



This is the Master Technical Manual for the XT-24 INTELOCATOR
relating to the following machine interfaces :-

AMPEX ATR 100
AMPEX MM1100/1200
3M M79
MCI JH-16
STUDER A80

Please do not release this Master Manual to clients.

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THE AUDIO KINETICS XT-24 INTELOCATOR

This is the first INTELigent autoLOCATOR made possible by microprocessor technology. It has a programmed capacity to learn a particular tape plus transport behaviour pattern, and subsequently optimise the locate sequence.

FEATURES

- * Intelligence
- * Interfaces with Ampex MM1200 and ATR 100/104
- * Utilises two separate counters, master and intelocate, both operating in minutes and seconds
- * Four pre or immediate load memories
- * Inches per second speedometer for vari-speed reference
- * Full standard tape transport remotes with LED indication
- * Leverwheel numerics for faster location point entry with physical memory
- * High accuracy of ± 2 seconds over 30 minutes of tape at 15 ips
- * Automatic compensation for HI/LO speed change - $7\frac{1}{2}/15$ or $15/30$ ips operation available by one switch
- * Automatic master count freeze display - for logging - on tape runout

The XT 24 consists of two units, an attractive small calculator style control unit and a compact logic computer unit 'brain' housed within the multitrack tape machine. An 8 metre miniature multicore cable links the two units.

FEATURES DESCRIPTION

The unique intelligence feature of the XT 24 results in the fastest search action possible with no overshoot, it is best described by the intelocation process :

When any search function is initiated for the first time, the following sequence occurs :

- A) The display converts from real time position to a reducing countdown to the selected location point
- B) The transport wind button LEDs will indicate direction of tape, regardless of wind mode
- C) Near the location point the machine will enter a momentary slow-down phase to check the available deceleration. At this time the display will convert to GO - L or GO - 0 or GO - 1 (or 2, 3, 4) depending upon the location point selected. The hyphen between GO and the designated point will flash proportionately with tape speed.
- D) The programme now continues to search using the newly derived deceleration figure, typically speeding up again until the correct point on the tape is reached to allow constant firm deceleration to a standstill at the location point.

- E) At the conclusion of the search, the newly derived figure is stored for re-use on subsequent searches to this location.

On any repeat of this search, the above sequence will be repeated. However the computer will now have optimised the point where initial deceleration should begin. In other words it has learnt the behaviour pattern of that section of the particular reel of tape with the given tape transport.

Such optimum data is stored in the computer until :

- A) The tape is wound off the machine at high speed
- B) The power is switched off from the locator
- C) The RESET button is depressed on the control unit

Note the data will not be lost if the tape is removed from the guides for editing.

The XT 24 can intelocate to any of six aim points comprising four memories, intelocate zero and the leverwheels setting. In addition cyclic sequences can be programmed between any two of the six aim points. The programming procedure is explained in the 'Operation' section.

The XT 24 has two completely separate counters; one is the master tape timer normally with zero reference at the beginning of the tape, the other is the intelocate counter with a resettable zero enabling cyclic programming to be referenced to a local zero without affecting the master counter. Note that the XT 24 will only permit the entry of an intelocate zero 'downstream' from the master zero e.g. where the master count is zero or positive. Any attempt to enter an intelocate zero point prior to the master zero point will be rejected by the computer which will indicate that it has sensed an illegal command by displaying the message 'HUH ?'

Four memory presets are provided which can be pre-loaded via the leverwheels or directly loaded with the current tape position. Theoretically, using a microprocessor, a large number of memories could be provided. We chose four as the maximum number a normal human being can remember under session conditions. In excess of four memories would result in the memory figure having to be logged thus negating the function.

The inches per second speedometer display i.e. 15.3" enables accurate logging in order that the precise speed can be achieved again on a subsequent recording session.

OPERATION OF XT 24 INTELOCATOR

We suggest that the full facilities of the XT 24 are best explained by a description of its use.

Initial Recording Session

When the machine is switched on the XT 24 initiates the RESET condition as follows :

- a) All transport characteristic memories are set to worst case deceleration
- b) Master and Intelocate counters are set to zero
- c) The four locate memories are set to zero
- d) Cycle and Re-cycle programmes are set between intelocate zero and the leverwheel settings.

The lacing of a new reel of tape automatically enables the two counters. If reference tones are recorded at the beginning of the tape, it is useful to re-zero both counters after the tones using MASTER . SET . ZERO.

Assuming the first take is not satisfactory, tape can be conserved by simply depressing the ZERO button; the machine will then intelocate to the zero position and stop, learning that part of the tape in the process. Simple logging of the real time read-outs at the beginning of good takes will enable the engineer to review any take quickly, by setting the minutes and seconds figure into the leverwheels and depressing the LEVER button. The machine will then accurately intelocate to the beginning of the desired take.

At the end of the session the tape should be spooled off the machine tails out, the locator counter will freeze automatically and display the master count. This figure should be logged on the tape box.

Overdubbing

The previously recorded tape is re-laced on to the machine tails out. We assume a previous final readout of 32' 35". By setting 32' 35" into the leverwheels and using the sequence MASTER . SET . LEVER these figures are loaded into the master counter. In other words the master counter is defined at the end of the reel, rather than zeroed at the beginning. This eliminates the need to re-spool the tape to zero in order to make use of the logged master count figures from the original recording session.

Assume that the first take to be worked on is at 7'30". By setting the leverwheels to 7'30" and depressing LEVER the machine will intelocate to the beginning of that take. At this point we suggest using SET . ZERO which will load the intelocate zero into the display. The take is then played through, stopping at the end. The display now reads 3' 00". By loading 3' 00" into the leverwheels, the take has its lower limit 0' 00" and its upper limit 3' 00" defined for the CYCLE process. By depressing CYCLE the machine will spool back to the beginning of the take, play it through automatically (to 3' 00") and then rewind to 0' 00" and stop. If the artist or engineer wish to hear the take many times, before attempting an overdub, use of the RECYCLE button will play the take over and over until some other function is selected.

When the artist is ready to record, simultaneous depression of RECORD + CYCLE will cause the machine to record on the selected track up to 3' 00" rewind to 0' 00" automatically play the take back to you, rewind to the beginning and stop. This is fine for straight through overdubbing. However

let us assume a problem vocal overdub at the chorus section. Using CYCLE play through the take again, at the beginning of the problem area press SET . 1 and at the end of the section press SET . 2. Memories 1 and 2 are now loaded with absolute points on tape (ie Master count figures) at the beginning and end of the first chorus. Now the CYCLE facility should be re-programmed using SET . CYCLE . 1 . 2. You have not lost the beginning and end of the main take which are still 0' 00" and 3' 00", you have merely re-assigned the CYCLE programme to where it is most needed. By using RECYCLE the machine will play through the chorus continuously until the artist is happy to record. The RECORD . CYCLE facility can then be used just for the chorus. This process can be repeated for the second chorus merely by updating SET . 1 and SET . 2.

Please note that multiple memories are not necessary. We provide four but doubt that 3 and 4 will be used frequently. The CYCLE/RECYCLE facility can be reprogrammed between any of the four memories, zero and or leverwheels.

Having completed the overdubs, by using SET . CYCLE . ZERO . LEVER, the take can be finally reviewed simply.

By using SET . ZERO at the beginning of the take, we replaced the master count with the intelocate count in the display. To find the next title or take, it is necessary to restore the master count to the display. This is done by using SET . MASTER. Consequently the logged minutes and seconds figure for the next take can be set into the leverwheels and found directly by using LEVER.

Should vari-speed be required whilst overdubbing, a reference readout is available in ips, displayed by depressing SET and PLAY together. This can be logged enabling exact duplication of the vari-speed setting easily.

Mixing

The use of the XT 24 for mixing is the same as for overdubbing without the use of record. It is likely that RECYCLE will be more frequently used allowing the engineer to concentrate on the console/sounds rather than tape position. The advantages of always working to a local zero, are important, as the engineer knows at a glance his correct tape position, without mental arithmetic.

SUMMARY OF BUTTON FUNCTIONS AND OPERATION

One button sequence

MASTER	Master count displayed for 1.5 seconds - designed for check on master count whilst using the intelocate count, without having to load the master count into the display.
ZERO	Machine intelocates to intelocate zero
LEVER	Machine intelocates to leverwheel settings
1 (or 2, 3, 4)	Machine intelocates to memory 1 (or 2, 3, 4)

- CYCLE** Assume XT 24 programmed to cycle between memories 3 and 4 where memory 3 is a higher real time figure than memory 4. The machine will intelocate to memory 4, play through to memory 3, rewind to memory 4 and stop.
- RECYCLE** As cycle except programme is repeated until cancelled by any other transport command function.

Two Button Sequences

All multiple button sequences should be entered one button at a time otherwise the entry will confuse the computer and the display will show 'HUH ?'

- SET.MASTER** Enters the master count figure into the intelocate counter
- SET.ZERO** Zeroes the intelocate counter
- SET.LEVER** Enters leverwheel settings into the intelocate counter
- SET.1 (2, 3, 4)** Enters master count figure, at split second of entry, into memory 1 (or 2, 3, 4).

Three Button Sequences

- MASTER.SET.ZERO** Re-zeroes both master and intelocate counters
- MASTER.SET.LEVER** Enters leverwheel settings into both master and intelocate counters, altering master zero reference.
- MASTER.SET.1 (2, 3, 4)** Enters leverwheel settings directly into memory 1 (or 2, 3, 4). Entries relate to master count only.

Four Button Sequences

- SET.CYCLE.ZERO** (or **LEVER** or 1, 2, 3, 4). **LEVER** (or **ZERO** or 1, 2, 3, 4)
- SET.RECYCLE.ZERO** (or **LEVER** or 1, 2, 3, 4). **LEVER** (or **ZERO** or 1, 2, 3, 4)

Note **CYCLE** and **RECYCLE** share the same programming. Also they can be programmed whilst the XT 24 is making an unrelated search operation, or even performing a different **CYCLE** or **RECYCLE** sequence.

Simultaneous Two Button Sequences

Unlike any other operation of the XT 24 the following sequences are only valid when both buttons are depressed momentarily simultaneously. Either button may be depressed first.

- PLAY + RECORD** Normal record mode entered
- CYCLE + RECORD** Machine intelocates to lower parameter (1) enters record to upper parameter (2) rewinds to (1) plays to (2) rewinds to (1) and stops
- RECYCLE + RECORD** Machine intelocates to (1) records to (2) rewinds to (1) plays to (2) rewinds to (1) plays to (2) until cancelled by another transport command
- SET + PLAY** Varispeed reference display in inches per second. Note if **SET** is depressed first, existing transport or intelocation function remains undisturbed

	Speed display is cancelled by pressing any XT 24 button
STOP + 1 (or 2, 3, 4)	Temporary memory 1 (or 2, 3, 4) recall to display whilst buttons are held down
STOP + RECORD	Button LED and all display segment check for 1.5 seconds

Special Facilities Ampex MM1100/1200, ATR100/104

TILT	Re-stabilises computer if affected by external influence, e.g. unsuppressed mains pulse.
RESET	Causes all computer memories to be reset including intelligence and customer cyclic and memory programming. It need only be used if a machine/locator interface fault occurs, but it may be used on loading a new tape, as a quick alternative to MASTER . SET . ZERO

Speed display is cancelled by pressing any XT 24 button

STOP + 1 (or 2, 3, 4) Temporary memory 1 (or 2, 3, 4) recall to display whilst buttons are held down

STOP + RECORD Button LED and all display segment check for 1.5 seconds

Special Facilities 3M M79

TILT Re-stabilises computer if affected by external influence, e.g. unsuppressed mains pulse.

RESET Causes all computer memories to be reset including intelligence and customer cyclic and memory programming. It need only be used if a machine/locator interface fault occurs, but it may be used on loading a new tape, as a quick alternative to MASTER . SET . ZERO

MUTE DEFEAT This M79 "Wind Listen" function is operational on a push on/push off basis. The function is only operational in the wind modes and can be left on without detriment to other modes.

RECORD CANCEL If the PLAY button is depressed whilst the transport is in the actual RECORD mode, the record function will drop out leaving the machine in PLAY. This allows continuous drop-ins and drop-outs without having to stop the machine.

Speed display is cancelled by pressing any XT 24 button

STOP + 1 (or 2, 3, 4) Temporary memory 1 (or 2, 3, 4) recall to display whilst buttons are held down

STOP + RECORD Button LED and all display segment check for 1.5 seconds

Special Facilities Studer A80

TILT Re-stabilises computer if affected by external influence, e.g. unsuppressed mains pulse.

RESET Causes all computer memories to be reset including intelligence and customer cyclic and memory programming. It need only be used if a machine/locator interface fault occurs, but it may be used on loading a new tape, as a quick alternative to MASTER . SET . ZERO

EDIT i.e. placing the tape against the heads, can be used in three ways :-

1. At rest the EDIT function will place the tape against the heads until cancelled by STOP or any other transport command
2. During WIND, operation of EDIT will momentarily place the tape against the heads as long as the button is held depressed
3. At the end of any search sequence EDIT is automatically engaged for 30 seconds, such that any subsequent PLAY command will have a minimum start time.

'bulb' This is a displayed warning that the A80 motion sensing LEDS or bulbs have failed. It can only be cancelled by the use of 'TILT' or 'RESET' or by replacing the faulty component.

STOP + RECORD Simultaneous depression of these buttons illuminates all button LEDS and all segments of the display characters. It is strictly a test function.

	Speed display is cancelled by pressing any XT 24 button
STOP + 1 (or 2, 3, 4)	Temporary memory 1 (or 2, 3, 4) recall to display whilst buttons are held down
STOP + RECORD	Button LED and all display segment check for 1.5 seconds

Special Facilities MCI JH-16

TILT	Re-stabilises computer if affected by external influence, e.g. unsuppressed mains pulse.
RESET	Causes all computer memories to be reset including intelligence and customer cyclic and memory programming. It need only be used if a machine/locator interface fault occurs, but it may be used on loading a new tape, as a quick alternative to MASTER . SET . ZERO



Installation Instructions for the XT-24 Intelocator in use with the Ampex
ATR-100/104

On the left underside of the ATR transport there is the cage containing the logic electronics. Protruding from the right of this cage is a P.C. The top connector links to the transport controls. The lower connector is for the autolocator. Simply plug in the interface cable supplied so that the cable leads off in the same direction as the top connector, eg. to the rear of the machine.

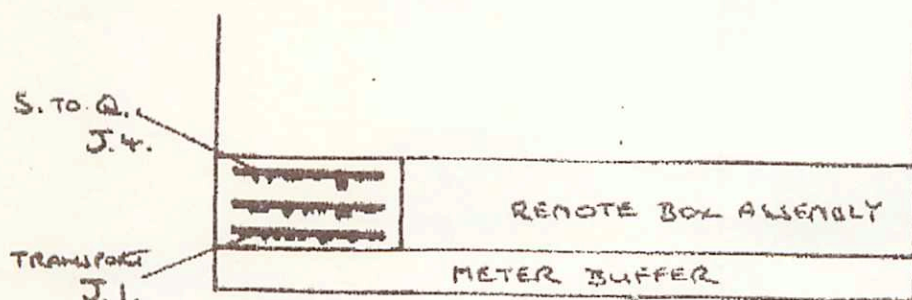
INSTALLATION INSTRUCTIONS FOR THE XT-24 INTELOCATOR WITH THE
AMPEX MM1200

1. Remove the Left Hand Side Panel from the MM1200
2. Remove the Remote Track Control Box Assembly from the MM 1200
3. Remove the Transport Control, Capstan Servo and Search-To-Cue PC cards from the Transport Control Assembly (Front left of machine under lid).
4. Remove the 4 rear mounting-screws securing the Transport Control Assembly (PC Card Cage) to the deck casting.

NOTE that access to the lower 2 securing screws is from within the deck assembly, and that these 2 lower screws double as cable harness clamps.

5. With the Meter panel fully extended, the P.C. Card Cage may now be rotated down into the area normally occupied by the Control Box Assembly. Transport control and Search-To-Cue edge connectors J1 and J4 will now be accessible from the left of the machine.
6. The supplied machine interconnect cable may now be introduced into the chassis of the machine through any convenient aperture; unless it is proposed to remove the Ampex Timer Display and Search-To-Cue in addition to the XT-24, a convenient method is as follows :-

Remove from the accessory panel on the rear of the MM 1200 the Accessory Socket together with attached sub-panel. This termination is used to extend the Ampex Timer Readout and Search-To-Cue function and is otherwise unused. Tape of this socket. Introduce the XT-24 cable through this aperture leading through with the existing harness to terminate on the edge connectors of the P.C. Card Cage.



INSTALLATION INSTRUCTIONS FOR THE XT-24 INTELOCATOR WITH THEAMPEX MM1200 continued

7. Connect the 17 required cores of the interconnect cable in parallel with the existing connections to J1 and J4 as shown below:-

J1	2	Red/Blue
	10	White/Blue
	11	Blue
	14	Yellow/Red
	20	Brown
	21	Yellow/Blue
	23	Red/Black
	25	Red/Brown
	26	Green/Red
	K	Orange
	W	Red
	Z	White/Red
	DD	Violet
	EE	Pink
	FF	Turquoise
J4	21	White.
	22	Black.

8. Re-assembly is a reversal of steps 1-5
9. Confirm that the mains voltage is indicated correctly on the exterior of the XT-24 Brain unit. If incorrect the mains tapings on the transformer inside the Brain may be adjusted as follows :-

115 vac working : remove any link 2/3 and then add links 1/3, 2/4.
 230 vac working : remove any links 1/3, 2/4 and then add link 2/3.

10. Connect the Brain to the mains a.c. outlet.
11. Switch off the MM1200 and connect the machine interconnect cable to the Brain.
12. Connect the XT-24 Controller to the Brain.
13. Switch on the MM 1200 - A relay in the XT-24 senses presence of +27v in the MM1200 and applies power to the XT-24.

NOTE this safeguard does not allow power to be applied to the XT-24 unless connected to the MM 1200 which is important when using sensitive computer circuitry. Consequently an ON/OFF switch is not required.

INSTALLATION INSTRUCTIONS FOR THE XT-24 INTELOCATOR WITH
THE 3M M79 TAPE MACHINE

A - SENSOR INSTALLATION (New Type)

1. Lift deck and unscrew (Allen Type) the retaining bolt for the transport turnaround idler - remove assembly.
2. Remove cap of idler assembly and dismantle roller from mounting shaft.
3. To minimise slippage the idler should be sand blasted to break the gloss finish, in order to improve tape adhesion. If no facilities for sand blasting exist locally, 3M UK Ltd. offer a part exchange scheme. Alternatively the idler can be replaced with a monothane coated idler now being supplied as standard by 3M USA.
4. After the above processing, select reflective disc from installation kit, peel off backing (do not bend disc), and fix to the bottom of the idler. Do not re-assemble the idler at this stage.
5. Remove trim plates. Release the lifter spring from its centre spigot at the rear of idler base position. Fit sensor assembly to machine and secure by replacing idler base on top of the sensor shim. Tighten the hex bolt of the idler base gently pulling it towards the front of the machine. Re-locate the lifter spring.
6. Remove black deck plate by removing the two rear screws and then sliding the assembly back towards the VU panel. Feed the sensor cable through the desk casting to the rear of the machine. Replace black deck plate.
7. Re-assemble turnaround idler to mounting shaft and replace trim plates.

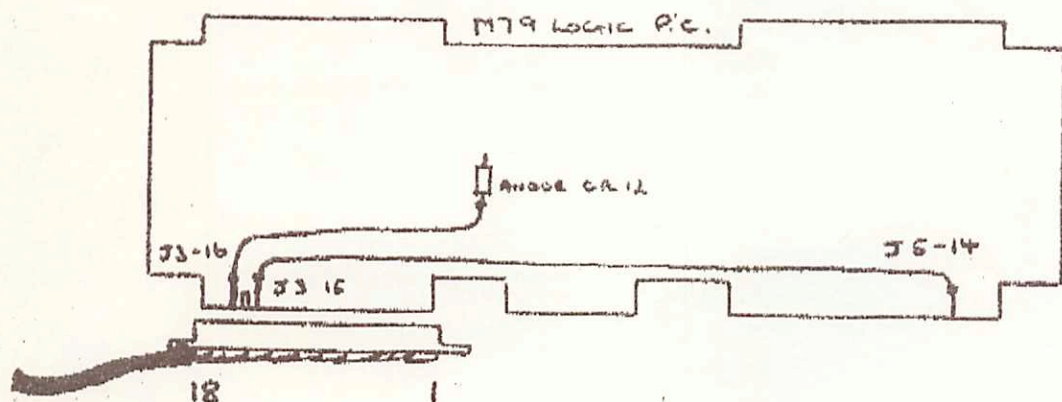
XT-24 INTELOCATOR/3M INSTALLATION continuedB - Logic Board Connections

Principal connections to the M79 are made via J3 on the M79 logic Board.

First, however, 2 terminals associated with J3 used with the 3M-company Selectake (TM) option must be revised for use with the XT-24; these two are J3-15 and J3-16 which are wire additions to the logic board.

Proceed as follows :-

1. Remove logic board for ease of working
2. Remove wire linking J3-15 to K3 terminal 4 (28 V to Selectake I)
3. Add wire linking J3-15 to J5-14 (EQ HI)
4. Remove wire linking J3-16 to R52/CR56 junction (Forward command for Slk1 I)
5. Add wire linking J3-16 to Anode of CR12

C - Interconnections

Switch off M79. The XT-24 contains sensitive circuitry which could sustain damage if connected or disconnected with power applied.

1. Select multiple cable already connected to sensor assembly and fit edge connector to J3 (Note that a keyway and identification numbers are printed on the socket and logic board for correct insertion).
2. Plug Controller cable into Computer 'Brain' unit.
3. Plug Machine cable into Brain unit
4. Connect a suitable mains connector to the 3 core captive mains cable attached to the Brain. (Brown - Live; Blue - Neutral; Green - Earth)
CHECK that the voltage available conforms with that marked on the Brain.
5. If not the mains tappings may be altered on the Brain transformer as follows :-

115 vac	Remove any link 2-3
	Add links 1-3, 2-4
230 vac	Remove any links 1-3, 2-4
	Add link 2-3

MODIFICATIONS - 3M M79

As from 14th August 1979 the following resistors have been changed in order to draw more current through the 3M M79 transport push buttons reducing the risk of bad ground continuity through worn 3M switches.

R18 from 100K to 1K

R21 from 27K to 220 ohms.

XT-24 INTELOCATOR/3M INSTALLATION continuedC - Interconnections continued

6. Connect XT-24 to A.C. power.

NOTE

+28 v derived from M79 is required to close relay within XT-24 to energise the unit. This is to protect the computer and acts in place of a mains ON/OFF switch.

7. Switch on M79; the unit should display 0.00 and no tallies. It is required that a tape be loaded and STOP selected at the M79 local control panel, before any executive commands will be available at the XT-24

D - Adjustments

No set-up is normally required, since a thorough checkout is made at the factory; however, after prolonged use or in the event of abnormally strong ambient lighting conditions certain adjustments may be necessary for optimum operation.

Proceed as follows :-

In the event of the timer stopping or slipping (especially in wind)

1. Connect a 0-5 vdc slugged analogue meter or a scope between TP0 (Gnd) and TP1. Set scope to 1 mSec/cm and 1 volt/cm.
 2. Load a full tape and enter wind mode.
 3. When the tape has reached maximum speed adjust RV1 (accessible via hole in Brain cover) for a reading of 2.5 vdc on the meter or a square wave display on the scope.
 4. Transfer meter/scope to TP2 and adjust RV2 similarly to step 3.
- The motion sensors have now been optimised for the prevailing lighting conditions.

Audio Kinetics do not recommend the recalibration of the TAPE SPEED readout since it has been set against a crystal standard during manufacture. Normally a 1% accuracy is maintained by this readout, settling to final accuracy some 5-6 minutes after switch-on. It may, however, be adjusted as follows :-

1. Depress SET and PLAY simultaneously on the controller engaging the PLAY mode. The controller will now display current tape speed until any further button is depressed on the controller.
2. Remove the brain lid and adjust, on the computer board RV1 until the desired reading is achieved.

ON NO ACCOUNT DISTURB RV2 or RV3

INSTALLATION INSTRUCTIONS FOR THE XT-24 INTELOCATOR WITH THE
STUDER A80 TAPE MACHINE

All connections to the A80 are made via the 36 way Remote Control Socket mounted at the right hand rear of the A80.

However two additional signals are required from the A80 by the XT-24, and these must be wired to spare pins 13 and 14 of the remote socket as follows :

1. Connect Pin 13 to the YBI-END signal available in the Logic Wire-Wrap Nest at EL-10 pin 6B using one of the supplied wire clips. (Tape Runout)
2. Connect Pin 14 to the YBI-LOW signal available in the Logic Wire-Wrap Nest at EL-10 pin 21A using the second supplied wire clip. (Speed Sense)
3. CHECK that the voltage supplied at the STUDER remote spare AC outlet on the right rear of the machine is the same as that specified on the XT-24 Brain Unit.
4. Should the supply voltage be incorrect, the MAINS TAPPINGS on the transformer inside the XT-24 Brain are adjusted as follows :

115 vac working : remove any link 2/3 and then add links 1/3, 2/4.

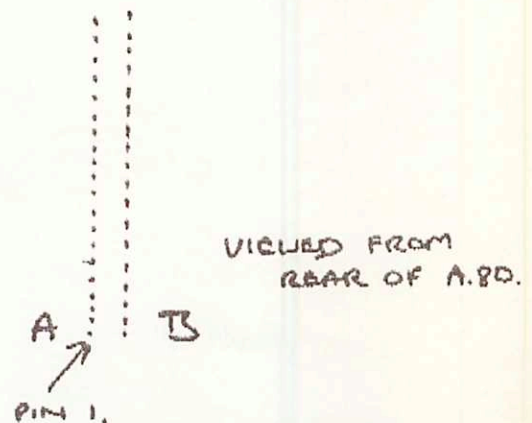
230 vac working : remove any links 1/3, 2/4 and then add link 2/3.

5. Connect the Controller cable to the Brain.
6. Connect the A80 to the XT-24 Brain.
7. Plug in to spare AC outlet on rear of A80.

NOTE That a relay within the XT-24 requires +24 vdc from the A80 to permit energising of the power unit within the XT-24. This safeguard does not allow power to be applied to the XT-24 unless connected to the A80 which is important when using sensitive computer circuitry. Consequently an ON/OFF switch is not required.

8. Switch on the A80; the XT-24 should display 0.00 and STOP. It is required that a tape be loaded on the A80 before any executive commands will be available at the XT-24.

17.



XT-24 INTELOCATOR INSTALLATION INSTRUCTIONS MCI JH-16 VERSION

Switch machine off then simply plug in 24 pin connector to J64 (Transport) on rear of machine and similarly the 12 pin connector to J65 (Autolocate).

Note:-

1. If it is desired to have the supplied MCI transport remote operational at the same time as the XT-24 remote, a 24 pin Y cord will need to be made.
2. The XT-24 has relay protection. It can only be energised by the machine being switched on.

RETENTION OF AUTOMATIC MONITOR CHANGEOVER

To retain automatic monitor changeover between play and stop, connections 2 and 21 of J.64 on the rear of the MCI transport must continue to be connected to the existing MCE transport remote panel in order to maintain power to the pinchwheel sensing relay mounted thereon. These connections are in addition to the connections newly made to the XT-24.

PARALLEL OPERATION WITH MCI REMOTE UNIT

The MCI remote unit presently connects any de-activated commands to +22v and conflict occurs if the XT-24 attempts to pull such a line to a -15v active condition.

The following modification to the MCI remote unit amends its action by permitting any de-activated command line to float.

The following applies to the MCI remote controls Rewind, Forward, Stop, Play. Not the record control.

- 1) Remove link 1-3 from each control.
- 2) Move remote command line from Pin 1 to Pin 3.

Operation of the remote tally bulbs imposes an additional load on the lamp drivers within the MCI machine, and may cause impaired operation of the XT-24 by apparent momentary loss of all tally at mode transitions. This state is interpreted as a 'Runout' condition by the XT-24, which will cancel any current search or cycle function. This situation may be avoided by adding a 1.5K $\frac{1}{2}$ w resistor to ground from each tally bus in the MCI remote unit. A convenient point to each tally is pin A of the associated mode control switch.

ADJUSTMENTS TO THE XT-24 INTELOCATOR

No set-up is normally required, since a thorough checkout is made at the factory; however, after prolonged use the following one adjustment may be deemed necessary.

Speed Readout/Adjustment

Engage PLAY mode, and simultaneously depress PLAY and SET on the XT-24 Controller. The display will now show current tape speed until any further button is depressed at the XT-24 Controller.

Normally a 1% accuracy is maintained by this readout, settling to final accuracy some 5-6 minutes after switch on.

AUDIO KINETICS do not recommend re-calibration of this readout, since it has been set against a crystal standard during manufacture; it may however, be adjusted as follows :

Remove the Brain cover and adjust trimmer RV1 on the computer board (The lower of the two boards) until the desired reading is achieved.

ON NO ACCOUNT DISTURB THE SETTINGS OF RV2 and RV3

XT-24 INTELOCATOR - M79 VERSION DIAGNOSTIC PROGRAM

This is a self-test routine built into the M79 Software. It is intended to totally check the operation of the control box. However, it should be borne in mind that as it is part of the program, catastrophic program failure may either make it impossible to 'access' the routine or may indeed 'corrupt' the diagnostic routine itself.

It may thus be regarded as a facility to give confidence to the operator that all is as it should be despite problems he may be experiencing due to unfamiliarity.

Entering the Diagnostic Routine

Since the purpose of the routine is to check the operation of the controller in the event of a suspected malfunction, it is obvious that no one particular button must be required to gain access, in case that button is the faulty one.

Consequently, it is arranged that in a condition of tape runout the depression of any XT-24 button will effect entry to the diagnostics. Since it may be useful to be able to enter with a tape loader, it is further arranged that the 'SET: LEVER' command will perform the entry function if the levers are in the all-zero position. Note that this does not preclude the entering to the counter of an all-zero figure, since this is covered by the 'SET : ZERO' command.

Display in Diagnostics

At entry, all tallies are extinguished apart from that of the button used to gain access; in this routine all tallies are arranged to alternately energise with successive depressions of the related button, although without the 'debounce' processing normally carried out in the remainder of the XT-24 program.

If a lamp test (Record + Stop) has been carried out prior to diagnostic entry, this alternate action facility can quickly isolate any faulty button.

The numerical display meanwhile gives a direct readout of the leverwheels, and may hence be used to show that the computer is correctly interpreting the setting of the leverwheels.

XT-24 Functions whilst in Diagnostics

All command functions of the unit are suspended while running in diagnostic mode, such that any button may be depressed without engaging the appropriate mode.

However, the tape counter remains in operation so that positional information is maintained if diagnostics are entered with the transport in a wind (or even a search) mode.

It should be noted, however, that if a search is in progress during the diagnostic operation, no 'SLOW DOWN', 'STOP' etc. instructions will be issued until the unit is returned to normal operation.

XT-24 INTELOCATOR - M79 VERSION DIAGNOSTIC PROGRAM - continuedExit from Diagnostics

This may be achieved in a number of ways:

- 1) By loading a tape (that is, by leaving a runout condition)
- 2) By depressing the TILT button
- 3) By arranging that all tallies are extinguished except STOP.

It should be noted that however the exit is achieved, it will be controlled by the program in such a way as to cause no alteration to machine status, i.e. Exit by pressing the STOP button will not cause the machine to stop.

Memory Readout during Tape Runout

Since during Runout conditions depression of any button causes entry to the Diagnostics, it might be thought impossible to read out memory contents (Stop+Mem1, 2, 3, 4). However, bear in mind that at entry all tallies are extinguished save the one associated with the operated button, consequently, the intelocator will enter and immediately exit the diagnostics if entry is performed by STOP during runout.

With STOP still depressed, a subsequent depression of the desired mem button will accomplish the desired readout.

In short, runout will have no effect on the ability to read out memory contents.

TROUBLE SHOOTING THE XT-24 INTELOCATORGeneral

The engineer should be aware of the three 5 volt monolithic regulators in the equipment; U18 and U19 on the computer board and U11 on the controller sub-board.

At commencement of any fault finding, confirm the presence of +5 volts from the two regulators in the computer with the controller and interface board first disconnected and then re-connected.

Repair or replace PSU components as necessary.

THENA - Computer Board Check

1. Disconnect controller and interface board
2. Jumper J1-12 to J1-11 (RESET N.C. to GROUND)
3. Check RST signal (U7-40) low for $\frac{1}{2}$ second approximately at switch on, then high; if this condition is not satisfied, probable U15 or U17 fault.
4. Check for an approx 1 KHz waveform at U13-18; if not present, probable U15 fault.
5. Check for narrow (20-50 μ Sec) pulses at approx 1 KHz repetition rate present at U13-7/8/9; isolated failure at any pin indicates probable U13 fault; total absence indicates probable clock or program fault. If O.K. go to step 7.
6. Check for 1 MHz square wave at U8-10, U7-3/36/37; partial failure indicates U17 fault; total failure indicates U16 fault.
7. Check that U12-2 thro' U12-7 are high; any failure indicates U12 or program fault.
8. If no faults remain at this stage, the computer board is probably functional.

B - Controller Checkout

1. Remove jumper added in step A2, and reconnect controller to computer unit.
2. Check that pressing 'RESET' on the controller causes U7-40 on computer board to go low until button released; failure indicates cable or computer U14 fault.
3. Check that pressing "TILT" on controller causes computer U14-3 to go low until button released; failure indicates cable or computer U14 fault.
4. If no characters are displayed at all, check for function of +5 volt regulator within controller (U11) or cable fault not delivering 10 volts unregulated to the regulator. If O.K. suspect U9 or U10 (character drivers).
5. If display present with some missing or additional segments :-
 - a) Same segment missing from each character indicates cable fault carrying appropriate data, or LED driver fault U5/U6/U7/A 8
 - b) Segment differences between characters indicate LED failure within the display chips.

NOTE :- RECORD and STOP simultaneously depressed is programmed to illuminate every button and display LED in the controller.

TROUBLE SHOOTING THE XT-24 INTELOCATOR continuedB - Controller Checkout continued

6. Suspected button or leverwheel malfunction :-
- Check for narrow (20-50 μ sec) pulses at controller J1-1/2/14; some waveform degradation is tolerable; isolated failure indicates cable fault.
 - Check that by operating tens of minutes of leverwheels from 0-9 causes an identifiable change to the waveforms on J1-8/9/10/16; any failure indicates leverwheel or U3/U4 fault.
 - Check that operating single minutes leverwheel from 0-9 causes an identifiable change to the waveform on J1-3/13/14/15; any failure indicates leverwheel or U1/U2 fault.
 - Check that operating each button as indicated in TABLE 1 causes an identifiable change in the waveform on the indicated J1 pin. Failure indicates button or defined chip fault.

TABLE 1

BUTTON	CHIP INVOLVED	SIGNAL NAME	J1 PIN
PLAY ZERO	U1	PB0	3
STOP LEVER		PB1	13
RECORD MEM. 1	U2	PB2	14
FORWARD MEM. 2		PB3	15
REWIND MEM. 3	U3	PB4	16
EDIT (M.D) MEM. 4		PB5	8
CYCLE MASTER	U4	PB6	9
RECYCLE SET		PB7	10

7. Any remaining fault is probably in the machine interface board (AK 2404 or 5) or in the cable to the machine.

TROUBLE SHOOTING THE XT-24 INTELOCATOR - continuedC - Machine Interface Board - Ampex MM1200

The board functions may be split into three categories; input; output and interrupt.

1. INPUT

Signals from the PLAY, STOP, RECORD, FWD and RWD indicator busses in the MM1200 arrive on-board via Ribbon connectors 27, 29, 33, 37, 41 and are applied to resistive dividers R1/2, R3/4, R5/6, R7/8 and R9/10.

Approximately 4 volts of signal is developed across the lower half of each divider when the mode is inactive, falling to zero when the mode is active. These attenuated signals are applied via Ribbon connectors 30, 32, 34, 36 and 38 to high impedance input pins PB0 through PB4 on the computer board.

Other status information presented to the computer includes end-of-tape status and machine speed selection. These signals arrive via Ribbon 1 and 5 and pass through isolation diodes D1, D2 to pull-up resistors at pins 1, 13 of U4, a resistor network.

The resultant 0-5 volt signals are passed to inputs 11 and 3 of U6, a CMOS AOI chip configured to selectively pass either these runout and speed signals or another two status signals; Range and Override Detect (See 'output' section for description of Override Detect).

Range is at a zero level when set to handle a machine operating at $7\frac{1}{2}/15$ ips, and a 5v level when set for a 15/30 ips machine. U6, the AOI chip, passes the selected pair of signals, as detailed above, via inverter/buffers U2-11/10 and U2-9/8 and Ribbon connectors 26, 28 to TTL inputs PA6, PA7 on the computer board. The command signal to U6 to select the appropriate signal pair comes from control output CA2 on the computer board, via Ribbon 14 to pins 2, 12 of U6. U8-2/1 inverts the command signal and applies this to pins 4, 10 of U6.

Two TTL level inputs remain to be covered; these are the DIRECTION and TACH signals. Resistive pull-ups at the input points of these signals (Ribbon 35, 31) optimise signal characteristics after passing down the machine connector cable. The DIRECTION signal is inverted by U2-1/2 and applied as count up/count down control to counter U5. After re-inversion in U2-3/4 and pull-up treatment to ensure a 0-5v signal swing, the signal passes via Ribbon 42 to high impedance input PB6 on the computer board.

The TACH signal after inversion in U2-5/6 is applied as the clock signal to U5. A signal at 1/8 TACH rate is fed from U5 with pull-up to ensure 0-5v level via Ribbon 44 to high impedance input PB7 on the computer board.

TROUBLE SHOOTING THE XT-24 INTELOCATOR continuedC.Machine Interface Board - Ampex MM1200 continued2. OUTPUT

Via Ribbon 12, 16, 18, 20, 22, 24, computer board outputs PA0 through PA5 may individually or in combination go active low, causing inverter outputs of U9 CMOS, to drive open-collector TTL inverter U10 active low, thus requesting action of the MM1200 via Ribbon 3, 11, 15, 19, 23, 25. These commands are inhibited during an END OF TAPE situation or during OVERRIDE DETECT.

Override Detect

AOI chip U7, with inverters in U8 and D3, 4, 6, 7, 8 resolves command contention problems as follows :-

The XT-24 is designed to drop out of any search, cycle or transport requesting mode, upon detection of a command not originating within the computer. Assume that an MM1200 mode button of the Ampex SEARCH-TO-CUE accessory requests a RWD function by pulling down the RWD command lines at some time when the XT-24 is not requesting this mode. At this time PA4 inactive high will be priming one input (pin 3) of AOI chip U7. The low-going external request will be transferred via D3 to inverter U8-5/4 which will complete the AND pattern at U7-4 and generate a low at U7-15, which may be monitored by the computer via the U6 selector circuitry.

3. INTERRUPTS

To conserve the limited processing time available in any real time microcomputer system, the program does not routinely examine the state of the mode every so often; rather it expects the interface circuit to tell it that a status change has occurred, and only then updates its internal status memory by looking at the tally inputs. Parity trees U1, U3 achieve this 'excuse me' or INTERRUPT function.

Examining the interface diagram it will be noted that U1 monitors DIRECTION, DIVIDED TACH, STOP and RECORD tallies. U1-4 will change state when any one of these inputs changes. This causes rapid status updates by the following reasoning :

- a) Neither WIND modes nor PLAY mode needs monitoring since DIVIDED TACH changes for every $\frac{1}{2}$ inch of tape motion.
- b) Theoretically the argument in a) could be extended to RECORD; however the XT-24 is capable of interfacing to machines other than the MM1200 where such rapid motion indications are not available, and in order rapidly to signal a change from PLAY to RECORD the RECORD tally is monitored.

TROUBLE SHOOTING THE XT-24 INTELOCATOR continuedC. - Machine Interface Board - Ampex MM1200 continuedInterrupts continued

c) During a WIND to STOP transition, the STOP tally does not appear until the 1200 has sensed a change in direction, so monitoring DIRECTION alone should be sufficient to update STOP tally status. However, as in case b) the XT-24 can be interfaced to machines employing similar logic but whose direction sensing is not synchronous with timer information, and for this reason the STOP status is monitored.

Pulse Forming

U1-4 is connected directly to U1-1 and via delay network R12/C3 to U1-2. U1-3 normally low then pulses high for a few microseconds at each transition of U1-4 and is applied via Ribbon 46 to interrupt input CBI on the computer board. Similar arguments hold for U3.

TROUBLE SHOOTING THE XT-24 INTELOCATOR continuedC - Machine Interface Board - 3M M79

The board functions may be split into three categories; input, output and interrupt.

1. Output

Via ribbon cables 12, 16, 18, 20, 22 and 24, output pins PA0, PA1, PA2, PA3, PA4, and PA5 on the computer board may individually or in combination go active low, causing inverter U1 to present active highs from pins 15, 12, 10, 6, 4 or 2 to NPN mode driver transistors Q6 through Q1. This action causes an active pull down to ground via isolation diodes D10 through D5 of the tape machines mode control lines, hence instigating the required mode.

These commands are inhibited whenever the computer is aware of a tape runout condition or depression of any button on the M79 or its no.1 remote unit, or in the event of failsafe (Tape loaded but no mode engaged).

During runout, pressing any XT-24 button engages a diagnostic test programme which may be used to give the operator confidence that the XT-24 is operational. Full details of this routine are given in the section DIAGNOSTICS.

During failsafe or depressed M79 button conditions, any transport request issued at the XT-24 gives a special display of 4 dashes to represent the absence of button ground chain continuity. This display will persist until the button ground is restored by releasing all M79 buttons with some mode engaged.

During normal operation, each transport command issued at the XT-24 will generate an output pulse of approximately 120 mSec wide; the length of the pulse may vary slightly, since the programme continues to output the command for an interval after it has detected the presence of the appropriate tally.

The mute defeat output is in reality identical to the lifter reverse control on the no.1 remote unit, and operates as follows:-

Output CB2 active high on computer board is routed via ribbon 48 to U2-6. U2-5 is a priming input required for activation of the external circuitry, and is active high if either the REW or FORW tally busses are active low. At this time, U2-4 active low is inverted by U6-2/3 and presented as an active high signal at Q7.

Q8 driven by Q7 then pulls up the mute defeat line via buffer resistor R28 to the 28 v level from the M79.

Although the external action is restricted to wind modes, a permanent XT-24 tally input is arranged by looping CB2 to PB5 which is arranged to function as a tally input similarly to normal transport mode tallies.

TROUBLE SHOOTING THE XT-24 INTELOCATOR continuedC - Machine Interface Board - 3M M79 continued2. Input

Tappings are made to the PLAY, STOP, FOR and REW mode busses and applied to resistor dividers R1/R2, R3/R4, R7/R8 and R9/R10. The RECORD tally input via Ribbon 33 is similarly applied to the R5/R6 divider.

Approximately 4 volts of signal is developed across the lower half of each divider when the mode is inactive; this drops to ground when the mode is active. The attenuated signals are applied via Ribbon 30, 32, 34, 36 and 38 to high impedance input pins PBO through PB4 on the computer board.

Four more input signals must be catered for; selected speed pair (range), tape runout, selected speed and button ground chain. These signals differ from the mode tallies in being either ground or open circuit.

They are applied via buffering resistors R19, R20, R21, and protection diodes D11, D12, D13 (or directly in the case of range) to pull up resistors R15, R16, R17, R18. Signals of 5 volts or approximately 1 volt are hence presented to the inputs of U7, a CMOS dual AND-OR-INVERT chip connected to select one or other pairs of inputs via inverter buffer segments of U6 and Ribbon 26, 28 to TTL compatible input pins PA6, PA7 on the computer board.

Selection of the appropriate pair is by program control via output pin CA2 on the computer board connected via Ribbon 14 to the select inputs of U7. U6-14/15 is used to derive complementary select signals; U6-9/10 inverts the runout signal to ease program requirements.

The tape motion sensor comprises 2 infra-red emitting diodes driven via current limiting resistor R35, whose interrupted output is picked up by 2 photo-darlington sensors receiving the reflection from a segmented reflective disc mounted under the turn-around idler on the M79. The optimum loads for the 2 sensors are obtained by adjustments to RV1, RV2 while observing test points TP1, TP2 accessible from the outside of the computer unit; square waves should be optimised with the transport running at full wind speed.

3. Interrupts

To conserve the limited processing time available in any real-time micro-computer system, the program does not routinely examine the state of the mode tally inputs every so often; rather, it expects the interface circuit to tell it that a status change has occurred, and only then updates its internal status memory by looking at the tally inputs. Parity trees U3, U4 achieve this 'excuse me' or INTERRUPT function.

TROUBLE SHOOTING THE XT-24 INTELOCATOR continuedC - Machine Interface Board - 3M M79 continuedInterrupts continued

Examining the M/c interface diagram, it will be noted that U3 monitors the two tape motion sensors and the stop and record mode tallies. U3-3 will change state when any one of these inputs changes. This causes rapid status updates by the following reasoning :-

1. Neither wind modes or play modes need monitoring, since timing waveform changes occur for every 0.375 inches of tape motion.
2. Theoretically, the argument in 1 could be extended to Record; however the XT-24 is capable of being interfaced to machines other than the M79, when such rapid motion indicators are not available, and in order to rapidly signal a change from Play to Record the Record bus is monitored.
3. Now consider the case when a tape is decelerating under influence of a wind mode; if STOP is selected when the tape has just come to rest, a good chance exists of the tape coming to rest with no further updates of the timer waveform, and of the computer continuing to believe that a wind mode is current. Consequently the STOP mode is monitored also.
4. Suppose that the machine is in RECORD and that STOP is then selected; if both tallies change at the same time, it is conceivable that U3-3 remain undisturbed. Consequently, the RECORD tally to U3-6 is slugged by C2 to establish a time difference.

Pulse Forming

U3-3 is applied directly to U3-12 and indirectly via low pass filter R25/C3 to U3-13. U3-11 normally low then pulses high for a few microseconds at each transition of U3-3, and is applied via Ribbon 46 to INTERRUPT INPUT CB1 on the computer board.

Similar arguments hold for U4.

TROUBLE SHOOTING THE XT-14, XT-24 FOR ERRATIC MODE BEHAVIOUR

A recent modification circulated by the 3M Company intended to eliminate "Logic Dropout" has caused some unexpected effects to occur in the field in particular, erratic behaviour of an XT-14 or XT-24 autolocator may result if connected to a so modified M79.

If fully implemented, e.g. 47 ohm isolating the mode flip-flops and 1K2 ohm in place of 2K7 ohm in certain resistor locations within the flip-flops, difficulty can occasionally be experienced in deselecting some modes. This tendency is increased if the mode button lamps have failed. A further undesirable effect is that RECORD is not now inhibited in fast wind modes.

If the XT-14 or XT-24 occasionally does not respond to Stop or Change of command, the M79 Logic Board should be checked to see if the modification has been carried out. This can be seen if the tracks immediately above the autolocator connector have been scratched and a 47 ohm resistor bridged across the gap.

If the modification has been done, install 22 ohm resistors in place of the 47 ohm resistors. Also check that R28 is 2K7 ohm and change if necessary.

A detailed argument for these changes is appended.

Assume that M79 is in REWIND and that FORWARD is required.

The changeover sequence is :

- 1) FORWARD mode bus is pulled toward ground by button or remote command.
- 2) If more than 30 mA is pulled, Q16 collector drops toward ground, Q19 cuts off and Q18 cuts on. Note that Q17 is still cut off by inhibit from REWIND bus via CR17.
- 3) FORWARD bus via CR15 resets REWIND FLIP-FLOP, removing inhibit on Q17.
- 4) Q17 latches via Q18, R52, R47 path.
- 5) Button or remote command is released.

Computer controlled tests using a standard Audio Kinetics XT-24 running a special test program on a typical M79 without 47 ohm isolating resistors showed that button or remote commands may safely be released some 20 mSec after depression . (18 mSec gave problems of no changeover perhaps once in 30 times). At no point, with commands down to 1 mSec in duration, did dropout occur. 10 metres of multicore cable of capacitance 390 pF/metre connected to the selectake input (J3) were used to input the commands.

A conservative minimum command duration of 30 mSec may thus confidently be recommended. (It may be noted in passing that the XT-24 gives a normal command duration of 125 mSec).

Now examining the mode changeover action with the full modification installed, we start with the following assumptions :

- 1) 0.3 volts exists across a saturated transistor.
- 2) 0.7 volts exists across a conducting P-N junction (diode or base-emitted junction).
- 3) A transistor is fully cut off if less than 0.5 volts is applied Base to Emitter.

Assume that again we wish to transfer from Rewind to Forward mode.

Let us further assume that a solid-state pulldown comprising an NPN transistor and series blocking diode is used to perform the pull-down. 1 volt will be dropped across the pull-down combination.

30mA must be sunk to gain control of the flip-flop, and this must be pulled through the new 47ohm isolating resistor. The voltage drop across the 47ohm resistor at 30mA will be 1.41 volt. Added to this 1 volt across the pull-down sink we see that the lowest voltage that can be achieved at the mode bus (junction of Q16/17) is 2.41 volts.

Now the maximum voltage at Q13 base to release the Rewind mode is 0.6v (Q13 B-E) + 0.7v (CR9) = 1.3 volts.

This will be achieved if the voltage at the R36/R41 junction is no greater than

$$\left[0.6 \left(\frac{1.2 + 0.51}{0.51} \right) \right] + 0.7 = 2.71 \text{ volts.}$$

Now the minimum voltage available from external pull-down applied to the cathode of CR15 has been shown to be 2.41 volts, and hence the minimum voltage that can appear at the anode of CR15 (which is the R36/41 junction) will be 2.41 + 0.7 = 3.11 volts.

This has been shown to be inadequate to safely release the Rewind flip-flop.

In practise, what this implies is that Q13 is close to cut-off and is capable of only carrying a few mA. Consequently, the load imposed by the mode indicator bulbs is adequate to pull up Q13 collector and remove the Q17 inhibit- however, if the bulbs have blown, it is likely the Q13 collector remains low.

If 22ohm instead of 47ohm are used for isolation, the minimum voltage achievable at the R36/R41 junction becomes 2.36 volts, which is satisfactorily lower than the 2.71 volt maximum required.

TROUBLE SHOOTING THE XT-24 INTELOCATOR - continuedC - Machine Interface Board - Studer A80

The board functions may be split into three categories; input, output and interrupt.

1. Output

Via ribbon cables 12, 16, 18, 20, 22 and 24, output pins PA0, PA1, PA2, PA3, PA4 and PA5 on the computer board may individually or in combination go active low, causing inverter U1 to, present active highs from pins 15, 12, 10, 6, 4, or 2 to NPN mode driver transistors Q6 through Q1. This action causes an active pull down to ground via isolation diodes D10 through D5 of the tape machines mode control lines, hence instigating the required mode.

These commands are inhibited whenever the computer is aware of a tape runout condition or depression of any A80 button.

During normal operation, each transport command requested of the XT-24 will only be sent to the A80 if an examination by the XT-24 of the mode tallies returning from the A80, indicates absence of the requested mode. ie if the A80 is in PLAY, a PLAY command entered at the XT-24 controller will not result in an active low at Q6, the play driver. Conversely, a RECORD command will result in an active low at both Q6 and Q4 (Record Driver) until both tallies are detected by the XT-24. To avoid latch-up in the event of a tally circuit malfunction, any command will be automatically terminated after a period of some 120 mSec regardless of tally information.

Direction Sense Safety Circuit

Early models of the A80 were fitted with incandescent light sources for the motion/timer sensors; in the event of failure of these sources the A80 was arranged to flash its mode tallies by periodic interruptions to the B-IND supply. The XT-24 monitors the state of B-IND (Ribbon 43, R29/R30, U6-3/2, Ribbon 48, computer input CB2) and upon detection of a flash condition clears and inhibits any XT-24 command action and brings up the message 'bulb'. In this condition, normal operation may only be restored by depressing 'TILT', 'RESET' or curing the fault condition.

2. Input

A80 Tallies B-REPR, B-STOP, B-REC, B-FORW and B-REW arrive on the interface board via Ribbon 29, 31, 33, 37, 41 and are applied to resistor dividers R1/R2, R3/R4, R5/R6, R7/R8, R9/R10.

Approximately 4 volts of signal is developed across the lower half of each divider when the mode is inactive; this drops to ground when the mode is active. The attenuated signals are applied via Ribbon 30, 32, 34, 36 and 38 to high impedance pins PB0 through PB4 on the computer board.

TROUBLE SHOOTING THE XT-24 INTELOCATOR continuedC - Machine Interface Board - Studer A80 continued2 Input continued

4 more input signals must be catered for; selected speed pair (Range), tape runout, selected speed and button ground chain. These signals differ from the mode tallies in being either ground or open circuit.

They are applied via buffering resistors R19, R20, R21 and protection diodes D11, D12, D13 (or directly in the case of Range) to pull up resistors R15, R16, R17, R18. Signals of 5 volts or approximately 1 volt are hence presented to the inputs of U7, a CMOS dual AND-OR-INVERT chip connected to select one or other pairs of inputs via inverter buffer segments of U6 and Ribbon 26, 28 to TTL compatible input pins PA6, PA7 on the computer board.

Selection of the appropriate pair is by program control via output pin CA2 on the computer board connected via Ribbon 14 to the select inputs of U7. U6-14/15 is used to derive complementary select signals; U6-9/10 inverts the runout signal to ease program requirements.

The timer stepper motor drives M4-1 and M4-3 arrive via Ribbon 23, 27 and are attenuated by dividers R13/R14 and R11/R12. Any overshoots present from reactive motor loads are clamped by diodes D1, D2, D3 and D4, and the resulting 0-5 v signal is fed via ribbons 44 and 42 to computer input pins PB7, PB6 and test points TP2, TP1

3 Interrupts

To conserve the limited processing time available in any real-time microcomputer system, the program does not routinely examine the state of the mode tally inputs every so often; rather it expects the interface circuit to tell it that a status change has occurred, and only then updates its internal status memory by looking at the tally inputs. Parity trees U3, U4 achieve this 'excuse me' or INTERRUPT function.

Examining the M/c interface diagram, it will be noted that U3 monitors the two motor drive waveforms and the STOP and RECORD mode tallies. U3-3 will change state when any one of these inputs changes. This ensures rapid status updates by the following reasoning :-

1. Neither WIND mode needs monitoring since timing waveform changes occur at least every 7.5 inches of tape, which is quickly covered at normal wind speeds
2. The same argument covers transitions from WIND to PLAY.
3. STOP to PLAY is rapidly indicated by monitoring STOP status.
4. PLAY to RECORD is rapidly indicated by monitoring RECORD status.

TROUBLE SHOOTING THE XT-24 INTELOCATOR continuedC - Machine Interface Board - Studer A80 continued3 Interrupts continued

5. Note that if the A80 is in RECORD and a STOP command is issued, it would be possible for the machine to come to rest without change in the timer waveforms. If the RECORD tally drops off simultaneously with the appearance of the STOP tally, it is conceivable that U3-3 remain undisturbed. Consequently, the RECORD tally to U3-6 is slugged by C2 to establish a time difference.

Pulse Forming

U3-3 is applied directly to U3-12 and indirectly via low-pass filter R25/C3 to U3-13. U3-11 normally low then pulses high for a few microseconds at each transition of U3-3, and is applied via Ribbon 46 to INTERRUPT INPUT CBI on the computer board. Similar arguments hold for U4.

TROUBLE SHOOTING THE XT-24 INTELOCATOR - continuedC - Machine Interface Board - MCI Machines

The board functions may be split into three categories; input, output and interrupt.

1. Input

Tappings are made to the PLAY, STOP, RECORD, FORWARD & REWIND tally buses via ribbon connectors 27, 31, 33, 37, & 39 and applied to resistor dividers R11/R12, R23/R24, R8/R9, R19/R20, & R5/R6.

Approximately 4 volts is developed across the lower half of each divider when the mode is inactive; this drops to ground when the mode becomes active. Safety resistors R7, R18, R10, R25, & R13 maintain the signal high in the event of machine tally bulb failure.

The attenuated signals are fed to high-impedance inputs of the computer via ribbon connections 30, 32, 34, 36, & 38.

The 'Range' input at Ribbon 2 is either open circuit or shorted to ground and with the action of pull-up resistor R14 a signal of either 5 volts or zero volts is fed via ribbon 26 to TTL - similar input PA6 of the computer.

Four inputs remain to be covered: UP, DOWN, COUNT & SPEED. These differ from the foregoing inputs in that they swing symmetrically by +/- 15 volts around ground; the two diodes and two resistors associated with each of these inputs modify the signal swing to lie within the limits of 0 - 5 volts.

2. Output

Six commands are required to be issued by the XT-24; these are PLAY, STOP, RECORD, FORWARD, REWIND, & LIFT DEFEAT.

Via Ribbon Connectors 12, 16, 18, 20, 22, & 24, computer outputs PA0, PA1, PA2, PA3, PA4, & PA5 may individually or in combination go active low which, via series limiting resistors R28 to R33, will cause the appropriate PNP Transistors from the Q1 to Q6 group to go into saturation. The Darlington Output drivers in U2 will be turned on as selected via limiting resistors R35 to R40 and the appropriate command line will be pulled down to - 15 volts.

Each command issued by the XT-24 takes the form of a pulse approximately 125 milliseconds in duration, unless superceded by a newer command, in which case the length may be reduced. The only exception to this is the LIFTER Command, which remains active until released.

The absence of all mode tallies is treated as a run-out signal by the XT-24 and at this time all output commands are inhibited. Note that this condition will occur if the MVC mode of WIND is selected at the machine; any button depression at the XT-24 while MVC is active will hence cause entry to the Diagnostic Routines. (Q.V.) Occasionally, difficulty in restoring control to the XT-24 may be experienced after using the MVC Mode; the remedy in this case is to depress the local machine buttons once or twice.

TROUBLE SHOOTING THE XT-24 INTELOCATOR - continuedC - Machine Interface Board - MCI Machines continued3. Interrupts

To conserve the limited processing time available in any real-time microcomputer system, the programme only infrequently examines the state of the input information, and as the response to certain input signals must be rapid, it falls to the input circuitry to 'tell' the computer that an important new signal has arrived. These 'excuse me' or interrupt signals are generated by the exclusive - OR circuitry of U1.

It is characteristic of the 'exclusive OR' element that a change on either of its inputs will cause a change at the output. Consequently, when any of the monitored conditions of speed selection, range selection, record mode, or stop mode undergoes a change, either Pin 4 or Pin 10 of U1 will change state.

Let us consider the case when Pin 4 changes; the change is transferred directly to Pin 2 and via a short delay network to Pin 1. This causes the two inputs at Pin 1 and Pin 2 to differ for a few microseconds, and during this condition the output at Pin 3 will be high; as soon as the delay has terminated, the two inputs will again be the same and the output will return low.

AUDIO KINETICS (UK) LTDXT-24 CONTROLLER CABLE

25 Way D Series Plug connector - 8 Metres of 25 Way Minature Cable -
20 Way Jermyn Red Plug

<u>D Connector Plug</u>		<u>Jermyn Plug</u>	<u>Core Function</u>
1	RED	5	PA 7
2	BLUE	1	PA 5
3	-	-	(PA 3)
4	YELLOW	7	PA 1
5	-	-	-
6	BLACK	10	PB 7
7	BROWN	8	PB 5
8	VIOLET	15	PB 3
9	ORANGE	13	PB 1
10	-	-	-
11	<u>SCREEN</u>	12	GROUND
12	GREY	17	RESET N.C
13	RED/BLUE	11	+10 V.UNREG.
14	GREEN/RED	2	PA 6
15	-	-	(PA 4)
16	WHITE/RED	6	PA 2
17	RED/BLACK	4	PA 0
18	-	-	-
19	YELLOW/BLUE	9	PB 6
20	WHITE/BLUE	16	PB 4
21	BLUE/BLACK	14	PB 2
22	ORANGE/BLUE	3	PB 0
23	YELLOW/GREEN	18	RESET N.O.
24	WHITE/GREEN	19	TILT N.O.
25	ORANGE/GREEN	20	TILT N.C.

Assembly Notes

1. A strain relief grommet should be threaded onto the cable before attaching the Jermyn 20 way connector. The relief sleeve towards the centre of the cable.
2. The screen connection to the D Plug should be made with a length of 7/.2 cable and NOT directly to the pin.
3. Leave 3" of the cores showing before the connection to the Jermyn Plug. I.e. strip back cable 3½"

TAKE CARE on 2 & 3 when connecting the screens to the link wire. If the screen is twisted tight around the multicores burning can result when the twisted screen is tinned. This can be avoided by untwisting the screen as it leaves the sheathing AFTER the original twisting.

AUDIO KINETICS (UK) LTDXT-24 AMPEX MACHINE CABLE 1100/1200 Version

25 Way D Series Socket Connector - 4 Metres of 25 Way Miniature Cable -
Pre-Tinned ends.

<u>D Connector Socket</u>		<u>Function</u>	<u>Edge Conn.</u>
1	Red	Runout ?	J1-W
2	Blue	Speed ?	J1-11
3	-		
4	-		
5	-		
6	-		
7	Brown	Lift :	J1-20
8	Mauve	Stop ?	J1-DD
9	Orange	Record ?	J1-K
10	Pink	Forward ?	J1-EE
11	Turquoise	Rewind ?	J1-FF
12	-		
13	Red/Blue	M/C 28v	J1-2
14	Green/Red	Play :	J1-26
15	Yellow/Red	Ground	J1-14
16	White /Red	Forward :	J1-Z
17	Red/Black	Stop :	J1-23
18	Red/Brown	Rewind :	J1-25
19	Yellow/Blue	Record :	J1-21
20	White/Blue	Play ?	J1-10
21	Blue/Black	Tach ?	J4-22 *
22	Orange/Blue	Direction ?	J4-21 *
23	-		
24	-		
25	-		

? = Tally to XT

: = Command from XT

AUDIO KINETICS (U.K.) LTD.Revision 1 ; 22.1.80.Ampex MM1200/1100 Machine cable for XT24 Intelocator.

<u>D Connector Socket.</u>	<u>Colour.</u>	<u>Function.</u>	<u>Edge Connector.</u>
1	Red.	Runout?	J1-W.
2	Blue.	Speed?	J1-11..
3	-		
4	-		
5	-		
6	-		
7	Brown.	Lift:	J1-20.
8	Violet.	Stop?	J1-DD.
9	Orange.	Record?	J1-K.
10	Pink.	Forward?	J1-EE.
11	Turquoise.	Rewind?	J1-FF.
12	-		
13	Blue/Red.	Machine 28V.	J1-2.
14	Green/Red.	Play:	J1-26.
15	Yellow/Red.	Ground.	J1-14.
16	White/Red.	Forward:	J1-Z.
17	Red/Black.	Stop:	J1-23.
18	Red/Brown.	Rewind:	J1-25.
19	Yellow/Blue.	Record:	J1-21.
20	White/Blue.	Play?	J1-10.
21	Black.	Tach?	J4-22*
22	White.	Direction?	J4-21*
23	-		
24	-		
25	-		

? = Tally to XT.

: = Command from XT.

Parts Required for Manufacture:

- 1 Cannon 'D' 25 Way Socket Connector.
- 1 Cannon 'D' 25 Way Connector Shell.
- 4m.20 Way Standard Screened Cable.
- 2 5mm Hellerman Sleeves.

Strip back outer casing and screening braid for 15cm. at machine end. Sleeve exit of cores from outer sheath at both ends of the cable.

AUDIO KINETICS (UK) LTDXT-24 AMPEX ATR 100/104 MACHINE CABLE

25 Way D Series Socket - 3 Metres of 25 Way Miniature Cable.
 - 28 Way P.C. Connector.

<u>D Socket</u>	<u>28 Way P.C.</u>	<u>Function</u>
1 RED	4	Runout ?
2 BLUE	M	Speed ?
3 -	-	-
4 -	-	-
5 -	-	-
6 -	-	-
7 BROWN	D	Lift :
8 VIOLET	6	Stop ?
9 ORANGE	B	Rec ?
10 PINK	V	Forward ?
11 TURQUOISE	18	Rewind ?
12 -	-	-
13 RED/BLUE	20	+ 20 v
14 GREEN/RED	16	Play :
15 YELLOW/RED	U	Ground (0 v)
16 WHITE/RED	22	Forward :
17 RED/BLACK	12	Stop :
18 RED/BROWN	21	Rewind :
19 YELLOW/BLUE	3	Record :
20 WHITE/BLUE	2	Play ?
21 BLUE/BLACK	N	Tach ?
22 ORANGE/BLUE	L	Direction ?
23 -	-	-
24 -	-	-
25 -	-	-

? = Tally to XT

: = Command from XT

Assembly Notes

1. Sleeve stripped back multicore before attaching to P.C. Connector.
2. Sleeve all terminations to 28 Way P.C. Connector leading cable in from A end. Allow a little slack on multicores.
3. Tie wrap cable to P.C. Connectors through hole at A end of connector.
4. Whilst looking at the face of the D Socket Connector with the cable towards the floor, assemble the connector into the shroud so that pins 1 - 13 (the longer row of pins) are on the left.

28/11/77

AUDIO KINETICS (UK) LTDXT-24 3M Machine Cable

25 Way D Series Connector - 2 Metres of 15 Way Miniature Cable - 18 Way P.C. Conn.
 Socket - 3 Metres of 4 Way Standard Cable - Sensor Assembly P.C.

<u>D. Socket</u>	<u>18 Way P.C.</u>	<u>Sensor P.C.</u>	<u>Core Function</u>
1 Red	16		Un-record (anode Cr.12)
2 Blue	6		Forward
3 Green	1		Button Ground
4 Yellow	11		Runout
5 White	15		Speed c/o (J5.14)
6 -	-		-
7 -	-		-
8 -	-		-
9 Orange	5		Record Indicate
10 -	-		-
11 -	-		-
12 -	-		-
13 Red/Blue	14		Machine 28 v.
14 Green/Red	7		Rewind
15 Yellow/Red	2		Ground
<u>+ BLUE</u>		B	Ground
16 Pink	3		Record
17 Turquoise	10		Stop
18 Grey	9		Play
19 <u>GREEN</u>	-	G	Sensor 1
20 <u>YELLOW</u>	-	Y	Sensor 2
21 -	-		-
22 -	-		-
23 <u>RED</u>	-	R	Leds
24 -	-		-
25 Black	4		Mute Defeat

Assembly Notes

1. Underlined Colours refer to standard 4 way cable for connection to sensor assembly P.C.
2. Hellerman or Shrink sleeve all terminations to 18 way P.C. connector
3. 15 way multicore should lead out from pin 18 side of P.C. connector, and be secured, using a cable tie, through unused connector fixing hole.
4. Cable tie 4 and 15 way cables together every 9 inches from D connector stopping 9" before 18 way P.C. connector.
5. Fit polarising key between pins 15 and 16 of 18 way P.C. connector.

AUDIO KINETICS (UK) LTDXT-24 STUDER MACHINE CABLE

25 Way D Series Socket Connector - 2 Metres of 25 Way Miniature Cable -
36 Way Amphenol Side Entry Plug

<u>D Connector Socket</u>		<u>Amphenol Plug</u>	<u>Core Function</u>
1	RED	25	S-EDIT
2	BLUE	21	S-FOR
3	GREEN	19	REM-IN
4	YELLOW	13	YBI-END *
5	WHITE	14	YBI-LOW *
6	-	-	-
7	-	-	-
8	VIOLET	4	B-PLAY
9	ORANGE	6	B-REC
10	PINK	3	B-FOR
11	TURQUOISE	2	B-REW
12	GREY	7	B-CUT
13	RED/BLUE	18	M/C 28v
14	GREEN/RED	20	S-REW
15	YELLOW/RED	36	FRAME GROUND
16	WHITE/RED	24	S-REC
17	RED/BLACK	23	S-STOP
18	RED/BROWN	22	S-PLAY
19	YELLOW/BLUE	34	M4-1
20	WHITE/BLUE	35	M4-3
21	BLUE/BLACK	5	B-STOP
22	-	-	-
23	-	-	-
24	WHITE/GREEN	1	B-IND
25	-	-	-

AUDIO KINETICS (UK) LTD. - XT-24 MCI J11-16 MACHINE CABLE

25 Way D Series Socket Connector - 3M 15 way miniature multicore
 To 24 pin 'Jones' plug
 3M 4 way standard multicore
 To 12 pin 'Jones' plug

	<u>D Connector Socket</u>	<u>24 pin Jones</u>	<u>12 pin Jones</u>	<u>Core Function</u>
1.	-	-	-	-15V
2.	Red	1	-	
3.	-	-	-	
4.	-	-	-	
5.	Blue	9	-	Rew:
6.	Green	13	-	Rec:
7.	Yellow	12	-	Play:
8.	<u>RED</u>	-	9	Speed?
9.	White	8	-	Rec?
10.	Black	4	-	Rew?
11.	<u>BLUE</u>	-	7	Up? (count)
12.	<u>GREEN</u>	-	6	Timer? (pulse)
13.	Brown	2	-	+22V
14.	-	-	-	Ground
15.	Violet	20	-	+15V
16.	Orange	3	-	Lifter:
17.	Pink	19	-	Forward:
18.	Turquoise	10	-	Stop:
19.	Grey	11	-	Play?
20.	Red/blue	7	-	Stop?
21.	Green/Red	6	-	
22.	-	-	-	
23.	Yellow/red	5	-	Fwd?
24.	<u>YELLOW</u>	-	8	Down? (Count)
25.	-	-	-	

? = Tally to XT
 : = Command from XT

Assembly Notes

1. Whilst looking at the face of the connector with the cable towards the floor, assemble the D connector into the shroud so that pins 1 - 13 (the longer row of pins) are on the left.
2. Underlined colours refer to Standard 4 way cable for termination to 12 way Jones plug.
3. Cable tie the 4 and 15 way cables together every 9 inches from D connector stopping 12 inches from the two Jones plugs.



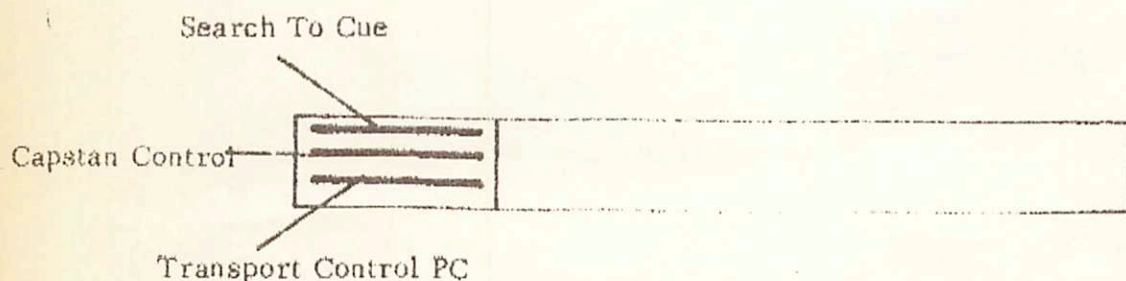
Guide to Demonstrating the XT-24 Intelocator with the Ampex
MM 1100/1200 Multi-Track Tape Machine

1. If the unit is to be demonstrated on an MM 1100, check that the machine is fitted with a Search to Cue PC Card and associated Tacho.
2. Remove Search to Cue PC and the Transport Control PC.
3. On the Search to Cue PC solder the blue/black wire to Pin 8 A1 and the orange/blue wire to the plated through hole by R7, as shown on the attached illustration. Alternatively, the blue/black wire may be connected to Pin 22 of the PC Connector and the orange/blue wire may be fitted to Pin 21 of the PC Connector.

(The blue/black wire conveys Tacho information and the orange/blue wire conveys direction information.)

4. Replace Search to Cue card.
5. Insert pre-wired Extender Card in normal Transport PC position adding the Transport PC on top. Please note orientation of PC Connector numbering.

The machine can now be switched on and a demonstration given.

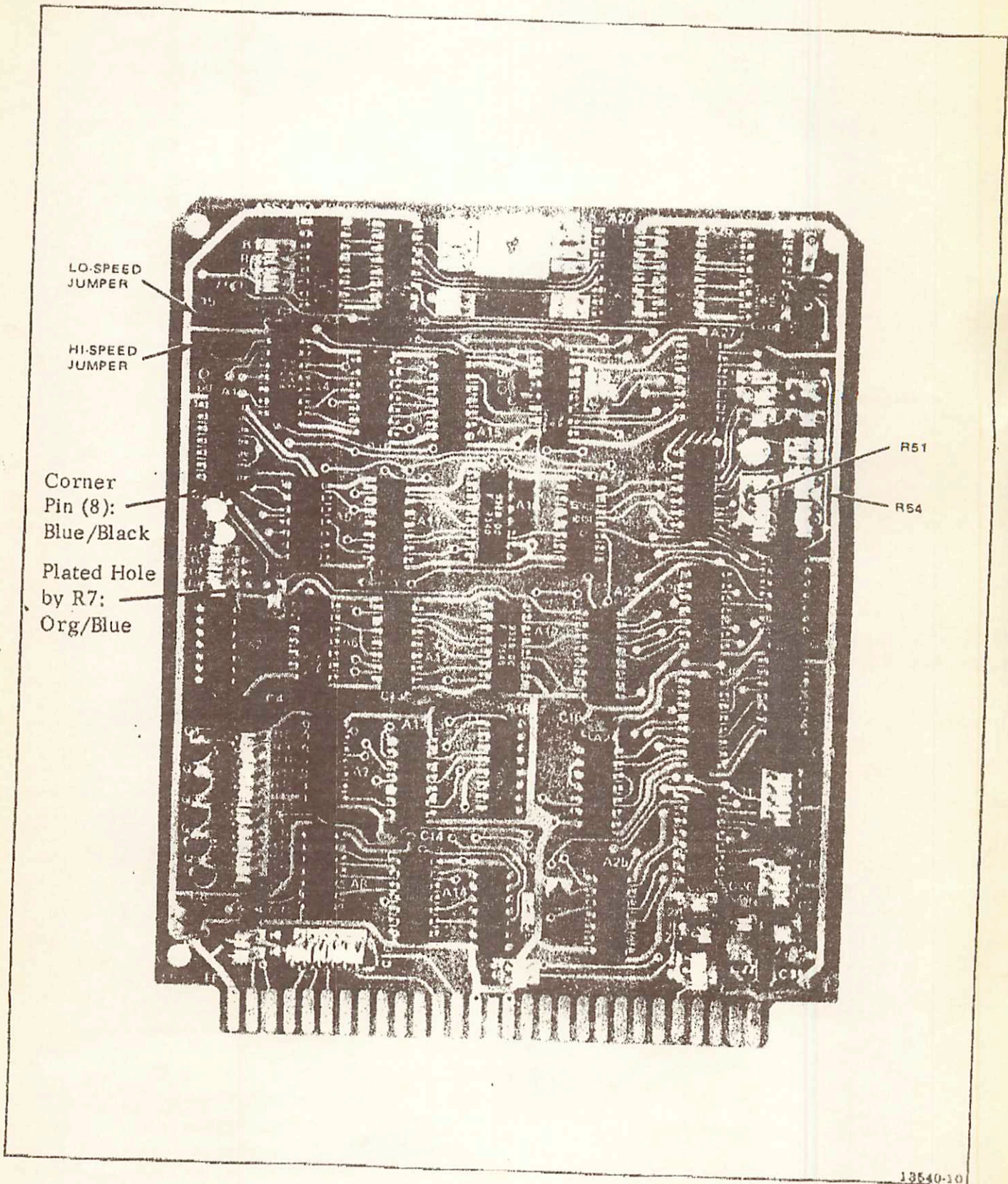


October 1978

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Verulam Road
St. Albans AL3 4DH
England
Tel: St. Albans 32191
STD Code 0727

Telex 299951



13540-10

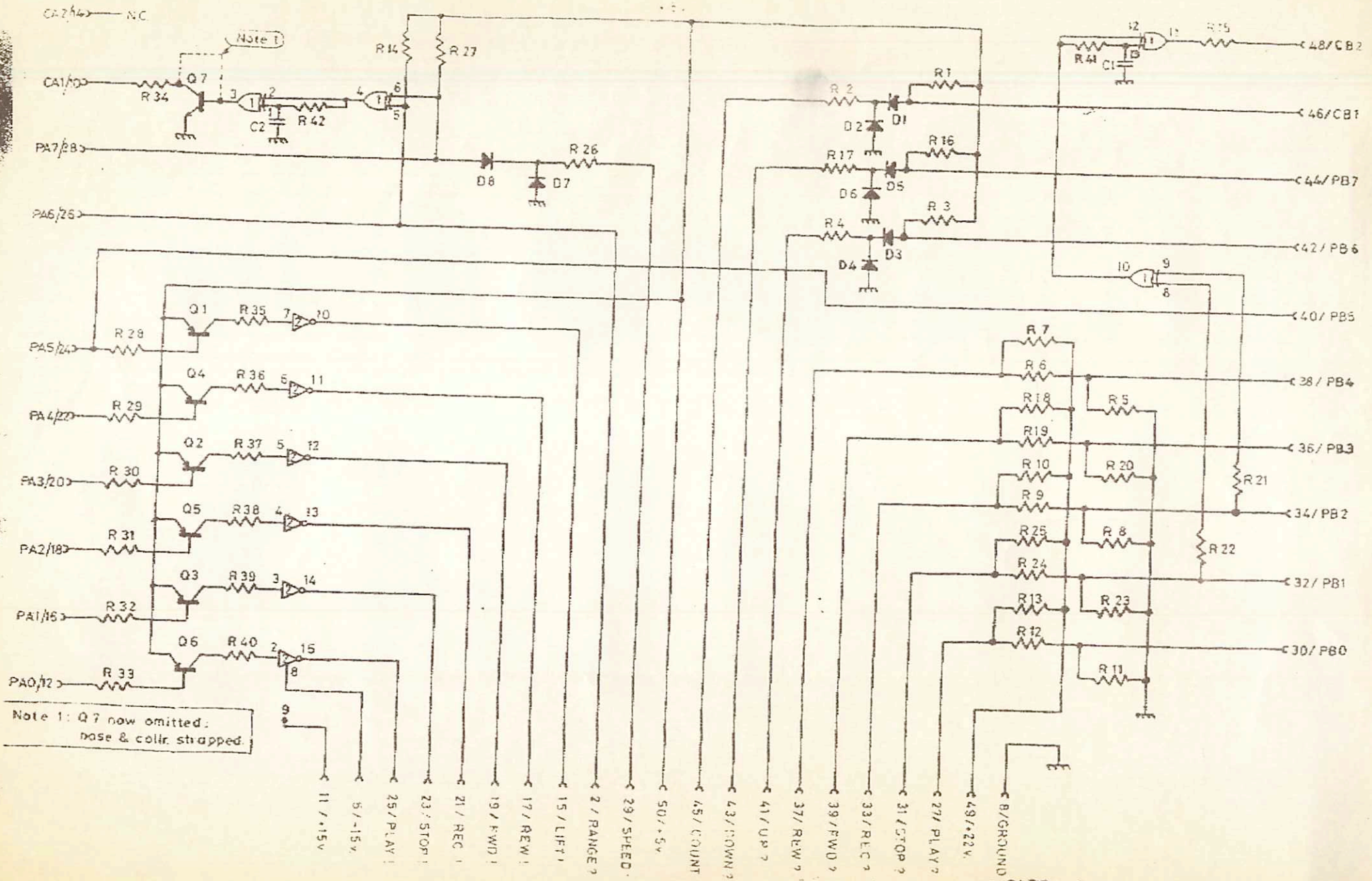
Figure 2-4. Search-to-Cue and Tape Timer PWA

AMPEX 4890400 01

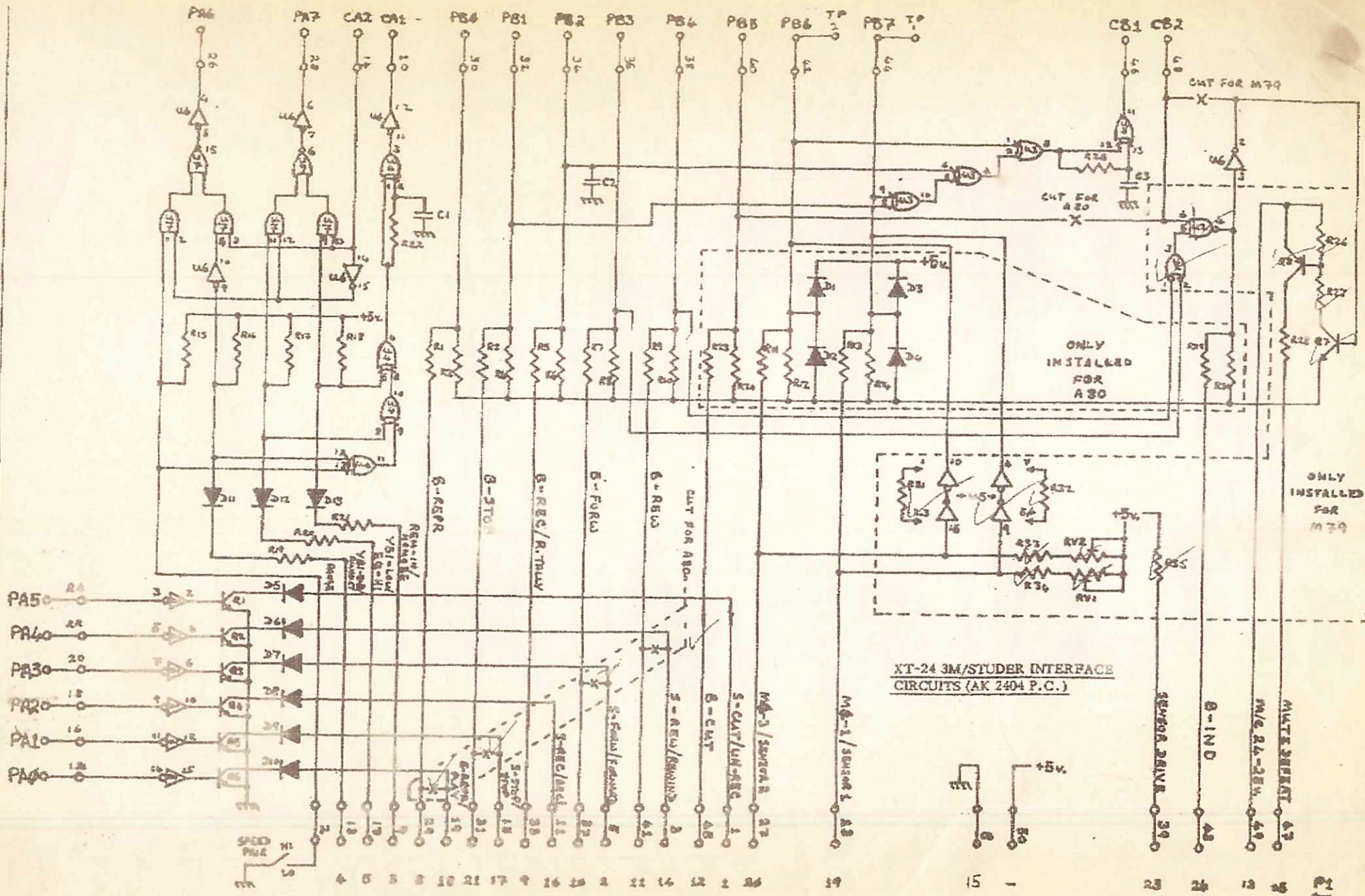
2-5/6

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XT-24: MCI 1/0 BOARD (AK 2407)



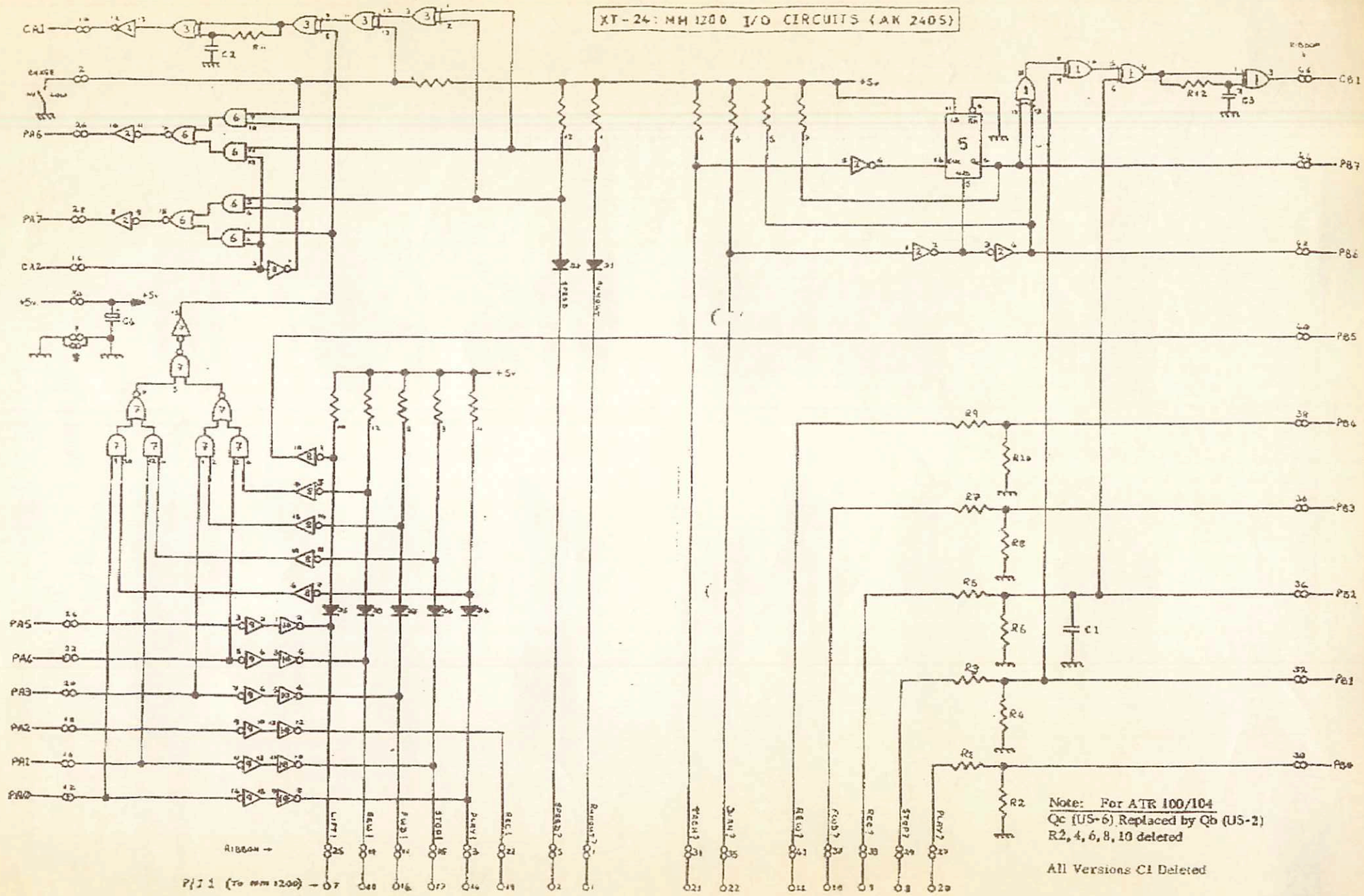
Note 1: Q7 now omitted. base & collr. strapped.



XT-24 3M/STUDER INTERFACE CIRCUITS (AK 2404 P.C.)

05-28-85 08:48 T-AUDIO KINETICS 0000 #575 -51

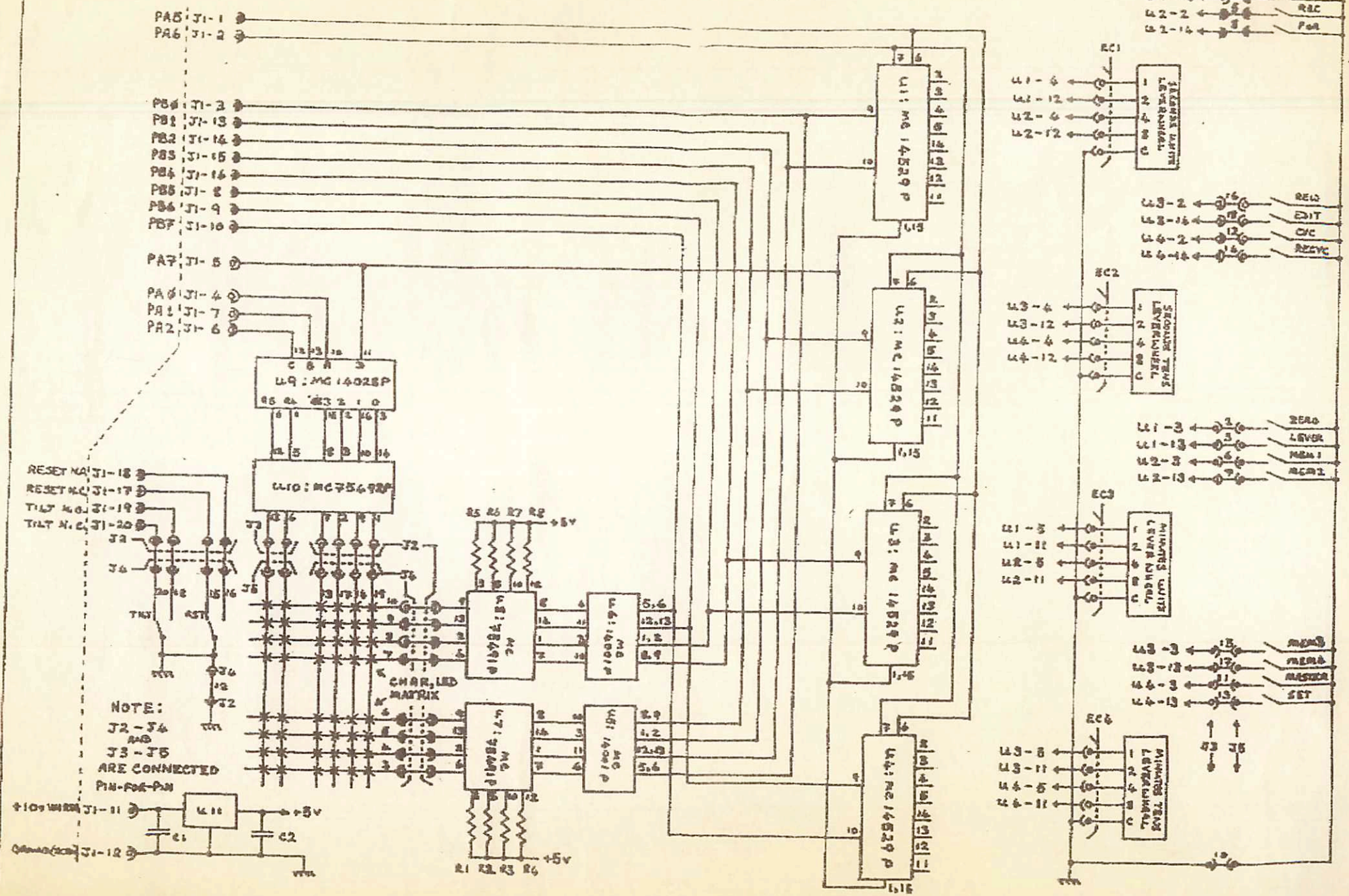
XT-24: MM 1200 I/O CIRCUITS (AK 2405)



Note: For ATR 100/104
Qc (US-6) Replaced by Qb (US-2)
R2, 4, 6, 8, 10 deleted

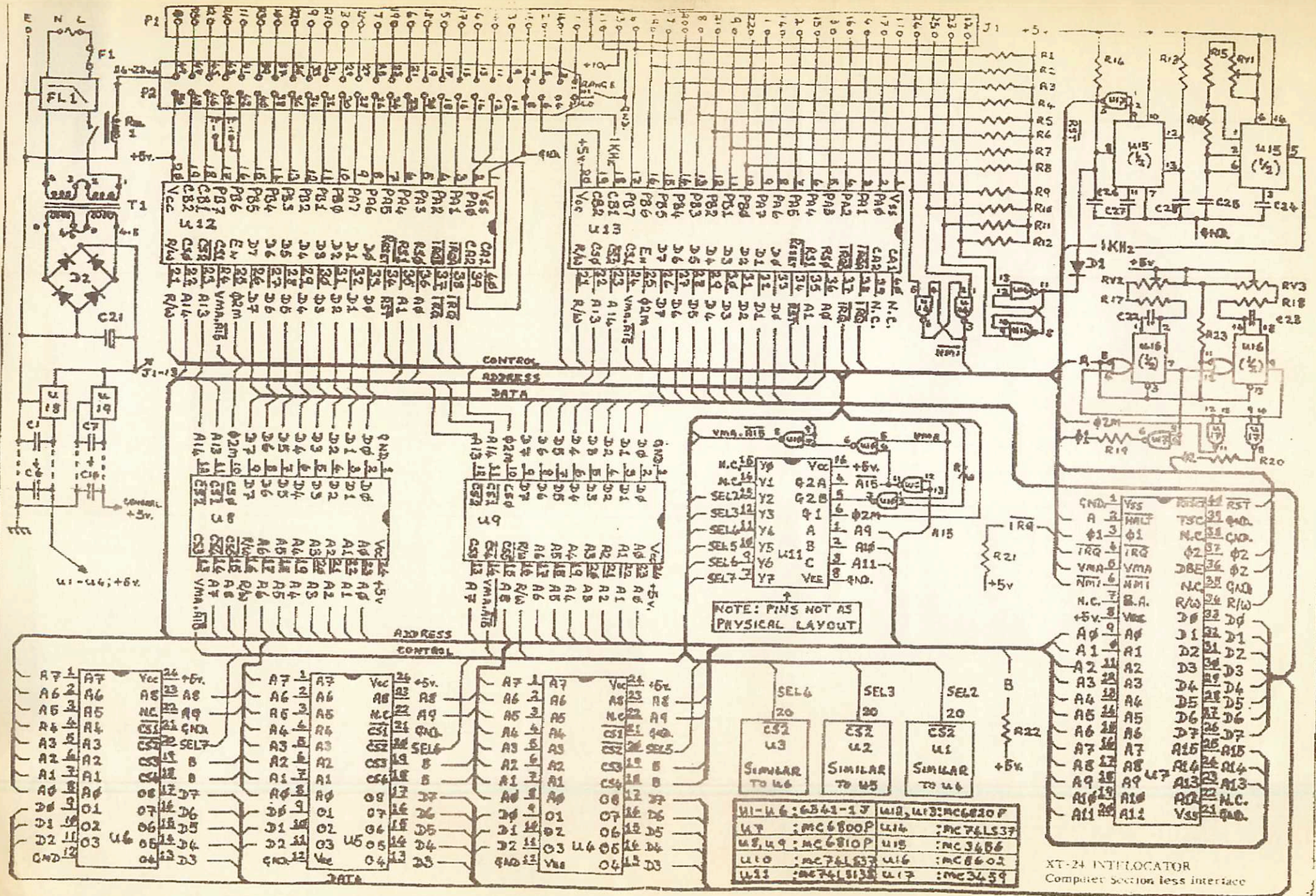
All Versions C1 Deleted

KT-24 INTELOGATOR CONTROLLER



NOTE:
 J2-34 AND
 J3-35
 ARE CONNECTED
 PIN-TO-PIN

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XT-24 INTEFLOCATOR
Computer Section, less interface