Guide to Operations and Service

SERIAL INPUT CONTROL MODULE

Model 1300

Table Of Contents

4 SERIAL INPUT CONTROL MODULE

4.1 Introduction

The Serial Input Control Module allows almost any device capable of RS-232 or RS-422 asynchronous serial communications to adjust the audio delay of the Model 1300. The communications protocol used is compatible with the Tektronix Model 110-S Synchronizer. Refer to section 4.4 for a complete description of the Model 1300 Serial Communications Protocol.

The module has a compensation mode which adds the delay compensation information received at its serial port to the fixed amount of delay selected by the base delay switches on the front panel, resulting in the desired total delay of the audio signal. When the compensation mode is active and the delay requested exceeds 17 milliseconds, delay changes are performed gradually at approximately a 1/2 second rate and continue in 17 ms steps until the total delay is reached. When the compensation mode is not active, all delay changes are instantaneous, regardless of their amounts.

The module can be configured for 50- or 60-Hz field versions for frame interpolation.

A BNC input connector is provided on the Model 1300 rear panel for RS-232 communications over coaxial cable with the Tektronix Model 110-S Synchronizer. A BNC output connector allows the linking of two or more Model 1300 units together to provide synchronous delay changes in each unit. As an option, the module may also be fitted with rear panel communications connectors such as a DB-25 type for RS-232 standards or a DE-9 type for RS-422 standards. With plug-in software updates these connectors facilitate interconnection and communications with a wide variety of remote devices.
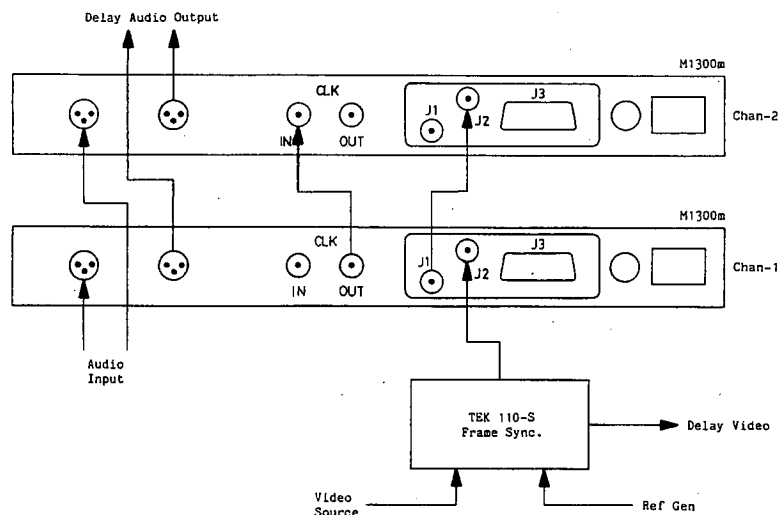
Figure 4.1. Connection diagram for a typical system configuration.

4.2 Basic Operation

1. Turn on the Model 1300 by plugging it in.

2. Set the front-panel DISPLAY switch to show delay time in either frames or milliseconds.

3. Set the four-position BASE DELAY switch (comprising four rotary thumb-wheel switches) to the appropriate fixed delay time in milliseconds (a known delay introduced by a satellite link or land lines, for example).

4. If you set the front-panel COMP toggle switch to IN, the microprocessor in the Serial Input Control Module adds the compensated delay to the fixed delay determined by the BASE DELAY switch, and applies the total delay to the audio input signal. Note that delay changes are performed gradually at a rate of either 0.6 or 0.7 frames per second, depending on the transmission standard being used.

5. If you set the COMP switch to OUT, the Model 1300 applies only the delay time determined by the BASE DELAY switch to the audio input signal. Signals received at the serial port will be ignored, and any changes in base delay take effect immediately.

6. Delay processing may be completely bypassed by setting the front-panel toggle switch labeled AUDIO to BYPASS.

4.3 Theory of Operation

This section describes how the Serial Input Control Module functions. For your convenience, the section is divided into three subsections:

- 4.3.1 Input/Output Control
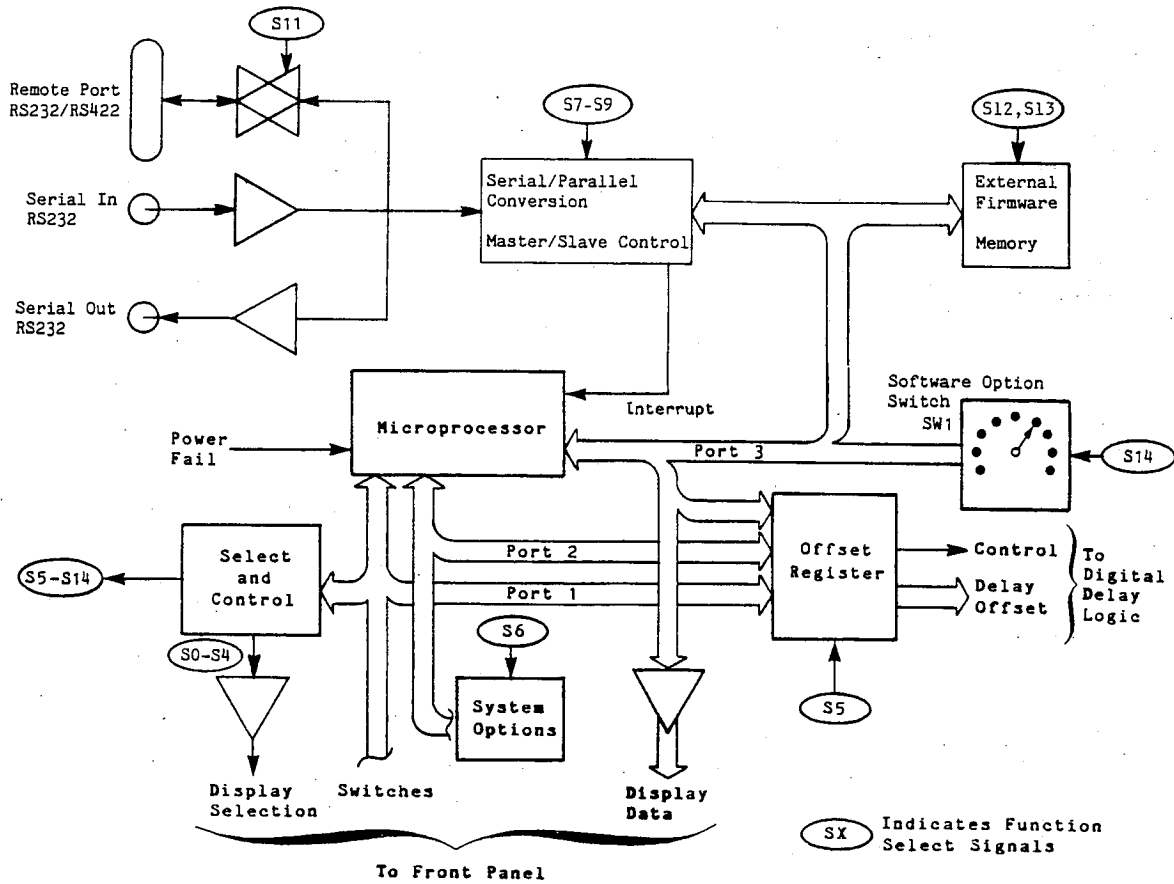- 4.3.2 Microprocessor
- 4.3.3 Firmware

Figure 4.2. Serial Input Control Module Block Diagram.

4.3.1 Input/Output Control

The BNC input connector routes standard RS-232C serial asynchronous data to level translator U20. Then the data is sent to UART U21 for serial reception and serial to parallel transformation. When a character is constructed by the UART, an interrupt is generated with the DA (Data Available) signal through U14. By routing this asynchronous serial signal directly out through the BNC output connector, an interrupt is generated in the next Model 1300 unit at the same time. Hence, synchronous compensation delay updates by multiple units is possible when they are daisy-chained together in this fashion.

Input RS-232 signals received either at the BNC input connector or the optional DB-25 connector are routed to the BNC output connector for reception by another Model 1300 unit. The signals received by the DE-9 (RS-422) connector are translated to the RS-232 standard and also transmitted via the BNC output connector, permitting multiple Model 1300 units to respond to the same control information simultaneously, regardless of the input signal standard being used.

Several jumper positions are provided to enable electrical modifications to the serial option circuitry. W1 jumper position should be installed when the Model 1300 is used with 50 Hz frame rate systems. It will cause the microprocessor to translate all delays displayed into the proper frame readout for SECAM or PAL standards. Without W1 installed all delays will be displayed in the NTSC 60 Hz standard when requested by the display FRAMES/ms mode switch.

W2 through W9 are used to select the serial communications baud rate. Rates available are from 300 b.p.s. to 38400 b.p.s. respectively. Only one position should be selected at any time.

W10 is a three position jumper where only two pins are selected at a time to provide the optional section of the RS-232 or RS-422 input standard. Shorting pins 1 & 2 is required to use the input RS-232 BNC connection or the optional DB-25 I/O.

When pins 2 and 3 of W10 are shorted, use of the RS-422 (DE-9) connector for input control is possible.

W11 is provided for future expansion of the serial circuitry and has been factory prewired.

4.3.2 Microprocessor

The Model 1300 uses a single chip microprocessor with three I/O ports for control and data transfer. The three port capability is required to provide both 18 bit delay offsets and control information simultaneously. These ports are also used to transfer data to and from the front panel circuitry to support the display, panel switches, and UART data communications.

The microprocessor controls hardware functions via the function select decoder U9. The decoder generates the signals S0 through S14 to control and enable data paths to the microprocessor I/O ports.

The microprocessor operates the front-panel display (through the select-decoder) using signals S0 through S3 to activate the digit positions in the front panel window and read the Base Delay switch settings.

S4 is used to activate front panel LEDs and to monitor all front panel toggle switches.

S5 permits the microprocessor to transfer from its I/O ports the offset delay information synchronously with the Model 1300 audio converter.

S6 permits monitoring of the Model 1300 option jumper assignments such as stereo/mono and memory size upon which the software can take appropriate action.

S7 through S10 are assigned to handle the UART receive data, transmit data, status register, and control register, respectively.

To control the RS-422 master/slave setup, signal S11 is used to transfer the microprocessor data to the U19 latch.

To facilitate future expansion, external microprocessor program memory has been provided for. When used, the latch (U13) and memory (U16) triple the amount of available program memory space. Signals S13 and S12 select external memory banks 1 and 2 respectively.

S14 provides the possibility of software flexibility by monitoring the software option switch (SW1).

4.3.3 Firmware

The single chip microprocessor contains all the program routines internally, along with memory to yield the operating system and overall machine function. Version 3.0A firmware allows the Model 1300 to work with the Tektronix Model 110-S Synchronizer. The 110-S has a BNC RS-232 serial output connector which is fully compatible with the Model 1300 serial input BNC connector. The serial information is decoded by the Model 1300 firmware to enable control of audio delays causing synchronous and matched video to audio alignment.

Following power on diagnostics, the program goes into a scan-cycle loop. This scanning permits front panel support by repetitively turning on each display digit and LED sequentially and also by monitoring each digit and toggle switch sequentially. The scan loop is timed to control the display intensity, but has no control over the headroom LEDs. Its timing is such that the panel support is finished in approximately 15 ms and then a stall loop of about 6 ms takes place before returning to the beginning of the scan cycle. Normally however, interrupts are expected every 17 or 20 ms, thereby preventing return to the beginning of the scan cycle from the stall loop. This makes it possible to both detect the loss of serial information and continue panel support.

Interrupts cause the software to break away from the scan cycle (normally the stall loop) to take immediate action on the information received by the UART. The information received comes in the form of two serial 8 bit characters which contain both field identifier and video delay information. The audio delay is modified only after both characters have been received in the correct order, and the information has been extracted and compared to previous values.

Two major routines follow interrupt processing; conversion of panel and interrupt information into delay offsets with control over creep amounts, and conversion of delay offsets to panel display information with control over frames or millisecond display images. Interrupts do not cause continuous updating and conversion. Most of the time they just return the program to the beginning of the scan cycle, causing a slight increase in panel intensity. When updates do occur, the programming is returned to the stall routine.

The ability to expand the firmware program memory (by simply plugging in a single memory chip and setting the appropriate software option switch configuration) gives the Model 1300 almost unlimited application possibilities.
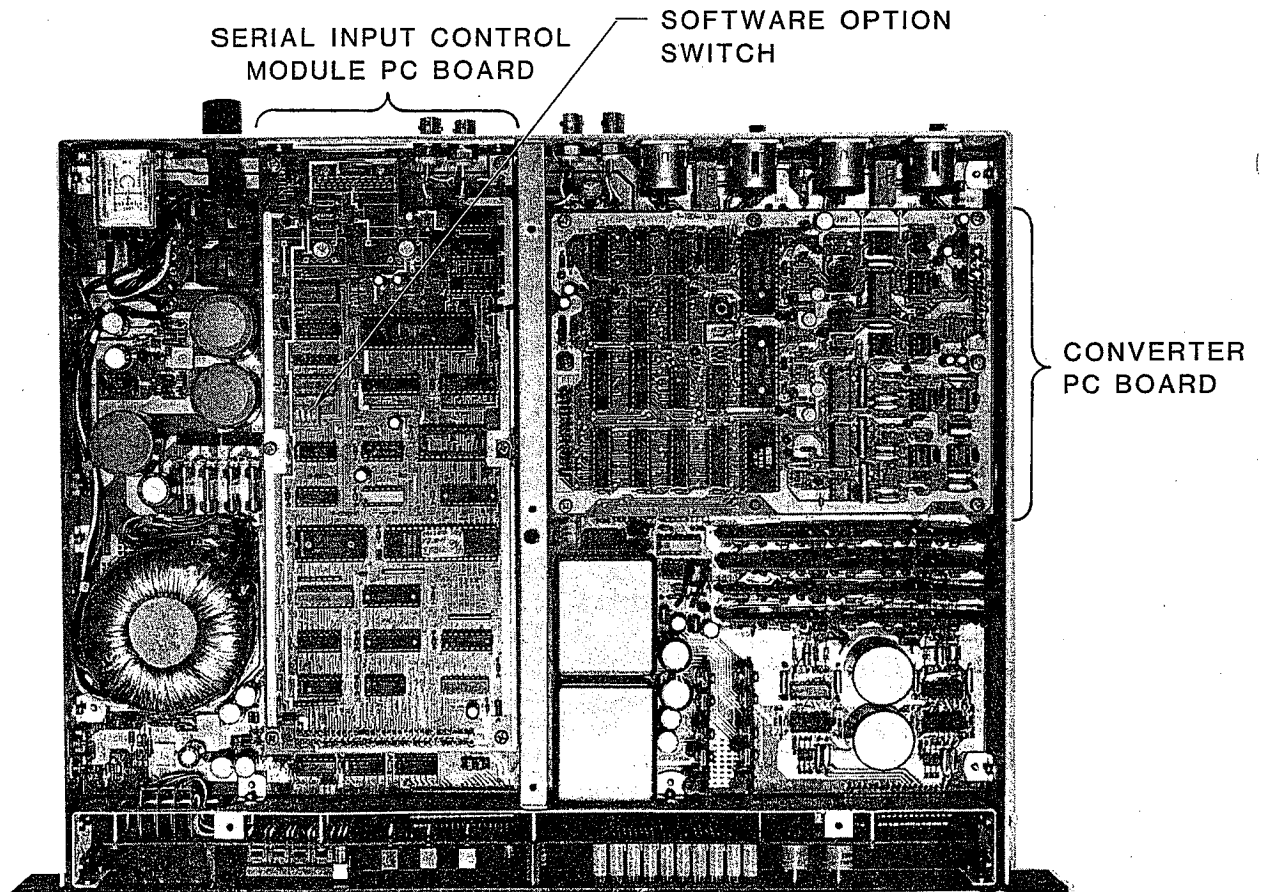
Figure 4.3. Internal view of the Model 1300S
with Serial Input Control Module installed.

4.4   Model 1300 Serial Communications Protocol

4.4.1   Hardware Interconnection

RS-232C   Standard asynchronous serial communications with
BNC coaxial input and output connectors
Optional DB-25 I/O connector

RS-422   Standard balanced asynchronous serial
communications with a DE-9 I/O connector

4.4.2   Protocol Description

The Model 1300 standard serial option firmware (V3.0A) provides a communications protocol for simplified remote control of audio delay. It expects to receive a pair of 8 bit control characters, with three bits used as the character identifier and the remaining five bits used to represent the audio delay requirement.

The character communication rate is 1200 b.p.s. with each character received at a video field rate. This permits the transmission of two characters per video frame period with a spacing of either 8.3 or 11.7 ms of time between each character, depending on the video standard in use.

4.4.3   Protocol Specification

First Character

Bits	Value	Delay	Definition
8	0		
7	1		Field 1 Identifier
6	0		
5	d5	4.20 ms	
4	d4	2.25 ms	
3	d3	1.13 ms	LSB of Delay (binary)
2	d2	0.56 ms	
1	d1	0.28 ms	

Second Character

Bits	Value	Delay	Definition
8	0		
7	1		Field 2 Identifier
6	1		
5	d10	144 ms	
4	d9	72 ms	
3	d8	36 ms	MSB of Delay (binary)
2	d7	18 ms	
1	d6	9 ms	

4.4.4 Notes on the Protocol

- Two characters with appropriate identifiers must be received in correct sequential order before any action is taken.

- Delay changes will only occur if the new character pairs are repeated more than 12 times

- Bits d1 though d10 are combined and translated into an audio delay offset with a minimum resolution (d1) of 281.3 us and a maximum delay (d1-d10 = "1") of 288.05 ms.

- Other baud rates and character rates are possible, but they would effect the display intensity. A range of baud rates between 300 and 38400 b.p.s. are selectable via hardware jumpers W2 through W9 respectively.

4.5 Specifications

4.5.1 General Performance

Resolution of Compensated Delay - Nominally 21 us

Configurations
    1-in/1-out mono -- Model 1300
    2-in/2-out stereo -- Model 1300S

Delay Change
    Compensation off: Instantaneous
    Compensation on: Gradual -- 0.42 frames/second for 50 Hz
                                    and 0.50 frames/second for 60 Hz

4.5.2 Indicators and Connectors

Front Panel
    Units/Mode LEDs
    Four LED indicators:
                  REF - No signal input when lit
                  VID - Signal error detected when lit
                   FR - Displaying frames
                  ms - Displaying milliseconds

Rear Panel
    Serial Compensation I/O:
    J1 = RS-232C BNC output loop-through connector
    J2 = RS-232C BNC input serial connector
    J3 = optional RS-232C DB-25 asynchronous I/O connector
or,
    J3 = optional RS-422 DE-9 asynchronous I/O connector

Software Version
    V3.0A, compatible with the communications protocol used by the Tektronix Model 110-S Synchronizer.

4.6 Model 1300 Serial Input Control Module Parts List

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  PART NO.      QTY        DESCRIPTION                        REF.
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PART NO.	QTY	DESCRIPTION	REF.
CARBON FLM RES			
202-00514	1	RES,CF,5%,1/4W,100 OHM	R8
202-00542	1	RES,CF,5%,1/4W,4.7K OHM	R3
202-00549	1	RES,CF,5%,1/4W,10K OHM	R1
202-00570	1	RES,CF,5%,1/4W,100K OHM	R2
NETWORK RES			
205-00241	6	RES,NET,SIP,2%,4.7KX7	RP1,3-7
205-02900	1	RES,NET,DIP,2%,120X8	RP2
ELECTROLYT CAP			
240-00608	2	CAP,ELEC,2.2uF,50V,RAD	C30,35
240-00614	3	CAP,ELEC,47uF,16V,RAD	C4,18,21
CERAMIC CAP			
245-00590	1	CAP,CER,150pF,50V,10%	C26
245-03609	27	CAP,CER,.1uF,50V,Z5U,AX	C1-3,5-11,13-17,19,20,22-25,27 C28,31,32,36,37
INDUCTORS			
270-00779	3	FERRITE,BEAD	FB1,2,6
DIODES			
300-01029	1	DIODE,1N914 AND 4148	CR1
300-02401	1	DIODE,BAR 35,SCHOTTKY,LOW VF	CR2
DIGITAL/CMOS IC			
330-00765	1	IC,DIGITAL,4001,CMOS	U12
330-00767	1	IC,DIGITAL,4013,CMOS	U11
330-00768	1	IC,DIGITAL,4049,CMOS	U3
330-02707	1	IC,DIGITAL,4503,CMOS	U1
330-03482	1	IC,DIGITAL,74HC04	U14
330-03496	1	IC,DIGITAL,CD4515,CMOS	U9
330-03582	1	IC,DIGITAL,74HC163	U22
330-03583	4	IC,DIGITAL,74HC374	U4,7,13,19
330-03585	1	IC,DIGITAL,74HC14	U15
330-03586	1	IC,DIGITAL,74HC/SC244	U18
330-03611	1	IC,DIGITAL,74HC273	U6
330-03638	1	IC,DIGITAL,74HC393	U17

Model 1300 Serial Input Control Module Parts List (continued)

PART NO.	QTY	DESCRIPTION	REF.
INTERFACE IC			
345-00751	1	IC,INTER,75492,LED DRVR	U2
345-01584	1	IC,INTER,DS1488N	U29
345-01585	1	IC,INTER,DS1489AN	U20
345-02913	1	IC,INTER,NE594,DSP DRVR,8-SEG	U5
345-03784	1	IC,INTER,MC3487	U28
345-03786	1	IC,INTER,MC3486	U23
MICROPROC IC			
365-04165	1	IC,uPROC,8749,M1300,V3.0	U10
365-03526	1	IC,uPROC,CDP1854 or IM6402	U21
PC DIP/PROG SW			
455-00968	1	SW,DIP,1P1TX4	SW1
CABLE CONN			
490-00153	2	CONN,BNC,1FC,MB,ISOLATED	J1,2
490-02356	2	CONN,JUMPER,.1X025,2FCG	W4,10
PC EDGE CONN			
500-03619	1	CONN,EURO,C,ROW a+c,MALE,INV	J19
PC MNT CONN			
510-01067	1	CONN,POST,100X025,HDR,12MCG	W1-10
510-03088	1	CONN,POST,100X025,HDR,10MCG	W1-10
510-03549	1	CONN,D-SUB,9MC,FB,PCRA	J3
SOCKETS			
520-00942	8	IC SCKT,14 PIN,PC,LO-PRO	U2,11,12,14,15,17,20,29
520-00943	5	IC SCKT,16 PIN,PC,LO-PRO	U1,3,22,23,28
520-00945	2	IC SCKT,24 PIN,PC,LO-PRO	U9,16
520-00946	2	IC SCKT,40 PIN,PC,LO-PRO	U10,21
520-01361	6	IC SCKT,20 PIN,PC,LO-PRO	U4,6,7,17-19
520-02177	1	IC SCKT,18 PIN,PC,LO-PRO	U5
CONN HDWR			
527-00138	2	CONN,D-SUB,JACKSOCKET,.150"	J3,4
MACHINE SCREWS			
640-01701	2	SCRW,4-40X1/4,PNH,PH,ZN	J3 MTG HARDWARE
640-03713	2	SCRW,6-32X1/4,PNH,PH,SEMS,ZN	REAR BRACKET
NUTS			
643-01732	2	NUT,4-40,KEP,ZN	J3 MTG HARDWARE
BULK WIRE			
670-02722	4	WIRE,JMP,22AWG,.75",TEF,WHT	J1,2

Model 1300 Serial Input Control Module Parts List (continued)

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   PART NO.      QTY         DESCRIPTION                    REF.
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```

BRACKETS
  701-04089   1   BRACKET,CONTROL,SERIAL,M1300

PANELS
  702-04153   1   PLATE,ADAPT,DB25 TO DE9,031THK   J3

PC BOARDS
  710-04067   1   PC BD,SER OPT BD,M1300

Additional Parts — Main Board Artwork Rev 1 or Previous Only

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   PART NO.      QTY         DESCRIPTION                    REF.
=============================================================================
```

ELECTROLYT CAP
  240-01262   1   CAP,ELEC,330uF,25V,RAD   C34

INDUCTORS
  270-00779   1   FERRITE,BEAD   FB4

MODULES
  380-04099   1   DC to DC CONV,5Vin to +12Vout   U24
  380-04100   1   DC to DC CONV,5Vin to -12Vout   U26

Additional Parts — Main Board Artwork Rev 2.0 or More Recent Only

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   PART NO.      QTY         DESCRIPTION                    REF.
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```

METAL FLM RES
  203-00457   2   RES,MF,1%,1/8W,1.50K OHM   R4,7
  203-02399   2   RES,MF,1%,1/8W,174 OHM   R5,6

ELECTROLYT CAP
  240-00608   1   CAP,ELEC,2.2uF,50V,RAD   C29

TANTALUM CAP
  241-00651   1   CAP,TANT,.22uF,35V,RAD   C33

INDUCTORS
  270-00779   2   FERRITE,BEAD   FB3,5

LINEAR IC
  340-02086   1   IC,LINEAR,LM317LH,TO-39   U25
  340-03782   1   IC,LINEAR,LM337H,TO-39   U27