Flesher Corporation

TU-300
OPERATORS MANUAL

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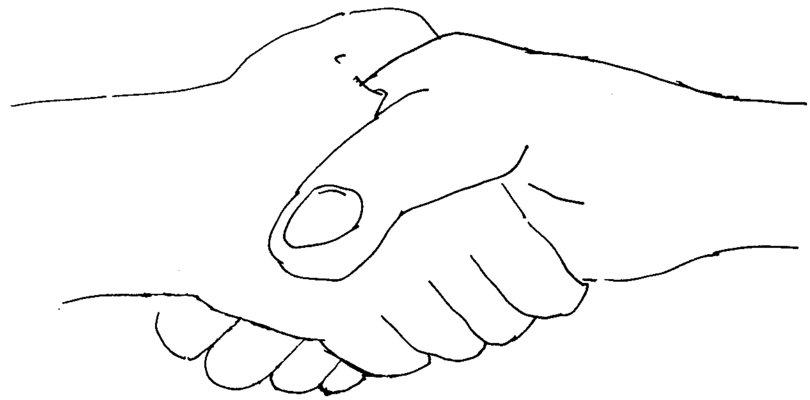
TU-300
INTRODUCTION



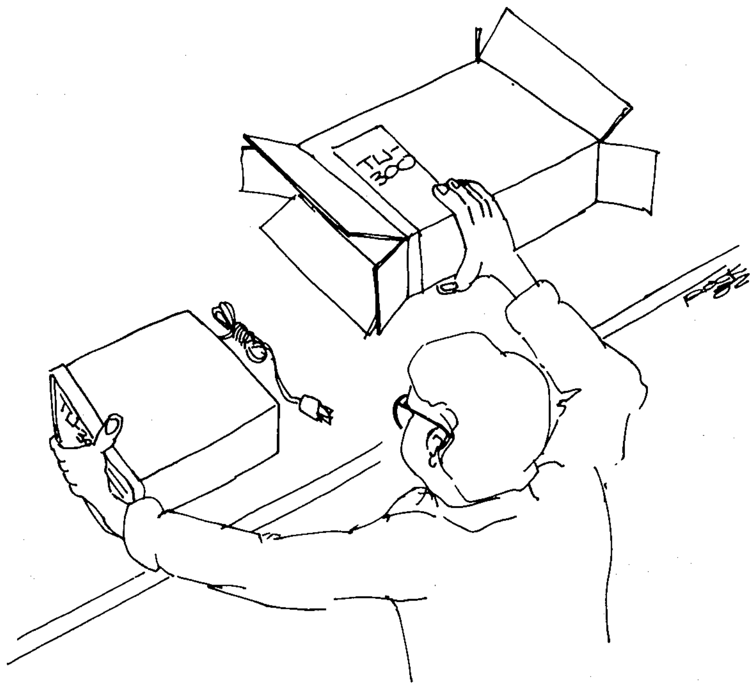
C O N G R A T U L A T I O N S

on your purchase of an Flesher Corporation professional quality TU-3ØØ RTTY terminal unit. Your investment in Flesher Corporation RTTY products is an investment in operating pleasure for years to come. Each Flesher Corporation product is backed up by years of engineering experience and technological innovation, assuring you a high degree of reliability you expect in professional electronic equipment.

The TU-3ØØ is a result of customer input and over a year of development. The combination of this input, professional engineering and quality components make the TU-3ØØ a highly reliable and versatile RTTY terminal unit. We welcome you to the growing family of Flesher Corporation product owners.

To be sure of obtaining the best possible performance from your new Flesher Corporation TU-3ØØ, read this operating manual carefully to become thoroughly familiar with the various features and controls before connecting it into your system.

TU-300
UNPACKING AND CARE



* Carefully remove all items from the container and check for damage.

* Before discarding any of the packing material, examine the container carefully for items you may have overlooked. It will be to your advantage to save original carton and fillers. They will prove valuable in preventing damage should you ever have to transport or ship the unit.

* Do not attempt installation without first reading the OPERATING INSTRUCTIONS and CONNECTION ILLUSTRATIONS.

* The TU-3ØØ must not be exposed to excessive moisture, or direct sources of heat.

* All wiring should be made as short in length as possible.

* Be sure the system is grounded with a good earth or water pipe ground to provide some protection agains voltage surges and built-up static charges. Ground leads should be as short as possible.

* To clean the cabinet, use a mild glass cleaner and soft cloth. Care should be exercised when cleaning the front panel or rear panel, markings could be damaged with excessive pressure and with certain cleaners.

* In extended non-use periods, it is recommended that the appliance power cord be unplugged from the outlet.

TU-300
SPECIFICATIONS

SIZE: 7 1/2" X 3" X 10"

POWER: 120VAC, 50-60 Hz, 5 watts.

INPUTS: CW KEY. Active in SEND only. TTL compatible. Requires pull-down to enable AFSK down to enable AFSK downshift for CW ID.

AFSK KEYING Input (TLL). TTL compatible, MARK high. Requires pull-down for SPACE.

AFSK KEYING Input (RS 232). Bi-polar input. MARK= -3V min., SPACE = +3V min.

AUDIO INPUT. Receiver audio input. May be connected to any source - 4 ohm to 600 ohms impedance. 100 mv min. input level.

SEND CONTROL (TTL). TTL compatible. Requires pull-down to place the TU-300 in SEND mode from an external control.

OUTPUTS: KEYING OUTPUT (TTL). TTL compatible demodulator output. MARK high.

KEYING OUTPUT (RS 232). Bi-polar demodulator output. MARK = -6V min., SPACE = +6V min. into a 3K ohm load.

SCOPE OUTPUTS. High impedance (50K ohms) MARK and SPACE filter outputs, phase corrected for accurate "+" scope tuning display.

AFSK AUDIO OUTPUT. Adjustable level (0 to 2 volts RMS), 600 ohm impedance.

FSK OUTPUT. Bi-polar output. MARK = -6V min., SPACE = +6V min. into a 3K ohm load.

AUXILIARY POWER (autostart). 5 amp relay contact output with standard U.S. 120 VAC power receptical on the rear chassis.

AUXILIARY SEND/RECEIVE switch contacts. Single pole, single throw auxiliary contacts from front panel SEND/RECEIVE switch.

RDA OUTPUT. Receive Data Available. TTL compatible output with active pull-down. Indicates presence of received signal in receive mode. Locked ON (pulled down) during SEND.

TU-300
SPECIFICATIONS

(CONT.)

DISPLAYS: TUNING INDICATOR: Ten segment LED bar graph signal strength indicator. Displays output level of filters.

POWER INDICATOR: Indicates when power is applied to unit.

SEND LED: Indicates when the TU-3ØØ is in send mode.

RDA LED: Receive Data Available. Indicates when signal is present and autostart relay is on.

MARK LED: Indicates the presence of a signal at the mark filter output when in the receive mode. In send mode, indicates the presence of MARK on the AFSK input.

SPACE LED: Indicates the presence of a signal at the space filter output when in the receive mode. In send mode, indicates the presence of SPACE on the AFSK input.

AUXILIARY INPUT/OUTPUT CONNECTOR P2: Auxiliary connector for optional loop power supply. TTL compatible keying input and output connections and +12 volts and ground.

TU-300 CIRCUIT DESCRIPTION

ACTIVE FILTER

The TU-3ØØ active filters consist of three stages of two pole active bandpass filters. Each stage is a low gain, low Q stage which, when cascaded with the other two stages, result in a very stable, high Q circuit.

On all filters except for the filter tuned for 2295 Hz, R1 is the input resistor. R2, R3, R4, C1 and C2 are not used. The first stage of the active filter consist of the first half of IC1, the second stage the other half of IC1, and the final stage, the first half of IC2. Each stage is tuned independently with a trimmer potentiometer. The second half of IC2 is used as a voltage level comparator. The output of the comparator switches the bias voltage for the gate of the field effect transistor Q1 which switches the audio output from the third active filter stage to the output connection of the filter board. Q1 transistor is switched off when the output "pin 7" of IC2 is approximately minus 1Ø volts. Q1 switches on when the output of IC2 changes to plus 1Ø volts. Pin 7 of IC2 is at the minus 1Ø volt potential when the inverting input (pin 6) is a higher voltage level than the non-inverting input (pin 5).

On the ACTIVE FILTER board tuned to 2295 Hz, an additional phase shift network is formed by resistors R2, R3, R4 and capacitors C1 and C2. This phase shift network provides sufficient additional delay of the signal passing throught the 2295 Hz filter to provide proper phase relationship between the mark and space signals of a 2125 Hz filter and the 2295 Hz filter to provide a proper plus shaped oscilloscope pattern which may be used for tuning.

Frequency select diodes Ø through 7 are used to select the output frequency of audio frequency shift keyer (AFSK) when one is installed.

DEMODULATOR

The TU-3ØØ DEMODULATOR consist of a discriminator stage, low pass filter stage, signal balance restorer circuit, slicer circuit and a mark hold circuit.

The discriminator circuit consist of diodes D1 and D2, and resistors R1, R2 and R15. The output from the discriminator is a pulsating DC voltage of the polarity determined by which of the filter signals (mark or space) is dominant.

The discriminator is connected to the input of the low pass filter at the junction of C1, R3 and R16. C2 and IC1 complete the low pass filter circuit.

The output of the low pass filter is connected to the signal balance restorer circuit. The circuit supplies an output voltage to

R8 which is summed with the output of the low pass filter through R6 to offset any signal level difference between the mark and space filter outputs, the mark output from the low pass filter is negative and the mark output is positive. This signal is connected to two precision rectifier stages, one being a positive rectifier and the other being a negative rectifier follower. The output from each rectifier charges capacitors C3 and C4 respectively and are summed through R4 and R5. Any difference in the level of the mark and space voltages at the output of the low pass filter then appears as a non-zero output from the summing resistors R4 and R5. This error voltage is amplified by IC1 part 'C' and summed with the original output voltage of the low pass filter at the inverting input of IC2, stage 'A'. The output from the signal balance restorer provides a bias voltage which will center the output levels of the low pass filter at the input of the slicer.
The slicer stage, IC2 stage 'A', is a positive feed back or hysteresis type slicer. As such, it has a dead band which is determined by the ratio R9 and R10 resistors, and will only change state when the input voltage exceeds the hysteresis level. This circuit prevents low level signal fluctuation from generating eroneous output signals.

The MARK HOLD circuit returns the TU-300 output to the mark state any time a space signal is longer than any normal space pulse width should be. On the TU-300 demodulator this is set at approximately 150 MS. The output of the slicer for a space signal is a positive going voltage. This positive going transition coupled through C5 raises the voltage across R12 to approximately +12 volts and then decays towards zero as capacitor C5 charges. The initial positive going signal is greater than the voltage level set by voltage divider R13 and R14 on the non-inverting input of IC2. This causes the output of IC2 to go positive. As C5 charges through R12, the voltage at the non-inverting input of IC2 decays towards zero and as this decaying voltage crosses the threshold level set by voltage divider resistors R13 and R14, the output of IC2 switches negative. Under normal conditions, the length of time that the output of the slicer is positive is less than the length of time required for C5 to charge through R12, therefore the mark hold circuit will have no noticable effect on the output signal. Only when the space signal from slicer output exists for longer than the decay time determined by C5 and R12 will the mark hold circuit take effect.

AUDIO FREQUENCY SHIFT KEYER (AFSK)

The TU-300 AUDIO FREQUENCY SHIFT KEYER is a crystal controlled oscillator, programmable frequency divider, and band pass filter which provides a sinusoidal audio frequency output in the range from 2000 to 3000 Hz.

The time base for the TU-300 AUDIO FREQUENCY SHIFT KEYER is a 5.508 Mhz crystal connected to a CMOS 4069 inverter. The output of the oscillator is connected directly to the input of the first programmable divider, IC2. The output of IC2 is conected to the second programmable frequency stage IC3. Together IC2 and IC3 provide frequency division by any integer number between 2 and 256. The output from the programmable dividers IC2 and IC3 is connected to a divide by sixteen divider IC4. IC4 is enabled or disabled by an external connection. By this method the output of the AUDIO FREQUENCY SHIFT KEYER is turned on and off. The output of IC4 is a symmetric square wave which is connected to the input of the low pass filter IC5. This low pass filter is designed to have a relative flat response in the range from 2000 to 3000 Hz.

MAIN CIRCUIT BOARD LOGIC

The MAIN CIRCUIT BOARD logic consist of the input and output circuits neccessary to interface the various plug in circuit boards with the front panel controls and the "outside world".

INPUTS

KEY-N input switches the AFSK to the downshift CW ID freqency when the TU-300 is in the transmit mode. KEY-N input is a TTL compatible input connected to an inverter transistor Q3. Q3 provides isolation from the outside world and the CMOS inverter IC3 (pin 2). The output of the inverter enables the CW ID frequency select diodes on the AFSK circuit board. The output of the inverter also connects to AND gates IC2 (pin 5 and pin 8). These two gates disable the mark and space freqency control. KEY-N must be pulled "LO" to downshift.

AFSKIN-TTL input signal causes the AFSK to switch between mark and space frequencies when the TU-300 is in the transmit mode. This input must be high for a mark frequency output and low for a space freqency output. AFSKIN-TTL signal connects to inverter transistor Q4 which provides isolation between the outside world and the CMOS inverter IC1. The output of IC1 (pin 14) is wired OR'ed with the output of IC1 pin 15 which is the bi-polar serial input for the AFSK. (AFSKIN-RS) This signal also connects to inverter IC1 (pin)1. Reverse shift of a send signal is accomplished by selecting either the input signal of IC1 (pin 1) or the output signal of the same stage (pin 16) "SEND REVERSE" switch. The output of this switch connects to IC2 (pin 6) and provides the frequency switching control for mark and space freqencies. AFSKIN-TTL is TTL compatible.

AFSKIN-RS input also provides the determination of the mark or space output frequencies when the TU-300 is in the transmit mode. This signal is connected through IC1 pin 2 and is wired OR'ed with the AFSKIN-TTL signal. AFSK-RS input requires a bi-polar input signal.

SEND-N controls the operating mode of the TU-300. When SEND-N line is left open or held at plus five volts the TU-300 is in the receive mode. Whe SEND-N is pulled down or to a low TTL level, the

TU-3ØØ is switched to the send mode. This signal disables the outputs of all the active filters by changing the bias level of the enable filter line through R37 and R38. The enable filter signal is at a positive voltage level in receive mode, and a negagive voltage level in the transmit mode. SEND-N also is connected to inverter transistor Q8 which serves as isolation between the outside world and the CMOS circuits. The collector of Q8 is connected to inverter IC3 which enables the AFSK and to the inputs of gates IC2 (pin 2) and IC2 (pin 12). When enabled, these gates allow the mark and space LED's on the TU-3ØØ front panel to indicate the status of the AFSK input signal. The mark and space LED's are turned on by IC1 (pin 1Ø) and IC1 (pin 11). The output of Q8 is low when in the send mode. This enables both the selected space filter select diodes and the mark filter select diodes through diodes D6 and D7 respectively. The AFSK input signal provides the final determination of which frequency is selected.

RECEIVE AUDIO input signal is the signal from the receiver audio output circuit which contains the audio freqency shifted TTY signal. This signal must be tuned so that the mark frequency is at 2125 Hz and the space signal 2295, 255Ø or 2975 Hz for 17Ø Hz shift, for 425 Hz shift, and 85Ø Hz shift respectively. Minimum audio input level is 1ØØ mv.

OUTPUT SIGNALS

RDA (RECEIVE DATA AVAILABLE) output indicates the presence of an output signal from either the mark or the space filter. Diodes D16 and D17 rectify the space and mark audio outputs respectively. These two signals are summed and filtered by C4. This voltage level is then compared to the reference level set by R28 and R29 at IC5 (pin 3). This reference voltage is approximately + 4 volts so that when the peak output of either filter exceeds 4 volts peak the output of IC5 (pin 1) will go to approximately negative 1Ø volts. This causes C5 to discharge through R44 and D2Ø and as soon as the decaying voltage drops below approximately 6 to 7 volts negative, the output of IC5 (pin 7) switches positive. This positive output drives the input of IC3 (pin 7) which pulls RDA output low. IC3 (pin7) also turns on the RDA LED on the front panel through R33. If the audio output level of the filters drops below the threshold voltage set by R28 and R29 the output of IC5 (pin 1) will go to approximately +1Ø volts. This positive voltage will charge capacitor C5 through R3Ø. When the voltage level of IC5 exceeds approximately 8 volts, the output of IC5 (pin 7) returns to the negative state and the RDA output goes to a TTL high level state. The comparator circuit is forced to the RDA 'ON' state by D9 when the TU-3ØØ is in the transmit mode, and is disabled when the front panel STANDBY switched is depressed.

DMOUT-TTL output is derived from the demodulator circuit board output which drives Q5 through D3 and R16 to a low state when a space output is present from the demodulator. DMOUT-TTL is pulled to a high TTL level by the voltage divider combination of the SIP and R15 when a mark signal is present at the demodulator output.

DMOUT-RS signal is the demodulator output signal passed through current limiting resistor R1Ø. This is a bi-polar signal, mark= -1Ø volts and space = +1Ø volts (no load).

SCOPE MARK output is a monitor output from the 2125 Hz mark filter through current limiting resistor R8.

SCOPE SPACE output is the audio output from the selected space filter through current limiting resistor R7.

OTHER CIRCUITS

MARK LED on the front panel is turned on by two different circuits depending on whether the TU-3ØØ is in transmit or receive mode. In the receive mode the MARK LED is driven by the audio output from the mark filter rectified through D5 which drives IC1 (pin 5). Since this input is a pulsating DC audio voltage, the output of IC1 (pin 12) will also be a pulsating voltage. The pulsation rate is too high to be noticed by the eye and the LED will appear to be fully on. Current is limited through the LED by resistor R2Ø. In the transmit mode the MARK LED is controlled by the condition of the AFSK input signal which is gated through IC2 (pin 3). This input drives the inverter IC1 (pin 6). The output of IC1 (pin 11) turns on the MARK LED through R18 and R2Ø current limiting resistors.

SPACE LED is controlled similar to the MARK LED.

RECEIVE AUDIO AMPLIFIER is a two stage amplifier consisting of Q1 and Q2. The audio input signal is coupled to Q1 through C1 and resistor R1. The voltage divider consisting of R2 and R3 provides base bias for the base of transistor Q1. Q2 is an emitter follower which drives the signal level clipping diodes D1 and D2. The clipped audio signal drives all active filter inputs......

FRONT PANEL SWITCH FUNCTIONS

POWER: Alternate action switch, turns power line on.

STAND-BY: Alternate action switch. Locks the demodulator output in the MARK state, and turns on the Autostart power output. Autostart power will remain on for approximately 5 seconds after normal mode is restored.

SEND/REC: Alternate action switch.

RECEIVE: Enables filters selected by the FREQUENCY SHIFT switches and places the demodulator output on the TTL and RS 232 output lines.

SEND: Locks the demodulator outputs in the MARK condition. Enables the AFSK audio output and closes the auxiliary switch contacts.

REVERSE SHIFT: Alternate action switch.

RECEIVE: Reverses the MARK and SPACE assignments of the selected audio frequencies. 2125 Hz becomes the SPACE frequency, and the higher frequency will become the MARK.

SEND: Reverses the output frequency assignments to MARK and SPACE AFSK inputs.

FREQUENCY SHIFT: Interlocking switches.

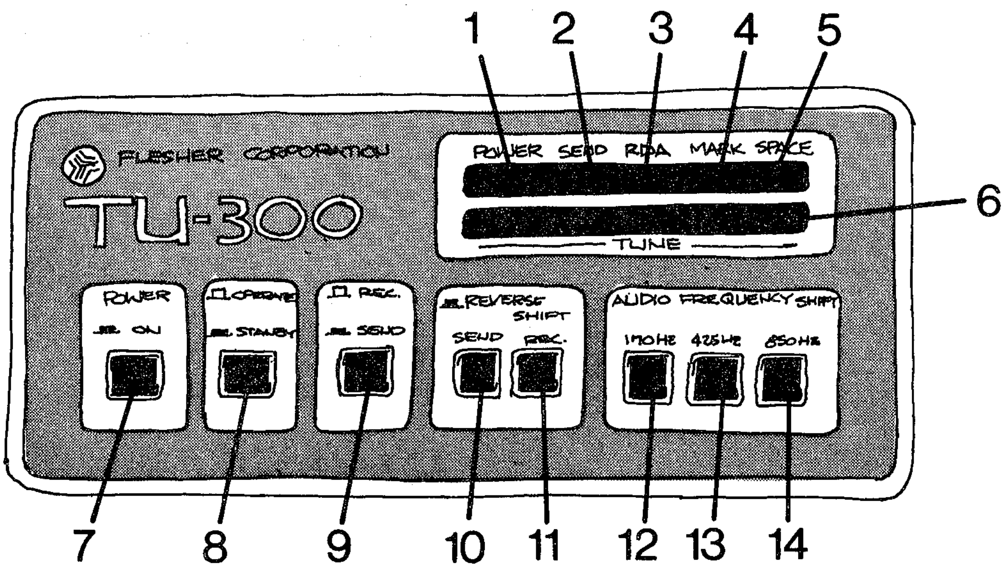
170 Hz - Selects 2295 Hz filter for SPACE frequency.

425 Hz - Selects 2550 Hz filter for SPACE frequency.

850 Hz - Selects 2975 Hz filter for SPACE frequency.

TU-300
OPERATING INSTRUCTIONS

(CONT.)



FRONT PANEL

I N D I C A T O R S	S W I T C H E S	
(1) POWER INDICATOR	(7) POWER	(13) 425 HZ SELECT
(2) SEND INDICATOR	(8) OPERATE/STANDBY	(14) 85Ø HZ SELECT
(3) RDA INDICATOR	(9) SEND/RECEIVE	
(4) MARK INDICATOR	(1Ø) REVERSE SEND	
(5) SPACE INDICATOR	(11) REVERSE RECEIVE	
(6) TUNING INDICATOR	(12) 17Ø HZ SELECT	

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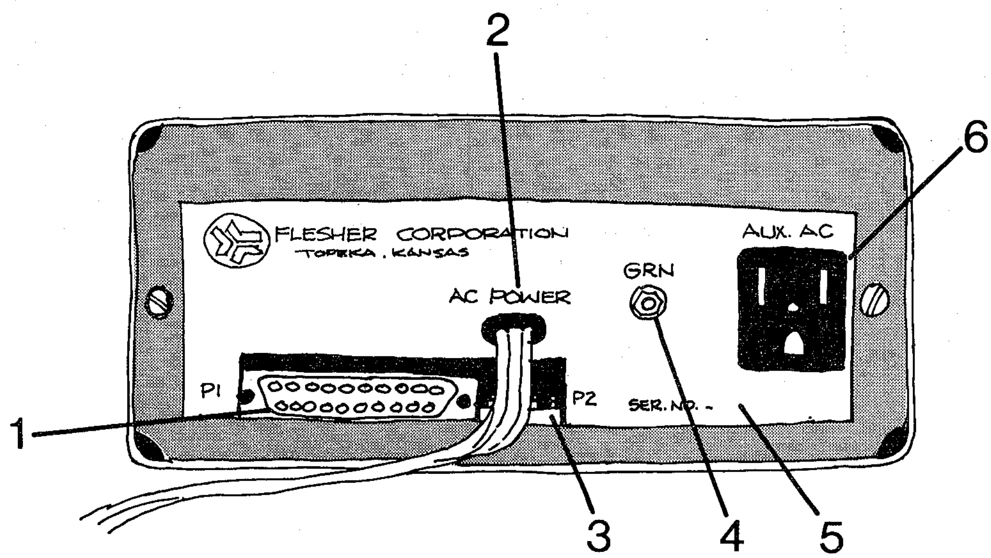
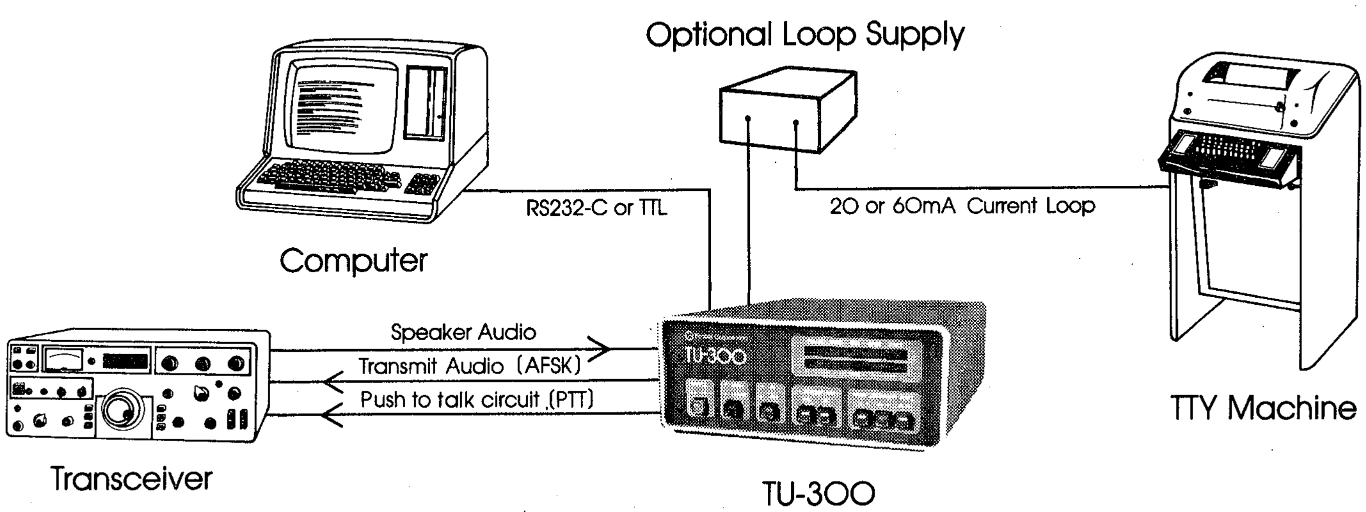


REAR CHASSIS PANEL

(1) P1 CONNECTOR	(3) P2 CONNECTOR	(5) SERIAL NO. (WIRED)
(2) AC POWER CORD	(4) GROUND TERMINAL	(6) AUXILIARY AC

TU-300
CONNECTION ILLUSTRATIONS

The following illustrations may not meet your exact wiring needs, but are intended to show typical connections. Flesher Corp. does not provide connection drawings for specific equipment because of the wide variety of equipment available today. The Flesher Corporation warranty does not cover damage resulting from improper connecting the TU-300 to other equipment, and makes no claim that the TU-300 is compatible with specific equipment. It is the user's responsibility to determine the compatibility of the TU-300 with other equipment. Refer to the TU-300 specifications and the specifications of the equipment to which it will be connected.



TU-300
CONNECTION ILLUSTRATIONS

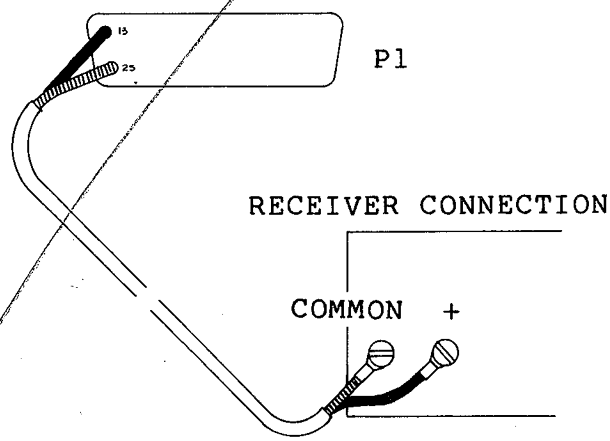
Make sure that the POWER SWITCH is in the OFF position and the unit unplugged before making any installation or connections.

SEE BULLETIN

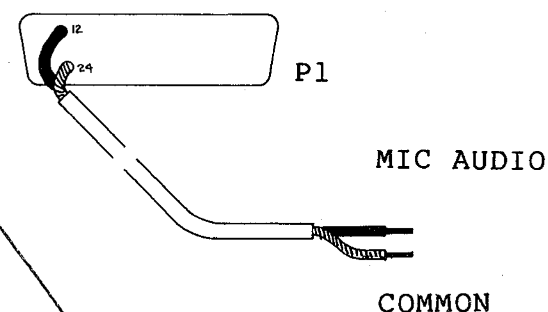
RECEIVER CONNECTION:

Connect pin 13 of TU-300 P1 to the receiver speaker plus terminal.

Connect Pin 25 of TU-300 P1 to the receiver speaker common terminal. Any output impedance from 4 ohms to 600 ohms will work fine.



AFSK VOX CONNECTION



TRANSMITTER AFSK VOX CONNECTION:

Connect pin 12 of TU-300 P1 to microphone audio input of transmitter.

Connect pin 24 of TU-300 P1 to transmitter common.

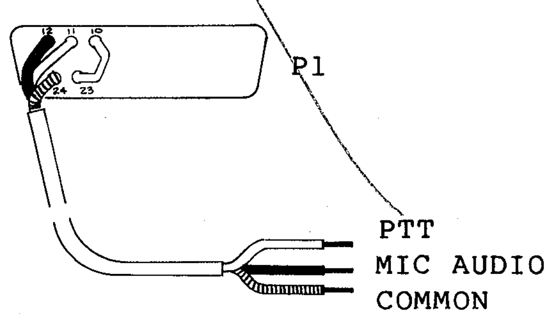
TRANSMITTER AFSK AND PTT CONNECTION:

Connect pin 12 of TU-300 P1 to microphone audio input of transmitter.

Connect pin 11 of TU-300 P1 to transmitter PTT.

Connect pin 24 of TU-300 P1 to the transmitter common.

Solder a jumper between pins 10 and 23 of TU-300 P1.

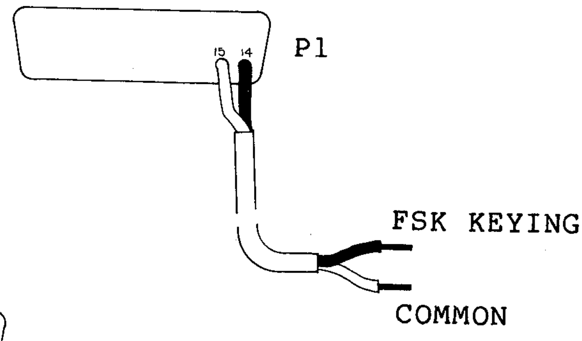


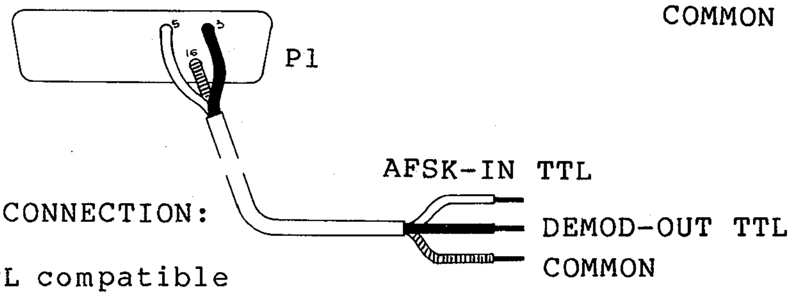
TU-300
CONNECTION ILLUSTRATIONS

TRANSMITTER FSK CONNECTION:

Connect pin 14 of TU-300 P1 to FSK keying input of transmitter.

Connect pin 15 of TU-300 P1 to transmitter common.



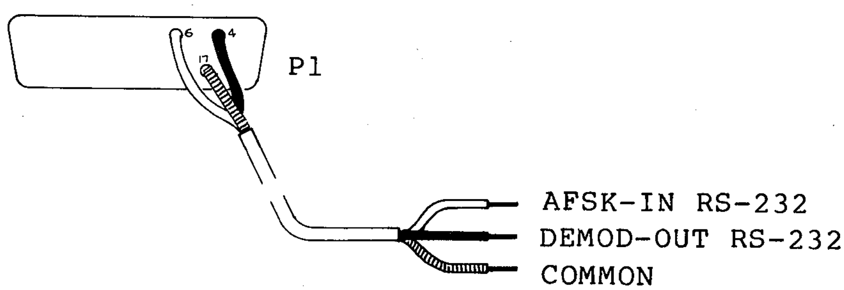


TTL COMPATIBLE INTERFACE CONNECTION:

TU-300 DEMODULATOR TTL compatible keying output connected at pin 3 of P1.

TU-300 AFSK TTL compatible keying input connected at pin 5 of P1.

TU-300 common at pin 16 of P1.



RS-232c COMPATIBLE INTERFACE CONNECTION:

TU-300 DEMODULATOR RS-232c compatible output keying connected to pin 4 of P1.

TU-300 AFSK RS-232c compatible keying input connected at pin 6 of P1.

TU-300 common connected at pin 17 of P1.

TU-300 ALIGNMENT

WITHOUT TEST EQUIPMENT, but WITH AFSK OPTION INSTALLED

If the AFSK (Audio Frequency Shift Keyer) option is not installed, the TU-3ØØ must be aligned with a calibrated sine wave AUDIO SIGNAL GENERATOR. (See "ALIGNMENT WITH TEST EQUIPMENT".)

Use of the BAR GRAPH front panel display and an installed and working AFSK in the following procedure eliminates the need for test equipment. Before alignment, check to make sure all the boards are properly installed in their sockets and are in the proper positions.

( ) Do not plug the TU-3ØØ into AC power until instructed.

( ) Remove the TU-3ØØ inter-chassis from outer cover by removing the two 8-32 X 3/8" screws on each side of the cabinet rear.

( ) Remove the circuit board support bracket fastened by two 6-32 X 1/4" flat head screws on either side.

( ) Bend a one inch length of 22 gauge bare (or a trimmed resistor lead) in a "U" shape and insert this wire in pins 12 and 13 of P1 connector on the rear of the chassis (the mating connector should not be installed). This jumper connects the AUDIO OUTPUT of the AFSK to the AUDIO INPUT of the DEMODULATOR.

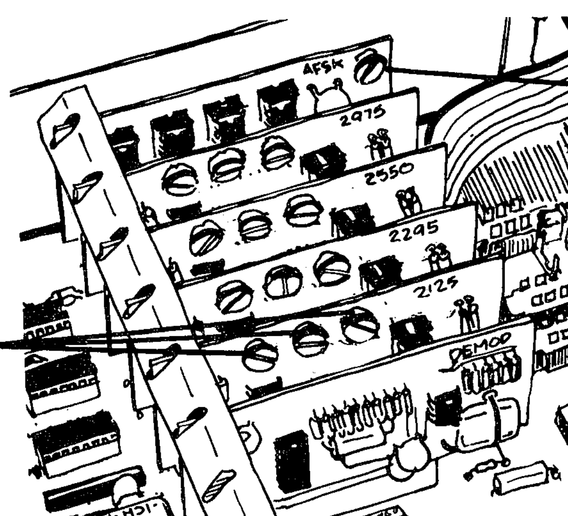
If you have built your TU-3ØØ from a kit, the following two steps may be skipped since the components refered to will not have been installed.

(x) ( ) Disconnect one lead of D9 on the MAIN CIRCUIT BOARD.

(x) ( ) Disconnect one lead of D1 on each FILTER board to be aligned.

( ) Adjust AFSK gain trimmer to center of rotation.

( ) Adjust all trimmers on FILTER BOARDS to center of rotation.

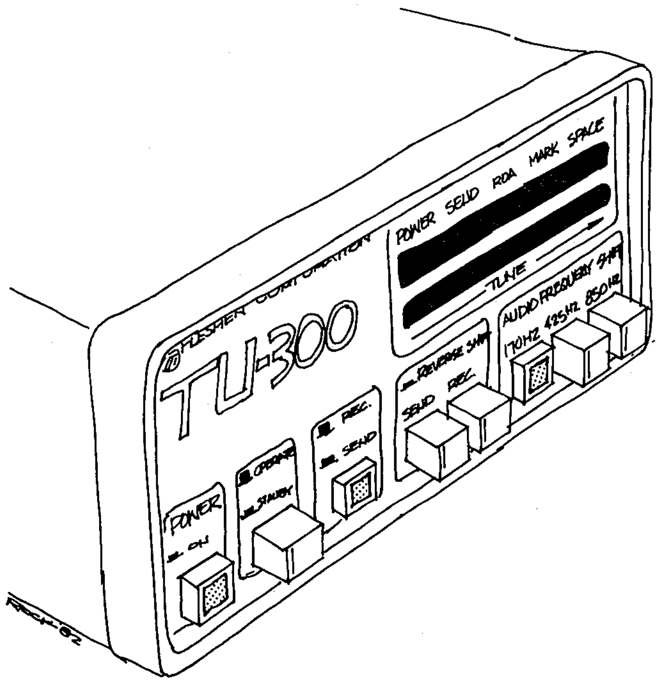


TU-300 ALIGNMENT

WITHOUT TEST EQUIPMENT, but WITH AFSK INSTALLED

( ) Apply power to the TU-3ØØ. Be sure the unit does not sit on a metal bench or on metal objects which may short out the circuits on the bottom of the circuit board.

( ) Set the front panel controls so that all switches are in the 'OUT' position except POWER, 17Ø HZ FREQUENCY SELECT and the SEND switches.



( ) Adjust the AFSK gain trimmer so the fifth or sixth LED of the BAR GRAPH display flickers or glows dimly.

( ) Adjust the three trimmers on the 2125 Hz filter for maximum indication on the BAR GRAPH display. You may have to reduce the AFSK gain while peaking the trimmers on the filters, to keep the signal strength indicator from exceeding full scale.

( ) Select REVERSE SEND on front panel switch.

( ) Adjust the gain trimmer of the AFSK so the fifth or sixth LED of the BAR GRAPH display flickers or glows dimly again.

( ) Adjust the three trimmers on the 2295 Hz filter for maximum indication on the BAR GRAPH display. Use the same procedure as before.

TU-300 ALIGNMENT

WITHOUT TEST EQUIPMENT, but WITH AFSK INSTALLED

If you do not have the 425 Hz and 85Ø Hz filter boards skip the next six instruction steps.

(x) ( ) Select 425 Hz on the front panel.

(x) ( ) Adjust the gain trimmer of the AFSK so the fifth or sixth LED of the BAR GRAPH display flickers or glows dimly again.

(x) ( ) Adjust the three trimmers on the 255Ø Hz filter for maximum indication on the BAR GRAPH display. Use the same procedure as before.

(x) ( ) Select 85Ø Hz on the front panel.

(x) ( ) Adjust the gain trimmer of the AFSK so the fifth or sixth LED of the BAR GRAPH display flickers or glows dimly again.

(x) ( ) Adjust the three trimmers on the 2975 Hz filter for maximum indication on the BAR GRAPH display. Use the same procedure as before.

( ) Turn the TU-3ØØ off and unplug it from AC power.

( ) Remove all filter circuit boards being careful not to move the trimmer positions.

( ) Install (or reconnect) D1 on all filter boards.

( ) Install (or reconnect) D9 on the MAIN CIRCUIT BOARD.

( ) Replace the filter circuit boards, again be careful not to move the trimmer adjustments.

( ) Remove the jumper from pins 12 and 13 of P1 connector.

( ) Final adjustment of the AFSK GAIN trimmer must be made according to your transmitter audio input requirements (and VOX requirements if used). Make this adjustment with your transmitter microphone gain set at either its normal setting or at mid-range. Adjust the AFSK gain for normal transmitter output.

( ) Position the board support bracket carefully over the top rear corners of the boards and line the bracket up with the holes on the chassis sides.

( ) Install a 6-32 X 1/4" flat head screw in each side and tighten both screws.

( ) Install inter-chassis into outer cover and secure with the two 8-32 X 3/8" screws on each side of rear chassis sides.

TU-300 ALIGNMENT

WITH AFSK AND A VOLTMETER

EQUIPMENT REQUIRED: AC VOLTMETER

Before alignment, check to make sure all the boards are properly installed in their sockets and are in the proper positions.

( ) Do not plug the TU-3ØØ into AC power until instructed.

( ) Remove the TU-3ØØ inter-chassis from outer cover by removing the two 8-32 X 3/8" screws on each side of the cabinet rear.

If you have built your TU-3ØØ from a kit, the follow step may be skipped since the PC board bracket has not been installed as yet.

(X) ( ) Remove the circuit board suport bracket fastened by two 6-32 X 14" flat head screws on either side.

( ) Bend a one inch length of 22 gauge bare (or a trimmed resistor lead) in a "U" shape and insert this wire in pins 12 and 13 of P1 connector on the rear of the chassis (the mating connector should not be installed). This jumper connects the AUDIO OUTPUT of the AFSK to the AUDIO INPUT of the DEMODULATOR.

If you have built your TU-3ØØ from a kit, the following three steps may be skipped since the components refered to will not have been installed.

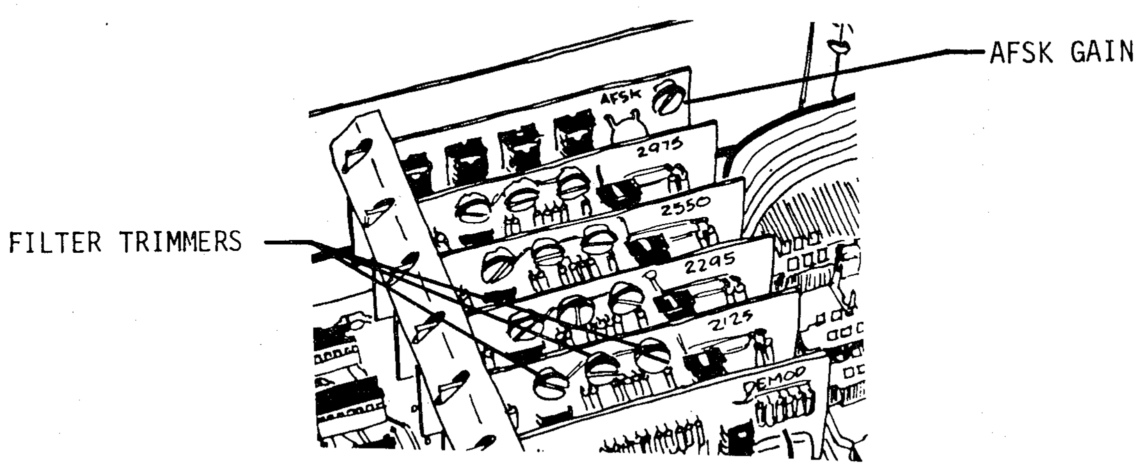
(X) (X) Remove the plug in circuit boards from the MAIN CIRCUIT BOARD.

(X) (X) Disconnect one lead of D9 on the MAIN CIRCUIT BOARD.

(X) ( ) Disconnect one lead of D1 of each FILTER BOARD to be aligned.

( ) Adjust AFSK gain trimmer to center of rotation.

( ) Adjust all trimmers on the FILTER BOARDS to center of rotation.



TU-300 ALIGNMENT

WITH AFSK AND A VOLTMETER

( ) Adjust AC volt meter for approximately 2Ø VAC.

( ) Attach the common lead of the volt meter to the ground lugs located at the rear of the chassis.

( ) Apply power to the TU-3ØØ. Be sure the unit does not sit on a metal bench or on metal objects which may short out the circuits on the bottom circuit board.

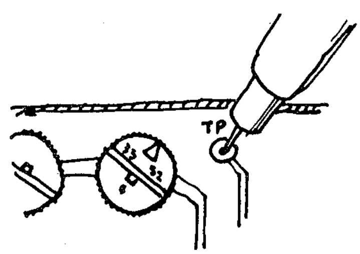
( ) Set the front panel controls so that all switches are in the 'OUT' position except POWER, 17Ø HZ FREQUENCY SELECT and the SEND switches.

( ) Touch the positive probe of the AC voltmeter to 'TP' of the 2125 Hz filter board.

( ) If neccessary, start with a low scale on the voltmeter and then graduate to a higher scale to obtain a good visual reading.

( ) Adjust the three trimmers on the 2125 Hz filter for maximum indication on the voltmeter.

( ) Select REVERSE SEND on the front panel switch.



( ) Touch the positive probe of the AC voltmeter to 'TP' of the 2295 Hz filter board.

( ) Adjust the three trimmers on the 2295 Hz filter for maximum indication on the voltmeter.

If you do not have the 425 Hz and 85Ø Hz filter boards skip the next five instructions steps.

(X) ( ) Touch the positive probe of the voltmeter to 'TP' of the 255Ø Hz filter board.

TU-300 ALIGNMENT

WITH AFSK AND A VOLTMETER

(X) ( ) Adjust the three trimmers on the 2550 Hz filter for maximum indication on the voltmeter.

(X) ( ) Select 850 Hz on the front panel.

(X) ( ) Touch the positive probe of the voltmeter to 'TP' of the 2975 Hz filtler board.

(X) ( ) Adjust the three trimmers on the 2975 Hz filter for maximum indication on the voltmeter.

( ) Turn the TU-300 off and unplug it from AC power.

( ) Remove common lead of AC voltmeter from the ground lug located at the rear of the chassis.

( ) Remove al filter circuit boards being careful not to move ;the trimmer positions.

( ) Install (or reconnect) D1 on all filter boards.

( ) Install (or reconnect) D9 on the MAIN CIRCUIT BOARD.

( ) Replace the filter circuit boards, again be careful not to move the trimmer adjustments.

( ) Remove the jumper from pins 12 and 13 of P1 connector.

( ) Final adjustment of the AFSK GAIN trimmer must be made according to your transmitter audio input requirements (and VOX requirements if used). Make this adjustment with your transmitter microphone gain set at either its normal setting or at mid-range. Adjust the AFSK gain for normal transmitter output.

( ) Postition the board support bracket carefully over the top rear corners of the boars and line the bracket up with the holes on the chassis sides.

( ) Install a 6-32 X 1/4" flat head screw in each side and tighten both screws.

( ) Install the inter-chassis into outer cover and secure with the two 8-32 X 3/8" screws on each side of the rear chassis sides.

TU-300 ALIGNMENT

WITHOUT AFSK, but WITH TEST EQUIPMENT

EQUIPMENT REQUIRED: Calibrated sine wave AUDIO SIGNAL GENERATOR,
OPTIONAL EQUIPMENT: AC VOLTMETER or OSCILLOSCOPE

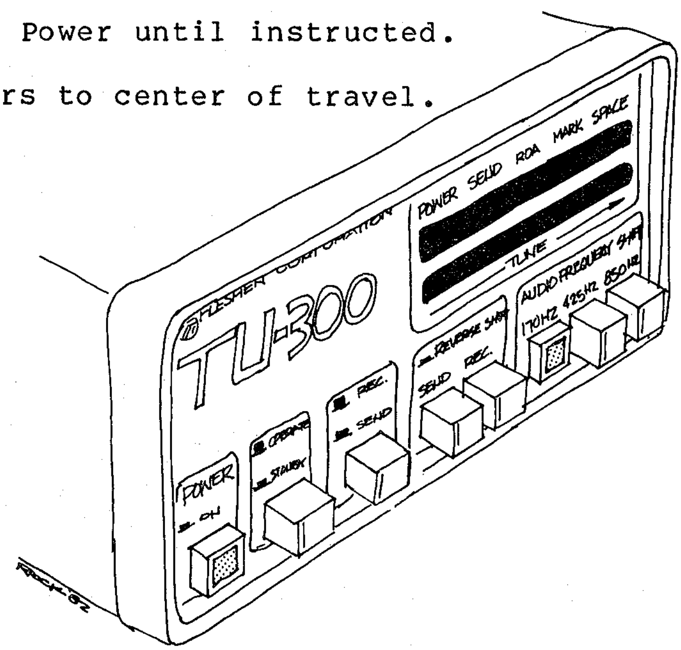
Before alignment, check to make sure all the boards are properly installed in their sockets and are in the proper positions.

The BAR GRAPH display is refered to in the following tuning instructions, but an AC voltmeter or oscilloscope can be used for tuning by connecting the instrument common lead to chassis ground and the probe lead to the test point of each filter board marked "TP".

( ) Do not plug the TU-300 into AC Power until instructed.

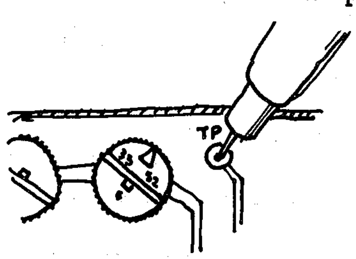
( ) Adjust all filter board trimmers to center of travel.

( ) Set the front panel controls so that all switches are in the 'OUT' position except POWER and 170 Hz FREQUENCY SELECT.



( ) Connect the common lead of the sine wave Audio Signal Generator to the chassis ground lug.

( ) Connect the output of the Audio Signal Generator to pin 13 of P1 using a scrap resistor lead or a piece of 22 gauge bare wire.



( ) Apply power to the TU-300. Be sure the unit does not sit on a metal bench or on metal objects which may short out the circuits on the bottom of the circuit board.

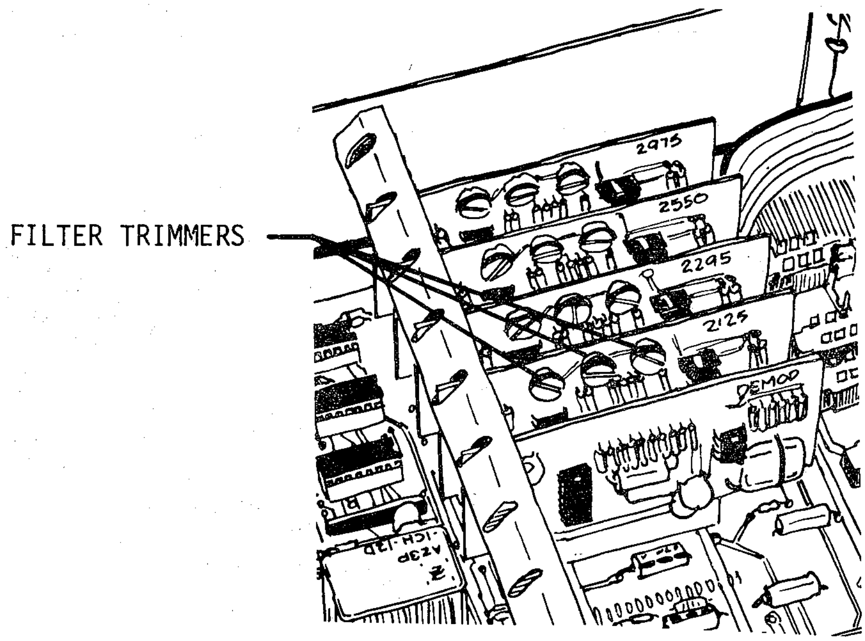
( ) Adjust the Audio Signal Generator for 2125 Hz.

TU-300 ALIGNMENT

WITHOUT AFSK, but WITH TEST EQUIPMENT

( ) Adjust the gain of the Audio Signal Generator so the fifth or sixth LED on the BAR GRAPH tuning indicator flickers or glows dimly.

( ) Adjust the three trimmers on the 2125 Hz filter for maximum indication on the BAR GRAPH display. You may have to reduce the Audio Signal Generator gain while peaking the trimmers on the filters to keep the signal strength indicator from exceeding full scale.



( ) Adjust the Audio Signal Generator for 2295 Hz.

( ) Adjust the three trimmers on the 2295 Hz filter for maximum indication on the BAR GRAPH display. Use same procedure as before.

( ) For optional filters, use the same tuning procedure with the appropriate frequency shift selected on the front panel and the proper frequency set on the Audio Signal Generator, depending on which filter is to be tuned.

( ) When all filters have been tuned, position the board support bracket over the top rear corners of the plug in boards and line the bracket up with the holes on the chassis sides.

( ) Installa 6-32 X 1/4" flat head screw in each side and tighten both screws.

( ) Install inter-chassis into outer cover and secure with the two 8-32 X 3/8" screws on each side of rear chassis sides.

TU-300 VOLTAGE CHART

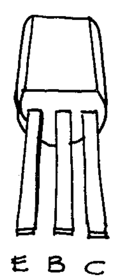
SWITCH CONDITIONS: POWER = ON   OPERATE/STANDBY = OPERATE   REC./SEND = REC.
REVERSE SHIFTS = OFF   FREQUENCY SHIFT = SELECT ANY

PINS	1	2	3	4	5	6	7	8	9	1Ø	11	12	13	14	15	16
IC1	+9	Ø	Ø	Ø	Ø	Ø	Ø	Ø	+9	+3.7	+3.7	+3.7	+3.7	+9	+9	+.6
IC2	+9	+.1	+.1	+.1	+12	+.6	Ø	+12	+.6	+.1	+.1	+.1	+.6	+12		
IC3	+.1	+.1	+.1	+.1	+4.5	Ø	Ø	Ø	+19	+5	+19	+.6	+12	+.6	+12	+.6
IC4	-12	Ø	-3	-12	-12	-1Ø	+12	Ø								
IC5	+12	Ø	+3.6	-12	-6.8	+12	-1Ø	+12								
IC6	-2Ø	-12	Ø	Ø	-5	Ø	Ø	+12	+19							
IC7	+19	Ø	+5													

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+.9	+1.6	+6.5
Q2	+5.8	+6.5	+12
Q3	Ø	.7	+.1
Q4	Ø	.7	+.1
Q5	Ø	Ø	+5
Q6	Ø	+.7	Ø

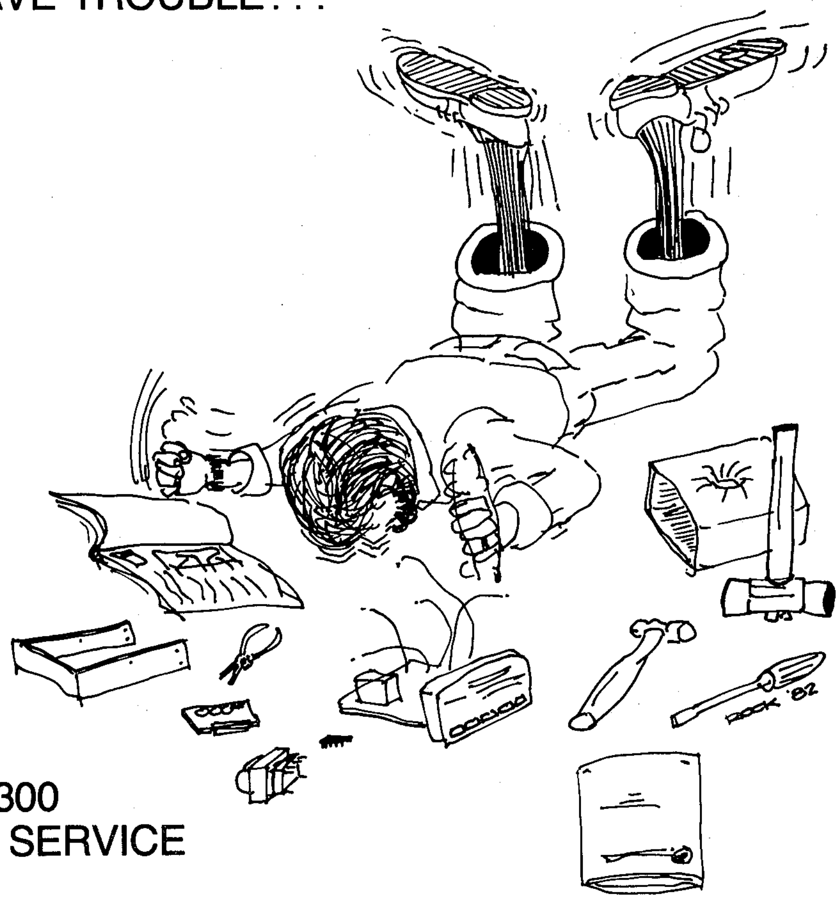
P1		P2
PIN 1 = +5	PIN 9 = +5	PIN 1 = +5
PIN 2 = +5	PIN 1Ø = Ø	PIN 2 = +12
PIN 3 = +5	PIN 11 = Ø	PIN 3 = +5
PIN 4 = -1Ø	PIN 12 = Ø	PIN 4 = Ø
PIN 5 = +5	PIN 13 = Ø	
PIN 6 = Ø	PIN 14 = -1Ø	
PIN 7 = Ø	PIN 15 TO 25 = GROUND	
PIN 8 = Ø		

All voltages are approximate and will vary somewhat from unit to unit.



ALL TRANSISTORS

IF YOU HAVE TROUBLE...



TU-300 FACTORY SERVICE

Occassionally it may become neccessary to have your TU-300 repaired. If difficulties arise, first check the fuse and then consult the VOLTAGE CHART to determine if the problem is of a minor nature which can be rectified quickly in your own home. If the problem is beyond this information, you may call CUSTOMER SERVICE DEPARTMENT (913-234-0198) to determine if it will be neccessary to ship it back to Flesher Corporation.

If service is required, ship the product postage prepaid to:

Flesher Corporation
P.O Box 976
Topeka, Kansas 66601

Or UPS prepaid to: 507 Jackson St.
Topeka, Kansas 66603

Your TU-300 should be packaged carefully using the original packing material. If packing has been discarded or damaged, write to the factory for new material. New packing material will be shipped to you at a nominal charge.

When shipping, insure the unit for the full value and be sure to obtain a receipt from the carrier.

The package should include a letter with a complete discription of the problem.

TU-300
MAIN CIRCUIT BOARD
PARTS LIST

ITEM	P.N.	DESCRIPTION				
R1	100 710	330 ohm resistor	1/4 watt	5%	ORG-ORG-BRN
R2	101 110	15K ohm resistor	1/4 watt	5%	BRN-GRN-ORG
R3	100 910	2.2K ohm resistor	1/4 watt	5%	RED-RED-RED
R4	100 910	2.2K ohm resistor	1/4 watt	5%	RED-RED-RED
R5	100 710	330 ohm resistor	1/4 watt	5%	ORG-ORG-BRN
R6	100 830	1K ohm resistor	1/4 watt	5%	BRN-BLK-RED
R7	101 230	47K ohm resistor	1/4 watt	5%	YEL-VIO-ORG
R8	101 230	47K ohm resistor	1/4 watt	5%	YEL-VIO-ORG
R9	100 990	4.7K ohm resistor	1/4 watt	5%	YEL-VIO-RED
R10	100 830	1K ohm resistor	1/4 watt	5%	BRN-BLK-RED
R11	100 930	2.7K ohm resistor	1/4 watt	5%	RED-VIO-RED
R12	100 930	2.7K ohm resistor	1/4 watt	5%	RED-VIO-RED
R13	100 930	2.7K ohm resistor	1/4 watt	5%	RED-VIO-RED
R14	100 930	2.7K ohm resistor	1/4 watt	5%	RED-VIO-RED
R15	100 950	3.3K ohm resistor	1/4 watt	5%	ORG-ORG-RED
R16	101 070	10K ohm resistor	1/4 watt	5%	BRN-BLK-ORG
R17	100 930	2.7K ohm resistor	1/4 watt	5%	RED-VIO-RED
R18	100 690	270 ohm resistor	1/4 watt	5%	RED-VIO-BRN
R19	100 690	270 ohm resistor	1/4 watt	5%	RED-VIO-BRN
R20	100 590	100 ohm resistor	1/4 watt	5%	BRN-BLK-BRN
R21	100 590	100 ohm resistor	1/4 watt	5%	BRN-BLK-BRN
R22	100 990	4.7K ohm resistor	1/4 watt	5%	YEL-VIO-RED
R23	100 990	4.7K ohm resistor	1/4 watt	5%	YEL-VIO-RED
R24	100 990	4.7K ohm resistor	1/4 watt	5%	YEL-VIO-RED
R25	100 990	4.7K ohm resistor	1/4 watt	5%	YEL-VIO-RED
R26	101 070	10K ohm resistor	1/4 watt	5%	BRN-BLK-ORG
R27	100 790	680 ohm resistor	1/4 watt	5%	BLU-GRY-BRN
R28	101 390	300K ~~220K~~ ohm resistor	1/4 watt	5%	RED-RED-YEL
R29	101 310	100K ohm resistor	1/4 watt	5%	BRN-BLK-YEL
R30	101 450	390K ohm resistor	1/4 watt	5%	ORG-WHT-YEL
R31	101 310	100K ohm resistor	1/4 watt	5%	BRN-BLK-YEL
R32	101 390	220K ohm resistor	1/4 watt	5%	RED-RED-YEL
R33	100 730	390 ohm resistor	1/4 watt	5%	ORG-WHT-BRN
R34	100 830	1K ohm resistor	1/4 watt	5%	BRN-BLK-RED
R35	101 390	220K ohm resistor	1/4 watt	5%	RED-RED-YEL
R36	101 310	100K ohm resistor	1/4 watt	5%	BRN-BLK-YEL
R37	101 310	100K ohm resistor	1/4 watt	5%	BRN-BLK-YEL
R38	101 450	390K ohm resistor	1/4 watt	5%	ORG-WHT-YEL
R39	100 990	4.7K ohm resistor	1/4 watt	5%	YEL-VIO-RED
R40	100 930	2.7K ohm resistor	1/4 watt	5%	RED-VIO-RED
R41	100 930	2.7K ohm resistor	1/4 watt	5%	RED-VIO-RED
R42	101 070	10K ohm resistor	1/4 watt	5%	BRN-BLK-ORG
R43	100 950	3.3K ohm resistor	1/4 watt	5%	ORG-ORG-RED
R44	101 110	15K ohm resistor	1/4 watt	5%	BRN-GRN-ORG
R45	100 990	4.7K ohm resistor	1/4 watt	5%	YEL-VIO-RED
R46	101 310	100K ohm resistor	1/4 watt	5%	BRN-BLK-YEL
R47	101 390	220K ohm resistor	1/4 watt	5%	RED-RED-YEL
R48	100 830	1K ohm resistor	1/4 watt	5%	BRN-BLK-RED
SIP	107 008	Resistor Array, 4.7K x 9			(1)

TU-300
MAIN CIRCUIT BOARD
PARTS LIST

(CONT.)

	ITEM	P.N.	DESCRIPTION
	C1	11Ø 23Ø	Capacitor .luf 12V disc
	C2	111 131	Capacitor 4.7uf 35V Electrolytic, Axial
	C3	11Ø 23Ø	Capacitor .luf 12V disc
	C4	111 1Ø1	Capacitor 1.Øuf 5ØV Electrolytic, Axial
	C5	111 131	Capacitor 4.7uf 35V Electrolytic, Axial
	C6	111 256	Capacitor 47Øuf 25V Electrolytic, Radial
	C7	111 235	Capacitor 22Øuf 25V Electrolytic, Radial
	C8	11Ø 2Ø5	Capacitor .Ølūf 1ØØØV Disc
	C9	11Ø 2Ø5	Capacitor .Ølūf 1ØØØV Disc
	C1Ø	111 131	Capacitor 4.7uf 35V Electrolytic, Axial
	C11	111 131	Capacitor 4.7uf 35V Electrolytic, Axial
	C12	11Ø 23Ø	Capacitor .luf 12V disc
	C13	11Ø 199	Capacitor .Ølūf 1ØØV disc
	C14	"	" " " "
	C15	"	" " " "
103 M	C16	"	" " " "
	C17	"	" " " "
√15	C18	"	" " " "
	C19	"	" " " "
	C2Ø	"	" " " "
	C21	"	" " " "
	C22	"	" " " "
	C23	"	" " " "
	C24	"	" " " "
	C25	"	" " " "
	C26	"	" " " "
	C27	"	" " " "
	D1	12Ø ØØ5	Diode, 1N4148
	D2	"	" "
	D3	"	" "
	D4	"	" "
√11	D5	"	" "
	D6	"	" "
	D7	"	" "
	D8	"	" "
	D9	"	" "
	D1Ø	"	" "
	D11	"	" "
	D12	12Ø Ø5Ø	Diode, 1N4ØØ3, Rectifier
√4	D13	"	" " "
	D14	"	" " "
	D15	"	" " "
	D16	12Ø ØØ5	Diode, 1N4148
	D17	"	" "
√5	D18	"	" "
	D19	"	" "
	D2Ø	"	" "

TU-300
MAIN CIRCUIT BOARD
PARTS LIST

(CONT.)

ITEM	P.N.	DESCRIPTION	
IC1	125 150	IC, MC1416	
IC2	125 012	IC, 4081, CMOS	
IC3	125 150	IC, MC1416	
IC4	125 078	IC, 741	
IC5	125 022	IC, MC1458CPI	
IC6	125 179	IC, NE5553U, Regulator	
IC7	125 000	IC, 7805, Regulator, 5V	
Q1	120 027	Transistor, 2N4123	
Q2	"	" "	
Q3	"	" "	
Q4	"	" "	
Q5	"	" "	
Q6	"	" "	
T1	130 001	Transformer	
	140 332	Fuse	(1)
	140 331	Clip, fuse mounting	(2)
	140 333	Switch set	(1)
P1	140 334	Connector, PC mount, DB25	
	137 180	Connector, PC mount, 15 pin male	(6)
	140 330	Relay	
P2	137 127	Header, right angle, 4 pin	
	140 101	Socket, IC, 16 pin	(2)
	140 100	Socket, IC, 14 pin	(1)
	140 191	Socket, IC, 8 pin	(2)
	145 079	Screw, Nylon, 4-40 x 3/8	(2)
	145 086	Screw, Nylon, 4-40 x 1 1/4	(2)
	145 049	Nut, Nylon, 4-40	(4)
	335 103A	Circuit Board	(1)

TU-300
DISPLAY
PARTS LIST

ITEM	P.N.	DESCRIPTION		
	335 1Ø4	Circuit board	(1)	
	17Ø Ø7Ø	Display module, National LM3914	(1)	
	137 188	Connector, 12 pin, Molex male	(1)	
	17Ø Ø68	Cable, flat, 8 conductor	(1)	
R1	1ØØ 71Ø	Resistor, 33Ø ohm, 1/4W, 5%		ORG-ORG-BRN
R2	1ØØ 83Ø	Resistor, 1K ohm, 1/4W, 5%		BRN-BLK-RED
POWER	12Ø Ø97	LED, RED, Litronix LD32C		
SEND	" "	" " " "		
RDA	" "	" " " "		
MARK	" "	" " " "		
SPACE	" "	" " " "		

TU-300
CHASSIS PARTS LIST

ITEM	P.N.	DESCRIPTION	QUANITY
	15Ø 497	Cover, chassis	(1)
	15Ø 498	Chassis, internal	(1)
	14Ø 495	Chassis, front panel	(1)
	15Ø 496	Extrusion	(1)
	15Ø 494	Bracket, PC support	(1)
	15Ø 499	Legend, front panel	(1)
	137 Ø19	Outlet, grounded AC	(1)
	14Ø Ø58	Cord, power, AC	(1)
	145 216	Screw, 4-4Ø X 1/4" LG, FH, Slotted	(7)
	145 Ø45	" " 6-32 X 1/4" " " "	(2)
	145 Ø23	" " 6-32 X 1/4" Binder head	(6)
	145 Ø43	" " 6-32 X 1/2" Binder head	(1)
	145 Ø15	Nut, 6-32	(2)
	145 Ø17	Lock washer, Int. star #6	(1)
	145 Ø39	Screw, 8-32 X 3/8 Binder head	(2)
	145 Ø79	Screw, 4-4Ø X 3/8 Nylon	(2)
	145 Ø49	Nut, 4-4Ø, Nylon	(4)
	14Ø 344	Lug, Int. star, ground	(2)
	14Ø Ø46	Strain relief	(1)
	15Ø 5Ø5	Feet, rubber	(4)
	145 Ø18	Washer, #6 flat	(2)
	145 Ø86	Screw, 4-4Ø X 1 1/4 Nylon	(2)

TU-300
DEMODULATOR BOARD
PARTS LIST

ITEM	P.N.	DESCRIPTION	
	335 1ØØ	Circuit board	
IC1	125 148	IC, 4741, quad Op Amp	
IC2	125 Ø22	IC, MC1458CP, dual Op Amp	
D1	12Ø ØØ5	Diode, 1N4148, silicon, fast switching	
D2	" "	" " " " "	
D3	" "	" " " " "	
D4	" "	" " " " "	
D5	" "	" " " " "	
D6	" "	" " " " "	
D7	" "	" " " " "	
C1	~~11Ø 236~~	~~Capacitor, .15uf~~, mylar	
C2	~~11Ø 143~~	~~" 22Øpf~~, disc	
C3	~~111 121~~	~~" 3.3uf~~, 25V, Electrolytic, Axial	
C4	~~" "~~	~~" "~~ " " "	
C5	~~11Ø 24Ø~~	~~" .22uf~~, mylar, (224K)	
C6	~~11Ø 199~~	~~" .Ø1uf~~, 1ØØV, disc	
C7	~~" "~~	~~" "~~ " "	
R1	1Ø1 31Ø	Resistor, 1ØØK, 1/4W, 5%	(BRN-BLK-YEL)
R2	" "	" " " " "	(BRN-BLK-YEL)
R3	1Ø1 25Ø	" 56K " " "	(GRN-BLU-ORG)
R4	1Ø1 19Ø	" 33K " " "	(ORG-ORG-ORG)
R5	~~" "~~	~~" "~~ " " "	(ORG-ORG-ORG)
R6	~~" "~~	~~" "~~ " " "	(ORG-ORG-ORG)
R7	~~1Ø1 11Ø~~	~~" 15K~~ " " "	(BRN-GRN-ORG)
R8	~~1Ø1 19Ø~~	~~" 33K~~ " " "	(ORG-ORG-ORG)
R9	~~" "~~	~~" "~~ " " "	(ORG-ORG-ORG)
R1Ø	~~1ØØ 91Ø~~	~~" 2.2K~~ " " "	(RED-RED-RED)
R11	~~" "~~	~~" "~~ " " "	(RED-RED-RED)
R12	~~1Ø1 47Ø~~	~~" 47ØK~~ " " "	(YEL-VIO-YEL)
R13	~~1Ø1 19Ø~~	~~" 33K~~ " " "	(ORG-ORG-ORG)
R14	~~1ØØ 99Ø~~	~~" 4.7K~~ " " "	(YEL-VIO-RED)
R15	~~1Ø1 11Ø~~	~~" 15K~~ " " "	(BRN-GRN-ORG)
R16	~~1Ø1 45Ø~~	~~" 39ØK~~ " " "	(ORG-WHT-YEL)
	137 175	Connector, 15 pin, female	
	14Ø 1ØØ	Socket, IC, 14 pin	
	14Ø 191	Socket, IC, 8 pin	

TU-300
UNIVERSAL FILTER
PARTS LIST

ITEM	P.N.	DESCRIPTION	
	335 099A	Circuit board (1)	
IC1	125 022	IC,MC1458CP, Dual Op Amp	
IC2	125 022	IC,MC1458CP, Dual Op Amp	
Q1	125 039	Transistor, MPF111, FET	
P1	106 041	Pot, 500 ohm, PC mount	
P2	106 041	Pot, 500 ohm, PC mount	
P3	106 041	Pot, 500 ohm, PC mount	
D1	120 005	Diode, 1N4148, silicon, fast switching	
	120 005	Diode, 1N4148 (for freq select) (5)	
* C1	110 181	Capacitor, .005uf, mylar (2AR02JT)	*see note
* C2	110 181	" " " " "	*see note
C3	" "	" " " " "	
C4	" "	" " " " "	
C5	" "	" " " " "	
C6	" "	" " " " "	
C7	" "	" " " " "	
C8	" "	" " " " "	
C9	110 199	Capacitor, .01uf, 100V, disc	
C10	110 199	Capacitor, .01uf, 100V, disc	

*NOTE: These capacitors are only used in the 2295 Hz filter board. The other filter boards will not use C1 and C2, and should not be installed.

The following is a list of resistors in universal package. You should refer to the resistor chart in selecting the correct values for the particular frequency you are tuning the filter for.

P.N.		VALUE			QUANITY	COLOR
100 780	Resistor,	620 ohm,	1/4W,	5%	(3)	BLU-RED-BRN
101 070	" "	10K	" "	"	(1)	BRN-BLK-ORG
101 150	" "	22K	" "	"	(3)	RED-RED-ORG
101 175	" "	30K	" "	"	(1)	ORG-~~WHT~~ BLK-ORG
101 190	" "	33K	" "	"	(1)	ORG-ORG-ORG
101 200	" "	36K	" "	"	(3)	ORG-BLU-ORG
101 220	" "	43K	" "	"	(3)	YEL-ORG-ORG
101 260	" "	62K	" "	"	(2)	BLU-RED-ORG
101 270	" "	68K	" "	"	(1)	BLU-GRY-ORG
101 350	" "	150K	" "	"	(3)	BRN-GRN-YEL
101 370	" "	180K	" "	"	(3)	BRN-GRY-YEL
101 390	" "	220K	" "	"	(3)	RED-RED-YEL
101 400	" "	270K	" "	"	(3)	RED-VIO-YEL
101 470	" "	470K	" "	"	(1)	YEL-VIO-YEL

31

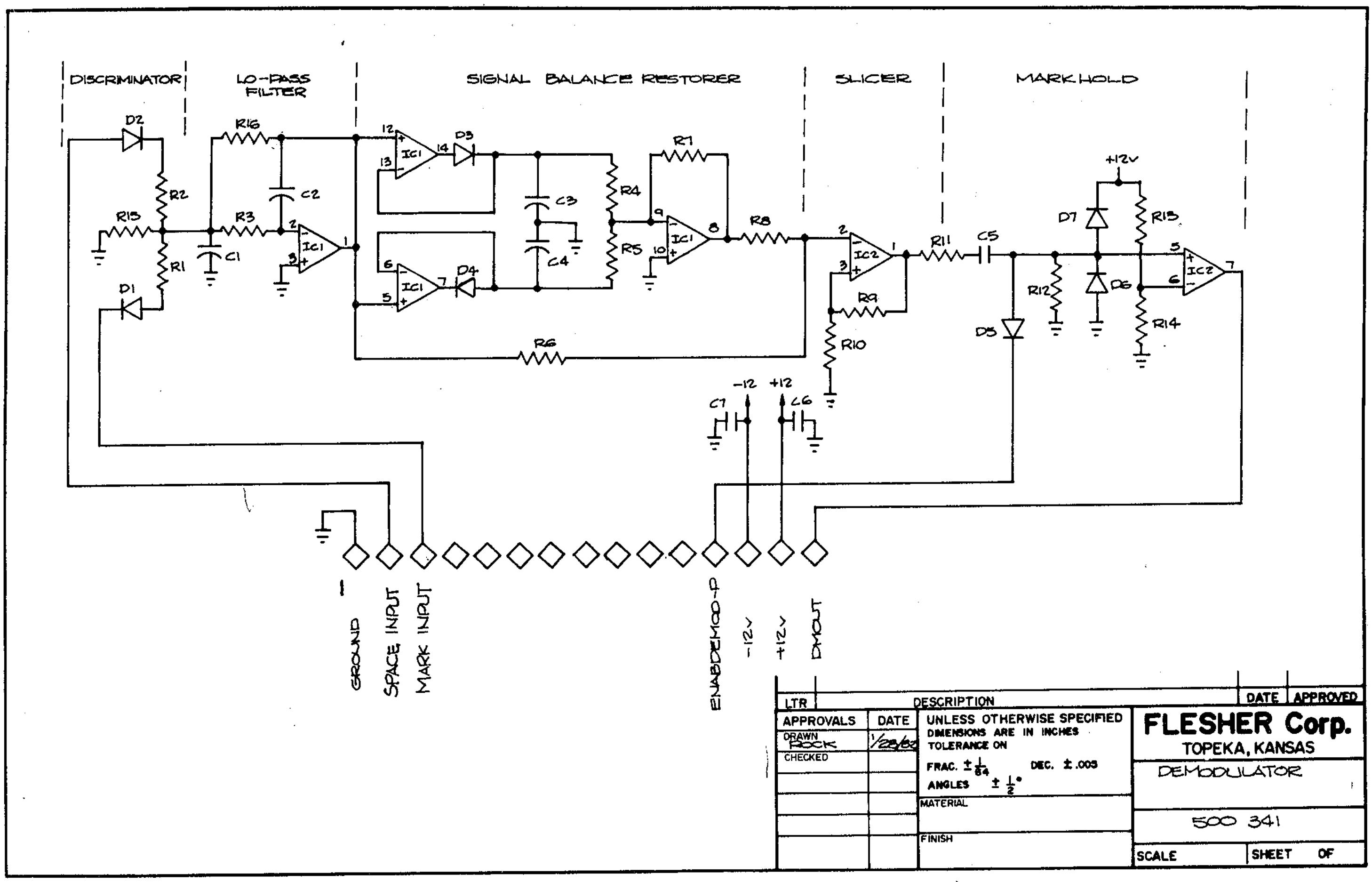
36

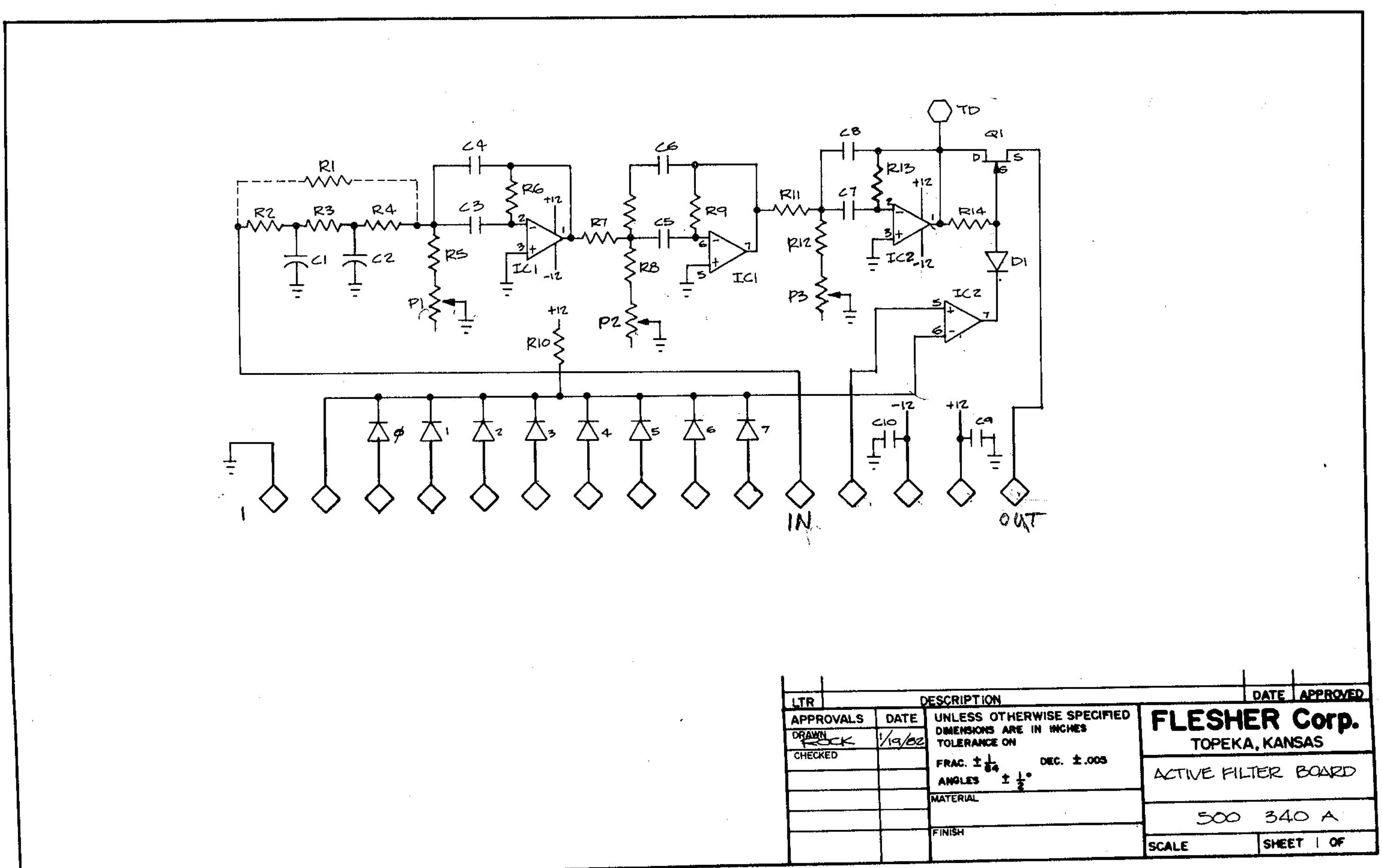
137 175	Connector, edge, 15 pin, female	(1)
140 191	Socket, IC, 8 pin	(2)

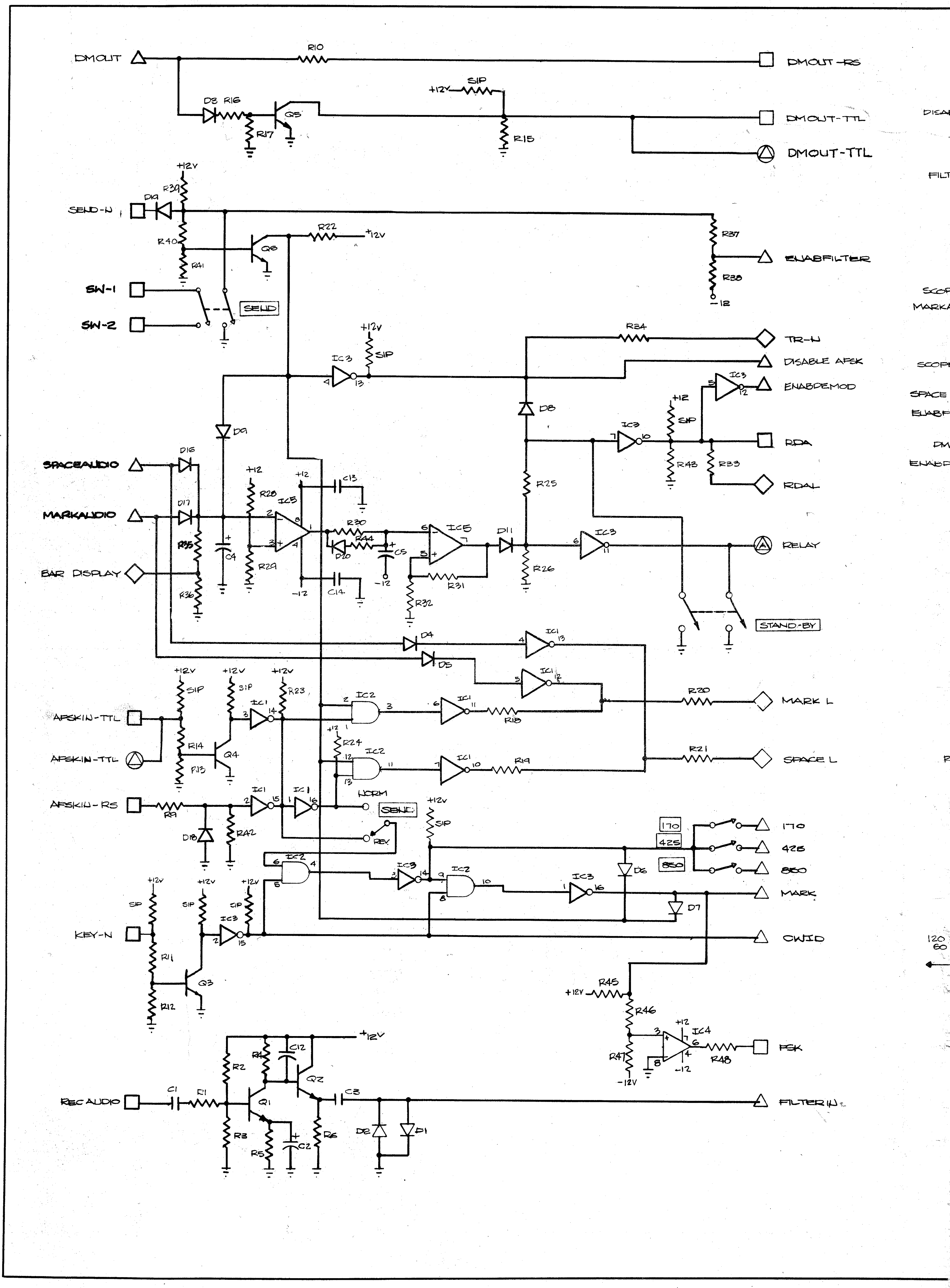
BRN R OR

TU-300
AFSK BOARD
PARTS LIST

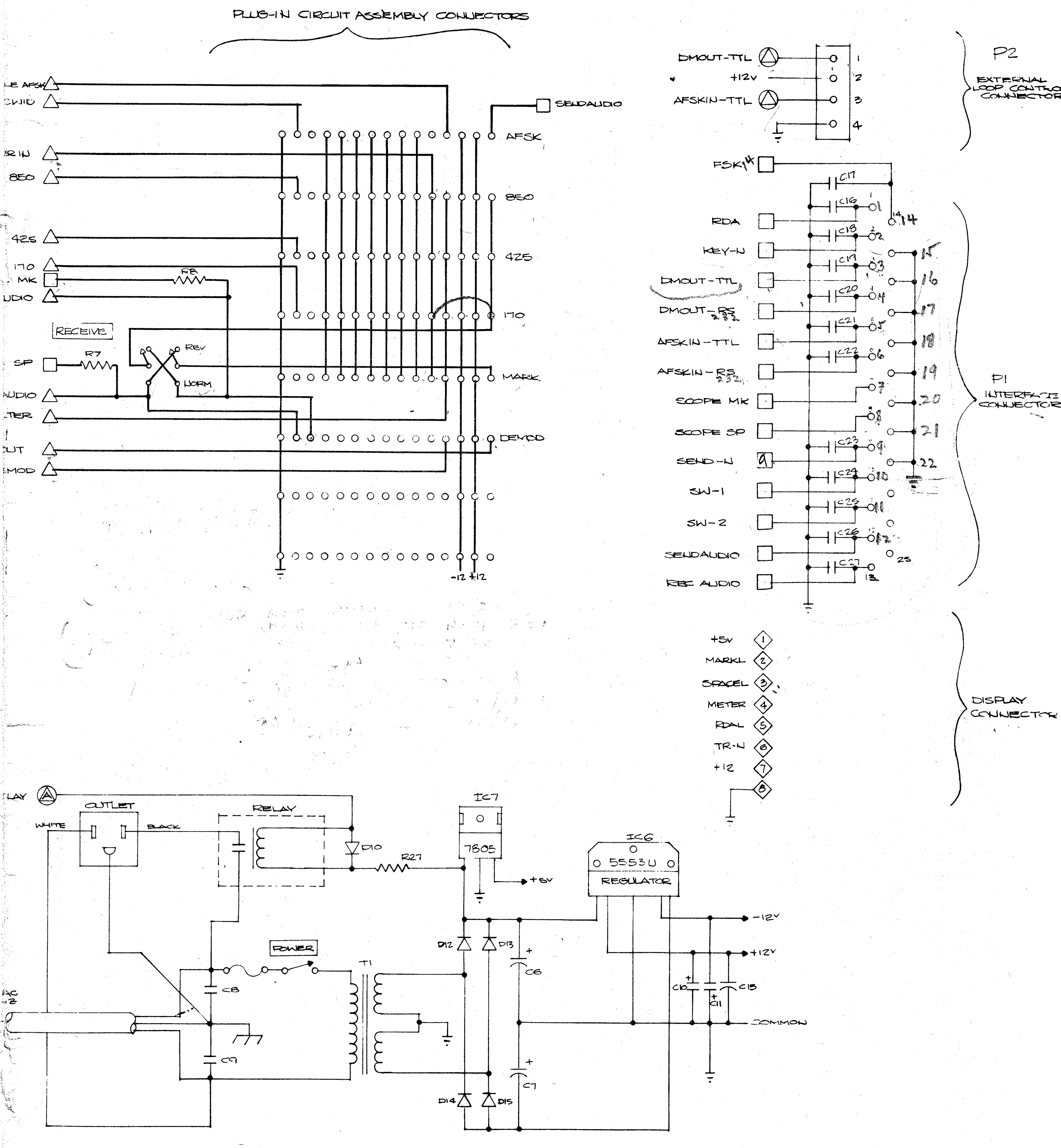
ITEM	P.N.	DESCRIPTION		
	335 098	Circuit Board		(1)
C1	110 120	Capacitor, 25pf disc		
C2	110 120	Capacitor, 25pf disc		
C3	110 240	Capacitor, .22uf, mylar (224K)		
C4	110 152	Capacitor, 750pf disc		
C5	110 199	Capacitor, .01uf, disc		
C6	110 199	Capacitor, .01uf, disc		
C7	110 199	Capacitor, .01uf, disc		
IC1	125 011	IC, 4069		
IC2	125 093	IC, 40193		
IC3	125 093	IC, 40193		
IC4	125 093	IC, 40193		
IC5	125 078	IC, 741 op amp		
P1	106 103	Pot, 10K		
R1	1101 ~~100 850~~ 600	Resistor, 2.2M ohm, 1/4 watt, 5%	RED-RED-GRN	
R2	100 670	Resistor, 220 ohm, 1/4 watt, 5%	RED-RED-BRN	
R3	101 470	Resistor, 470K ohm, 1/4 watt, 5%	YEL-VIO-YEL	
R4	101 470	Resistor, 470K ohm, 1/4 watt, 5%	YEL-VIO-YEL	
R5	100 730	Resistor, 390 ohm, 1/4 watt, 5%	ORG-WHT-BRN	
R6	100 790	Resistor, 680 ohm, 1/4 watt, 5%	BLU-GRY-BRN	
R7	100 190	Resistor, 33K ohm, 1/4 watt, 5%	ORG-ORG-ORG	
	107 008	Resistor Array, 4.7K X 9		
D1	120 005	Diode, 1N4148		
D2	120 005	Diode, 1N4148		
D4	120 005	Diode, 1N4148		
D6	120 005	Diode, 1N4148		
XT	140 321	Crystal, 5.508 Mhz		
	137 175	Connector, Edge, Molex, 15 pin female		(1)
	140 101	Socket, IC, 16 pin		(3)
	140 100	Socket, IC, 14 pin		(1)
	140 191	Socket, IC, 8 pin		(1)


DISCRIMINATOR
LO-PASS FILTER
SIGNAL BALANCE RESTORER
SLICER
MARKHOLD
D2
R2
R15
R1
D1
R16
C2
R3
C1
IC1
12
13
IC1
14
D3
C3
C4
6
5
IC1
7
D4
R4
R5
R7
9
10
IC1
8
R8
R6
IC2
R9
R10
R11
C5
R12
D5
+12v
D7
D6
R13
R14
IC2
-12
+12
C7
C6
GROUND
SPACE INPUT
MARK INPUT
ENABDEMOD-P
-12v
+12v
DMOUT
LTR
DESCRIPTION
DATE
APPROVED
APPROVALS
DATE
DRAWN
ROCK
1/23/82
CHECKED
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCE ON
FRAC. ± 1/64
DEC. ± .005
ANGLES ± 1/2°
MATERIAL
FINISH
FLESHER Corp.
TOPEKA, KANSAS
DEMODULATOR
500 341
SCALE
SHEET
OF


TD
Q1
D
S
G
C8
R13
+12
C7
R1
R2
R3
R4
C1
C2
C4
C3
R6
+12
IC1
-12
R5
P1
R7
C6
C5
R9
R8
P2
IC1
+12
R10
R11
R12
P3
IC2
-12
R14
D1
IC2
-12
+12
C10
C9
IN
OUT
LTR
DESCRIPTION
DATE
APPROVED
APPROVALS
DATE
DRAWN
ROCK
1/19/82
CHECKED
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCE ON
FRAC. ± 1/64
DEC. ± .005
ANGLES ± 1/2°
MATERIAL
FINISH
FLESHER Corp.
TOPEKA, KANSAS
ACTIVE FILTER BOARD
500 340 A
SCALE
SHEET 1 OF

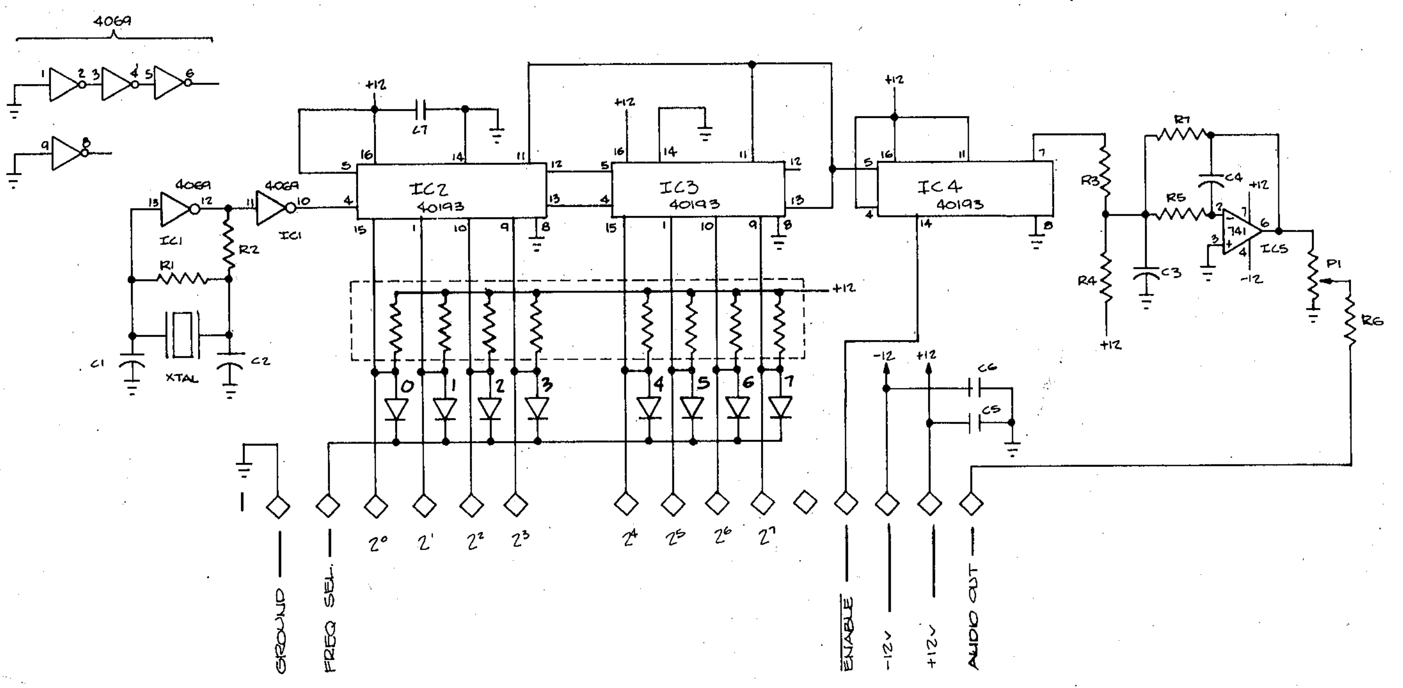


DMOUT
R10
DMOUT-RS
+12V
SIP
D3
R16
Q5
R17
R15
DMOUT-TTL
DMOUT-TTL
+12V
R39
D19
SEND-N
R40
R41
Q6
R22
+12V
R37
ENABFILTER
R38
-12
SW-1
SW-2
SEND
IC3
SIP
R34
TR-N
DISABLE AFSK
IC3
ENABDEMOD
D8
+12
SIP
IC3
RDA
R43
R33
RDAL
D9
D16
SPACEAUDIO
MARKAUDIO
D17
+12
R28
IC5
C13
R25
R35
C4
R29
R30
R44
D20
C5
IC5
D11
IC3
RELAY
BAR DISPLAY
R36
C14
-12
R32
R31
R26
STAND-BY
D4
IC1
D5
IC1
+12V
SIP
R23
IC2
IC1
R20
MARK L
AFSKIN-TTL
IC1
R18
R14
Q4
R24
IC2
IC1
R21
AFSKIN-TTL
R13
R19
SPACE L
AFSKIN-RS
R9
IC1
IC1
NORM
SEND
D18
R42
REV
SIP
170
170
425
425
850
850
IC2
IC3
IC2
D6
IC3
MARK
D7
KEY-N
IC3
CWID
R11
Q3
R12
R45
R46
IC4
R47
R48
FSK
-12V
R4
C12
R2
Q2
C1
R1
C3
REC AUDIO
Q1
FILTER IN
R3
C2
R6
D2
D1
R5



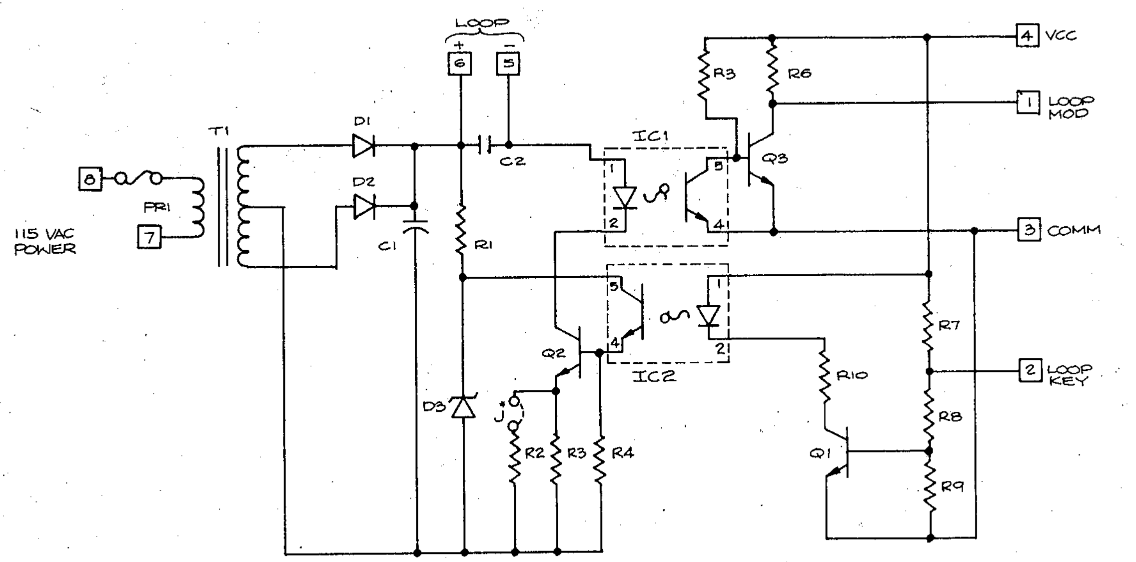
LTR	DESCRIPTION	DATE	APPROVED

APPROVALS	DATE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	FLESHER Corp. TOPEKA, KANSAS
DRAWN Rock	1/15/82	.X±.030 .XX±.015	
CHECKED		.XXX±.005 ANGLES ± 1/2	WIRING DIAGRAM TU-300
		MATERIAL	
		FINISH	500 346 A.
			SCALE SHEET OF



LTR	DESCRIPTION	DATE	APPROVED

APPROVALS	DATE		
DRAWN ROCK	1/19/82	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON FRAC. $\pm\frac{1}{64}$ DEC. $\pm.005$ ANGLES $\pm\frac{1}{2}°$	**FLESHER Corp.** TOPEKA, KANSAS
CHECKED		MATERIAL	AFSK BOARD
		FINISH	500 339
			SCALE / SHEET 1 OF



R1 27K 1W
R2 100 1/2W
R3 220 1/2W
R4 10K
R5 10K
R6 4.7K
R7 4.7K
R8 2.7K
R9 2.7K
R10 470

C1 47μf 160V
C2 .01μf 1000V

D1 1N4003
D2 1N4003
D3 5.1VZ

Q1 2N4123
Q2 MJE 340
Q3 2N4123

IC1 4N28
IC2 4N28

* JUMPER FOR 60 mA. LOOP

LTR	DESCRIPTION	DATE	APPROVED

APPROVALS	DATE		
DRAWN ROCK	4/2/82	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCE ON FRAC. $\pm\frac{1}{64}$ DEC. $\pm.005$ ANGLES $\pm\frac{1}{2}°$	**FLESHER Corp.** TOPEKA, KANSAS
CHECKED		MATERIAL	LOOP SUPPLY WIRING DIAGRAM
		FINISH	500 375 A
			SCALE / SHEET OF