TABLE OF CONTENTS

Chapter 1: Special Features

1.1 Introduction

The Modulation Sciences, Inc. TV SIDEKICK SAP Generator combines the five elements needed for successful SAP operation: subcarrier generator, modulation monitor, audio processor, dbx® (BTSC) encoder, and transmitter tuning aid. Modulation Sciences has engineered these five devices into one package designed to work together. This system approach provides a level of performance previously unobtainable. Simplified operation, ease of installation, and economy are among the benefits to be derived.

TV SIDEKICK is cost-effective because there is no need for redundant power supplies, packaging, or input/output interfacing for each element.

Each subsystem of TV SIDEKICK is unique and has been specially engineered for its tasks.

1.2 Subcarrier Generator

TV SIDEKICK is video locked to horizontal sync. In the event that sync lock is lost, the unit reverts to internal crystal control. When crystal controlled, TV SIDEKICK has a frequency stability of ± 0.01% over 0° to 50° C.

1.3 Modulation Monitor

A built-in modulation meter eliminates the need to purchase an additional modulation monitor for SAP. No-type accepted modulation monitor is required.

The modulation meter provided is simple to read and very accurate. The peak/hold indicating circuit causes the meter to rise to the maximum deviation and remain there without much jitter. The meter can also be easily calibrated in the field with only a frequency counter and a DC voltage source.

1.4 Integrated Audio Processor

Audio processing is often a weak link in SAP transmission systems. Typically, the audio processing has been a hand-me-down from the main channel. As in main channel operation, poor audio peak control means low average modulation.

A fully BTSC compliant dbx® noise reduction encoder is included. This circuit is included under patent license from dbx® and is required for SAP operation.

1.5 Transmitter Tuning Aid

This function may be new to some television broadcasters. In many transmitters, proper tuning of the driver and power amplifier stages plays a major role in minimizing crosstalk between the PRO and main channel and vice versa.

The TV SIDEKICK contains a random noise generator and an incidental AM noise meter. The entire baseband is noise loaded and incidental AM is measured from an aural RF sample. The RF tuning can then be “tweaked” for minimum AM. A dramatic reduction in crosstalk often results from this procedure.

All of the devices needed to do minimum AM tuning are built into TV SIDEKICK. No additional equipment is needed.

Chapter 2: Specifications

SIZE: FRONT PANEL: 3.5”H x 19”W(88.9mmH x 482.6mmW)
CHASSIS: 3.5”H x 16.75”W x 9.25”D(88.9mmH x 425.5mmW x 235mmD)

POWER	95 to 130 VAC, 50/60 Hz, 12 W maximum 190 TO 260 VAC option available
TEMPERATURE RANGE	0° to 50° C
RF PROTECTION	All inputs and outputs RF suppressed
CONTROLS	See block diagram and accompanying explanation

CONNECTORS/LEVELS/IMPEDANCES

AUDIO IN:	No. 6 screw terminals -30 to +10 dBm 600Ω resistive ± 2%

SUBCARRIER REMOTE CONTROL:
No. 6 screw terminals
6 to 24 VAC, 10 to 24 VDC

TV SYNC LOCKED REMOTE STATUS:
No. 6 screw terminals
Isolated relay closure

BASEBAND IN:	BNC connector Unity gain to composite output 10 KΩ unbalanced
BASEBAND OUT:	BNC connector Composite level: 0.4 to 4 V P-P SAP level: 0.04 to 0.4 V P-P Noise test level: 0.4 to 4 V P-P 50Ω output impedance 600Ω minimum load impedance

SAP OUT: BNC connector
.35 to 3.5 V P-P
50Ω output impedance
600Ω minimum load impedance

COMPOSITE VIDEO IN/OUT:
BNC connectors
Bridged loop through

AURAL RF IN: BNC connector
0.1to 2 W
50Ω

FREQUENCY RESPONSE[2]
-3 dB at 50 Hz and 10 kHz
± 1 dB from 70 Hz to 7.5 kHz

SUBCARRIER FREQUENCY ACCURACY (UNLOCKED)[3]
± 0.02% at 25° C.

SUBCARRIER FREQUENCY DRIFT (UNLOCKED)[2]
± 0.005% from 0° to 50° C.

SPURIOUS COMPONENTS
2nd HARMONIC: better than 40 dB below subcarrier
3rd HARMONIC: better than 45 dB below subcarrier
ALL OTHER COMPONENTS, 50 Hz to 100 kHz: better than 60 dB below subcarrier

SUBCARRIER SUPPRESSION WHEN MUTED
Better than 50 dB

MUTING LEVEL: Adjustable from 10 to 30 dB below peak deviation set by “DEV” control. See block diagram, “Broadband Limiter”.

MUTING DELAY Selectable from 300 ms to 6 seconds.

METER CIRCUIT Peak deviation: ±5% accuracy
Synchronous AM: -20 to –60 dB sensitivity

[2] Measured with signal below compression threshold.
[3] When locked to TV sync, frequency performance is a function of the accuracy and stability of the horizontal line rate.

Chapter 3: Installation

3.1 Installation Location

The TV SIDEKICK should be installed in a location where the ambient temperature will remain within 0° to 50° C and where it will not be exposed to extremely high magnetic fields. It may be installed in an equipment rack immediately adjacent to most pieces of processing or test equipment. However, a separation of at least 6 to 12 inches from any high-power transformers should be maintained. The only other restriction on location is that cable lengths should not exceed the limits given in the following section.

3.2 Composite and SAP Connections

The COMPOSITE and SAP outputs are each driven by high slew rate amplifiers having a 50Ω output impedance and are able to drive loads as low as 600Ω. Up to 30 feet of cable may be used between TV SIDEKICK and the exciter inputs. Since the COMPOSITE output has considerably more drive capability than is available from most stereo generators, the TV SIDEKICK may be used as a buffer amplifier to extend the length of cable between the stereo generator and the exciter.

Any signal at the COMPOSITE input appears at the same level at the COMPOSITE output. In addition, the subcarrier signal will normally appear at this output unless an internal strap has been changed. Only the SAP subcarrier signal appears at the SAP output. The SAP subcarrier level at the COMPOSITE output is approximately 10% of the SAP level at the SAP output. A number of connections are possible, depending on the inputs available on the exciter and the desired operation.

3.2.1 Connection to an MSI Television Stereo Generator

The Modulation Sciences Television Stereo Generator (STV-784) has a SAP input connector. This input should be driven by the signal appearing at the SAP output connector on the TV SIDEKICK. Be sure to use the SAP input and not the PRO input. This signal is automatically mixed into the composite stereo signal within the stereo generator and is accurately metered on the STV-784 for correct injection level. This function, combined with the deviation meter built into the TV SIDEKICK, provides a full function SAP modulation monitor.

3.2.2 Input using Wideband Input of Exciter

Connect the stereo signal to the COMPOSITE input of the TV SIDEKICK.

Connect the COMPOSITE output to the wideband input of your exciter. The SAP output will not be used in this case. The noise generator signal will be substituted for the stereo signal when both the NOISE and READ buttons on the front panel of the TV SIDEKICK are engaged.

3.2.3 SCA Input on Exciter

Connect the SAP output of TV SIDEKICK to the auxiliary input on your exciter. The COMPOSITE input and output connections will be unused except when the noise generator in TV SIDEKICK is being used for transmitter tuning. Since the noise test signal appears only at the COMPOSITE output, a temporary connection will have to be made between the COMPOSITE output and the wideband input of the exciter during the tuning procedure.

3.2.4 Eliminating Hum Problems

Although the TV SIDEKICK has sufficient output drive capability to handle long cables, hum due to ground loops may still be a problem in some installations if your exciter has an unbalanced input. If you have a hum problem, try improving the ground connection between TV SIDEKICK and your exciter. Re-routing the cable away from sources of strong electromagnetic fields may also help. In extreme cases, the only solution may be to locate TV SIDEKICK closer to the exciter or to use a Modulation Sciences Composite Line Driver, Model CLD-2500.

3.3 Aural RF Input Connection

The signal at the RF input is applied to an AM demodulator so that synchronous AM can be measured. The measuring circuit includes an automatic RF level compensator so that correct results will be obtained for any RF level from 0.1 to 2 watts. RF levels above 2 watts may damage the internal termination resistor.

The aural RF signal should preferably be obtained from a sampler on your feedline before diplexing. For best results, the transmitter should be tuned for minimum synchronous AM when driving the antenna, since many transmitters behave somewhat differently when driving a dummy load. The most accurate method is to shut down the visual transmitter and driver for these tests. Any visual RF greater than 50 dB below the aural carrier level will invalidate these measurements. If you are on a master antenna installation or are in any other situation where the reverse power in your antenna feedline may contain some power from stations on other frequencies, it may be necessary to derive the RF sample with a directional coupler to ensure accurate measurement results. It is important that the RF sample contain aural signal only.

3.4 Audio Input Connections

Connect the audio signal to the screw terminals on the rear of the TV SIDEKICK. Shielded twisted pair cable is recommended for the audio connection. However, due to the extremely good common-mode rejection of the audio input circuit, non-shielded twisted pair wiring may work acceptably in many installations. The input impedance is 600Ω resistive, thus ensuring proper termination of telephone lines without the use of external pads. Input signal levels as low as –30 dBm can be accommodated. In most cases, this will allow direct connection to telephone lines without the use of external booster amplifiers. The terminal connections for various input levels can be determined from the following table:

Input Level (dBm)	Audio Terminals	Strap
+6 to +10	1,2	5,6
-14 to +5	1,2	None
-30 to -15	4,5	None

If you are unsure of the audio level in your application, start with the highest level connection and proceed with the rest of the installation instructions. If sufficient gain reduction cannot be achieved with the INPUT LEVEL control at maximum sensitivity, move the input connection to the next lower level setting and try again.

3.5 Remote Control Connections

The remote control signals should be connected to the appropriate screw terminals on the rear panel. Each control input is fully floating and is optically isolated from the internal control circuitry. Control signals may be either AC from 6 to 24 volts or DC from 10 to 24 volts. IF DC is used, the polarity marked on the input terminals must be observed. The signal at any remote control terminal should be maintained within 60 volts of chassis ground.

A relay closure output provides a remote control indication that the TV SIDEKICK is locked to the horizontal sync of the video that is looped through the unit.

The TV SIDEKICK can be modified to operate with 5 volt DC control signal by replacing the 4N37 optoisolators on the control inputs with 4N33s. If this is done, some care may have to be used to prevent spurious actuation of the remote control inputs.

3.6 Mode and Muting Controls

When power is applied to the TV SIDEKICK, it will normally be in READY mode unless the internal strapping has been changed (see section 7.2). The remote control terminals on the rear panel may be used to switch the unit between READY and OFF-LINE modes. For most television applications, the MUTE DEFEAT switch should be engaged so that the SAP subcarrier will be on whenever the unit is in the READY mode. If the MUTE DEFEAT switch is not engaged, the SAP subcarrier will be turned on and off by the muting circuit at whatever audio level is set by the MUTE LEVEL control. The mute delay can be changed by changing the value of an internal resistor (see section 7.3). It is set at the factory to 0.5 seconds.

3.7 Audio Processor Controls

The processor controls should initially be set as follows:

DEV	1 o'clock
LIMIT	12 o'clock
HFR	12 o'clock
MUTE LEVEL	9 o'clock

The INPUT LEVEL control is used to adjust the amount of gain reduction. Set the meter switch to the GR position. The meter should read full scale with no audio input. Now apply normal SAP program audio and adjust the INPUT LEVEL control for the desired amount of gain reduction. At gain reductions of up to 5 dB, the unit behaves mostly as a compressor-limiter with very little automatic level control operation. If your program signal maintains a very consistent level and you desire to do a minimum of dynamic range reduction, the gain reduction reading on the meter should be set to between 3 and 5 dB. At gain reductions of greater than 5 dB, the automatic level control circuit begins to operate, maintaining a consistent amount of dynamic range reduction at any gain reduction up to 20 dB. For most program material, best results will be obtained for gain reduction readings of 5 to 10 dB.

Now set the meter switch to the HFR position. If no high frequency reduction is taking place, the meter should read full scale (0 dB gain reduction). Most program material will cause gain reductions of 5 to 15 dB. The amount of high frequency reduction is adjusted by the HFR control and is also affected by the setting of the LIMIT control. These two controls should be adjusted while listening to the signal until the desired sound is obtained. The following paragraphs outline the effects and interactions of these controls.

The high frequency limiter is effectively a program-controlled equalizer. When it detects excessive amounts of high frequency signal, it introduces a high frequency roll off to keep peaks below its threshold. The broadband limiter sets any peaks which exceed its threshold. The threshold control circuit continuously

monitors the amount of broadband limiting and will reduce the threshold levels of both the high frequency limiter and the compressor if an excessive amount of broadband limiting takes place. The LIMIT control sets the threshold of both the high frequency limiter and the compressor relative to the broadband limiter.

Turning the HFR control clockwise will cause increasing amounts of high frequency roll off, thus causing the signal to sound "duller." However, since high frequency peaks will be reduced in level, this will allow increased RMS modulation, thus reducing apparent crosstalk into the SAP channel. Turning the LIMIT control clockwise causes less compression and high frequency limiting to occur. Thus, increasing numbers of peaks will be removed by the broadband limiter. When done in moderation, this will increase the RMS modulation of the signal and will usually make it sound somewhat brighter. When done excessively, this will cause transients to sound "splashy" and distorted. In general, the maximum clockwise setting of both controls cannot be used at the same time. A compromise setting must be found which yields maximum RMS modulation without making the signal sound dull or distorted.

After appropriate settings for the processor controls have been found, set the meter switch to the DEV position and adjust the DEV control for 10 kHz peak deviation.

3.8 Transmitter Tuning for Minimum Crosstalk

Connect an aural RF input signal to the TV SIDEKICK as described under "RF INPUT CONNECTION." Simultaneously engage the NOISE and READ switches. This removes the composite input signal and connects the internal noise generator to the COMPOSITE output. If your stereo signal does not run through the TV SIDEKICK, you will need to make a temporary connection from the COMPOSITE output to the wideband input of your exciter. Adjust the NOISE control for ±75 kHz deviation total modulation using your modulation monitor. Adjust the READ control for a mid-scale reading on the meter. Now adjust the transmitter tuning to minimize the meter reading. If necessary, readjust the READ control to maintain a convenient reading on the meter. In general, transmitters which produce minimum synchronous AM have less crosstalk between main and SAP channels and vice versa. Some compromise may be necessary, however, to maintain an acceptable efficiency for the transmitter.

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Chapter 4: SAP Setup

The critical parameters of SAP setup--injection and modulation--are both defined for stations operating in BTSC stereo by the FCC in Bulletin OET-60, Revised. OET-60 is the only official place these standards exist. They are NOT included in the usual Part 73 of the FCC Rules regulating broadcasting.

Technically, a monaural TV station broadcasting a SAP signal may choose almost any parameters for SAP transmission. However, in order to maintain compatibility with consumer television receivers, the FCC values should be strictly maintained.

Frequently, the difference between SAP channel injection and SAP channel modulation creates confusion. Injection is the frequency deviation of the main aural carrier by the 78.67 kHz (5H) SAP subcarrier. It is a static parameter that does not vary with any program material. SAP injection can be seen on a wideband main channel modulation monitor as an unvarying modulation of the aural carrier.

SAP modulation is the deviation of the SAP subcarrier by the program being carried on the SAP. The SAP modulation bounces with the program material. SAP channel modulation is not discernible on a main channel modulation monitor. However, if the monitor demodulates the SAP channel, SAP channel modulation can be measured and heard.

4.1 Injection

Injection is specified at ±15 kHz deviation of the main carrier. This can be set using the “SAP INJECTION” mode of a BTSC modulation monitor or by setting the meter on the Modulation Sciences Model STV-784 Television Stereo Generator to 0 on the VU scale.

Modulation of the SAP channel is specified at ±10 kHz peak deviation. It can be set using the “DEV” position of the meter on the TV SIDEKICK or by using the “SAP MODULATION” position of a BTSC modulation monitor.

Note that because of the action of the dbx® compander circuit, modulation may not fall to zero even with no input signal. This is a normal condition and does not indicate any malfunction in the TV SIDEKICK or monitor.

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Chapter 5: Maintenance

5.1 Factory Service

Each TSCA-189 is subjected to an extensive multi-stage test procedure, including a minimum 72-hour burn-in, before leaving the factory. Should any problems arise which cannot be corrected by simply replacing a defective integrated circuit (all of which are socketed for easy replacement), the unit should be returned to the factory for service after first determining that the problem is not in some other piece of equipment. If you have any doubt as to the cause of any problem that may be associated with your unit, please contact us for technical assistance.

When returning your unit for service, be sure to enclose a letter describing the nature of the malfunction along with your company name and shipping address to ensure proper handling. Contact us for a return authorization number before shipping your unit.

In general, any failure due to defects in materials or workmanship during your first three years of ownership should be covered by warranty. For full warranty details, see Chapter 6.

5.2 Field Repair

As mentioned above, MSI recommends that defective units be returned for factory service. If you must attempt field service, the following points should be kept in mind:

1. Some components are specially tested and/or matched to extremely tight tolerances. (See the parts list, Chapter 7, for details.) Replacing any of these components with an untested equivalent may result in severely degraded performance. It is especially important that matched components be replaced in groups rather than singly. MSI will be happy to supply sets of matched components for a nominal cost, should you require them.

2. When replacing components, care should be taken not to overheat traces in de-soldering. For ease of removal, we suggest cutting component leads flush with the top of the board before attempting de-soldering from the bottom.

3. Replacing certain components may make it necessary to retrim one or more of the various trim pots or variable capacitor CV1.

4. The above information and any other material relating to servicing is provided as a courtesy to those who feel that they must do their own repairs. MSI assumes no liability for damage or other problems arising from attempts to service units in the field. Any attempt at user servicing will void the warranty on that unit, although MSI will continue to provide non-warranty service at prevailing rates.

Chapter 7 provides further information on the operation of the SAP Sidekick. We will be glad to respond to inquiries for additional information relating to particular problems that may arise.

Chapter 6: Warranty

6.1 Warranty

FOR A SUMMARY OF THIS TEXT AND INFORMATION ON OBTAINING WARRANTY SERVICE, PLEASE SEE THE PAGES FOLLOWING THIS WARRANTY.

SELLER warrants the products sold shall be free from defects in materials and workmanship under normal use and service for a period of three (3) years from the date of delivery when properly installed. SELLER's sole obligation under this warranty shall be limited to repair or replacement, at SELLER's option, of any such part or parts of the products which may prove defective under normal use and service within said three (3) years and which the SELLER's examination shall disclose to its satisfaction to have been defective. If BUYER wishes to have warranty services performed at the facilities of SELLER, BUYER shall obtain, in advance, permission to return product(s) and shall ship said product(s) properly packed and insured to the address specified. Service performed at the facilities of SELLER under this warranty shall include parts plus labor. Items returned under this warranty must be transportation prepaid unless otherwise agreed by SELLER. It is expressly agreed that SELLER's obligation to repair or replace defective parts is the sole and exclusive remedy of BUYER for breach of this warranty. UNDER NO CIRCUMSTANCES SHALL SELLER BE LIABLE FOR ANY OTHER DAMAGES, EITHER DIRECT OR CONSEQUENTIAL.

SELLER may, from time to time, make certain representations concerning the compliance of its products with the Rules and Regulations of particular governmental agencies. No such representation can be a basis of the bargain unless it is in writing by an authorized representative of SELLER. Should this representation be found to be untrue, BUYER's sole remedy is the right of recession, at BUYER's option. Under no circumstances shall SELLER be liable for any other damages, either direct or consequential.

THE WARRANTY TO REPAIR OR REPLACE DEFECTIVE PARTS AND THE REPRESENTATION OF COMPLIANCE WITH GOVERNMENTAL RULES AND REGULATIONS, WHEN GIVEN IN WRITING, ARE EXPRESSLY IN LIEU OF AND HEREBY IN DISCLAIMER OF ALL OTHER EXPRESS WARRANTIES, AND IN LIEU OF AND IN DISCLAIMER AND EXCLUSION OF ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AS WELL AS ALL OTHER IMPLIED WARRANTIES, IN LAW OR EQUITY, AND OF ALL OBLIGATIONS OR LIABILITY ON SELLER'S PART. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION HEREOF.

SELLER neither assumes nor authorizes any person to assume for it any liability or obligation in connection with the sale of SELLER'S product except said repair or replacement of the defective part and, when given, compliance with the applicable governmental agency Rules. SELLER'S liability does not include any labor charges for replacement of parts, adjustments, repairs or any other work done outside SELLER'S factory and SELLER'S liability does not include any consequential or resulting damage to person, property, equipment, goods, merchandise, profits, goodwill, or reputation arising out of any defect in or failure of SELLER'S product.

SELLER'S obligation to repair or replace shall not apply to any product(s) which shall have been repaired or altered outside SELLER'S factory in any way or which shall have been subject to negligence, misuse, unauthorized alteration or abuse.

SELLER'S warranty runs only to the FIRST END USER and does not extend, expressly or by implication, to any other person. No claim under this warranty will be allowed for materials damaged in transit. Expenses incurred in connection with claims for which SELLER is not liable hereunder will be charged to BUYER. SELLER shall not be responsible for any field repairs performed by BUYER unless such work is authorized in writing by SELLER.

6.2 Summary

Note:
This is not the warranty. It is the summary of MSI's standard warranty and a description of how to obtain warranty service. The current, actual warranty is printed in its entirety on the preceding pages and supersedes warranty information which may be found elsewhere.

1. WHO RECEIVES WARRANTY PROTECTION?
   Modulation Sciences' standard warranty protects the original end-user purchaser of record but does not apply to subsequent owners.

2. WHAT DOES THE WARRANTY COVER?
   Modulation Sciences agrees to repair or replace at its expense any unit which has a defect in materials or workmanship for a period of three (3) years after the date of sale to the original end-user purchaser. This warranty includes all parts, labor, calibration, and packing.

3. WHAT DOESN'T THE WARRANTY COVER?

   MSI's warranty does not cover:

a) Freight and insurance charges paid by the purchaser in returning the unit for repair.

b) Defects which result from modifications or repairs to the unit not made by or authorized in writing by Modulation Sciences.

c) Compensation for incidental or consequential damages resulting from any defect.

d) Trivial or cosmetic defects which do not affect the unit's ability to function normally.

4. HOW IS THE WARRANTY PERIOD COMPUTED?
The warranty period begins on the date of delivery to the original end-user purchaser and is in effect for the next 1095 days. The starting date is deemed to be the date on the invoice from Modulation Sciences, its agent, dealer, or distributor to the first end-user purchaser. Do not lose your invoice; it is your way to establish your warranty is still in force.

5. WHAT IF THE UNIT CANNOT BE REPAIRED OR IS TOO EXPENSIVE TO REPAIR?
If Modulation Sciences decides not repair or replace a given unit, Modulation Sciences agrees to refund to the first end-user purchaser its full purchase price. Payment of that amount will end MSI's responsibilities and Modulation Sciences may keep the unit.

6. HOW IS WARRANTY SERVICE OBTAINED?

To claim your rights under this warranty:

a) Contact the dealer or distributor from whom this product was purchased. Describe the problem and ask if there is an easy solution.

b) If your dealer cannot help, contact Modulation Sciences' service department at (800) 826-2603 or (732) 302-3090 and explain the problem. If the unit requires factory service, you will be given a return authorization number.

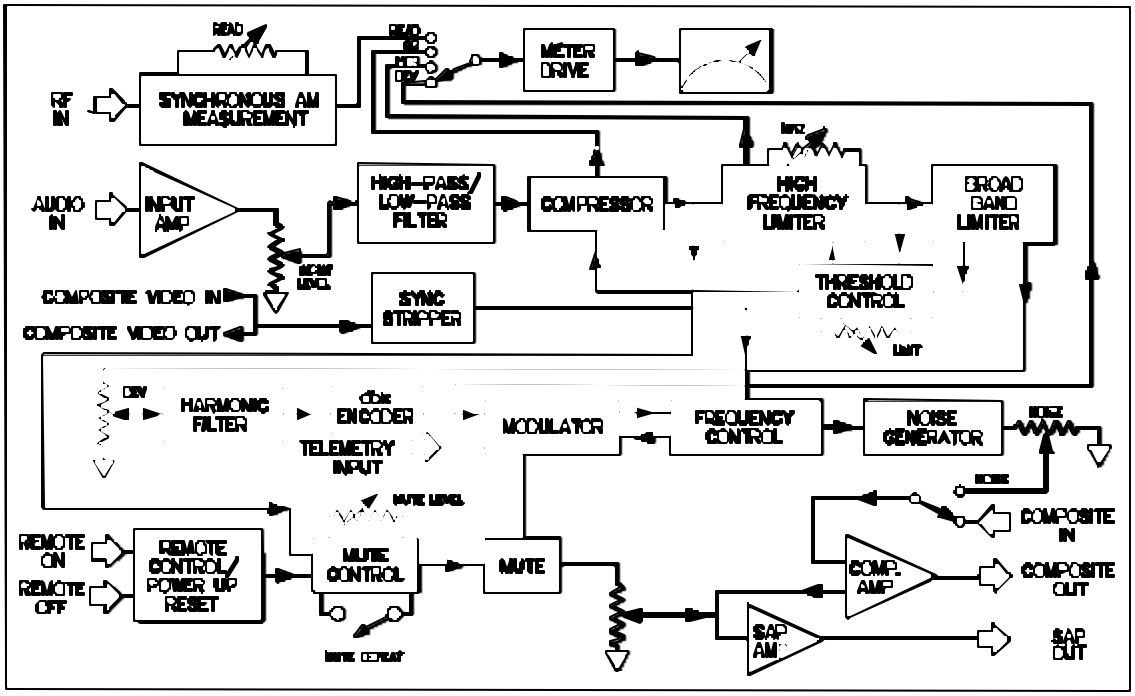
c) When you have your return authorization number, you may return the unit. Pack it carefully for shipment, preferably using the original shipping carton and packing materials. **ASSUME THAT THE BOX WILL**

BE DROPPED SEVERAL TIMES DURING SHIPMENT. USE UPS OR SOME OTHER PRIVATE CARRIER YOU KNOW TO BE RELIABLE. DO NOT USE THE POSTAL SERVICE. The risk of loss is yours. Modulation Sciences will not be responsible for damage or loss until the package is received by Modulation Sciences. **INSURE THE UNIT FOR ITS FULL REPLACEMENT VALUE. SHIP THE UNIT PREPAID TO THE ADDRESS SPECIFIED WHEN YOU RECEIVE YOUR RETURN AUTHORIZATION, AND BE SURE TO ENCLOSE A NOTE GIVING THE FOLLOWING INFORMATION:**

I. Your company name and shipping address (not a P.O. Box).
II. Your return authorization number.
III. A copy of your original invoice establishing the starting date of your warranty.
IV. As full a description as possible of the problem(s).

Chapter 7: Field Service

Block Diagram and Explanation



Input Amp

Function: 600Ω input accepts balanced or unbalanced audio input signals from -30 to +10dBm.

Controls: “INPUT LEVEL” potentiometer provides gain control at the output of this stage.

Options: Input signal level range is selected by connecting appropriate terminals on the input terminal strip.

High-Pass, Low-Pass Filters

Function: Limits bandwidth from the 50 Hz to 10 kHz range suitable for SAP program material.

Compressor

Function: Multiple time constant circuit combines automatic level control and compression.

Controls: Amount of gain reduction is adjusted by interaction between “INPUT LEVEL” and “LIMIT” potentiometers. See “THRESHOLD CONTROL.”

High-Frequency Limiter

Function: Provides both preemphasis and high-frequency gain reduction.

Controls: “HFR” potentiometer adjusts the threshold of high frequency limiting relative to the broadband compressor threshold.

Broadband Limiter

Function: Sets an absolute limit on program level to prevent overmodulation.

Controls: “DEV” potentiometer sets signal level to modulator. See “THRESHOLD CONTROL.”

Threshold Control

Function: Provides feedback control to compressor and high frequency limiter to control balance between limiting and compression.

Controls: “LIMIT” potentiometer sets the desired balance between limiting and compression. By adjusting this potentiometer and the input level control, any desired combination of limiting and compression can be achieved.

Harmonic Filter

Function: Low-pass filter removes harmonics outside the SAP region.

DBX Encoder

Function: Precision compander compresses audio to follow the BTSC specification for SAP.

Sync Stripper

Derives a clock signal from composite video NTSC video to lock the SAP average carrier at five times the horizontal sync rate (5H). Provides the logic signal to control the front panel SYNC LOCK indicator and operate the relay that provides remote control indication of video sync lock. Video signal passes through TV SIDEKICK via a video loop-through that is bridged by the SYNC STRIPPER.

Modulator

Function: Generates the subcarrier, frequency modulated by program audio.

Controls/Options: See “FREQUENCY CONTROL”, below.

Frequency Control

Function: Takes the clock signal from the SYNC STRIPPER and locks the average SAP frequency to the clock. A crystal-controlled digital frequency-locked loop provides precise control of the subcarrier frequency when composite video is not available. This circuit also supplies a clock signal to the noise generator.

Noise Generator

Function: Creates pseudo-random pink noise for use in transmitter tuning.

Controls: NOISE potentiometer sets level to composite output amp.

Composite Amp

Function: Provides output drive to exciter.

Controls: When both NOISE and READ switches are engaged, the normal composite input is disconnected and the noise generator output is sent to the exciter for transmitter tuning.

Options: Wire-wrap strapping selects input to include or exclude the subcarrier, according to transmitter requirements. This option has no affect on the transmitter tuning mode.

SAP Amp

Function: Provides output containing only subcarrier, for exciters that require composite stereo and SAP as separate inputs.

Remote Control/Power-up Reset

Function: Provides direct external control of mute circuit, which turns the subcarrier on and off. This circuit also determines the state of the mute circuit when power is first applied to the unit.

Controls: External control voltages from 5 to 24 volts AC or DC, applied to the input terminal strip, turn mute circuit on or off.

Options: The power-up state of the mute circuit is determined by wire-wrap strapping. Normally, this would be factory set so that the subcarrier would be turned on when power is first applied.

Mute Control

Function: This circuit activates the mute circuit (turns off the subcarrier) either in response to the remote control/power-up reset circuit or when the signal level at the output of the compressor falls below the muting threshold.

Controls: “MUTE LEVEL” potentiometer sets the muting threshold. “MUTE DEFEAT” switch, when engaged, causes the subcarrier to remain on regardless of the program level. The remote on/off function is not affected by this switch. Generally, in SAP service the MUTE is defeated.

Mute

Function: Provides “soft” on/off switching of the subcarrier.

Controls: “INJECT” potentiometer sets the subcarrier level into the composite amp and/or the SAP amp.

Options: See “REMOTE CONTROL/POWER UP RESET”, above.

Synchronous AM Measurement

Function: Detects undesirable AM modulation of the main aural carrier. Transmitter can be tuned for minimum crosstalk by nulling this reading.

Controls: “READ” potentiometer adjusts the sensitivity of the meter reading. See “NOISE GENERATOR AND COMPOSITE AMP”, above.

Meter Drive

Function: Drives the meter. Also scales levels and selects ballistics to suit the parameter being measured. When peak deviation is measured, the ballistics are peak reading; for others, they are averaging.

Controls: Push buttons select meter functions:
READ measures synchronous AM, as detailed above.
GR measures broadband gain reduction.
HFR measures high-frequency gain reduction.
DEV measures peak deviation of subcarrier (modulation).

7.2 Strap-Selectable Options

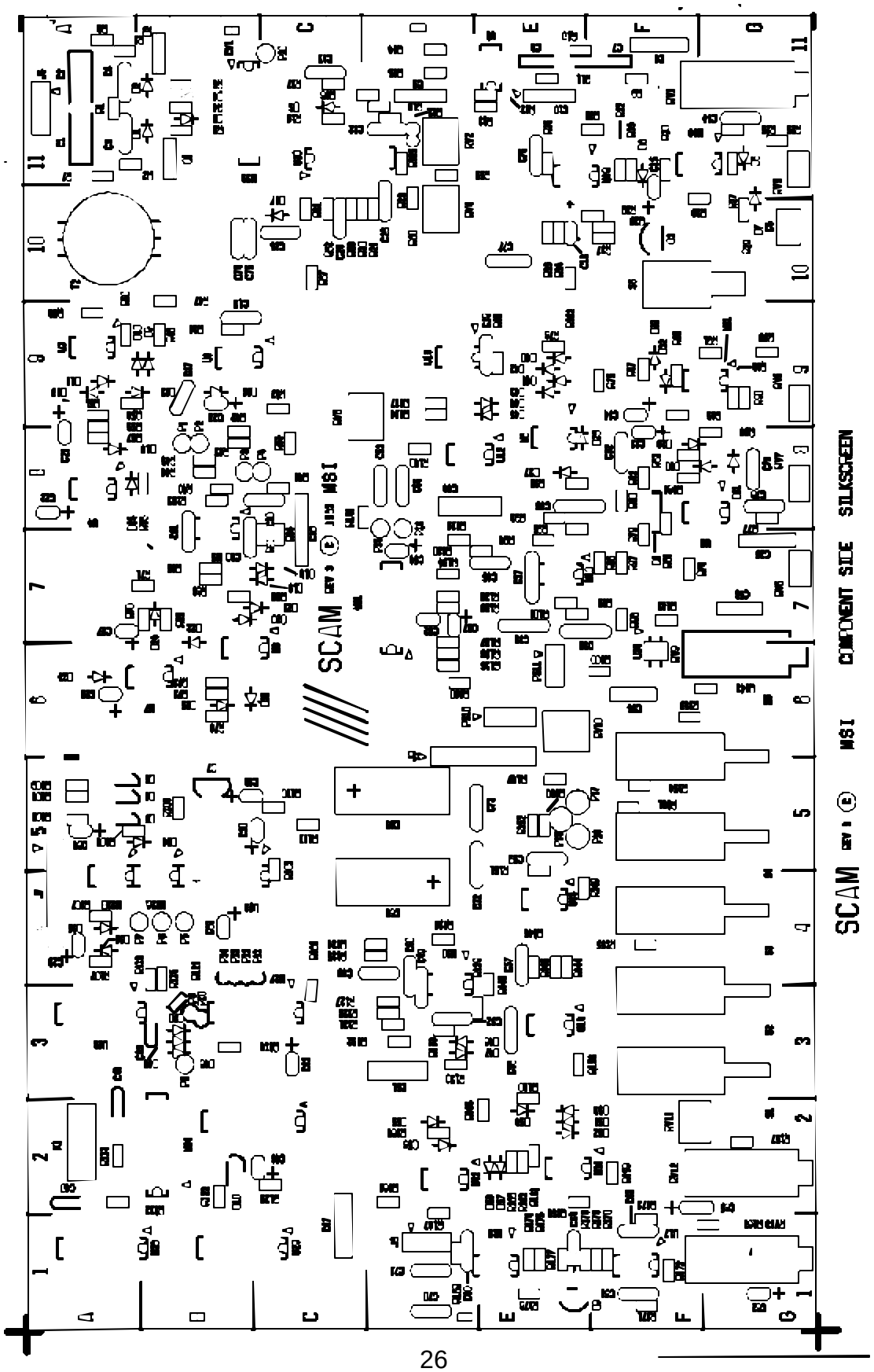
Option	Strap	Open	Location
Ready on power-up	P6-P5	P6-P7	B4
Off-line on power-up	P6-P7	P6-P5	B4
Subcarrier to COMPOSITE OUT*	P17-P19	P18-P19	E5
No subcarrier to COMPOSITE OUT	P18-P19	P17-P19	E5

**Factory setting*

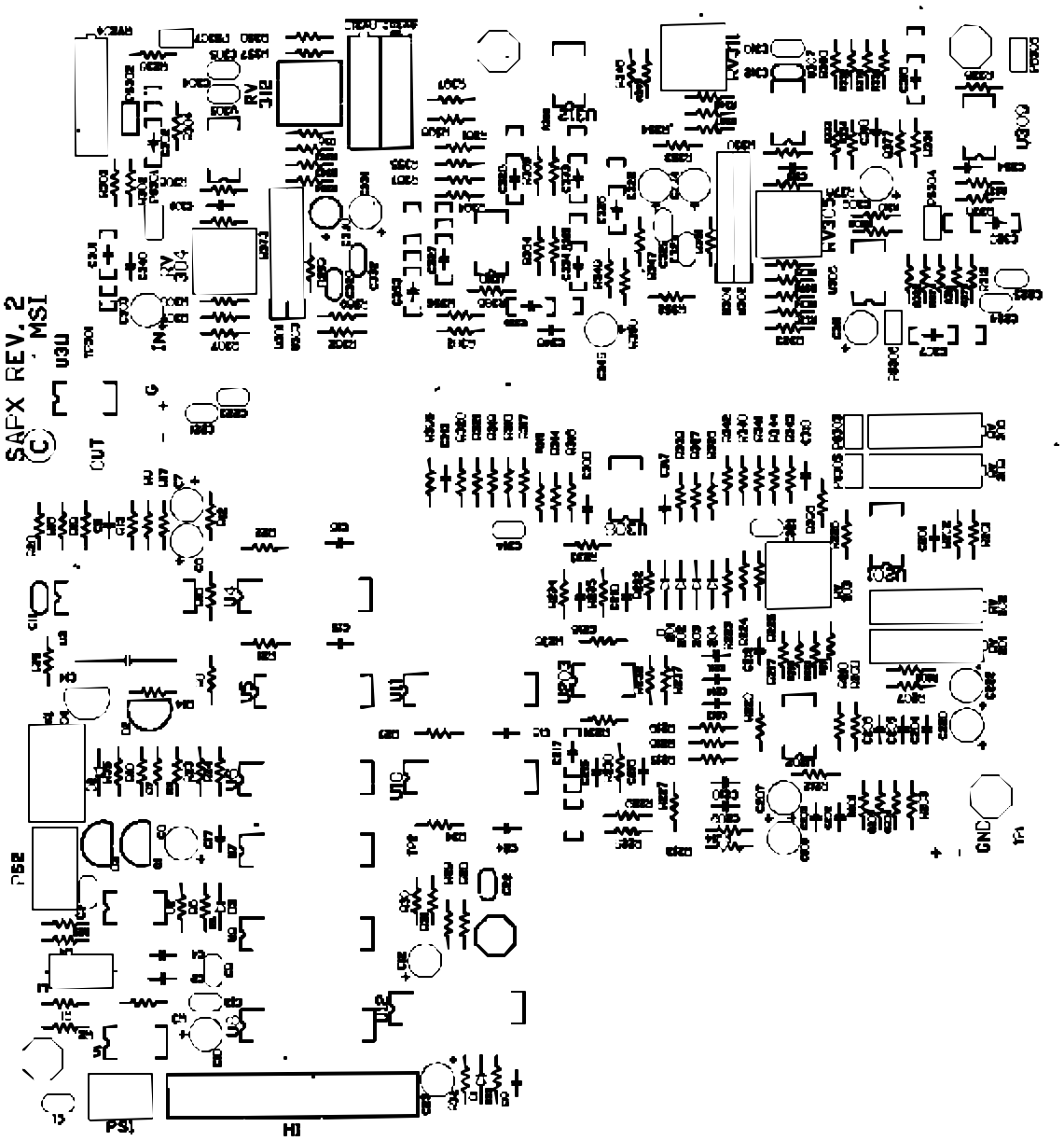
7.3 Mute Delay Time Setting

Mute delay time (seconds)	R182 (kΩ)
0.3	0.0
0.5	0.47
0.75	1.1
1.0	1.8
1.5	3.6
2.0	5.6
3.0	12
4.0	24
5.0	56
6.0	open

7.4 Parts Layout: SCAM Board



7.4.1 Parts Layout: SAPX Board



7.5 Explanation of Type Abbreviations

AE:	Aluminum Electrolytic Capacitor
BH:	Binding Head
BL:	Black
BUSH:	Bushing
CC:	Carbon Composition Resistor
CF:	Carbon Film Resistor
CM:	Cable Mount
DT:	Dipped Tantalum Capacitor
FH:	Flat Head
LH:	Left Hand
LW:	Lockwasher
MC:	Monolithic Ceramic Capacitor
MF:	Metal Film Resistor
MINI-BAY	Mini-Bayonet Base Lamp
MT:	Mount
MY:	Mylar Capacitor
OX:	Oxide Coated
PHIL:	Phillips Head
RH:	Round Head
SF:	Stacked Film Capacitor
SM:	Silver Mica Capacitor
SPAC:	Spacer
SS:	Solder Socket
WW:	Wire-Wrap Pin

7.6 Explanation of Manufacturer Abbreviations

Allenbradl	Allen-Bradley Co.
Amphenol	Amphenol
Analogdevi	Analog Devices
Analogsyst	Analog Systems, Inc.
Arco	Arco Electronics, Inc.
Belden	Belden Corporation
Bussman	Bussman
Centralab	Centralab, Inc.
Clairex	Clairex
Curtisinst	Curtis Instruments, Inc.
Dennison	Dennison Manufacturing Co.
Exar	Exar
Fairritepr	Fair-Rite Products Corp.
Hewlettpac	Hewlett-Packard
Heymanmanu	Heyman Manufacturing Co.
Hhsmith	Herman H Smith Inc, N. American Phillips

Idi	Industrial Devices, Inc.
Ittschadow	ITT Schadow, Inc.
Keystone	Keystone Electronics Corp.
Leecraft	Leecraft Manufacturing Co., Inc.
Magnetcoil	Magnetic Coils, Inc.
Motorola	Motorola, Inc.
Murataerie	Murata Erie North America, Inc.
Nationalse	National Semiconductor Corp.
Okmachine	OK Machine and Tool Corp.
Panduit	Panduit
RCA	RCA Solid State
Robinsonnu	Robinson Nugent, Inc.
Samtec	Samtec
Siemens	Siemens Corp.
Signetics	Signetics Corp.
Solidstate	Solid State Scientific, Inc.
Spectrol	Spectrol Electronics Corp.
Spraguelec	Sprague Electric Company
Texasinstr	Texas Instruments
Trimtronic	Trim-Tronics, Inc.
Tusonix	Tusonix, Inc.
Uscrystal	United States Crystal Corp.

MSI PART NUMBER	QTY	DESCRIPTION	REFERENCE DESIGNATOR	MANUFACTURER	MANUFACTURER PART NUMBER
V01-SCAP					
A02-S105US001	2	10K UPRIGHT TRIMPOT	RV1,RV2	BOURNS	3386W-1-103
A04-1006JPNG1	9	.1 UF 100V MET/POLY 10%	C1-C6,C16,C18,C23	PAN	ECQ-E1104KF
A04-1008FANH1	3	10 UF 35V EL 20%	C21,C22,C24		
A04-3302RCAF1	1	33PF 100V CER NPO 5%	C20	PAN	ECC-F2A330JCE
A04-4705JPNF1	2	.047 UF 100V MET/POLY FILM	C7,C8	PAN	ECQ-E1473KF
A04-4708HANG1	5	47UF 50V 10%EL 2.5mmLS	C10,C11,C13,C14,C17	PAN	ECE-A1HU470
A05-150260021	1	15-60PF TRIM CAP	C19	MURATA	DV11PS60Q
A10-040000001	1	4.000 MHZ CRYSTAL	XTAL1	ACCORD	4.000 MHZ CRYSTAL
B01-1N914	8	GLASS DIODE	D1-D8	VAR	1N914
B04-N3904	2	2N3904 NPN TRANSISTOR TO92	Q2,Q3	VAR	2N3904
B05-J310	1	N CHANNEL FET	Q1	MOT	J310
C01-2F0000012	4	DUAL OP AMP PLASTIC	U1-U4	TI	TL074CN
C01-MX165CP	1	TONE DECODER, PLASTIC	U13	MX-COM	MX165CP
C02-1P501L001	1	+5 VOLT 5% LOW PWR R	U12	NSC	LM78L05ACZ
C06-100000002	6	4N37 GEN. ELEC. OPTO ISOLATOR	U6-U11	VAR	4N37
D01-CGS3322M	1	OCS/DRIVER, SURF. MOUNT	U5	NSC	CGS3322M
G04-SCAP	1	SCAP PWB	PWB		
H08-003PMS001	1	MASCON 3-PIN LATCHEADW/GOLD	H2 POWER	PANDUIT	MLSS100-3-CB OR DB
H08-004PMS002	1	MASCON HEAD,4-PIN W/GOLD	H3 IND	PANDUIT	MLSS100-4-DA OR DB
H08-005PMS001	1	MASCON 5-PIN HEAD. W/ GOLD	H1 AUDIO	PANDUIT	MLSS100-5-DA OR DB
H08-012PMS001	1	MASCON 0.1" 12 PIN HEADER	H4 CTL	PANDUIT	MLSS100-12-CB OR DB
J01-260000001	4	BUS WIRE, TINNED, 26AWG	C9P1-C9P2, U10P4-C20 (bot), R28(bot)-U3P3,R21(top)-R28(bot)		
L03-PWBSERLAB	1	SERIAL LABEL (KAPTON)		CRITCHELY	CR3-KG10F
U05-SCAP	1	ASSEMBLY LABOR, V01-SCAP		MSI	V01-SCAP
Z02-1005	15	10.0 K 1/4W 1% MF	R5-7,R9-11,R14-15,R18-20,R25,R28,R32,R47		
Z02-1006	4	100 K 1/4W 1% MF	R1-2,R37,R59		
Z02-1075	1	10.7 K 1/4W 1% MF	R24		
Z02-1504	1	1.50 K 1/4W 1% MF	R57		
Z02-1505	4	15.0 K 1/4W 1% MF	R48,R49,R55,R56		
Z02-1585	1	15.8K 1/4W 1% MF	R53		
Z02-1785	1	17.8K 1/4W 1% MF	R29		

Z02-1825	1	18.2 K 1/4W 1% MF	R35
Z02-1875	2	18.7 K 1/4W 1% MF	R4,R8
Z02-2004	1	2.0 K 1/4W, 1% MF	R60
Z02-2005	1	20.0 K 1/4W 1% MF	R34
Z02-2105	2	21.0 K 1/4W 1% MF	R22,R23
Z02-2215	5	22.1K 1/4W 1% MF	R26-27,R31,R33,R38
Z02-2264	2	2.26 K 1/4W 1% MF	R50,R51
Z02-2435	1	24.3K 1/4W 1% MF	R16
Z02-2744	6	2.74 K 1/4W 1% MF	R39,R42-R46
Z02-3013	1	301 OHM 1/4W 1% MF	R58
Z02-3325	1	33.2 K 1/4W 1% MF	R21
Z02-3484	1	3.48 K, 1/4W, 1%, MF	R3
Z02-3924	1	3.92 K 1/4W 1% MF	R12
Z02-4755	2	47.5 K 1/4W 1% MF	R41,R52
Z02-4874	1	4.87 K 1/4W 1% MF	R36
Z02-6194	1	6.19 K, 1/4W,1% MF	R54
Z02-8454	2	8.45K 1/4W 1% MF	R13,R17

MSI PART NUMBER	QTY	DESCRIPTION	REFERENCE DESIGNATOR	MANUFACTURER	MANUFACTURER PART NUMBER
V03-SCAT					
A04-1203UCBG1	2	120 PF DISC	C401-C402	SPRAGUE	10TST12
A04-2703UCBG1	6	270 PF CER DISC, 2KVDC 10% NO DD-271 !! Too Big!!	C403-C406	CENTRALAB	DD-271
A06-FBEAD0001	8	FERRITE BEAD	L401-L402,L404-L407	FAIRRITEPR	2743002111
A06-FBEAD0002	2	FERRITE BEAD	L403	FAIRRITEPR	28730024020
G04-SCAT	1	PC BOARD 3 larger holes are #19 drill	PCB4	QUALITYCIR	SCAT
H08-004CFW001	1	4 PIN CM END CONNECT W/GOLD			
K06-H3510NT90	2	5 1/2 inch long cable tie		HEYMANMANU	3510NT90
Z02-3014	2	3.01 K 1/4W 1% MF	R402-R403	VARIOUS	1/4 W 1 % MF
Z02-6653	3	665 OHM 1/4W 1% MF	R401,R404-R405	VARIOUS	1/4 W 1 % MF

SI PART NUMBER	QTY	DESCRIPTION	REFERENCE DESIGNATOR	MANUFACTURER	MANUFACTURER PART NUMBER
V01-SAPX					
A02-M104FS001	2	TRIMPOT, 20T 1K00 FS SIDE	RV201-RV202	BOURNS	3006P1-102
A02-M105FS001	2	TRIMPOT, 10K0 20-T	RV306,RV309	BOURNS	3006P1-103
A02-M504FS001	3	5K 20-T TRIMPOT	RV204,RV307,RV310	BOURNS	3006P1-502
A02-S105FT001	1	TRIMPOT, 01T 10K0 FS TOP	RV203	BOURNS	3386P1-103
A02-S205FT001	4	TRIMPOT, 01T 20K0 FS TOP	RV304-RV305,RV311-RV312	BOURNS	3386P1-203
A04-1002JMEG1	2	CAP 10PF MC 10%	C4,C354	AVX	SR151A100K
A04-1003RSNF1	1	100 PF 5% SM	C16	VARIOUS	DM15FD101J03
A04-1003UCBG1	1	100 PF DISC	C18	SPRAGUE	10TST10
A04-1004HMAD2	7	1.0 NF 300V 1% 6 mm ls	C201,C206,C213,C215-C216,C218-C219	SFETECHNOL	G505BY102F
A04-1005HMBG1	2	.01 UF 50 V 10% MC	C323,C329	MURATA ERIE	RPE110X7R103K50V
A04-1005JRNF1	1	.01 UF 5% 100V PC	C301,(RECORD ACTUAL VAL)	PARTS NOT SUPPLIED	INSTALLED AT MSI.
A04-1006HMCH1	17	.1 UF 50 V 20% MC	C1,C3,C9,C13,C22,C221,C223-C225,C304-C305,C310,C312,C314	C321,C325,C332, MALLORY	C20C104M5UICA
A04-1007GTNH1	5	1 UF 35 V DT	C6,C10,C12,C23,C348	SPRAGUE	199D105X0035BB1
A04-1007HPNF1	1	1 UF 5% 63V PY LS 10MM	C217	WIMA MKS4RM10	1UF/5/63 (10MM)
A04-1008FTNH1	1	10 UF 25 V DT	C331	SPRAGUE	199D106X0025CB1
A04-1008FTNH1	1	10 UF 25 V DT	C330,(RECORD ACTUAL VAL)	PARTS NOT SUPPLIED	INSTALLED AT MSI.
A04-1503UCBG1	1	150 PF DISC	C17	SPRAGUE	10TST15
A04-2202UCCH1	2	22 PF DISC	C306,C315	SPRAGUE	10TSQ22
A04-2203UCBG1	1	220 PF CER DISK 0.25 LS	C7	SPRAGELEC	10TST22
A04-2204HMAD1	9	2.2 NF 1% 50 V MC	C320,C328,C302,C307,C318,C326,C333-C335,(MATCH/REC %)	SFETECHNOL	G505BY222F
A04-3903UCBG1	4	390 PF DISC 5%	C308,C313,C317,C319	ARCO	CCD391
A04-4703RSND1	1	470 PF 1 % SM 8.5MM LS	C2	VARIOUS	DM15FD471F03
A04-4706HPNF2	1	0.47 UF 5% 63V PY	C327	WIMA	MKS4RM7 0.47/63/5 (7.5MM
A04-4708BTNH1	3	47 UF 6 V DT	C303,C309,C311	ITTCAP	TAP47M6.3
A04-5602HCAF1	1	56 PF 5 % COG DISC	C316	MALLORY	CEC560J

A04-5603HMAD1	9	560 Pf 300V 1% Polypropylene Film 5.9 mm ls	C202-C205,C209-C212,C214,(MATCH/REC %)	parts not supplied	INSTALLED AT MSI.
A04-6807FTNH1	6	6.8 UF 25 V DT	C8,C207-C208,C220,C222,C322	ITTCAP	68K35
A04-8203NSND1	3	820 PF 1% SM 300V	C15,C19,C24	VARIOUS	DM15FD821F03
A04-XXXXXXXXX	3	CAPACITOR SELECT AT TEST	C340,C346,C353	PARTS NOT SUPPLIED	MSI TO INSTALL
A06-3305F0001	1	33 uH RF CHOKE, 10%	L1	JWMILLER	9310-52
AT4-3307FTNH1	1	3.3 UF 25V DT (TESTED)	C324,(REC VAL)	PARTS NOT SUPPLIED	INSTALLED AT MSI.
B01-000000001	4	1N5711 H.P. SCHOTTKY DIODE	D201-D204,(MATCH/REC FORWD VOLT) HP 1N5711	PARTS NOT SUPPLIED	INSTALLED AT MSI.
B01-4148	2	GLASS DIODE	ECO (u3p10-u3p14)	VARIOUS	1N4150
B01-4148	3	GLASS DIODE	C5,D1-D2, INSERT DIODE AT C5 WITH THE CATHODE FACING	UC11 SEE SAMPLE!!!	
B04-N3904	2	2N3904 NPN TRANSISTOR TO92	ECO Q5(u3p3p16p2),Q6(u3p17p18r18)	VARIOUS	2N3904
B04-N3904	2	2N3904 NPN TRANSISTOR TO92	Q2,Q4	VARIOUS	2N3904
B04-P3906	2	LOW POWER PNP TRANSISTOR	Q1,Q3	VARIOUS	2N3906
C01-1B0000003	1	NE5534P TI OP AMP, PLASTIC	U309	SIGNETICS	NE5534N
C01-1F0000005	1	LM310N VOLTAGE FOLLOWER	U1	NATIONALSE	LM310N
C01-1F0000006	1	LM-318P OP AMP PLASTIC	U2	TEXASINSTR	LM318P (TI ONLY)
C01-2B0000001	3	NE5532P DUAL OP AMP, PLASTIC	U202,U306-U307	TEXASINSTR	NE5532P (TI ONLY)
C01-2F0000002	1	LF412CN Dual OP AMP Nsc#	U308	NATIONALSE	LF412CN
C01-2F0000007	6	TL082CP RAYTHEON DUAL OP AMP	U201,U203,U305,U310-U312	RAYTHEON	TL082CP
C07-100000001	2	VCA	U301-U302	DBX	2151
C10-100000002	2	RMS TO DC CONVERTOR	U303-U304	DBX	2252
D01-401030001	2	PGMABLE DIVIDER	U8-U9	RCA	CD40103BE
D01-4020X0001	1	14-BIT BINARY COUNT	U6	RCA	CD4020BE
D01-4029X0001	1	PRESET 1/0 10'S COUN	U11	SOLIDSTATE	SCL4029BE
D01-4046X0001	1	PHASE LOCK LOOP	U12	RCA	CD4046BE
D01-4053X0001	1	3 X SPDT ANALOG SW	U7	SGSATES	HCF4053BE
D01-4538X0001	2	DUAL MONO MULTIVIBR	U4,U10	SGSATES	HCF4538BE
D01-4584X0001	1	HEX SCHMITT TRIGGER	U5	MOTOROLA	MC14584BCP
G04-SAPX	1	PC BOARD	PCB1	TECHCIRCUI	SAPX
H05-008000001	13	8 PIN EDGE GRIP SS	US1-US2,US201-US203,US305-US312	AMP	2-640463-2
H05-014000002	1	14 PIN FACE GRIP SS	US5	AMP	2-641261-20
H05-016000002	8	16 PIN FACE GRIP SS	US4,US6-US12	AMP	2-641262-20

H05-018000002	1	18 PIN FACE GRIP SS	US3	AMP# 2-641611-2	
H08-001PMS001	3	TEST POINTS	TP1-TP2,TP301	OXLEY	040/30P/KP2/L
H08-002PMW002	8	2 PIN WW STRIP	PS301-PS308	SAMTEC	TSW-102-07-GS
H08-003CFW001	1	3 PIN CM END CONNECT W/GOLD PL	P1	PANDUIT	CE100F24-3-CA
H08-004CFW001	1	4 PIN CM END CONNECT W/GOLD	P2	PANDUIT	CE100F24-4-DA
H08-004PMS002	1	MASCON HEAD,4-PIN W/GOLD	PS1	PANDUIT	MLSS100-4-DA
H08-005PMS001	1	MASCON 5-PIN HEAD. W/ GOLD	PS2	PANDUIT	MLSS100-5-DA
H08-016PMS001	1	16 COND SOLDER HEAD	H1	3M	3408-2002
H14-S00800001	4	8 MACH PIN SIL	US301-US304	SAMTEC	SS-108-G-2
H19-002000001	8	0.1` WW PIN JUMPER	PS301-308	3M	SHC-1002-001010-BOS
I07-001201202	1	SPDT 12VDC RELAY	K1	AROMAT	DS1E-S-DC12V
J03-K266X0001	1	BLUE,KYNAR			
J03-P243X0001	9	ORANGE 24 AWG Stranded hook-up wire	+ TO P2 PIN 4 (QTY IN INCHES)	9 1/2 INCHES EACH	1 PC. PER BOARD
J03-P244X0001	9	YELLOW 24 AWG stranded hook-up wire	OUT TO P1 PIN 1 (QTY IN INCHES)	9 1/2 INCH EACH	1 PC. PER BOARD
J03-P247X0001	9	VIOLET,24 AWG WIRE 100',STRND	- TO P2 PIN 3 (QTY IN INCHES)	9 1/2 INCHES EACH	1 PC. PER BOARD
J05-001824001	8	SHEILDED RACK WIRE 24 AWG	RED(+ TO P1 PIN3), BLK(G TO P2 PIN 1)	EACH PIECE IS 8 1/2 IN	(1 PC PER BOARD)
J09-T24900001	2	24 AWG TEFLON TUBING	Q5P2		
K04-1450D	1	4/40 X 3/4` HEX SPAC		KEYSTONE	1450D
K04-379	1	4/40 X 3/4` RND. PH		KEYSTONE	379
K04-S00000001	4	4/40 X 3/4` M/F SPCR		RAF	4538-440-S-1
U05-SAPX	1	ASSEMBLY LABOR, V03-SAPX			
Z01-000	1	O OHM 1/4W 5% CF	R35	VARIOUS	.4" JUMPER
Z01-104	6	1K 1/4W 5% CF	R7,R321,R334,R344,R348,R361	VARIOUS	1/4 W 5 % CF
Z01-105	5	10K 1/4W 5% CF	R2,R10,R24,R27,ECO:C11/R20	VARIOUS	1/4 W 5 % CF
Z01-106	1	100K 1/4W 5% CF	R30	VARIOUS	1/4 W 5 % CF
Z01-107	2	1 M 1/4W 5% CF	R1,R212	VARIOUS	1/4 W 5 % CF
Z01-154	2	1.5 K 1/4W 5% CF	R314,R327	VARIOUS	1/4 W 5 % CF
Z01-225	1	22K 1/4W 5% CF	R23	VARIOUS	1/4 W 5 % CF
Z01-226	1	220K 1/4W 5% CF	R233	VARIOUS	1/4 W 5 % CF
Z01-228	2	22M 1/4W 5% CF	R351,R359	VARIOUS	1/4 W 5 % CF
Z01-304	1	3 K 1/4W 5% CF	R11	VARIOUS	1/4 W 5 % CF
Z01-334	1	3.3K 1/4W 5% CF	R31	VARIOUS	1/4 W 5 % CF

Z01-335	1	33K 1/4W 5% CF	R28	VARIOUS	1/4 W 5 % CF
Z01-336	1	330 K 1/4W 5% CF	R32	VARIOUS	1/4 W 5 % CF
Z01-476	1	470 K 1/4W 5% CF	R33	VARIOUS	1/4 W 5 % CF
Z01-512	2	51 OHM 1/4W 5% CF	R315,R328	VARIOUS	1/4 W 5 % CF
Z01-513	1	510 OHM 1/4W 5% CF	R3	VARIOUS	1/4 W 5 % CF
Z01-514	1	5.1 K 1/4W 5% CF	R5	VARIOUS	1/4 W 5 % CF
Z01-683	1	680 OHM 1/4W 5% CF	R25	VARIOUS	1/4 W 5 % CF
Z01-685	1	68 K 1/4W 5% CF	R29	VARIOUS	1/4 W 5 % CF
Z02-1004	2	1.0 K 1/4W 1% MF	R4, also install resistor from R20 TO R13 0N U311 SIDE	SEE SAMPLE!!!	1/4 W 1 % MF
Z02-1005	3	10.0 K 1/4W 1% MF	R6,R12-R13	VARIOUS	1/4 W 1 % MF
Z02-1214	1	1.21 K 1/4W 1% MF	R337	VARIOUS	1/4 W 1 % MF
Z02-1245	1	12.4 K 1/4W 1% MF	R230	VARIOUS	1/4 W 1 % MF
Z02-1305	2	13.0 K 1/4W 1% MF	R222-R223	VARIOUS	1/4 W 1 % MF
Z02-1335	1	13.3 K 1/4W 1% MF	R22	VARIOUS	1/4 W 1 % MF
Z02-1407	2	1.40 M 1/4W 1% MF	R353,R364	VARIOUS	1/4W1%MF
Z02-1506	2	150 K 1/4W 1% MF	R306,R325	VARIOUS	1/4 W 1 % MF
Z02-1824	1	1.82 K 1/4W 1% MF	R227	VARIOUS	1/4 W 1 % MF
Z02-1826	1	182 K 1/4W 1% MF	ECO: U3P9-U3P15	VARIOUS	1/4 W 1% MF
Z02-1966	1	196 K 1/4W 1% MF	R21	VARIOUS	1/4 W 1 % MF
Z02-2212	2	22.1 OHM 1/4W 1% MF	R347,R360	VARIOUS	1/4 W 1 % MF
Z02-2435	1	24.3K 1/4W 1% MF	R235	VARIOUS	1/4 W 1 % MF
Z02-2875	2	28.7 K 1/4W 1% MF	R395-R396	VARIOUS	1/4 W 1 % MF
Z02-3925	2	39.2 K 1/4W 1% MF	R345,R357	VARIOUS	1/4 W 1 % MF
Z02-4754	5	4.75 K 1/4W 1% MF	R9,R14,R234,R373,R376	VARIOUS	1/4 W 1 % MF
Z02-4755	2	47.5 K 1/4W 1% MF	R346,R358	VARIOUS	1/4 W 1 % MF
Z02-4992	2	49.9 OHM 1/4W 1% MF	R307,R324	VARIOUS	1/4 W 1 % MF
Z02-4993	1	499 OHM 1/4W 1% MF	R228	VARIOUS	1/4 W 1 % MF
Z02-5115	1	51.1 K 1/4 1% MF	R34	VARIOUS	1/4 W 1 % MF
Z02-5496	4	549 K 1/4W 1% MF	R318-R319,R340-R341	VARIOUS	1/4 W 1 % MF
Z02-5624	1	5.62 K 1/4W 1% MF	R229	VARIOUS	1/4 W 1 % MF
Z02-8664	1	8.66 K 1/4W 1% MF	R224	VARIOUS	1/4 W 1 % MF

Z02-XXXX	19	RESISTOR 1% SELSCT AT TEST	R203,R205,R213,R215,R354,R363,R374-R375,R377-R387	VARIOUS	1/4 W 1 % MF
Z03-1005	8	10.0 K RN55 1/4W 1% 50 PPM	R210,R220,R231,R236,R316,R320,R339,R343	MILITARY	RN55CF
Z03-1215	1	12.1K 1/4W 1% MF RN55 50PPM	R226	MILITARY	RN55CF
Z03-1245	1	12.4 K 1/4W 1% MF RN55 50PPM	R330	MILITARY	RN55CF
Z03-1786	1	178 K 1/4W 1% MF RN55 50 PPM	R355	MILITARY	RN55CF
Z03-1825	1	18.2 K 1/4W 1% MF RN55 50 PPM	R366	MILITARY	RN55CF
Z03-1826	1	182 K 1/4W 1% MF RN55 50 PPM	R201	MILITARY	RN55CF
Z03-2005	1	20.0 K 1/4W 1% MF RN55 50 PPM	R305	MILITARY	RN55CF
Z03-2214	1	2.21 K 1/4W 1% MF RN55 50 PPM	R221	MILITARY	RN55CF
Z03-2215	1	22.1 K 1/4W 1% MF RN55 50 PPM	R225	RCD	MF55C - SORTED
Z03-2874	1	2.87 K 1/4W 1% MF RN55 50 PPM	R303	MILITARY	RN55CF
Z03-3015	1	30.1 K 1/4W 1% MF RN55 50 PPM	R202	MILITARY	RN55CF
Z03-3325	3	33.2 K 1/4W 1% MF RN55 50 PPM	R317,R336,R342	MILITARY	RN55CF
Z03-3326	2	332 K 1/4W 1% MF RN55 50 PPM	R352,R362	MILITARY	RN55CF
Z03-3405	2	34.0 K 1/4W 1% MF RN55 50 PPM	R302,R304	MILITARY	RN55CF
Z03-4325	1	43.2 K 1/4W 1% MF RN55 50 PPM	R367	MILITARY	RN55CF
Z03-4754	1	4.75K 1/4W 1% MF RN55 50 PPM	R211	MILITARY	RN55CF
Z03-4994	6	4.99K 1/4W 1% MF RN55 50 PPM	R232,R237-R238,R365,R397-R398	RCD	MF55C - SORTED
Z03-4995	1	49.9K 1/4W 1% MF RN55 50 PPM	R219	MILITARY	RN55CF
Z03-7154	2	7K15 RN55 1% 1/4W 50 PPM	R349-R350	MILITARY	RN55CF
Z03-8065	1	80.6 K RN55 1/4W 1% 50 PPM	R338	MILITARY	RN55CF
Z03-8455	1	84.5 K 1/4W 1% MF RN55 50 PPM	R209	MILITARY	RN55CF
Z03-9094	1	9.09K 1/4W 1% MF RN55 50 PPM	R333	MILITARY	RN55CF
Z03-9534	1	9.53 K 1/4W 1% MF RN55 50 PPM	R356	MILITARY	RN55CF
Z14-1005	4	10.0K RN55.1% 1/4W 50 PPM	R309-R310,R322-R323	MILITARY	RN55CF
Z14-1335	4	13.3K .1% 1/4W 50 PPM RN55	R214,R216-R218	MILITARY	RN55CF
Z14-1826	4	182K RN55.1% 1/4W 50PPM	R311,R326,R331-R332	MILITARY	RN55CF
Z14-2005	4	20.0K RN55 .1% 1/4W 50PPM	R204,R206-R208	MILITARY	RN55CF
Z14-3654	2	3.65K RN55 .1% 1/4W 25PPM	R312,R335	MILITARY	RN55CF

MSI PART NUMBER	QTY	DESCRIPTION	REFERENCE DESIGNATOR	MANUFACTURER	MANUFACTURER PART NUMBER
VO1-SAPM					
A02-M104FS001	1	TRIMPOT, 20T 1K00 FS SIDE	RV9	BOURNS	3006P1-102
A02-M106UT001	1	TRIMPOT, 20T 100K UR TOP	RV2	SPECTROL	64Y-104
A02-M204FS001	2	2K 20-T TRIMPOT	RV1,RV12	BOURNS	3006P1-202
A02-M205FS001	1	20K 20-T TRIMPOT	RV13	BOURNS	3006P1-203
A02-S106FT001	2	100K 1T FLAT TRIMPOT	RV4,RV11	BOURNS	3386P1-104
A02-S205FT001	1	TRIMPOT, 01T 20K0 FS TOP	RV10	BOURNS	3386P1-203
A02-S205US001	1	20K UPRIGHT TRIMPOT	RV7	BOURNS	3386W1-203
A02-S504US001	2	5K UPRIGHT TRIMPOT	RV5-RV6	BOURNS	3386W1-502
A02-S505FT001	1	50K 1-T FLAT TRIMPOT	RV8	BOURNS	3386P1-503
A04-1002JMEG1	3	CAP 10PF MC 10%	C59,C63,C85 (BACKSIDE)	AVX	SR151A100K
A04-1004RSND3	6	1 NF 1% SM 8.50MM LS 100V	C9-C10,C36-C39	CORNEL	CD19FA102F03
A04-1004SCDG1	1	1 NF 10% DISC	C48	CENTRALAB	CE102
A04-1005HMBG1	3	.01 UF 50 V 10% MC	C50,C82,C86(BACKSIDE)	MURATA ERIE	RPE110X7R103K50V
A04-1006HMCH1	14	.1 UF 50 V 20% MC	C45,C58,C70-C81	MALLORY	C20C104M5UICA
A04-1006JPNF1	5	.1 UF 5% 100V PY	C6-C8,C35,C47	WIMA	MKS4RM7 0.1/100/5(7.5MM)
A04-1007GTNH1	4	1 UF 35 V DT	C23,C28,C54,C65	SPRAGUE	199D105X0035BB1
A04-1007HPNF1	1	1 UF 5% 63V PY LS 10MM	C44	WIMA	MKS4RM10 1UF/5%/63V/PY/LS
A04-1007HPNF1	2	1 UF 5% 63V PY LS 10MM	C1-C2	Wima#	MKS4RM10 1uf/5%/63v
A04-1008FTNH1	1	10 UF 25 V DT	C67	SPRAGUE	199D106X0025CB1
A04-1009FANI1	2	100 UF 25 V AE	C68,C69	ECE-B1EU01Y PAN/UCC	STANDARD RADIO
A04-1203UCBG1	1	120 PF DISC	C13	SPRAGUE	10TST12
A04-1503UCBG1	3	150 PF DISC	C12,C26,C60	SPRAGUE	10TST15
A04-1506GTNH1	1	.15 UF 35 V DT	C46	SPRAGUE	199D154X0035AB1
A04-1506JPNF1	1	.15 UF 5% 100V PY	C51	WIMA	MKS4RM10 .15/5/100 (10MM)
A04-1804JPNG1	1	1.8 NF 5% 100V PY	C56	WIMA	FKS3RM7 1800/100/5(7.5MM)
A04-2205JRNG1	2	0.022 UF 100 V 10% P	C17,C18	WIMA	
A04-2704MCFG1	1	2.7 NF, 100V,DISC,Y5P,10%	C49	MALLORY	SM272K
A04-3302JMAG1	1	33 PF 100 V 10% MC	C20	AVX	SR151A330KAA

A04-3303RSNE1	1	330 PF 2% SM 300V	C66	VARIOUS	DM15FD331G03
A04-3307FTNH1	4	3.3 UF 25 V DT	C21-C22,C27,C33	SPRAGUE	199D335X0025BB1
A04-3902UCBG1	1	39 PF 1KV CER DISC	C61	SPRAGUE	10TSQ39
A04-3903RSND1	3	390 PF 1% SM	C3-C4-C53	VARIOUS	CM05FD391F03
A04-3903UCBG1	3	390 PF DISC 5%	C32,C43,C52	ARCO	CCD391
A04-4708BTNH1	1	47 UF 6 V DT	C64	ITTCAP	TAP47M6.3
A04-5001UCBG1	3	5 PF DISC	C19,C24,C57	ARCO	CCD-050
A04-5604JMEG1	2	5.6 NF 100 V 10% MC	C11,C25	CENTRALAB	CW15A562K
A04-6802JMAG1	2	68 PF 100 V 10% MC	C40-C41	CENTRALAB	CN15A680K
A04-6804JRNF1	1	6.8 NF 5% 100 V PC	C55	WIMA	FKC2 6800/100/5 (7.5M)
A04-6807FTNH1	3	6.8 UF 25 V DT	C34,C42,C62	ITTCAP	68K35
A05-550118021	1	5.5-18 TRIM CAP	CV1	TUSONIX	538-011A-5.5-18
A06-FCORE0001	2	POT CORE (2 / UNIT)	T2	PHILIPS	2213P-L00-3B7
A10-032768001	1	3.2768 MHZ XTL PARAL CAP HC33U	X1	JANCRYSTAL	MP-HC33
B01-4148	44	GLASS DIODE	D1-D5,D9-D14,D16-D33,D44-D58	VARIOUS	1N4150
B04-N3904	2	2N3904 NPN TRANSISTOR TO92	Q7,Q10	VARIOUS	2N3904
B04-P3906	1	LOW POWER PNP TRANSISTOR	Q8	VARIOUS	2N3906
B04-P5087	1	LOW POWER TRANSISTOR	Q9	VARIOUS	2N5087
B05-N15202001	1	MED POWER TRANSISTOR	Q1	MOTOROLA	MPSU05
B05-P15202001	1	MED POWER TRANSISTOR	Q2	MOTOROLA	MPSU55
BT1-000000001	5	1N5711 H.P. SCHOTTKY DIODE	D15,D40-D43 (parts installed by MSI!	Tested for forward voltage drop	IN TEST FIXTURE DF1.
C01-1B0000003	2	NE5534P TI OP AMP, PLASTIC	U13,U15	TEXASINSTR	NE5534P
C01-1B0000004	1	MA332CP ANALOGSYST OP AMP	U14	ANALOGSYST	MA332CP
C01-2F0000002	3	LF412CN Dual OP AMP Nsc#	U1-U2,U5	NATIONALSE	LF412CN
C01-2F0000007	13	RAYTHEON DUAL OP AMP	U3-U4,U6-U12,U17,U30-U32	RAYTHEON	TL082CP
C03-100000002	1	Intersil Waveform Generator, Cermic	U21	INTERSIL	ICL8038CCJD
C05-100000001	1	RCA TRANSCOND AMP	U16	RCA	CA3080E
C07-200000002	1	DUAL VCA Obsolete Curtis#	U20, NOTE !!!!!!!!!!!!!!!	This part won't fit on board without MSI#	H08-140000001
C99-100000001	1	AD524AD Analog Devices, Balance input Amp	U33	ANALOGDEVI	AD524AD
D01-4006X0001	1	18 BIT SHIFT REG	U28	SGSATES	HCF4006BE
D01-401030001	1	PGMABLE DIVIDER	U25	RCA	CD40103BE
D01-401300001	1	DUAL D FLIP-FLOP	U26	MOTOROLA	MC14013

D01-4020X0001	1	14-BIT BINARY COUNT	U27	RCA	CD4020BE
D01-4060X0001	1	XTAL OSC/FREQ DIV	U24	SOLIDSTATE	SCL4060BE
D01-4070X0001	1	QUAD EXCL OR GATE	U29	NATIONALSE	CD4070BCN
ECO-CUT	2	??	SEE SAMPLE		
ECO-HOLE	1	??	DRILL 0.116" HOLE IN BACK OF, R192 ON TRACE		
ECO-JUMPER	1	??	AROUND NYLON HEX SPACER		
ECO-JUMPER	1	??	Q5C TO Q5E		
ECO-JUMPER	1	??	U34P2-U34P4 "Facing C55		
H05-008000001	20	8 PIN EDGE GRIP SS	US1-US17,US30-US32	TEXASINSTR	C930802
H05-014000002	5	14 PIN FACE GRIP SS	US20,US21,US26,US28-US29	AMP	2-641261-20
H05-016000002	3	16 PIN FACE GRIP SS	US24,US27,US33	AMP	2-641262-20
H06-016000001	1	16 PIN WW SOCKET	US25	ASSMAN	AR16-HZW
H08-001PMS001	1	TEST POINTS	P20	OXLEY	040/30P/KP2/L
H08-001PMW001	16	SINGLE WW PIN	P1-P4,P8-P19	SAMTEC	TSW-101-09-GS
H08-002CFW001	1	2 PIN FEM END CONN W/GOLD	J1	PANDUIT	
H08-002PMW002	1	2 PIN WW STRIP	1 PC. CONNECTS U34P3- U34P4	NOTE: LOCATED BY WIMA CAP REF# C55	
H08-003PMW001	1	3 PIN WW STRIP	PS11	SAMTEC	TSW-103-09-GS
H08-004PMS002	3	MASCON HEAD,4-PIN W/GOLD	J6,J8,J10	PANDUIT#	MLSS100-4-DA or CA
H08-005CFW001	1	5 PIN END CONNECTOR,GOLD PLAT	J2		
H08-009PMS002	2	Straight Mascon Header	PS7,PS9	PANDUIT	MLSS100-9-DA
I02-020100201	1	ALT ACT 2P2T PC SWCH	S6	ITTSCHADOW	F2UEE
I02-050400201	1	5 STA INTERLOCK SWITCH	Stototo1to5	ITTSCHADOW	F17.5054UGRN
J03-P240X0001	4	Blk 24 AWG stranded hook-up wire	S6P3 TO J1P1 (QTY IN INCH)		UL1007
J03-P240X0001	9	Blk 24 AWG stranded hook-up wire	R12(LIFTED END) TO J2P,1 (QTY IN INCH)		UL1007
J03-P241X0001	6	BROWN 24 AWG STRND WIRE	R77(TOP) TO J2P2 (QTY IN INCH)		
J03-P242X0001	9	RED 24 AWG stranded hook-up wire	R12PAD TO J2P3 (QTY IN INCH)		
J03-P243X0001	6	Orange 24 AWG Stranded hook-up wire	R77(BOTTOM) J2P5 (QTY IN INCH)		
J03-P249X0001	4	White 24 AWG Stranded hook-up wire	S6P2 - J1P2 (QTY IN INCH)		
K01-A02COV001	4	20-T TRIMPOT COVER	RVC1,RVC9,RVC12-RVC13	BOURNS	H-83-P
K01-I02IND001	1	BLK/YEL LAMPLESS INDICATOR	SC6	ITTSCHADOW	FA201 BLACK/YELLOW

K01-I02IND002	3	BLK/GREEN LAMPLESS INDICATOR	SC3-SC5	ITTSCHADOW	FA101 BLACK/GREEN
K01-I02IND003	1	LAMPLESS INDICATOR BLK/ORANGE	SC1	ITTSCHADOW	FA101 BLACK/ORANGE
K01-I02IND004	1	LAMPLESS INDICATOR BLK&YELLOW	SC2	ITTSCHADOW	FA101 BLACK/YELLOW
K04-1450D	9	4/40 X 3/4` HEX SPAC		KEYSTONE	1450D
K04-1902E	1	4/40X1" HEX SPACER NYLON	MNTING HOLE BACK OF R92		
K04-2205	3	4/40X1" HEX SPACER ALUM	RV5,RV6,RV7		
U05-PCGM	1	ASSEMBLY LABOR, V01-PCGM		MSI	PCGM
V04-SCA186T2	1	Transformer, (Wire/Bobbin) 3-pc.part, needs assembly.			
Z01-000	5	O OHM 1/4W 5% CF	BY SCAM LOGO		
Z01-103	2	100 OHM 1/4W 5% CF	R19,R60	VARIOUS	1/4 W 5 % CF
Z01-104	4	1K 1/4W 5% CF	R17,R22,R61-R62	VARIOUS	1/4 W 5 % CF
Z01-105	15	10K 1/4W 5% CF	R11,R54,R73-R74,R88-R89,R115,R121,R128,R148,R153,R175,	R177,R178,R184	VARIOUS 1/4 W 5 % CF
Z01-106	7	100K 1/4W 5% CF	R68,R122,R140,R142,R170-R171,R180	VARIOUS	1/4 W 5 % CF
Z01-107	1	1 M 1/4W 5% CF	R123	VARIOUS	1/4 W 5 % CF
Z01-108	3	10 M 1/4W 5% CF	R86,R113,R166	VARIOUS	1/4 W 5 % CF
Z01-125	2	12 K 1/4W 5% CF	R161,R163	VARIOUS	1/4 W 5 % CF
Z01-126	3	120 K 1/4W 5% CF	R24,R59,R157	VARIOUS	1/4 W 5 % CF
Z01-127	1	1.2 M 1/4W 5% CF	R185	VARIOUS	1/4 W 5 % CF
Z01-155	2	15K 1/4W 5% CF	R52,R69	VARIOUS	1/4 W 5 % CF
Z01-156	2	150K 1/4W 5% CF	R91,R173	VARIOUS	1/4 W 5 % CF
Z01-186	3	180K 1/4W 5% CF	R10,R18,R134	VARIOUS	1/4 W 5 % CF
Z01-203	1	200 OHM 1/4W 5% CF	R168	VARIOUS	1/4 W 5 % CF
Z01-204	1	2 K 1/4W, 5% CF	R129	VARIOUS	1/4 W 5 % CF
Z01-222	2	22 0HM 1/4W 5% CF	R5-R6	VARIOUS	1/4 W 5 % CF
Z01-224	2	2.2K 1/4W 5% CF	R79,R188(BACKSIDE)	VARIOUS	1/4 W 5 % CF
Z01-225	5	22K 1/4W 5% CF	R1,R80,R126,R133,R141	VARIOUS	1/4 W 5 % CF
Z01-226	3	220K 1/4W 5% CF	R82,R85,R125	VARIOUS	1/4 W 5 % CF
Z01-227	1	2.2 M 1/4W 5% CF	R71	VARIOUS	1/4 W 5 % CF
Z01-274	1	2.7 K 1/4W 5% CF	R112	VARIOUS	1/4 W 5 % CF
Z01-275	2	27 K 1/4W 5% CF	R9,R72	VARIOUS	1/4 W 5 % CF

Z01-333	3	330 OHM 1/4W 5% CF	R162,R174,R187(BACKSIDE)	VARIOUS	1/4 W 5 % CF
Z01-334	5	3.3K 1/4W 5% CF	R81,R116,R118,R183,R186	VARIOUS	1/4 W 5 % CF
Z01-335	3	33K 1/4W 5% CF	R16,R131,R176	VARIOUS	1/4 W 5 % CF
Z01-363	1	360 OHM 1/4W 5% CF	R20	VARIOUS	1/4 W 5 % CF
Z01-435	1	43 K 1/4W 5% CF	R154	VARIOUS	1/4 W 5 % CF
Z01-474	1	4.7K 1/4W 5% CF	R169	VARIOUS	1/4 W 5 % CF
Z01-475	4	47 K 1/4W 5% CF	R51,R56,R70,R83	VARIOUS	1/4 W 5 % CF
Z01-476	1	470 K 1/4W 5% CF	R55	VARIOUS	1/4 W 5 % CF
Z01-477	2	4.7 M 1/4W 5% CF	R87,R165	VARIOUS	1/4 W 5 % CF
Z01-512	2	51 OHM 1/4W 5% CF	R147,R152	VARIOUS	1/4 W 5 % CF
Z01-514	1	5.1 K 1/4W 5% CF	R130	VARIOUS	1/4 W 5 % CF
Z01-515	1	51 K 1/4W 5% CF	R23	VARIOUS	1/4 W 5 % CF
Z01-563	1	560 OHM 1/4W 5% CF	R172	VARIOUS	1/4 W 5 % CF
Z01-564	1	5.6K 1/4W 5% CF	R132	VARIOUS	1/4 W 5 % CF
Z01-565	4	56 K 1/4W 5% CF	R67,R90,R124,R155	VARIOUS	1/4 W 5 % CF
Z01-567	1	5.6 M 1/4W 5% CF	R57	VARIOUS	1/4 W 5 % CF
Z01-624	1	6.2 K 1/4W 5% CF	R53	VARIOUS	1/4 W 5 % CF
Z01-625	2	62 K 1/4W 5% CF	R46,R58	VARIOUS	1/4 W 5 % CF
Z01-683	1	680 OHM 1/4W 5% CF	R111	VARIOUS	1/4 W 5 % CF
Z01-684	3	6.8 K 1/4W 5% CF	R4,R21,R179	VARIOUS	1/4 W 5 % CF
Z01-685	1	68 K 1/4W 5% CF	R158	VARIOUS	1/4 W 5 % CF
Z01-823	1	820 OHM 1/4W 5% CF	R108 "Should be facing	VARIOUS	1/4 W 5 % CF
Z01-824	1	8.2K 1/4W 5% CF	R156	VARIOUS	1/4 W 5 % CF
Z01-825	2	82 K 1/4W 5% CF	R78,R127	VARIOUS	1/4 W 5 % CF
Z01-826	1	820K 1/4W 5% CF	R84	VARIOUS	1/4 W 5 % CF
Z01-XXX	2	RESISTOR 5% SELECT AT TEST	R137,R181	VARIOUS	1/4 W 5 % CF
Z02-1005	15	10.0 K 1/4W 1% MF	R2-R3,R15,R47-R50,R63-R66,R95,R101,R146,R160	VARIOUS	1/4 W 1 % MF
Z02-1006	4	100 K 1/4W 1% MF	R114,R117,R119-R120	VARIOUS	1/4 W 1 % MF
Z02-1007	2	1.00 M 1/4W 1% MF	R7-R8	VARIOUS	1/4 W 1 % MF
Z02-1215	1	12.1 K 1/4W 1% MF	R164	VARIOUS	1/4 W 1 % MF
Z02-1504	1	1.50 K 1/4W 1% MF	R143	VARIOUS	1/4 W 1 % MF
Z02-1625	1	16.2 K 1/4W 1% MF	R135	VARIOUS	1/4 W 1 % MF

Z02-1824	2	1.82 K 1/4W 1% MF	R40,R41		1/4W 1% MF
Z02-2104	1	2.10 K 1/4W 1% MF	R159	VARIOUS	1/4 W 1 % MF
Z02-2105	2	21.0 K 1/4W 1% MF	R43-R44	VARIOUS	1/4 W 1 % MF
Z02-2265	2	22.6 K 1/4W 1% MF	R42,45		1/4W 1% MF
Z02-2675	2	26.7 K 1/4W 1% MF	R99,R151	VARIOUS	1/4 W 1 % MF
Z02-3015	3	30.1 K 1/4W 1% MF	R75-R76,R149	VARIOUS	1/4 W 1 % MF
Z02-3244	1	3.24 K 1/4W 1% MF	R139	VARIOUS	1/4 W 1 % MF
Z02-3404	1	3.40 K 1/4W 1% MF	R138	VARIOUS	1/4 W 1 % MF
Z02-3924	1	3.92 K 1/4W 1% MF	R96	VARIOUS	1/4 W 1 % MF
Z02-3925	1	39.2 K 1/4W 1% MF	R93	VARIOUS	1/4 W 1 % MF
Z02-4424	1	4.42 K 1/4W 1% MF	R167	VARIOUS	1/4 W 1 % MF
Z02-4994	4	4.99 K 1/4W 1% MF	R94,R100,R144-R145	VARIOUS	1/4 W 1 % MF
Z02-5114	1	5.11K 1/4W 1% MF	R14	VARIOUS	1/4 W 1 % MF
Z02-5625	1	56.2 K 1/4W 1% MF	R13	VARIOUS	1/4 W 1 % MF
Z02-7154	1	7.15 K 1/4W 1% MF	R92	VARIOUS	1/4 W 1 % MF
Z02-7503	1	750 OHM 1/4W 1% MF	R97	VARIOUS	1/4 W 1 % MF
Z02-7684	2	7.68 K 1/4W 1% MF	R98,R150	VARIOUS	1/4 W 1 % MF
Z02-8664	1	8.66 K 1/4W 1% MF	R136	VARIOUS	1/4 W 1 % MF
Z03-2215	1	22.1 K 1/4W 1% MF RN55 50 PPM	R12	RCD	MF55C - SORTED

MSI PART NUMBER	QTY	DESCRIPTION	REFERENCE DESIGNATOR	MANUFACTURER	MANUFACTURER PART NUMBER
V02-SAPH					
A04-1203UCBG1	4	120 PF DISC	C502-C505	SPRAGUE	10TST12
A04-1203UCBG1	4	120 PF DISC	C502-C505	SPRAGUE	10TST12
A04-1504XHNI1	4	1.5 NF FEED-THRU	C501,C506-C508	TUSONIX	357-001-X5U0-152M
A04-1504XHNI1	4	1.5 NF FEED-THRU	C501,C506-C508	TUSONIX	357-001-X5U0-152M
A04-3301UCBG1	1	3.3 PF DISC	C509	CENTRALAB	DD3R3
A04-3301UCBG1	1	3.3 PF DISC	C509	CENTRALAB	DD3R3
A06-FBEAD0001	4	FERRITE BEAD	L501-L504	FAIRRITEPR	2743002111
A06-FBEAD0001	3	FERRITE BEAD	L501-L504	FAIRRITEPR	2743002111
A08-112202801	1	PWR XFRMR, DUAL 28VCT 0.42A	T1	MAGNETCOIL	4/7/5028
A08-132202801	1	POWER TRANSFORMER		SIGNALTRAN	241-6-28
A09-S3AG01251	1	FUSE, SLOW BLOW, 1/8 AMP	F1	LITTLEFUSE	313.125
A09-S3AG01881	1	FUSE, SLOW BLOW, 3/16 AMP	F1	LITTLEFUSE	313.1875
A09-S3AG02501	1	FUSE, SLOW BLOW, 1/4 AMP			
A09-S3AG02501	1	FUSE, SLOW BLOW, 1/4 AMP			
B01-000000001	1	1N5711 H.P. SCHOTTKY DIODE	D501	HEWLETTPAC	1N5711
B01-000000001	1	1N5711 H.P. SCHOTTKY DIODE	D501	HEWLETTPAC	1N5711
B02-6276A	4	16V TRANS SUPPRESSOR	D502-D505	MOTOROLA	1N6276A
B02-6276A	4	16V TRANS SUPPRESSOR	D502-D505	MOTOROLA	1N6276A
E01-I20000001	1	RED LED	D37	IDI	5100H1
E01-I40000001	1	YELLOW LED, IDI# 5100H7	D38, READY LED	IDI	5100H7
E01-I40000001	1	YELLOW LED, IDI# 5100H7	D38	IDI	5100H7
E01-I50000001	1	GREEN LED IDI# 5100H5	D39, CARRIER LED	IDI	5100H5
E01-I50000001	2	GREEN LED IDI# 5100H5	D39,D59	IDI	5100H5
E02-282080001	1	28V MINI-BAY LAMP	B1	MICROLAMP	757
E02-282080001	1	28V MINI-BAY LAMP	B1	MICROLAMP	757
H02-002F00002	5	CONNECTOR, BNC FEMALE, UG1094U	J1-J5	AMPHENOL	31-221
H02-002F00002	6	CONNECTOR, BNC FEMALE, UG1094U	J1-J5,J10	AMPHENOL	31-221
H02-003F00002	1	1/4" PHONE JACK, STEREO	HEAD PHONE JACK	SWITCHCRAFT	MT332B
H02-003M00001	2	3 PIN M PANEL MT XLR CONNECTOR	J4A(MAIN OUT),J3A(PRO OUT)	SWITCHCRAFT	D3M
H04-PN0000001	1	FUSE HOLDER	FH1	BUSSMAN	HKP

H04-PN0000001	1	FUSE HOLDER			
H04-PN0000001	1	FUSE HOLDER	FH1	BUSSMAN	HKP
H08-002CFW001	1	2 PIN FEM END CONN W/GOLD	J12 (CTCSS CARRIER LED, D39 WHITE= P1)		
H08-002CFW001	3	2 PIN FEM END CONN W/GOLD	FOR 3 CABLES,J4(PRRF MAIN LINE OUT),J3(PR2M PRO LINE OUT),J2		
H08-002CFW002	1	2 PIN .156"END CONN. W/GOLD	J7,(DC INPUT PWR CABLE ASSY)	PANDUIT	CE156F20-2
H08-003CFW001	6	3 PIN CM END CONNECT W/GOLD PL	PWR CONN CABLES FOR BDS,4 CABLES,(PRRF,PR2M,P2PB,P2FP)	PANDUIT	CE100F24-3
H08-004CFW001	2	4 PIN CM END CONNECT W/GOLD	J6,J8	PANDUIT	CE100F24-4-DA
H08-004CFW001	3	4 PIN CM END CONNECT W/GOLD	J6,J8,J11	PANDUIT	CE100F24-4-DA
H08-005CFW001	1	5 PIN END CONNECTOR,GOLD PLAT	J12	PANDUIT	CE100F24-5-DA
H08-005CFW002	1	5 PIN .156"END CONN. W/GOLD	J2(P2PS),AC INPUT PWR CABLE ASSY	PANDUIT	CE156F20-5
H08-009CFW001	2	9 PIN CM END CONNECT W/GOLD	J7,J9	PANDUIT	CE100F24-9-DA
H08-009CFW001	2	9 PIN CM END CONNECT W/GOLD	J7,J9	PANDUIT	CE100F24-9-DA
H08-012CFW001	1	12 PIN FEM END CONN	J11 CTCSS CABLE		
H08-03121026	1	2 PIN FEMALE PWR CONNECTOR	PACKAGE W/H08-181212222	MOLEX	3-12-1026
H08-031220210	1	DC CONNECTOR, 2 PIN (SHELL)	J7A,(DC INPUT PWR CABLE ASSEMBLY)	MOLEX	3/12/25
H08-18121222	2	TERM PIN, FEMALE 16-18 AWG	PACKAGE W/H08-03121026	MOLEX	18-12-1222
H08-M18122222	2	TERM PIN, MALE, 16-18 AWG	J7A (DC INPUT PWR CONN)	MOLEX	18-12-2222
H09-002GS0001	1	2 TERMINAL STRIP		HHSMITH	820
H09-002GS0001	1	2 TERMINAL STRIP		HHSMITH	820
H09-012PR0001	1	12 POS 6/32 SCREW Terminal		BEAUPRODUC	71712
H09-012PR0001	1	12 POS 6/32 SCREW Terminal		BEAUPRODUC	71712
H10-025F00006	1	D-SUB 25 PIN FEM PANEL MOUNT	AUX	AMP	747913-2
H10-025F00006	1	D-SUB 25 PIN FEM PANEL MOUNT			
H10-025F00007	1	25P FEM D CONN FILTERED	J10 (CTCSS CONTROL)		
H11-CRN160401	2	Crimp lug, screw size 6	Green wire on power cord, Gray wire on meter.	ZIERICKMAN	A3651W/.144"HOLE
H11-CRN160401	2	Crimp lug, screw size 6		ZIERICKMAN	A3651W/.144"HOLE
H11-CSI180601	3	NO.6 SPADE LUG FOR 22-18		VACO	63206

H11-CSI180601	3	NO.6 SPADE LUG FOR 22-18		VACO	63206
H99-001000001	1	PANEL MT BNC GND LUG		AMPHENOL	31-759
H99-001000001	1	PANEL MT BNC GND LUG		AMPHENOL	31-759
H99-003000001	1	POWER INPUT MODULE CORCOM 6J4	J2A	CORCOM	6J4
J01-200000001	2	NO. 20 AWG BUS WIRE TINNED	J3AG TO J3AP1,J4AG TO J4AP1		
J03-P200X0001	162	20AWG BLACK STRANDED HOOK-UP WIRE	3.5" for J7AP2 to J7P1, 9.5" for J2AF to J2P4, 1.5" for J2AL		
J03-P202X0001	12	RED 20AWG STRANDED HOOK-UP WIRE	3.5" FOR J7AP1 TO J7P2, 9.5" FOR J2AE TO J2P2		
J03-P203X0001	9	ORANGE 20AWG STRD WIRE	FROM CORCOM FILTER TO J2		
J03-P205X0001	114	GREEN 20AWG STRANDED HOOK-UP WIRE	J7ACASE TO J7P1		
J03-P206X0001	114	LT BLUE 20 AWG STRANDED HOOK-UP WIRE	J7AN TO J7AJ		
J03-P240X0001	35	Black 24 AWG stranded hook-up wire, UL1007	15" for PRRF,11" for PR2M,9" for P2PB		
J03-P242X0001	70	RED 24 AWG STRANDED HOOK-UP WIRE	15"X2 for PRRF,11"X2 for PR2M,9"X2 for P2PB		
J03-P248X0001	114	GREY 24AWG STRANDED HOOK-UP WIRE			
J03-P24910001	4	White/Brown Striped 24AWG Stranded Hook-up	J3AP2 TO J3P2		
J03-P24950001	4	White/Green Striped 24 AWG Stranded Hook-up	J3AP3 TO J3P1		
J03-P24960001	10	White/Blue Striped 24 AWG Stranded Hook-up	J4AP3 TO J4P1		
J03-P24970001	10	White/Violet Striped 24 AWG Stranded hook-up	J4AP2 TO J4P2		
J07-P18000001	1	6 FOOT LINE CORD, 1.8 METERS	CH1	BELDEN	17237B
J07-P18000001	1	6 FOOT LINE CORD, 1.8 METERS			
J07-P18000001	1	6 FOOT LINE CORD, 1.8 METERS	CH1	BELDEN	17237B
J07-P18000005	1	POWER CORD 2.3 METER THIN LINE		ALPHAW	535
K02-000000005	3	.250 ID INSULATING (BLACK)	TOP COVER	HEYCO	2810
K04-1450C	4	4/40 X 1/2` HEX SPACER	UPSA PWBA	KEYSTONE	1450C
K04-1450C	4	4/40 X 1/2` HEX SPACER		KEYSTONE	1450C
K04-883	4	#6 1/8" NYLON RND SPACER	POWER SUPPLY PWBA STUDS	KEYSTONE	883
K05-E02000001	1	MINI-BAY LAMP HOLDER	BH1	LEECRAFT	6-Jul
K05-E02000001	1	MINI-BAY LAMP HOLDER	BH1	LEECRAFT	6-Jul
K06-D08461	4	ADHESIVE WIRE TIE MT		DENNISON	8461
K06-D08461	4	ADHESIVE WIRE TIE MT		DENNISON	8461
K06-H3510NT90	14	5 1/2 inch long cable tie		HEYMANMANU	3510NT90
K06-H3510NT90	2	5 1/2 inch long cable tie	For cable assembly		

K06-H3510NT90	14	5 1/2 inch long cable tie		HEYMANMANU	3510NT90
K06-PFCCAC8	1	ADHESIVE CABLE MOUNTS	Clip 50 Conductor Cable at allcall studs		
K06-PTM2S6M	3	WIRE TIE MOUNT		PANDUIT	TM2S6-M
K06-PTM2S6M	3	WIRE TIE MOUNT		PANDUIT	TM2S6-M
K09-H10SCL001	1	`D` SUB SCREWLOCK-SET OF 2 PCS	FASTEN H10-025F00006		
K09-H10SCL001	1	`D` SUB SCREWLOCK-SET OF 2 PCS	FASTEN H10-025F00006		
K09-H10SCL001	1	`D` SUB SCREWLOCK-SET OF 2 PCS	FASTEN H10-025F00006		
K99-000000003	1	3/8` STEEL HOLE PLUG			
N01-000000002	1	LOCTITE 242 THREAD LOCK	PHONE JACK SCREW	LOCTITE	242
O05-000000001	1	STRAIN RELIEF, 5N-4 BLACK		HEYMANMANU	5N-4BLACK
O05-000000001	1	STRAIN RELIEF, 5N-4 BLACK		HEYMANMANU	5N-4BLACK
O09-000000001	13	SMALL POP RIVET		AVDEL	1693-0410
O09-000000001	4	SMALL POP RIVET	XLR CONNECTORS	AVDEL	1693-0410
O09-000000001	13	SMALL POP RIVET		AVDEL	1693-410
V01-RFPR	1	Msi 100 Preamplifier RF Board Assembly	Assembled RFPR Board		
V03-P2FP	1	PRO-II DISPLAY BD. ASSY.			
V03-P2PS	1	PRO-II POWER SUPPLY BD. ASSY.			
V03-SCAR	1	PWB ASSY, REGULATOR, SCA (ALL)		MSI	
V03-SCAR	1	PWB ASSY, REGULATOR, SCA (ALL)		MSI	
V03-SCAT	1	PWB ASSY, TERMINAL, SCA (ALL)		MSI	
V03-SCAT	1	PWB ASSY, TERMINAL, SCA (ALL)		MSI	
V03-UPSA	1	PWB ASSY, POWER SUPPLY		MSI	
V03-UPSA	1	PWB ASSY, POWER SUPPLY			
V03-UPSA	1	PWB ASSY, POWER SUPPLY		MSI	
V04-TSCA189M1	1	PEAK DEVIATION METER			
V05-PRO2CABLE	1	26 IN. 50 conductor flat cable assembly PRO-II			
Z05-512	1	51 OHM 2W 5% CC HB TYPE	R501	ALLENBRADL	HB TYPE 2W 5% CC
Z05-512	1	51 OHM 2W 5% CC HB TYPE	R501	ALLENBRADL	HB TYPE 2W 5% CC
Z10-103	1	100 OHM 10% 1WATT GB Type	R502	ALLENBRADL	GB TYPE 1 W 10 % CC
Z10-103	1	100 OHM 10% 1WATT GB Type	R502	ALLENBRADL	GB TYPE 1 W 10 % CC

MSI PART NUMBER	QTY	DESCRIPTION	REFERENCE DESIGNATOR	MANUFACTURER	MANUFACTURER PART NUMBER
V03-SCAR					
A04-1006HMCH1	2	.1 UF 50 V 20% MC	C301-C302	CENTRALAB	CZ20C104M
A04-1007GTNH1	2	1 UF 35 V DT	C305-C306	SPRAGUE	199D105X0035BB1
A04-100AGANH1	1	1000 UF 35V AE 20%	C307	PANA	ECE-B1VGE102
A04-6807FTNH1	2	6.8 UF 25 V DT	C303-C304	SPRAGUE	199D685X0025CB1
B01-4003	1	RECTIFIER DIODE	D301	VARIOUS	1N4003
C02-1NVARM001	1	LM337T VOLTAGE REG. ADJ.-1.5 AMP TO-220	U302	TEXASINSTR	LM337KC
C02-1PVARM002	1	LM317T VOLTAGE REG. ADJ +1.5 AMP TO-220	U301	TEXASINSTR	LM317KC
G04-SCAR2	1	PC BOARD W/SOLDER MASK & SILKS	PCB3	QUALITYCIR	SCAR-2
K02-000000003	2	ELECT. ISOLATING THE		BERGQUIST	K4-62
K02-3051	2	NO 2 SHOULDER BUSH		KEYSTONE	3051
K06-4INCH	1	4 INCH CABLE TIES			
K08-SCARMB	1	MOUNTING BRACKET	MB301	MSI	SCAR-MB
Z01-105	1	10K 1/4W 5% CF	R306	VARIOUS	1/4W5%CF
Z01-825	1	82 K 1/4W 5% CF	R305	VARIOUS	1/4W5%CF
Z02-1024	2	1.02 K 1/4W 1% MF	R301-R302	VARIOUS	1/4 W 1 % MF
Z02-1213	2	121 OHM 1/4W 1% MF	R303-R304	VARIOUS	1/4 W 1 % MF