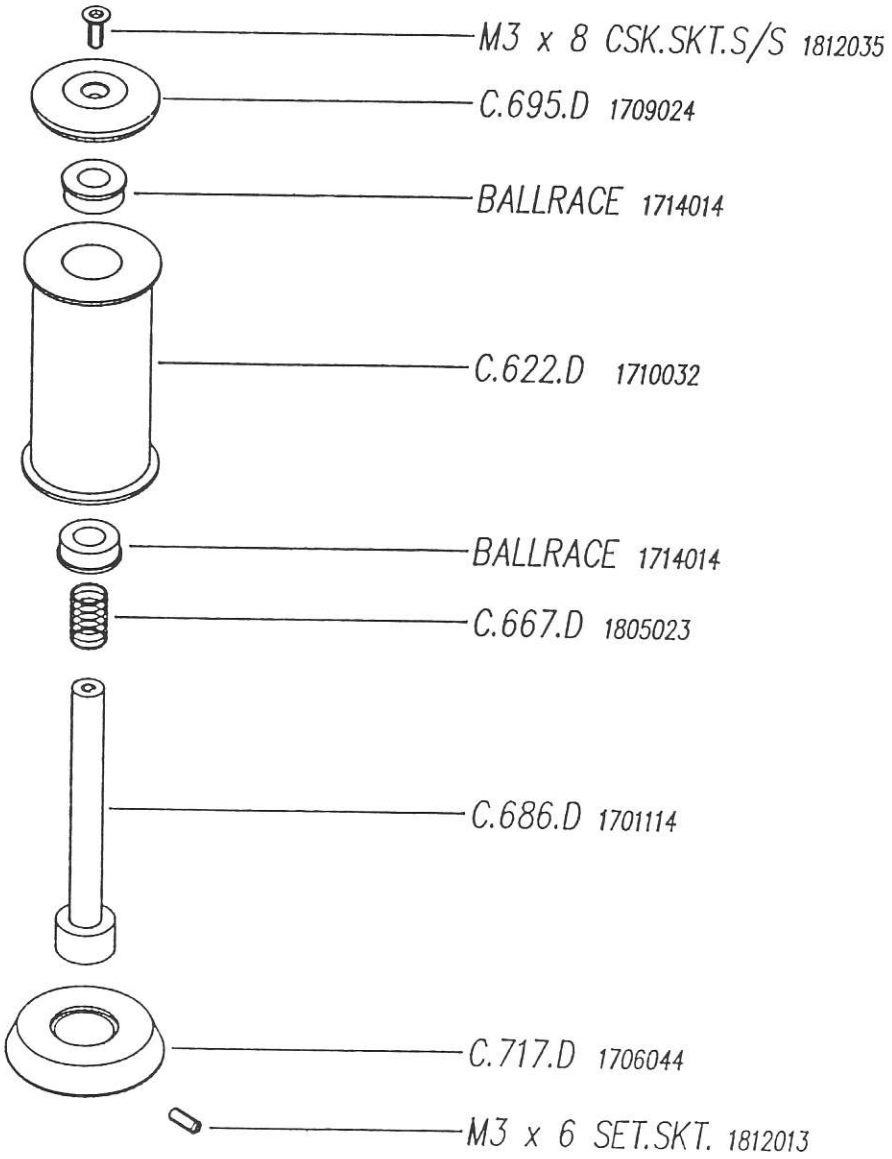
SATURN FLUTTER ROLLER
TYPE 2 ASSEMBLY.
Assy.No.1303016
Drg.No.C.902.A/03 Soundcraft Magnetics Ltd

Soundcraft



SATURN FLUTTER ROLLER
TYPE 2 ASSEMBLY.
Assy.No.1303016
Drg.No.C.902.A/03 Soundcraft Magnetics Ltd

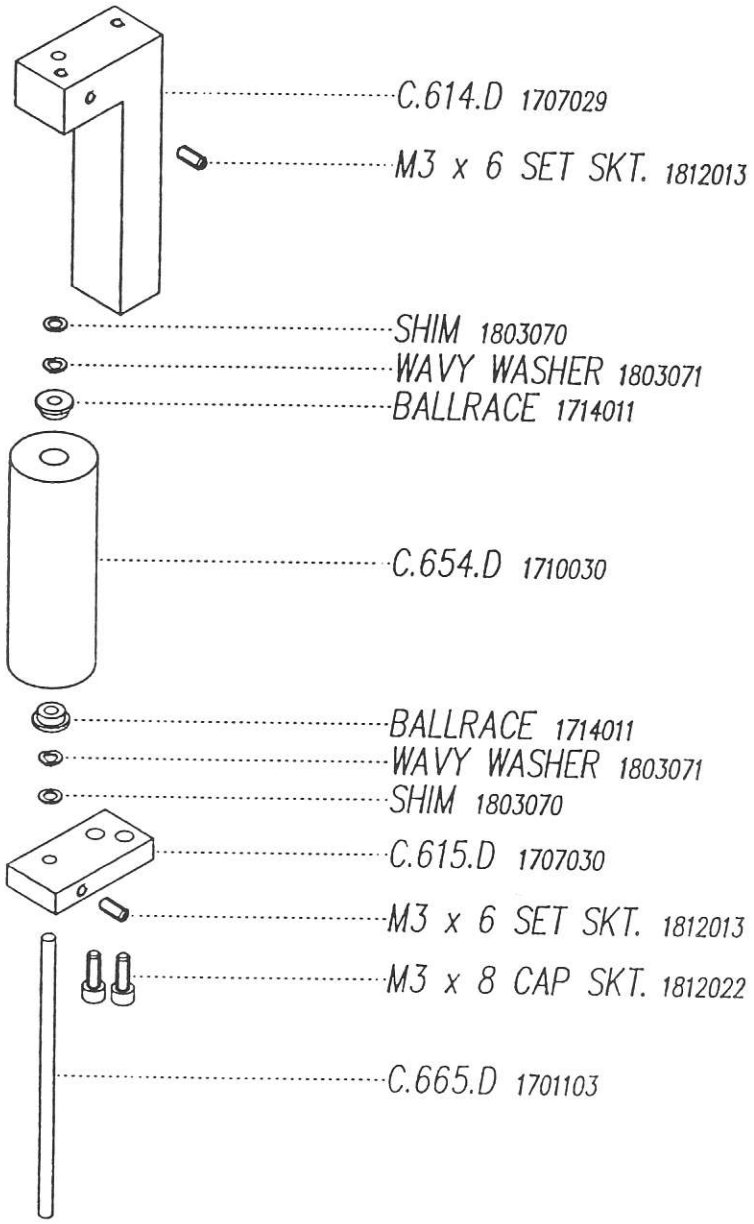
Soundcraft



SATURN DAMPER ARM ROLLER
TYPE 2 ASSEMBLY.

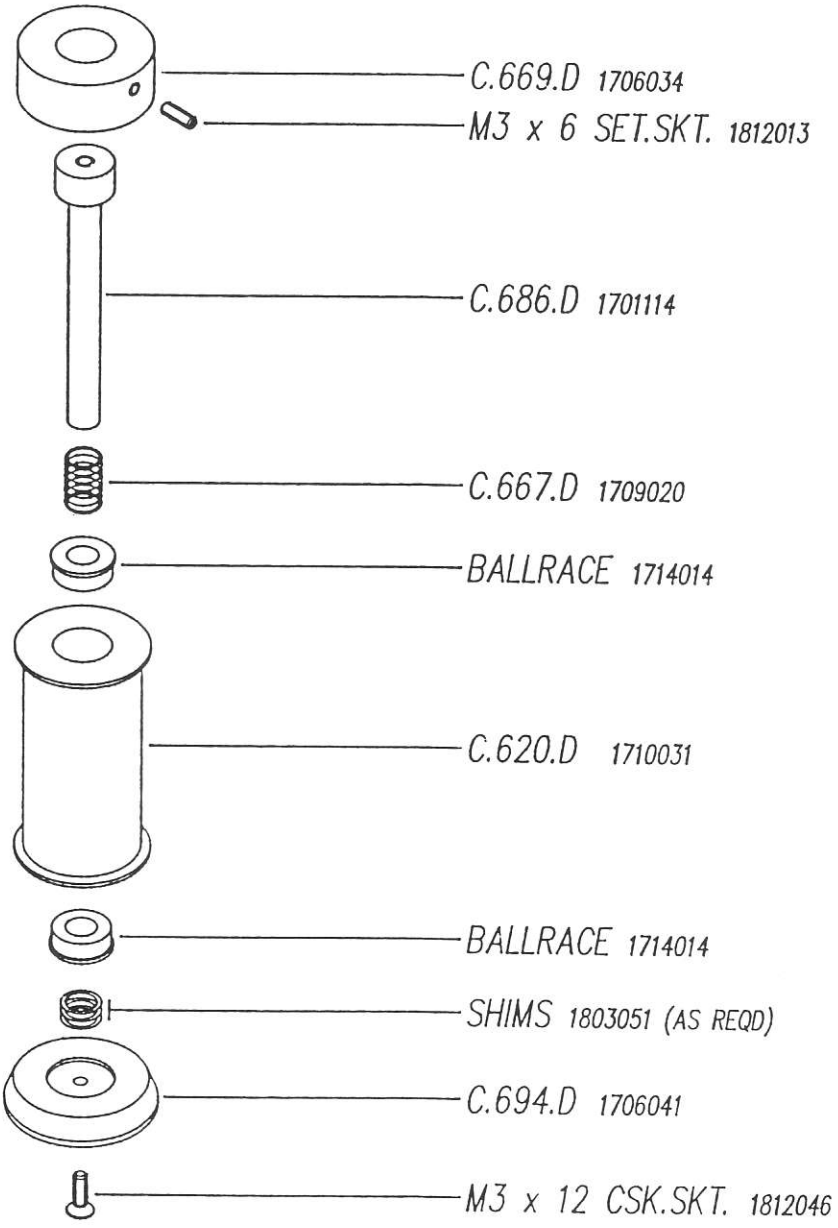
Assy.No.1303020
Drg.No.C.903.A/03 Soundcraft Magnetics Ltd

Soundcraft



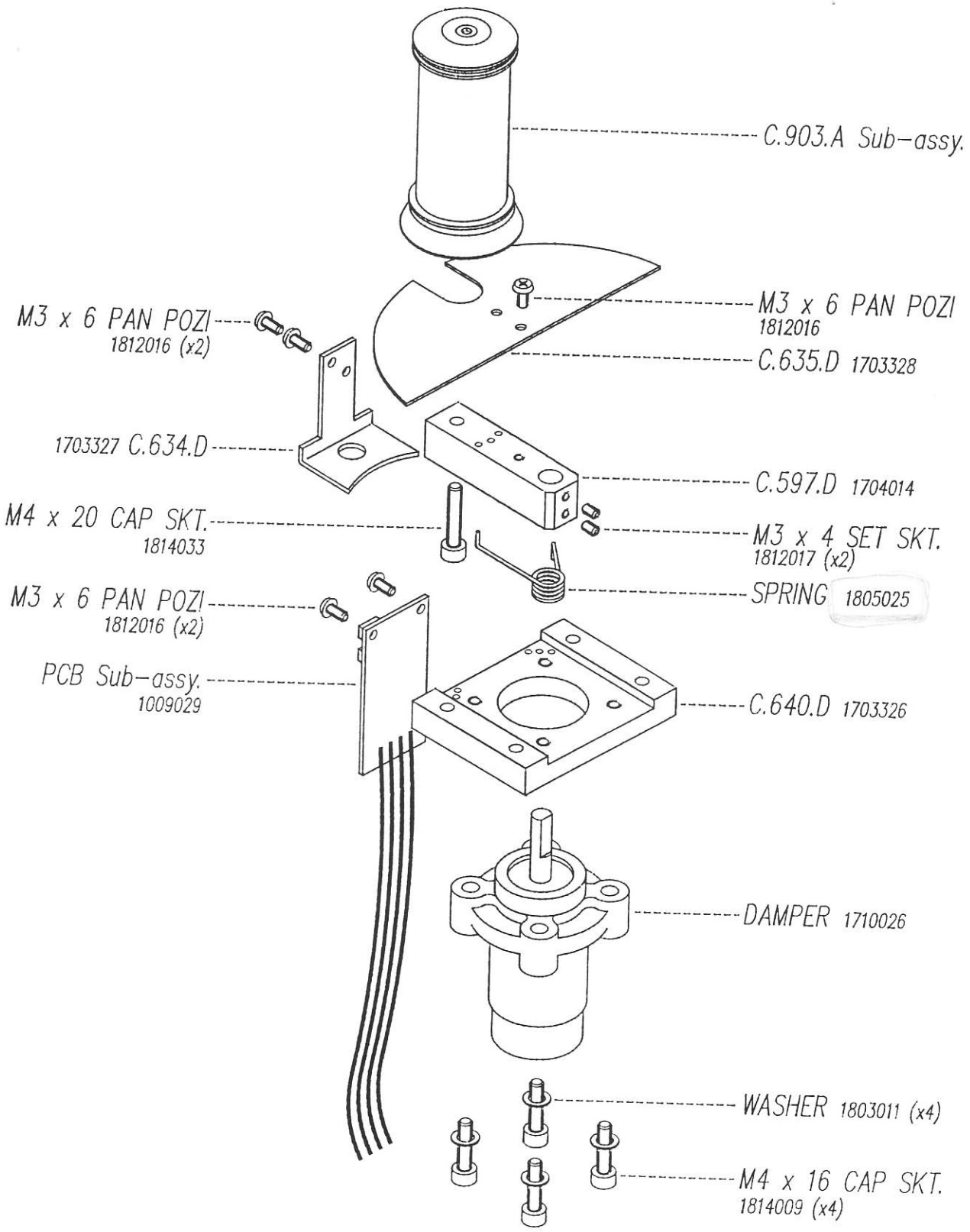
SATURN SCRAPE
FILTER ASSEMBLY.
(Part of) Assy.No.1303007
Drg.No.C.904.A/02 Soundcraft Magnetics Ltd

Soundcraft



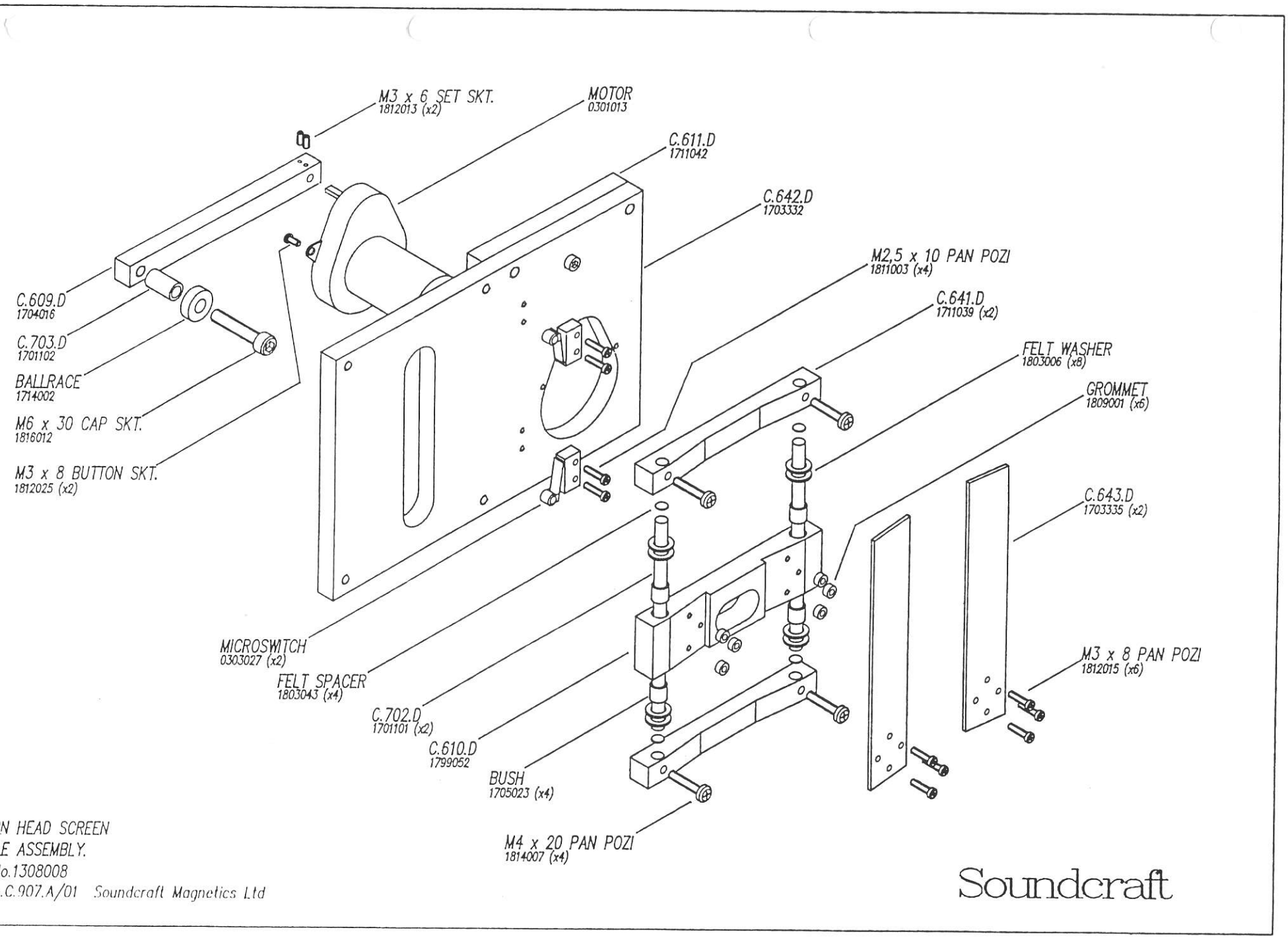
SATURN ENTRY GUIDE ROLLER
TYPE 2 ASSEMBLY.
Assy.No.1303018
Drg.No.C.905.A/03 Soundcraft Magnetics Ltd

Soundcraft



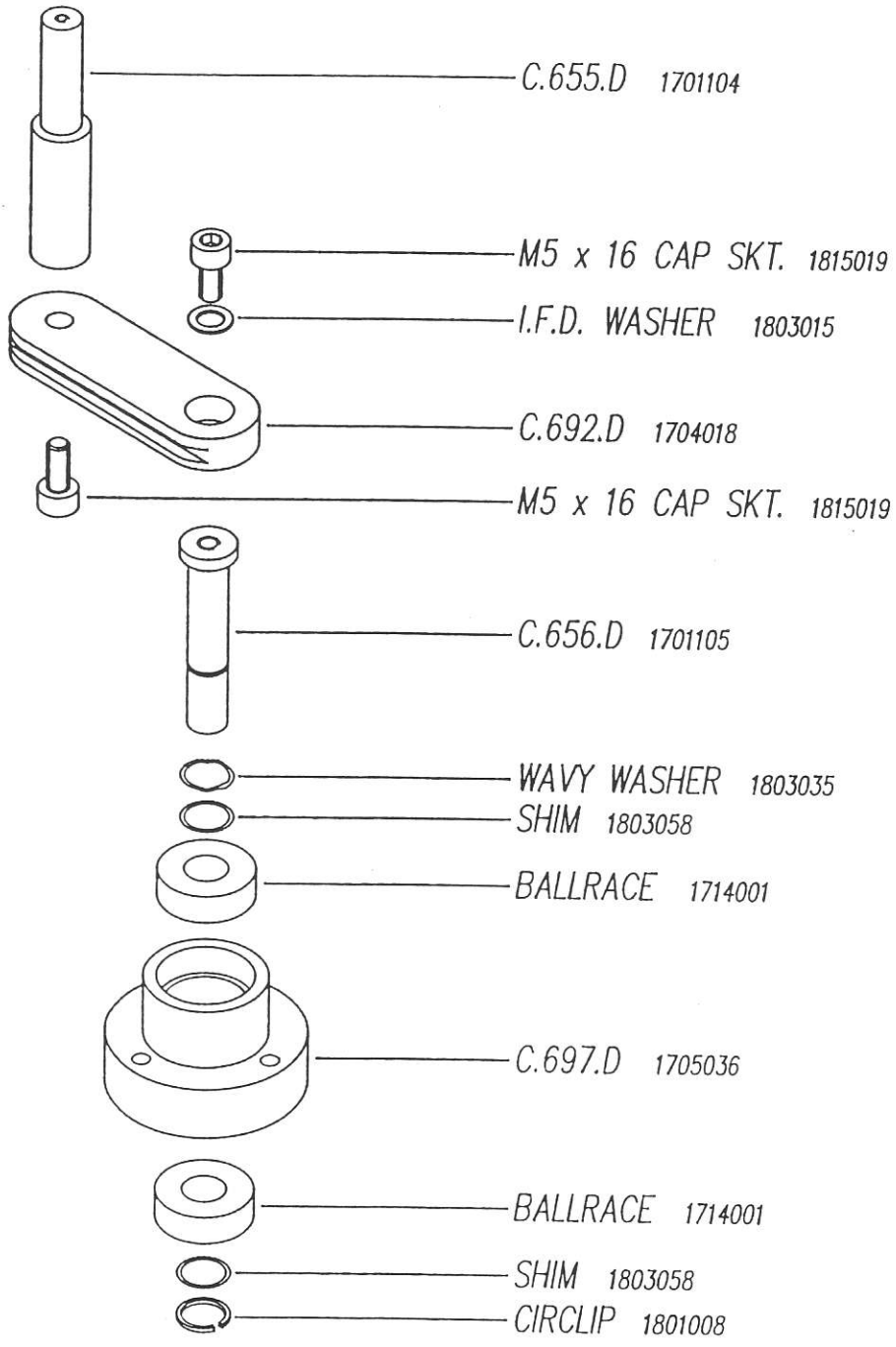
FEED DAMPER ARM
MODULE ASSEMBLY.
Assy.No.1303004
Drg.No.C906.A/01 Soundcraft Magnetics Ltd

Soundcraft



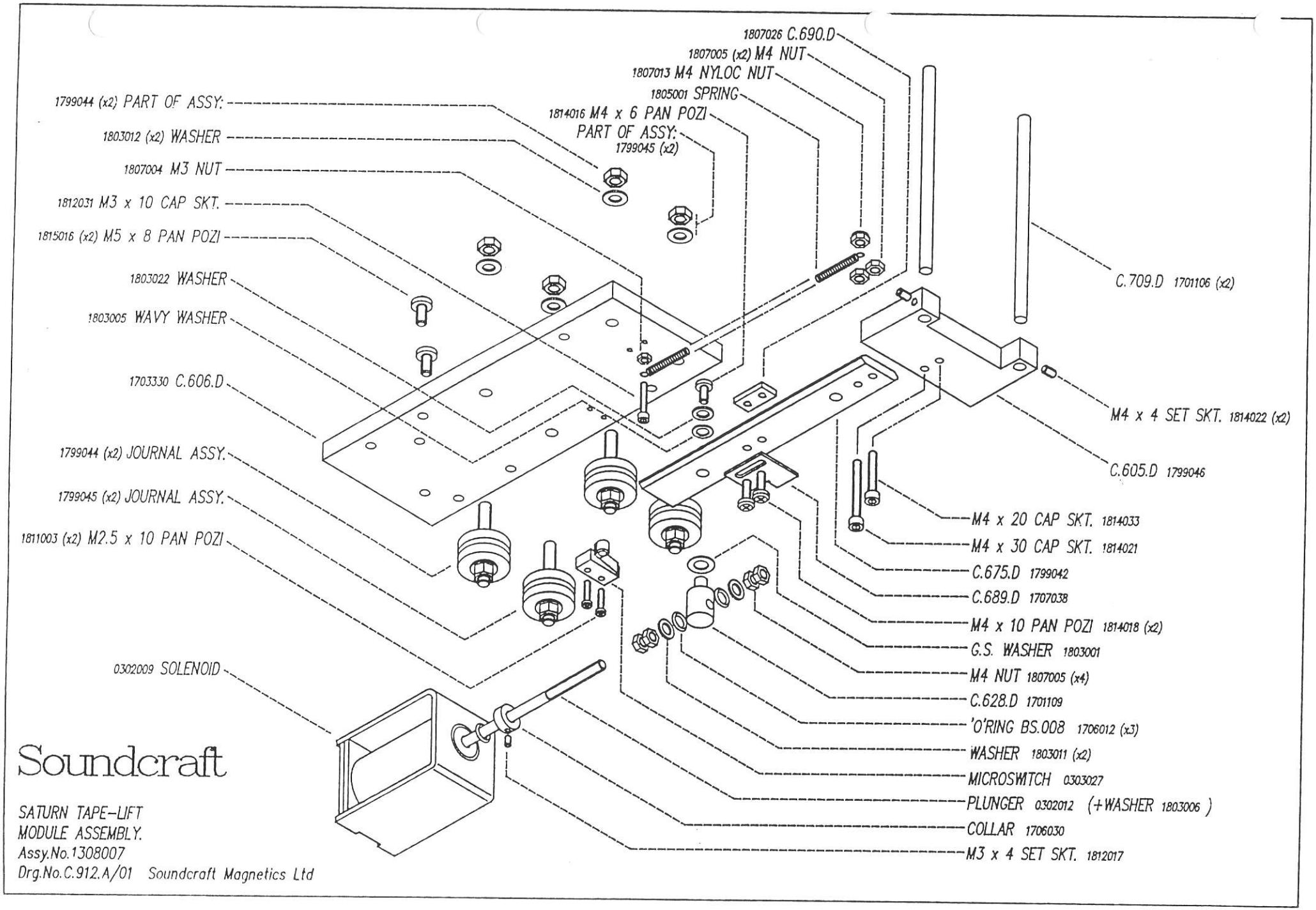
SATURN HEAD SCREEN
MODULE ASSEMBLY.
Assy.No.1308008
Drg.No.C.907.A/01 Soundcraft Magnetics Ltd

Soundcraft



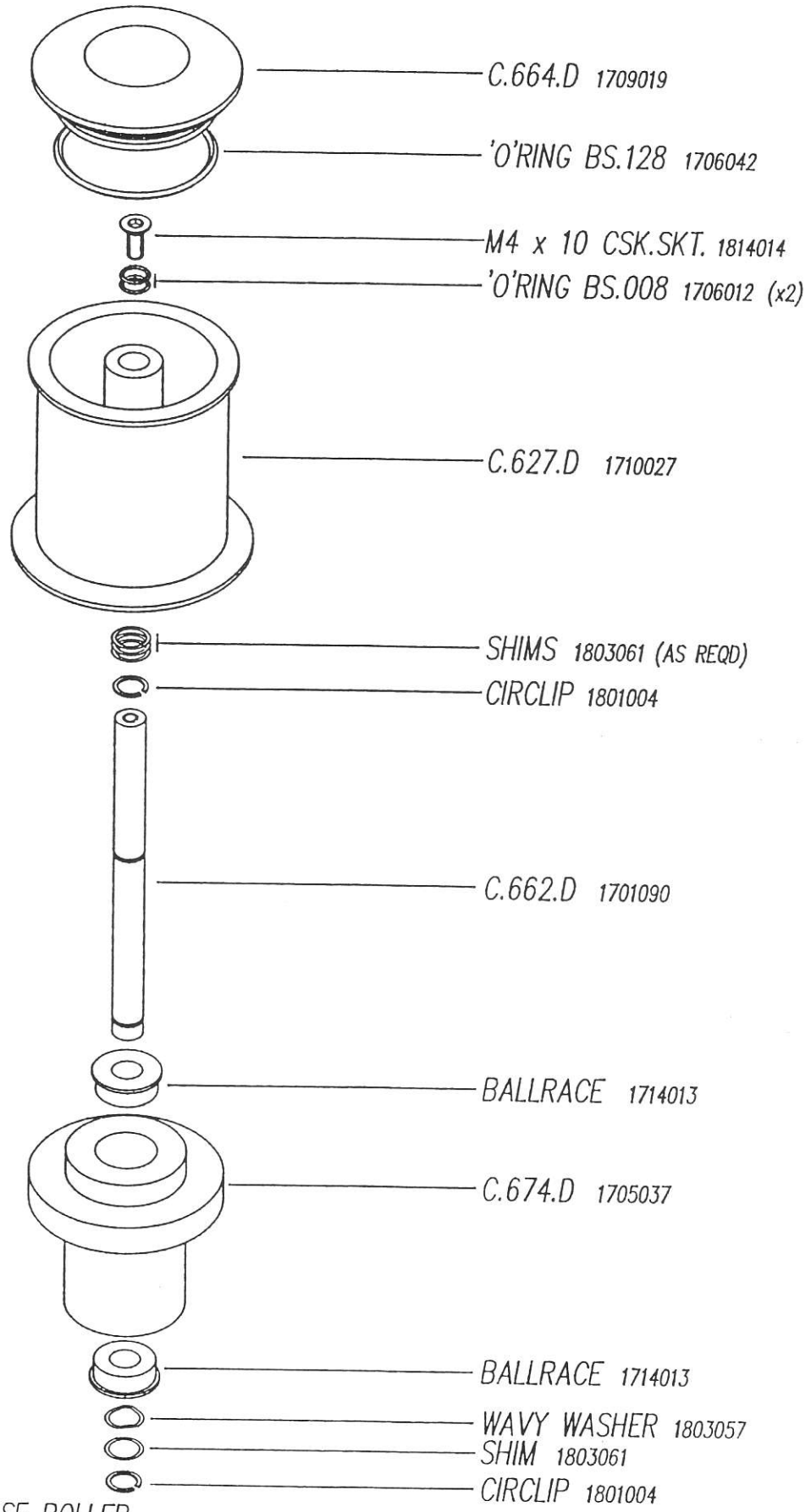
SATURN PINCH ARM PIVOT
TYPE 2 ASSEMBLY.
(Part of) Assy.No.1308006
Drg.No.C.910.A/01 Soundcraft Magnetics Ltd

Soundcraft



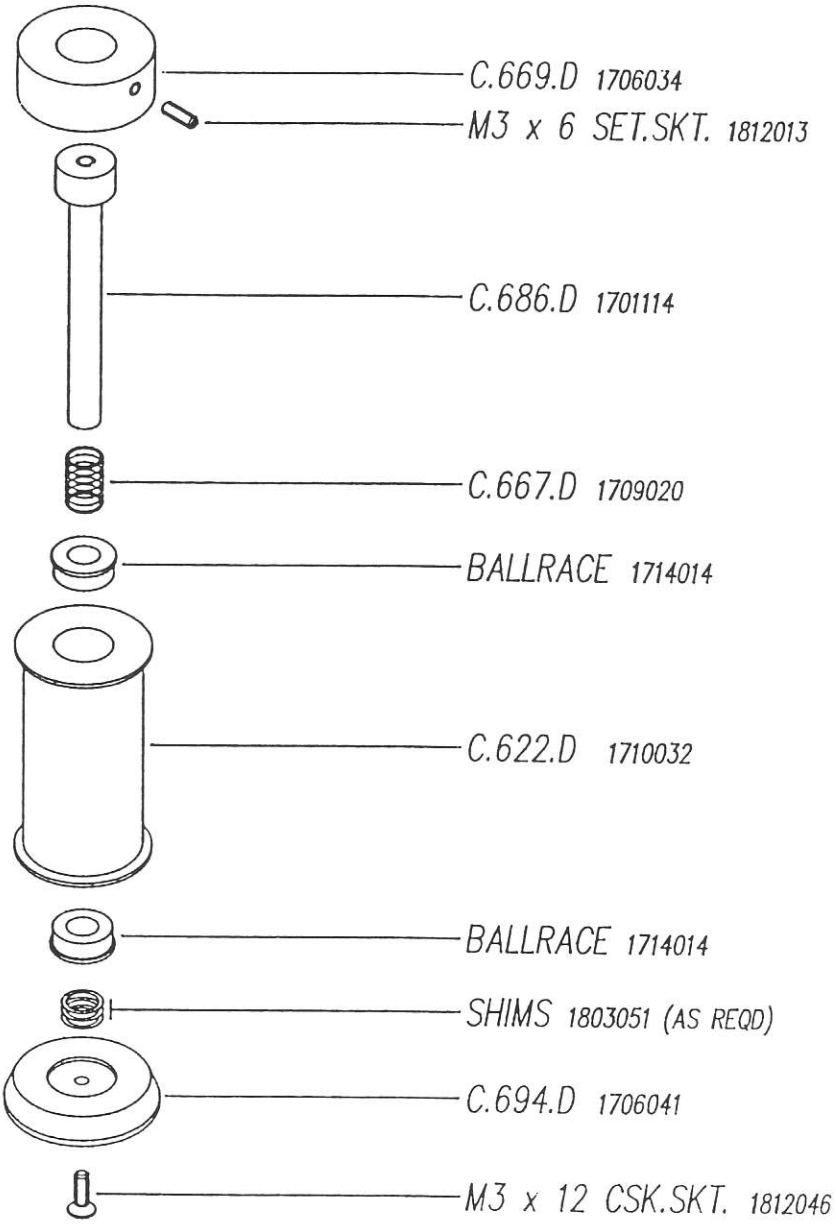
Soundcraft

SATURN TAPE-LIFT
MODULE ASSEMBLY.
Assy.No.1308007
Drg.No.C.912.A/01 Soundcraft Magnetics Ltd



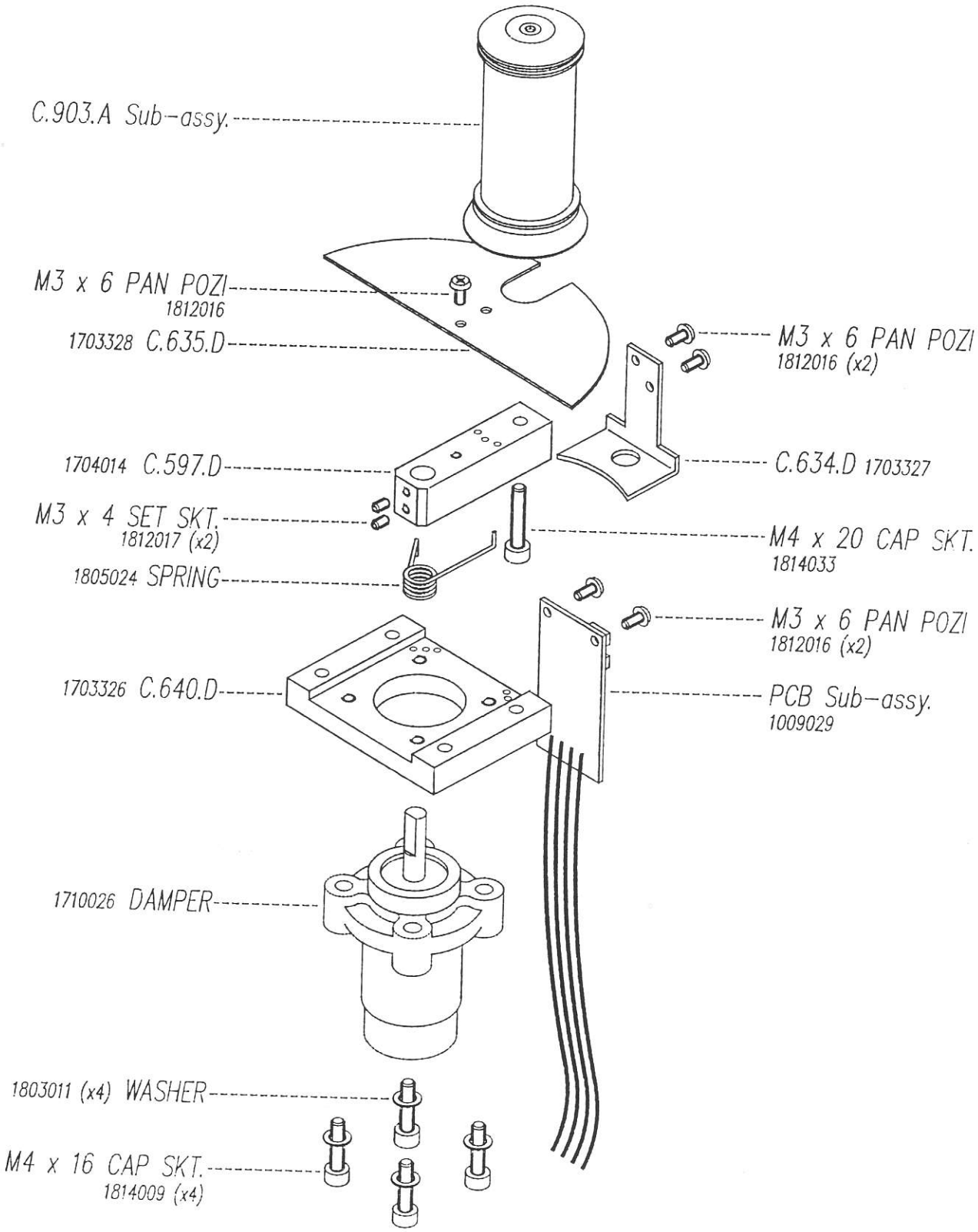
SATURN MOTION SENSE ROLLER
TYPE 2 ASSEMBLY.
Assy.No.1303017
Drg.No.C.914.A/02 Soundcraft Magnetics Ltd

Soundcraft



SATURN EXIT GUIDE ROLLER
TYPE 2 ASSEMBLY.
Assy.No.1303019
Drg.No.C.915.A/02 Soundcraft Magnetics Ltd

Soundcraft

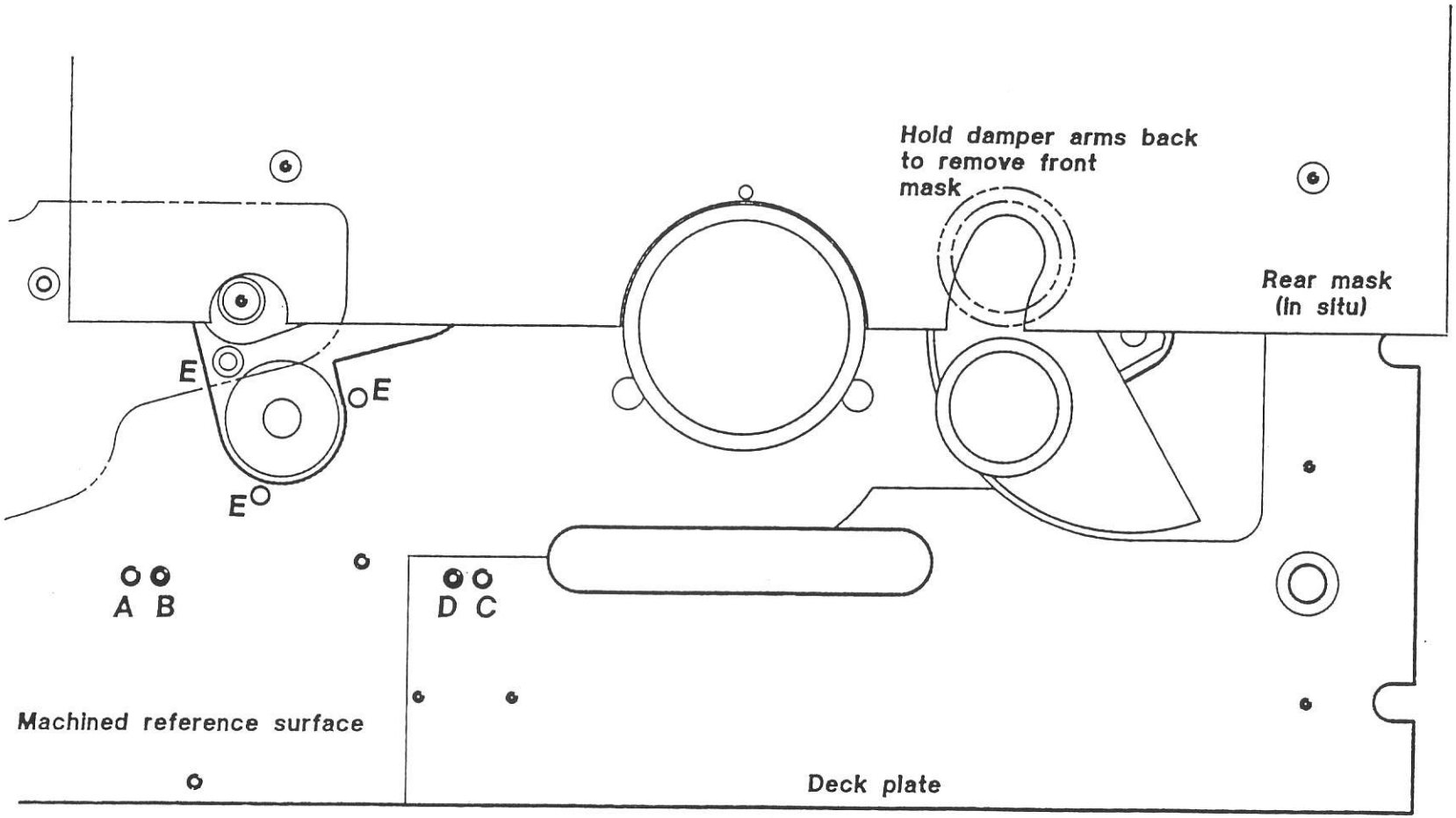


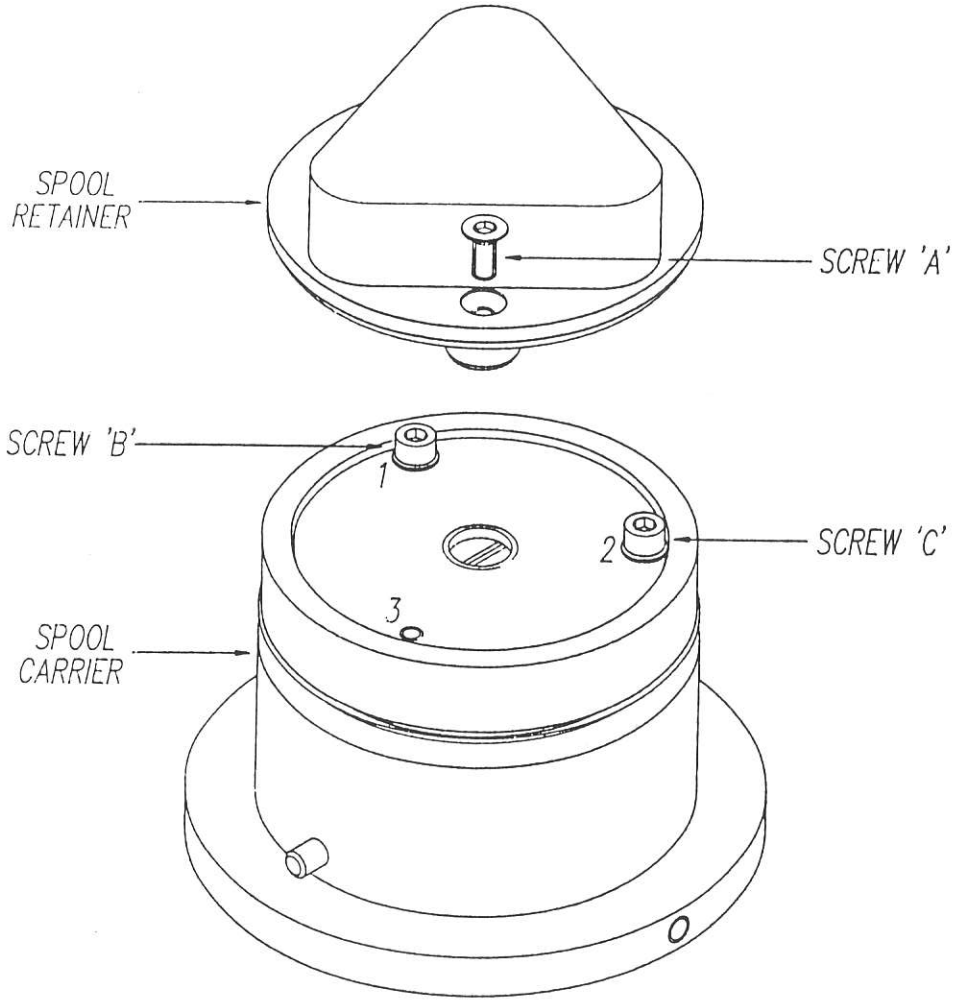
TAKE-UP DAMPER ARM
MODULE ASSEMBLY.
Assy.No.1303003
Drg.No.C.916.A/01 Soundcraft Magnetics Ltd

Soundcraft

Drg.no: C.919.A/01
Soundcraft Magnetics Ltd

Soundcraft

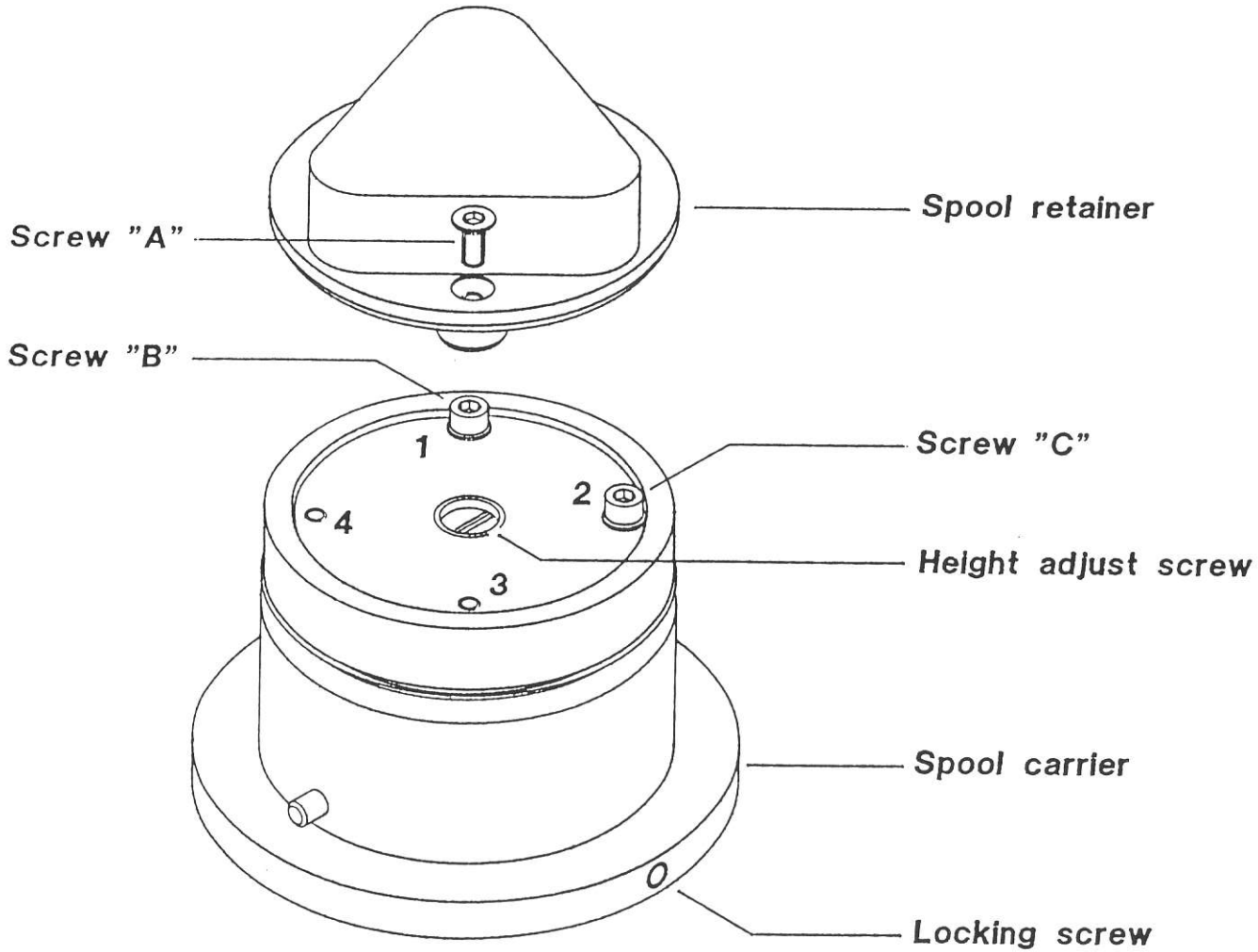




1: Remove screw 'A'
2: Remove Spool retainer, by unscrewing from Spool carrier.
3: To increase effective diameter of carrier, move screw 'B' from position '1' to position '3'. This will enable the carrier to grip spools with larger diameter centres.
To decrease effective diameter of carrier, move screw 'C' from position '2' to position '3'. This will allow spools with smaller diameter centres to fit over the carrier.
4: Replace the Spool retainer with the correct spool in place, and tighten the retainer until the carrier just grips the spool.
5: Replace screw 'A', ensuring that the Spool retainer can rotate through at least 180°.

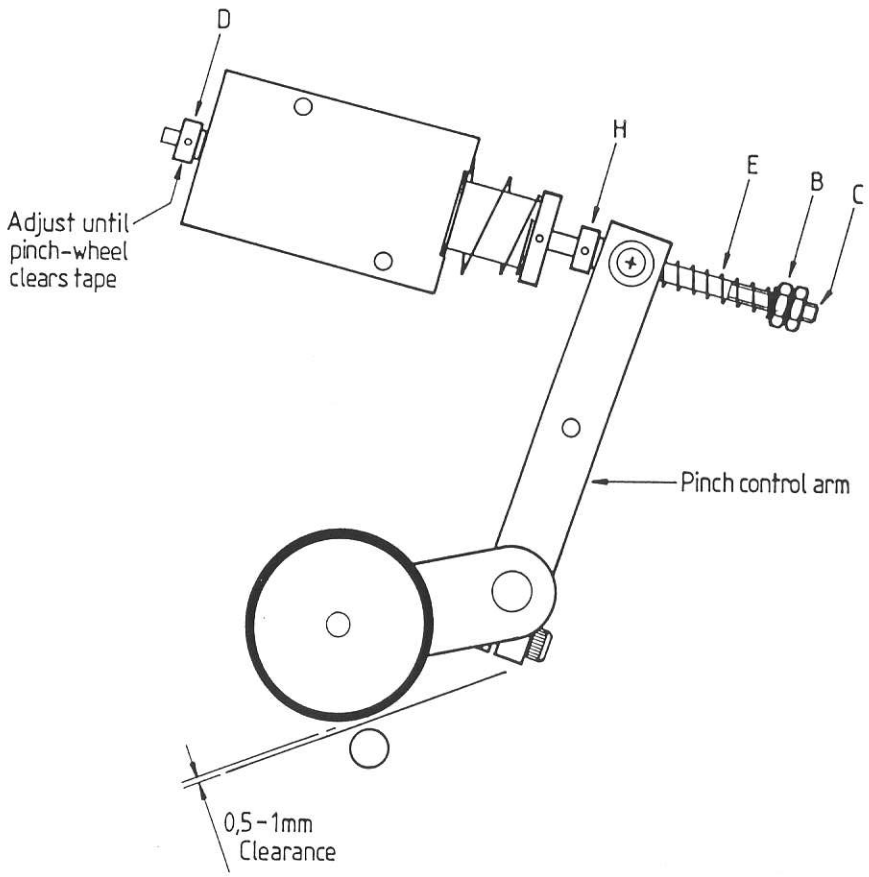
If required, this adjustment may be repeated to accomodate oversize or undersize spools.

SPOOL RETAINER ADJUSTMENT
Drg.No.C.921.A/01 Soundcraft Magnetics Ltd

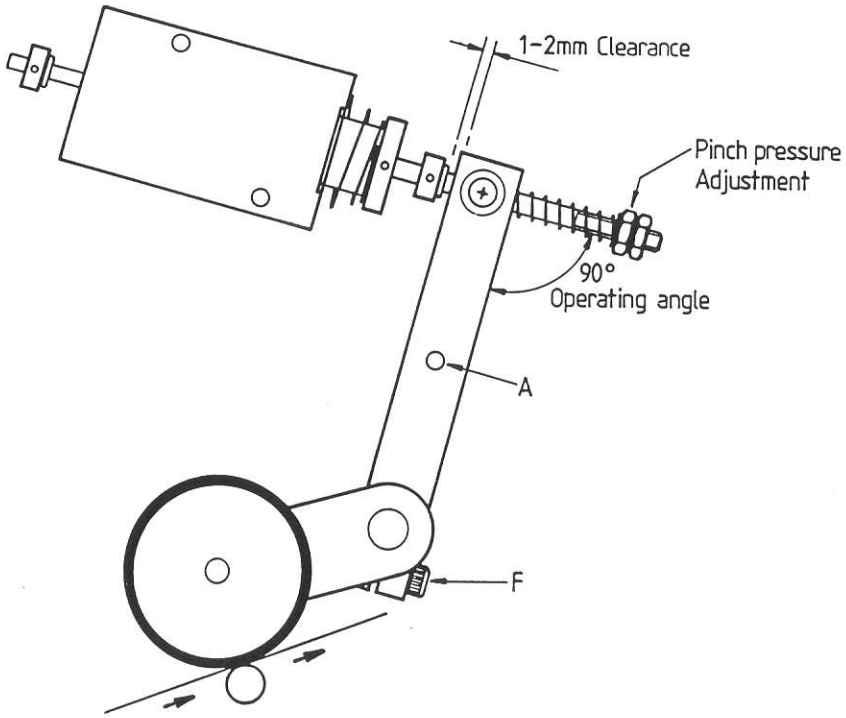


Drg.no: C.931.A/01
Soundcraft Magnetics Ltd

Soundcraft

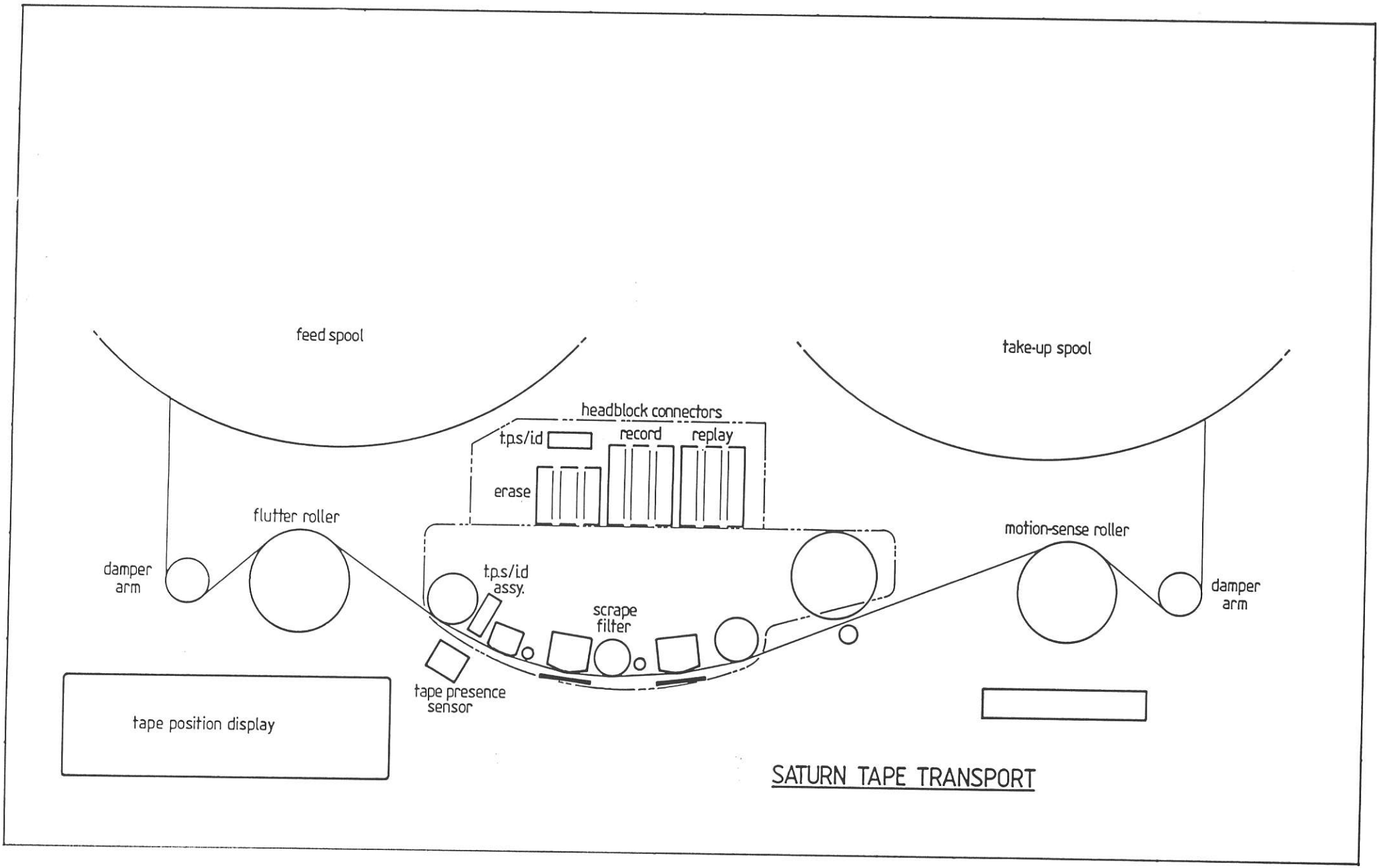


Solenoid not energised
eg: 'STOP' MODE

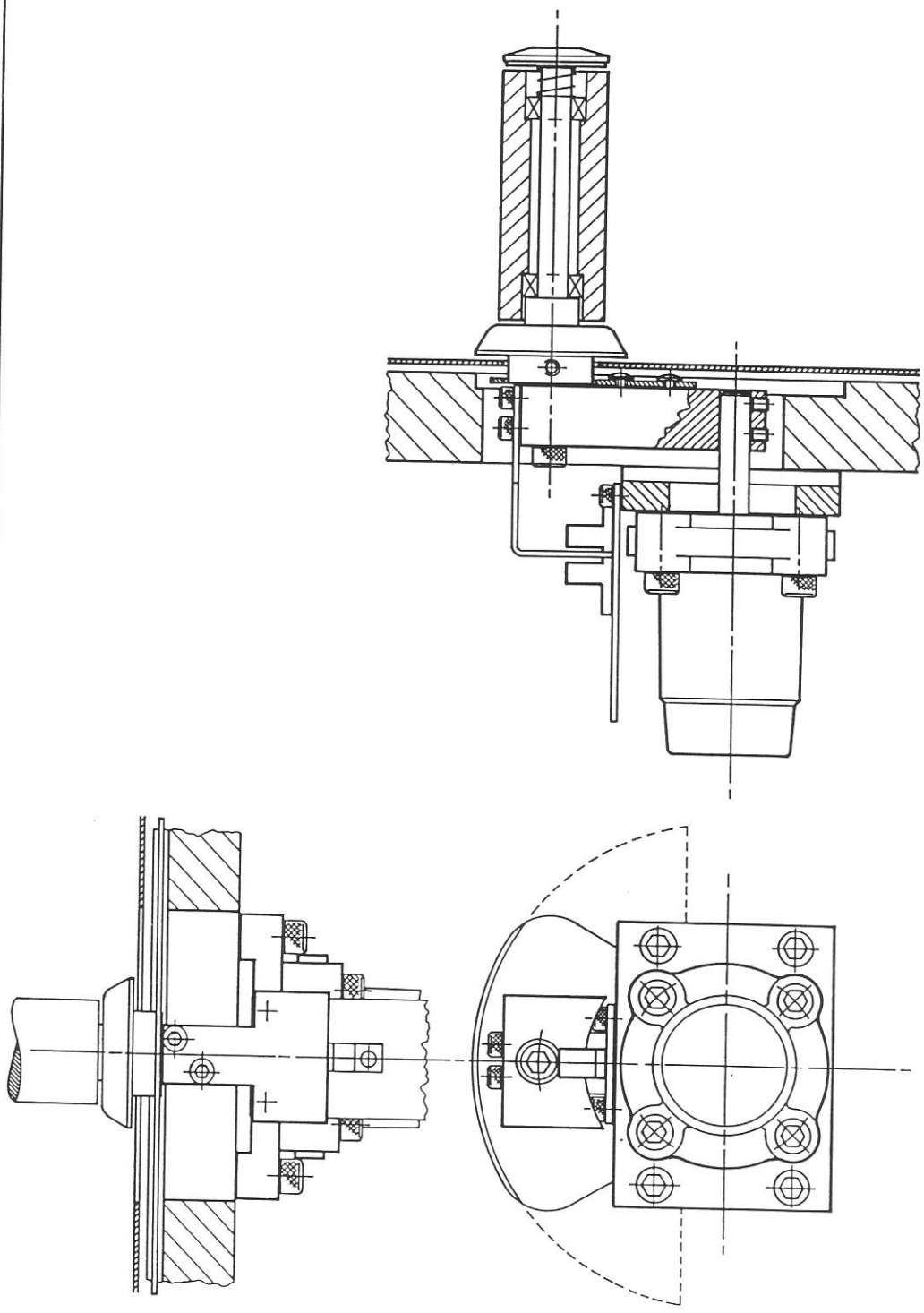


Solenoid energised
eg: 'PLAY' MODE

SATURN
PINCH MECHANISM
ADJUSTMENTS



SATURN TAPE TRANSPORT



-SECTION 4-

19. Circuit Diagrams

Saturn System block diagram
Saturn wiring list

PSU block diagram
PSU wiring diagram
PSU main board circuit diagram
+/- 8/18 volt regulator
Modified Surge suppressor board
heatsink pcb circuits

Audio channel
Audio control board
Audio mother board (1-8)
Audio mother board (9-16)
Audio interface board
Remote meter amplifiers
Local meter amplifiers
Remote meter assembly

Transport wiring diagram
Deck distribution board
Headblock board
PLL capstan servo board
Motion sense board

Digital mother board
CPU
Interface board

Alignment panel
Remote control unit (2 sheets)

Aux rack mother board
Remote bus buffer
Parallel (synchroniser) interface
Meter overbridge LED drivers
Noise reduction control interface

ISSUE 5 23.09.86

SATURN WIRING

WIRE No.	FROM	TO	FUNCTION
PART NO. 1411002	DECK POWER CABLE		
8 WIRES			
010	DDB J11,2	PSU, J22,5	LEFT VOLTS (M1-)
011	DDB J13,1	PSU, J22,2	RIGHT VOLTS (M2-)
012	DDB J11,1	PSU, J22,6	LEFT VOLTS (M1+)
013	DDB J13,2	PSU, J22,3	RIGHT VOLTS (M2+)
022	DDB J12,3	PSU, J2,1	0V CLEAN
023	DDB J12,4	PSU, J2,2	+24V
024	DDB J12,2	PSU, J2,3	0V DIRTY
025	DDB J12,1	PSU, J2,4	+5V

01	DIG 0V PSU	STAR POINT	0V
02	AUX 0V PSU	STAR POINT	0V
03	DIG +5V	AUX +5V	
04	PSU +5V	DIG +5V	
05	PSU BLOCK1 +5V	PSU PCB +5V	
06	PSU CHASSIS	MACHINE CHASSIS	

0V

PART NO. 1411003 MAIN MACHINE LOOM
34 WIRES

030	DIG	J10,8	PSU, J1,1	-18V
031	DIG	J10,5	PSU, J1,2	0V CLEAN
032	DIG	J10,7	PSU, J1,3	+18V
033	DIG	J10,1	PSU, J1,4	+24V
034	DIG	J10,2	PSU, J1,5	0V DIRTY
035	DIG	J10,11	PSU, J1,6	+5V
050	1-8,	J30,1	PSU, J4,1	-18V
051	1-8,	J30,4	PSU, J4,2	-8V
052	1-8,	J30,7	PSU, J4,3	+8V
053	1-8,	J30,8	PSU, J4,4	+18V
054	1-8,	J30,11	PSU, J4,5	0V CLEAN
055	1-8,	J30,9	PSU, J4,6	ERASE GND
056	1-8,	J30,3	PSU, J3,1	LOGIC GND
057	1-8,	J30,2	PSU, J3,2	+5V
060	9-16,	J30,1	PSU, J5,1	-18V
061	9-16,	J30,4	PSU, J5,2	-8V
062	9-16,	J30,7	PSU, J5,3	+8V
063	9-16,	J30,8	PSU, J5,4	+18V
064	9-16,	J30,11	PSU, J5,5	0V CLEAN
065	9-16,	J30,9	PSU, J5,6	ERASE GND
070	17-24,	J30,1	PSU, J6,1	-18V
071	17-24,	J30,4	PSU, J6,2	-8V
072	17-24,	J30,7	PSU, J6,3	+8V
073	17-24,	J30,8	PSU, J6,4	+18V
074	17-24,	J30,11	PSU, J6,5	0V CLEAN
075	17-24,	J30,9	PSU, J6,6	ERASE GND
080	AUX	J2,3	PSU, J7,1	-18V
081	AUX	J2,2	PSU, J7,2	0V CLEAN
082	AUX	J2,4	PSU, J7,3	+24V
083	AUX	J2,1	PSU, J7,4	+18V
084	AUX	J2,7	PSU, J7,5	0V DIRTY
085	AUX	J2,10	PSU, J7,6	+5V
086	AUX	J2,8	PSU, J23,1	0V DIRTY
087	AUX	J2,9	PSU, J23,2	+12V(UNREG)

WIRE No.	FROM	TO	FUNCTION
PART NO. 1411023 34 WIRES	PSU HEATSINK		
410	BLOCK2	PSU, J9,1	(+18V) UNREG
411	BLOCK2	PSU, J9,2	0V (18)
412	BLOCK2	PSU, J9,4	+18V
413	BLOCK2	PSU, J10,1	(-18V) UNREG
414	BLOCK2	PSU, J10,4	-18V
SCN	BLOCK2	PSU, J18,1	SCN OF 421
421	BLOCK2	PSU, J18,2	RIGHT FETS DRIVE
422	BLOCK2	PSU, J18,3	RIGHT MOTOR SUPPLY
423	BLOCK2	PSU, J21,2	RIGHT MOTOR RETURN
430	BLOCK2	PSU, J19,1	FAN (+24V)
431	BLOCK2	PSU, J19,2	FAN (0V)
432	BLOCK2	PSU, J19,3	TEMP (0V)
433	BLOCK2	PSU, J19,4	TEMP
510	BLOCK1	PSU, J13,1	(+24) UNREG
511	BLOCK1	PSU, J13,2	0V (+24V)
512	BLOCK1	PSU, J13,3	+24V
513	BLOCK1	PSU, J13,4	(+5V) UNREG
514	BLOCK1	PSU, J13,5	0V (+5V)
515	BLOCK1	PSU, J13,6	+5V
520	BLOCK1	PSU, J11,1	(+8V) UNREG
521	BLOCK1	PSU, J11,2	0V (+8V)
522	BLOCK1	PSU, J11,4	+8V
523	BLOCK1	PSU, J12,1	(-8V) UNREG
524	BLOCK1	PSU, J12,4	-8V
SCN	BLOCK1	PSU, J18,4	SCN OF 531
531	BLOCK1	PSU, J18,5	LEFT FETS DRIVE
532	BLOCK1	PSU, J18,6	LEFT MOTOR SUPPLY
533	BLOCK1	PSU, J21,1	LEFT MOTOR RETURN
4	BLOCK1 FET BD	BLOCK2 FET BD	-18V
6	BLOCK1 FET BD	BLOCK2 FET BD	+18V
420	BLOCK2 REG BD	BLOCK2 FET BD	+18V

PART NO. 1411022 TRANSFORMER
10 WIRES

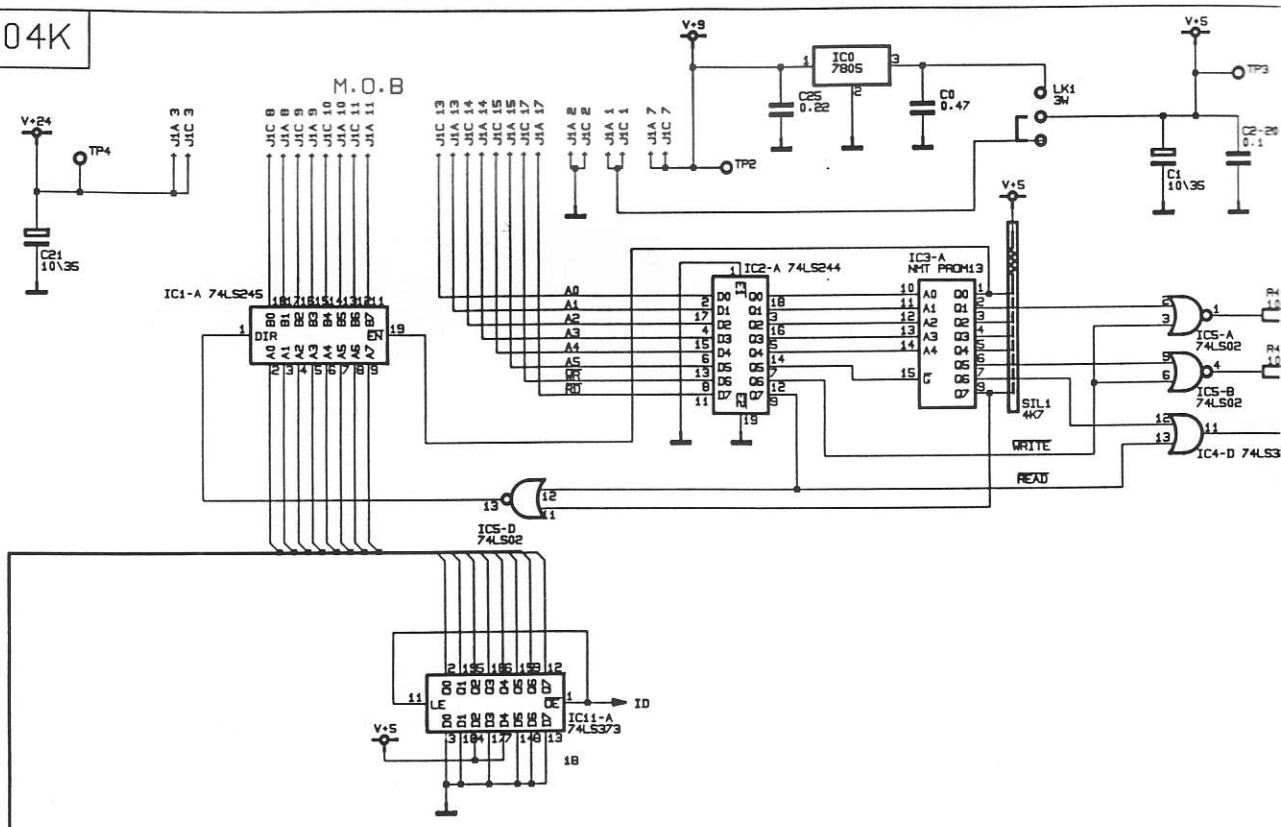
551	TX1	PSU, J16,1	0V (18-0-18)
552	TX1	PSU, J16,2	18V (AC)
553	TX1	PSU, J16,3	18V (AC)
554	TX1	PSU, J16,4	10V (AC)
556	TX1	PSU, J16,6	0V (10.5)
557	TX1	PSU, J16,7	10V (AC)
559	TX1	PSU, J16,9	10.5V (AC)
560	TX1	PSU, J16,10	0V (10-0-10)
561	TX1	PSU, J16,11	18V (AC)
562	TX1	PSU, J16,12	0V (18)

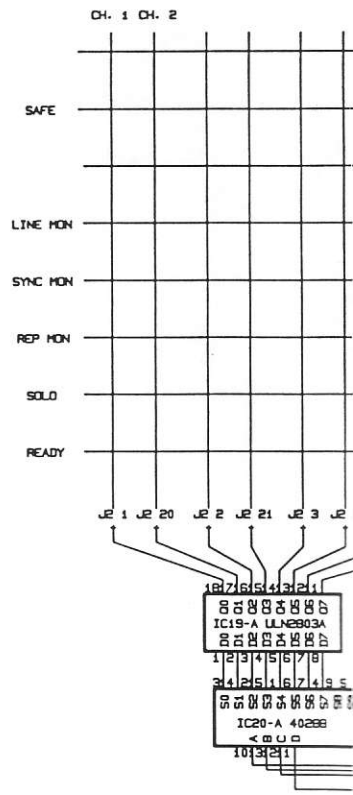
PART No. 1411034 MOTOR CAP
7 WIRES

434	CAP+	PSU, J19,5	MOTOR VOLTS +
434	CAP+	2K2 RESISTOR	
435	CAP-	PSU, J19,6	MOTOR VOLTS -
435	CAP-	2K2 RESISTOR	
436	EARTH BREAK SW	STAR POINT	

C104K

M.O.B





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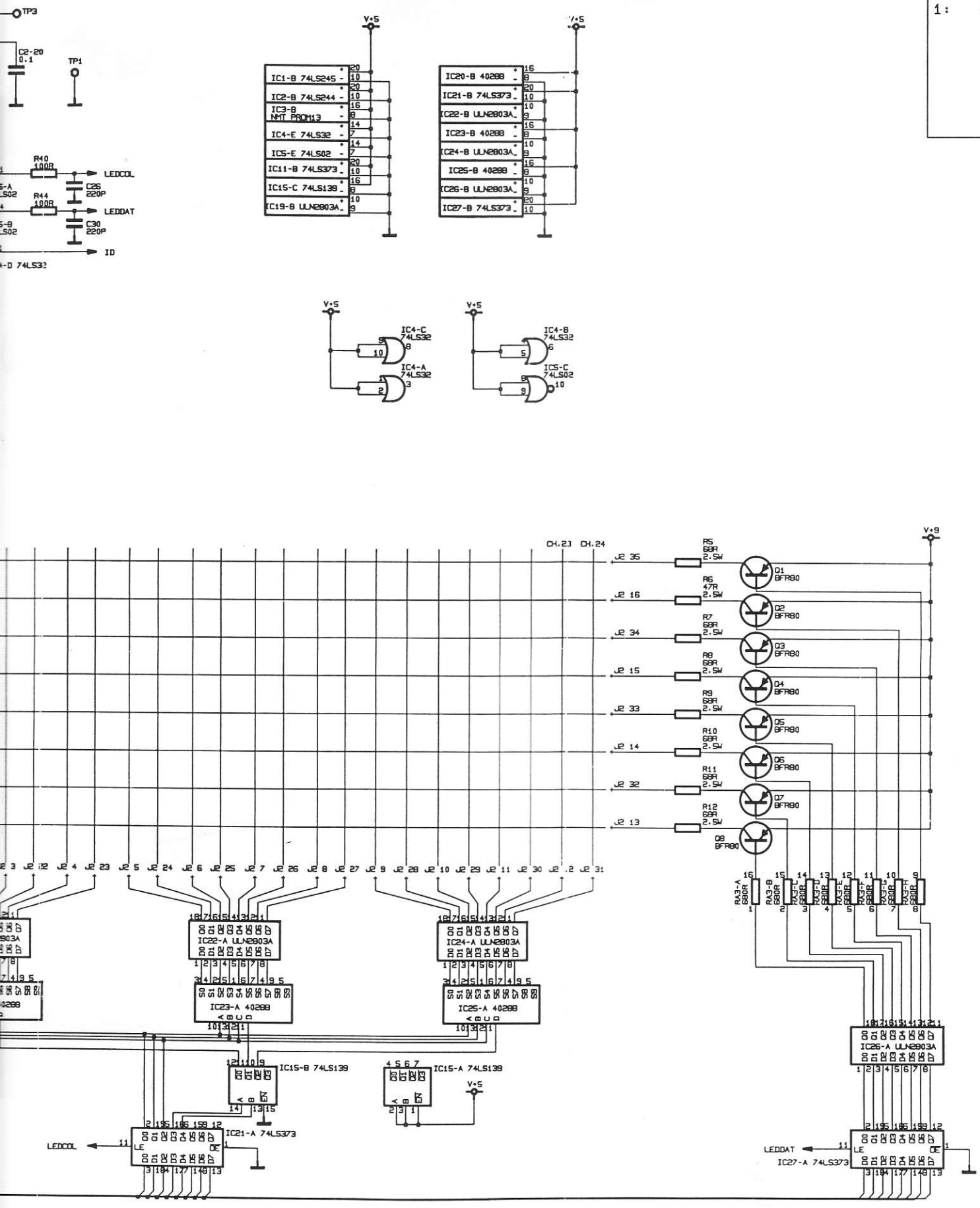
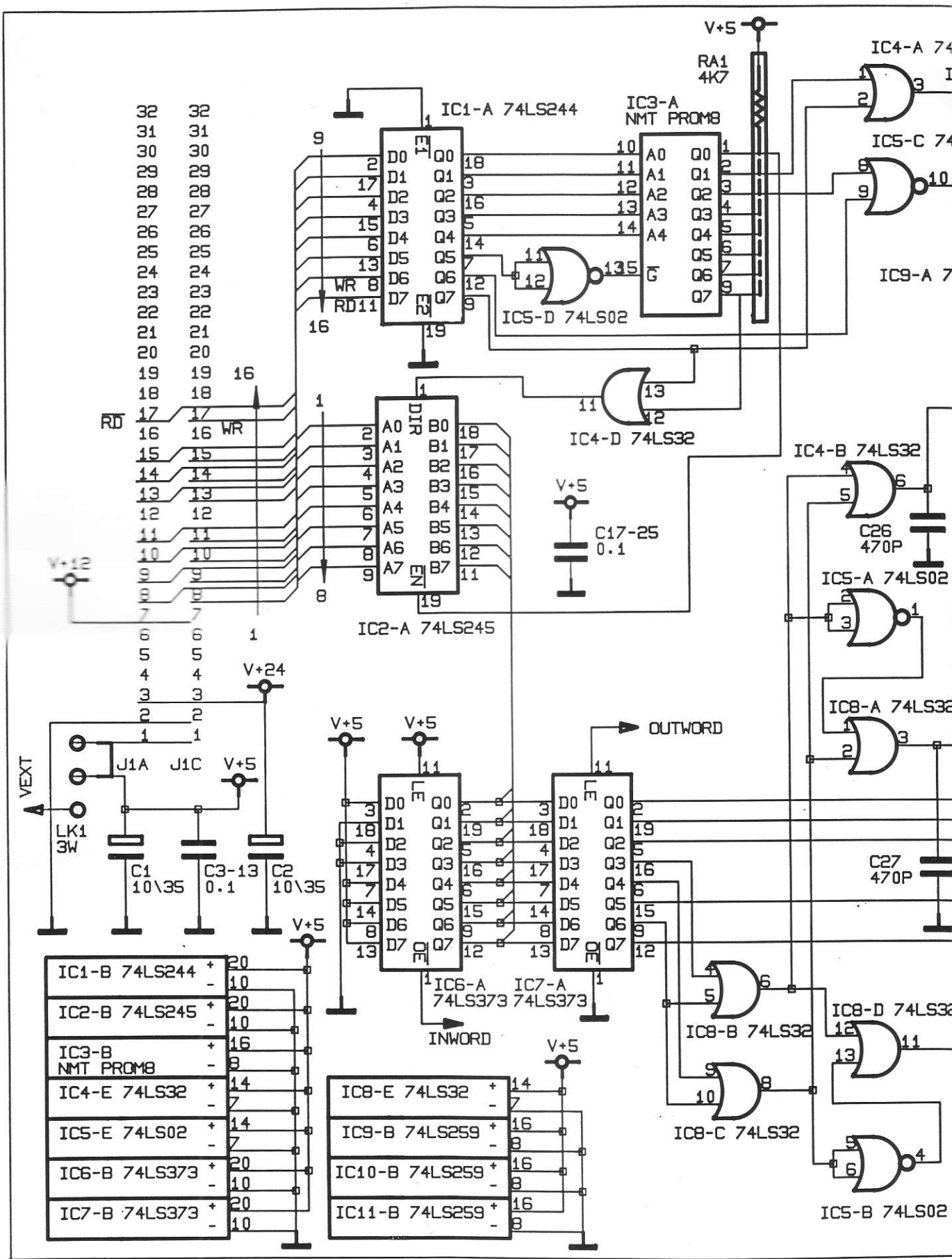


TITLE SATURN
METER OVERBRIDGE
LED DRIVER BOARD
CIRCUIT DIAGRAM

C104K



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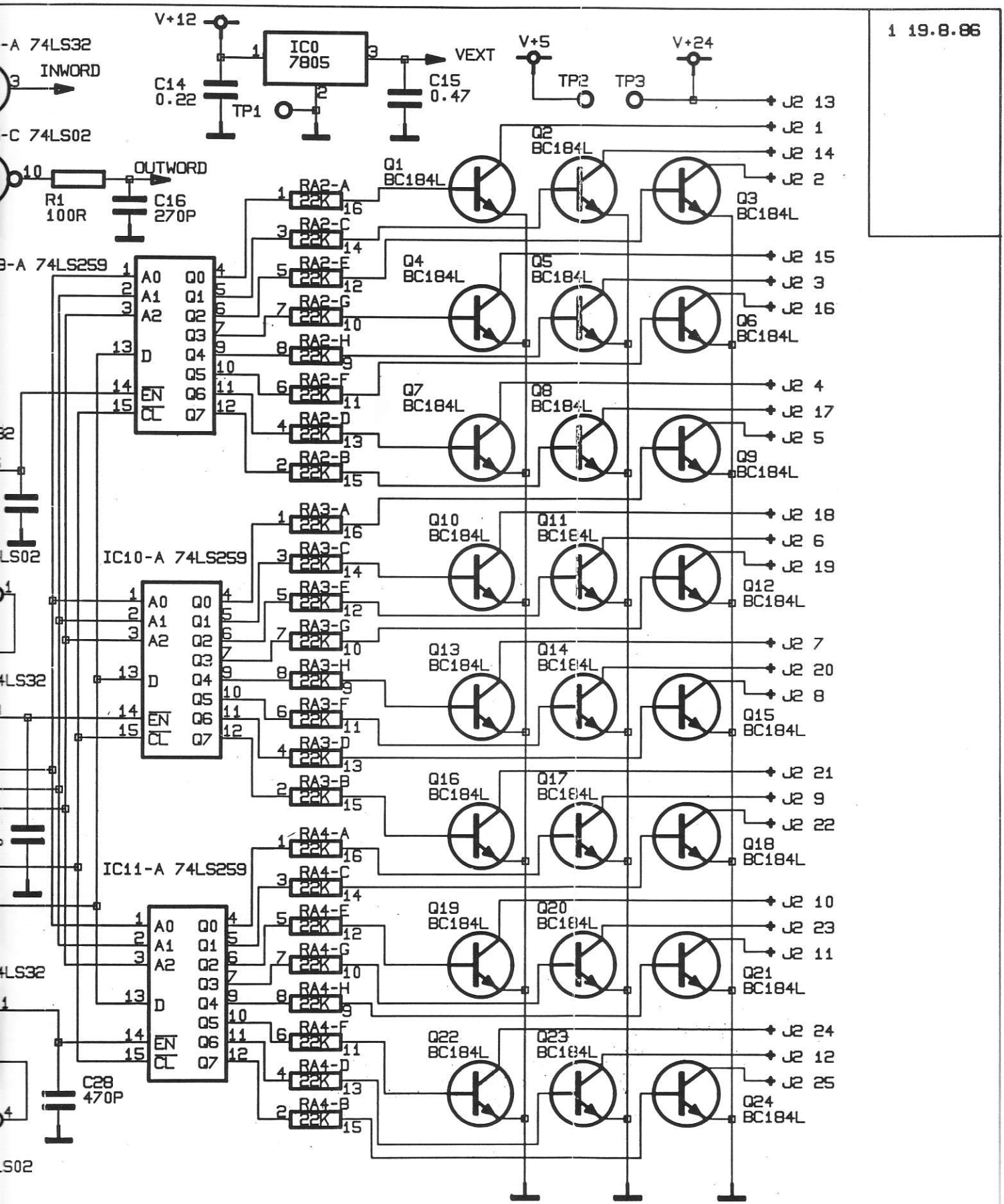
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7805
VEXT
C14
0.22
TP1
C15
0.47
V+5
TP2
TP3
V+24
INWORD
OUTWORD
R1
100R
C16
270P
C28
470P
IC10-A 74LS259
IC11-A 74LS259
A0
A1
A2
D
EN
CL
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
RA2-A
RA2-C
RA2-E
RA2-G
RA2-H
RA2-F
RA2-D
RA2-B
RA3-A
RA3-C
RA3-E
RA3-G
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RA3-D
RA3-B
RA4-A
RA4-C
RA4-E
RA4-G
RA4-H
RA4-F
RA4-D
RA4-B
22K
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Q2 BC184L
Q3 BC184L
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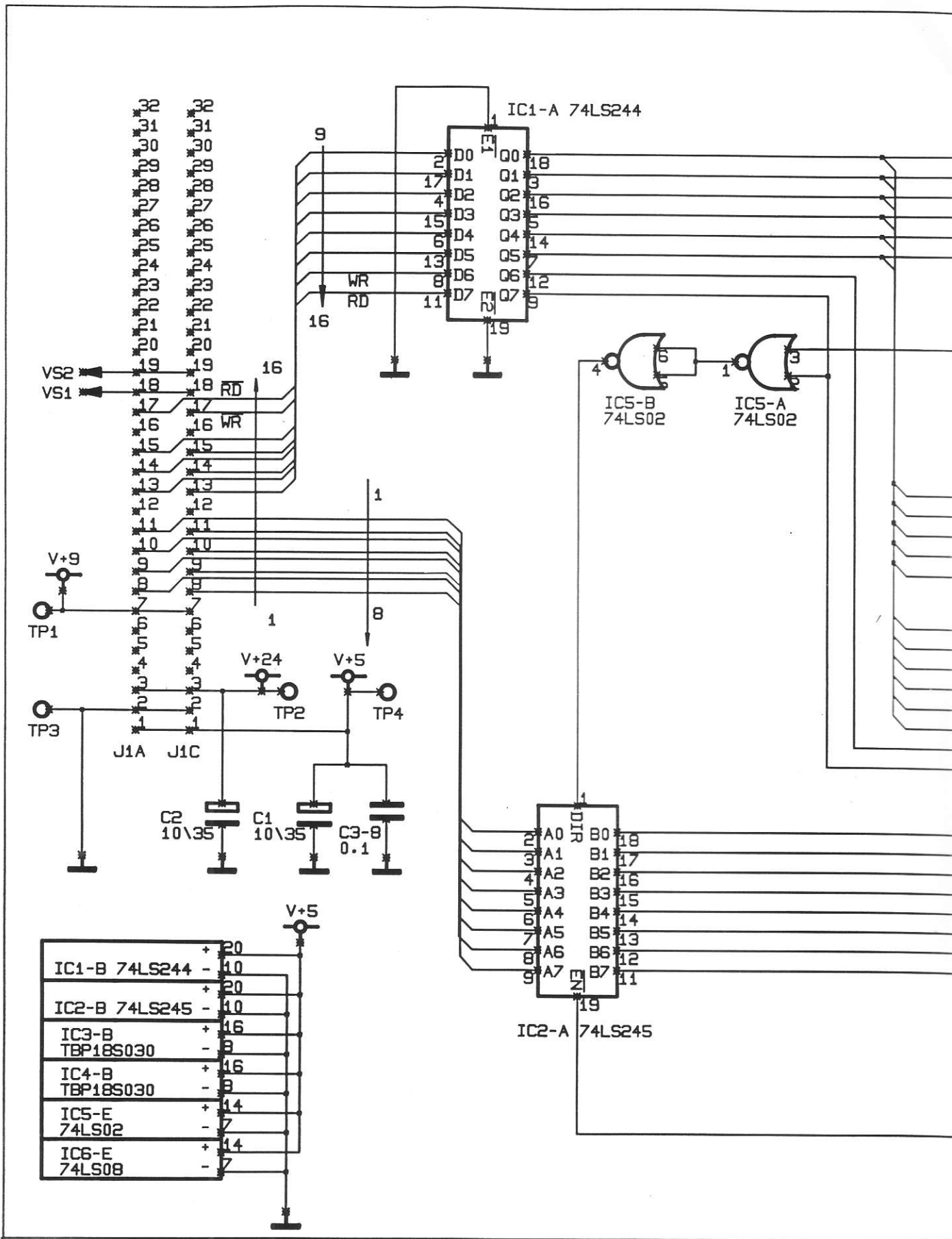
C136K/01
TITLE
SATURN
NOISE REDUCTION
CONTROL PCB



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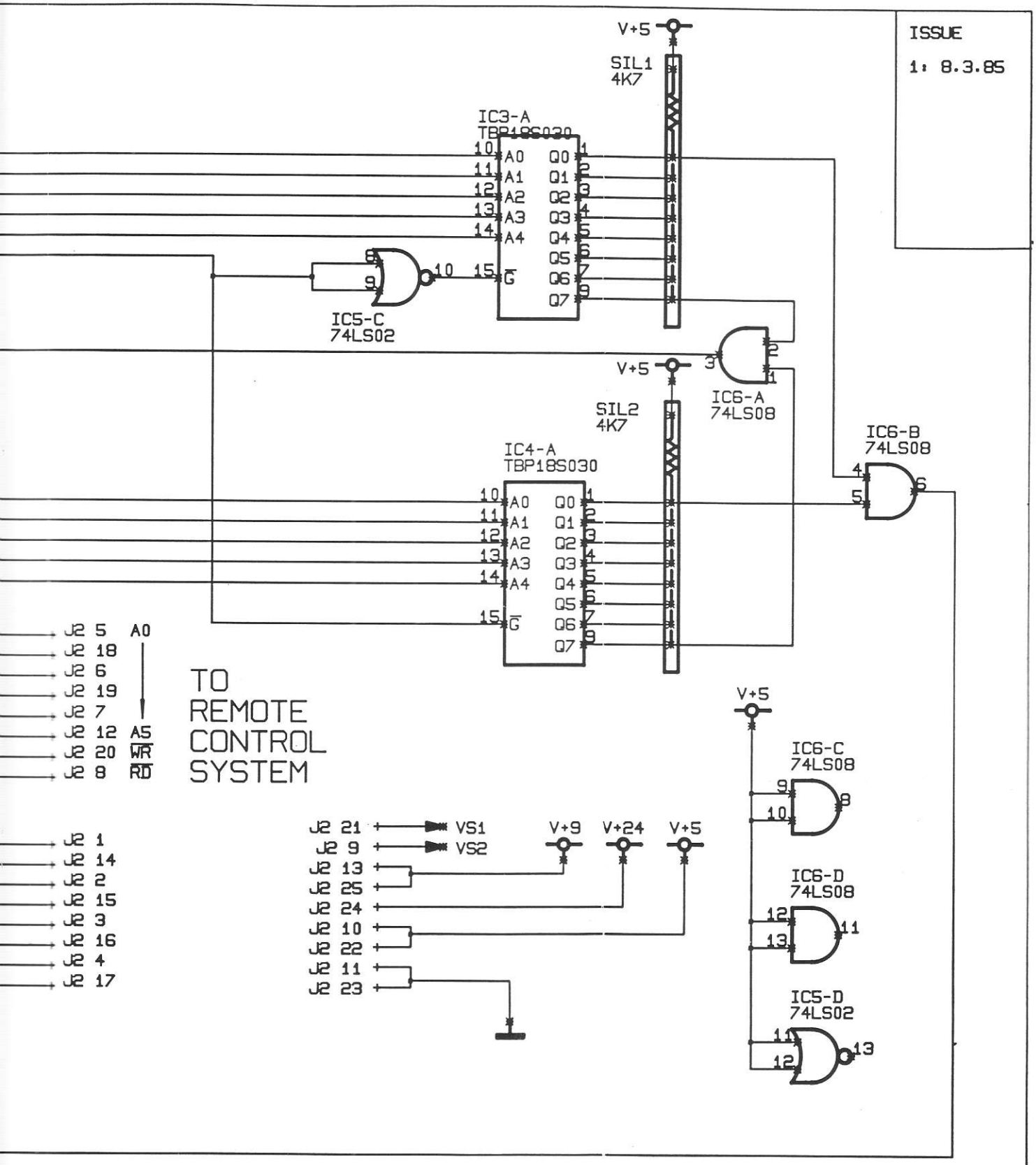

NOTES

CM138K

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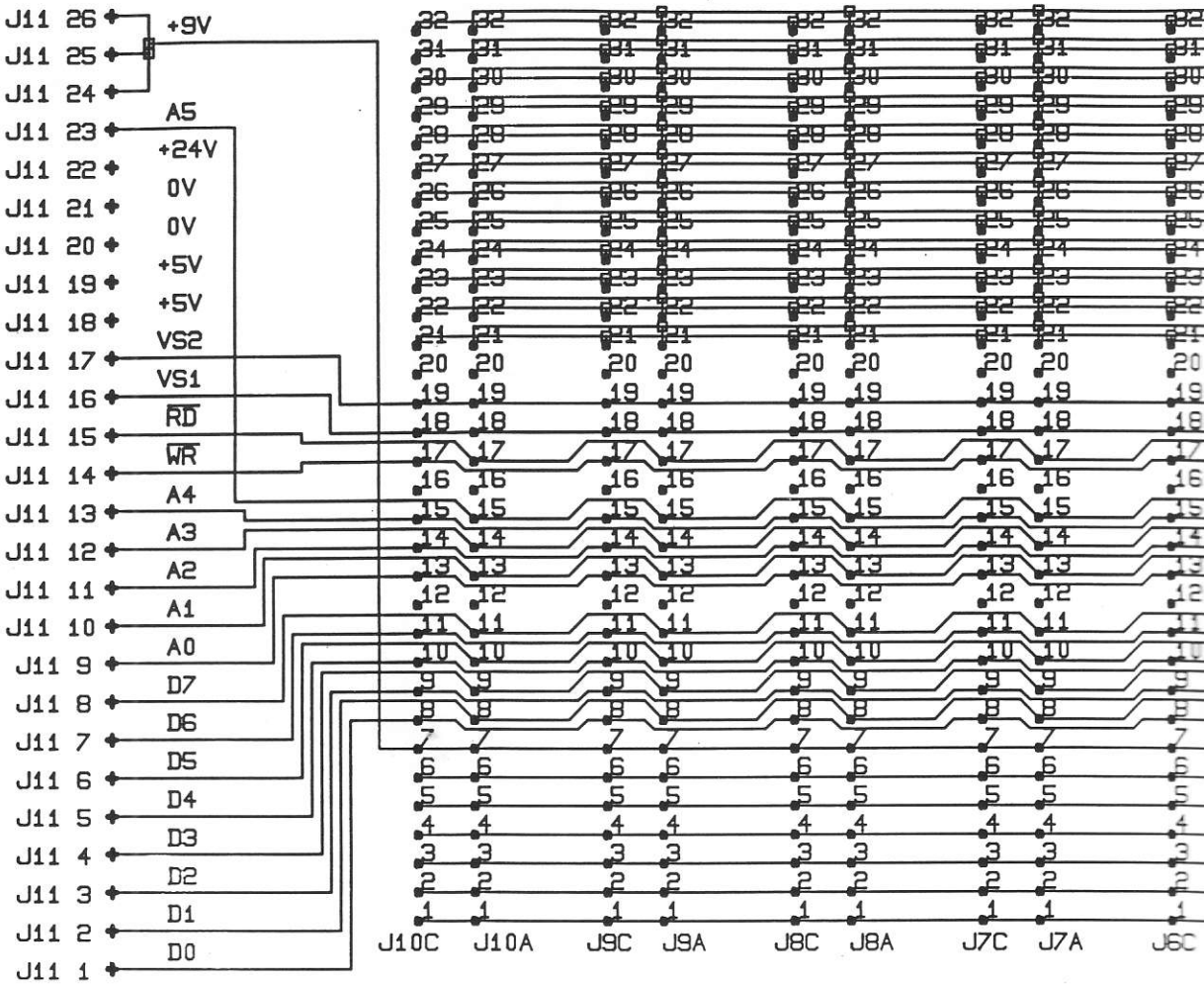
SATURN
REMOTE BUS
BUFFER SM3832

M.O.B



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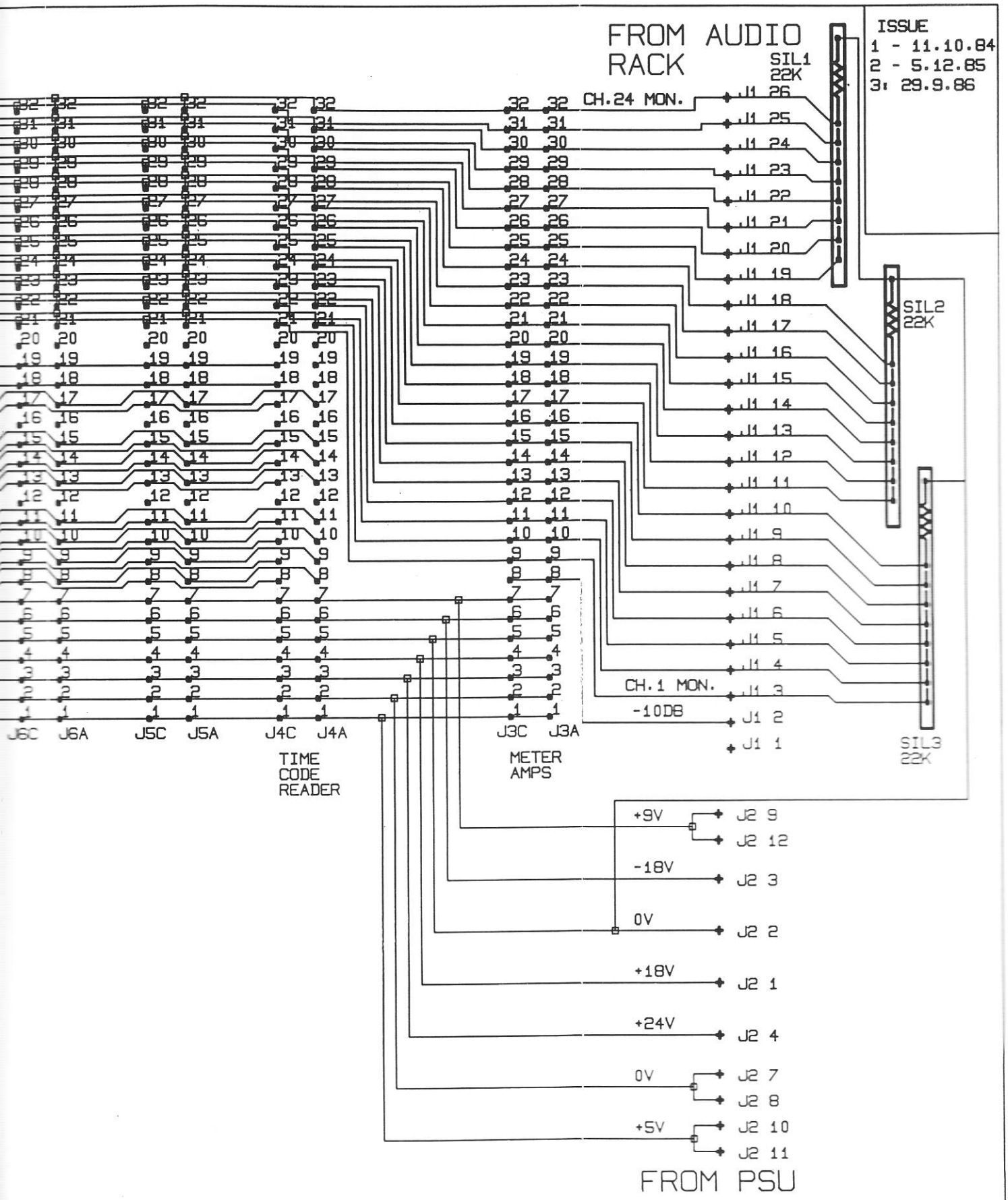
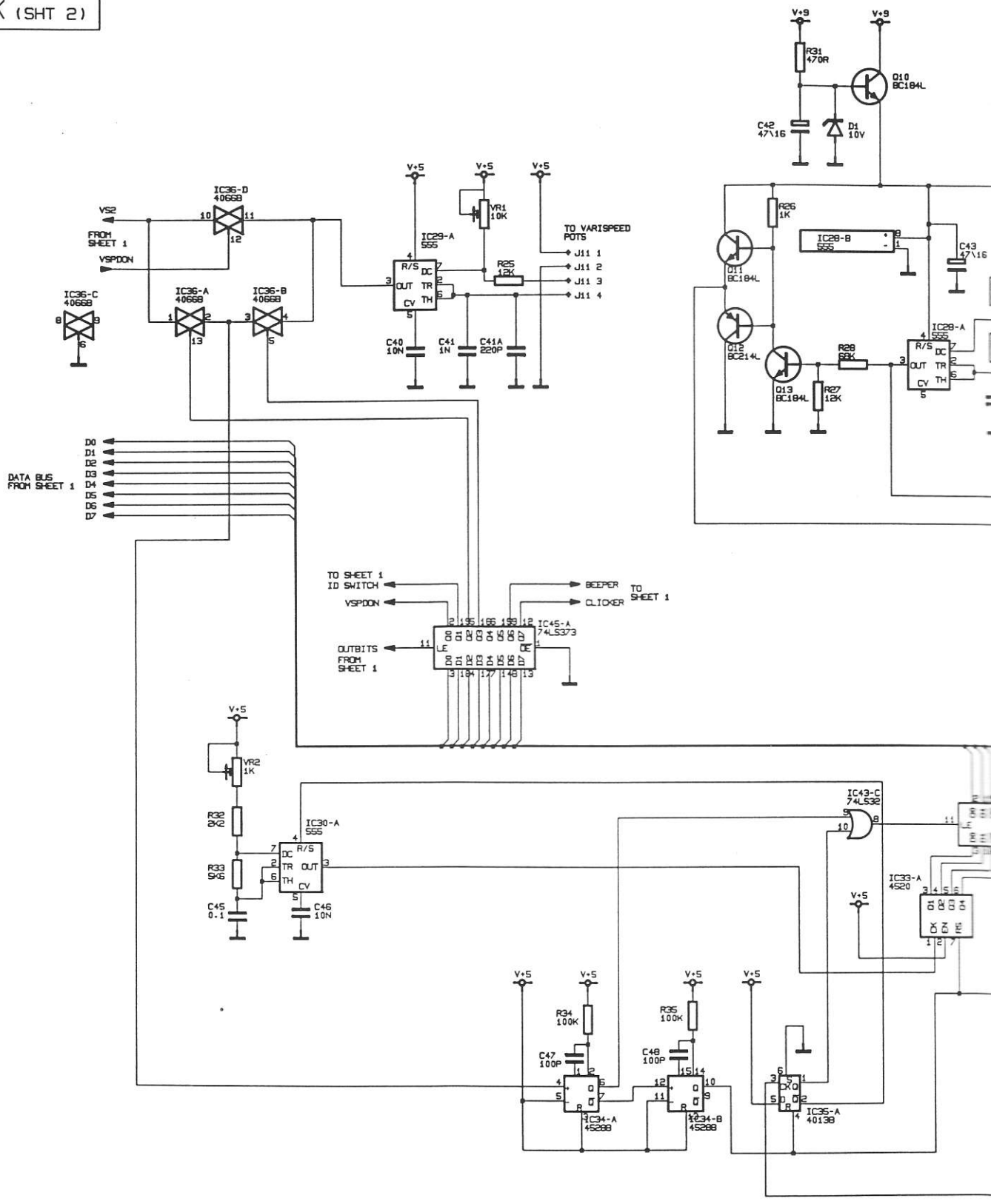


NOTES

C130K

TITLE
SATURN
AUXILLIARY RACK
MOTHERBOARD SM3718

C119K (SHT 2)



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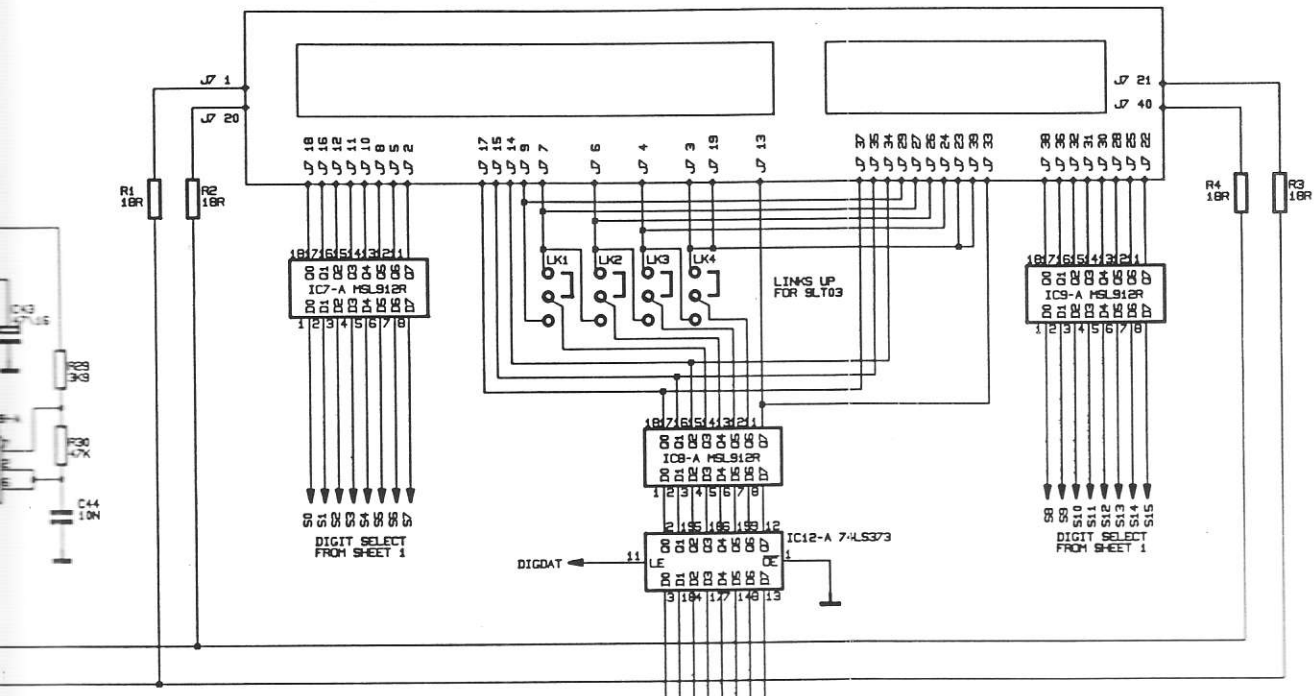
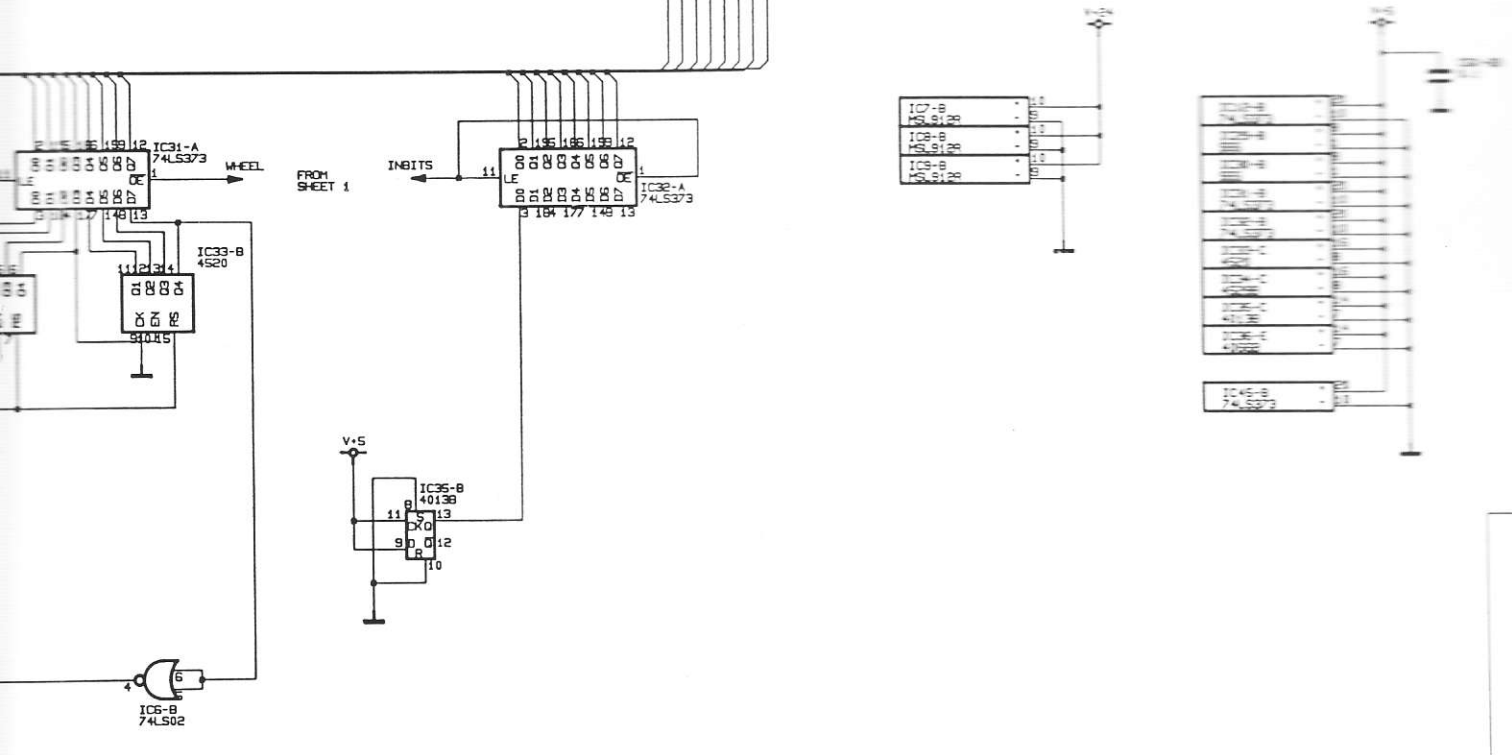
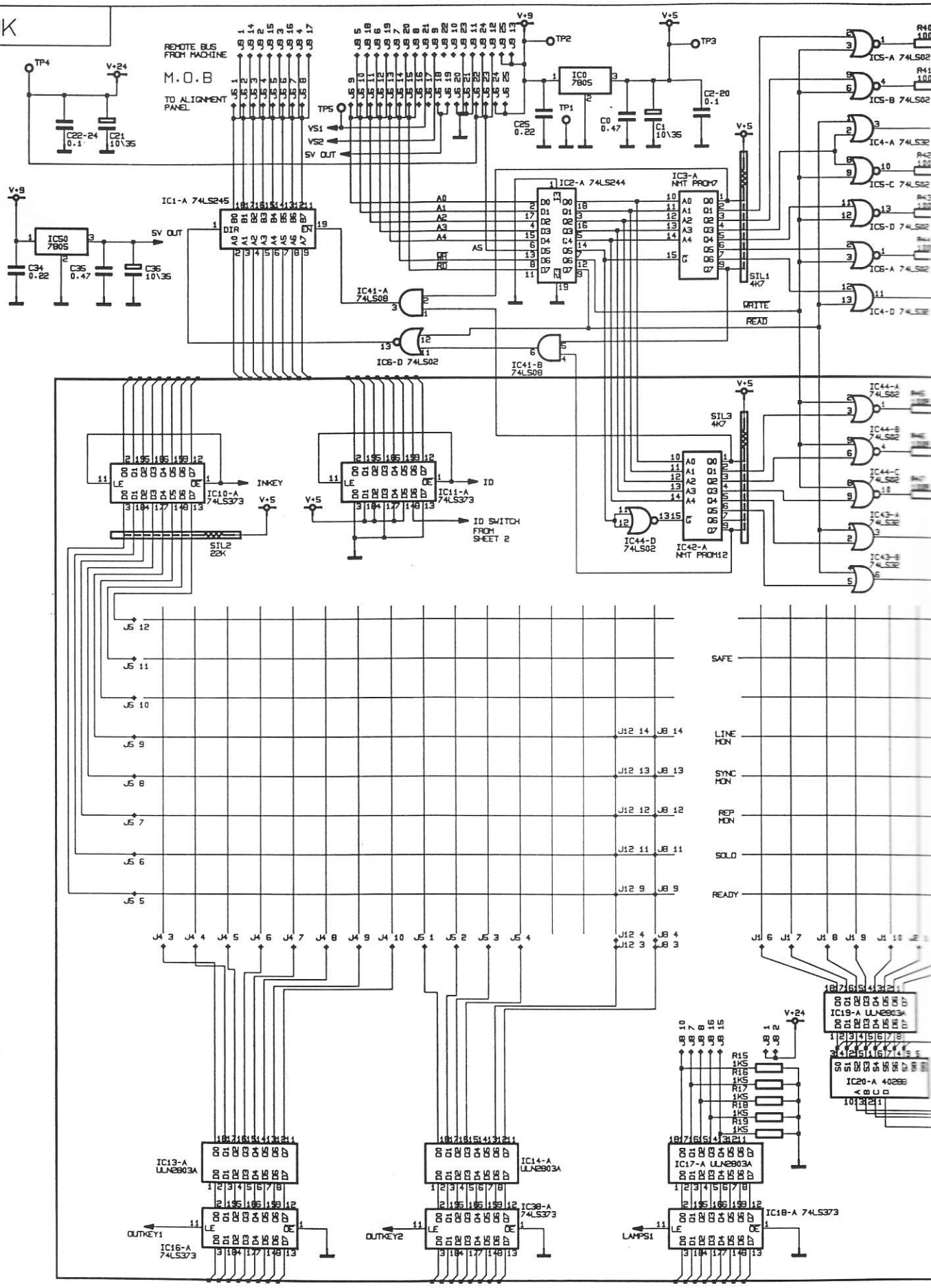




TITLE SATURN
REMOTE CONTROL UNIT
CIRCUIT DIAGRAM
SHEET 2

C119K (SHT 2)

C119K



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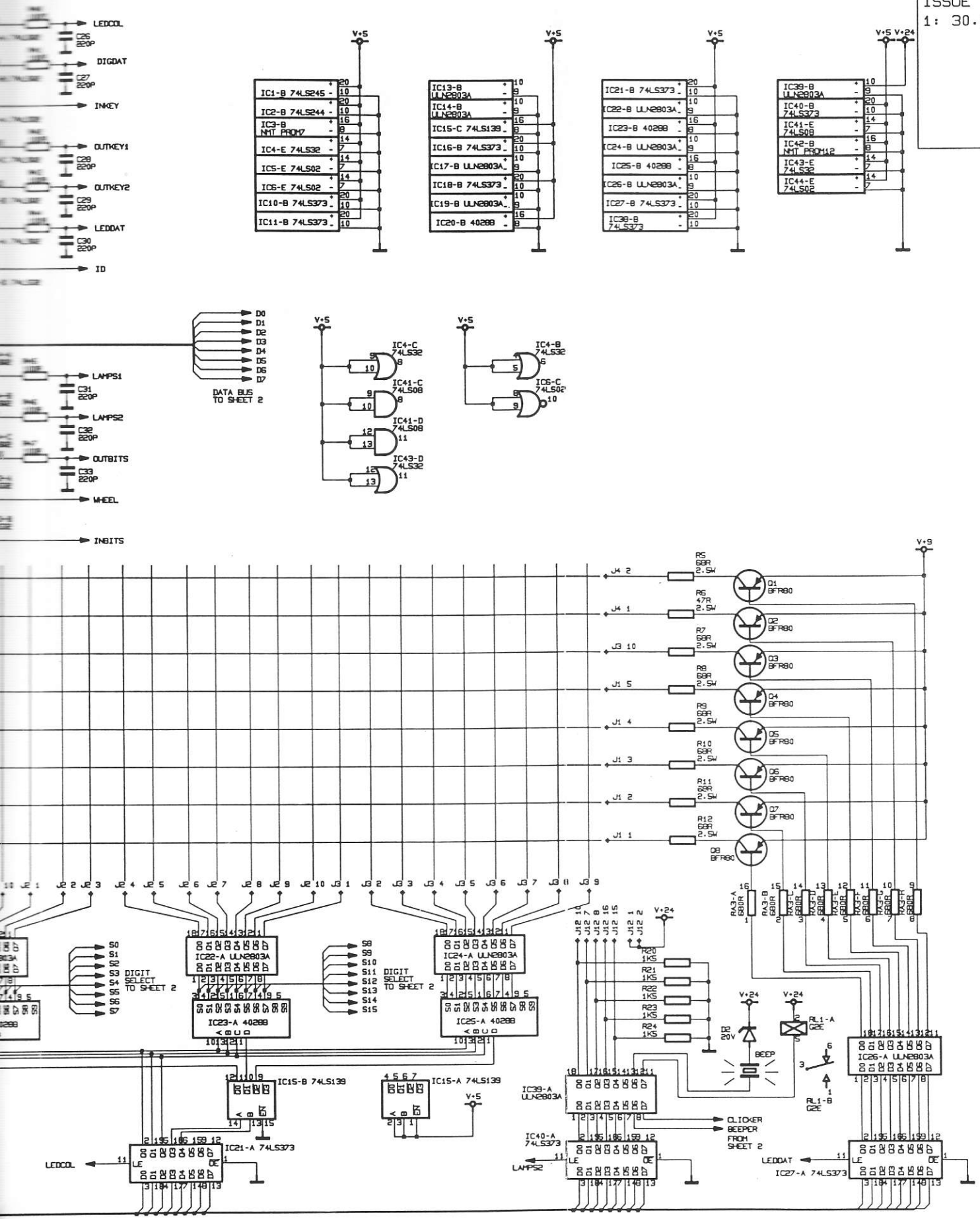

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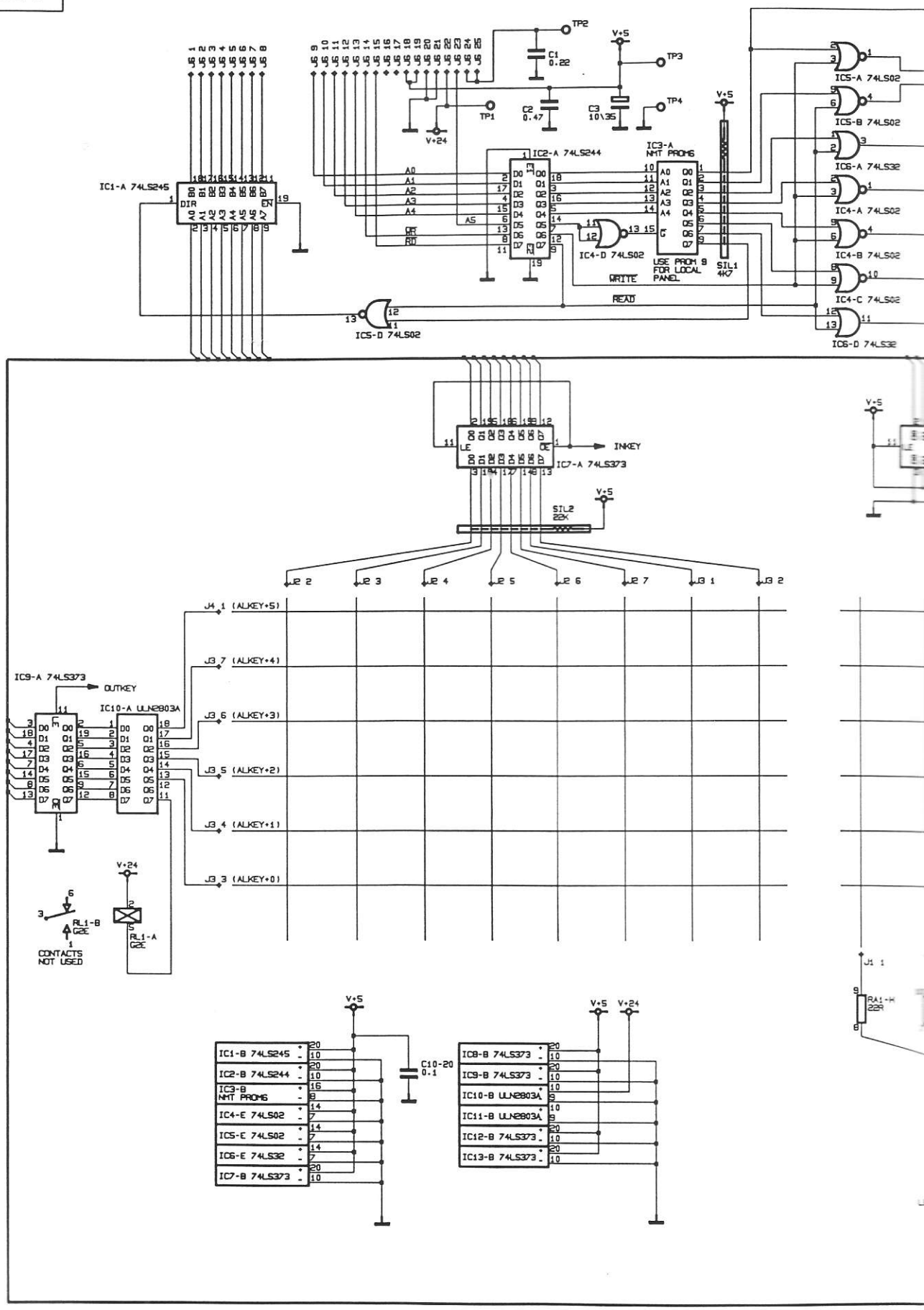
REMOTE CONTROL UNIT
CIRCUIT DIAGRAM
SHEET 1

C119K

C108K



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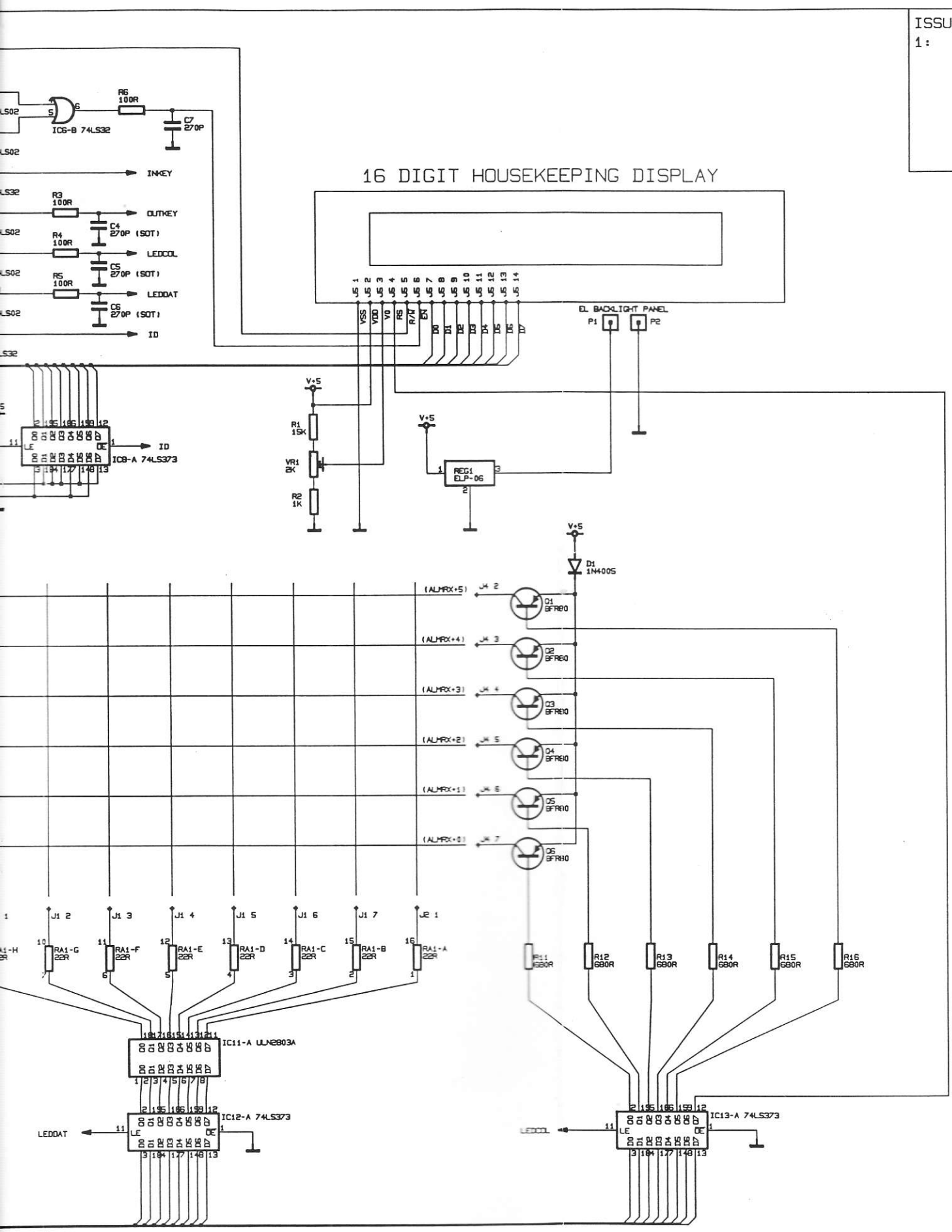
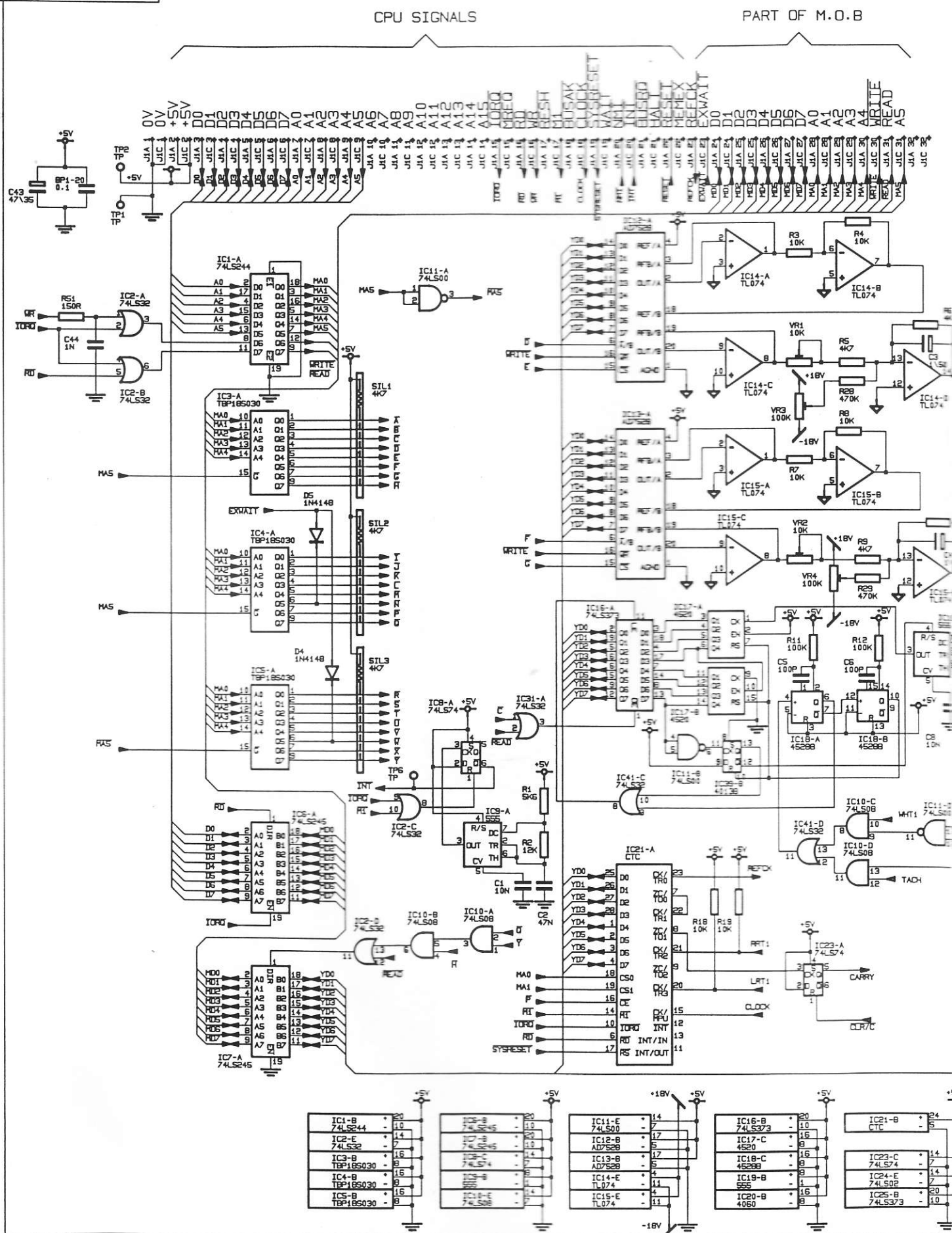


TITLE
SATURN
ALIGNMENT PANEL
CIRCUIT DIAGRAM

C108K

C147K



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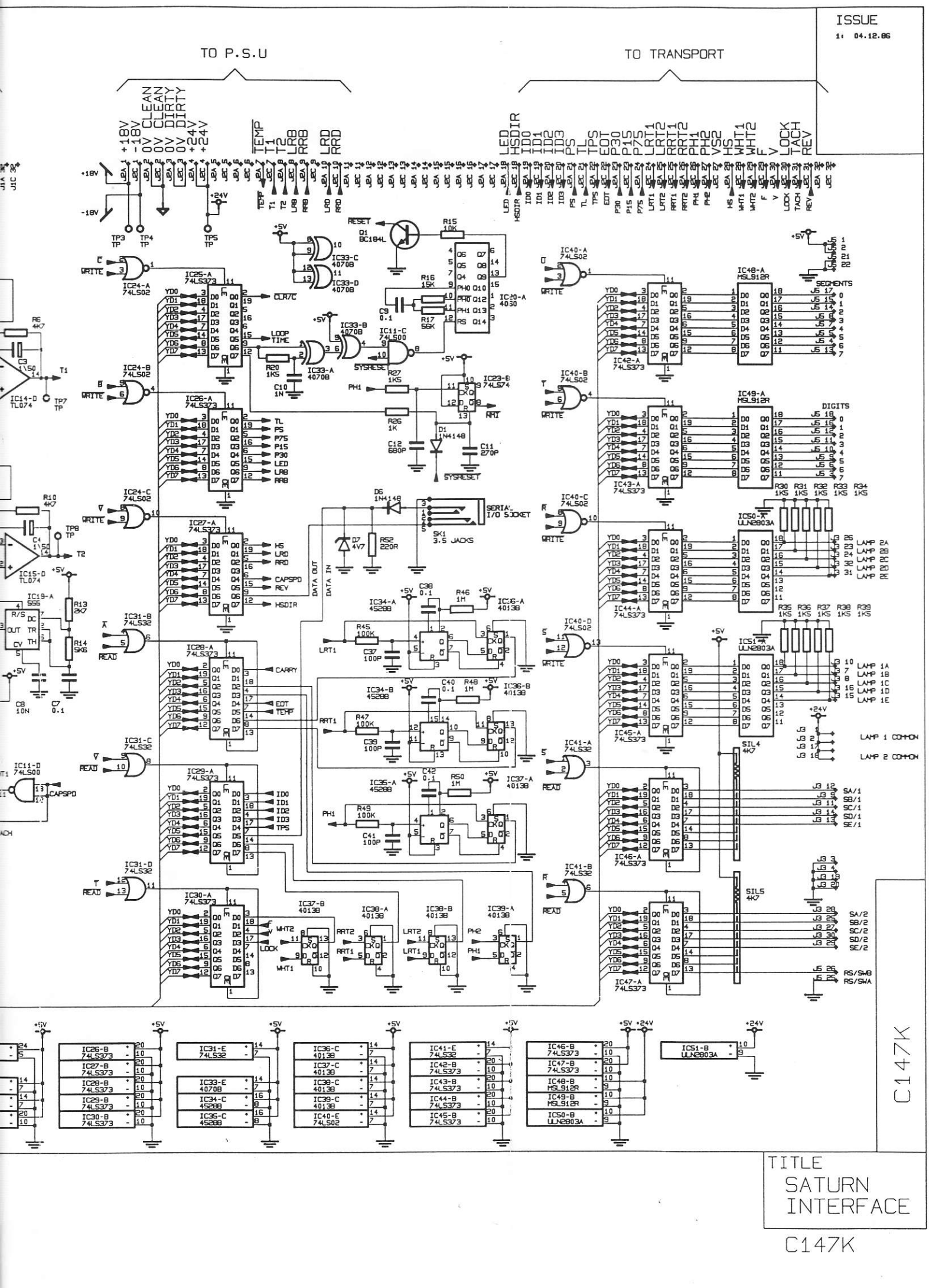
QUOTE REF: 19002230
FAX 01-881-1362


ISSUE
1: 04.12.86
TO P.S.U
TO TRANSPORT
+18V
-18V
0V CLEAN
0V CLEAN
0V DIRTY
0V DIRTY
+24V
+24V
TEMP
T1
T2
LRB
RRB
LRD
RRD
LED
HSDIR
IDO
ID1
ID2
ID3
PS
TL
TPS
EOT
P30
P15
P7S
LRT1
LRT2
RRT1
RRT2
PH1
PH2
VS2
HS
WHT1
WHT2
F
V
LOCK
TACH
REV
TP3
TP4
TP5
RESET
D1 BC184L
R15 10K
R16 15K
R17 56K
C9 0.1
IC30-A 4050
IC33-C 4070B
IC33-D 4070B
IC33-B 4070B
IC33-A 4070B
IC11-C 74LS00
IC23-B 74LS74
SYSRESET
LOOP TIME
R20 1KS
C10 1N
R27 1KS
R26 1K
C12 680P
C11 270P
D1 1N4148
NMI
IC24-A 74LS02
IC24-B 74LS02
IC24-C 74LS02
IC31-B 74LS32
IC31-C 74LS32
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IC25-A 74LS373
IC26-A 74LS373
IC27-A 74LS373
IC28-A 74LS373
IC29-A 74LS373
IC30-A 74LS373
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TL
PS
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P15
P30
LED
LRB
RRB
HS
CAPSPD
REV
HSDIR
CARRY
EDT
TEMP
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ID2
ID3
TPS
WHT2
WHT1
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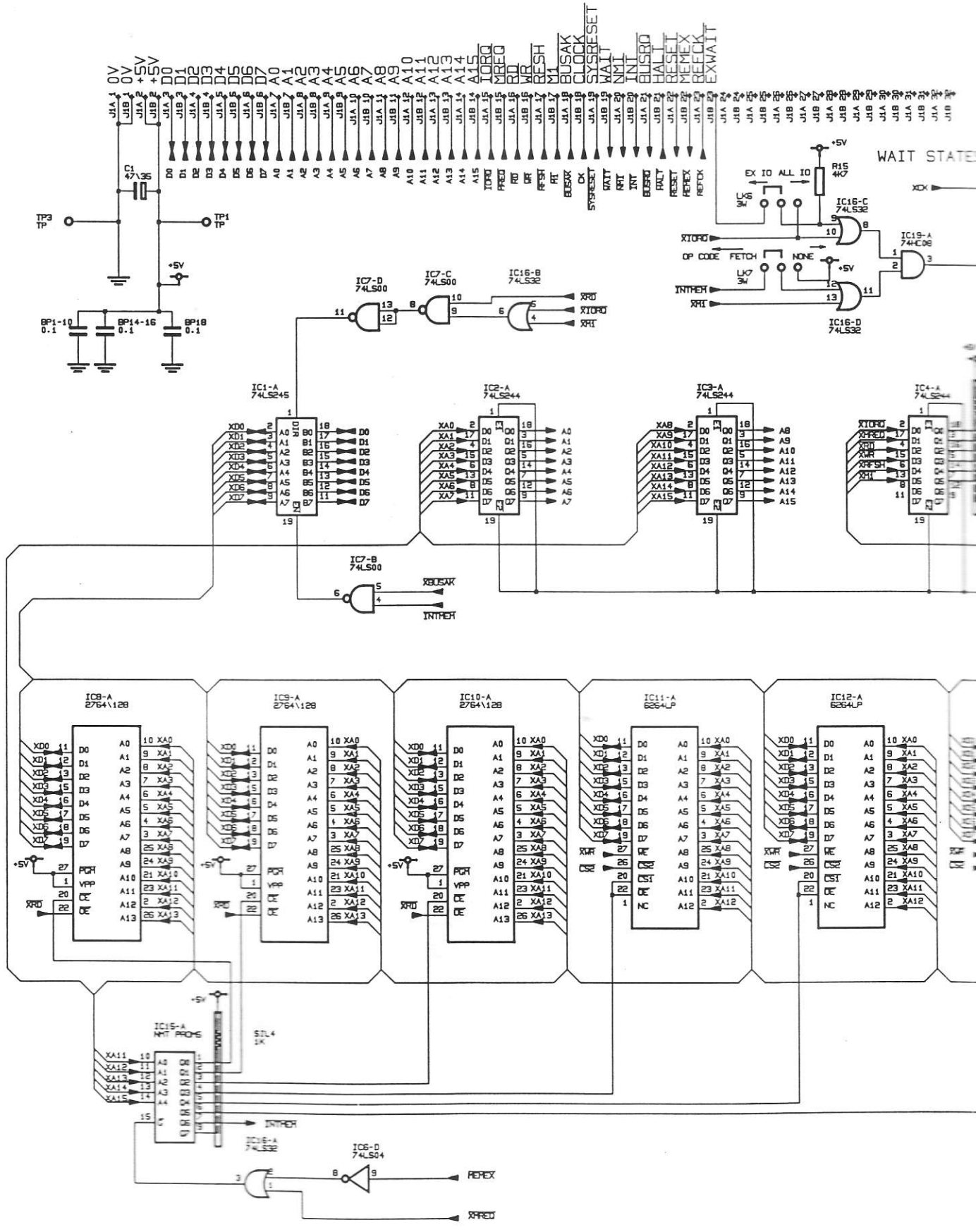
LRT1
RRT2
RRT1
PH2
PH1
WRITE
READ
D6 1N4148
D7 4V7
R52 220R
SK1 3.5 JACKS
SERIAL I/O SOCKET
DATA OUT
DATA IN
IC34-A 4528B
IC35-A 4528B
IC34-B 4528B
IC35-B 4528B
IC36-A 4013B
IC37-A 4013B
IC36-B 4013B
IC37-B 4013B
IC38-A 4013B
IC39-A 4013B
IC38-B 4013B
IC39-B 4013B
C38 0.1
C40 0.1
C42 0.1
R46 1M
R48 1M
R52 1M
R45 100K
R47 100K
R49 100K
C37 100P
C39 100P
C41 100P
IC40-A 74LS02
IC40-B 74LS02
IC40-C 74LS02
IC40-D 74LS02
IC41-A 74LS32
IC41-B 74LS32
IC42-A 74LS373
IC43-A 74LS373
IC44-A 74LS373
IC45-A 74LS373
IC46-A 74LS373
IC47-A 74LS373
IC48-A MSL912R
IC49-A MSL912R
IC50-A ULN2803A
IC51-A ULN2803A
SEGMENTS
DIGITS
R30 1KS
R31 1KS
R32 1KS
R33 1KS
R34 1KS
R35 1KS
R36 1KS
R37 1KS
R38 1KS
R39 1KS
LAMP 2A
LAMP 2B
LAMP 2C
LAMP 2D
LAMP 2E
LAMP 1A
LAMP 1B
LAMP 1C
LAMP 1D
LAMP 1E
LAMP 1 COMMON
LAMP 2 COMMON
SIL4 4K7
SIL5 4K7
SA/1
SB/1
SC/1
SD/1
SE/1
SA/2
SB/2
SC/2
SD/2
SE/2
RS/SWB
RS/SWA
R6 4K7
R10 4K7
R13 2K7
R14 5K6
C3 1N
C4 1N
C8 10N
C7 0.1
IC14-D TL074
IC15-D TL074
IC19-A 555
T1
T2
TP7
TP8
IC26-B 74LS373
IC27-B 74LS373
IC28-B 74LS373
IC29-B 74LS373
IC30-B 74LS373
IC31-E 74LS32
IC33-E 4070B
IC34-C 4528B
IC35-C 4528B
IC36-C 4013B
IC37-C 4013B
IC38-C 4013B
IC39-C 4013B
IC40-E 74LS02
IC41-E 74LS32
IC42-B 74LS373
IC43-B 74LS373
IC44-B 74LS373
IC45-B 74LS373
IC46-B 74LS373
IC47-B 74LS373
IC48-B MSL912R
IC49-B MSL912R
IC50-B ULN2803A
IC51-B ULN2803A
C147K
TITLE
SATURN
INTERFACE
C147K

C109K



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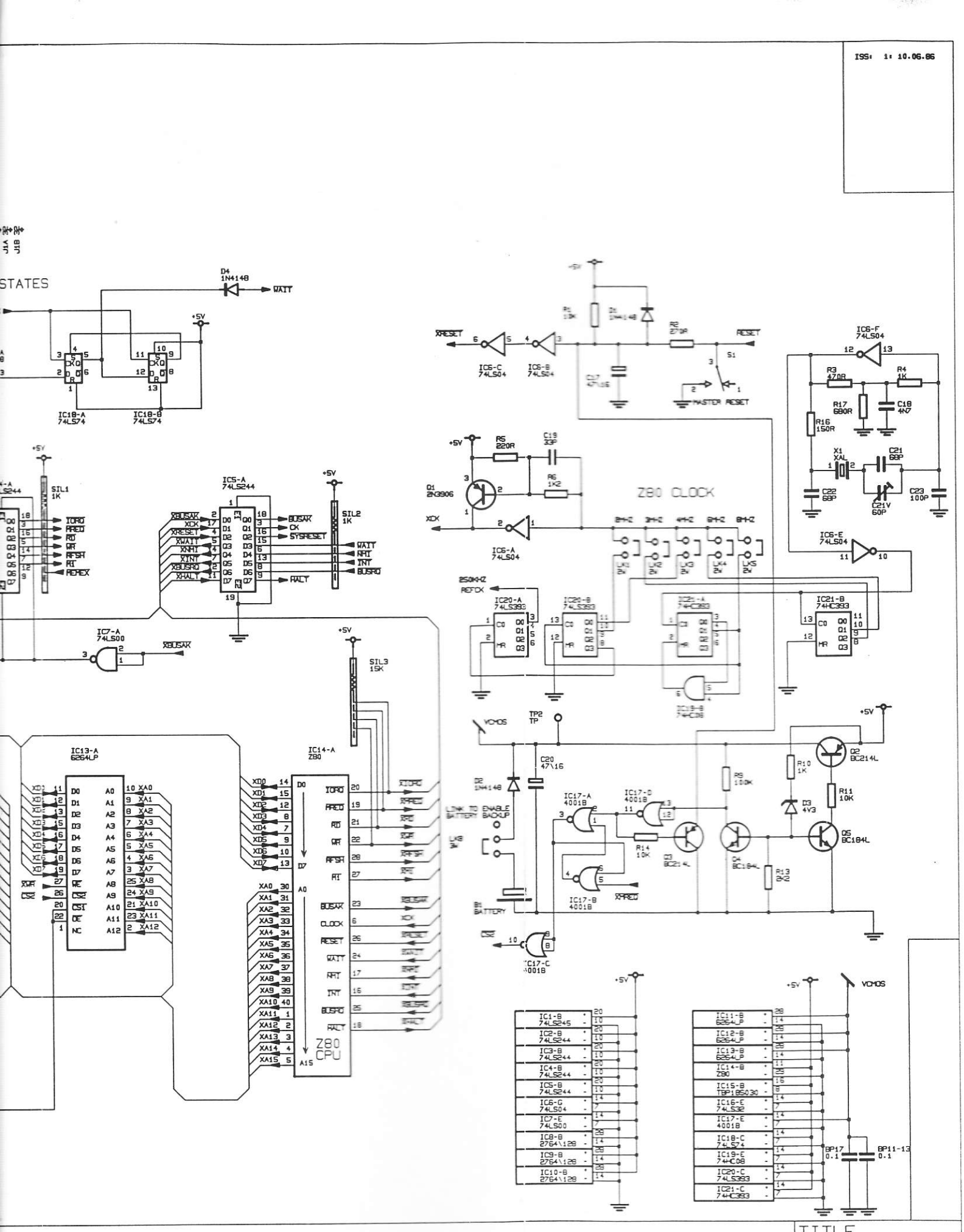
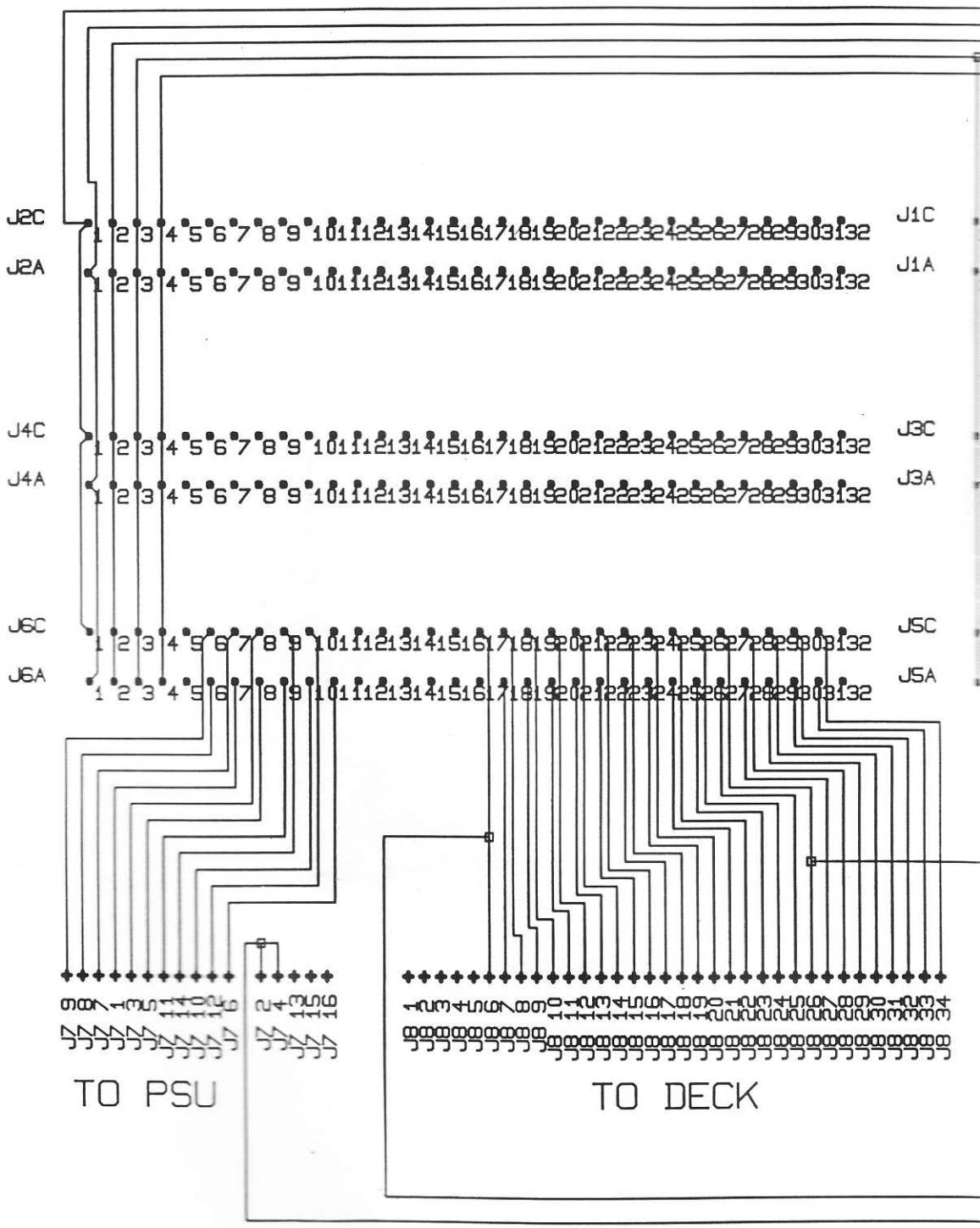
FAX 01-881-1382

ISS: 1: 10.06.86


STATES
WAIT
IC18-A 74LS74
IC18-B 74LS74
IC6-C 74LS04
IC6-B 74LS04
RESET
MASTER RESET
IC6-F 74LS04
IC6-A 74LS04
Z80 CLOCK
IC6-E 74LS04
IC5-A 74LS244
IC7-A 74LS00
XBUSAK
IC20-A 74LS393
IC21-B 74HC393
IC13-A 6264LP
IC14-A Z80
Z80 CPU
IC17-A 4001B
IC17-B 4001B
IC17-C 4001B
Q2 BC214L
Q5 BC184L
Q3 BC214L
Q4 BC184L
D3 4V3
IC1-B 74LS245
IC2-B 74LS244
IC3-B 74LS244
IC4-B 74LS244
IC5-B 74LS244
IC6-G 74LS04
IC7-E 74LS00
IC8-B 2764\128
IC9-B 2764\128
IC10-B 2764\128
IC11-B 6264LP
IC12-B 6264LP
IC13-B 6264LP
IC14-B Z80
IC15-B TBP18S030
IC16-E 74LS32
IC17-E 4001B
IC18-C 74LS74
IC19-E 74HC08
IC20-C 74LS393
IC21-C 74HC393
VCMOS
TITLE
SATURN CPU
CIRCUIT DIAGRAM
C109K



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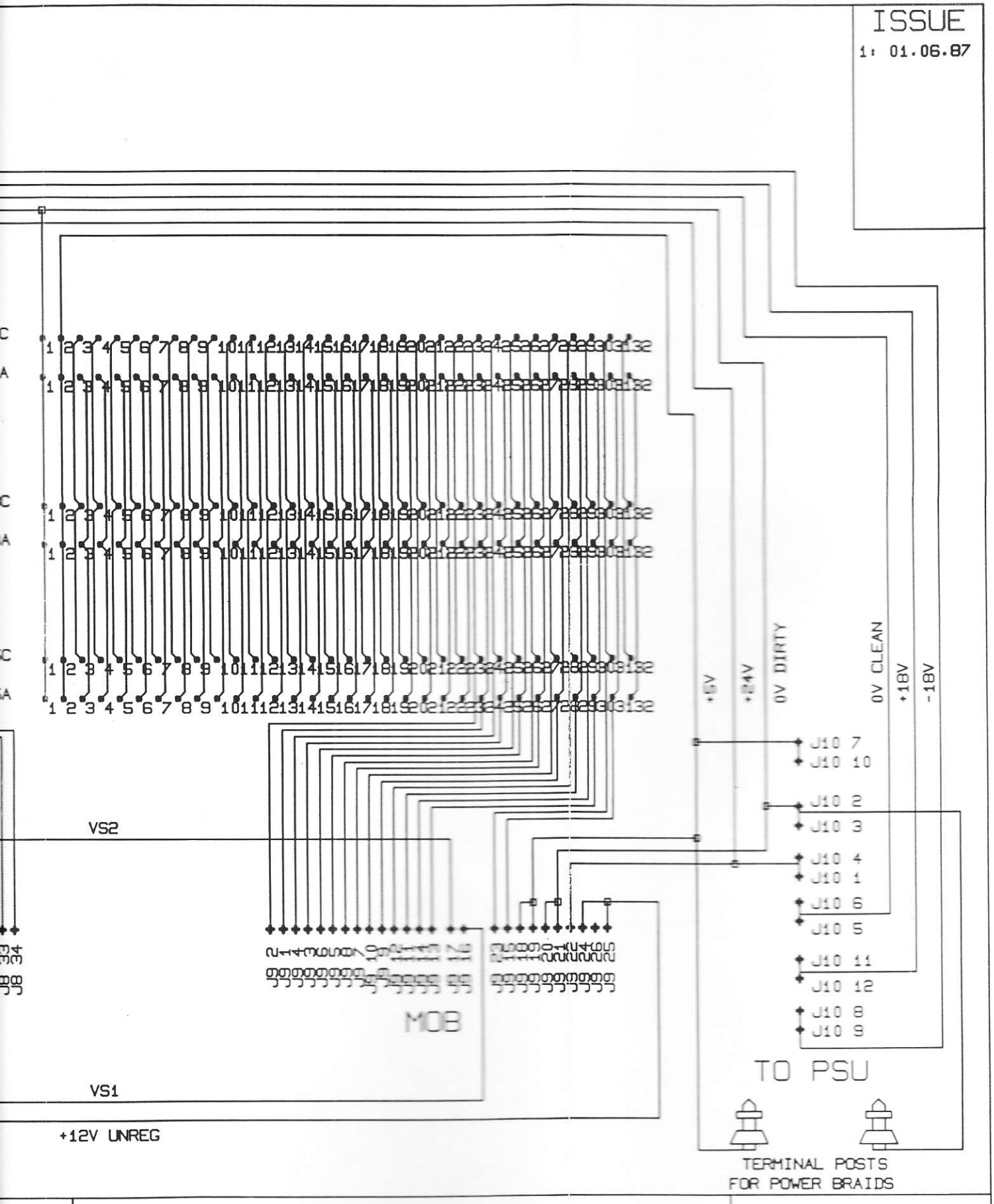
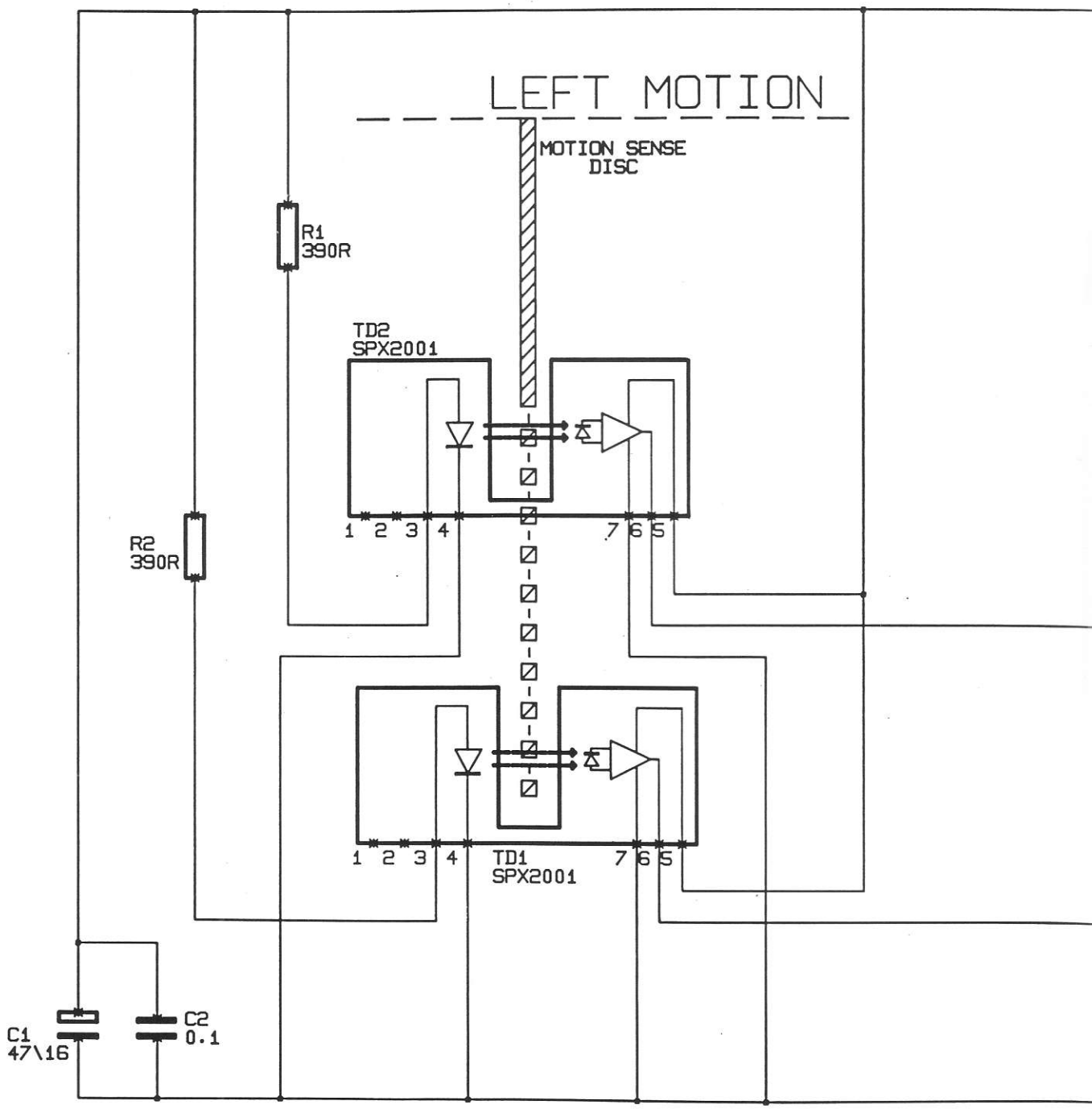


NOTES

C118K

TITLE

SATURN
DIGITAL
MOTHERBOARD



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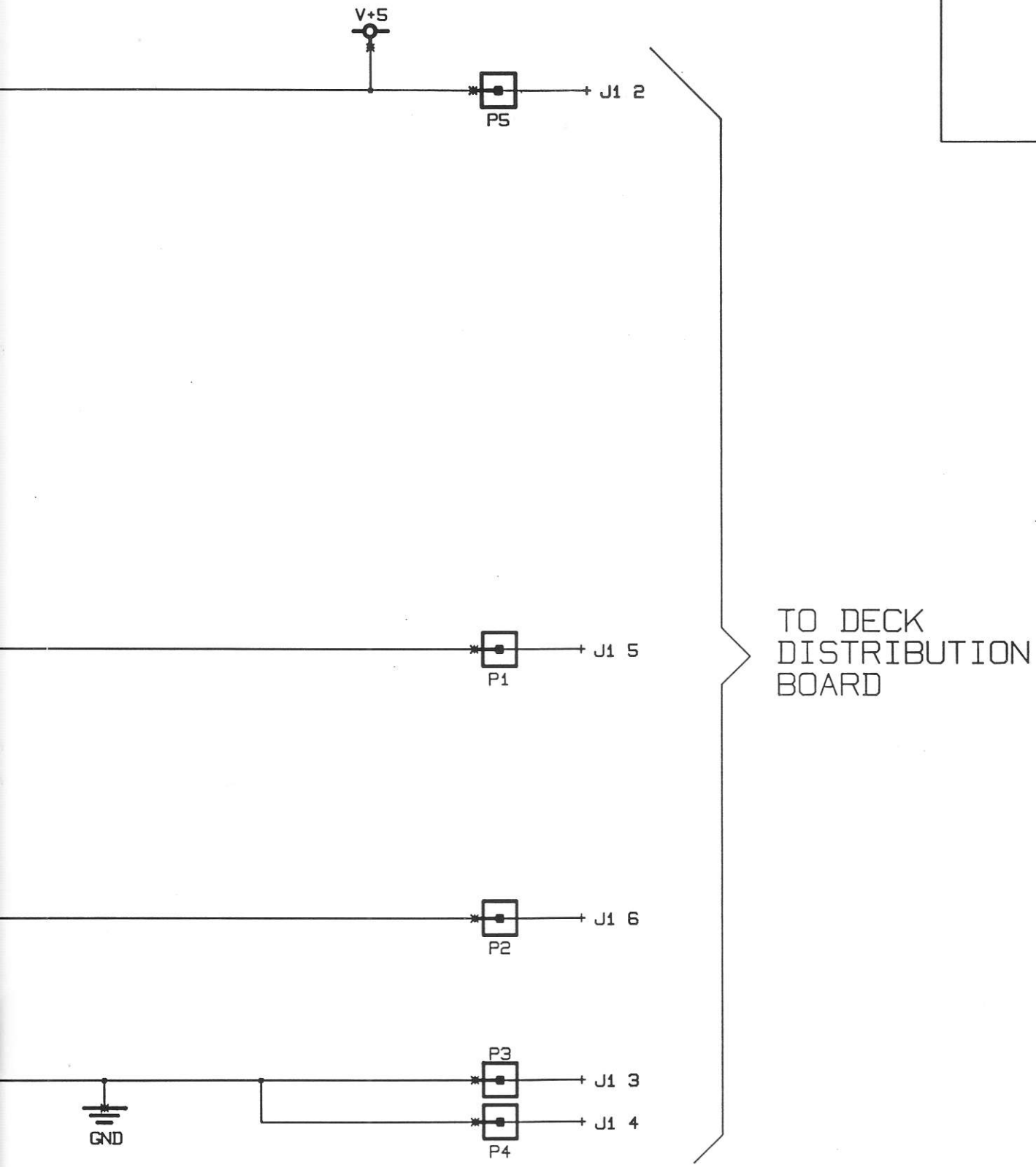
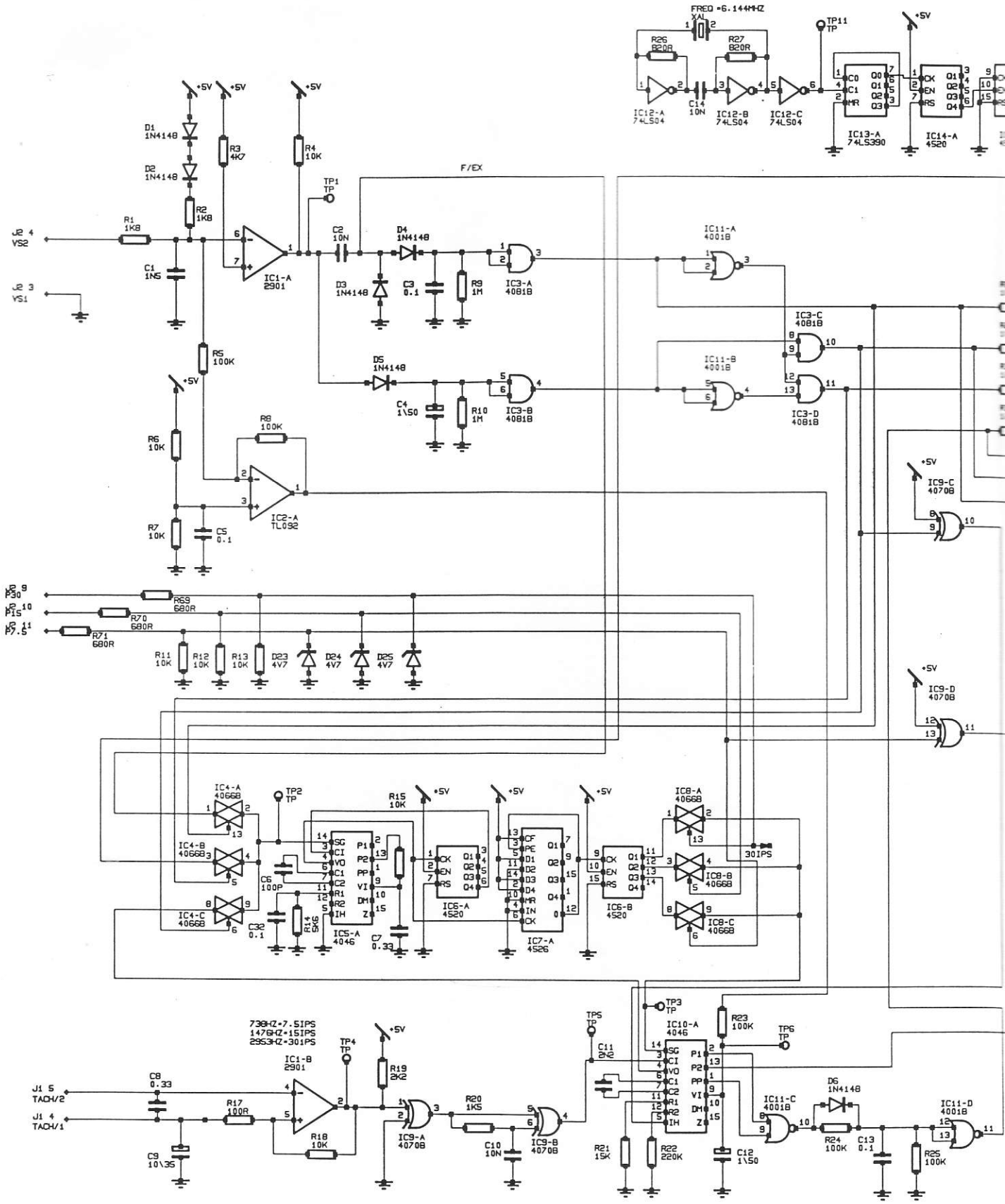


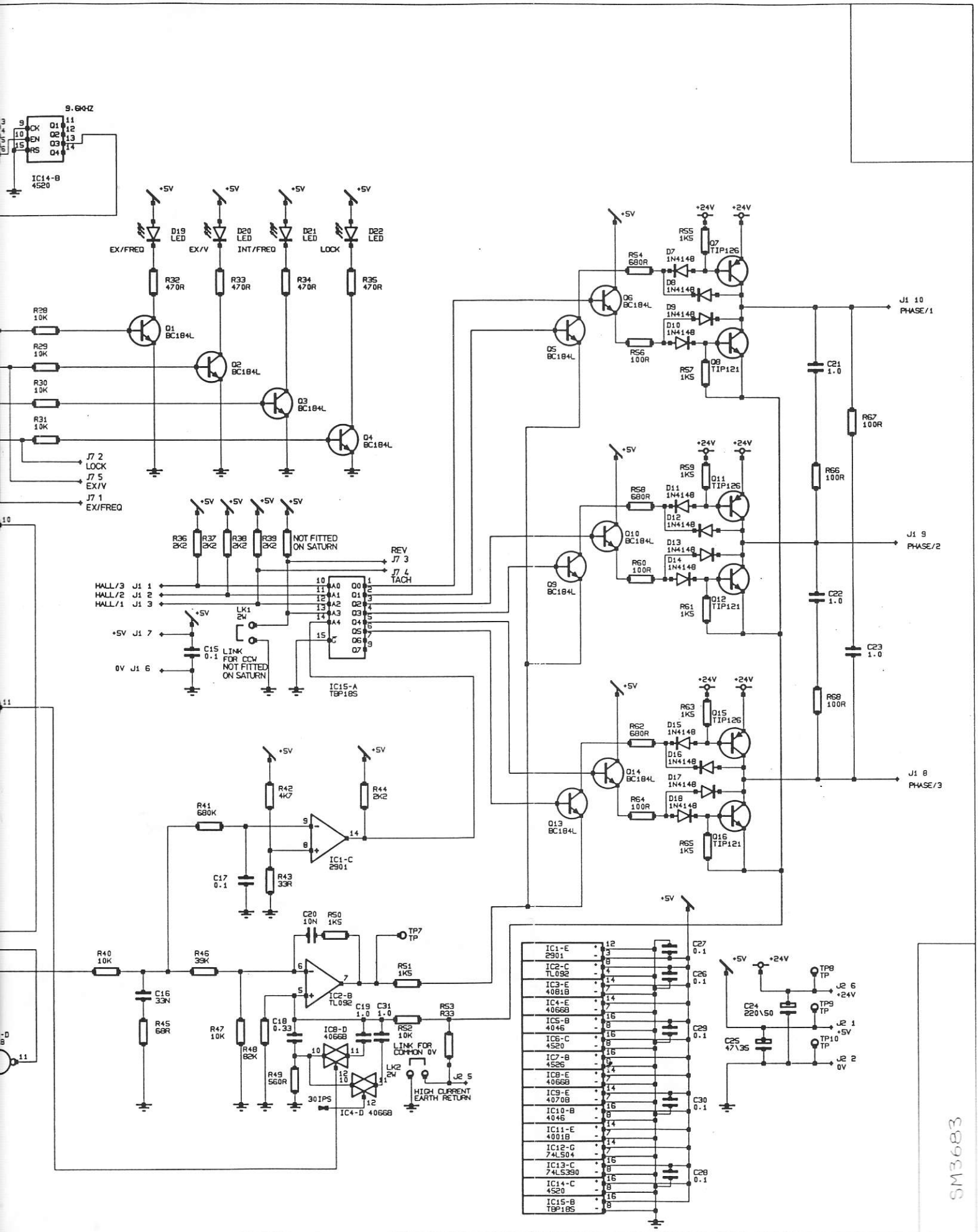
NOTES

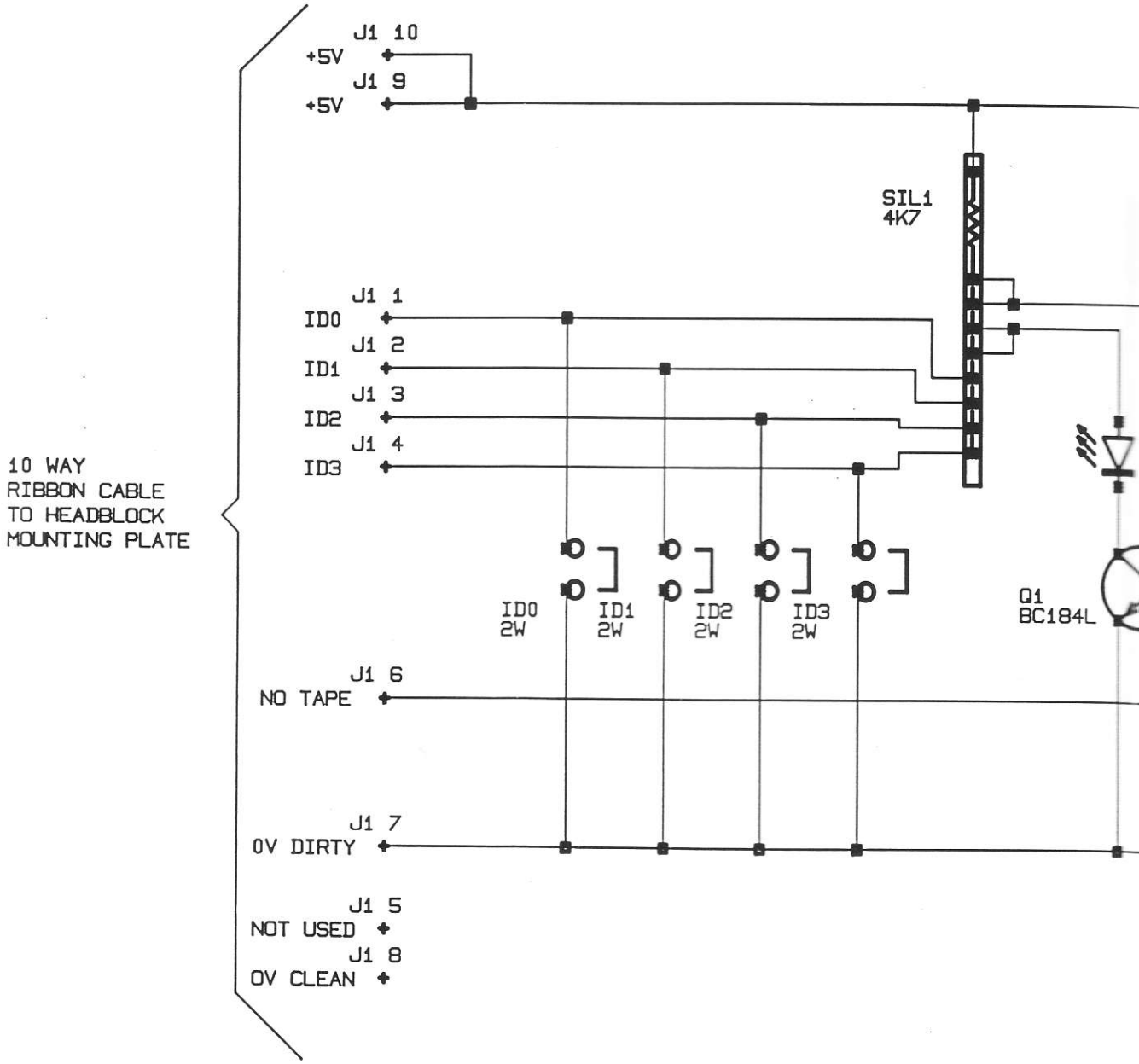
CM129K

TITLE

SATURN
MOTION SENSE PCB
SM3495


FREQ =6.144MHZ
XAL
R26 820R
R27 820R
IC12-A 74LS04
C14 10N
IC12-B 74LS04
IC12-C 74LS04
TP11 TP
IC13-A 74LS390
IC14-A 4520
+5V
F/EX
D1 1N4148
D2 1N4148
R3 4K7
R4 10K
TP1 TP
R2 1K8
R1 1K8
J2 4 VS2
J2 3 VS1
C1 1N5
C2 10N
D4 1N4148
IC1-A 2901
D3 1N4148
C3 0.1
R9 1M
IC3-A 4081B
IC11-A 4001B
IC3-C 4081B
IC11-B 4001B
IC3-D 4081B
D5 1N4148
C4 1\50
R10 1M
IC3-B 4081B
R5 100K
R8 100K
R6 10K
R7 10K
C5 0.1
IC2-A TL092
IC9-C 4070B
IC9-D 4070B
J2 9 P30
J2 10 P15
J2 11 P7.5
R69 680R
R70 680R
R71 680R
R11 10K
R12 10K
R13 10K
D23 4V7
D24 4V7
D25 4V7
IC4-A 4066B
IC4-B 4066B
IC4-C 4066B
TP2 TP
C6 100P
C32 0.1
R14 5K6
IC5-A 4046
R15 10K
C7 0.33
IC6-A 4520
IC7-A 4526
IC6-B 4520
IC8-A 4066B
IC8-B 4066B
IC8-C 4066B
301PS
730HZ=7.5IPS
1476HZ=15IPS
2953HZ=30IPS
TP4 TP
IC1-B 2901
J1 5 TACH/2
J1 4 TACH/1
C8 0.33
R17 100R
C9 10\35
R18 10K
R19 2K2
IC9-A 4070B
R20 1K5
C10 10N
IC9-B 4070B
TP5 TP
C11 2N2
TP3 TP
IC10-A 4046
R23 100K
TP6 TP
R21 15K
R22 220K
C12 1\50
IC11-C 4001B
D6 1N4148
R24 100K
C13 0.1
IC11-D 4001B
R25 100K


9.6KHZ
IC14-B 4520
D19 LED EX/FREQ
D20 LED EX/V
D21 LED INT/FREQ
D22 LED LOCK
R32 470R
R33 470R
R34 470R
R35 470R
R28 10K
R29 10K
R30 10K
R31 10K
Q1 BC184L
Q2 BC184L
Q3 BC184L
Q4 BC184L
J7 2 LOCK
J7 5 EX/V
J7 1 EX/FREQ
R36 2K2
R37 2K2
R38 2K2
R39 2K2
NOT FITTED ON SATURN
REV J7 3
J7 4 TACH
HALL/3 J1 1
HALL/2 J1 2
HALL/1 J1 3
LK1 2W
+5V J1 7
0V J1 6
C15 0.1
LINK FOR CCW NOT FITTED ON SATURN
IC15-A TBP18S
RS4 680R
RS5 1K5
Q7 TIP126
D7 1N4148
D8 1N4148
D9 1N4148
D10 1N4148
Q6 BC184L
Q5 BC184L
RS6 100R
RS7 1K5
Q8 TIP121
J1 10 PHASE/1
C21 1.0
R67 100R
R66 100R
RS8 680R
RS9 1K5
Q11 TIP126
D11 1N4148
D12 1N4148
D13 1N4148
D14 1N4148
Q10 BC184L
Q9 BC184L
R60 100R
R61 1K5
Q12 TIP121
J1 9 PHASE/2
C22 1.0
C23 1.0
R68 100R
RS2 680R
R63 1K5
Q15 TIP126
D15 1N4148
D16 1N4148
D17 1N4148
D18 1N4148
Q14 BC184L
Q13 BC184L
R64 100R
R65 1K5
Q16 TIP121
J1 8 PHASE/3
R42 4K7
R44 2K2
R41 680K
C17 0.1
R43 33R
IC1-C 2901
C20 10N
RS0 1K5
TP7 TP
RS1 1K5
R40 10K
R46 39K
C16 33N
R45 68R
IC2-B TL092
C19 1.0
C31 1.0
RS3 R33
RS2 10K
LINK FOR COMMON 0V
R47 10K
C18 0.33
R48 82K
IC8-D 40668
LK2 2W
J2 5 HIGH CURRENT EARTH RETURN
R49 560R
30IPS
IC4-D 40668
IC1-E 2901
IC2-C TL082
IC3-E 4081B
IC4-E 40668
IC5-B 4046
IC6-C 4520
IC7-B 4526
IC8-E 40668
IC9-E 4070B
IC10-B 4046
IC11-E 4001B
IC12-G 74LS04
IC13-C 74LS390
IC14-C 4520
IC15-B TBP18S
C27 0.1
C26 0.1
C29 0.1
C30 0.1
C28 0.1
TP8 TP
TP9 TP
TP10 TP
J2 6 +24V
J2 1 +5V
J2 2 0V
C24 220\50
C25 47\35
SM3683
TITLE P.L.L CAPSTAN SERVO



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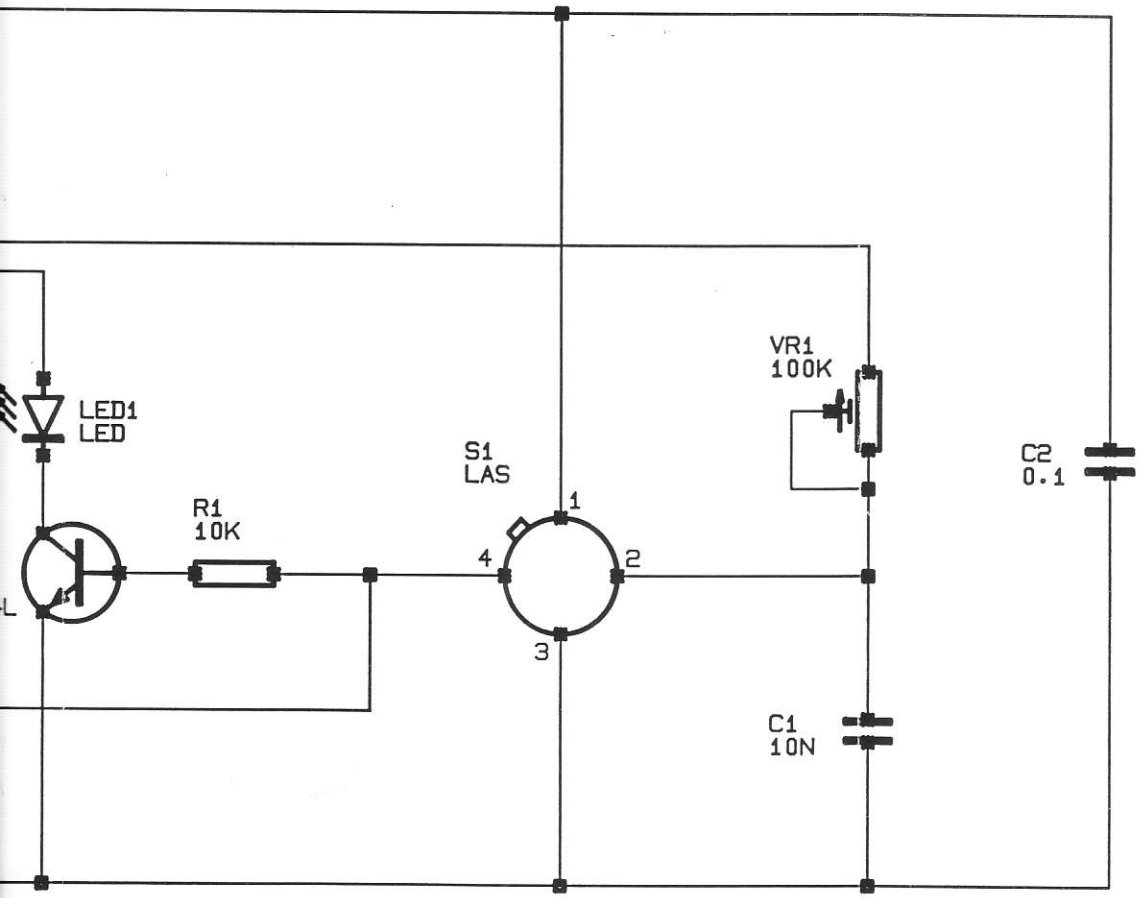
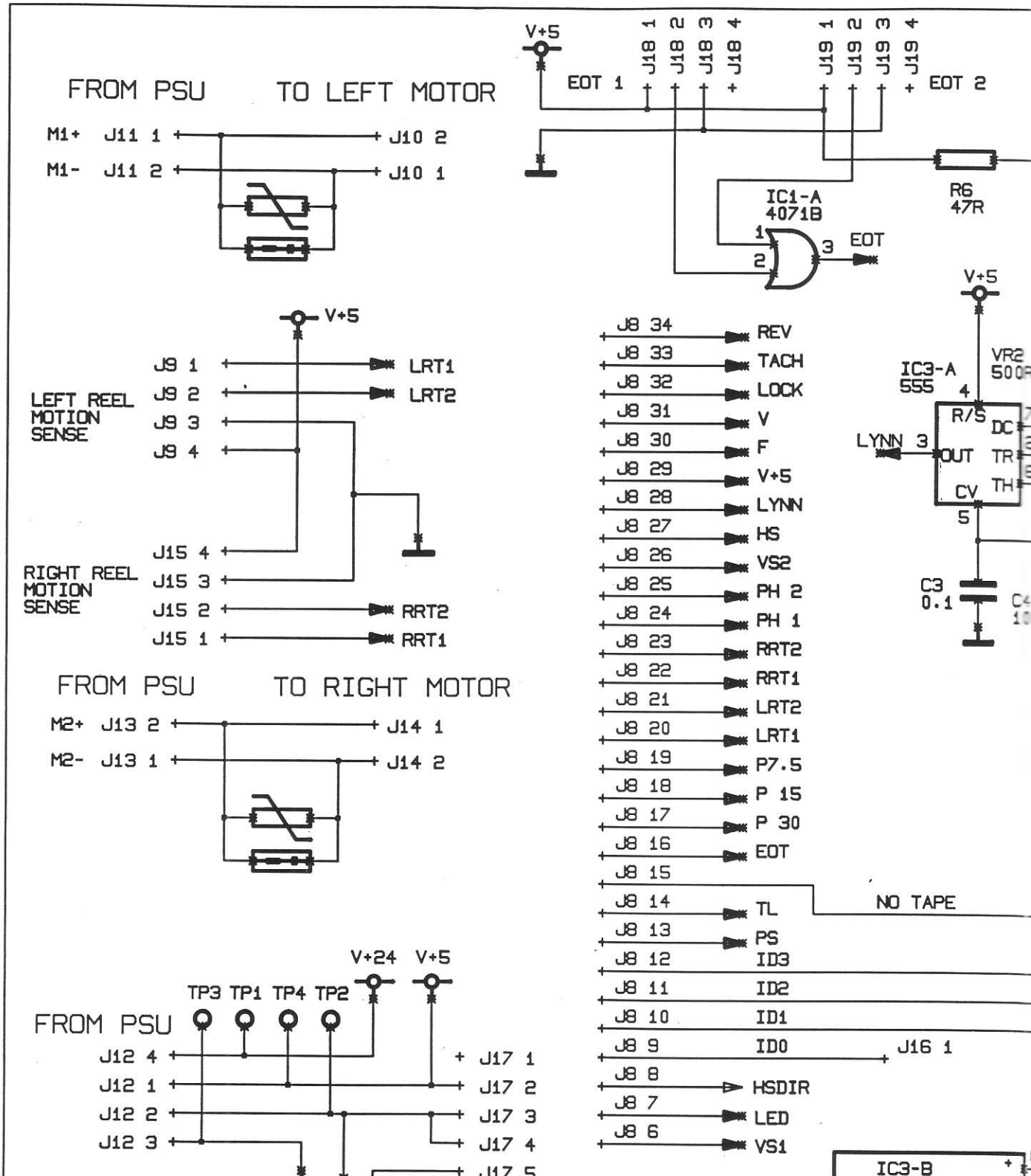


NOTES	CM120K	TITLE SATURN HEADBLOCK PCB SM5057



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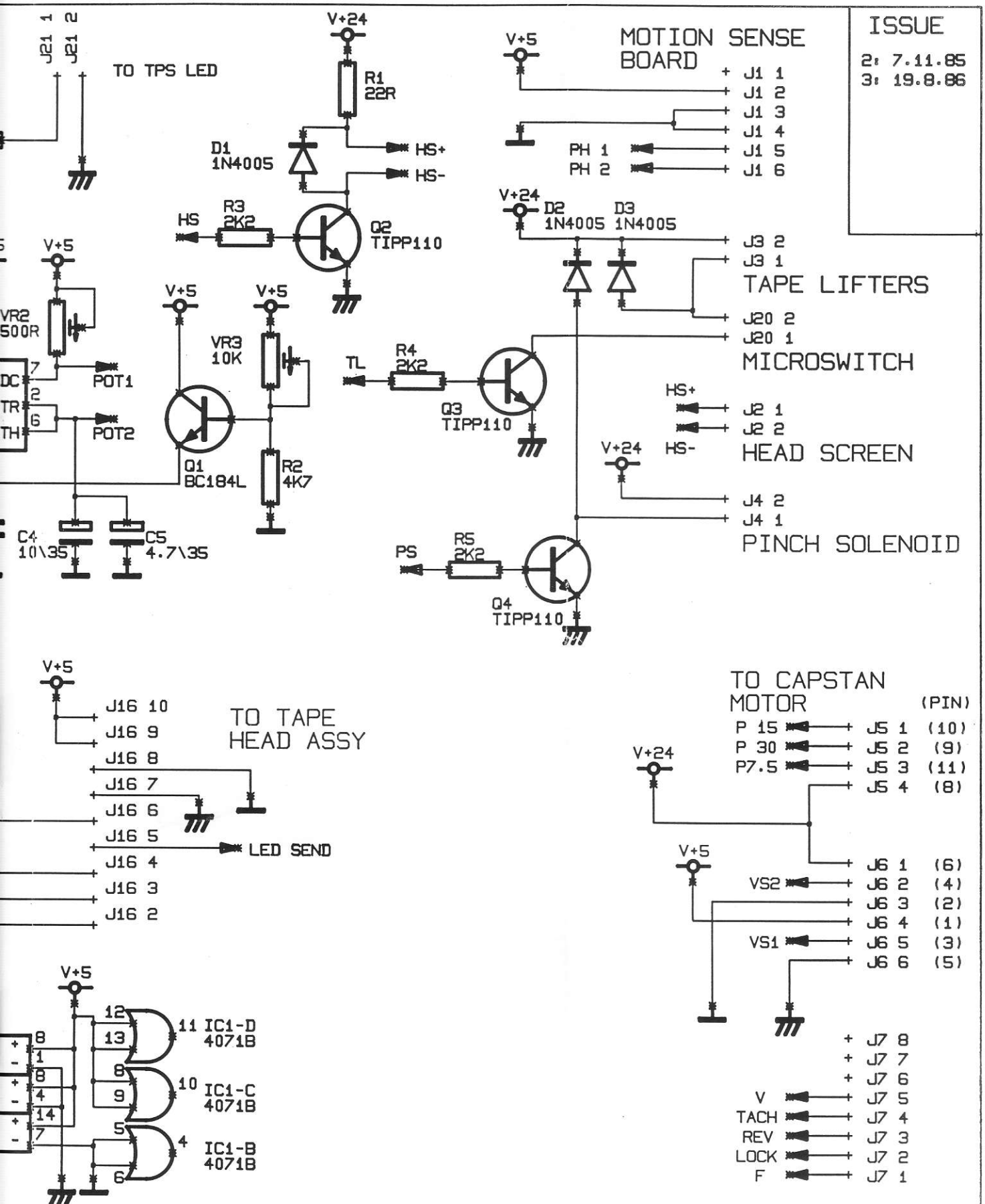
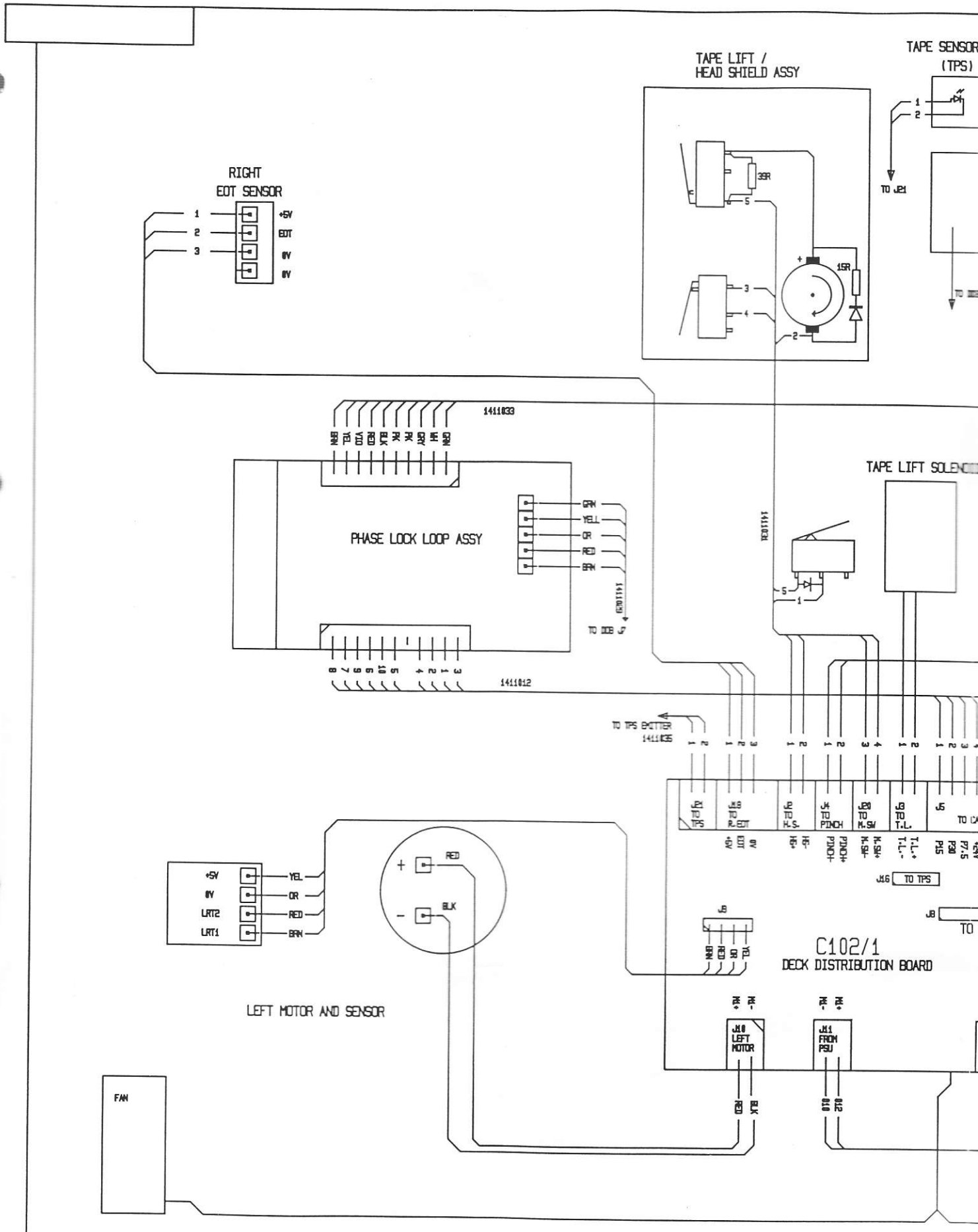

ISSUE
2: 7.11.85
3: 19.8.86
J21 1
J21 2
TO TPS LED
V+24
R1
22R
D1
1N4005
HS+
HS-
HS
R3
2K2
Q2
TIPP110
V+5
VR2
500R
POT1
POT2
DC
TR
TH
VR3
10K
Q1
BC184L
R2
4K7
C4
10\35
C5
4.7\35
MOTION SENSE
BOARD
J1 1
J1 2
J1 3
J1 4
PH 1
PH 2
J1 5
J1 6
D2
1N4005
D3
1N4005
J3 2
J3 1
TAPE LIFTERS
J20 2
J20 1
MICROSWITCH
TL
R4
2K2
Q3
TIPP110
HS+
J2 1
J2 2
HEAD SCREEN
HS-
J4 2
J4 1
PINCH SOLENOID
PS
R5
2K2
Q4
TIPP110
J16 10
J16 9
J16 8
J16 7
J16 6
J16 5
J16 4
J16 3
J16 2
TO TAPE
HEAD ASSY
LED SEND
TO CAPSTAN
MOTOR
(PIN)
P 15
P 30
P7.5
J5 1 (10)
J5 2 (9)
J5 3 (11)
J5 4 (8)
J6 1 (6)
VS2
J6 2 (4)
J6 3 (2)
J6 4 (1)
VS1
J6 5 (3)
J6 6 (5)
IC1-D
4071B
IC1-C
4071B
IC1-B
4071B
J7 8
J7 7
J7 6
V
J7 5
TACH
J7 4
REV
J7 3
LOCK
J7 2
F
J7 1
NOTES
CM102K
TITLE
SATURN
DECK DISTRIBUTION
PCB



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ISSUE

2 : 16.11.86

SENSOR ASSY
(TPS)

TPS EMITTER

TPS RECEPTOR

TO DDB. J16

CAPSTAN MOTOR

MOTION SENSE ASSY

LEFT EOT SENSOR

SOLENOID

PINCH SOLENOID

J5 TO CAPSTAN MOTOR

J6

J4 TO MOT. SENSE

J7

J9 TO L.EOT

J7 TO PLL BD

TO DIGITAL MOTHER BD

J15

+

−

RIGHT MOTOR AND SENSOR

J12 FROM PSU

J13 FROM PSU

J14 RIGHT MOTOR

FAN

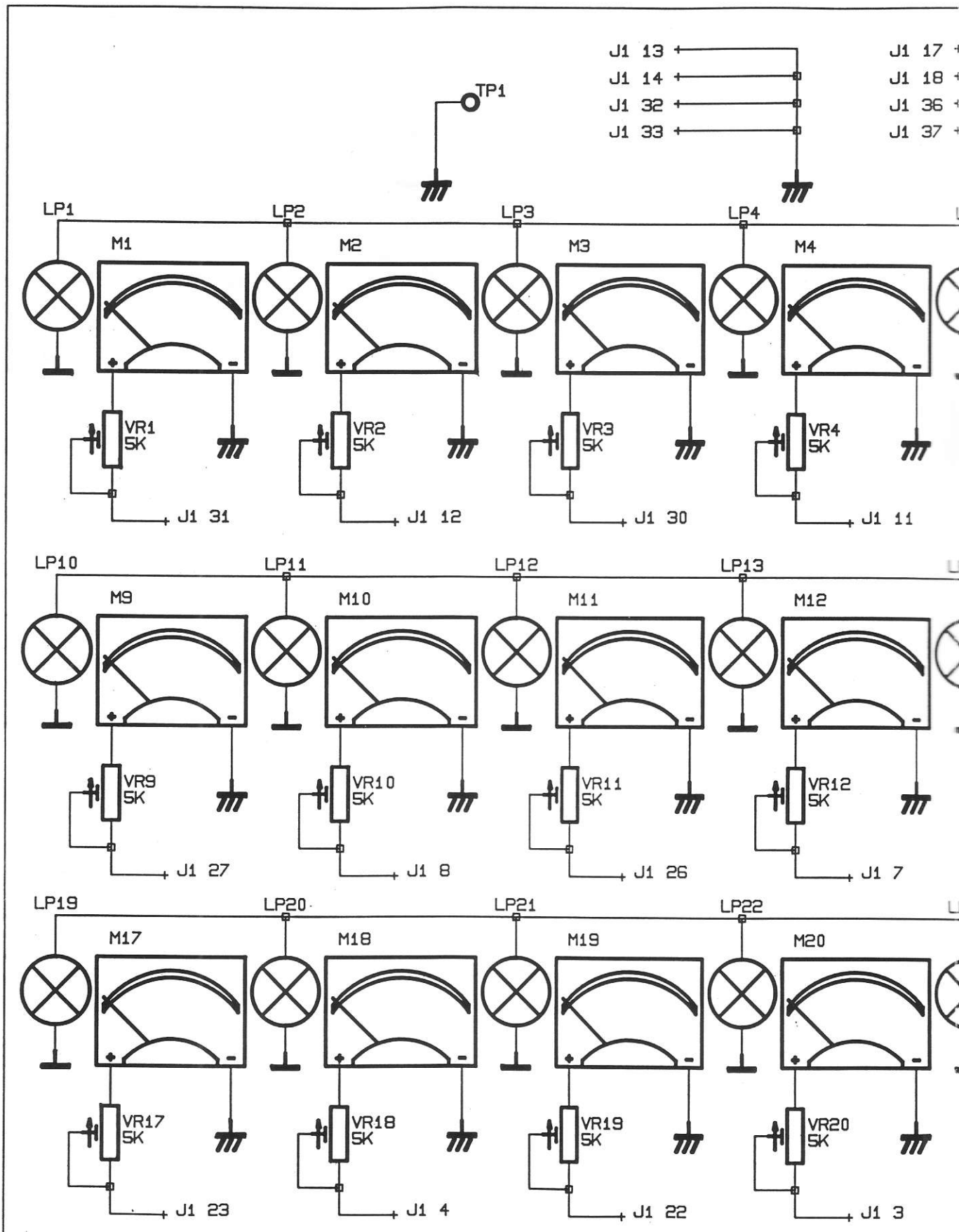
8 WIRES

TO PSU
1411002

C107L/2

TITLE C107L/2

SATURN TRANSPORT
WIRING DIAGRAM



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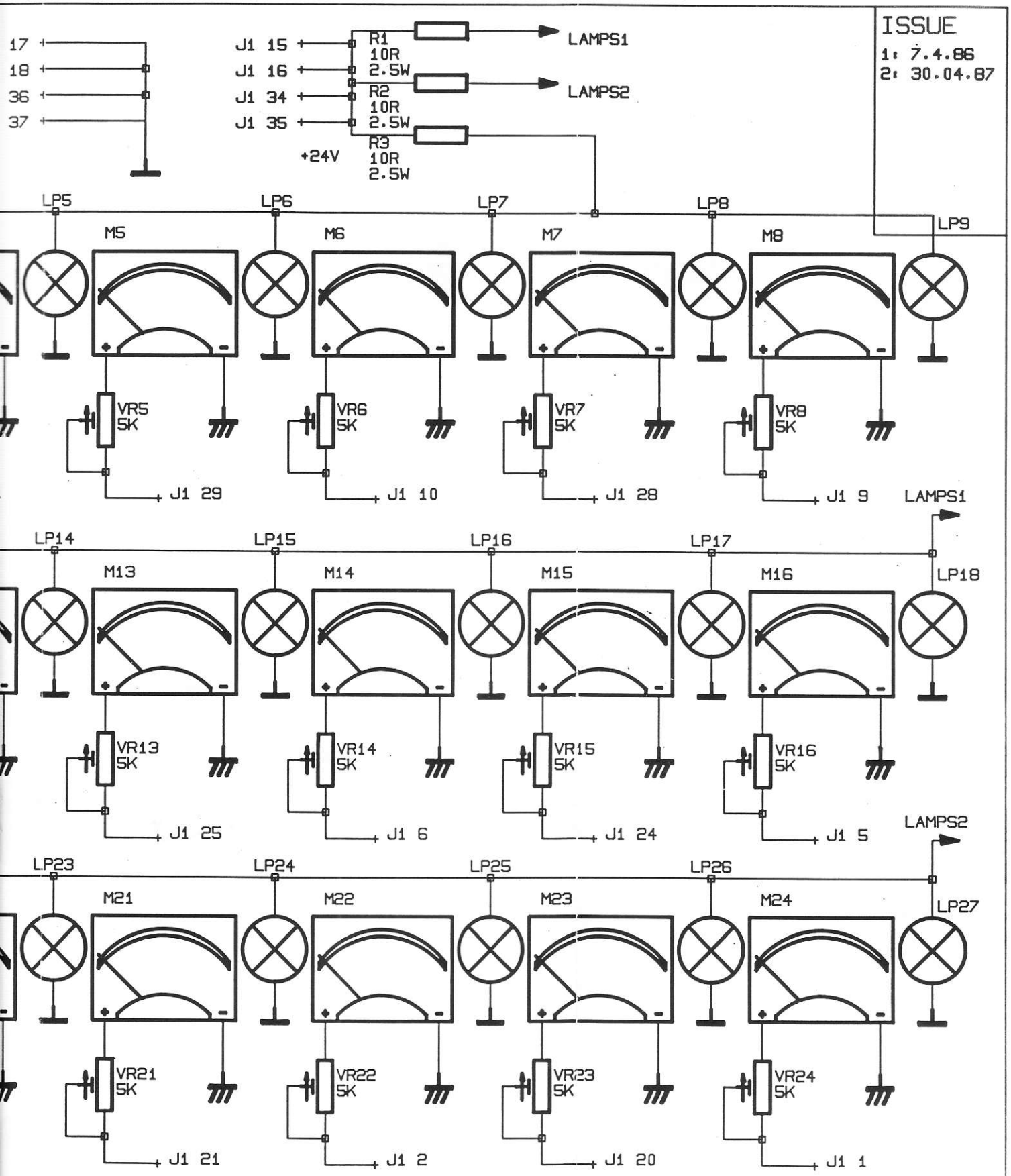


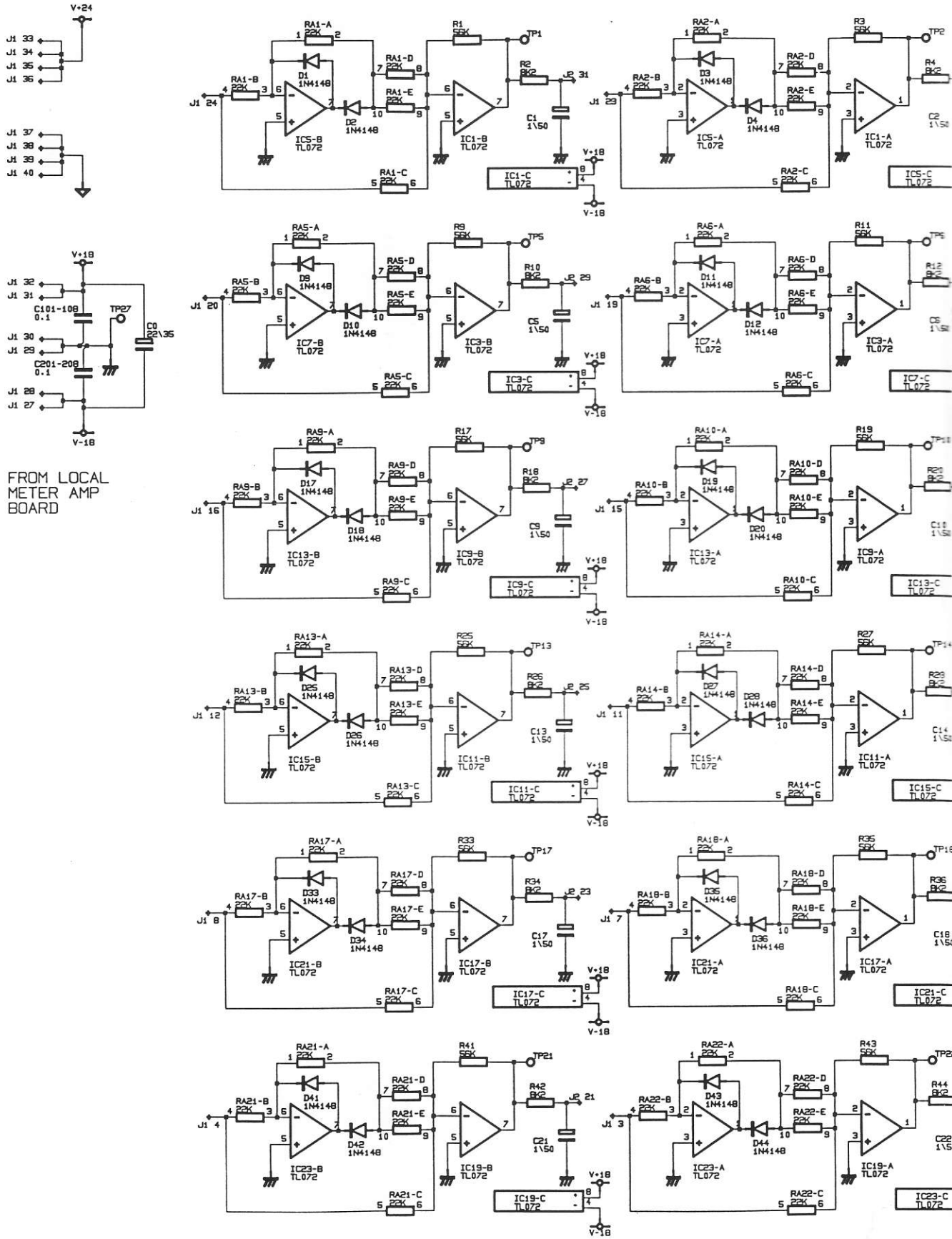
NOTES

C100K

TITLE

SATURN
REMOTE METER
ASSEMBLY

C101K



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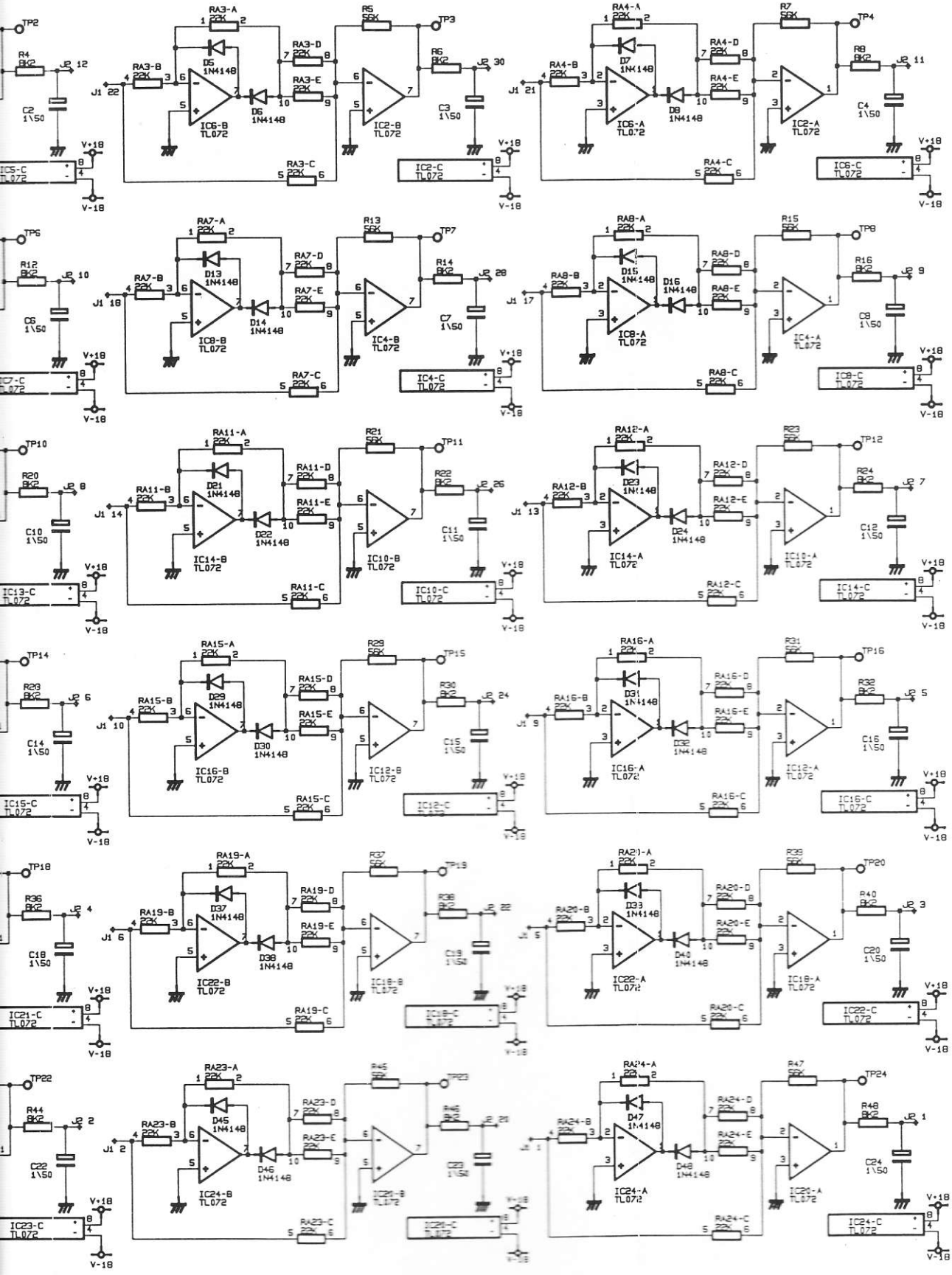
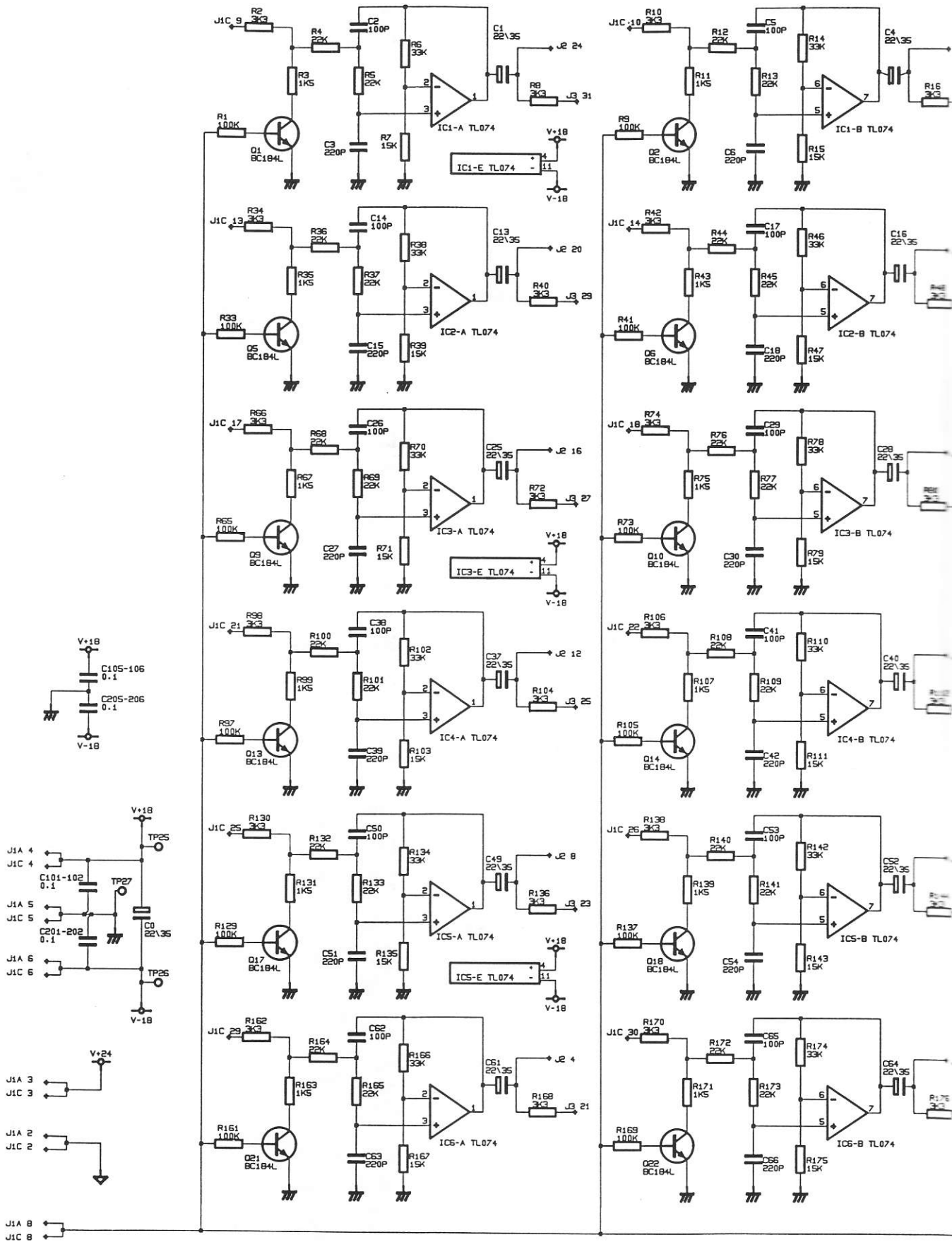
ISS 1: 11.12.84
ISS 2: 09.06.86



TITLE REMOTE METER AMPLIFIERS CIRCUIT DIAGRAM

C101K

C103K



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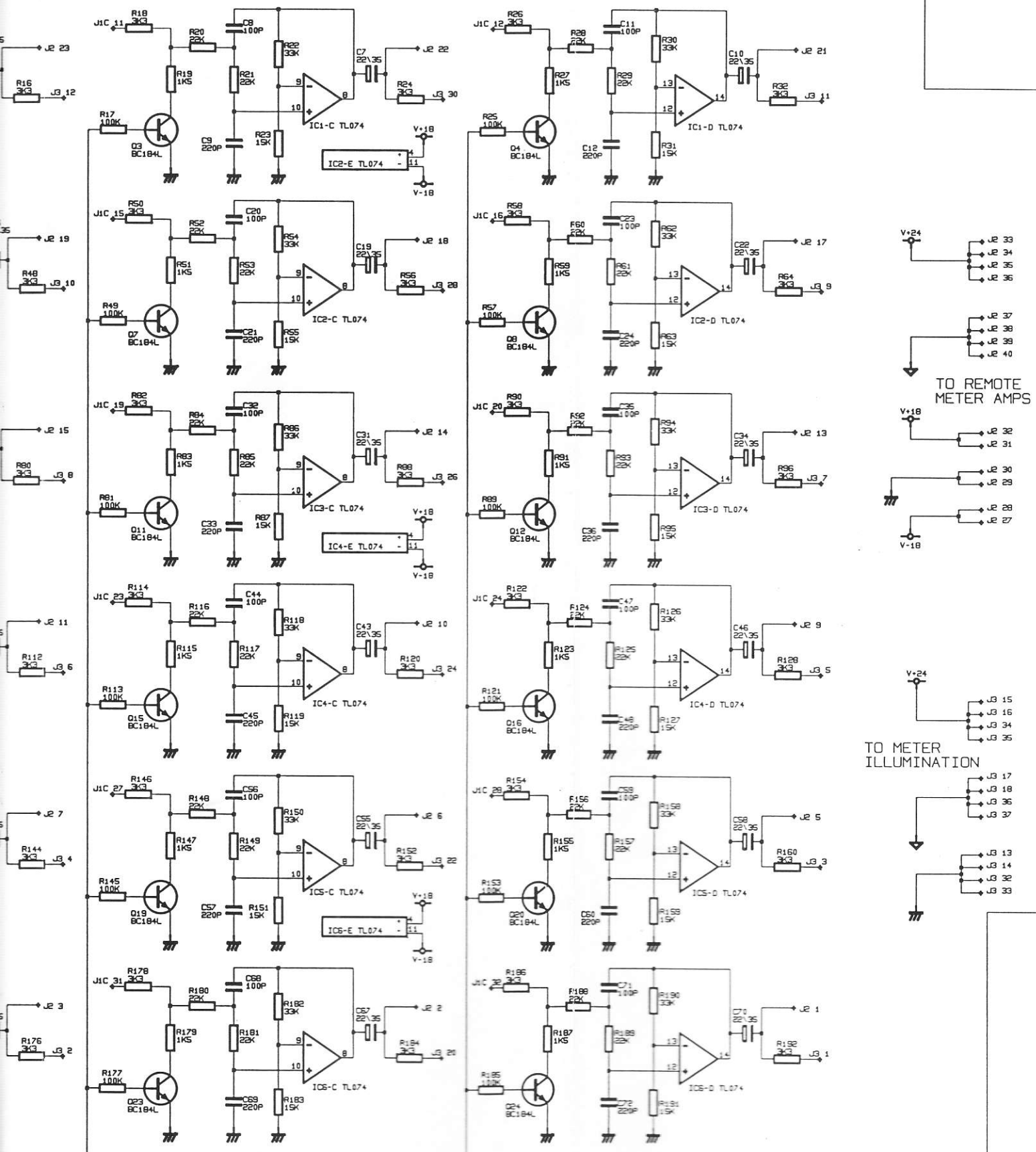
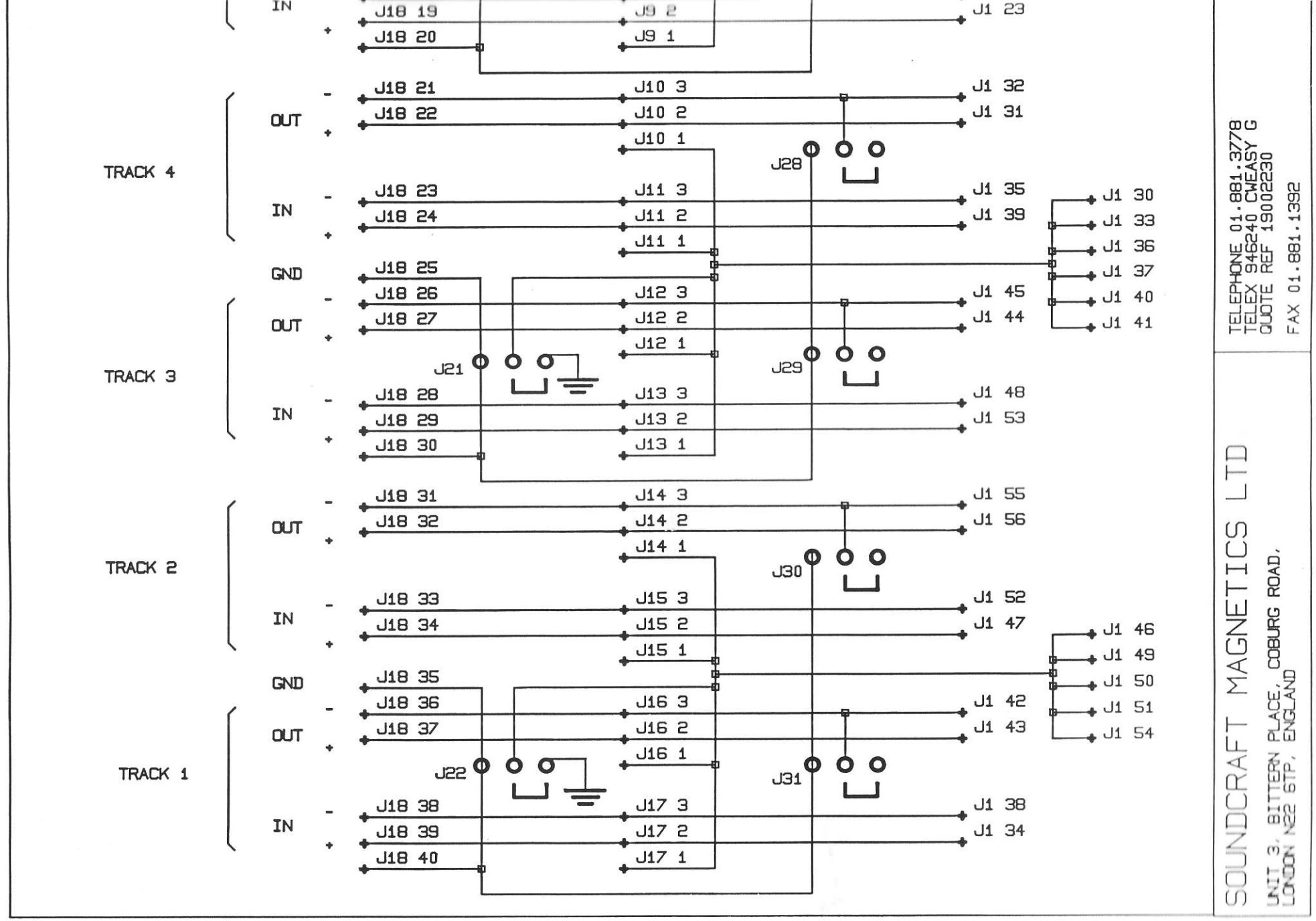
ISS 1: 12.12.84
ISS 2: 09.06.86
ISS 3: 15.04.87



TITLE NMT LOCAL METER AMPLIFIERS CIRCUIT DIAGRAM

C103K



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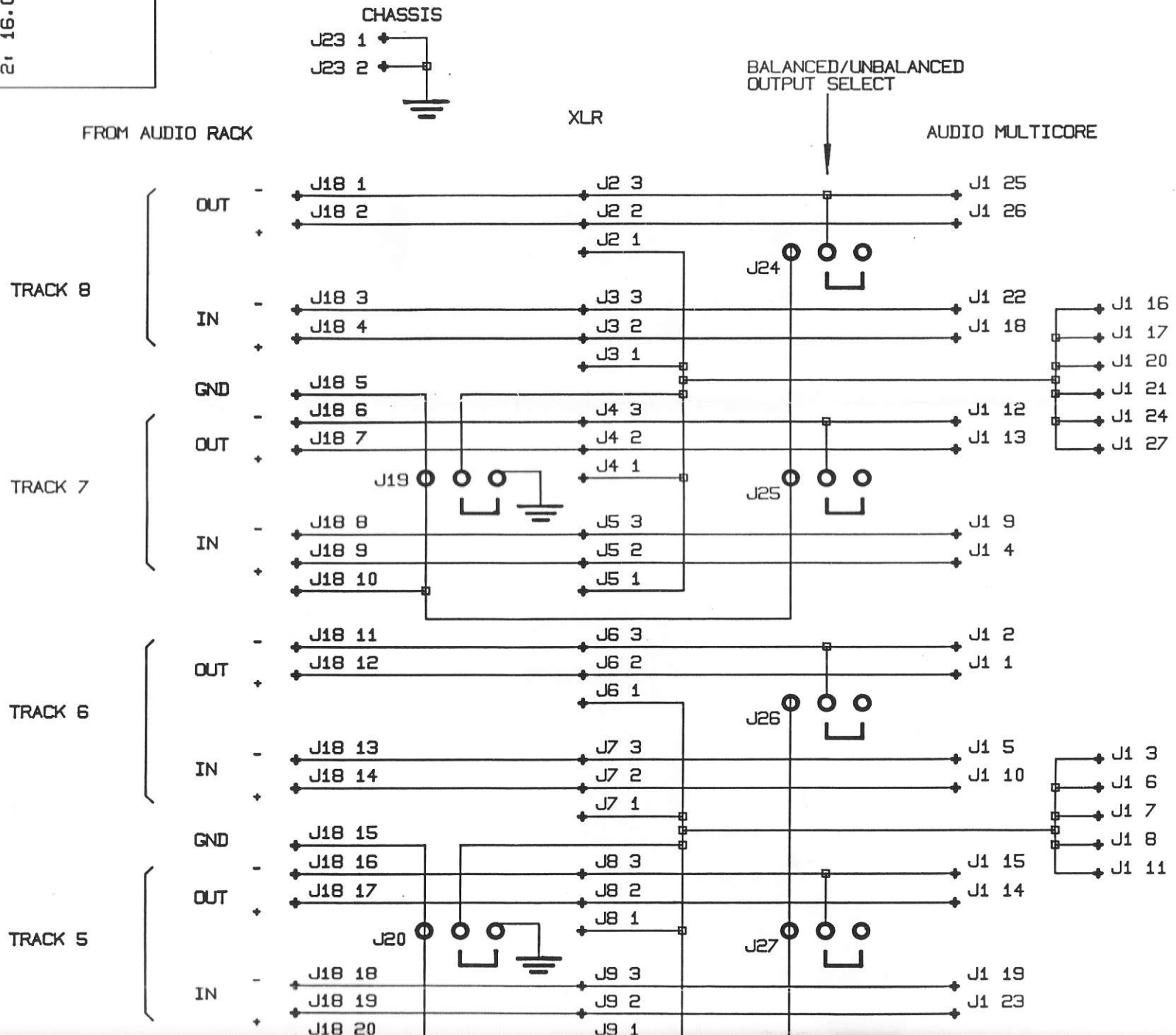
ISSUE
1: 25.9.85
2: 16.06.87

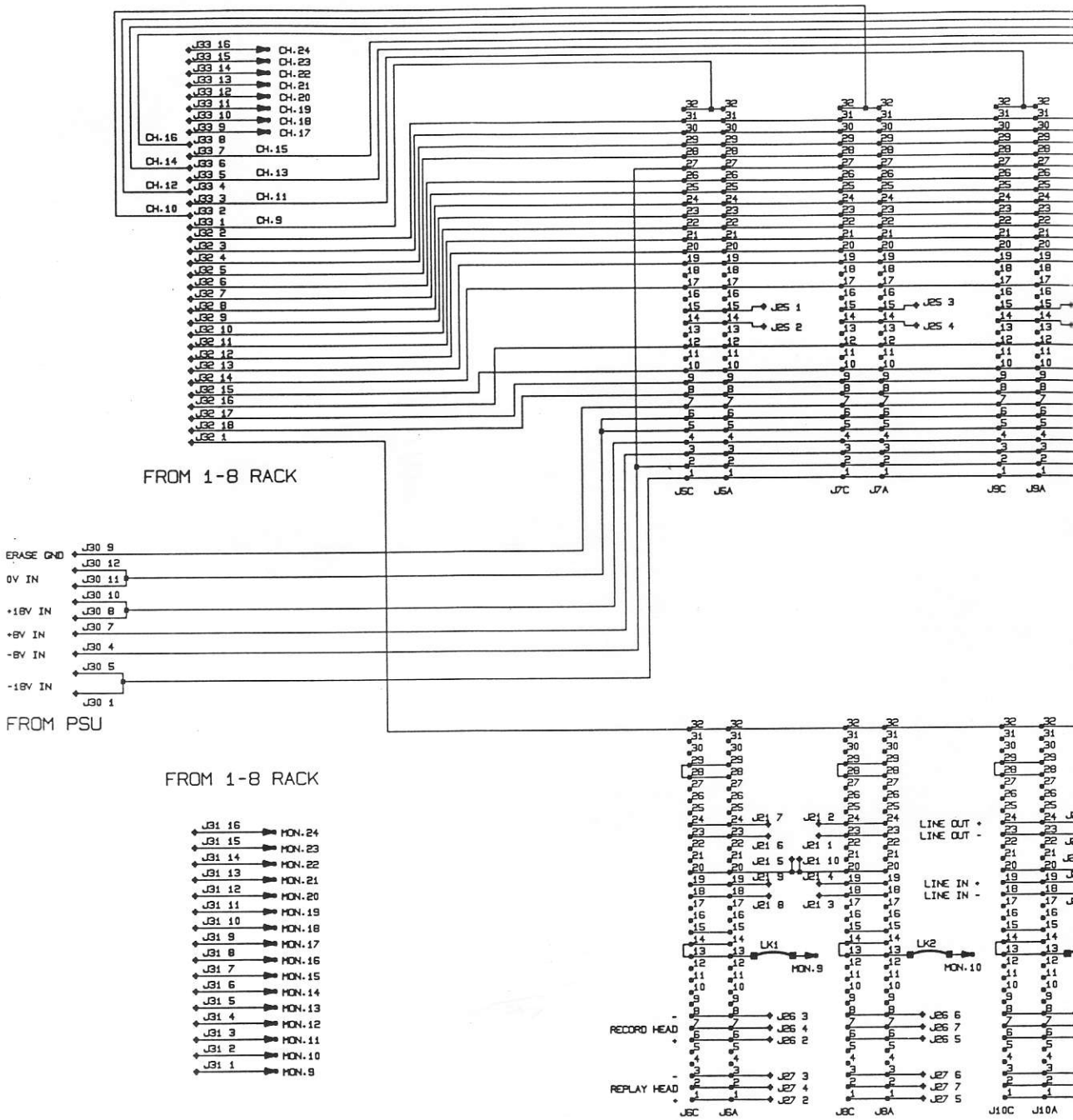
TITLE SATURN
AUDIO INTERFACE BOARD
CIRCUIT DIAGRAM

C122K/02

NOTES



C116K



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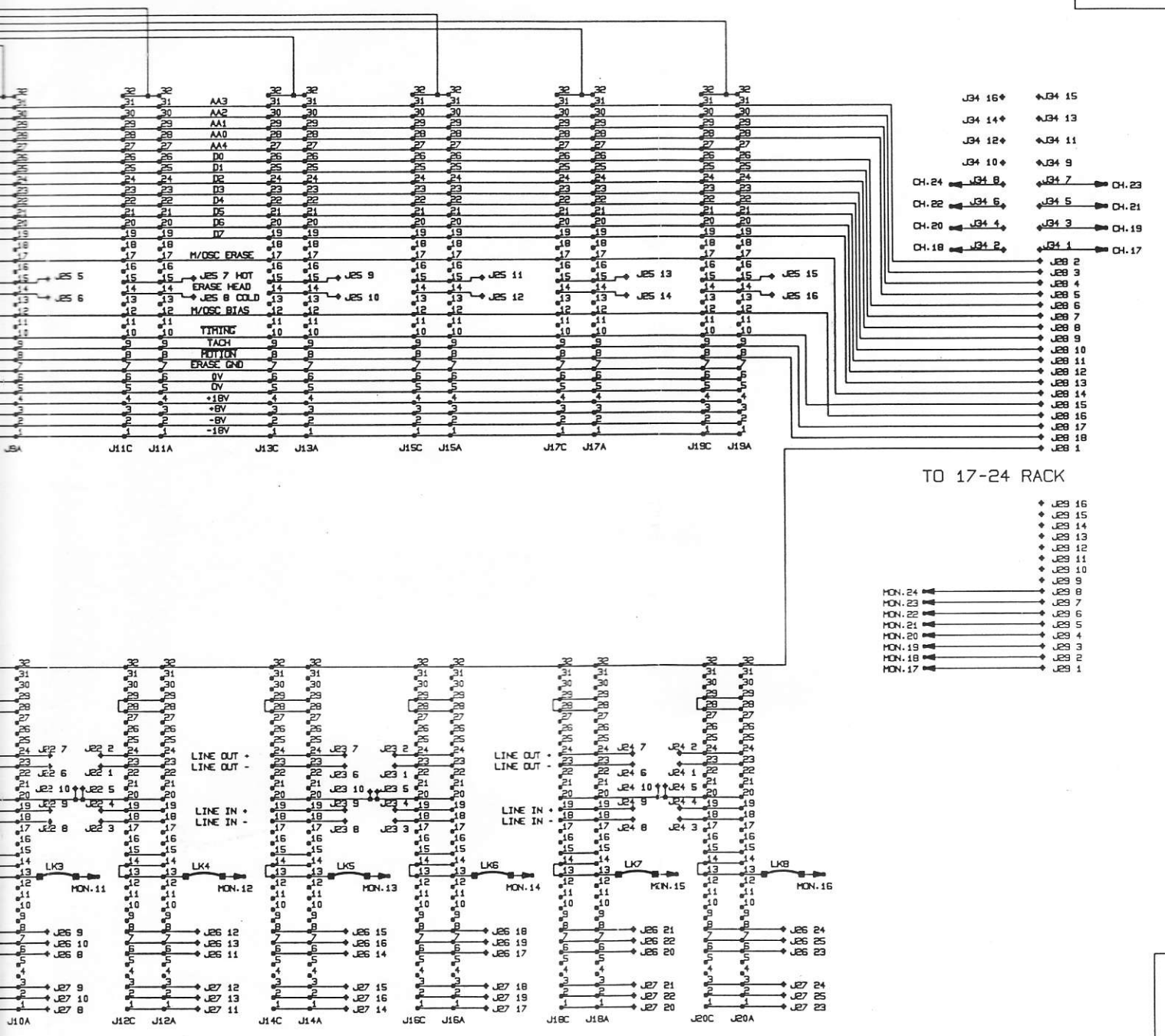
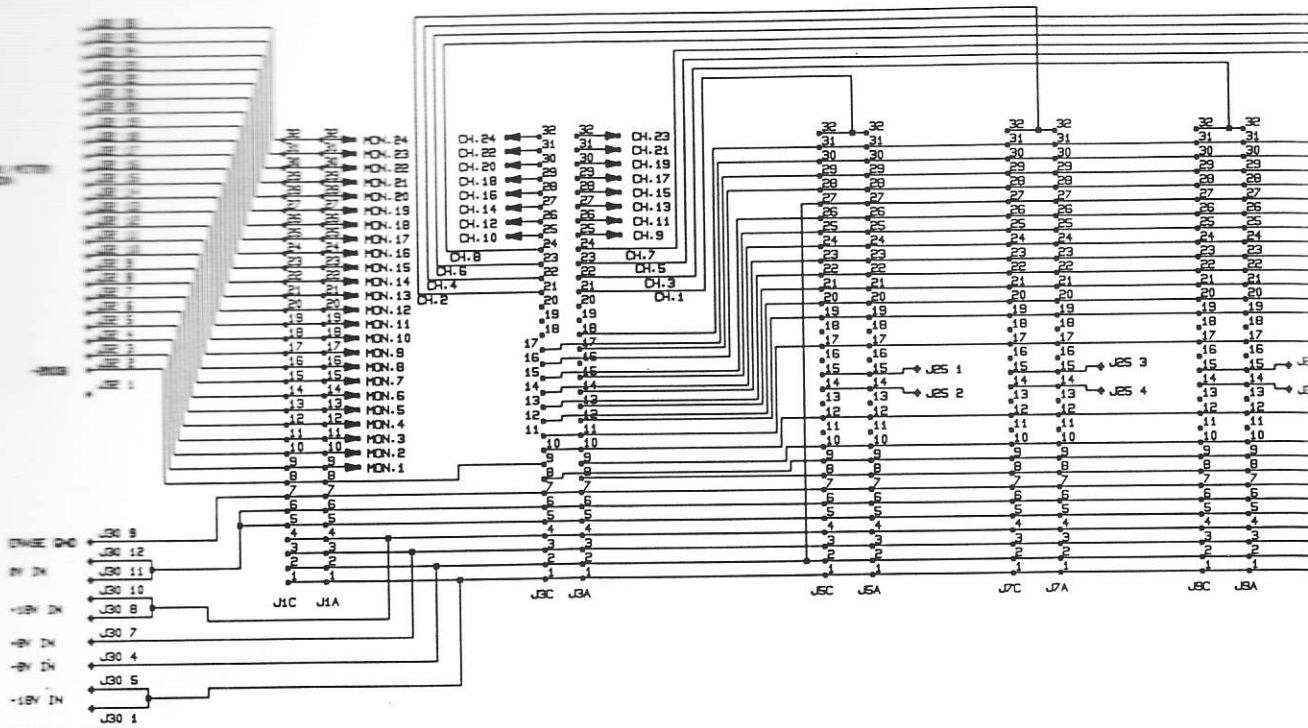
ISSUE
ISS 1: 28.05.87



TITLE
AUDIO RACK
MOTHER BOARD (9-16
CIRCUIT DIAGRAM

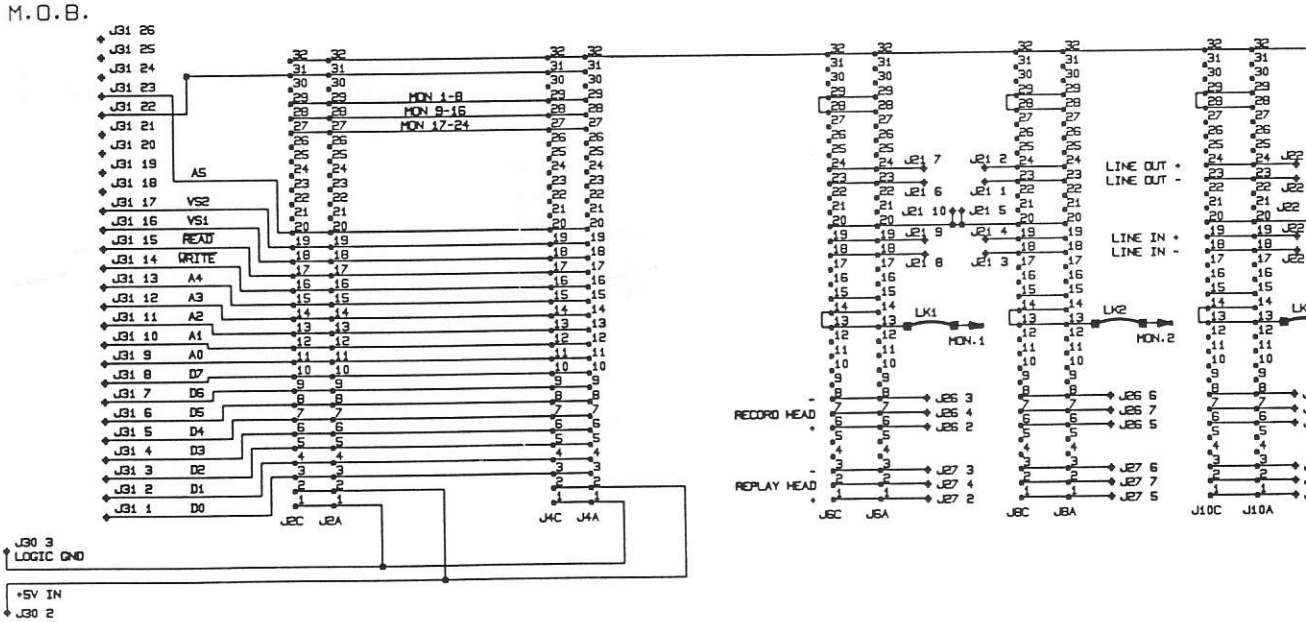
C116K

C124K



FROM PSU

M.O.B.



FROM PSU

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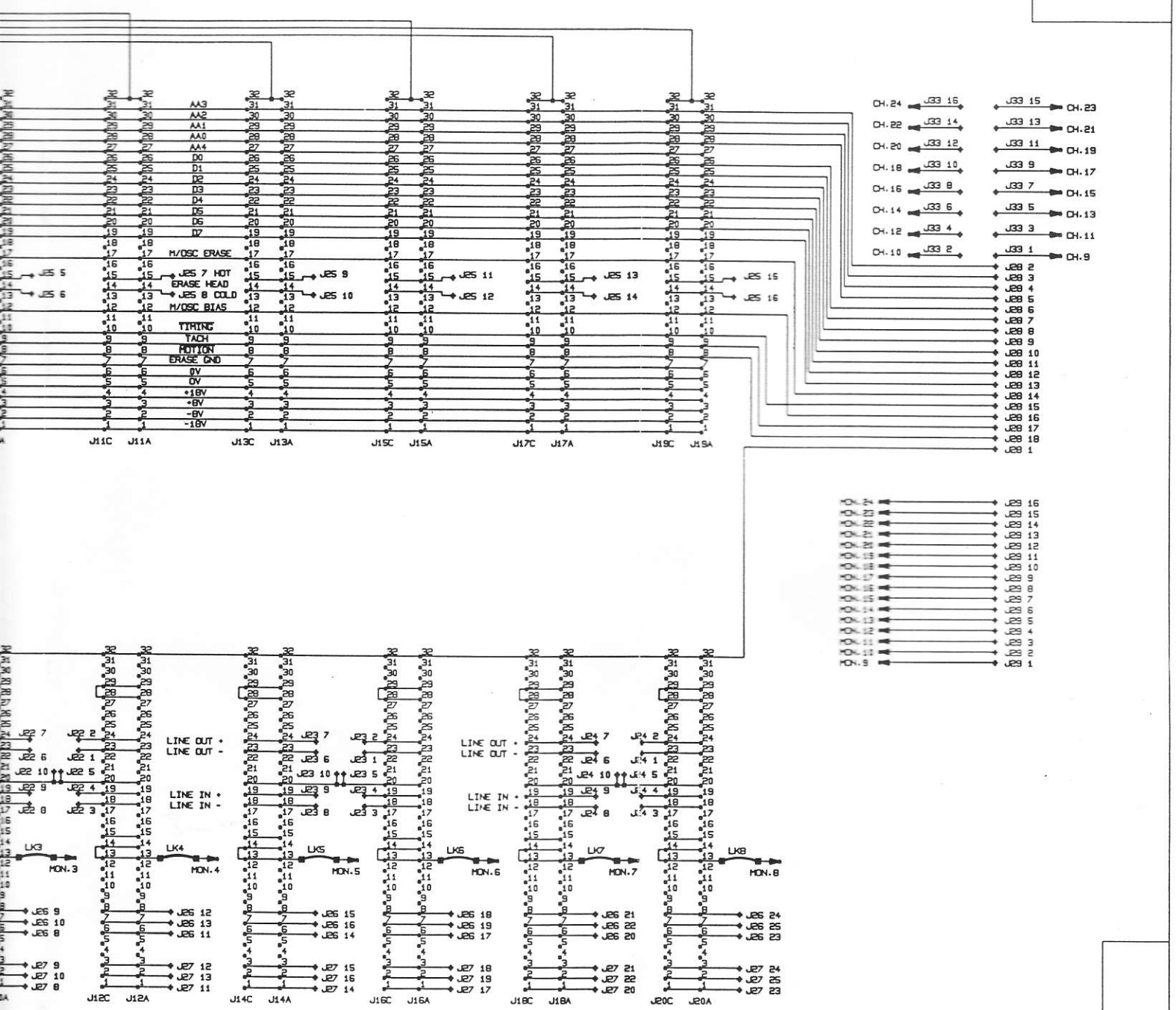
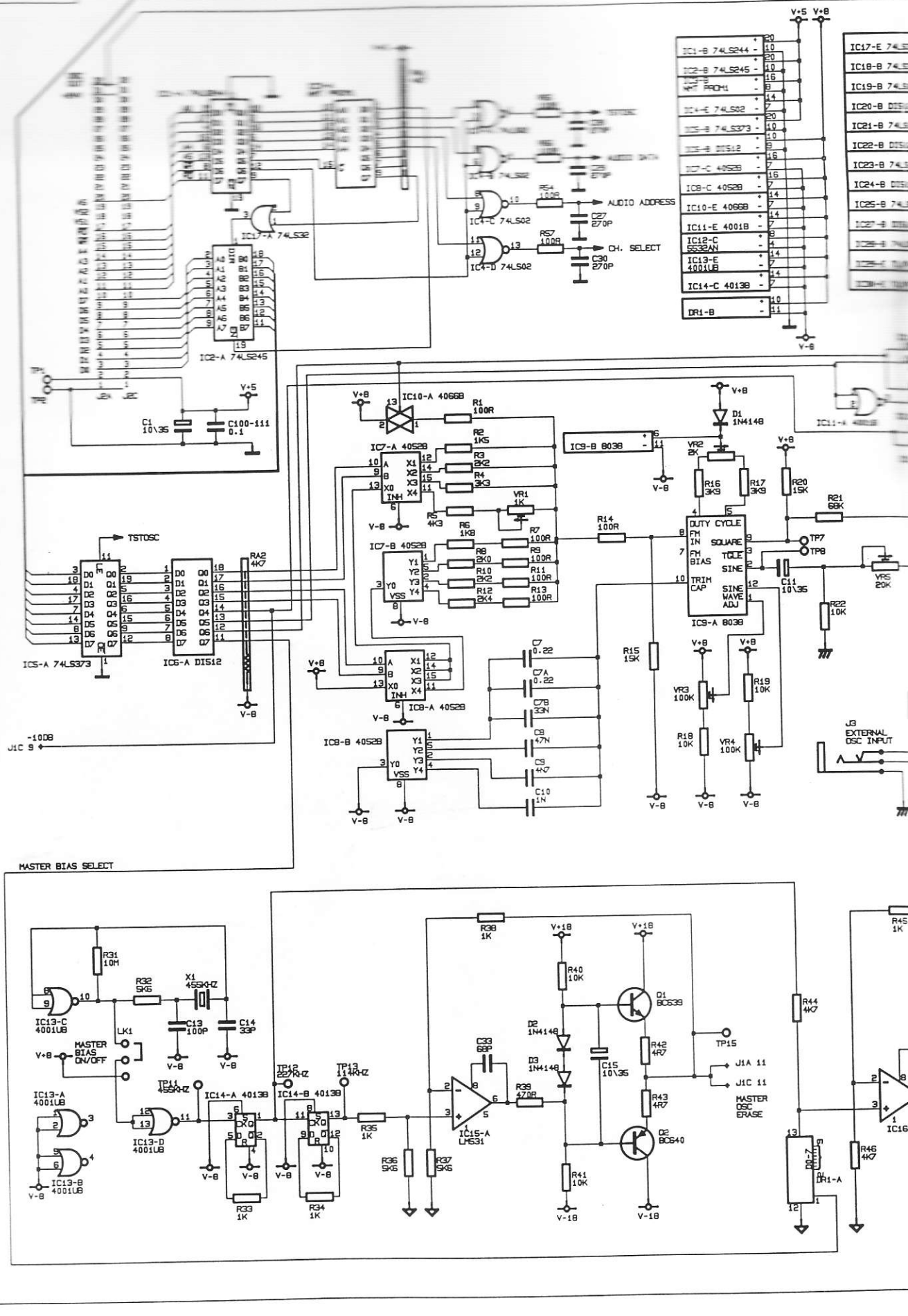
ISS 1: 28.05.87



TITLE
AUDIO RACK
MOTHER BOARD (1-8)
CIRCUIT DIAGRAM

C124K


V+5
V+8
IC1-B 74LS244
IC2-B 74LS245
IC3-B 74LS373
IC4-E 74LS02
IC5-B DI512
IC7-C 40528
IC8-C 40528
IC10-E 40668
IC11-E 4001B
IC12-C 6532AN
IC13-E 4001UB
IC14-C 40138
DR1-B
IC17-E 74LS
IC18-B 74LS
IC19-B 74LS
IC20-B DI5
IC21-B 74LS
IC22-B DI5
IC23-B 74LS
IC24-B DI5
IC25-B 74LS
IC4-C 74LS02
IC4-D 74LS02
IC17-A 74LS32
IC2-A 74LS245
AUDIO ADDRESS
CH. SELECT
C27 270P
C30 270P
R54 100R
R57 100R
C1 10\35
C100-111 0.1
IC10-A 40668
IC7-A 40528
IC7-B 40528
IC8-A 40528
IC8-B 40528
IC9-B 8038
IC9-A 8038
IC11-A
R1 100R
R2 1K5
R3 2K2
R4 3K3
R5 4K3
R6 1K8
R7 100R
R8 2K0
R9 100R
R10 2K2
R11 100R
R12 2K4
R13 100R
R14 100R
R15 15K
R16 3K9
R17 3K9
R20 15K
R21 68K
R22 10K
VR1 1K
VR2 2K
VR3 100K
VR4 100K
VR5 20K
D1 1N4148
DUTY CYCLE
FM IN
FM BIAS
TRIM CAP
SQUARE
TOGLE
SINE
SINE WAVE ADJ
TP7
TP8
C11 10\35
R18 10K
R19 10K
J3 EXTERNAL OSC INPUT
TSTOSC
RA2 4K7
IC5-A 74LS373
IC6-A DI512
-10D8
J1C 9
C7 0.22
C7A 0.22
C7B 33N
C8 47N
C9 4N7
C10 1N
MASTER BIAS SELECT
R31 10M
R32 5K6
X1 455KHZ
C13 100P
C14 33P
LK1
MASTER BIAS ON/OFF
IC13-C 4001UB
IC13-A 4001UB
IC13-B 4001UB
IC13-D 4001UB
TP11 455KHZ
TP12 227KHZ
TP13 114KHZ
IC14-A 40138
IC14-B 40138
R33 1K
R34 1K
R35 1K
R36 5K6
R37 5K6
R38 1K
R39 470R
C33 68P
C15 10\35
IC15-A LM531
R40 10K
R41 10K
R42 4K7
R43 4K7
D1 BC639
D2 BC640
D2 1N4148
D3 1N4148
TP15
J1A 11
J1C 11
MASTER OSC ERASE
R44 4K7
R45 1K
R46 4K7
DR1-A
IC16
V-8
V-18

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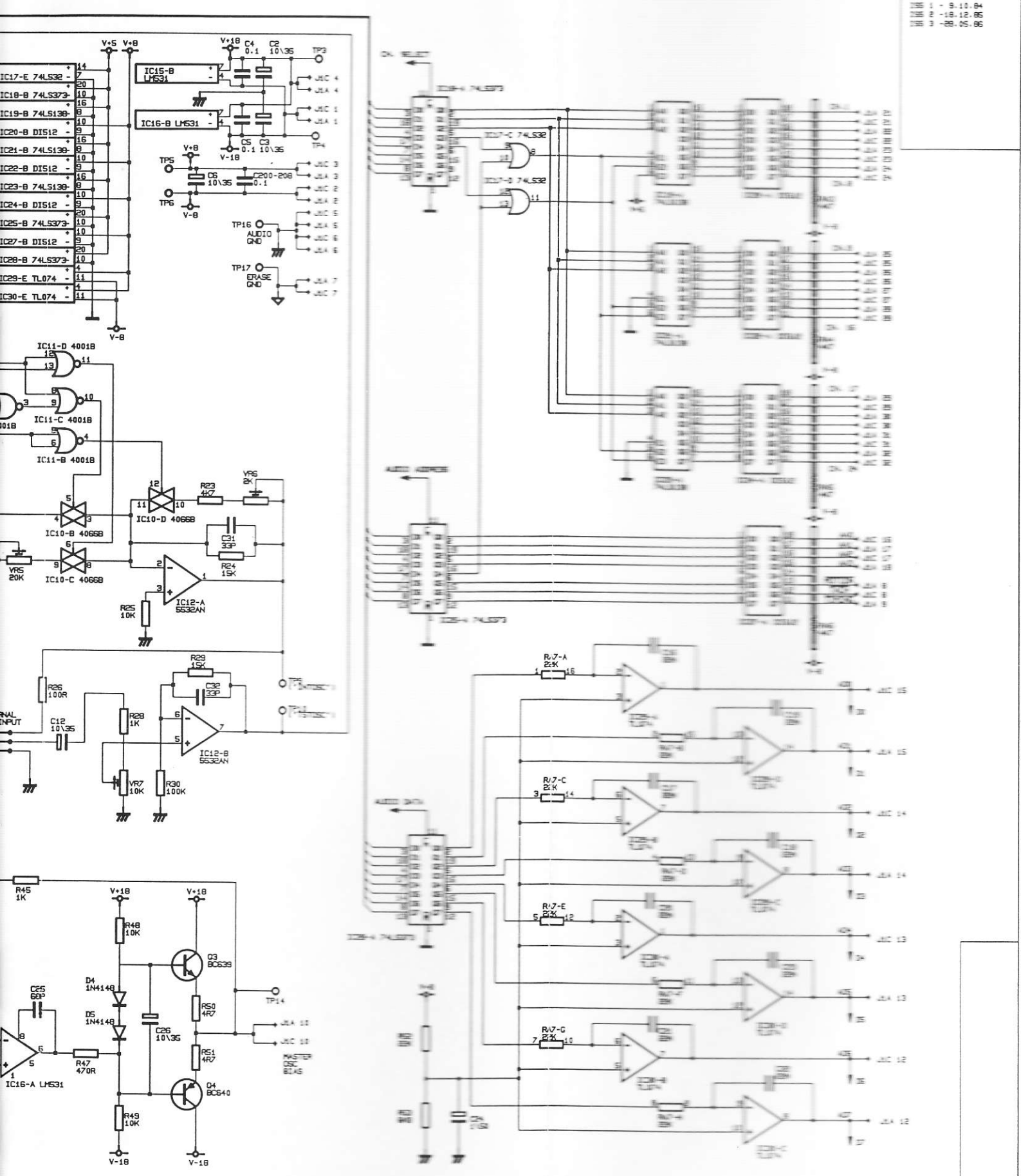
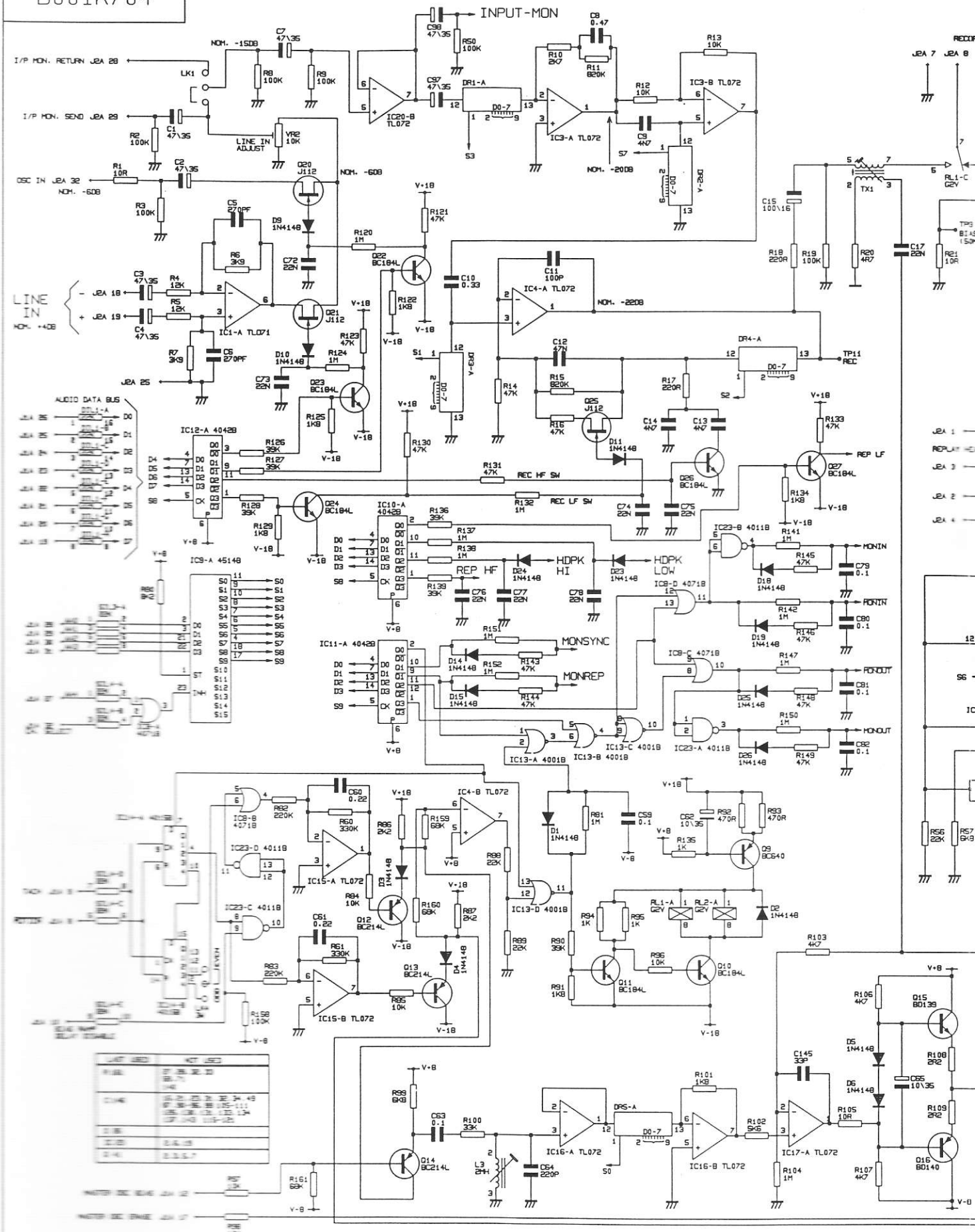


TITLE
AUDIO
CONTROL BOARD
CIRCUIT DIAGRAM

CM117K

B001K/04


INPUT-MON
I/P MON. RETURN J2A 28
I/P MON. SEND J2A 29
OSC IN J2A 32
LINE IN
LINE IN ADJUST
NOM. -15DB
NOM. -60B
NOM. -20DB
NOM. -22DB
NOM. +4DB
LK1
AUDIO DATA BUS
REC HF SW
REC LF SW
REP HF
REP LF
HDPK HI
HDPK LOW
MONSYNC
MONREP
MONIN
MONOUT
REC
TP11
TX1
RL1-C
IC1-A TL071
IC4-A TL072
IC3-A TL072
IC3-B TL072
IC20-B TL072
IC15-A TL072
IC15-B TL072
IC16-A TL072
IC16-B TL072
IC17-A TL072
IC9-A 4514B
IC12-A 4042B
IC10-A 4042B
IC11-A 4042B
IC8-B 4071B
IC8-D 4071B
IC9-C 4071B
IC23-B 4011B
IC23-D 4011B
IC23-C 4011B
IC23-A 4011B
IC13-A 4001B
IC13-B 4001B
IC13-C 4001B
IC13-D 4001B
IC4-B TL072
DR1-A
DR2-A
DR3-A
DR4-A
DR5-A
D0-7
J2A 18
J2A 19
J2A 25
J2A 7
J2A 8
J2A 1
J2A 2
J2A 3
J2A 4

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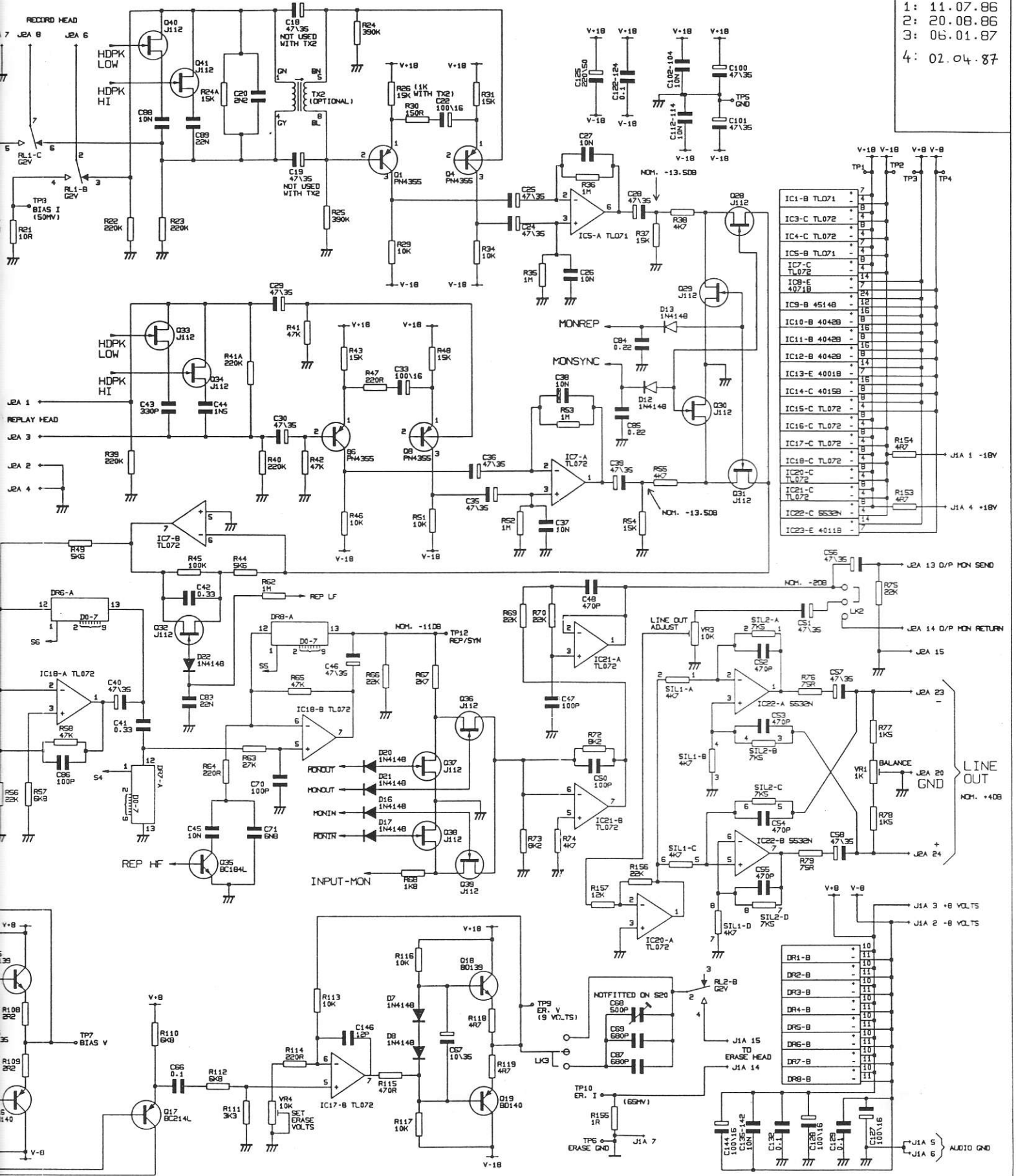
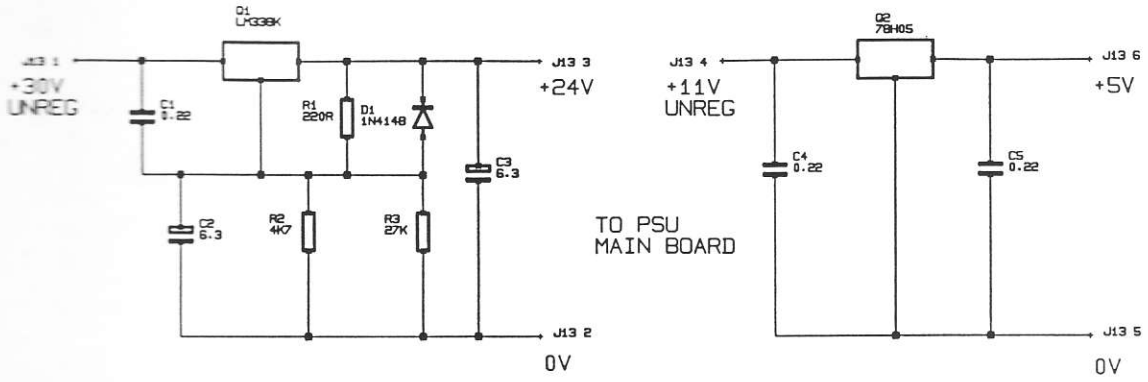
3: 06.01.87
4: 02.04.87



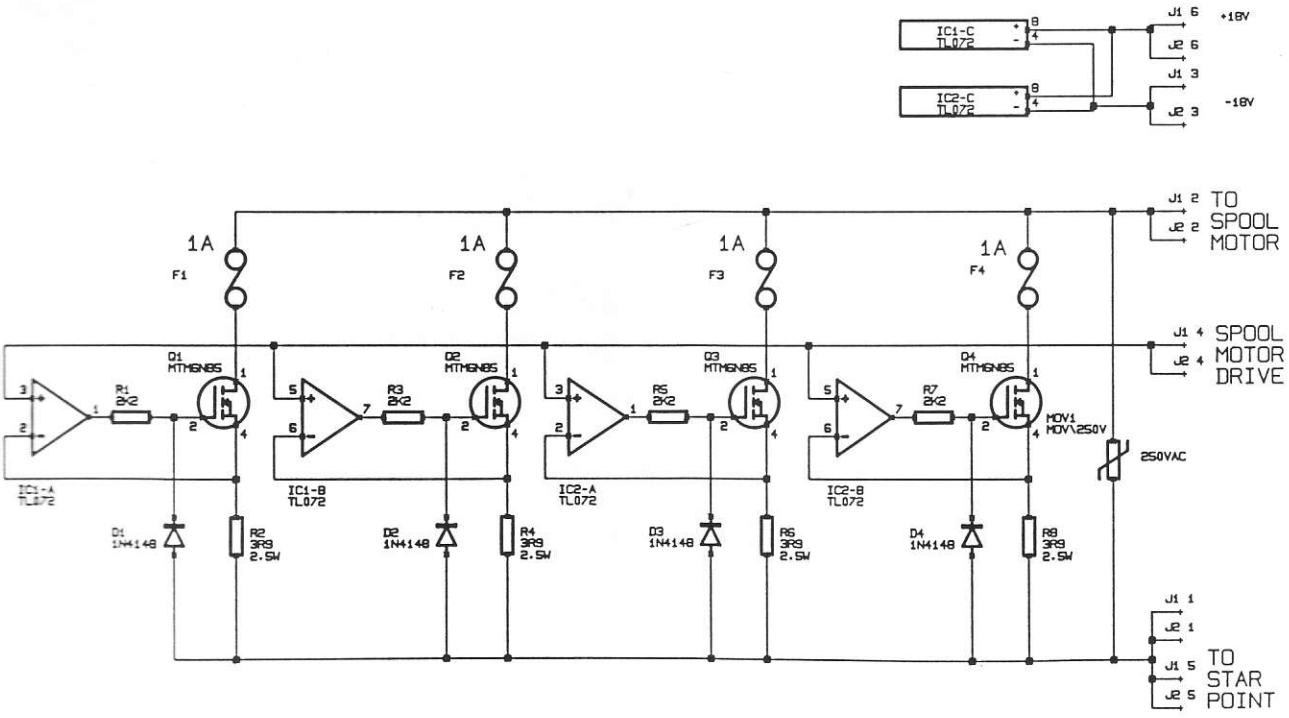
TITLE B001K/04

S20/SATURN
AUDIO CHANNEL
CIRCUIT DIAGRAM

SM3949 24/5 VOLT REGULATOR PCB



SM3947 FET BOARD (TWO PER MOTOR)



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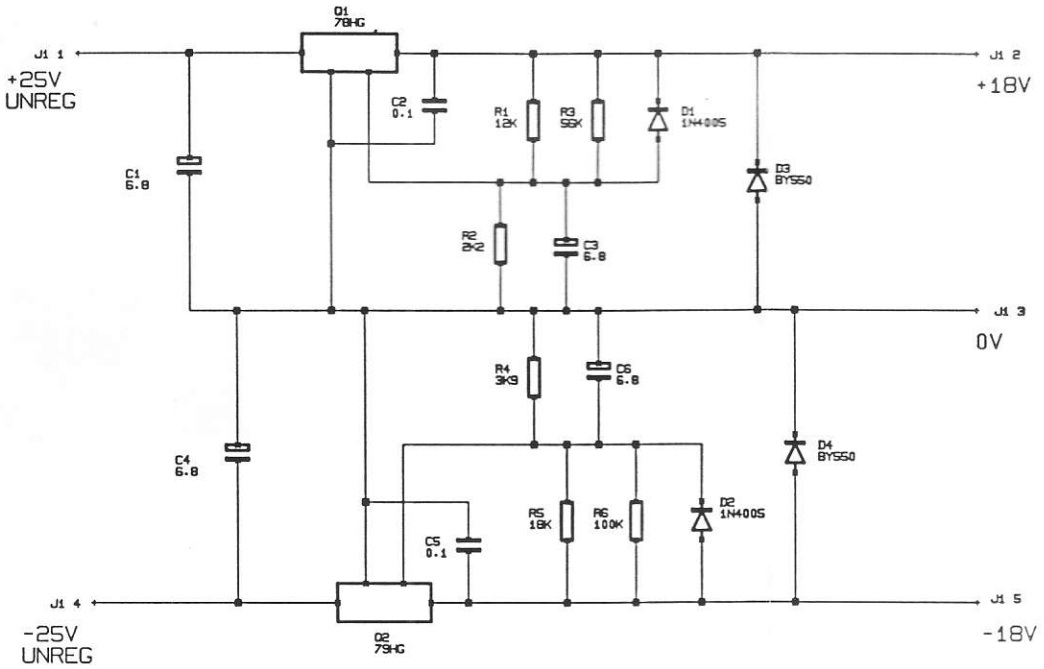
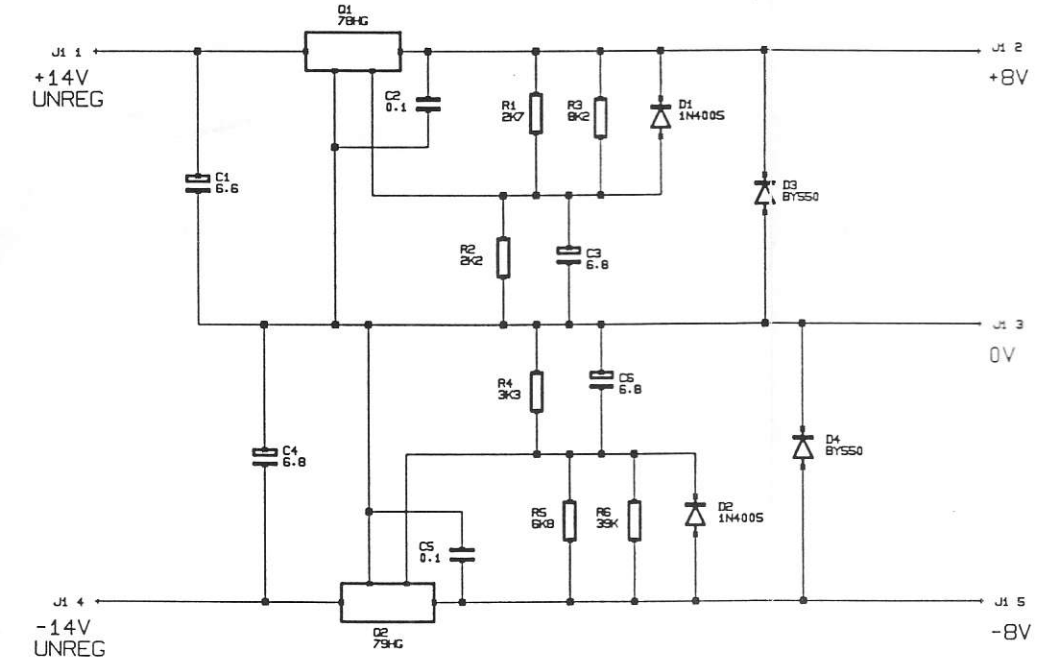
1 18.8.86

SM3948 +-18V REGULATOR

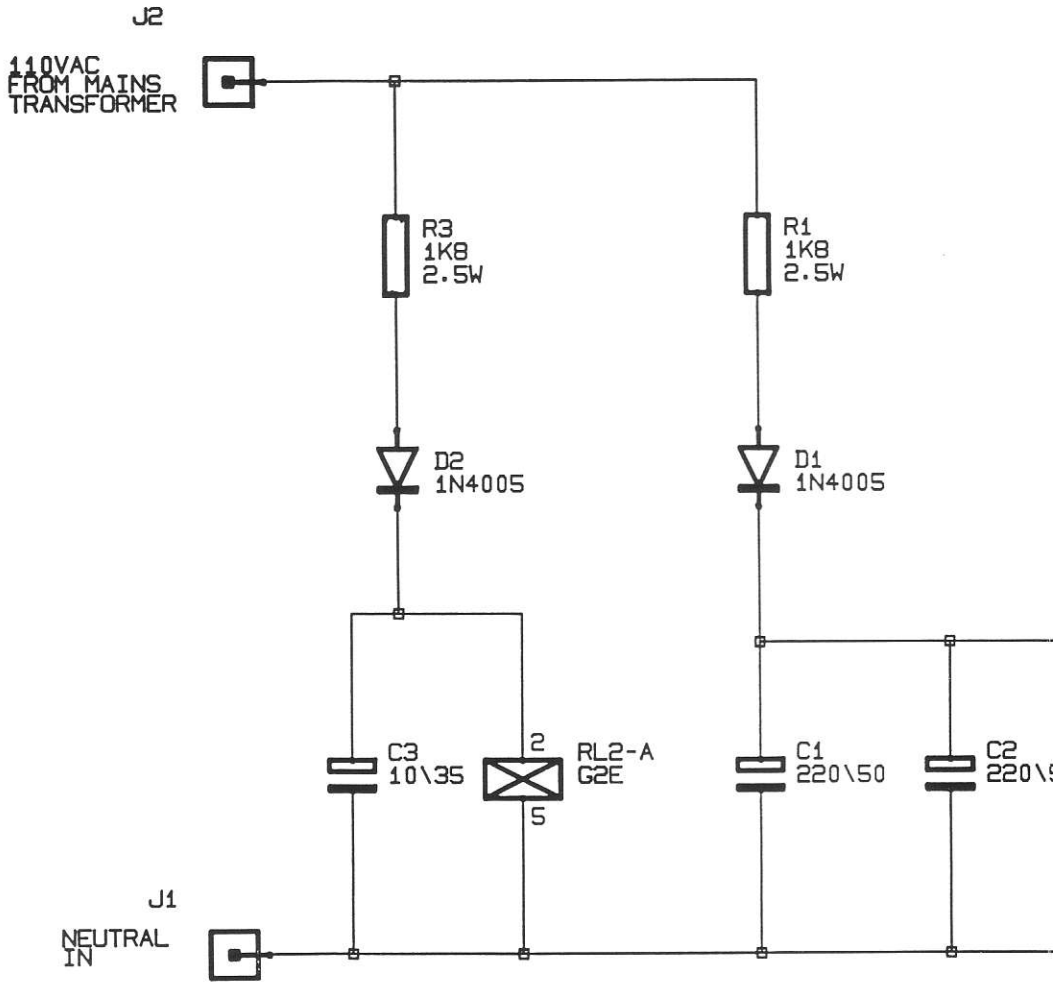


SM3948 +-8V REGULATOR



CM126K

TITLE
SATURN
HEATSINK
PCB CCTS



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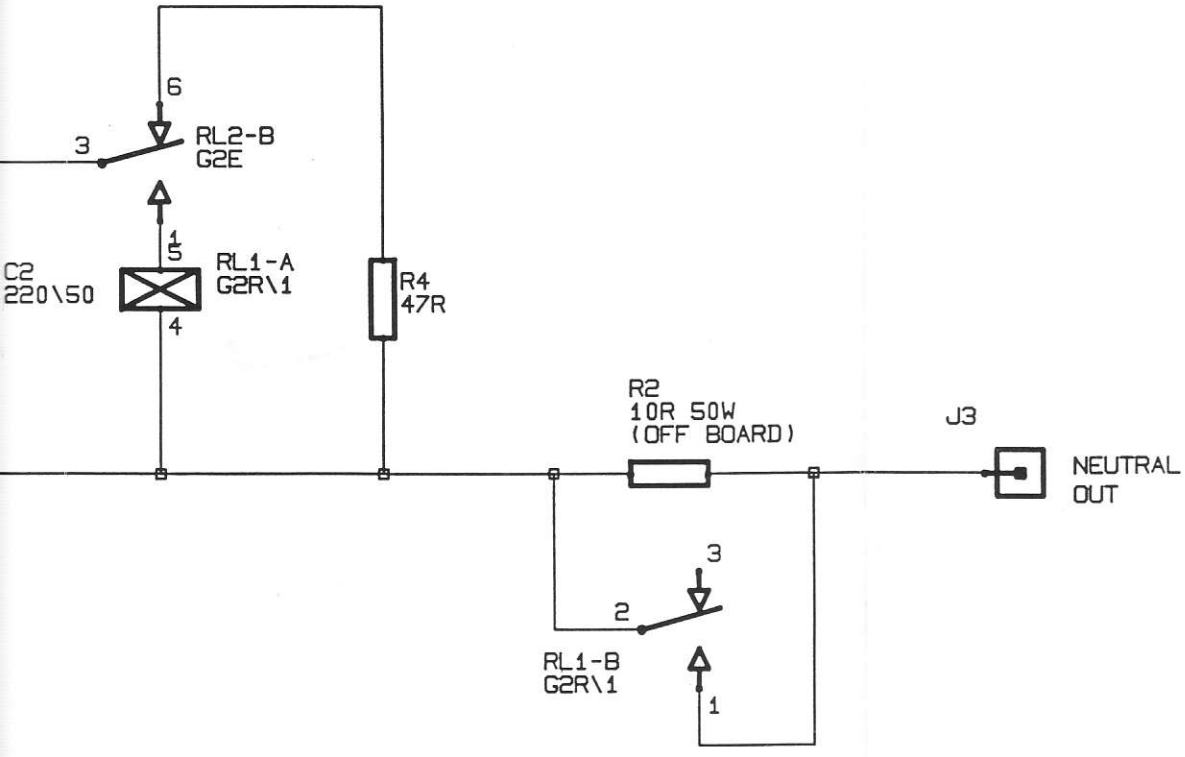
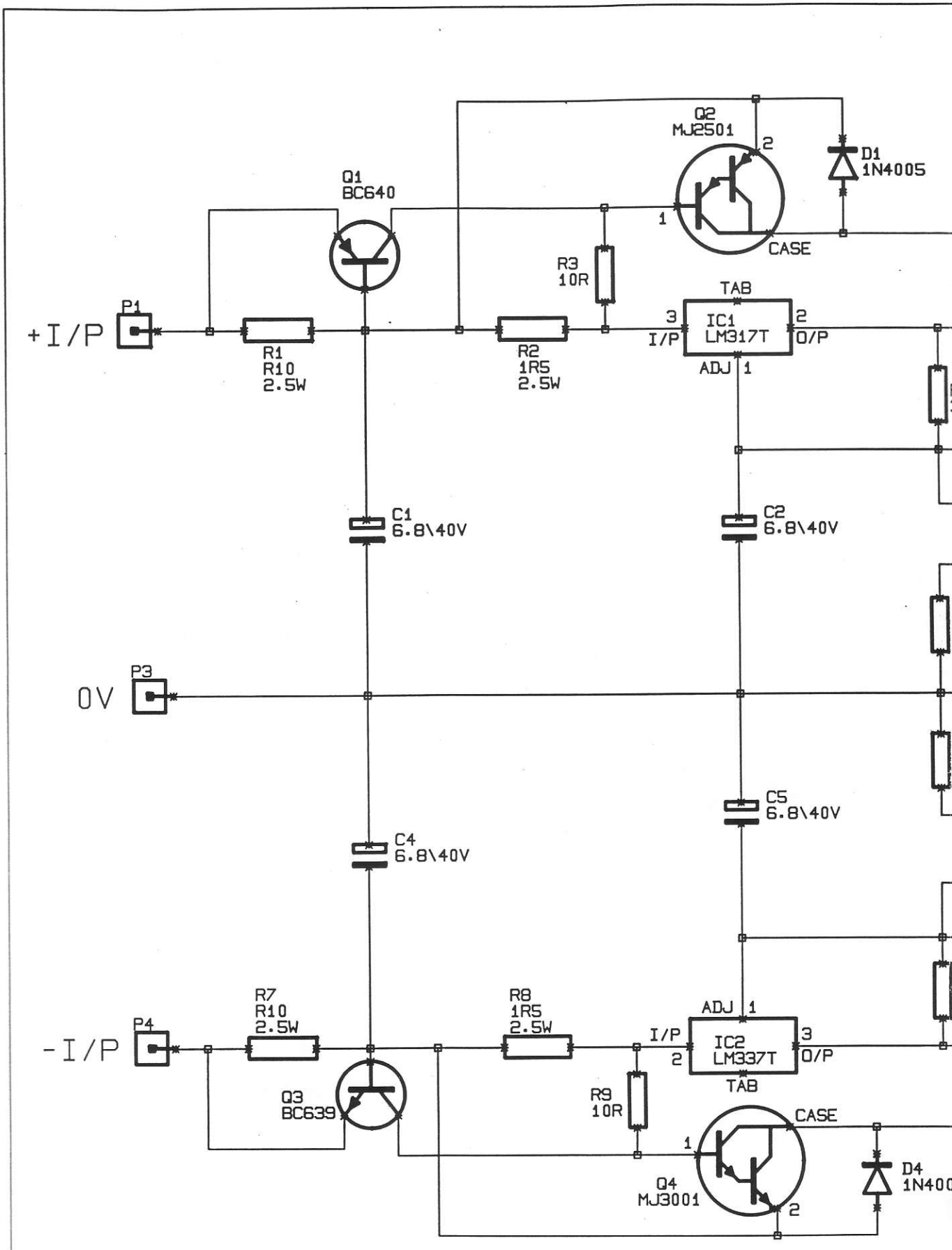
10.3.86
2: 9.9.86



NOTES

C144K

TITLE
SATURN
SURGE SUPPRESSOR
PCB



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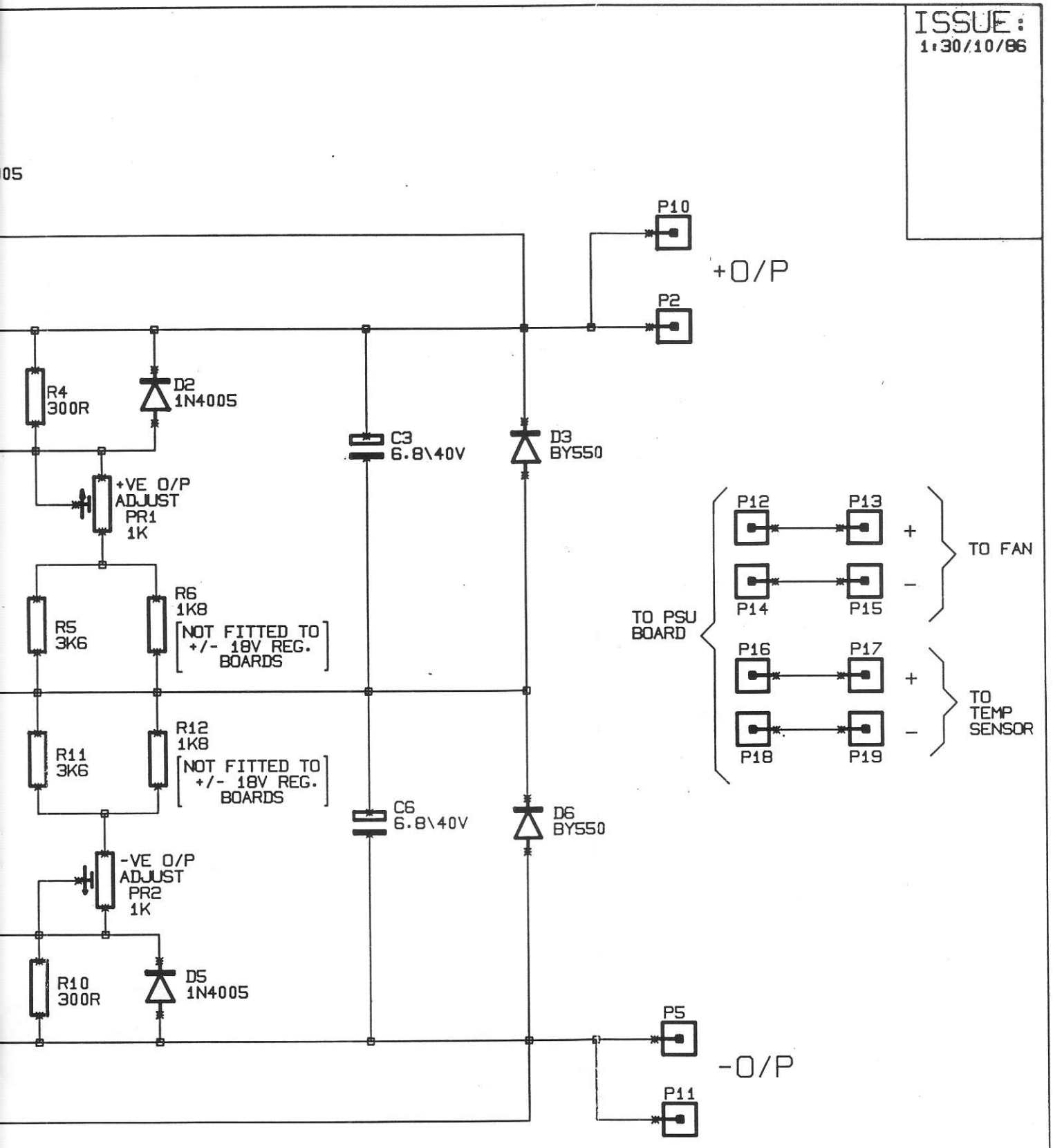
ISSUE:
1:30/10/86



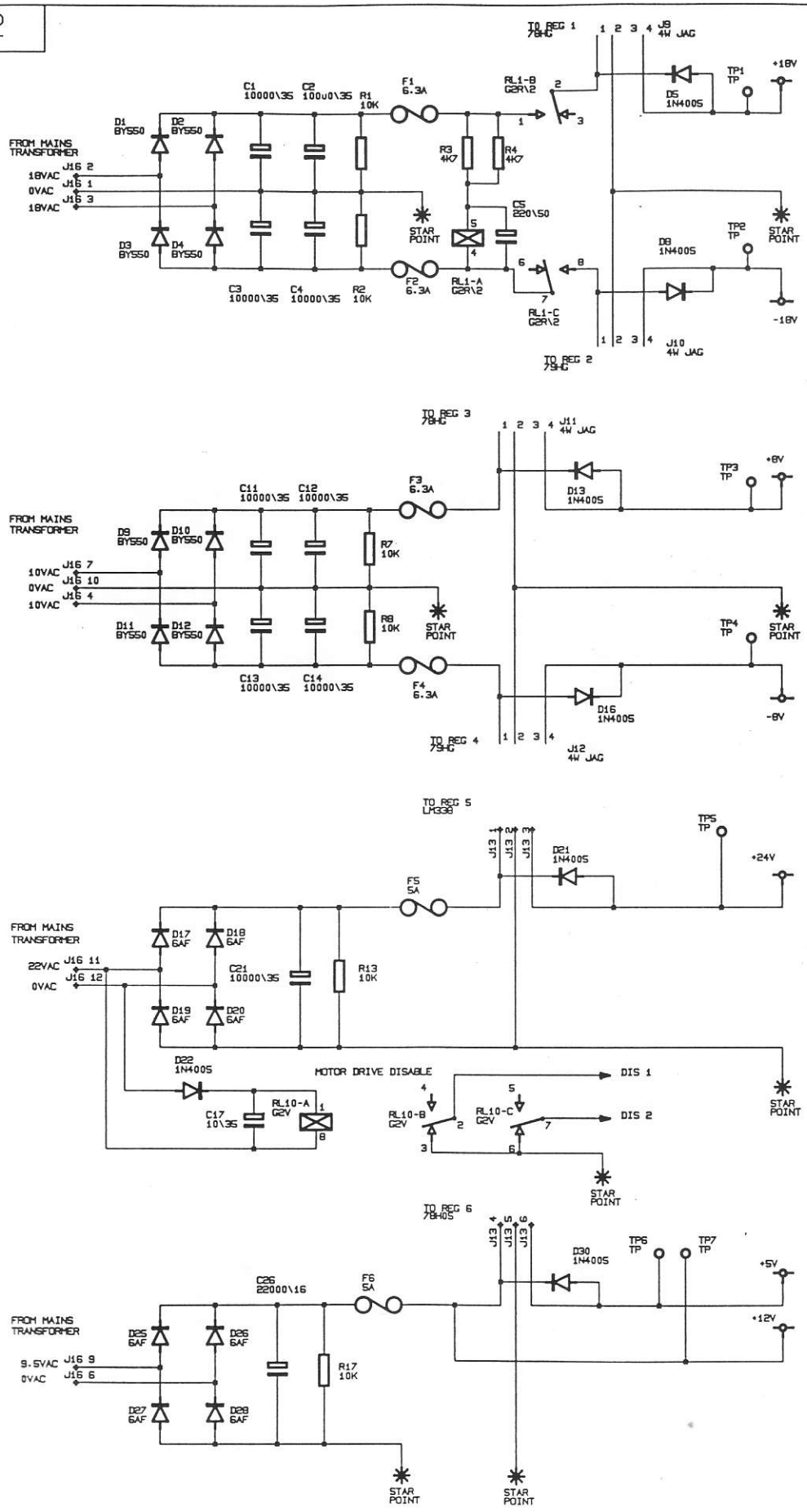
D4
1N4005

NOTES

C110K

TITLE SATURN
+/- REGULATOR
BOARD (8/18V)

C137K/02



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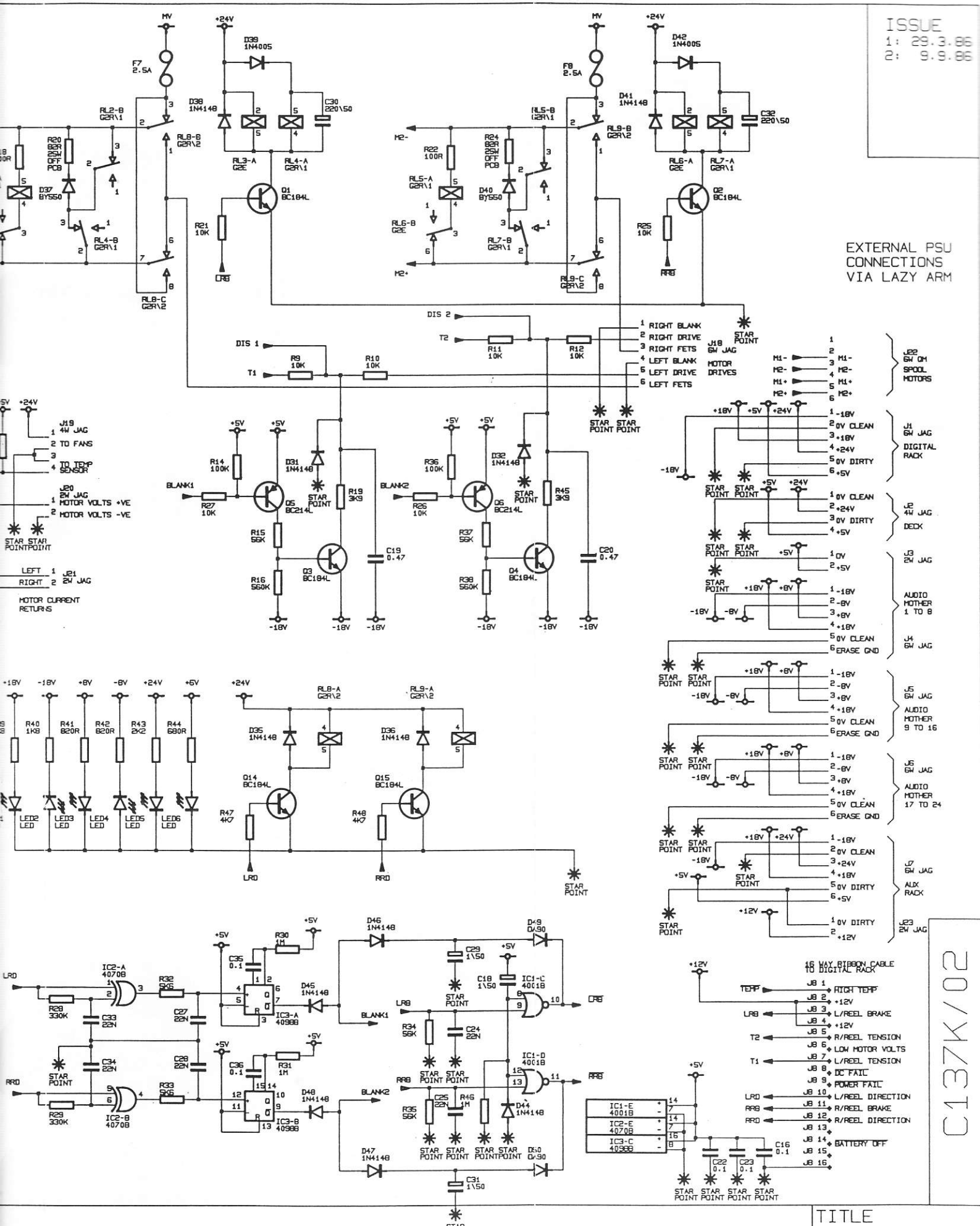
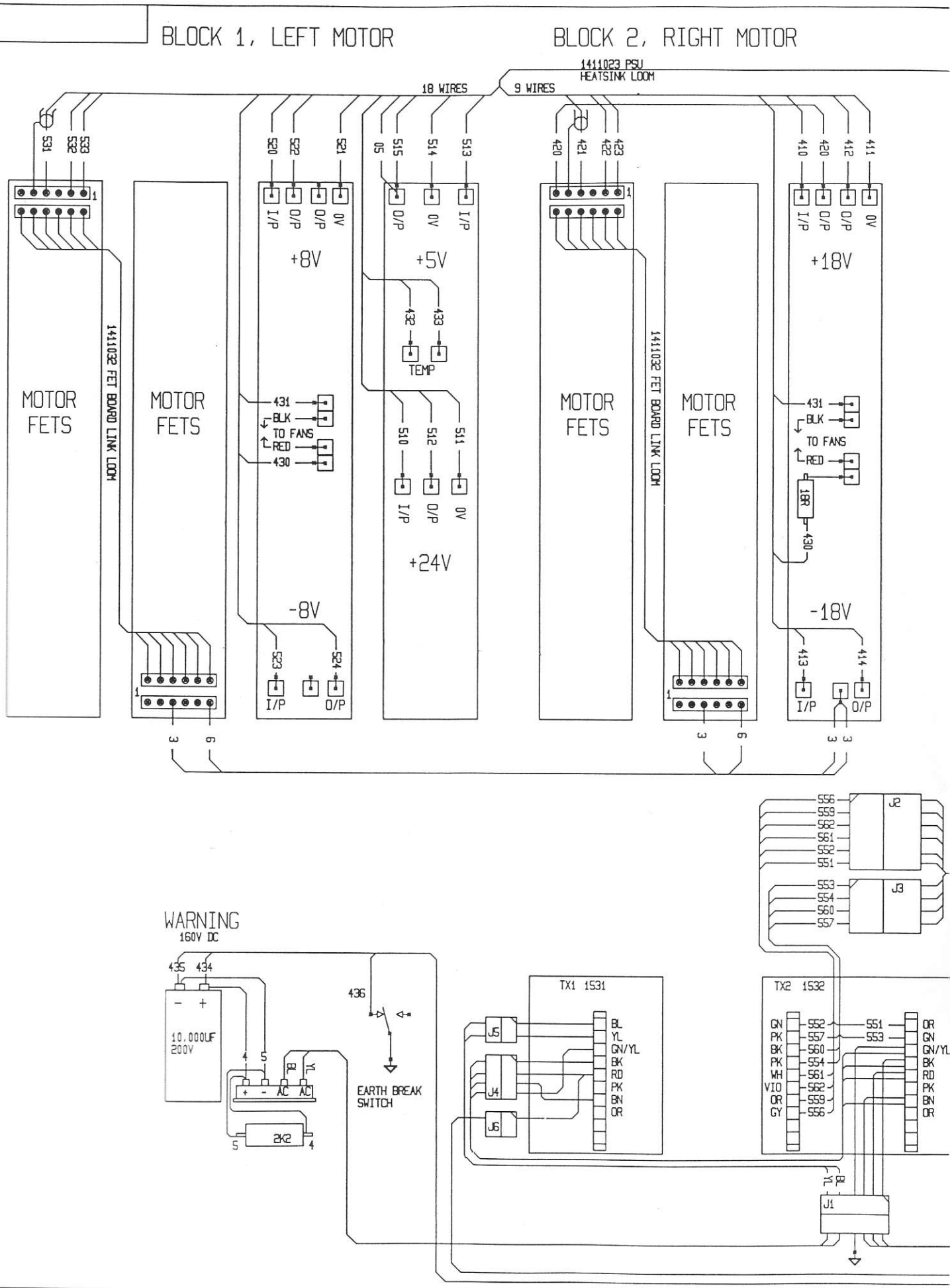

ISSUE
1: 29.3.86
2: 9.9.86
EXTERNAL PSU CONNECTIONS VIA LAZY ARM
C137K/02
TITLE
SATURN
PSU MAIN BOARD
CIRCUIT DIAGRAM
C137K/02



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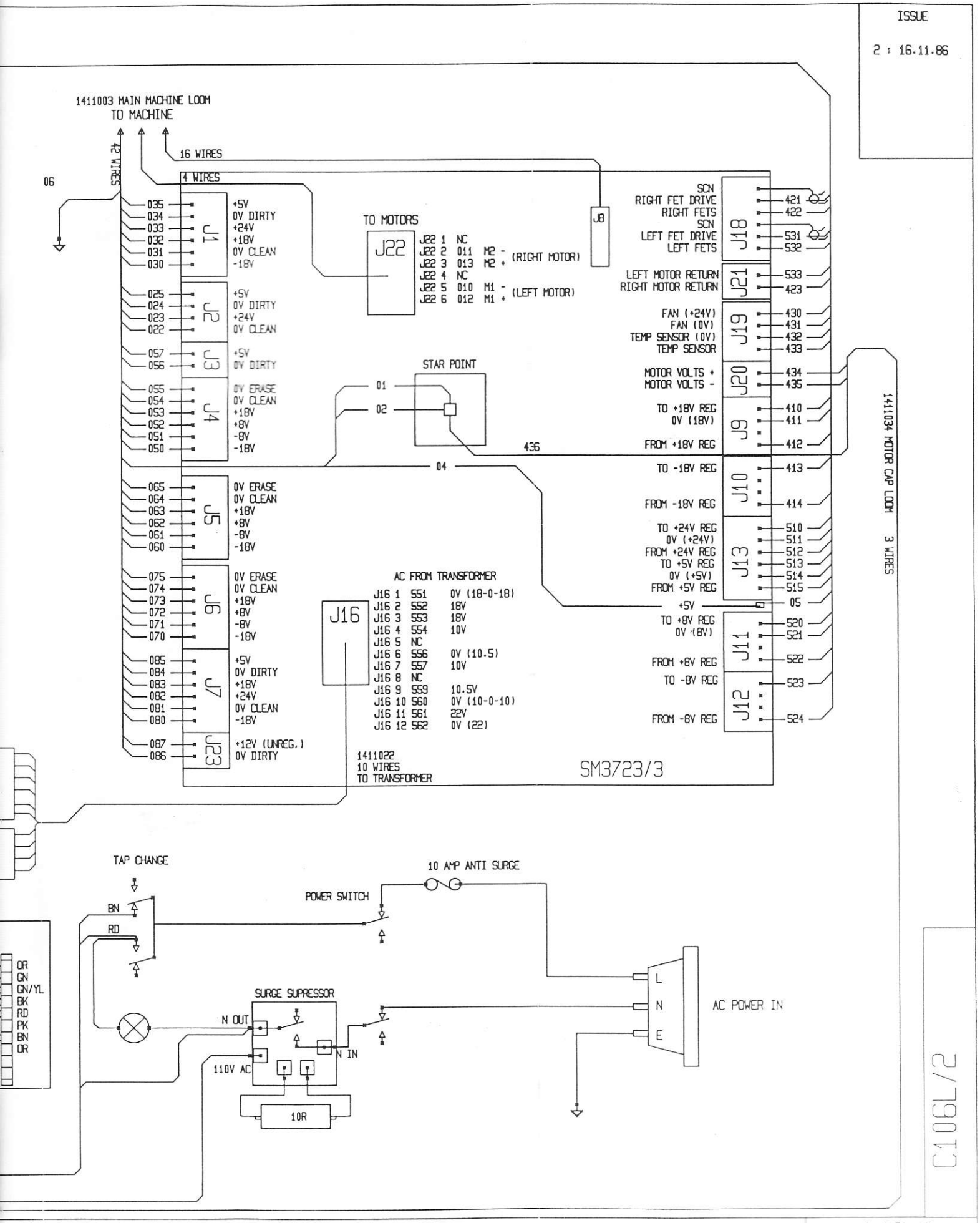
ISSUE

2 : 16.11.86



C106L/2

WARNING !

HIGH VOLTAGES WITHIN THIS UNIT

TITLE C106L/2
SATURN PSU
WIRING DIAGRAM

SOFTWARE VERSION 0.9C

Summary of changes from issue 0.99

1) UP/DOWN leds now work correctly

2) Stop key cancels recording in the audio system more quickly.

3) Stop pulse weaker. Incorrect tension settings (eg when going from tail-out to tail-in) are less likely to cause the damper arms to hit the end stops.

4) Synchroniser servo request forces "true speed" readout

5) Ready flash rate doubled. This makes it easier to confirm visually that a track is in "ready"

6) Peripheral initialisation less error prone. It should no longer be necessary to hit the reset button occasionally when the Saturn fails to "recognise" that units are plugged in.

7) Muting system changed:
   Sync only switches to input when rec/ready selected
   Sync muting as replay
   Unmute command from synchroniser only affects time code track

8) Speed reading errors when locating have been removed.

9) "Last message" can be recalled by pressing the current display selection again.
   If you hear a warning 'beep' from the remote and did not see why it occurred and if for example the unit is selected to "Audio Param" then pressing the "Audio Param" button will bring back the warning message to the display.

10) Stop key now stops the tape first time when a function key is executing.

11) Loss of tape motion now cancels record mode properly. This allows 7.5 ips recording to be reliable.
    The monostable on the Interface board controlling the detection of "motion" can be restored to its correct values
    (C42 = 0.1 R50 = 1M).

12) Locator offsets now work properly.

13) Eq errors when switching from replay to line monitor now corrected. It is no longer possible to find yourself with replay eq selected when listening to sync.

14) Eq errors when using "lift defeat" now corrected. The dimmed monitor condition is now always cancelled after using lift defeat.

15) SSL interface now works with momentary or latched inputs. See manual for details.

16) Shift- reverse play puts lifters in and head screens up in stop mode. Selecting shift - reverse play again reverts to the opposite condition.

17) "Exhibition mode" prevents recording in the audio channels. All the LED's, and audio monitoring, switch as normal.
This can also be used as a "rehearse" mode. Future releases may include this as a user feature - Suggest key??

18) Test mode 15 allows no channel to be selected for time code (use edit key)

19) Record punch in timing has been overhauled - now more consistent and quicker. See also Saturn Engineering Memo no. 21

20) Remote transport key scanning speeded up

21) Stop key will now work when another key is pressed (or even stuck).

22) Transport initialisation speeded up to ensure correct "brown out" handling. See also Saturn Engineering Memo no.20

23) Using the edit key to defeat the head screens in play mode is now a latched function. Press once to lower the screens, press again to raise.

24) "Tape Type Copy" function is implemented. Shift - audio param allows the record alignment to be copied from one tape type to another.

25) Handling of rapid changes of capstan speed is improved, especially when using 14 inch spools.

26) A simple check of the Saturn RAM is made on power up and on reset. A failure is indicated in the display but does not stop the software running.

27) Automatic Alignment of the Saturn record system is implemented.

Errors discovered.....

1) Monitor selection from the SSL interface can cause stuck key message.

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SATURN ENGINEERING MEMOS

It should be noted that the following Saturn Engineering Memos are provided for your information only, all the modifications detailed will have been carried out during the manufacture of your machine.
Any future update sheets will be automatically supplied to you either direct from us or via your local dealer as the need arises.

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SATURN ENGINEERING MEMO No1

07 Feb 1987

Subject: Punch in/out timing

It has been noticed that the time to enter record on the Saturn is too long. Software version 0.96 (and later) goes some way to reducing this time. However a full cure is only possible by modifying the audio channels

1. Fit a 330k resistor in parallel with both C60 and C61, these components are situated either side of IC15.

The audible time delay can be further reduced by speeding up the ramps on the bias and erase waveforms. This will be accompanied by a small increase in punch-in noise.

2. Remove R82 and R83 (both 330k and situated either side of IC15), and replace each with a 180K resistor.

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SATURN ENGINEERING MEMO No2

07 Feb 1987

Subject: Write Delay modification

1) With machine switched off, remove the Interface board (1009013). This is the lower of the two boards in the digital rack, which is situated immeadiatly below the audio rack. The two flat cables connected to the front edge of the board will have to be removed.

2) Carefully cut the track (on the component side of the pcb) connected to pin1 of IC2.

3) Solder a 100R resistor across track cut.

4) Solder a 1nF capacitor between pin1 of IC2 and 0V. This is best done on the component side of the board with the capacitor directly connected between pin1 of IC2 and pin10 of IC6.

5) Plug board back into the machine and re-connect cables to sockets on front edge of board.

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ENGINEERING MEMO No.3 25/02/87

SATURN TAPE LIFT MODIFICATION

It has been noticed that under certain circumstances, the operation of the Tape Lifters and Head Shield mechanisms can interfere with each other and consequently the Head Shield can clip the tape as it rises.
Obviously this is not a desired feature!
The reason for this problem is that the Head Shield at present has no way of 'knowing' the position of the Tape Lifters.
We now have available a modified Tape Lift Slide assembly, Part No.1308007, which has a microswitch fitted to it in order to cure this problem.

INSTALLATION PROCEDURE

1: TURN POWER OFF. Loosen retaining screws and raise deck

2: Remove the four M5 screws securing the Tape Lifter assembly to the Deckplate (access to these screws is easier if the Jaguar connectors adjacent are unplugged)

3: Remove entire Tape Lifter assembly taking care not to damage the heads or any wiring in close proximity

4: Unplug the Tape Lifter assembly from the Deck Distribution PCB (Jaguar connector No.3)

5: Remove both uncammed Slide Journals by removing their fixing nuts from beneath the assembly (these Journals do not have a black washer beneath their fixing nuts).
Remove the Solenoid and Lifter Pin Block from the Slide assembly taking care not to lose any components

6: Remove both uncammed Slide Journals from the new assembly and refit the Solenoid and Lifter Pin Block to the new Slide.
Refit both uncammed Slide Journals and check for smooth slide action.
If you have only removed the uncammed Journals, the original factory alignment should remain unchanged

7: Refit the modified assembly to the Deckplate

8: Refer to Deck Wiring Drawing C107L/2.
Locate wire No.1 coming from J2 to Head Shield and cut it approximatly 30cm from the Deck Distribution PCB.
Fit the supplied male bullet connector to the end coming from the Deck Distribution PCB and fit the supplied female bullet connector to the end going to the Head Shield.
connect these two connectors to their mating counterparts.
Set the switch actuator so that the switch is operated with the machine is in play.

This completes the installation procedure.

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SATURN ENGINEERING MEMO No.4 17/03/87

POWER FAIL BRAKING

It has been noticed that under certain conditions two resistors in the power fail braking circuitry (R20,R24) can burn out due to excessive loading.
At present they are 68R 2.5W wirewound types, they should be replaced with 82R 25W metal clad types mounted off board

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SATURN ENGINEERING MEMO No.5 23/03/87

SOLENOID DRIVE TRANSISTORS

Due to the extremly high gain of the Darlington solenoid drive transistors, it is possible that a potential difference between 'Starpoint' 0V and 'Local' 0V could cause the devices to be turned on regardless of actual drive condition.
The cure for this is to add a 5K6 resistor between Base and Emitter of all three devices Q2,3,4 on the Deck Distribution Board.

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SATURN ENGINEERING MEMO No.6 25/03/87

PROCESSOR CARD RAM BACKUP

Under certain conditions it is possible that the output of IC17-C pin 10 (NOT CS2) may toggle when the RAM backup battery comes into operation during power down.
This may allow spurious write operations to RAM to occur, corrupting important data.

The remedy for this is to add a 270K resistor between IC17-A pin 2 and Q4 Base.

Refer to drawing No.SM3736/CD Saturn CPU circuit diagram

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SATURN ENGINEERING MEMO No.7 25/03/87

WHISTLING CAPSTAN MOTORS

It has been noticed that some capstan motors are prone to 'whistling' at certain speeds. This noise can prove obtrusive during sessions.

To remedy this problem add a 10nF Polycarbonate capacitor in parallel with the following diodes on the Capstan Servo Board, D8, D9, D12, D13, D16, D17.

Refer to drawing No.SM3683 Capstan Servo Board.

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SATURN ENGINEERING MEMO No.8 08/04/87

SYNCHRONISER INTERFACE

When the machine is being used with an external synchroniser using FM capstan control, it is essential that the frequency modulation voltage swing is at TTL voltage level (at least 4.5v) in order for the synchroniser to control the capstan speed correctly.
Refer to section 5.2 in the operation manual

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SATURN ENGINEERING MEMO No.9 15/04/87

REMOTE CONTROL MODIFICATIONS

In certain circumstances it is possible for timing signals within the remote control unit to become out of sync with each other causing erratic operation.
The cure for this problem is to carry out the following modifications to the remote control unit.

Remove (8X) 220pF capacitors C26,27,28,29,30,31,32,33

Replace (8X) 100R resistors R40,41,42,43,44,45,46,47 with 10R resistors.

Refer to drawing No.SM3719/CD NMT REMOTE CONTROL UNIT

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SATURN ENGINEERING MEMO No.10 30/06/87

AUTO-ALIGNMENT RECOGNITION

In order for the microprocessor to acknowledge the presense of the Auto Alignment card, a small modification must be made on the Audio Control card.

Using a length of thin insulated wire, link J2 pin 17 to both sides of J2 pin 27.

Refer to Drawing No.CM117K

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SATURN ENGINEERING MEMO No.11 14/07/87

MOTION SENSE ROLLER ASSEMBLY

It has been noticed that in certain instances, the Motion Sense Roller has become loose on its shaft, this of course will at least result in tape position inaccuracy and could possibly cause severe tape damage during a wind operation.
It is therefore well worth checking that this assembly is correctly set.
To check the assembly, lift up the deck plate and hold the slotted Tacho Disk. Hold the Motion Sense Roller and feel for any rotational play in a CLOCKWISE direction, if the disk slips then you must retighten the M3 screws at both ends of the shaft. It is worth noting that the screw securing the slotted disk should be 'Loctited'
In the event that the screws are tight but the disk or roller still slips, check that the mating surfaces of the shaft and roller are free from any contamination and clean with Isopropyl Alcohol if necessary.

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SATURN ENGINEERING MEMO No.12 04/08/87

CMOS RAM TYPES

The CMOS RAM chips on the CPU card should be low power types, they can be identified by the 'LP' suffix in the type number thus: HM6264LP-15 is a low power type while HM6264P-12 is a standard power type.
Due to the difference in power drain between the two types being a factor of 10, it is possible for the Lithium memory retention battery to be drained far too quickly causing loss of important data.
With the low power types the expected life of the battery is 10 years.

Due to an oversight, a number of machines may have standard power types fitted.
If you find that your machine has standard types fitted to the CPU card please contact your dealer or the factory for further advice.

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SATURN ENGINEERING MEMO No.13 06/08/87

VARISPEED MODIFICATION

It has been noticed that there is a speed 'glitch' apparent when reverting to fixed speed from varispeed. This can be demonstrated by setting varispeed to the current fixed speed and then defeating varispeed, the speed will momentarily drop below the fixed speed causing an unpleasant pitch change.
This is caused by the operation of the speed reference detection circuitry in the PLL servo board.
Under normal fixed speed operation the speed reference is derived from the internal crystal oscillator, but under varispeed operation the speed reference is derived from an external oscillator. When the varispeed is defeated the detection circuitry detects a DC component in the internal oscillator signal and switches to external voltage control momentarily.
The easiest way to cure this problem is to inhibit the external voltage control mode by removing D5 (1N4148) on the PLL servo board.
As few systems use external voltage control this should present no problems for synchroniser use.
Refer to PLL CAPSTAN SERVO drawing.

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SATURN ENGINEERING MEMO No.14 29/09/87

PROCESSOR CARD MODIFICATION

Due to an oversight during PCB layout, there are two spare gates that have been left 'floating' on IC19 (74HC08) on the processor card.
Although this has not caused any problems to our knowledge, it is bad practice to leave these gates 'floating'.
In order to rectify this situation, link the following pins of IC19 together; 7,9,10,12,13

Refer to drawing No.SM3736/CD Saturn CPU circuit diagram

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SATURN ENGINEERING MEMO No.15 29/09/87

NOISY SPOOLING MOTORS

It has been noticed that some spooling motors are prone to 'squeaking' at certain speeds.
This noise is generally caused by sharp edges on the motor brushes where they come into contact with the commutator.
To rectify this problem the edges of the brushes need to be chamfered slightly.

In order to access the brushes follow the procedure below.

1/ Raise the deckplate

2/ Locate and remove the black cover beneath the offending motor, taking care not to strain the cables from the motor tacho sensor (four screws)

3/ Locate and carefully remove the motor tacho sensor taking care not to damage the slotted rotor vane (two screws)

4/ Locate and remove the slotted rotor vane assembly from the motor shaft (two screws)

5/ Locate and remove the knurled brass terminal screws using a large flat bladed screwdriver or a coin, at this point the brushes should drop out of their housings

6/ Using a flat file, gently chamfer all four edges of the contact end of the brush (take care not to overdo this as the brush material is quite soft)

7/ Reverse the procedure for reassembly of units

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SATURN ENGINEERING MEMO No.16 21/10/87

AUDIO CHANNEL REPLACEMENT

In certain circumstances it may become necessary to swap or replace audio channel cards within a machine. It is important to realise that by doing this, the erase amplifier and possibly the bias amplifier will no longer be correctly tuned to the heads. The usual result of this incorrect tuning is noisy 'drop in' caused by the erase amplifier going into saturation.
In order that this should not happen it is necessary to retune the erase and bias amplifiers to match the heads correctly every time an audio channel is replaced.

The retuning procedure is as follows;
You will require an audio millivoltmeter with a bandwidth of at least 3MHz, an oscilloscope and probes.

1/ Place audio channel on extender card and attatch the probe tip to the bias testpoint (TP8). The ground lead can be connected to any local ground on the audio channel (end of R25).

2/ Power up the machine and put ONLY the audio channel under test into record.

3/ Adjust L3 for maximum signal then adjust TX1 for maximum signal.
You will need to realign bias via the Alignment Panel after doing this adjustment.

4/ Transfer the probe tip to the erase testpoint (TP10) and the ground lead to erase ground (TP6).

5/ Monitor the signal on both the millivoltmeter and the oscilloscope and adjust VR4 to minimum, now adjust C68 for maximum signal. Set VR4 for a signal level of 45mV.
When the setting is correct, the signal waveform should be a reasonable sinewave. If the signal looks more like a distorted triangle then it is due to the erase amplifier saturating and the adjustment has not been carried out correctly.

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SATURN ENGINEERING MEMO NO.17 05/11/87

SUBJECT: ALIGNMENT RANGE

It has been noticed that under certain circumstances, there is insufficient adjustment range available on Sync and Repro Gain. To rectify this situation two resistors need to be changed on each Audio Card:

R38 (Sync) changed to 3K9
R55 (Repro) changed to 3K3

These values will give an adjustment range from approximatly 120 nWb/m to approximatly 680 nWb/m.

Refer to drawing No.B001/K02 Audio Channel.

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SATURN ENGINEERING MEMO No.18 17/11/87

Position Display brightness

It has been noticed that on some machines the 'Position' and 'Locate' displays can be quite dim with the individual display segments having uneven brightness.

To rectify this problem change R28 in the Remote Unit from 68K to 33K.

Refer to drawing No.SM3719/CD Remote Control Unit

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SATURN ENGINEERING MEMO No.19 27/11/87

Spool motor wiring

It has been noticed that the high transients generated when the spool motor directions are changed can induce spurious 'glitches' on the Direction line. This could cause problems when spooling.

In order to rectify this condition we are now fitting screened cables from the PSU to the Deck Distribution Board.

We will supply new cables Part No.1411039 free of charge

The new cables retrofit directly in place of the existing cables. You must also connect pins 1 and 2 of J22 on the PSU board to the 0V star point. These pins are located nearest to the 0V star point.

Refer to drawing No.SM3723

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SATURN ENGINEERING MEMO No.20 01/12/87

PROCESSOR CARD RESET

Due to various software updates, it has been discovered that the hardware reset time is too long at present.
The timing capacitor C17 should be changed from 47uF/16V to 4.7uF/16V

Refer to drawing No.SM3736/CD Saturn CPU circuit diagram

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SATURN ENGINEERING MEMO No.21 03/12/87

RECORD PUNCH-IN TIMING

Software revision 0.9C, and later, contains the results of extensive work on improving the punch in performance of the Saturn. The main benefits of this are...

Quicker response to the pressing of the record button.

More accurate timing of the bias and erase ramps.

In most applications the software update will provide perfectly acceptable performance. However in the most demanding cases, further improvements can be obtained by modifying the audio channel hardware. Refer to drawing No.B001K/04 Saturn Audio Channel circuit diagram

1. Ramp generators .. IC15

***** CHANGE R60 AND R61 to 220k *****

This reduces the time to start the ramp after the command from the shift register. Note that in current production R82 and R83 are also 220k.

Note that this supercedes Engineering Memo No.1

2. Master oscillator signal

***** REMOVE R161 *****

This raises the master oscillator signal level in Q14.

Raise the "MASTER BIAS" signal to (say) "D0" using the alignment panel controls. See section 9.1.2 in the manual.

The purpose of this is to increase the effectiveness of the DC ramp on the collector of Q14 allowing the signal ramp to start earlier.

***** CHANGE R100 to 68k *****

This restores the range of adjustment in the bias preset.

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SATURN ENGINEERING MEMO No.22 03/12/87

MONITOR SWITCHING

It has been recently noticed that a mute of approximately 20mS occurs when switching between sync and input signals and thus also during punch-in.

This does not affect all machines

It does not affect the signal on tape

In most applications this is perfectly acceptable performance. However in the most demanding cases, this can be reduced to approximately 3mS by modifying the audio channel hardware.

Refer to drawing No.B001K/04 Saturn Audio Channel circuit diagram

***** CHANGE R141,142,147 AND R150 to 120k *****

***** REMOVE R145,146,148 AND R149 *****

***** CHANGE C79,80,81 AND C82 to 10nF *****

***** CHANGE D16 AND D21 to 10 ohm resistors *****

***** INSERT 1N4148 DIODES DIRECTLY IN THE GATE LEADS *****
OF Q36 AND Q39 (AS D16 AND D21)

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SATURN ENGINEERING MEMO No.23 14/01/88

REMOTE BUS TERMINATION

In order to correctly terminate the Remote Bus, six 470R pulldown resistors need to be fitted from address lines A0 - A5 to 0V. These resistors should be fitted adjacent to J6 on the Remote Unit as follows;

A0 - J6 pin 9
A1 - J6 pin 10
A2 - J6 pin 11
A3 - J6 pin 12
A4 - J6 pin 13
A5 - J6 pin 23

Refer to drawing No. SM3719/CD

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