1 KW DIGITAL ANTENNA COUPLER

CU-9150

Operation and Maintenance Manual (Rev. C)

3131 SW 42nd Street, Fort Lauderdale, Florida 33312 U.S.A.
http://www.sunairelectronics.com

Proprietary/Confidentiality Notice

Return Material Authorization (RMA) Procedures

In case of difficulty, please contact the Sunair Product Service Department between the hours of 8:30 a.m. and 5:30 p.m. EST.

Telephone: (954) 400-5100

Fax: (954) 583-7337

Email: techsupport@sunairelectronics.com

To return an item for repair or replacement, a Return Material Authorization (RMA) is required from the Product Service Department. When you receive the RMA number, carefully pack the item(s) and ship the package(s) to the address provided by your Product Service Representative.

Write the RMA number in a visual location on the outside of the shipping container.

Retain a copy of all information sheets included with the packaging.

Warranty Policy

Ground and Marine Products

Sunair Electronics warrants each piece of equipment manufactured by it to be free from defects in material and workmanship, under normal use for the lesser of one (1) year from the date of installation or 15 months from the date of shipment from Sunair.

Sunair will repair or replace, at its option, any defective equipment or component of the equipment returned to it at its factory, transportation prepaid, within such warranty period. No reimbursement will be made for non-factory repair charges.

This warranty is void if equipment is modified or repaired without authorization, subject to misuse, abuse, accident, water damage or other neglect, or has its serial number defaced or removed.

THIS WARRANTY IS ESPECIALLY IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. The obligation and responsibility of Sunair shall be limited to that expressly provided herein and Sunair shall not be liable for consequential or other damage or expense whatsoever therefore or by any reason thereof.

Sunair reserves the right to make changes in the design or additions to or improvements in its equipment without obligation to install such additions or improvements in equipment theretofore manufactured.

Training

Sunair offers training programs of varying lengths covering operation, service and maintenance of all Sunair manufactured equipment. For details please contact the Product Service Department.

Revision Record

Revision	Page(s)	Manual Revision Date	Unit Serial No. Effectivity	Addendum Covered
B				
Page changes 1:		05/27/98		
Page changes 2:		07/15/98		
Page changes 3:		08/24/99		
Page changes 4:		06/25/03		
C		3/22/2011		
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• Re-created some of the hand-drawn diagrams using illustrating software.	2-6, 2-8, 2-10,			

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Abbreviations/Acronyms

*(asterisk)	Selected function
ACC	Automatic Carrier Control
ADDR	Address
AFSK	Audio Frequency-Shift Keying
AGC	Automatic Gain Control
ALC	Automatic Level Control
ALE	Address Latch Enable Automatic Link Establishment
AM	Amplitude Modulation
AME	Amplitude Modulation Equivalent
AMP/AMPL	Amplifier
ARQ	Automatic Request
ATC	Air Traffic Control
AUD	Audio
AUTO	Automatic
AUX	Auxiliary
BAUD	Variable unit of data transmission speed (bits per second)
BELL U.S.	Telephone standards
BFO	Beat Frequency Oscillator
BITE	Built In Test Equipment
BRD	Board
CH/CHAN/ CHL/CHN	Channel
CLR	Clear
CMOS	Complementary Metal Oxide Semiconductor
CPLR	Coupler
CPU	Central Processing Unit (Computer)
CTCSS	Continuous Tone Coded Squelch System
CW	Continuous Wave
dB	Decibel
dBm	Decibels referred to 1 milliwatt
DCS	Digital Coded Squelch
DSBSC	Double Sideband Suppressed Carrier
DSP	Display Digital Signal Processor
DTMF	Dual Tone Multi-Frequency
DUART	Dual Asynchronous Receive/ Transmit
EEPROM	Electrically Erasable and Programmable Read Only Memory
EIA	Electronics Industry Alliance
EL	Electroluminescent
EMI	Electromagnetic Immunity
EMP	Electromagnetic Pulse
ENTR	Enter
EPROM	Eraseable Programmable Read Only Memory
ESD	Electrostatic Discharge
ETSI	European Telecommunications Standards Institute
FAX	Facsimile
FEC	Forward Error Correction
FM	Frequency Modulation
FREQ	Frequency
FSK	Frequency Shift Keying
FWD	Forward
GRP	Group
HF	High Frequency
HPAC	High Power Amplifier Controller
Hz	Hertz
IC	Integrated Circuit
IF	Intermediate Frequency
IMD	Intermodulation Distortion
I/O	Input/Output
IONCAP	Ionospheric Communications Analysis and Prediction (Program)
ISB	Independent Sideband
kHz	Kilohertz
kW	Kilowatt
LCD	Liquid Crystal Display
LCL	Local
LED	Light Emitting Diode
LK	Link
LO	Local Oscillator
LRU	Lowest Repairable Unit
LSB	Lower Sideband
LT	Light
LVL	Level
MIC	Microphone

Abbreviations/Acronyms *(Continued)*

MAN	Manual
M CH	Manual Channel
MED	Medium
MHz	Megahertz
MED	Medium
MHz	Megahertz
MIC	Microphone
MIL-STD	Military Standard
MNL	Manual
ms	Millisecond
MTBF	Mean Time Between Failures
MTR	Meter
MTTR	Mean Time To Repair
NAR	Narrow
NB	Narrow Band
PA	Power Amplifier
P.C.	Printed Circuit
PEP	Peak Envelope Power
PLL	Phase-Locked Loop
P/N	Part Number
PNL	Panel
POSTSL	Post-Selector
PRESEL	Pre-Selector
PTT	Push-To-Talk
PWR	Power
RCV	Receive
REFD/REFL/ RFL	Reflected
REV	Revision
RF	Radio Frequency
RFI	Radio Frequency Interference
RMA	Return Material Authorization
RMT	Remote
RS232	Computer control, hardwired up to 50 feet maximum
RS422	Computer control, hardwired up to 4000 feet maximum
RS485	Computer control, hardwired for multiple users
RTTY	Radio Teletype
RX	Receive
RU	Rack Unit
SDR	Software Defined Radio
SEL	Select
SINAD	Signal to Noise and Distortion
SLO	Slow
S MTR	Signal Strength Meter
SPKR	Speaker
SPLX	Simplex
SRAM	Static Random Access Memory
SSB	Single Sideband
TCXO	Temperature Compensated Crystal Oscillator
TFT	Thin Film Technology
TGC	Transmit Gain Control
THD	Total Harmonic Distortion
TTL	Translator Transistor Logic
TX	Transmit
USB	Upper Sideband
UTC	Universal Time Coordinated
VC	Voltage Control
VCO	Voltage Controlled Oscillator
VHF	Very High Frequency
VRMS	Volts Root Mean Square
VSWR	Voltage Standing Wave Ratio
W	Watt
WB	Wide Band
WPM	Words Per Minute
XMT	Transmit

Electrical Safe Work Practices

Accidents involving electricity can cause burns, explosions, shocks, and death. Only trained and qualified personnel should service, install, or repair electrical equipment.

The general safety procedures for personnel servicing electronic and electrical equipment include:

1. Always turn off or disconnect power before working on electric equipment, electronic circuits, or any type of electrical item.
2. Turn off and disconnect power before checking or replacing fuses.
3. Locate and correct the cause of a blown fuse or tripped circuit breaker before replacing the fuse or resetting the circuit breaker.
4. Never defeat the purpose of a fuse or circuit breaker. Always install a fuse with the correct amperage rating for the circuit. Never install a fuse with a higher rating.
5. Always have a second trained and qualified person present when working on electrical systems (protected or unprotected).
6. Always remove metal jewelry, watches, rings, etc., before working on electrical circuits or any electrical equipment.
7. Do not work on electrical equipment in a wet area. Never place containers of liquid on electrical equipment.
8. Do not touch an object that may provide a hazardous path to earth ground.
9. Safely discharge capacitors in equipment before working on the circuits (refer to ESD procedures).
10. Inspect cabling for defects, including frayed wiring, loose connections, or cracked insulation. Replace defective cords and plugs.
11. Always check the electrical ratings of equipment and verify that the ratings are correct.
12. Never overload circuits.
13. Verify grounding of equipment chassis/cabinets. Never cut off or defeat the ground connection on a plug.
14. When working at any site, always observe all safety signs and safety procedures. They exist to protect personnel from injuries.
15. All persons working on or around electrical/electronic equipment should have first aid training, including resuscitation procedures and external cardiac compression.

Electrostatic Discharge (ESD)

Electrostatic Discharge (ESD) can severely damage sensitive components located on printed circuit cards. Electrostatic discharge measurements as high as 35,000 volts, can occur from walking across a carpet.

To avoid potential damage to electronic equipment, follow correct electrostatic discharge preventive procedures when handling or working with the hardware.

1. Always wear an electrostatic discharge wrist strap when handling electronic hardware.
2. Connect the electrostatic discharge wrist strap to a reliable earth ground.
3. Replace worn or frayed electrostatic discharge wrist straps and connecting cords.
4. Check your electrostatic discharge strap every month.
5. Do not use electrostatic discharge straps that are out of calibration.
6. Place printed circuit cards in an electrostatic discharge bag or other ESD container to avoid damage from stray static charge.
7. Do not place printed circuit cards on any surface that is not an approved electrostatic discharge surface correctly connected to earth ground.
8. Always handle printed circuit cards by the edges. Avoid touching any of the sensitive circuits on the card.

Hazardous Materials

Hazardous materials are likely to be present at the maintenance facility. Many of the following substances are toxic (causing illness or death): flammable materials, explosive materials, corrosive materials that cause the skin or eyes to burn on contact, reactive materials that, when exposed to heat, air, water, or certain other chemicals, can cause burning or release of toxic vapors.

Some hazardous substances are obvious, for example, adhesives, solvents, abrasives, fuels, and pesticides. Other substances are less obvious, for example, toner in office copiers and printers and heavy-duty cleaning and disinfectant products. The list of substances identified as hazardous in the workplace is constantly increasing as new processes and new technologies create new chemicals.

Post a list of hazardous materials in each work area. In the United States, hazardous materials include a material safety data sheet that describes the material, the health/safety risks, correct usage procedures, recommended storage facilities, and the method(s) to treat exposure. If local codes do not require use of a material safety data sheet, a simple list may describe the type of material, correct usage and storage methods, and its hazard(s). Include emergency first aid procedures in the event that personnel experience exposure to the material.

Lockout/Tagout Policy

Lockout/Tagout refers to the complete isolation of equipment during maintenance or service work. It is good practice to require use of locks or tags as warning devices to prevent injuries to service personnel from accidental machine start-ups.

While servicing equipment, place a red or yellow tag on the equipment, indicating it is out of use for repairs or maintenance. Treat these tags as a lockout tag. To obtain information regarding when that piece of equipment will become available for use, contact the person who signed the tag.

Examples of equipment/service to tag/lock out during servicing include:

- Power supplies
- Transmitters
- RF equipment
- Motors
- Antennas
- Generators
- Fan systems

Work situations where unexpected application of power or starting of equipment could occur include:

- New construction
- Installation or set-up of equipment
- Equipment that is being:
  - Adjusted
  - Inspected
  - Serviced
  - Repaired

Power types include:

- Electrical
- Hydraulic
- Chemical
- Mechanical
- Pneumatic
- Thermal

WARNING

Do not attempt to start, energize, or use a machine or equipment that is locked out for service or maintenance.

Warnings, Cautions, and Notes

Warnings, cautions, and notes alert the user to special conditions regarding safety or correct performance of a particular step(s).

WARNINGS – Used when a procedure, technique, or restriction could result in injury or death to personnel.

CAUTIONS – Used when a procedure, technique or restriction could result in damage to equipment.

NOTES – Used whenever emphasis or consideration for the performance of a procedural step or steps are necessary.

Some personnel in the work place should be trained in rendering first aid. In those places where high voltages are present, they should be familiar with methods of resuscitation.

Keep Away from Live Circuits

Operating personnel must observe at all times all safety regulations. Do not replace components inside the equipment with the power supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position due to circuit design or charges retained by capacitors. Remove watches and rings before performing any maintenance procedures.

Do Not Service or Adjust Alone

Under no circumstances should any person reach into or enter the enclosure to service or adjust the equipment except in the presence of someone who is capable of rendering aid.

Resuscitation

Personnel working with or near high voltage should be familiar with methods of resuscitation.

Chapter I

1.0 General Information

1.1 Scope of Manual

This manual contains information necessary to install, operate, maintain and repair the CU-9150 1 KW Automatic Digital Antenna Coupler.

1.2 General Description

The CU-9150 is a 1000 watt high quality remotely controlled antenna coupler, capable of providing efficient matching of antennas 23 feet and longer to a 50 ohm transmission line, over the frequency range of 1.6 to 30 MHz. In addition, the coupler may be used as a 'line flattener' to correct the VSWR of resonant antennas. The unit is designed as a companion to the Sunair LPA-9600 1 kW or LPA-9500 500 Watt Linear Power Amplifiers.

The CU-9150 is designed to operate at separations of up to 250 feet from the Exciter/Transceiver. The coupler control is located on the front panels of Sunair 9000 Series Exciters/Transceivers. Manual tuning cycles are initiated by pressing the **CPLR TUNE** pushbutton on 9000 Series front panel. A meter for indicating forward and reflected power is also located on the 9000 Series front panel. During a tuning cycle, the linear power amplifier is disabled and tune power (35-45 Watts) is supplied by the Exciter/Transceiver. The operating power and commands to the coupler are also supplied by the Exciter/Transceiver alone. The coupler may be used directly with a 125 watt Exciter/Transceiver if low power operation is desired or the linear amplifier is off-line.

1.2.1 Assemblies

1.2.1.1 Input Connector Assembly 1A1A2

The Input Connector Assembly 1A1A2 provides the required mounting surface for the various electrical and mechanical components. It serves as interconnect for signals to and from the CU-9150, the Exciter/ Transceiver and the LPA-9600 kilowatt linear power amplifier.

1.2.1.2 CPU Assembly 1A1A3

The CPU Assembly 1A1A3 contains the microprocessor responsible for the operations and functions of the CU-9150.

1.2.1.3 RF Detector Assembly 1A1A4A1

The RF Detector Assembly contains the magnitude, phase, reflected power detectors and a 50 ohm calibration source.

1.2.1.4 Input Capacitor Assembly 1A1A4A2

The Input Capacitor Assembly contains the input capacitance binary variable network element.

1.2.1.5 Motherboard 1A1A1

The Motherboard 1A1A1 interconnects the CPU Assembly, RF Detector, Input Capacitor and Network Relays.

1.2.1.6 Chassis Assembly 1A1

The Chassis Assembly contains three binary variable reactive network elements. These are the series inductance (L series), output capacitance (C-out), and output inductance (L-out).

1.3 Technical Specifications

1.3.1 General

Frequency Range	1.6 to 30 MHz
Tuning Capabilities	35-foot Whip, 50 to 150 Long Wires

NOTE: Long Wire Adapter required; 23 foot Whip, 3 to 30 MHz.

RF Input Power	1.6 to 2.0 MHz 500 W average, 1 kW PEP 2.0 to 30 MHz 1 kW average, 1 kW PEP
Input Impedance	50 ohms
Duty Cycle	Continuous
Tuning Time	1 second typical; 25 ms from memory. Channel Memory, 128 channels.
Tune Power Required	25 W RF delivered
Tune Accuracy	1.5:1 VSWR or better (99.5% of all operating frequencies)
Remote Capability	Up to 250 ft. from Exciter/Transceiver
Power Input	28 VDC supplied from Exciter/Transceiver
Circuit Protection	(A) RF Input Spark Gap (B) Control Line Lightning Impulse
Weight	20.4 kg (45 lbs)
Size	Height: 24.38 cm (9.6”) Width: 45.47 cm (17.9”) Depth: 73.15 cm (28.8”)
MTTR	15 minutes
MTBF	12,000 hours

1.3.2 Environmental

Temperature Range:	Operating -50^{o}C to +65^{o}F (-58^{o}C to +149^{o}F) Storage: -55^{o}C to +85^{o}F (-67^{o}C to +185^{o}F).

Humidity: MIL-STD-810C, Method 507.1, Proc. II

Shock and Vibration: MIL-STD-810C, Method 516.2 and 514.2

Enclosure MIL-STD-810C, Method 510.1, waterproof

1.4 Equipment Supplied

Table 1.4-1 List of Equipment Supplied

Equipment	Sunair Part Number
CU-9150 Automatic Digital Antenna Coupler	8120000056 Gray 8120000099 Olive Drab
Button up	8120001052 Gray
Operation and Maintenance Manual	TM-8120000501
Connector Kit, consisting of:	8092000298
Bushing, Telescoping, .561 D	0700550054
Bushing, Telescoping, .621 D	0700550062
Bushing, Telescoping, .751 D	0700550071
Connector, Power, 37 Pin Round	0747640009
Connector, RF, N UG-21 B/U	0754140008

1.5 Equipment Required, Not Supplied

Table 1.5-1 List of Equipment Required, Not Supplied

Equipment	Sunair Part Number
Control Cable Assembly	8092500096
Order by length. Contains:	
Connector, Power, 37 Pin Round	8092000298
Connector, RF, N UG-21 B/U	0588680001
LPA-9600/LPA-9500 mating connector and hardware	User Supplied
Coax Cable Assembly	8104906097
Order by length desired. Contains:	
Coax Cable RG-213	1010770021
Connector, RF, N UG-21 B/U 2 each	0754140008

1.6 Optional Equipment

Table 1.6-1. Optional Equipment

Equipment	Sunair Part Number
Linear Amplifiers/Exciter/Transceiver	Consult Sunair Marketing Department
TS-9150 Diagnostic Test Set	8120907591
Depot Spares Kit	8120900090
Field Module Kit	8120905792
35 Foot Fiberglass Antenna	0715850008
Feed-Thru Antenna Mount, 1 kW	1004890001
Base Antenna with Flange	0715780000
KW Longwire Antenna Kit	1003090010
Control Cable Assembly - Used to connect coupler directly to exciter/transceiver	8076004195
Long-Wire Adapter Kit	8120909003

END OF CHAPTER I

CHAPTER II – Installation

2.0 Installation

2.1 General

Section II contains all necessary instructions for the unpacking, inspection, and if necessary, reshipping of damaged equipment or parts. In addition, further information regarding location and mounting considerations, power requirements, antenna and ground system hook-ups and installation test is also provided.

2.2 Unpacking and Inspection

As soon as you have received your unit(s), unpack and inspect all components and accessories. Check the packing list to be sure you have received all items ordered and that all items necessary for operation have been ordered.

NOTE: Be sure to retain the carton and its associated packing materials should it be necessary to reship damaged equipment.

Do not accept a shipment when there are visible signs of damage to the cartons until a complete inspection is made. If there is a shortage of items or any evidence of damage, insist on a notation to that effect on the shipping papers before signing the receipt from the carrier. If concealed damage is discovered after the shipment has been accepted, notify the carrier immediately in writing and await his inspection before making any disposition of the shipment. A full report of the damage should also be forwarded to Sunair's Product Services Department. Include the following:

- Order Number
- Model and Serial Number
- Name of Transportation Agency
- Applicable dates.

When Sunair receives this information, arrangements will be made for repair or replacement.

2.3 Return of Equipment to Factory

The shipping container for the CU-9150 has been carefully designed to protect the equipment during shipment. The container and its associated packing materials should be used to reship the unit. When necessary to return equipment to Sunair for warranty or non-warranty repair, an authorization number is required. This number can be obtained from our Product Services Department:

Telephone: (954)-400-5100

FAX: (954)-583-7337

e-mail: techsupport@sunairelectronics.com.com.

If the original shipping carton is not available, be sure to carefully pack each unit separately, using suitable cushioning material where necessary. Very special attention should be given to providing enough packing material around connectors and other protrusions from the coupler. Rigid cardboard should be placed at the corners of the equipment to protect against denting.

When returning subassemblies or components for repair or replacement, be sure to pack each item separately, using suitable cushioning material.

Shipment to be made prepaid consigned to:

Sunair Electronics, Inc.
Product Services Department
3131 SW 42 Street
Ft. Lauderdale, Florida 33312
U.S.A.

Plainly mark with indelible ink all mailing documents as follows:

U.S. Goods Returned For Repair
Value For Customs - $100.00

Mark all sides of the package:

FRAGILE - ELECTRONIC EQUIPMENT!

NOTE: Before shipping, carefully inspect the package to be sure it is marked.

2.4 Power Requirements

All power necessary to operate the CU-9150 1 KW Automatic Digital Coupler is supplied from a companion Exciter/Transceiver via the LPA-9600/LPA-9500 control cable. See Figure 2.11-1 for control cable connections.

2.5 Installation Considerations and Mounting Information

The satisfactory operation of the equipment will depend upon the care and thoroughness taken during the installation.

2.5.1 General Installation Procedures and Requirements

1. Carefully plan radio/amplifier/coupler/antenna locations, observing the following requirements before starting installation.
2. Provide best possible RF ground for all equipment. Use flat copper strap 1" wide or #6 (or larger) wire and make connections to the ground terminal of all system components. Leads to ground system should be as short as possible.

   After the system grounds have been installed, connect the station ground system to the antenna coupler ground terminal. Bear in mind that the antenna ground lead is actually part of the antenna itself, and therefore will have a marked effect on the antenna input impedance. If a 35-foot vertical antenna is to be used, at least 12 separate 35-foot radials connected to a common ground stake are recommended.

3. Provide the maximum separation between coupler/antenna and the radio with its associated wiring. 100 feet is the recommended minimum distance and up to 250 feet separation may be used.
4. The antenna lead from the antenna coupler RF output insulator must be insulated for at least 15 kV potential. As an alternative, copper tubing with an outside diameter of at least 1/4" may be used, provided that it is routed to the antenna terminal so that it is spaced at least six inches from any metal objects in its vicinity. It is important to keep the length of this lead to an absolute minimum since it forms a part of the radiating portion of the antenna. Three (3) feet would be the maximum distance if antenna efficiency is not to be compromised.
5. Linear amplifiers with low level modulation such as used in Sunair exciters/transceivers will sometimes oscillate if the high RF power level output is radiated or conducted into the low level stages. Evidence of this situation is erratic or excessive power output. This is caused by too close proximity of the coupler output and antenna to the transmitter and/or inadequate RF grounds. Carefully following the above procedures will prevent this from occurring.

2.5.2 Mounting Considerations

See Figure 2.11-2 for Coupler outline dimensions.

The mounting position for the CU-9150 is dependent on the available space for mounting. Four mounting feet with 3/8" wide slots are provided on the coupler. If it is necessary to mount the coupler on a wooden pole, simple angle-iron adapter brackets may easily be fabricated. Since the total weight of the unit is only 45 pounds, two wooden 4 x 4s set in cement would provide dependable support.

2.5.3 Installation of Remote Control and RF Cables

It is recommended that the remote control cable be procured from Sunair. However, if necessary, the cable may be made from individual No. 20 AWG stranded wire with an overall braided shield and PVC jacket. Interconnection cable details are given in Figure 2.11-1.

2.6 Antennas and Ground Systems

2.6.1 General

Sunair Exciters/Transceivers are designed to operate into a 50 Ohm resistive antenna system with a maximum voltage standing wave ratio (VSWR) of 2:1. When used with the CU-9150 1 KW Automatic Digital Antenna Coupler alone or with the LPA-9600 Linear Amplifier, the system will match antennas 35 feet and longer. The CU-9150 is placed close to the antenna (within 3 feet or less) and controlled from the front panel of the exciter/ transceiver. This optimizes both operator convenience and electrical performance. As there are numerous types of antennas, a complete discussion is beyond the scope of this manual; however, some general DOs and DON'Ts of antenna installation are listed below:

- The antenna should be clear of all large objects such as trees and buildings.

- When using whip antennas, the ground system actually forms part of the radiating system. Where space permits (such as in a base station installation) a good ground plane or radial system should be installed at the base of the antenna. (See Figure 2.11-3.)

NOTE: An inadequate ground system is most often responsible for disappointing performance when using a whip antenna.

2.6.2 Random Length Non-Resonant Antennas

See Figure 2.11-3, Figure 2.11-4, and/or Figure 2.11-5 as needed.

Whips and longwires are popular non-resonant antennas. The whip antenna is often used in mobile, marine, portable or semi-portable installations because it is rugged and self-supporting. The antenna impedance is strongly dependent on the operating frequency, and an antenna coupler, therefore, must be used to match the antenna to the transceiver. Thirty-five foot whip antennas offer a good compromise between practical height and good electrical performance at low frequencies. The whip's performance is greatly influenced by its ground system. For temporary base station installations, a minimum of four 6-foot long ground rods should be driven into the ground, symmetrically placed around the antenna base. The rods should be bonded together with heavy strap and then connected to the antenna coupler ground by another short, heavy strap. If the antenna is mounted on the roof of a building where a short ground lead to coupler cannot be obtained, a minimum of four symmetrically placed ground radials should be installed at the base of the antenna, bonded together, and connected to the antenna coupler ground post. The radials should be made of number 12 gauge wire or larger and should be at least 1/4 wave long at the lowest operating frequency. (Radial length in feet = 246/frequency in MHz.) The whip's radiation pattern is omni-directional in the azimuthal plane.

The longwire antenna, illustrated in Figure 2.11-5, is a popular base station antenna where a wide range of operating frequencies are used. The antenna impedance varies greatly with frequency and, therefore, must be matched to the transmitter with the antenna coupler. The CU-9150 will efficiently match longwire antennas up to 150 foot in length. The radiation pattern of the longwire antenna is also a strong function of operating frequency. The two most popular longwire antennas, (75 and 150 foot) available from Sunair, exhibit excellent low frequency radiation efficiency.

2.7 Long-Wire Adapter Kit (1A1A5) 8120909003

The Long-Wire Adapter Kit is required for wire antennas between 50 and 150 feet in length. See Figure 2.11-6 for installation details.

Operation using a 23- to 35-foot whip antenna is still possible after installation of the long-wire adapter kit. This is accomplished by changing the point at which the wire from K19 on the chassis (1A1K19) is connected to the long-wire adapter kit. See Figure 2.11-7 for details.

A **WHIP / LONG-WIRE** identification plate is included with the long-wire adapter kit. It should be secured to the top cover of the coupler by one of the cover hold-down screws. It is meant to indicate whether the long-wire adapter kit is configured for whip or long-wire operation.

2.8 TX Only Function

If the coupler is being installed in a system with separate transmit and receive antennas and where two or more transmitters are using collocated antennas, the TX ONLY function should be enabled. When this function is enabled, the coupler opens the RF path between the tuning network and the radio system when the radio system is in receive mode. Therefore, high RF voltages induced by adjacent transmitters are confined to the coupler.

The TX ONLY function is enabled by soldering a jumper wire between E4 and E4 of the 1A1A4A1 RF Detector Board.

2.9 Software Revision

In order for the CU-9150 to function properly, the software revision in the companion transceiver or exciter and linear amplifier must be equal to or later than the following:

Equipment	Software Revision
RT-9000 or RT-9000A	D4
T-9400	B1
LPA-9500	B1
LPA-9600	B1

2.10 Checks after Installation

Follow steps outlined in Section 3.2 for your particular system configuration.

WARNING - HIGH VOLTAGE

The radio operator and service technician should exercise caution not to contact the ANTENNA INSULATOR E2 output while transmitting.

2.11 Integration with Third Party Radio Systems

Refer to Section 4.9 for interface information required to integrate the CU-9150 with Third Party Radio Systems.

A2206B

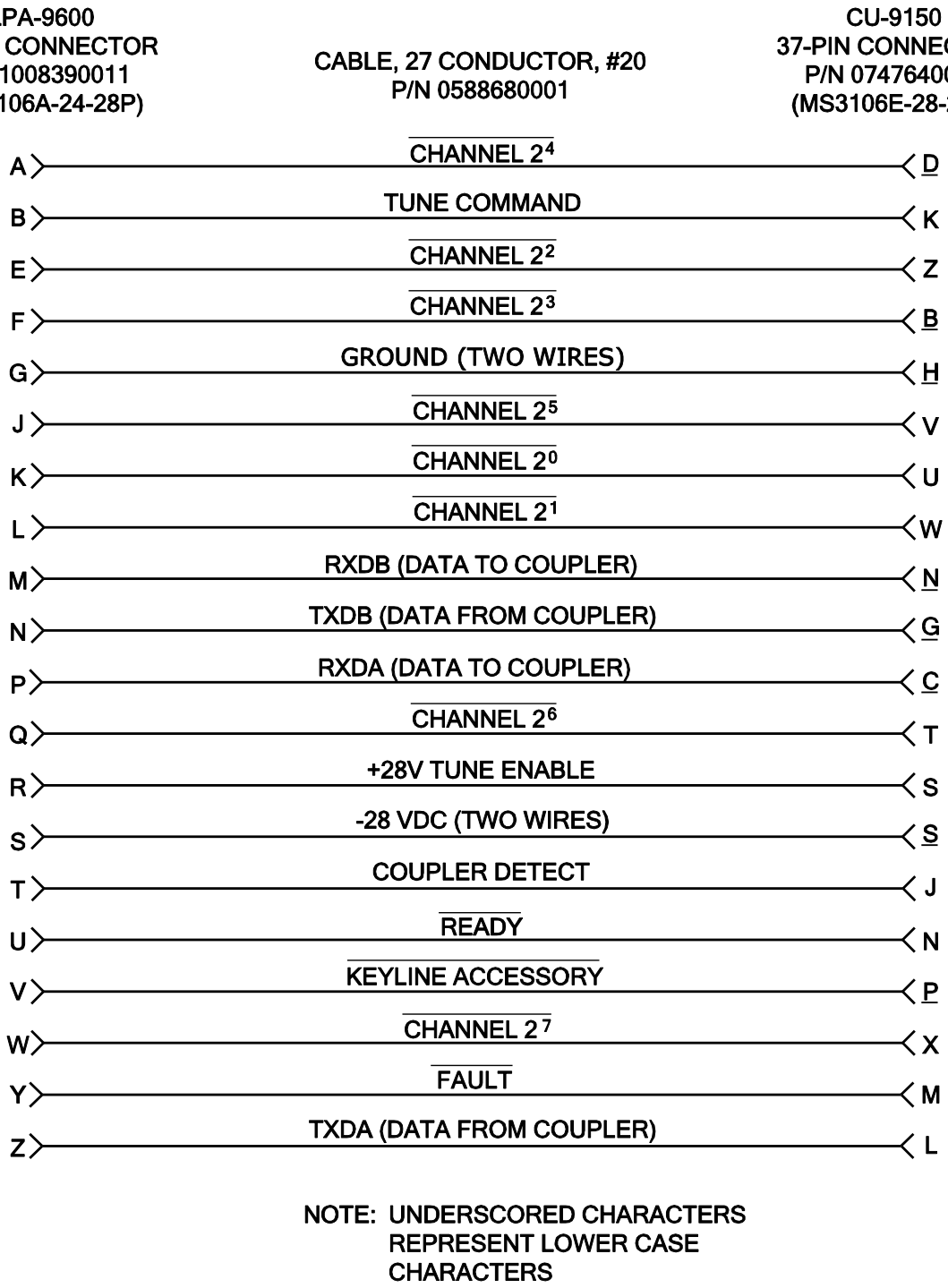

Figure 2.11-1. CU-9150 Control Cable P/N 8092500096

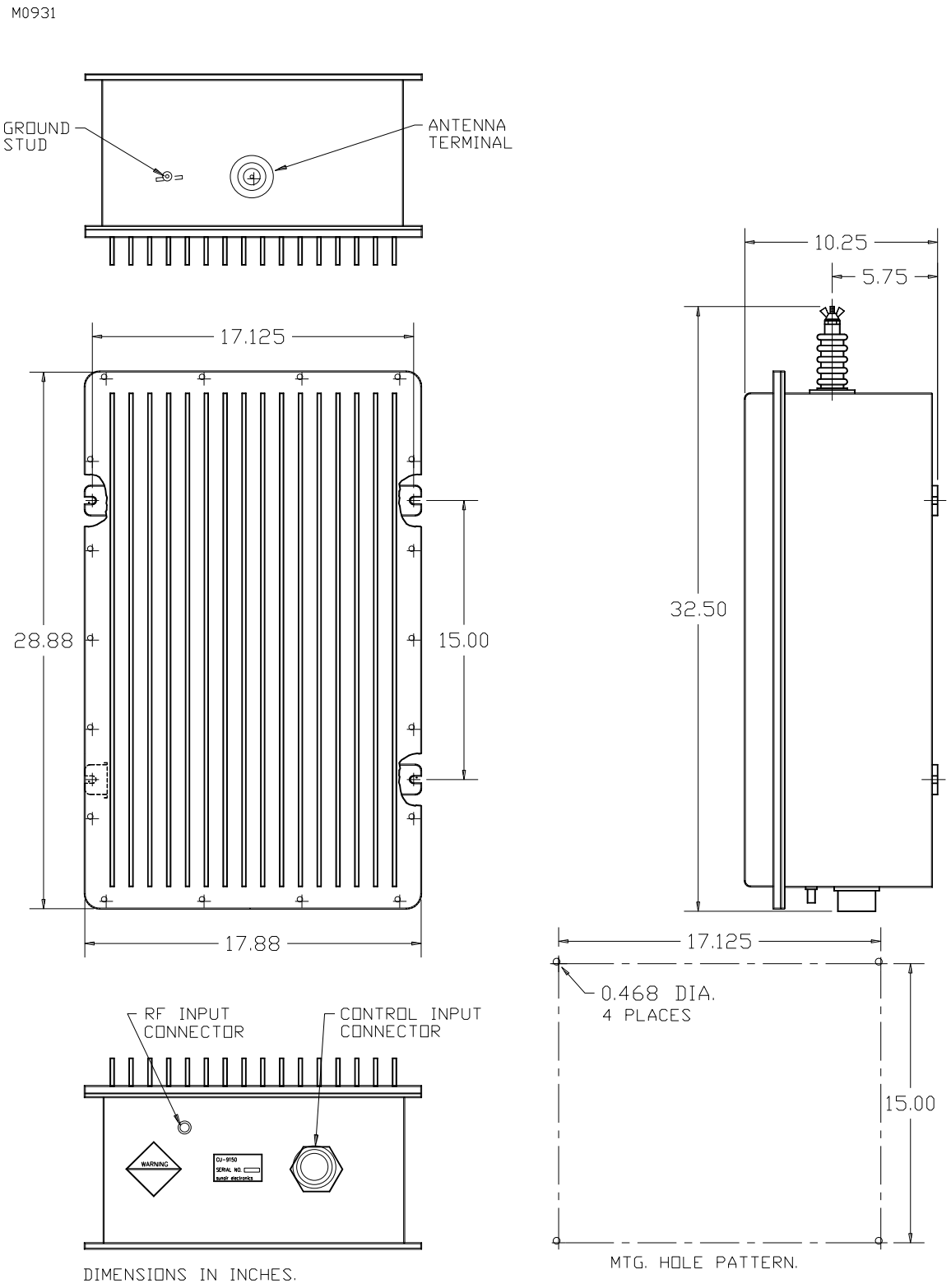

Figure 2.11-2. Coupler Outline Dimensions

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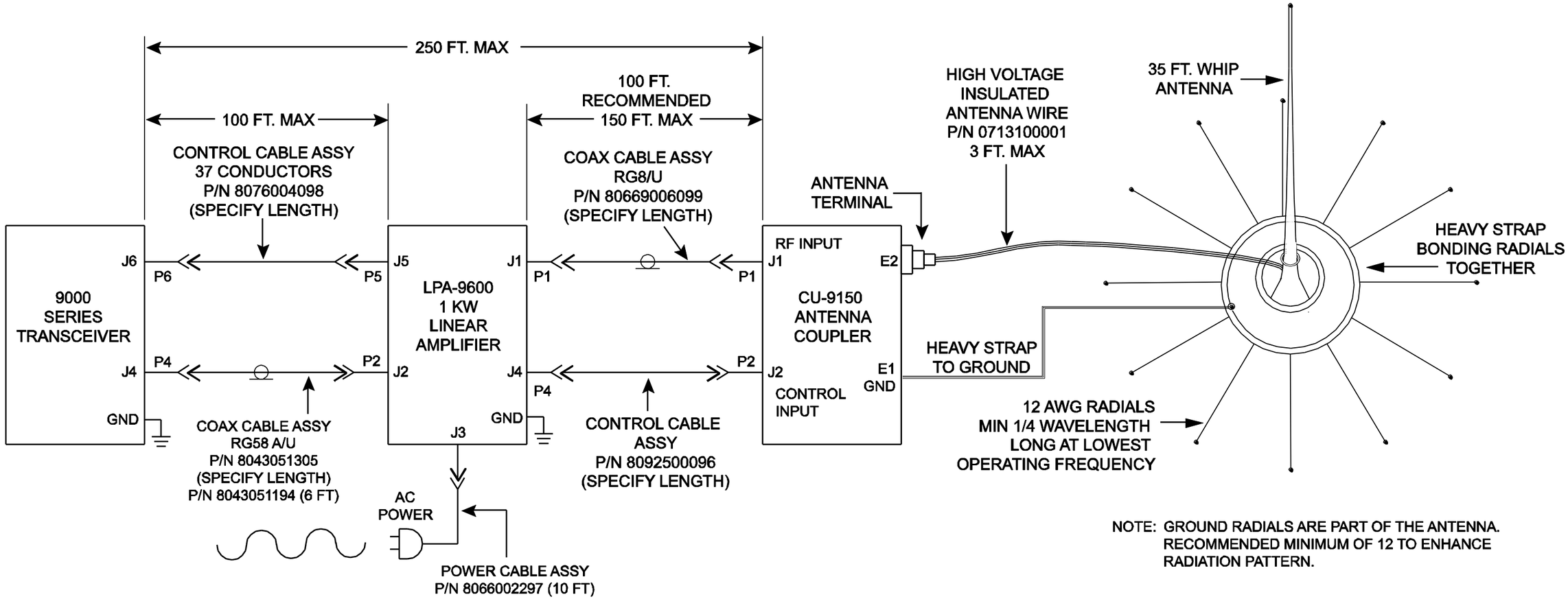

Figure 2.11-3. LPA-9600 with CU-9150, 35-Foot Antenna (Roof Top Installation)

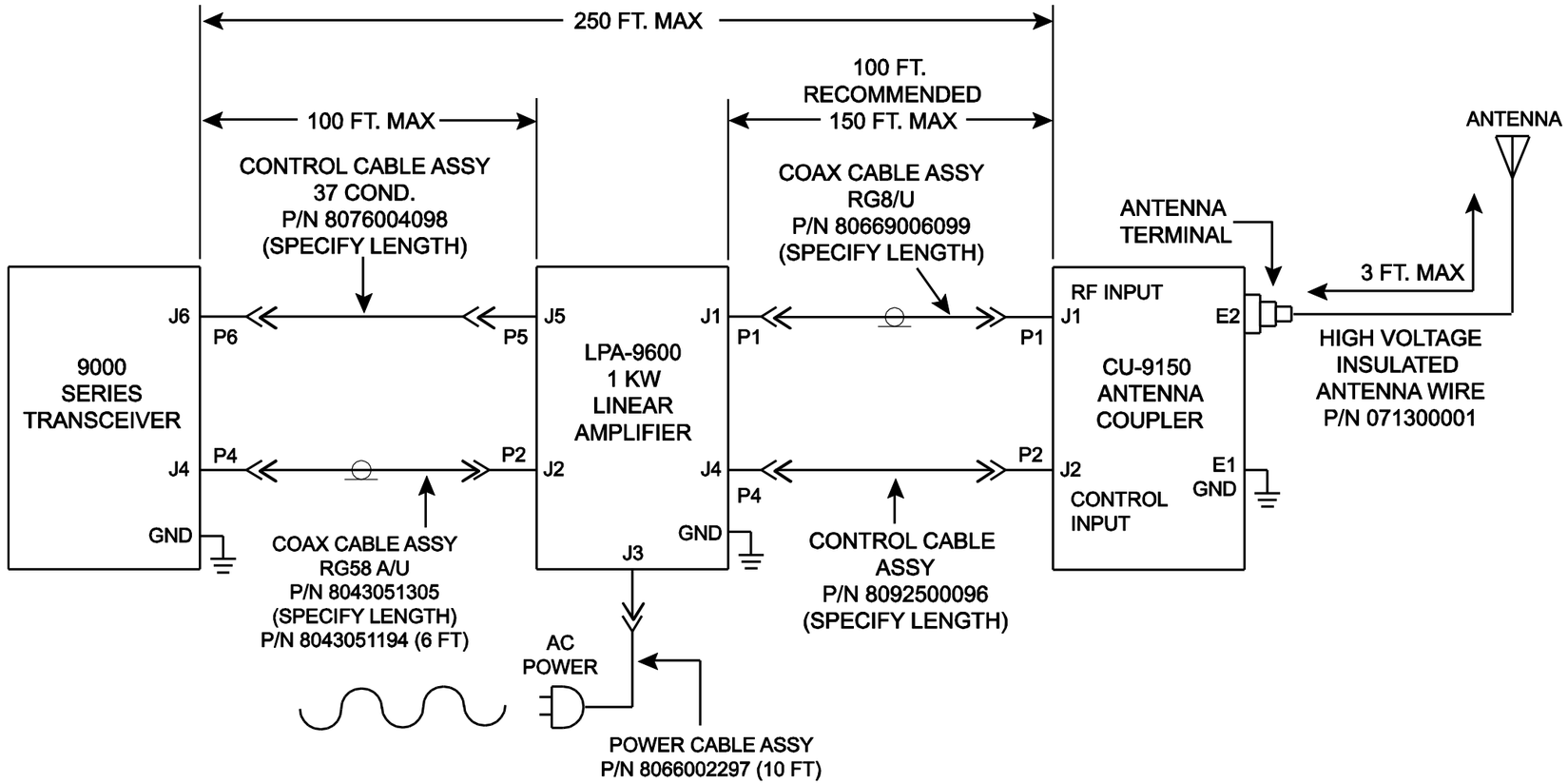

Figure 2.11-4. LPA-9600 with CU-9150, Non-Resonant Antenna

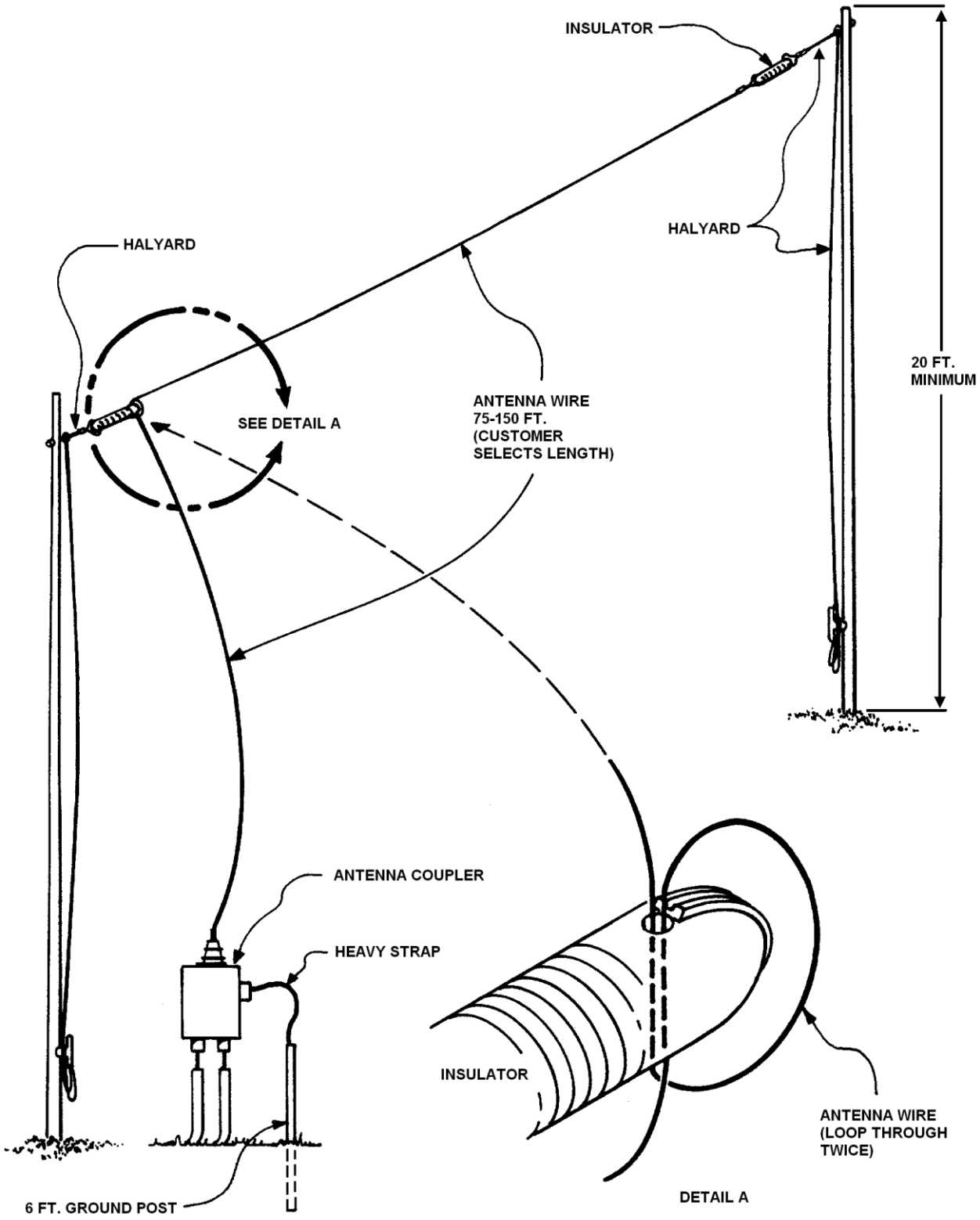

Figure 2.11-5. Longwire Antenna Kit

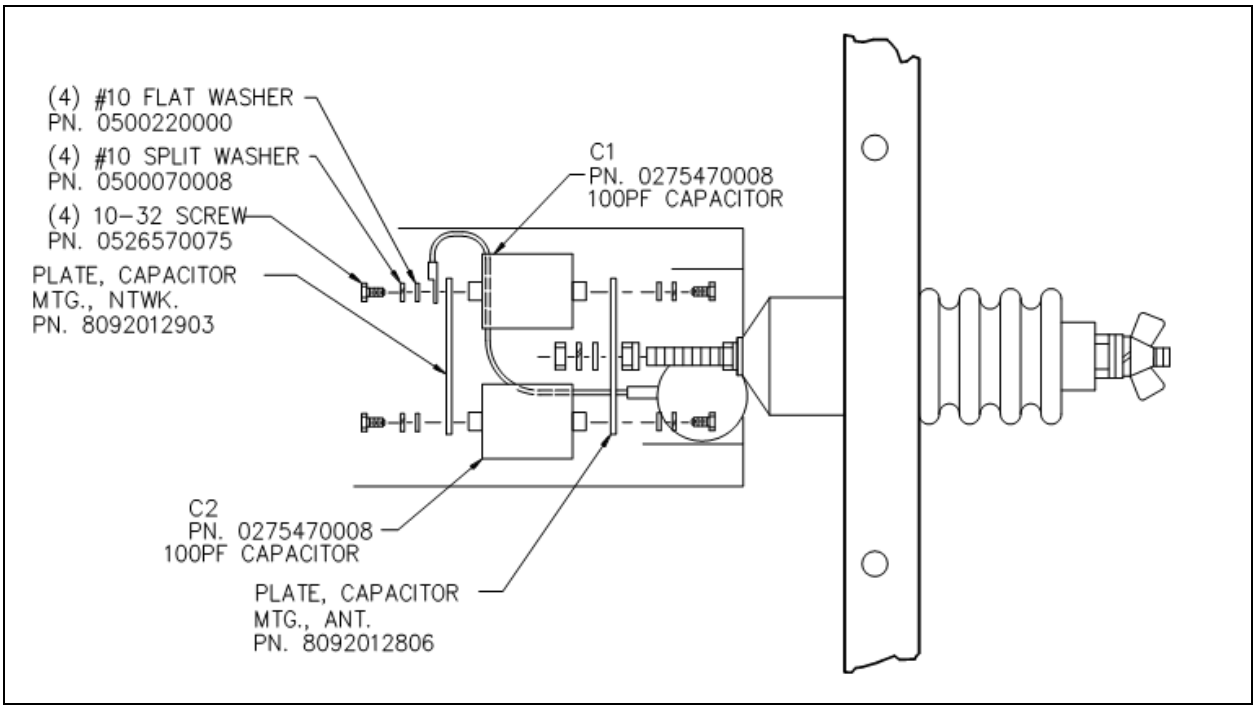

Figure 2.11-6. Long-Wire Adapter Kit (1A1A5) 81200909003 Installation Configured for Long-Wire Operation

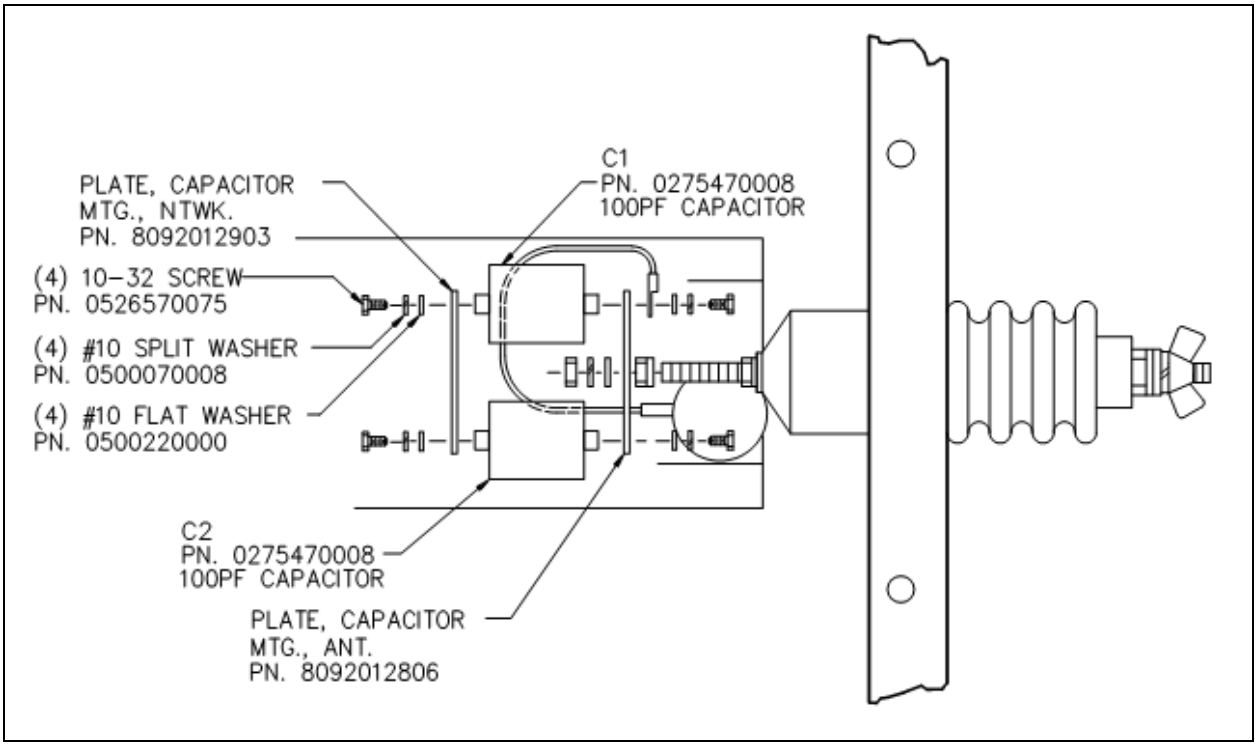

Figure 2.11-7. Long-Wire Adapter Kit (1A1A5) 81200909003 Installation Configured for Whip Wire Operation

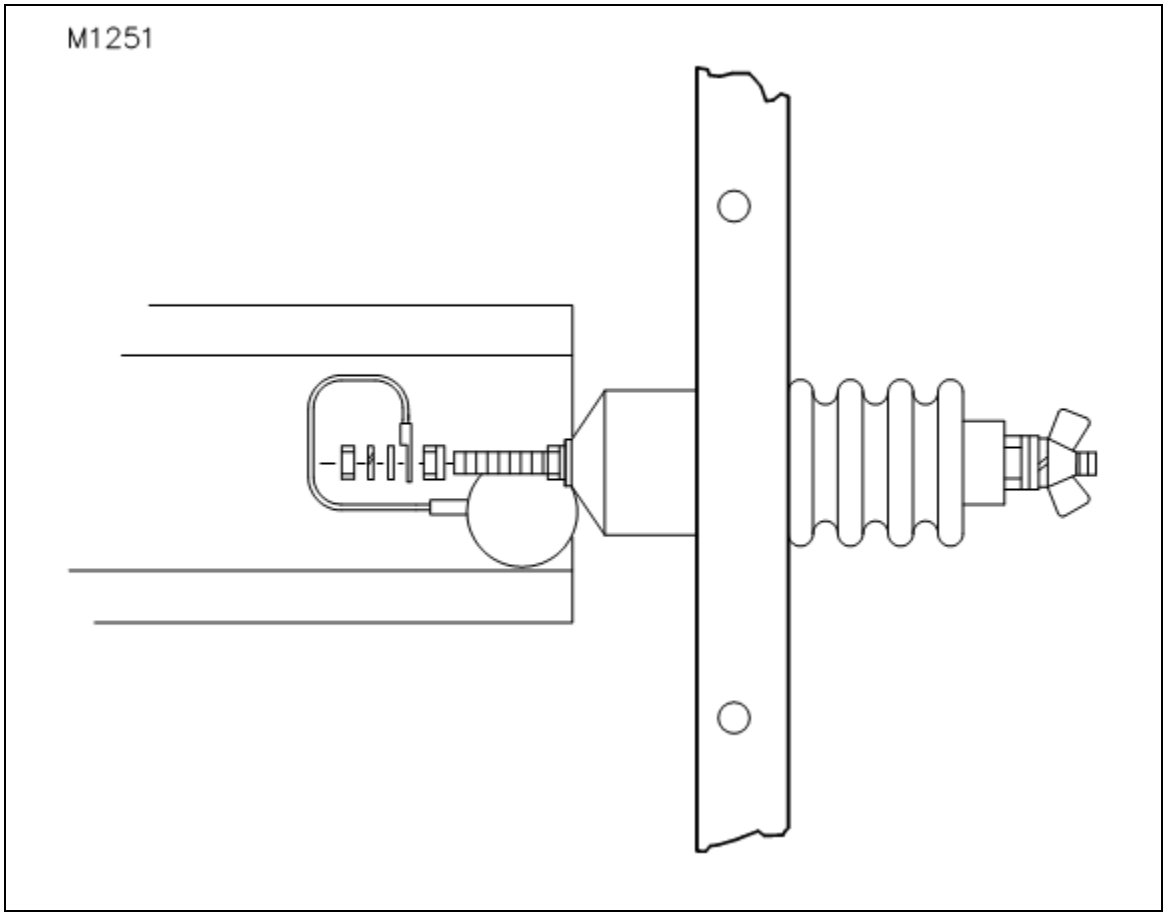

Figure 2.11-8. Assembly/Disassembly of Antenna Output Lead (Long-Wire Adapter Kit Not Installed)

END OF CHAPTER II

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CHAPTER III – Operation

3.0 Operation

3.1 General

The CU-9150 Automatic Digital Antenna Coupler operates with the LPA-9600 1 kW or LPA-9500 500 Watt Solid State Linear Power Amplifier and 9000 Series Exciters/Transceivers. Refer to the LPA-9600 or LPA-9500 manual and/or the applicable Exciter/Transceiver manual for operational considerations of the individual unit.

3.2 Operating the CU-9150

3.2.1 Operation with 9000 Series Exciters/Transceivers and LPA-9600

Ensure that the Exciter/Transceiver, LPA-9600/LPA-9500 and CU-9150 are installed properly. Refer to Section II of the applicable manuals.

1. Apply power to the Exciter/Transceiver and LPA-9600 and select 1 kW (for the LPA-9500, select 500 W).
2. On the LPA-9600/LPA-9500, the green **POWER** lamp will light and the LCD will display system messages:

   FAULT: **COUPLER UNTUNED, METER: FWD, PWR LVL: 1 kW** (LPA-9500 displays **500 W**)
3. Select desired operating frequency on the Exciter/Transceiver.
4. Press the **CPLR TUNE** pushbutton on the Transceiver front panel.
5. On the LPA-9600/LPA-9500, the following system messages will appear:

   COUPLER TUNING, **COUPLER TUNED**, **KW SYSTEM OPERATIONAL**
6. Tuning will be accomplished in typically 1 to 2 seconds.
7. lf the red **FAULT** lamp of the LPA-9600/LPA-9500 lights during a tune attempt, the CU-9150 has not tuned. Press the **CPLR TUNE** pushbutton again and allow the system to retune. If the **FAULT** does not clear, refer to Section 5.0 of this manual and the Exciter/Transceiver manual.

3.2.2 1000 Watt Operational Checkout

1. Select **CW MODE** and frequency 29.9900 MHz. Press the **CPLR TUNE** pushbutton and observe a **SYSTEM READY** condition.
2. Key the Exciter/Transceiver with the CW key and check the forward and reflected power on LPA-9600 front panel meter. An acceptable tune should show 700 to 1000 Watts forward and 28 to 40 Watts reflected maximum. Refer to Table 3.2-1.

   NOTE The LPA-9500 should show 300 to 500 Watts (refer to Table 3.2-2).

Table 3.2-1. Acceptable Reflected Power Chart for VSWR 1.5:1. for LPA-9600

Forward Watts	Reflected Watts Maximum
700	28
800	32
900	36
1000	40

Table 3.2-2. Acceptable Reflected Power Chart for VSWR 1.5:1. for LPA-9500

Forward Watts	Reflected Watts Maximum
350	14
400	16
450	18
500	20

3. Continue tuning through the HF Spectrum from 1.6 to 30 MHz in 1 MHz steps and check for an acceptable tune at each frequency. If problems occur, refer to Section to determine how to correct the problem.

END OF CHAPTER III

CHAPTER IV – Theory of Operation

4.0 Theory of Operation

4.1 General

The CU-9150 is a fully digital antenna coupler designed for use with the LPA-9600 1 kW or LPA-9500 500 Watt Linear Power Amplifiers and the Sunair 9000 series Exciters and Transceivers. The coupler is rated for 1000 Watts PEP or average power and will tune common shipboard and ground based antenna systems such as 23 foot and 35 foot verticals or 50 to 150 foot end-fed wire antennas.

A 128 channel non-volatile memory system is provided for use with Transceivers or Exciters providing channel information to the coupler.

Figure 4.9-2 provides an assembly tree of all the major assemblies, their part numbers, and reference designations. Figure 4.9-3 provides a block diagram for the unit. Both are at the end of this section.

4.2 Antenna Impedance Matching Network

The antenna impedance matching network is a lowpass PI and PI-L network depending on the frequency and antenna system employed. The lowpass PI network offers several desirable advantages over high-pass network configurations such as:

- Harmonic Attenuation. 5 to 20 dB depending on the antenna type and operating frequency.
- Pipeline Operation (Bypass) for Automatic Link Establishment (ALE) receives scan operation. This technique conserves mechanical relay life.

The PI network can be viewed as two L-networks placed in back-to-back configuration. The PI network is very flexible, it can provide a number of network component solutions for any one impedance matching problem, by modifying the antenna impedance with shunt output capacitance. However, excessive amounts of shunt output capacitance results in a low network impedance, producing significant circulating current in both the series-L and shunt C components. The CU-9150's RF network and tuning algorithm have been carefully designed to use the minimum amount of output capacitance required to achieve a satisfactory network solution. This ensures that the matching network operates at maximum efficiency and reduces electrical stress on the RF network components and relays.

Operation at 5 MHz and above with the specified antennas results in a PI-network solution. When operating below 5 MHz, with electrically short antennas, a large negative reactive component will appear at the antenna terminal. To solve this, additional series inductance is required: three selectable values are included in the network, transforming it to a PI-L. Frequency information is supplied to the coupler via the channel lines.

A block diagram of the CU-9150 is shown in Figure 4.9-3. The input capacitor bank (50 Ohm side), located on the Input Capacitor Assembly, consists of C1 through C11D and provides binary stepped capacitance values from 5.6 pF to 10,233 pF. The L series inductor assembly consists of inductors L1 through L9 providing binary stepped inductance values of 0.025 µH

through 12.75 µH. The L-out assembly consists of L10 through L12, providing 12.6 µH through 63 µH. The output capacitor bank, consisting of C2 through C6D provides binary stepped capacitance values from 25 pF to 775 pF. Capacitor C1, 15 pF serves as a fixed ballast capacitor.

4.3 Chassis Assembly 1A1

4.3.1 General

The chassis assembly contains the RF network components, Input Connector Assembly 1A1A2, CPU Assembly 1A1A3, RF Detector 1A1A4A1, Input Capacitor Assembly 1A1A4A2 and Mother Board Assembly 1A1A1.

4.4 Input Connector Assembly 1A1A2

4.4.1 General

The Input Connector Assembly serves as the interconnect between the LPA-9600/9500 and 9000 series radio equipment.

4.4.2 Configuration and Operation

The Input Connector Assembly provides T-lowpass RF filters on each of the signal, control and power lines entering and exiting the CU-9150 with the exception of the TX/RX data lines. The TX/RX data lines are used during service or system evaluation and are normally not connected during routine operation. The T-lowpass filters prevent unwanted RF radiation emitted by the antenna matching network from appearing on the control cable and interfering with the companion transceiver or exciter circuitry.

In addition to this protection, each of the aforementioned lines are supplied with Metal Oxide Varistor, transient voltage surge suppressors. The suppressors will minimize transient voltage levels that can appear on any signal, power or control line in the event of a lightning surge.

4.5 CPU Assembly 1A1A3

4.5.1 General

The CPU Assembly contains the system microprocessor, memory, D/A converter and relay drivers.

4.5.2 Microprocessor

The CPU assembly utilizes the 80C188EB (16 bit internal / 8 bit external) microprocessor, U103, operating at an external clock speed of 14.7456 MHz. The 80C188EB contains internal chip select logic, three hardware timers, parallel I/O, and two asynchronous serial I/O channels in single package. Its operating firmware is contained in EPROM (27C010-040), U301. SRAM (TC551001), U302 is used to hold program variables and temporary data such as phase and magnitude discriminator error correction levels. EEPROM (28C64-256), U303 is non-volatile memory used to store channel network solutions.

The 80C188EB controls its associated memory and peripherals using three busses:

- AD0 through AD7, a multiplexed address/data bus containing either data or address information.
- A8 through A15, which always contain address information.
- The Control/Status bus, which contains signals RD, WR, IO/M, and ALE.

4.5.3 Serial Communication

Communication between the microprocessor and the Serial Breakout Board on the TS-9150 Diagnostic Test Set is mainly accomplished by U101. U101 is a MAX490 RS-422 interface chip. Since R111 and R112 are installed and L101 and L102 are not installed, the system is configured for transmitting RS-422 data only. This data is sent over the control cable to the Serial Breakout Board, where it is converted to RS-232 levels. After conversion, the data is sent to a PC for display.

4.5.4 A/D Converter

U208 is an LTC1290 12 bit analog to digital converter. It reads the analog voltages from the RF Detector board and converts them to a digital serial stream which can be read by the microprocessor. The output values from the LTC1290 are accurate to within 1.25 millivolts.

4.5.5 Relay Drivers

Several different types of relay drivers are used on the CPU board. The first type is the UCN5801A (U401-403). These drivers supply coil current to the relays on the Input Capacitor board. U401, U402, and U403 are addressed over the parallel data bus of the microprocessor.

The second type of relay driver is a UCN5842A (U501-U504 and U304). These drivers are loaded serially by the microprocessor. U501 through U504 are used to drive the K44P type relays on the coupler chassis. The K44P relays are used to switch the Lseries and Cout network components. U304 lights the status LEDs and sends the READY and FAULT signals back to the radio. U304 also drives the tune/bypass relays on the RF Detector board (1A1A4A1K1 and 1A1A4A1K2), and the soft start relay on the motherboard (1A1A1K101).

The last relay driver type consists of U404, U405, and Q401-Q404. U404 is addressed over the parallel data bus. U405 converts the 5 volt output of U404 to 12 volt logic which drives Q401 through Q404. These transistors provide the coil current for the KC-12 relays on the coupler chassis. The KC-12 relays are used to switch the Lout network components.

4.5.6 Channel Change and Tune Command Detectors

In normal operation, the 80C188EB microprocessor is only active when tuning or changing channels. The rest of the time, the microprocessor is in “Powerdown Mode”. In Powerdown Mode, the microprocessor oscillator is stopped. This prevents the oscillator from being heard by the radio receiver.

When the microprocessor is in Powerdown Mode it can only be started up by a RESET signal or a non-maskable interrupt (NMI). Therefore the CPU assembly includes circuitry to detect when the channel information from the radio has changed. When the channel does change, an NMI signal is generated.

The channel change detector consists of U604, U605, and U601. The microprocessor reads the channel lines through U605. Every time a read is performed, the state of each channel line is latched by U604. U605 compares the current channel state from the radio with the state stored in U604. If they are different, a CHANNEL CHANGE signal is sent to U105. U105 generates an NMI signal to "wake up" the microprocessor when it receives this CHANNEL CHANGE signal or when a tune command is detected through U104.

4.6 RF Detector Assembly 1A1A4A1

4.6.1 General

The RF 1A1A4A1 Detector contains the phase and magnitude discriminators, -3 dB power pad and precision 50 Ohm calibration termination resistor.

The RF detector provides two variable dc signal voltages to the CPU. The phase signal voltage is proportional to the reactive component of the impedance and the magnitude signal voltage is proportional to the magnitude of the impedance. The phase and magnitude signals are referenced to 50 Ohms.

4.6.2 Magnitude Discriminator

The magnitude discriminator consists of RF transformer T2 and its associated components. It provides a means of measuring the relative magnitude of the transformed antenna impedance relative to 50 Ohms. For a impedance magnitude greater than 50 ohms, the magnitude discriminator produces an output voltage less than the +2.5 VDC reference voltage. For a magnitude less than 50 Ohms, an output greater than the +2.5 VDC reference voltage is produced. A voltage sample is provided from the transmission line by C8 and C9 and is rectified by CR9 producing a DC voltage proportional to the RF voltage on the line. A voltage proportional to the current in the transmission line is generated by transformer T2 and is rectified by CR7. Capacitor C8 is adjusted so that the voltage sample is exactly equal to the current sample when the transmission line is terminated with 50 Ohm non-reactive load. The output of this discriminator is supplied to A/D converter on the CPU assembly.

4.6.3 Phase Discriminator

The phase discriminator consists of transformer T1 and associated components. It provides a means of measuring the relative phase angle at the input to the tuning network by comparing the phase of the line voltage with line current. The phase discriminator output is zero when the transmission line voltage and the current samples are in phase (pure resistance terminating the transmission line). The voltage sample is delivered by C5 R9 and C6 which shifts the phase by 90 degrees. The current sample is generated by transformer T1 and is in phase with the line current. The voltage sample is fed to T1 center tap and the resulting output is detected by CR4 and CR5, producing a DC voltage proportional to the phase difference between the voltage on the transmission line and the current in the line. R8 is the phase discriminator balance control and is adjusted so the phase output is nulled (relative to +2.5 V DC) when the transmission line is terminated with a 50 ohm non-reactive load.

The output of this discriminator is supplied to A/D converter on the CPU assembly.

4.6.4 Attenuator Pad, -3 dB

The 3 dB PI-attenuator pad consists of precision power resistors R1, R2, R3 and R4. The pad is switched between the antenna tuning network and the transmitter whenever the tune relays K1 and K2 are energized. The pad provides protection for the transmitter by limiting the impedance variations placed on the transmitter during the tuning cycle. When a satisfactory tune has been achieved, the pad is switched out. During normal operation (no tune cycle) the pad is not used.

Tune relays K1/ K2 and CR10 (Amber LED) are energized by the tune relay signal from the CPU Assembly.

4.6.5 50 Ohm Calibration Termination

A 50 Ohm, 1% calibration termination resistor controlled by relay K3 allows the phase and magnitude detectors to be calibrated at the beginning of the tune cycle.

When the tune command is received from the transceiver the CPU assembly engages the -3 dB RF power pad and the calibration termination resistor. The phase and magnitude detectors are then evaluated at the tune frequency and their respective error voltages are temporally stored in the CPU memory. The calibration termination is then switched out-of-circuit and the detectors are applied to the tuning network. During the tune cycle the phase and magnitude detector voltage is compared with the 50 Ohm calibration voltage values stored in the CPU memory. The RF tuning network solution is adjusted by the CPU to arrive at the 50 Ohm calibration voltage levels.

This system provides two significant advantages over conventional RF detector systems:

- The phase and magnitude detectors are calibrated for temperature and component drift each time the coupler is tuned.
- The phase and magnitude detectors do not require periodic field alignment.

4.6.6 TX Only Function

The TX Only function is used under the following conditions:

- Separate transmit and receive antennas.
- Two or more transmitters with collocated antennas. Typical of shipboard systems.

The TX Only function opens the RF transmission line between the RF network and the RF input connector J1. This occurs only when the TX ONLY jumper E3 to E4 is installed and the transceiver is in the receive condition or the exciter is in the standby condition. The open transmission line prohibits high voltage generated from the adjacent transmitter from appearing at peripheral equipment such as Pre-postselectors.

During tuning or transmitting the KEYLINE is low (less than 12 V DC). Comparator U1-A buffers the low and turns Q2 off.

During receive the KEYLINE is high (greater than 12 V DC). Comparator U1-A buffers the high, turning Q2 on. Q2 energizes relay K1. The common contact of K1 is connected to the normally open and the common contact of K2 is connected the normally closed contact of K2, thus opening the RF path to the RF IN terminal J1.

4.7 Input Capacitor Assembly 1A1A4A2

4.7.1 General

The Input Capacitor assembly is located on the 50 Ohm side of the RF tuning network.

4.7.2 Configuration and Operation

The Input Capacitor Assembly 1A1A4A2, consists of eleven binary capacitance values from 5.6 pF to 10,233 pF in 5.6 pF steps. Each binary capacitance value is constructed from porcelain high RF power multilayer capacitors. These capacitors are specifically characterized for RF transmitting duty and are ideally suited for antenna matching network application. Each of the individual capacitance values are controlled by a single or dual magnetic latching relay. The latching relays operate by placing a 10 ms pulse on the OPEN or CLOSE field winding. Maximum operating time is 5 ms. Relay drivers and their control is provided by the CPU Assembly.

4.8 Mother Board Assembly 1A1A1

4.8.1 General

The Mother Board 1A1A1 interconnects all assemblies, including the RF network relays, through printed circuit wiring tracks, with exception of the Input Connector Assembly which is connected to the Mother Board by ribbon cable.

4.8.2 DC Power

+28 Volt DC power, supplied by the transceiver or exciter, is filtered by capacitors C1 and C2. A total of 13,600 µF is provided. During power-up the capacitors are charged through a 3 Ohm resistor, R1. When the CPU +5 VDC power is achieved and the microprocessor is operating correctly, the microprocessor energizes K101, bypassing resistor R1.

4.8.3 Series L and Shunt C Relays

The series L, K1-9 and Shunt C, K10-14, relays utilize latching high-speed RF relays that switch the inductive series and capacitive shunt network elements. The relays operate by placing a 7 ms pulse on the OPEN or CLOSE field winding. Maximum operating time is 5 ms.

Each relay is rated for 7 kV and 35 amperes at 2.5 MHz. These ratings, of course decrease as the operating frequency increases, but in all expected network configurations, the relays are conservatively rated.

4.8.4 L-OUT Relays

The L-Out relays, K16, 17 and 18, control the high-value series inductors. These relays and associated network components are used with electrically short antennas such as 23 or 35 foot whip antennas and operating frequencies below 3 MHz. At 1000 Watts, extremely high voltages and high currents can be expected in the L-Out network. This places special operating requirements on these relays. Each relay is rated for 15 kV and 30 amperes at 2.5 MHz. In all expected network configurations, the relays are conservatively rated.

The L-Out relays are conventional non-latching relays and must have continuous field current to operate.

4.9 Interface Requirements for Third Party Equipment

4.9.1 Signal Descriptions

Table 4.9-1 provide a description of signals.

Table 4.9-1. Signal List and Descriptions

Signal	Description
TUNE COMMAND	This signal is used to initiate a coupler tune. A low is 0V to 2.5V and a high is 7.5V to 12V. A high on this line indicates that the radio system is requesting a tune cycle. The coupler will respond by bringing +28V TUNE ENABLE high (to 28V). The radio system should then bring TUNE COMMAND low and wait for the coupler to bring +28V TUNE ENABLE low. At this point the coupler is ready to receive frequency information over the channel lines. The radio system should then output the frequency in megahertz, in packed BCD format, on the channel lines. Bringing TUNE COMMAND high will cause the coupler to latch the frequency information. When the coupler brings +28V TUNE ENABLE high for the second time, it indicates that the frequency information has been read and that the radio should restore the channel to the channel lines. See Figure 4.9-1 for details of this operation and timing requirements. TUNE COMMAND should be brought low before the application of tune power.
+28V TUNE ENABLE	This is a PNP open collector output. Maximum output drive is 15 mA. Maximum output voltage is the voltage at the +28V supply input. See TUNE COMMAND for details regarding the meaning of this output.
READY	This active low output is pulled low when the coupler is in a tuned state and can accept 1KW RF power. This is an open collector output. At a sink current of 100 mA, the output voltage will be less than 1.1 V. This output is rated for 50 V in the off state. When READY is pulled low, indicating the end of a successful tune, the radio system should stop transmitting tune power. When the coupler detects that tune power has been removed, it will bring +28V TUNE ENABLE low. At this point the coupler is ready to operate at the 1KW power level.
FAULT	This active low output is pulled low when the coupler has failed to find a network solution. This is an open collector output. At a sink current of 100 mA, the output voltage will be less than 1.1 V. This output is rated for 50 V in the off state. When FAULT is pulled low, indicating the end of a failed tune, the radio system should stop transmitting tune power. When the coupler detects that tune power has been removed, it will bring +28V TUNE ENABLE low.
KEYLINE	This signal is presently unsupported by the coupler and should be left unconnected.

Table 4.9-1. Signal List and Descriptions (Continued)

Signal	Description
Channel Lines	These 8 channel lines are used to provide the coupler with channel and frequency information. A 10K pull-down resistor is provided which pulls each line to ground. Each line should be pulled to between 3.5V and 5.0V to assert a high. Channels 0 thru 127 are valid for normal operation. These lines are active low, so to select channel 0 (for example) all lines must be pulled to 5V. These lines are also active low when passing frequency information in packed BCD (Binary Coded Decimal) format, so to select 15 MHz (for example), 0xEB must be driven on the channel lines.
COUPLER DETECT	This line allows the radio system to detect the presence or absence of a coupler. This signal is high (about 21 V) when a coupler is present. Current draw from this line should be less than 30mA.
+28V	This is the power supply for the coupler. This supply must be between 22V and 30V. Maximum inrush current is limited to 10A by the 3 ohm resistor R1 on the motherboard. Maximum idle current is 2A. Maximum current draw during a tune cycle is 5A.
RF INPUT	Maximum RF input power when READY is low is 1KW PEP. Tune power should be between 25W and 75W.

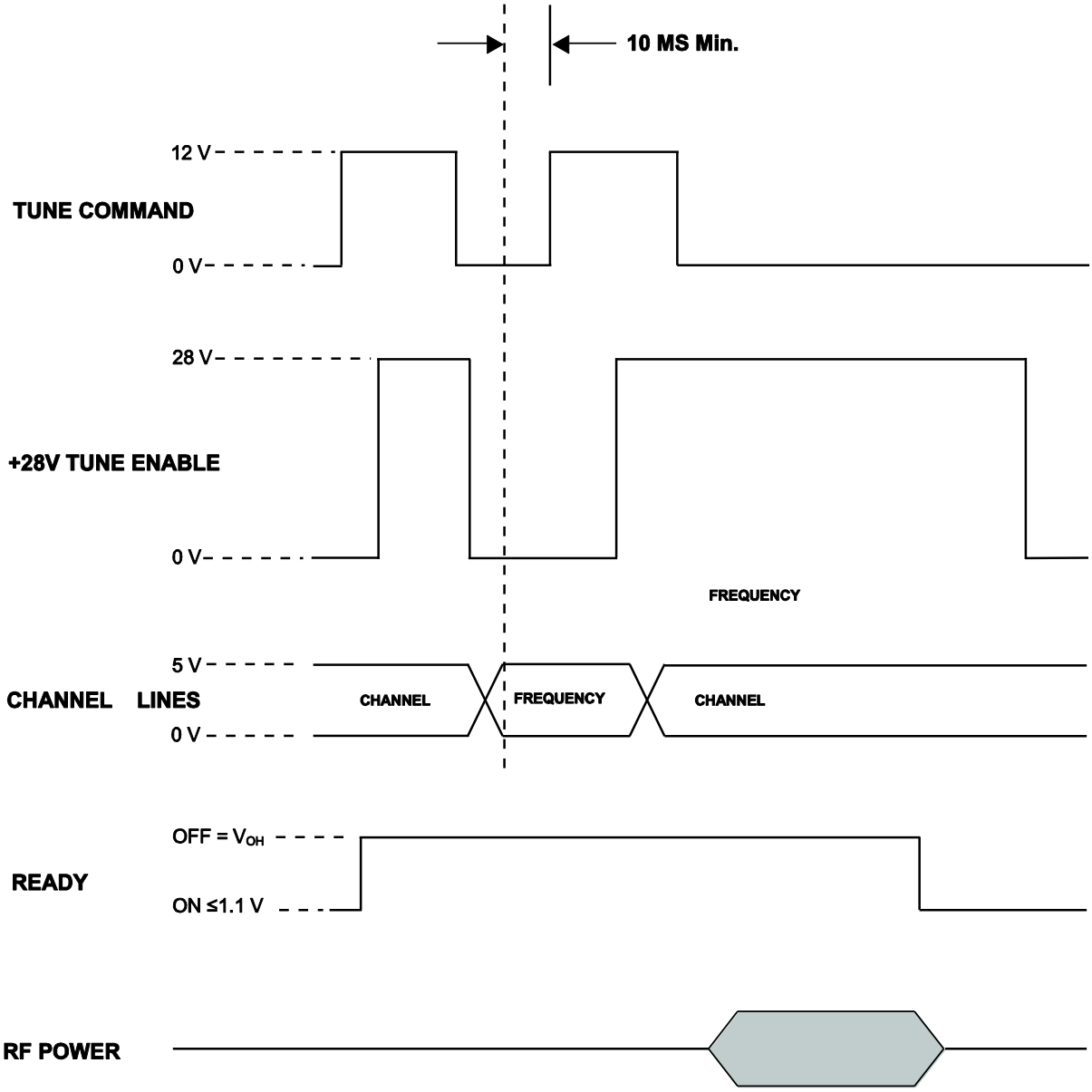

Figure 4.9-1. Coupler Interface Timing

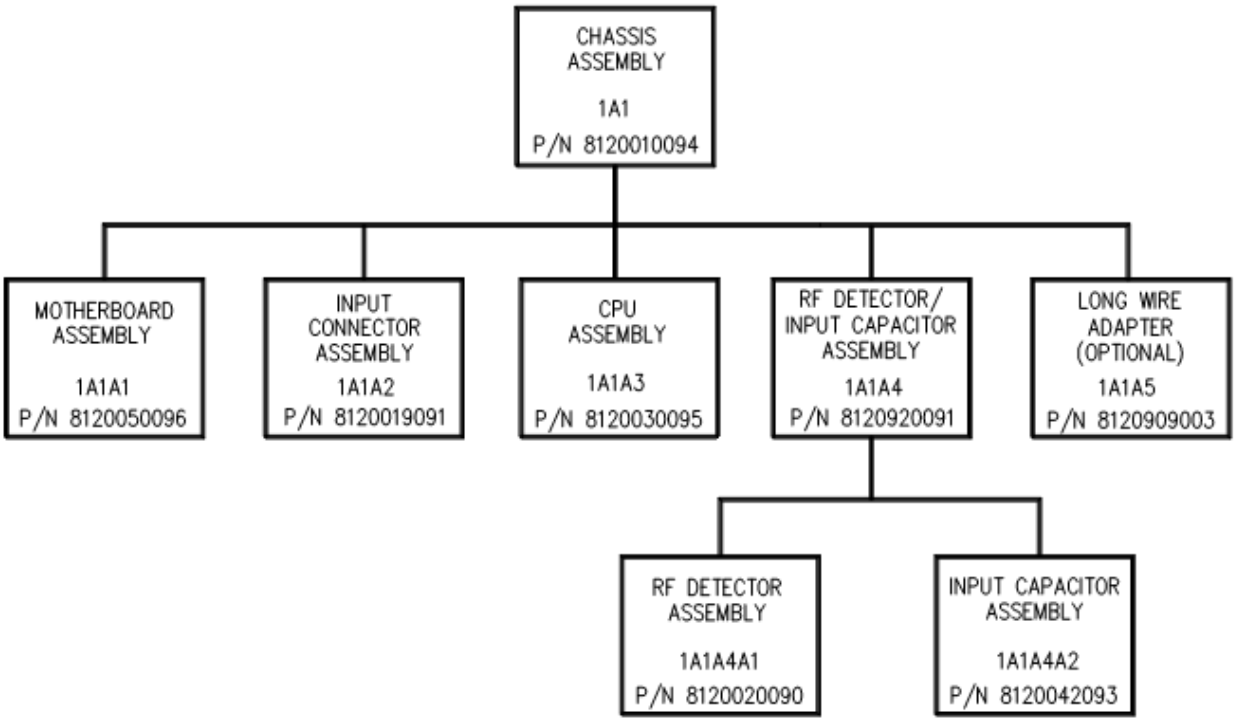

Figure 4.9-2. CU-9150 Assembly Tree

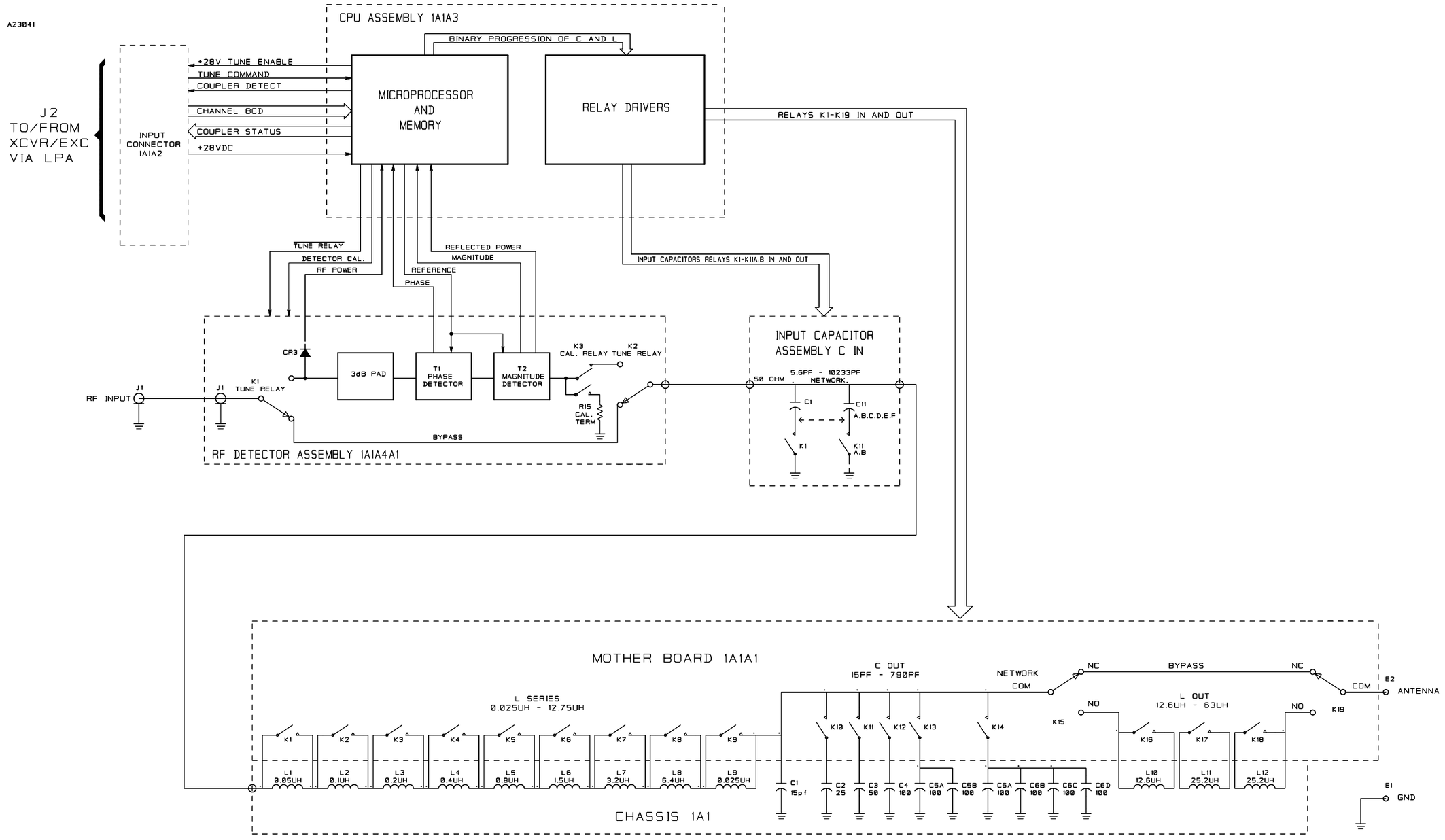

Figure 4.9-3. CU-9150 Block Diagram

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Chapter V – Maintenance and Repair

5.0 General

This section provides the procedures for preventative maintenance, fault isolation, maintenance and repair to the Lowest Repairable Unit (LRU) level.

5.1 Preventive Maintenance

Scheduled preventative maintenance ensures reliable operation of the CU-9150 antenna coupler.

Interval: Two (2) Weeks

When installed in a harsh maritime or tropical environment (i.e. salt air, salt water) wash the complete outside of the coupler with fresh water.

Interval: Monthly

- Inspect the unit for dust, dirt and foreign substance accumulation on the output insulator. Also inspect for loose electrical connections, missing hardware, case deformation, damaged fasteners or damaged electrical connectors.
- Clean, adjust or replace as applicable.

Interval: Once a year.

- Replace the gasket as described in Section 5.1.1.
- With the top cover removed inspect the following:
    1. Inspect connectors for broken parts, check insulation for cracks and check connector pins for damage misalignment or bad plating
    2. Inspect chassis wiring and subassemblies for any signs of physical damage or charring. Any damaged wires must be replaced.
    3. Inspect for leaky, blistered, charred or cracked electronic or electrical components. Check for loose or corroded terminal connections.

5.1.1 Gasket Replacement

Whenever the coupler is opened the gaskets should be carefully inspected to ensure that they are not cracked, broken, frayed or worn. If the gaskets require replacement, use the materials listed below and complete the following procedure. See Figure 5.2-1.

5.1.1.1 Materials Required

The chemicals and gaskets specified in the procedure are available from Sunair.

- 8120001265: Gasket, Flat, Weldment, Case. Quantity 1 required per coupler.
- 1006990038: Cord, O-ring, .210 Diameter. Neoprene. Specify 8.0 feet per coupler when ordering.
- 0864820003: GC Bond Cement, 2 fl. oz. (59 ML).

- 0840330006: Super Glue, 0.07 oz. (2 Grams).
- 1013140001: Super Lube Corrosion Inhibitor, 3.0 oz. (85 Grams).

5.1.1.2 Replacement Procedure

1. Remove and discard the flat and O-ring gaskets.
2. Clean the case gasket mounting surface and the O-ring gasket mounting grove on the top cover.
3. Install the self-adhesive flat gasket P/N: 8120001265. Ensure that the holes in the gasket align with the holes in the case.
4. Cement the O-ring gasket P/N: 1006990038 into the top cover groove using GC Electronics GC Bond cement, GC Electronics P/N: 10-4302 or equivalent at approximately three spots along each of the 4 sides.
5. Join the O-ring ends and trim the excess material with a razor.
6. Apply a small amount of Ross Super Glue or equivalent where the ends meet.
7. Apply a small amount of Super Lube Corrosion Inhibitor, Permatex (Loctite) P/N: 82325 or equivalent to each of the 18 top cover 10-32 x 1" mounting screws.
8. Install the top cover using the 10-32x1" mounting screws, lock and flat washers. Hand tighten the mounting screws.
9. Tighten the screws using a torque screwdriver adjusted for 15 inch-pounds. Follow the torque sequence procedure described in Figure 5.2-1.

5.2 Disassembly

Disassembly should be only to the extent necessary to accomplish the repair or replacement of the defective LRU.

5.2.1 Cover Removal

Three covers are present in the CU-9150. For most maintenance procedures, all three covers must be removed.

1. The top cover is taken off by removing the 18 Phillips head screws around the perimeter.
2. The clear plastic safety shield is removed by unscrewing four Phillips head screws.
3. The inner cover is removed by unscrewing four Phillips head screws.

5.2.2 CPU Removal

The CPU Assembly (1A1A3) is removed by grasping it firmly at the top of the assembly and pulling straight up.

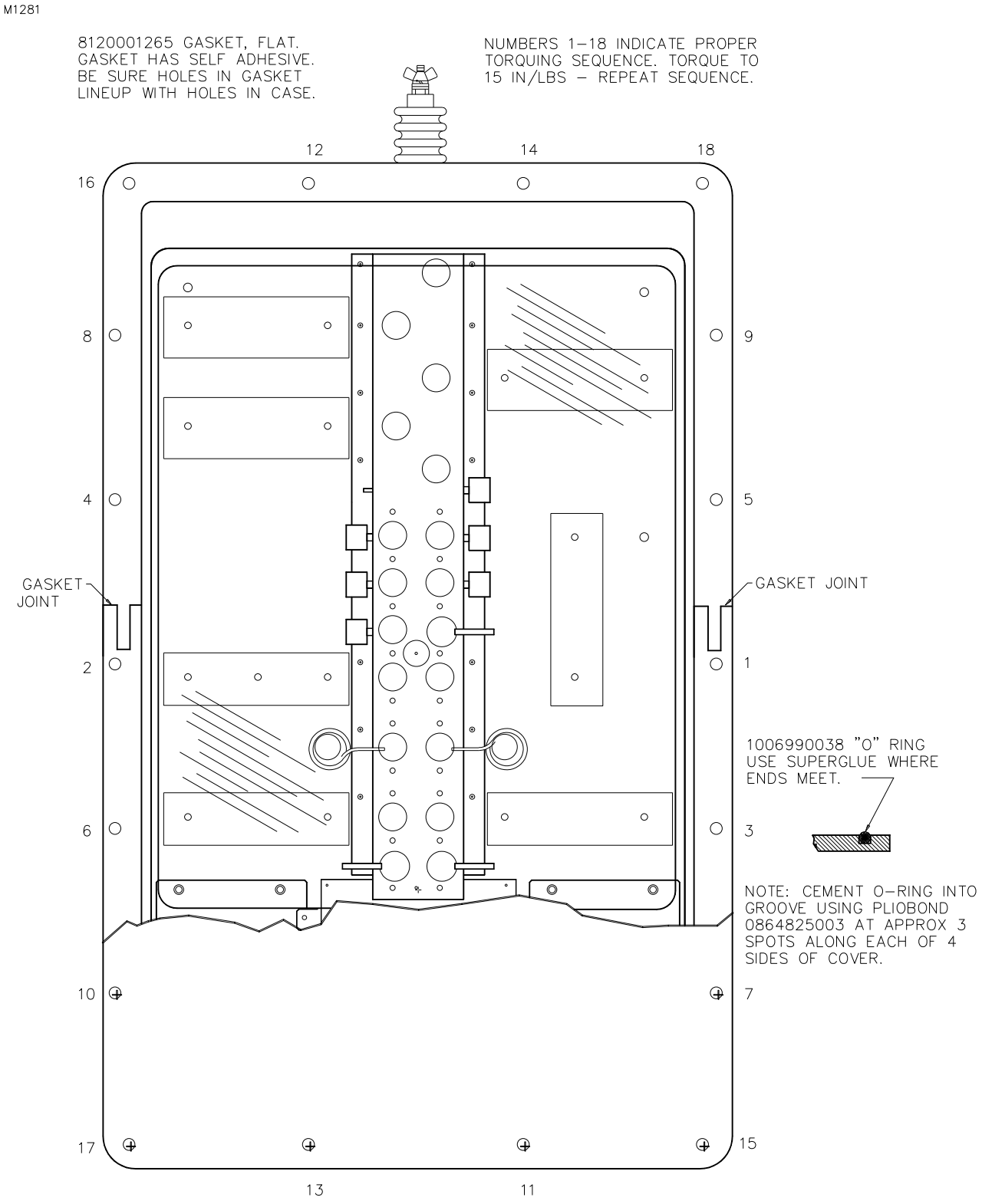


Figure 5.2-1. Gasket Installation and Torque Sequence

5.2.3 RF Detector/Input Capacitor Removal

Before removing the RF Detector/Input Capacitor Assembly (1A1A4), disconnect the coaxial cable going to the RF Detector (1A1A4A1J1) and remove the screw connecting the Input Capacitor Board (1A1A4A2) to the RF Network on the 1A1 Chassis Assembly.

CAUTION	**Failure to remove the screw connecting the 1A1A4A2 input capacitor board to the RF network on the 1A1 chassis will result in damage to the input capacitor board as the assembly is removed.**

Remove the RF Detector/Input Capacitor Assembly by grasping it firmly at the top of the assembly and pulling straight up.

5.2.4 Chassis Removal

Before removing the Chassis Assembly (1A1) from the case, remove the retaining clip from the ribbon cable going from the Motherboard (1A1A1) to the Input Connector Board (1A1A2J2) and disconnect the cable. Also disconnect the coaxial cable going to the RF Detector (1A1A4A1J1).

- If the 1A1A5 Long Wire Adapter Kit is installed:
  1. Remove the lead going from K19 on the chassis to the Long Wire Adapter Kit (see Figure 2.11-6 for details).
  2. Using a 7/16” nutdriver, remove the nut holding the Long Wire Adapter to the antenna output insulator and remove the Long Wire Adapter.
- If the 1A1A5 Long Wire Adapter Kit is not installed:
  1. Remove the lead going from K19 on the chassis to the antenna output insulator.
  2. Using a 7/16” nutdriver, remove the seven nuts holding the chassis to the bottom of the case. Remove the seven split washers. See Figure 5.2-2.

CAUTION	**When removing the Chassis Assembly, grasp it only by the sheet metal components or by the white standoffs that support the clear plastic safety cover. Do not grasp the inductors, capacitors, relays, straps, or wiring.**

- Remove the chassis from the case in the following manner:
  1. Lift the chassis straight up about 1/2” to clear the studs in the case.
  2. Lift the CPU side of the chassis high enough to clear the side of the case and slide the chassis out in that direction.

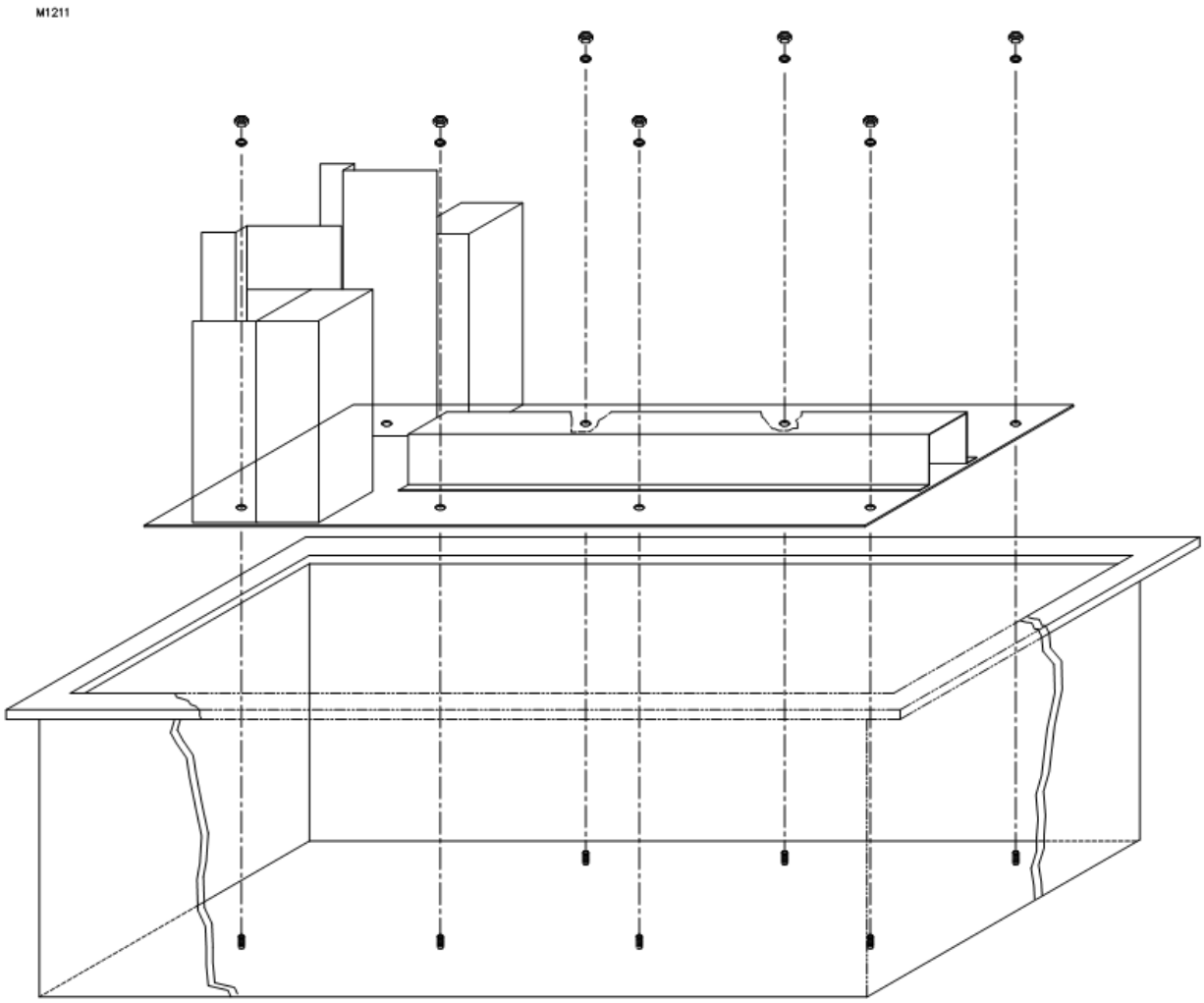


Figure 5.2-2 Chassis Removal

5.3 Indicators

Table 5.3-1 lists the indicators and their meanings for the CU-9150.

Table 5.3-1. CU-9150 Indicators and Meanings

Indicator	Meaning
READY	This green LED on the 1A1A3 CPU (CR302) indicates that the coupler is tuned and ready for RF from the radio system.
TUNING	This yellow LED on the 1A1A3 CPU (CR301) indicates that the coupler is attempting to find a tune solution.
TUNING FAULT	This red LED on the 1A1A3 CPU (CR303) indicates that the coupler failed to find an acceptable tune solution during the previous tune cycle.

Table 5.3-1. CU-9150 Indicators and Meanings (Continued)

Indicator	Meaning
CPU FAULT	This red LED on the 1A1A3 CPU (CR304) indicates that a software error occurred during the CPU program execution which prevents the program from continuing. The CPU will stop program execution at the point where the failure occurred, so the CPU must be reset, or the system power must be cycled, to resume normal coupler operation.
TUNE RELAY	This yellow LED on the 1A1A4A1 RF Detector (CR10) indicates that the magnitude discriminator, phase discriminator, and 3 dB pad are switched into the RF path. This indicator is only lit when the **TUNING** indicator on the CPU is lit.

5.4 Test Equipment Required or Equivalent

Digital Multimeter ..... Fluke 77

Oscilloscope ..... Tektronix 465

Alligator clip cables ..... Two required

5.5 Alignment and Checks

Unless a component of the 1A1A4A1 RF Detector Assembly has failed and required replacement, routine alignment of the CU-9150 is generally not required. This is due to the self-calibrating nature of the CU-9150. At the beginning of each tune cycle, a 50-ohm calibration load is switched in and the CPU reads the output of the magnitude and phase discriminators. These readings are subtracted from all future measurements, ensuring that minor discriminator imbalances over time, temperature, and frequency do not affect the network solution.

Alignment of the CU-9150 consists solely of adjusting a trimmer capacitor and a potentiometer on the RF Detector Assembly (1A1A4A1). For component and test point locations see Figure 5.5-1. The alignment is accomplished as follows:

1. Turn off the radio set.
2. Remove the 1A1A3 CPU Assembly.
3. Connect the multimeter negative lead to ground on the RF Detector (1A1A4A1TP6). Connect the positive lead to RF POWER (1A1A4A1TP1).
4. Using alligator clips, ground TP7 and TP8 on the 1A1A4A1 RF Detector to the chassis.

   NOTE It may be necessary to remove the 1A1A4 RF Detector/Input Capacitor Assembly in order to attach a test clip to TP8. Refer to Section 5.2.3 for removal instructions for this assembly. If the assembly is removed, be certain to remove the Phillips head screw which attaches the assembly to the 1A1 Chassis Assembly.

5. Turn the radio set on (it is permissible to power up the coupler without the CPU installed for alignment and troubleshooting). Set the frequency to 29.0 MHz. Set the mode to

AM. Set the power level to 125W. If a linear amplifier such as a LPA-9600 or an LPA-9500 is in the system, turn it off.

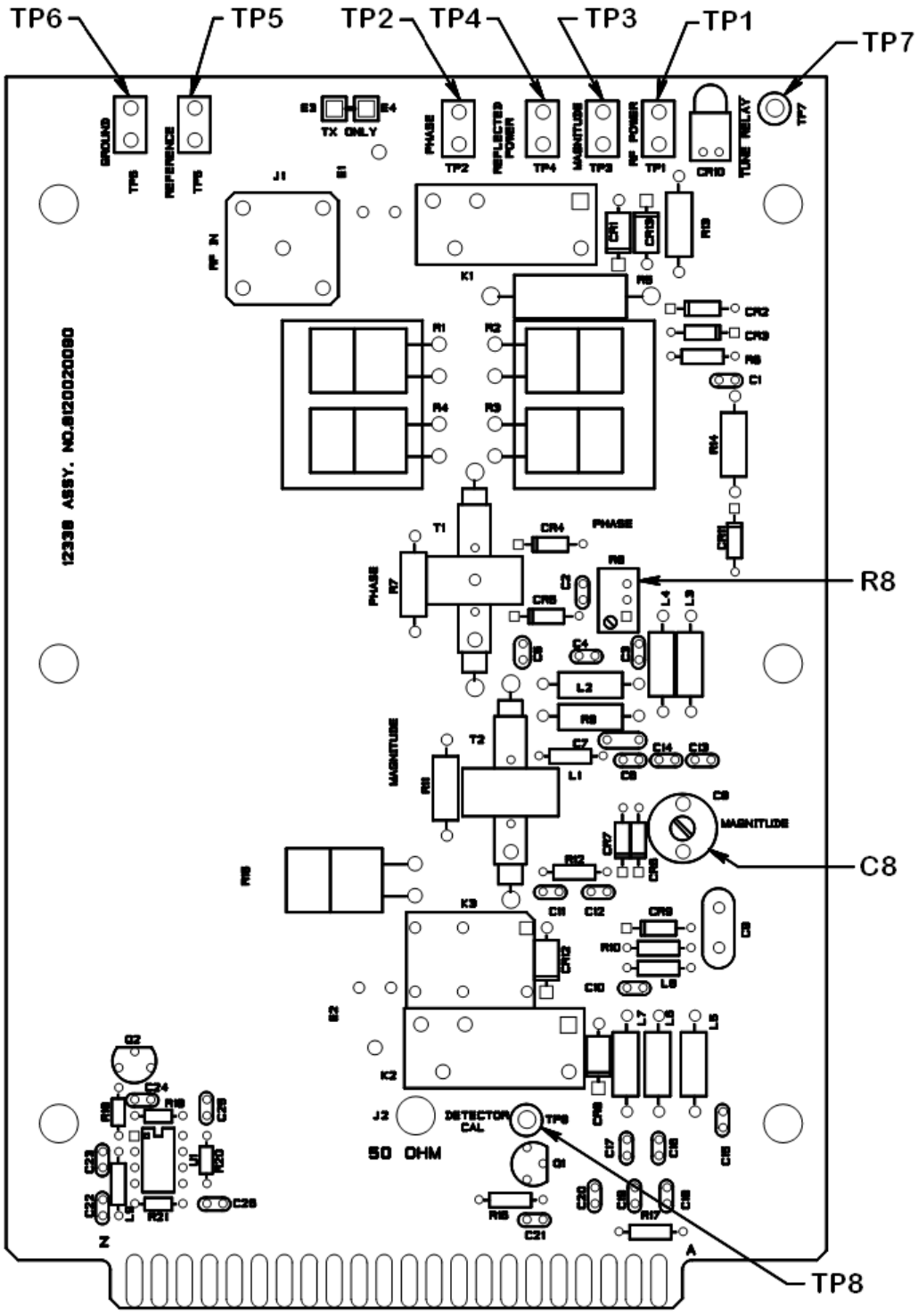


Figure 5.5-1. 1A1A4A1 RF Detector Alignment Adjustment Locations

CAUTION Applying more than tune power (AM carrier power in the 125w power setting, which is about 40 watts) to the coupler during this alignment procedure will destroy the pad and the calibration load on the RF detector board.

6. Key the radio. The multimeter should read 4.0 to 5.5 volts DC.
7. Unkey the radio. Move the negative lead of the multimeter to the **REFERENCE** test point (1A1A4A1TP5) and connect the positive lead to the **REFLECTED POWER** test point (1A1A4A1TP4). Key the radio. The reading on the multimeter should not exceed 0.5 volts DC.
8. Unkey the radio. Move the positive lead of the multimeter to the PHASE test point (1A1A4A1TP2). Key the radio. Adjust R8 on the RF Detector so that the reading on the multimeter is between -.02 and .02 volts DC.
9. Unkey the radio. Move the positive lead of the multimeter to the **MAGNITUDE** test point (1A1A4A1TP3). Key the radio. Adjust C8 on the RF Detector so the reading on the multimeter is between -.02 and .02 volts DC.
10. Unkey the radio and turn it off. Remove the alligator clips and the multimeter. Put the CPU back in the chassis.

5.6 Troubleshooting

5.6.1 Coupler Will Not Tune - No Relay Action - No Tuning Fault

1. Check for +28 volts DC at R1 on the 1A1A1 Motherboard Assembly. If the supply is not present, check for +28 volts at L29 on the 1A1A2 Input Connector assembly. If +28 volts is not present at L29, the problem is probably due to the control cable between the radio set and the CU-9150.
2. Check the voltage drop across R1 on the 1A1A1 Motherboard Assembly. A measured drop greater than .1 volts indicates that the soft start relay K101 on the 1A1A1 Motherboard Assembly is not being engaged by the 1A1A3 CPU. This is generally the result of the CPU not starting. Proceed to the next step for CPU troubleshooting.
3. Check for a green **READY** indicator on the 1A1A3 CPU after initial power-up. The lack of a **READY** indicator indicates that the CPU is not executing its program correctly.
   a. Check for +5V at U109 pin 20.
   b. Check for +12V at U405 pin 16.
   c. Check for a 14.7456 MHz signal with an amplitude of at least 4 volts peak to peak on both sides of Y101.
   d. If the three checks above look good, the CPU needs to be analyzed in its test fixture. Refer to Section 6.1.2.1.

5.6.2 Coupler Will Not Tune - No Relay Action - Tuning Fault Indicated

Note the amount of time that elapses between pressing the **CPLR TUNE** button on the radio and the coupler **TUNING FAULT** indicator lighting.

If this time is 10 seconds:

1. Using the oscilloscope, check for at least 20 volts peak to peak of RF at the RF INPUT to the coupler during the tune cycle. If RF is not present at the input to the coupler, a cabling problem probably exists between the radio set and the coupler.
2. If RF is present at the coupler input, check for the same signal at E1 of the 1A1A4A1 RF Detector Assembly. If the RF signal did not make it this far, the cable between the RF input and the RF Detector Assembly is probably bad.
3. Use the multimeter to check for 4.0 to 5.5 volts between TP1 (**RF POWER**) and TP6 (**GROUND**) during the tune cycle. The CPU waits for this signal to go high before starting to look for a tune solution.

If this time is two seconds:

The software revision in the transceiver or exciter does not support the CU-9150. Contact Sunair Product Support for software upgrade information.

5.6.3 Relays Operate But Tuning Fault Indicated

Run a BITE test. Refer to Section 6.1.2.4 for instructions and theory. If the BITE test fails, a TS-9150 Diagnostic Test Set is required to display which components the coupler suspects to be faulty.

If the BITE test is successful, the radio system is probably at a frequency where the coupler cannot find an acceptable network solution. This situation can usually be alleviated by changing the frequency. If changing frequency is not possible and a long-wire antenna is being used, lengthening or shortening the antenna somewhat will often result in successful tunes.

5.6.4 Coupler Tunes but Memory Does Not Work

This situation is usually results when the coupler CPU does not receive the channel information from the radio correctly.

1. Check that the control cable is correctly wired.
2. Turn the radio set off. Using the multimeter, check each of the inductors on the 1A1A2 Input Connector Assembly for continuity.
3. Check L601 through L608 on the 1A1A3 CPU Assembly for continuity.
4. If the above checks fail to find the problem, replace the 1A1A3 CPU Assembly.

5.7 DIP Switch Settings

All of the 1A1A3S201 CPU DIP switches should normally be in the down position. Table 5.7-1 explains the function of the switch settings.

After making a change to the DIP switch settings, a CPU reset is required to make the change effective. This can be done by pressing S101 on the CPU board or by powering the system down and then up again.

Table 5.7-1 S201 DIP Switch Settings

Switch	Function
8	Setting this switch to the **UP** position enables the keyline detector circuitry. This function is currently unsupported by the CPU software, so this switch should always be set to the **DOWN** position.
7	Setting this switch to the **UP** position stops the CPU from going into powerdown mode after tuning or changing channels. This switch should be in the up position when using the Display Board in the TS-9150 Diagnostic Test Set, but should be set to the **DOWN** position for normal operation.
6	Setting this switch to the **UP** position causes the coupler to allow more time for the relays to change state. As the relays age, they take longer to change state. Try setting this switch to the UP position on couplers which start to indicate tune failures intermittently and which have been in service for several years. The tune timeout changes from 10 seconds to 17 seconds when this switch is set.
5	Not used.
4	Not used.
3	Not used.
2	Not used.
1	Not used.

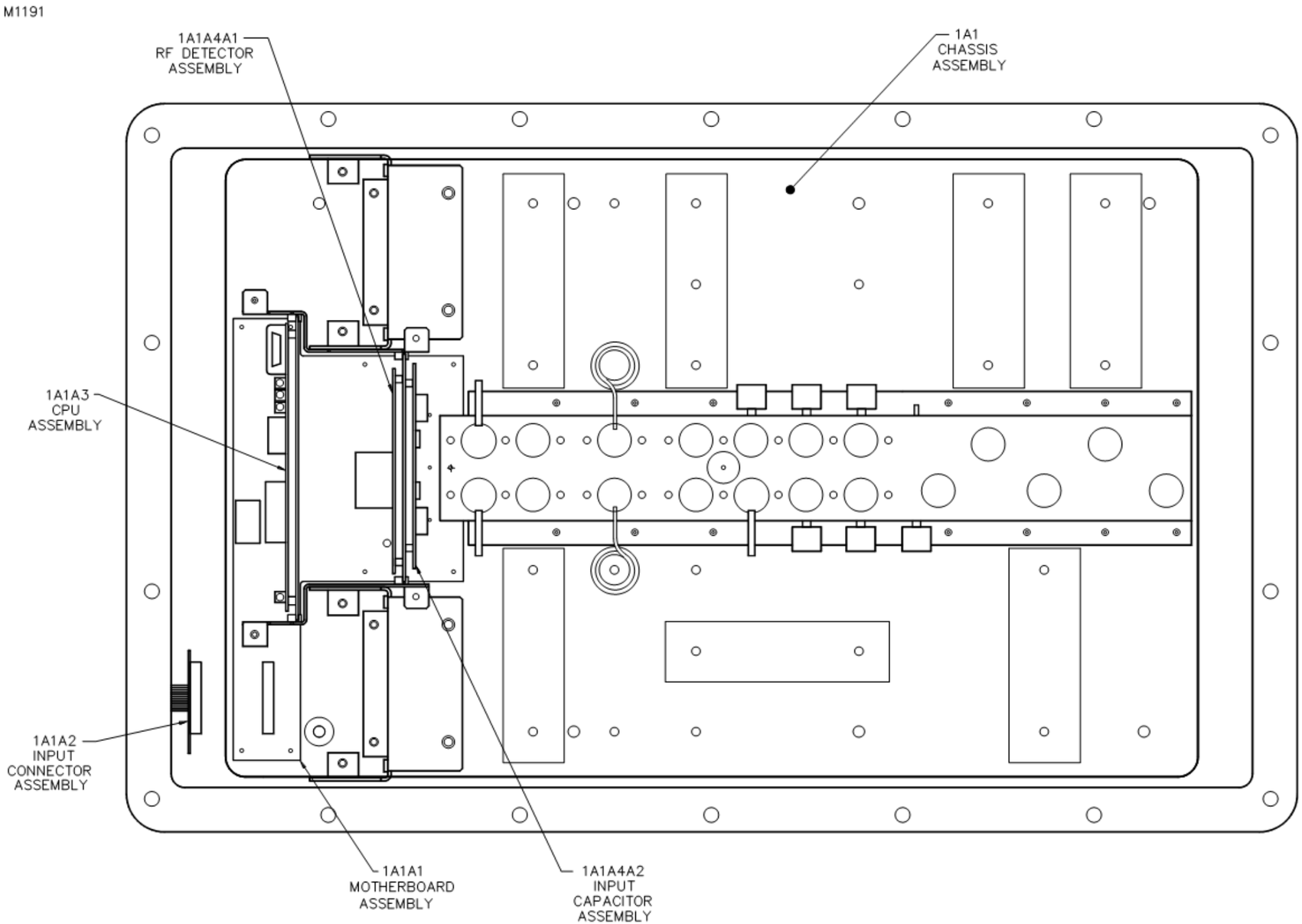


Figure 5.7-1 CU-9150 Assembly Locations

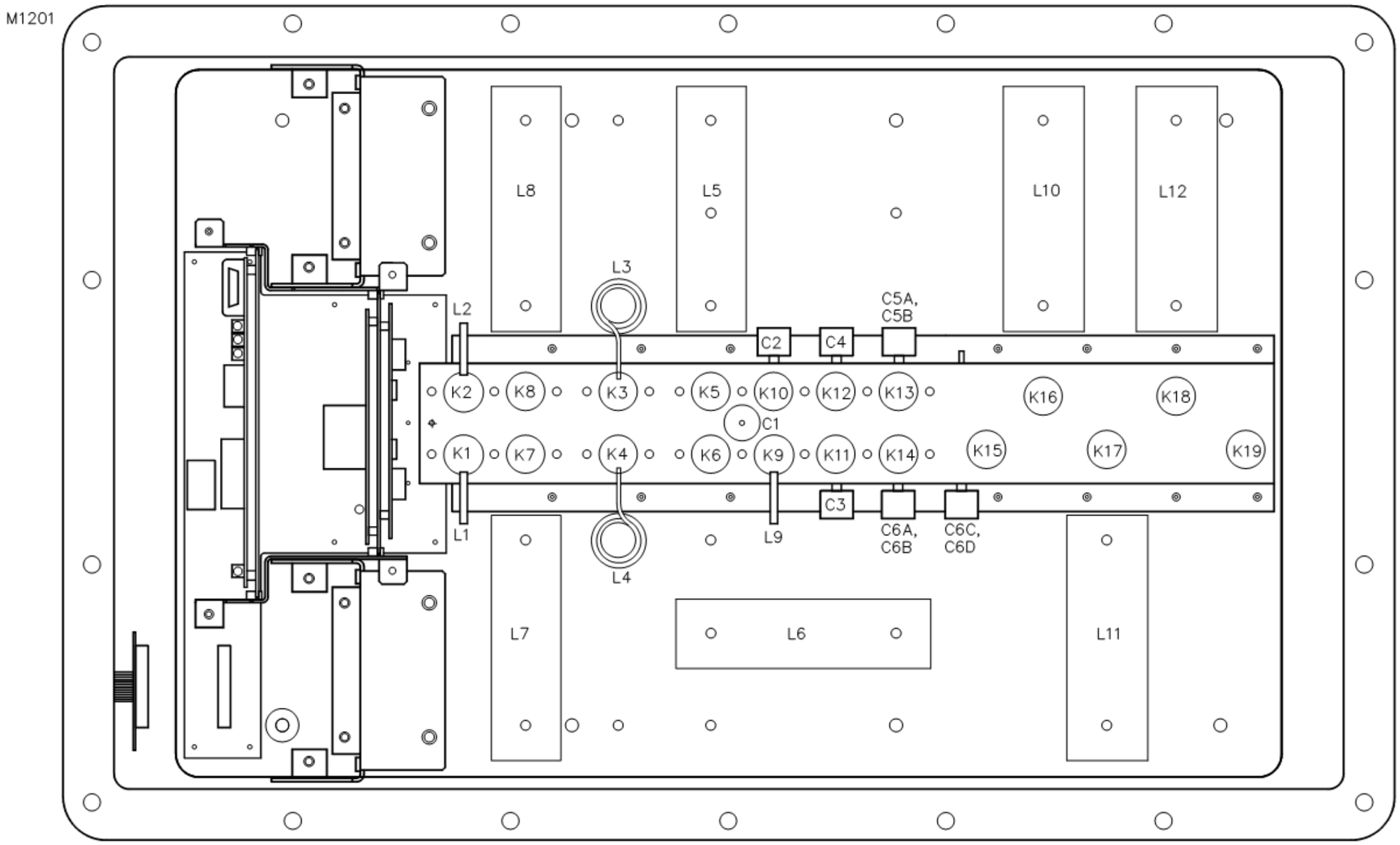


Figure 5.7-2 1A1 Chassis Component Locations

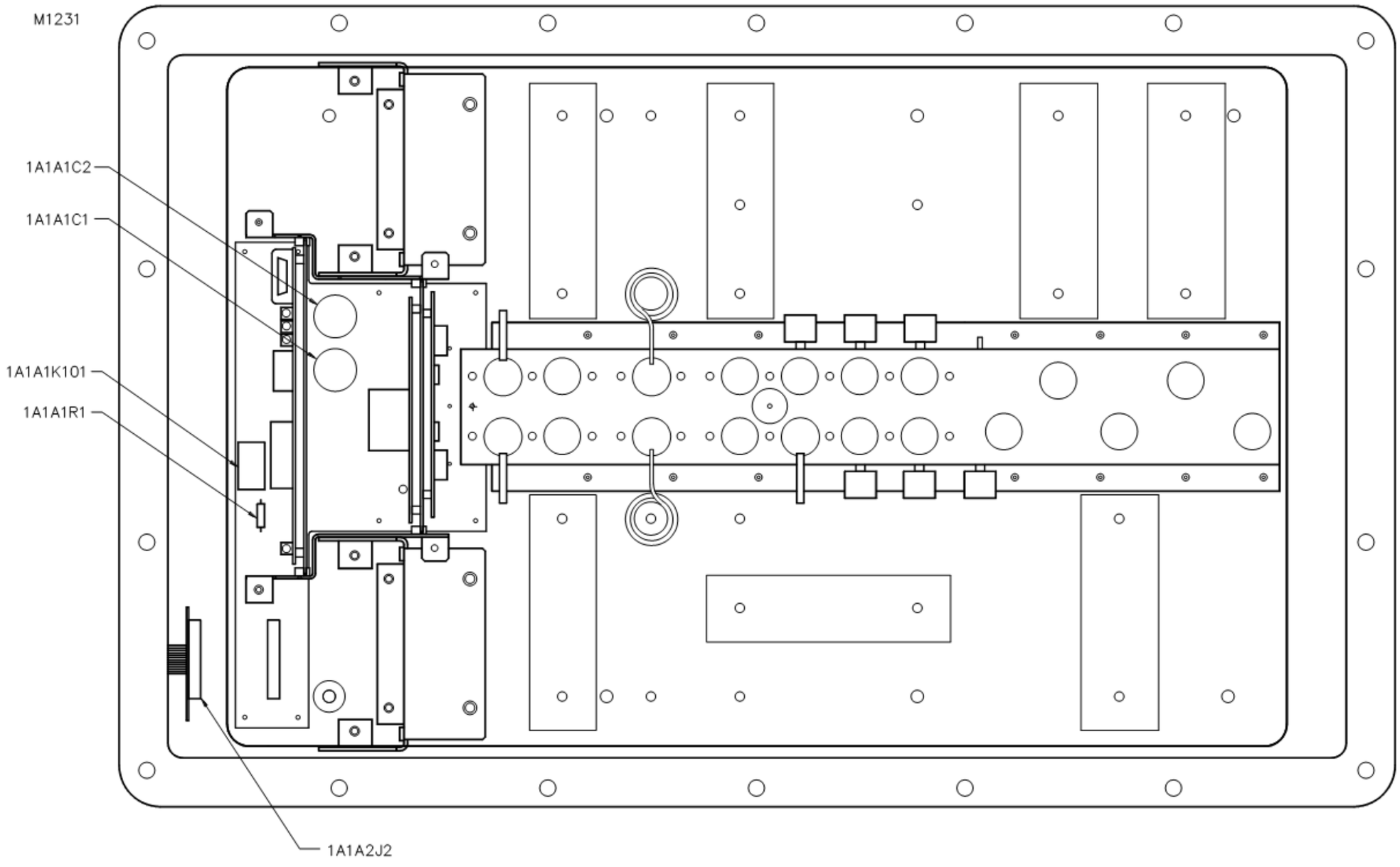


Figure 5.7-3. Non-Chassis Component Locations

Table 5.7-2 CU-9150 Detailed Assemblies List

FINAL ASSEMBLY TESTED CU-9150

	FINAL ASSY,TESTED,GRAY CU-9150	8120001257
	WASHER, SPLIT #6	0500040001
	WASHER, SPLIT #10	0500070008
	WASHER, FLAT #10 .500 OD	0500220000
	WASHER, FLAT .250 ID .500 OD	0500330000
	SCREW, PH 6-32 X 5/16 LG.	0500890056
	SCREW, PH 10-32 X 1 LG.	0500940169
	CAPLUG NO. EC-10	0508270006
	CAPLUG NO. EC-28	0508740002
	WASHER, SPLIT 1/4	0538370009
	LABEL, WARNING, HI-VOLTAGE	1003030009
	CORD, O-RING, .210 DIA NEOPR	1006990038
	SCREW, 1/4-20 X 5/8, PHIL	1013400020
	COVER, ANTENNA COUPLER, GRY	8104010514
	GASKET, FLAT, WELDMENT, CASE	8120001265
	FINAL ASSY, GRAY, CU-9150	8120001354
	PROTECTIVE COVER, CLEAR	8120018109
	INNER COVER	8120018206
1A1	CHASSIS ASSY, KW CPLR	8120010094

FINAL ASSEMBLY CU-9150

	FINAL ASSY, GRAY, CU-9150	8120001354
	LUG, SOLDER, PLAIN .625 ID	0501830006
	VALVE, BREATHER	1000090035
	SIGN, WARNING, RF RADIATION	1006240004
	COAX, SHIELDED, RG-142 B/U	1008460010
	CONNECTOR, RF, BNC, UG-913	1008460036
	CLIP, 34 PIN SOCKET RETAINER	1013430026
	INSULATOR, SLEEVE, RF	6029102303
	RING, RETAINER	6029102401
	WELDMENT, CASE, GRY	8092010412
	NAMEPLATE, CU-9150	8120003004
1A1	CHASSIS ASSY, KW CPLR	8120010094
1A1A2	PC ASSY, INPUT CONNECTOR	8120019091
1A1A4A1	PC ASSY. RF DETECTOR	8120020090
1A1A3	PC ASSY, CPU	8120030095
1A1A3U 301	EPROM W/CU-9150 SOFTWARE U301	8120033299
1A1A4A2	PC ASSY, INPUT CAPACITOR	8120042093

CHASSIS ASSEMBLY 1A1

	CHASSIS ASSY	8120010094
C1	CAPACITOR,15 PF	1013220021
C2	CAP. 25PF, 7.5KV, NPO	0290320003
C3	CAP. 50PF, 7.5KV, NPO	0290200008
C4	CAPACITOR,100 PF,7.5 KV NPO	1012740030
C5A	CAPACITOR,100 PF,7.5 KV NPO	1012740030
C5B	CAPACITOR,100 PF,7.5 KV NPO	1012740030
C6A	CAPACITOR,100 PF,7.5 KV NPO	1012740030
C6B	CAPACITOR,100 PF,7.5 KV NPO	1012740030
C6C	CAPACITOR,100 PF,7.5 KV NPO	1012740030
C6D	CAPACITOR,100 PF,7.5 KV NPO	1012740030
C7	CAP. 0.1 UF, 50V, X7R	1011180014
C8	CAP. 0.1 UF, 50V, X7R	1011180014
FAN1	FAN, 24VDC, MUFFIN XL-DC	1009130005
FAN2	FAN, 24VDC, MUFFIN XL-DC	1009130005
K1	RELAY, VACUUM, K44P334	1013210026
K2	RELAY, VACUUM, K44P334	1013210026
K3	RELAY, VACUUM, K44P334	1013210026
K4	RELAY, VACUUM, K44P334	1013210026
K5	RELAY, VACUUM, K44P334	1013210026
K6	RELAY, VACUUM, K44P334	1013210026
K7	RELAY, VACUUM, K44P334	1013210026
K8	RELAY, VACUUM, K44P334	1013210026
K9	RELAY, VACUUM, K44P334	1013210026
K10	RELAY, VACUUM, K44P334	1013210026
K11	RELAY, VACUUM, K44P334	1013210026
K12	RELAY, VACUUM, K44P334	1013210026
K13	RELAY, VACUUM, K44P334	1013210026
K14	RELAY, VACUUM, K44P334	1013210026
K15	RELAY, VACUUM, KC-12	1013200021
K16	RELAY, VACUUM, KC-12	1013200021
K17	RELAY, VACUUM, KC-12	1013200021
K18	RELAY, VACUUM, KC-12	1013200021
K19	RELAY, VACUUM, KC-12	1013200021
L1	INDUCTOR, 0.05 UHY	8120013204
L2	INDUCTOR, 0.1 UHY	8120013701
L3	INDUCTOR, 0.2 UHY	8120018095
L4	INDUCTOR, 0.4 UHY	8120017099
L5	INDUCTOR ASSY, 0.8 UHY	8120016092
L6	INDUCTOR ASSY, 1.6 UHY	8120015096
L7	INDUCTOR ASSY, 3.2 UHY	8120014090

CHASSIS ASSEMBLY 1A1 (Continued)

	CHASSIS ASSY (Continued)	8120010094
L8	INDUCTOR ASSY, 6.4 UHY	8120013093
L9	INDUCTOR, 0.025 UHY	8120012704
L10	INDUCTOR ASSY, 12.6 UHY	8120012097
L11	INDUCTOR ASSY, 25.2 UHY	8120011091
L12	INDUCTOR ASSY, 25.2 UHY	8120011091
	ROD, THD. 1/4-20,.875LG	1009280007
	STRAP, COPPER, 1/2W, .030 THK	1012730034
	TERMINAL, RING, FOR 1/4 STUD	1012790037
	STANDOFF, F-F, 6-32 .690 L	6035142109
	STANDOFF, F-F, 1/4-20, 3.19 L	8092016500
	BRACKET FAN	8120012577
	BRACKET, PC ASSY, LEFT	8120013506
	BRACKET,PC ASSY, RIGHT	8120013603
	PLATE, CHASSIS	8120015207
	GROUND BAR, CHASSIS	8120015304
	BRACKET, RELAY MOUNTING	8120015401
	STANDOFF,COIL MOUNT	8120016505

RF DETECTOR/INPUT CAPACITOR ASSEMBLY 1A1A4

	RF DETECTOR/ INPUT CAPACITOR ASSY	8120920091
	WASHER, SPLIT #4 SS DNP	0500020001
	WASHER, FLAT #4 .81 OD DNP	0500180008
	SCREW, PH 4-40 X 5/16 LG. DNP	0500850054
1A1A4A1	PC ASSY, RF DETECTOR.	8120020090
1A1A4A2	PC ASSY , INPUT CAPACITOR	8120042093

LONG WIRE ADAPTER KIT 1A1A5

	ADAPTER KIT, LONG-WIRE ANTENNA	8120909003
C1	CAP. 100PF, 15KV, N750	0275470008
C2	CAP. 100PF, 15KV, N750	0275470008
	WASHER, SPLIT #10	0500070008
	WASHER, FLAT #10 .500 OD	0500220000
	SCREW, HEX HD 10-32 X 7/16 LG.	0526570075
	BAG, PLASTIC 3 X 5 X 4MZ DNP	0841251011
	PLATE, CAPACITOR MTG., ANT.	8092012806
	PLATE, CAPACITOR MTG., NTWK.	8092012903
	WHIP/LONG-WIRE ID PLATE	8120909011

A2203D

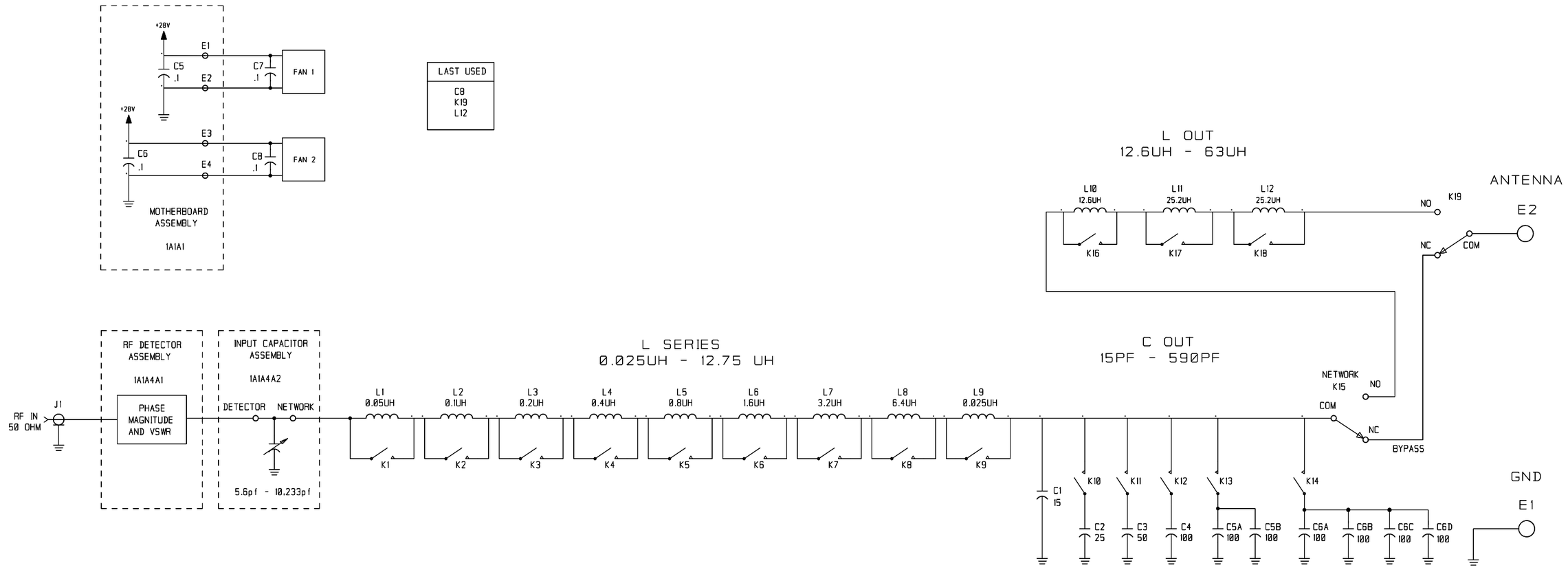


Figure 5.7-4. Final Assembly Tested CU-9150, Chassis Assembly 1A1 and Long Wire Adapter Kit 1A1A5
(Page 1 of 2)

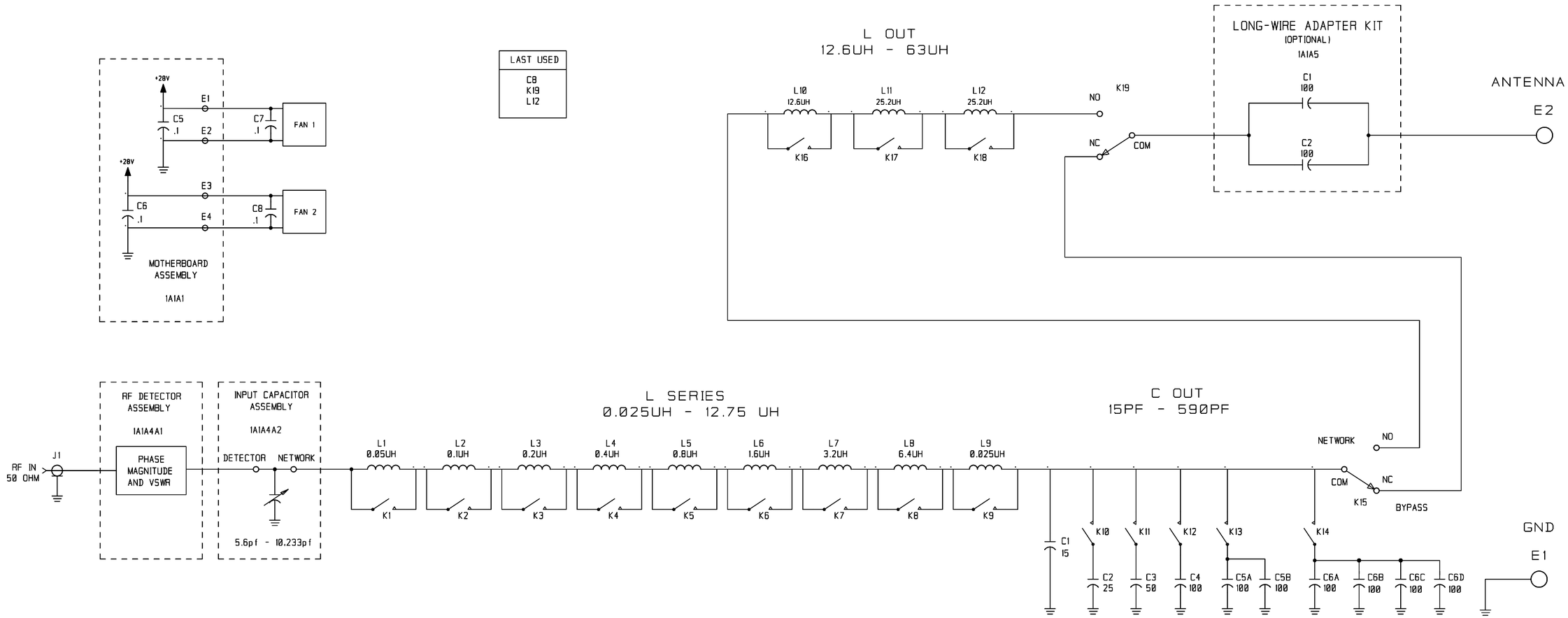
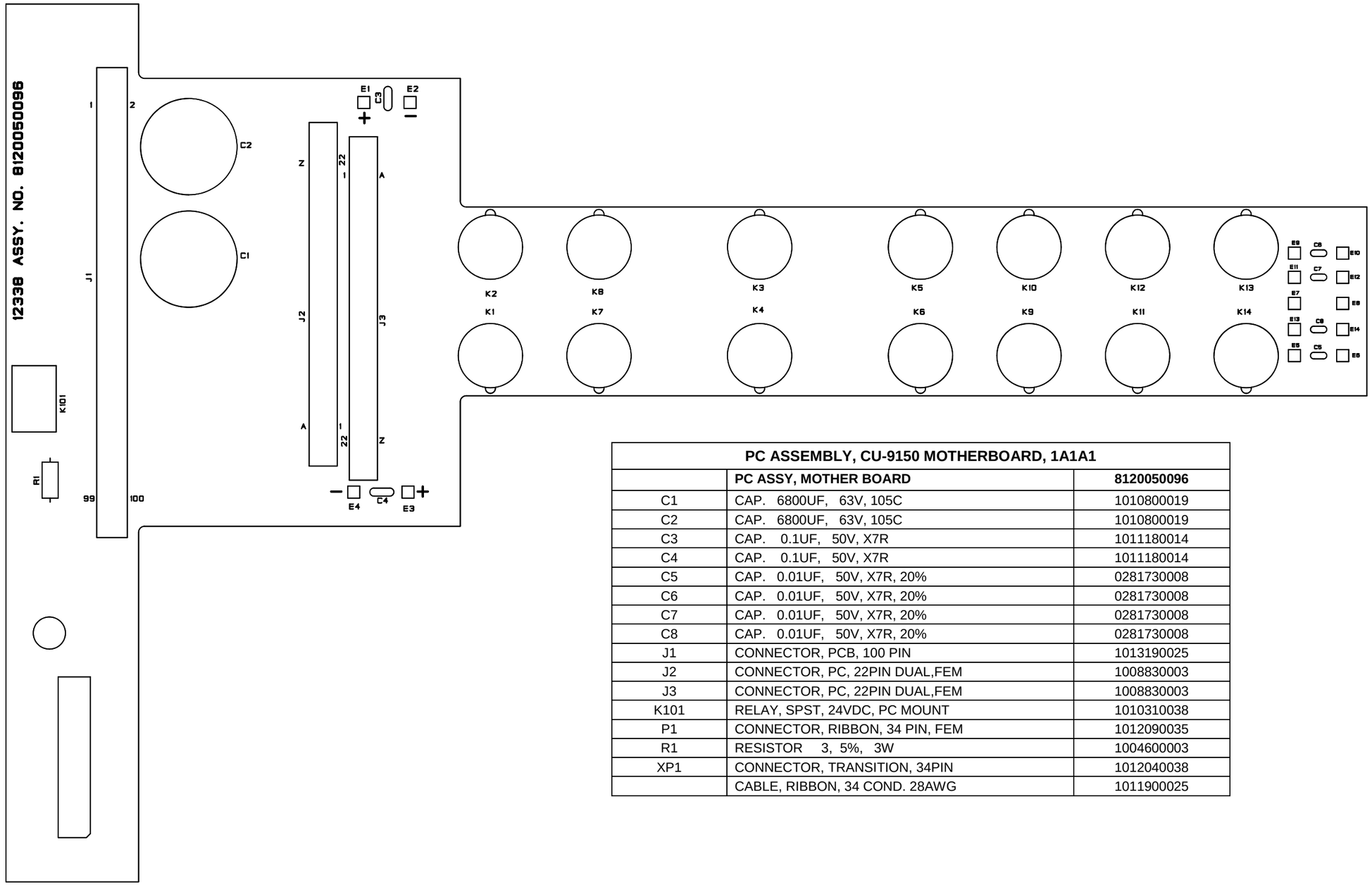


Figure 5.7-4. Final Assembly Tested CU-9150, Chassis Assembly 1A1 and Long Wire Adapter Kit 1A1A5
(Page 2 of 2)



PC ASSEMBLY, CU-9150 MOTHERBOARD, 1A1A1		
	PC ASSY, MOTHER BOARD	**8120050096**
C1	CAP. 6800UF, 63V, 105C	1010800019
C2	CAP. 6800UF, 63V, 105C	1010800019
C3	CAP. 0.1UF, 50V, X7R	1011180014
C4	CAP. 0.1UF, 50V, X7R	1011180014
C5	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C6	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C7	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C8	CAP. 0.01UF, 50V, X7R, 20%	0281730008
J1	CONNECTOR, PCB, 100 PIN	1013190025
J2	CONNECTOR, PC, 22PIN DUAL,FEM	1008830003
J3	CONNECTOR, PC, 22PIN DUAL,FEM	1008830003
K101	RELAY, SPST, 24VDC, PC MOUNT	1010310038
P1	CONNECTOR, RIBBON, 34 PIN, FEM	1012090035
R1	RESISTOR 3, 5%, 3W	1004600003
XP1	CONNECTOR, TRANSITION, 34PIN	1012040038
	CABLE, RIBBON, 34 COND. 28AWG	1011900025

Figure 5.7-5. PC Assembly, CU-9150 Motherboard, 1A1A1
(Page 1 of 3)

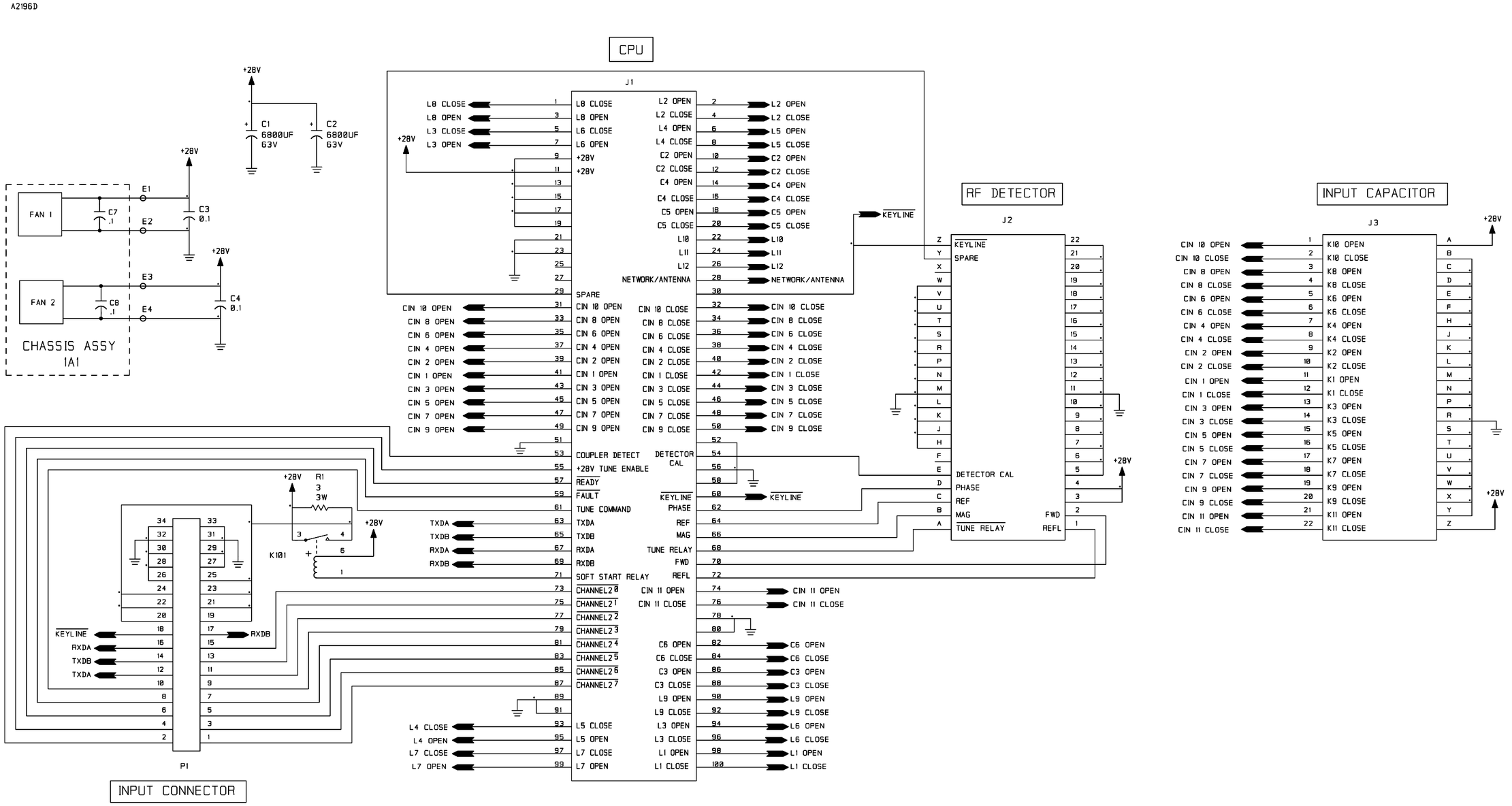


Figure 5.7-5. PC Assembly, CU-9150 Motherboard, 1A1A1
(Page 2 of 3)

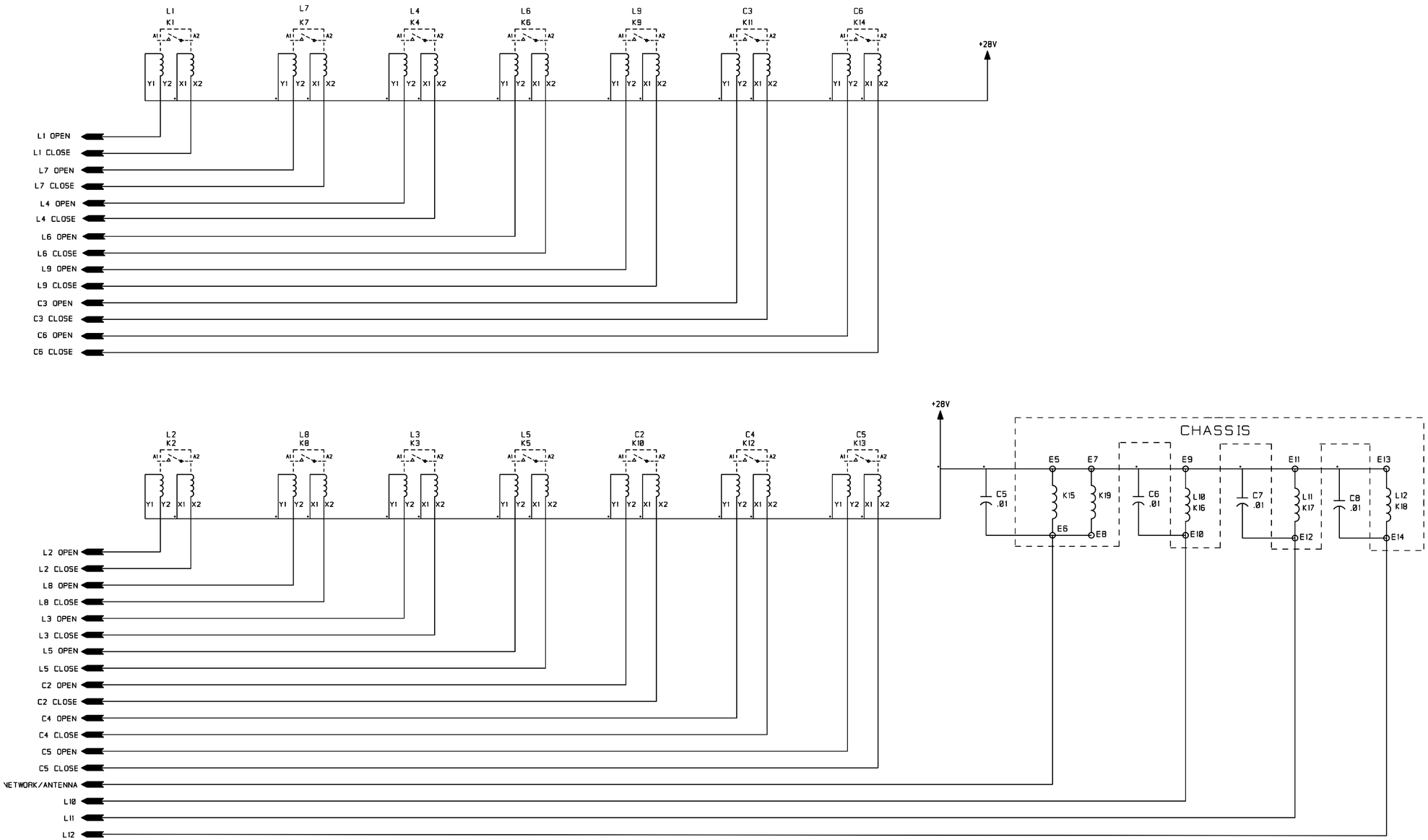


Figure 5.7-5. PC Assembly, CU-9150 Motherboard, 1A1A1
(Page 3 of 3)

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PC ASSEMBLY, INPUT CONNECTOR, 1A1A2

	PC ASSY, INPUT CONNECTOR	8120019091
C1	CAP 0.1UF, 50V, X7R, 20%	0281610002
C2	CAP 0.1UF, 50V, X7R, 20%	0281610002
C3	CAP 0.1UF, 50V, X7R, 20%	0281610002
C4	CAP 0.1UF, 50V, X7R, 20%	0281610002
C5	CAP 0.1UF, 50V, X7R, 20%	0281610002
C6	CAP 0.1UF, 50V, X7R, 20%	0281610002
C7	CAP 0.1UF, 50V, X7R, 20%	0281610002
C8	CAP 0.1UF, 50V, X7R, 20%	0281610002
C9	CAP 0.1UF, 50V, X7R, 20%	0281610002
C10	CAP 0.1UF, 50V, X7R, 20%	0281610002
C11	CAP 0.1UF, 50V, X7R, 20%	0281610002
C12	CAP 0.1UF, 50V, X7R, 20%	0281610002
C13	CAP 0.1UF, 50V, X7R, 20%	0281610002
C14	CAP 0.1UF, 50V, X7R, 20%	0281610002
C15	CAP 0.1UF, 50V, X7R, 20%	0281610002
J1	CONNECTOR, POWER, 37 PIN ROUND	1009330004
J2	CONNECTOR, HEADER, 34 PIN MALE	1011880024
L1	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L2	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L3	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L4	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L5	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L6	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L7	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L8	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L9	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L10	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L11	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L12	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L13	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L14	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L15	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L16	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L17	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L18	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L19	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L20	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L21	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L22	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L23	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L24	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L25	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L26	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L27	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L28	INDUCTOR, MOLDED, 22UH, 10%	0664060005
L29	INDUCTOR, MOLDED, 6.8UH, 10%	0652200001
L30	INDUCTOR, MOLDED, 6.8UH, 10%	0652200001
L31	INDUCTOR, MOLDED, 6.8UH, 10%	0652200001
L32	INDUCTOR, MOLDED, 6.8UH, 10%	0652200001
ZS1	VARISTOR, V56RA8	1013360028
ZS2	VARISTOR, V56RA8	1013360028
ZS3	VARISTOR, V56RA8	1013360028
ZS4	VARISTOR, V56RA8	1013360028
ZS5	VARISTOR, V56RA8	1013360028
ZS6	VARISTOR, V56RA8	1013360028
ZS7	VARISTOR, V56RA8	1013360028
ZS8	VARISTOR, V56RA8	1013360028
ZS9	VARISTOR, V56RA8	1013360028
ZS10	VARISTOR, V56RA8	1013360028
ZS11	VARISTOR, V56RA8	1013360028
ZS12	VARISTOR, V56RA8	1013360028
ZS13	VARISTOR, V56RA8	1013360028
ZS14	VARISTOR, V56RA8	1013360028
ZS15	VARISTOR, V56RA8	1013360028
	WASHER, SPLIT #6	0500040001
	WASHER, FLAT #6 .312 OD	0500200009
	SCREW, PH 6-32 X 1/4 LG.	0500890048
	SCREW, PH 6-32 X 3/8 LG.	0500890064
	STANDOFF, M-F, 6-32 .375 L	0542930005

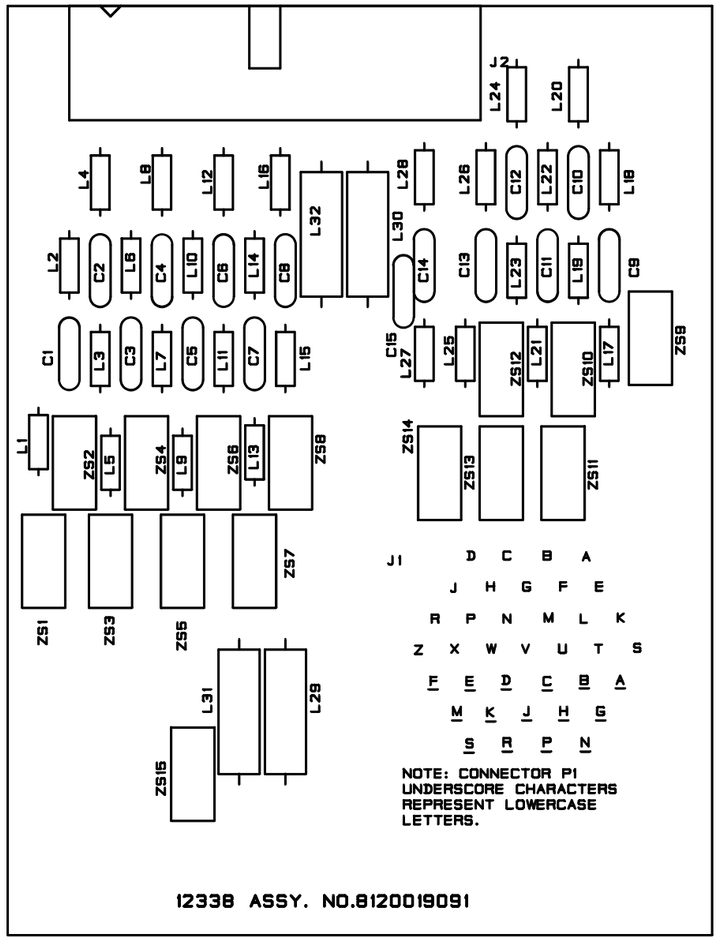

Figure 5.7-6. PC Assembly, Input Connector, 1A1A2
(Page 1 of 2)

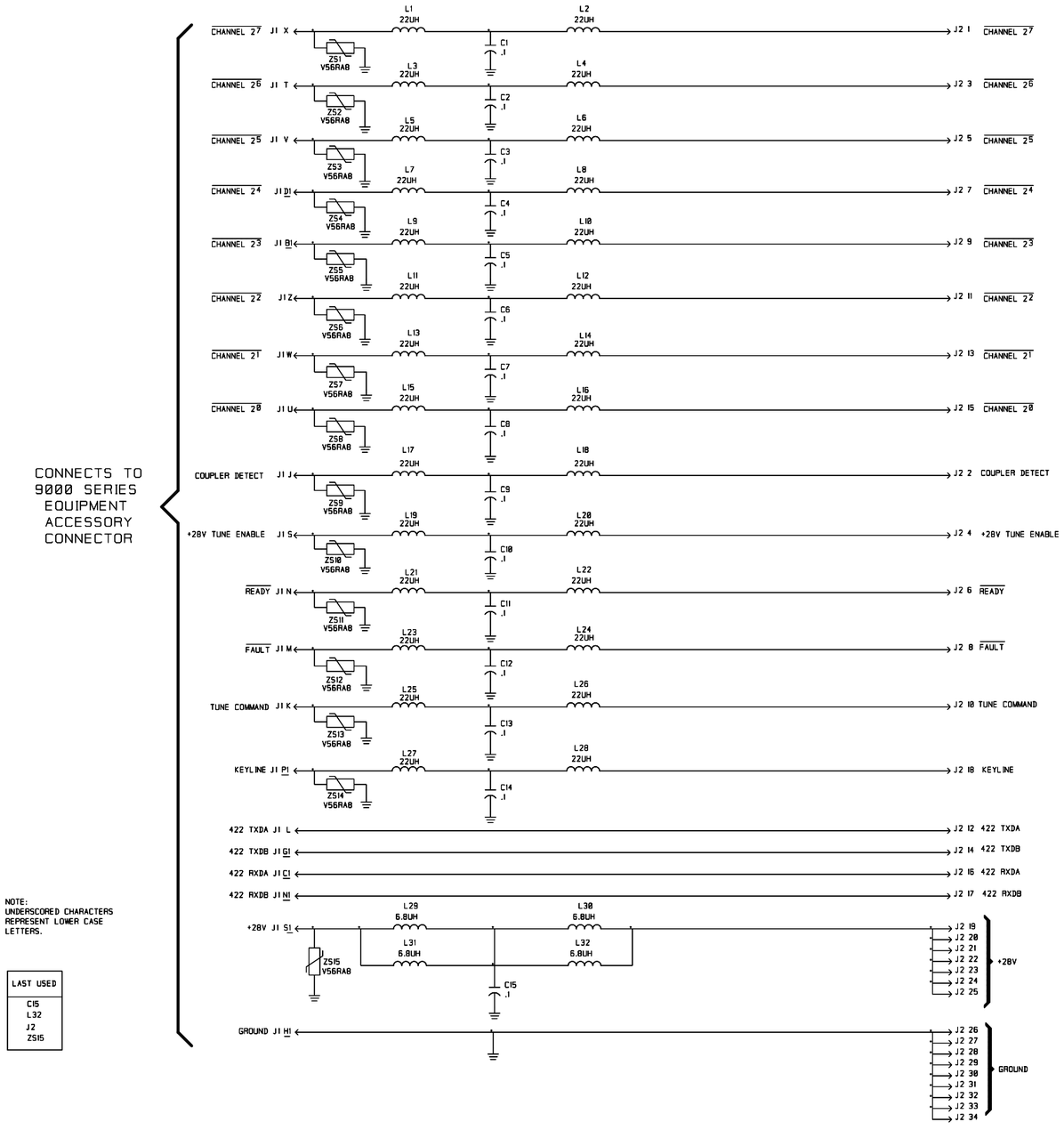

Figure 5.7-6. PC Assembly, Input Connector, 1A1A2
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PC ASSEMBLY, INPUT CONNECTOR, 1A1A2

	PC ASSEMBLY, CPU	8120030095
C101	CAP. 10UF, 20V	1007290005
C102	CAP. 0.1UF, 50V, X7R	1011180014
C103	CAP. 1UF, 35V	0281660000
C104	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C105	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C106	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C107	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C108	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C109	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C110	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C111	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C112	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C113	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C114	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C115	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C116	CAP. 22PF, 200V, NPO, 5%	1012902200
C117	CAP. 22PF, 200V, NPO, 5%	1012902200
C118	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C119	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C120	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C121	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C122	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C123	CAP. 1UF, 35V	0281660000
C124	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C201	CAP. 0.1UF, 50V, X7R	1011180014
C205	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C206	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C207	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C208	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C209	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C210	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C211	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C212	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C213	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C214	CAP. 6.8UF, 20V	0296780006
C215	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C217	CAP. 0.1UF, 50V, X7R	1011180014
C218	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C219	CAP. 22UF, 15V	0281690006
C220	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C301	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C302	CAP. 10UF, 20V	1007290005
C303	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C304	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C305	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C306	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C307	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C308	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C309	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C310	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C311	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C312	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C313	CAP. 0.1UF, 50V, X7R	1011180014
C401	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C402	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C403	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C404	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C405	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C406	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C407	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C408	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C409	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C410	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C411	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C412	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C413	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C414	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C415	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C416	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C417	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C418	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C419	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C420	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C421	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C422	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C423	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C424	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C425	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C426	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C427	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C428	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C429	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C430	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C431	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C432	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C433	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C434	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C435	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C436	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C437	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C438	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C439	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C440	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C441	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C442	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C443	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C444	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C445	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C446	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C447	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C448	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C449	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C450	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C451	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C452	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C453	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C454	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C455	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C456	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C457	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C458	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C459	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C501	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C502	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C503	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C504	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C505	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C506	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C507	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C508	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C509	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C510	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C511	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C512	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C513	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C514	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C515	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C516	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C517	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C518	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C519	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C520	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C521	CAP. 0.01UF, 50V, X7R, 20%	0281730008

Figure 5.7-7. PC Assembly, CPU, 1A1A3
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PC ASSEMBLY, INPUT CONNECTOR, 1A1A2 (Continued)

C522	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C523	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C524	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C525	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C526	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C527	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C528	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C529	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C530	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C531	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C532	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C533	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C534	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C535	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C536	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C537	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C538	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C539	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C540	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C541	CAP. 0.1UF, 50V, X7R	1011180014
C542	CAP. 0.1UF, 50V, X7R	1011180014
C543	CAP. 0.1UF, 50V, X7R	1011180014
C544	CAP. 0.1UF, 50V, X7R	1011180014
C545	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C546	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C547	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C548	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C549	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C550	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C551	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C552	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C553	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C554	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C557	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C558	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C559	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C560	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C561	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C562	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C563	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C564	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C565	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C566	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C601	CAP. 1UF, 35V	0281660000
C602	CAP. 0.1UF, 50V, X7R	1011180014
C603	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C604	CAP. 0.1UF, 50V, X7R	1011180014
C605	CAP. 6.8UF, 20V	0296780006
C606	CAP. 0.1UF, 50V, X7R	1011180014
C607	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C608	CAP. 0.1UF, 50V, X7R	1011180014
C609	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C610	CAP. 68UF, 15V	0296540005
C611	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C612	CAP. 1000UF, 35V, 105C	1011420031
C613	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C614	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C616	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C617	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C618	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C619	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C620	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C621	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C622	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C623	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C624	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C625	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C626	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C628	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C629	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C630	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C631	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C632	CAP. 0.01UF, 50V, X7R, 20%	0281730008
CP601	CAP. NTWK. 0.1UF, 10 PIN	1006580018
CP602	CAP. NTWK. 0.1UF, 10 PIN	1006580018
CR101	DIODE, SIGNAL, SIL. 1N4454	0405270003
CR201	DIODE, SIGNAL, SIL. 1N4454	0405270003
CR301	DIODE, LED, AMBER 550-2305	1011480000
CR302	DIODE, LED, GREEN 550-2205	1011030012
CR303	DIODE, LED, RED 550-2405	1008480029
CR304	DIODE, LED, RED 550-2405	1008480029
CR305	DIODE, SIGNAL, SIL. 1N4454	0405270003
CR401	DIODE, RECTIFIER 1N4004	0405180004
CR402	DIODE, RECTIFIER 1N4004	0405180004
CR403	DIODE, RECTIFIER 1N4004	0405180004
CR404	DIODE, RECTIFIER 1N4004	0405180004
CR501	DIODE, TRANSIENT SUP. 1.5KA18A	1010960032
CR502	DIODE, TRANSIENT SUP. 1.5KA18A	1010960032
CR503	DIODE, TRANSIENT SUP. 1.5KA18A	1010960032
CR504	DIODE, TRANSIENT SUP. 1.5KA18A	1010960032
CR601	DIODE, ZENER 1N5245B	0405210001
CR602	DIODE, ZENER 1N5343B	1003060005
J1	CONNECTOR, DB-9, FEMALE RT ANG	1012550028
L103	INDUCTOR, MOLDED, 8.2UH, 5%	0652060005
L104	INDUCTOR, MOLDED, 8.2UH, 5%	0652060005
L106	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L201	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L202	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L203	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L204	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L301	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L302	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L303	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L304	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L305	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L401	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L402	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L403	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L404	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L405	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L406	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L407	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L408	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L409	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L410	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L411	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L412	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L413	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L414	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L415	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L416	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L417	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L418	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L419	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L420	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L421	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L422	INDUCTOR, MOLDED, 2.7UH, 5%	0652180001
L423	INDUCTOR, MOLDED, 10UH, 5%	0650240006
L424	INDUCTOR, MOLDED, 10UH, 5%	0650240006
L425	INDUCTOR, MOLDED, 10UH, 5%	0650240006
L426	INDUCTOR, MOLDED, 10UH, 5%	0650240006
L601	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L602	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L603	INDUCTOR, MOLDED, 47UH, 5%	0652680003

Figure 5.7-7. PC Assembly, CPU, 1A1A3
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PC ASSEMBLY, INPUT CONNECTOR, 1A1A2 (Continued)

L604	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L605	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L606	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L607	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L608	INDUCTOR, MOLDED, 47UH, 5%	0652680003
L609	INDUCTOR, MOLDED, 10UH, 5%	0650240006
Q101	TRANSISTOR, N-CH, FET 2N7000	1011050013
Q201	TRANSISTOR, N-CH, FET 2N7000	1011050013
Q301	TRANSISTOR, PNP, SI. 2N2907A	0448390001
Q302	TRANSISTOR, N-CH, FET 2N7000	1011050013
Q401	TRANSISTOR, N-CH, FET MTP3055E	1010750011
Q402	TRANSISTOR, N-CH, FET MTP3055E	1010750011
Q403	TRANSISTOR, N-CH, FET MTP3055E	1010750011
Q404	TRANSISTOR, N-CH, FET MTP3055E	1010750011
R101	RESISTOR 2.7K, 5%, 1/8W	1010802721
R102	RESISTOR 10K, 5%, 1/8W	1010801031
R103	RESISTOR 470, 5%, 1/8W	1010804715
R104	RESISTOR 47K, 5%, 1/8W	1010804731
R105	RESISTOR 4.7K, 5%, 1/8W	1010804723
R106	RESISTOR 0.0, 0%, 1/4W	1011600021
R107	RESISTOR 10K, 5%, 1/8W	1010801031
R108	RESISTOR 10K, 5%, 1/8W	1010801031
R109	RESISTOR 47K, 5%, 1/8W	1010804731
R110	RESISTOR 10K, 5%, 1/8W	1010801031
R112	RESISTOR 0.0, 0%, 1/4W	1011600021
R202	RESISTOR 10K, 5%, 1/8W	1010801031
R203	RESISTOR 10K, 5%, 1/8W	1010801031
R204	RESISTOR 47K, 5%, 1/8W	1010804731
R205	RESISTOR 4.7K, 5%, 1/8W	1010804723
R206	RESISTOR 47K, 5%, 1/8W	1010804731
R207	RESISTOR 10K, 5%, 1/8W	1010801031
R208	RESISTOR 47K, 5%, 1/8W	1010804731
R209	RESISTOR 10K, 5%, 1/8W	1010801031
R210	RESISTOR 10, 5%, 1/8W	1010801007
R211	RESISTOR 0.0, 0%, 1/4W	1011600021
R213	RESISTOR 22, 5%, 1/8W	1010802208
R214	RESISTOR 10, 5%, 1/8W	1010801007
R302	RESISTOR 0.0, 0%, 1/4W	1011600021
R304	RESISTOR 2.7K, 10%, 1/2W	0165780002
R305	RESISTOR PTC	1012680011
R306	RESISTOR 47K, 5%, 1/8W	1010804731
R307	RESISTOR PTC	1012680011
R308	RESISTOR 10K, 5%, 1/8W	1010801031
R309	RESISTOR 47K, 5%, 1/8W	1010804731
R401	RESISTOR 47K, 5%, 1/8W	1010804731
R402	RESISTOR 47K, 5%, 1/8W	1010804731
R403	RESISTOR 47K, 5%, 1/8W	1010804731
R404	RESISTOR 47K, 5%, 1/8W	1010804731
R501	RESISTOR 4.7, 5%, 1/4W	1001060024
R502	RESISTOR 4.7, 5%, 1/4W	1001060024
R503	RESISTOR 4.7, 5%, 1/4W	1001060024
R504	RESISTOR 4.7, 5%, 1/4W	1001060024
R505	RESISTOR 4.7, 5%, 1/4W	1001060024
R506	RESISTOR 4.7, 5%, 1/4W	1001060024
R507	RESISTOR 4.7, 5%, 1/4W	1001060024
R508	RESISTOR 4.7, 5%, 1/4W	1001060024
R509	RESISTOR 4.7, 5%, 1/4W	1001060024
R510	RESISTOR 4.7, 5%, 1/4W	1001060024
R511	RESISTOR 4.7, 5%, 1/4W	1001060024
R512	RESISTOR 4.7, 5%, 1/4W	1001060024
R513	RESISTOR 4.7, 5%, 1/4W	1001060024
R514	RESISTOR 4.7, 5%, 1/4W	1001060024
R515	RESISTOR 4.7, 5%, 1/4W	1001060024
R516	RESISTOR 4.7, 5%, 1/4W	1001060024
R517	RESISTOR 4.7, 5%, 1/4W	1001060024
R518	RESISTOR 4.7, 5%, 1/4W	1001060024
R519	RESISTOR 4.7, 5%, 1/4W	1001060024
R520	RESISTOR 4.7, 5%, 1/4W	1001060024
R521	RESISTOR 4.7, 5%, 1/4W	1001060024
R522	RESISTOR 4.7, 5%, 1/4W	1001060024
R523	RESISTOR 4.7, 5%, 1/4W	1001060024
R524	RESISTOR 4.7, 5%, 1/4W	1001060024
R525	RESISTOR 4.7, 5%, 1/4W	1001060024
R526	RESISTOR 4.7, 5%, 1/4W	1001060024
R527	RESISTOR 4.7, 5%, 1/4W	1001060024
R528	RESISTOR 4.7, 5%, 1/4W	1001060024
R601	RESISTOR 0.0, 0%, 1/4W	1011600021
RP101	RES NTWK 10 PIN SIP 10K COM	1006130021
RP201	RES NTWK 10 PIN SIP 10K COM	1006130021
RP601	RES NTWK 10 PIN SIP 10K COM	1006130021
S101	SWITCH, PUSHBUTTON,SPST	1010710001
S201	SWITCH, SPST, DIP, 8 POSITION	1012930033
U101	IC DIGITAL, MAX 490	1013240022
U102	IC. DIGITAL TL7705B	1012210006
U103	IC. DIGITAL, CPU 80C188EB-8	1012580008
U104	IC. LINEAR LM2903	1011410036
U105	PAL W/CU-9150 PAL SFTWRE U105	8120033698
U107	IC. DIGITAL 74HC373	1006480030
U108	IC. DIGITAL 74HC373	1006480030
U109	IC. DIGITAL 74HC245	1006470034
U202	IC. DIGITAL 74HC138	1006480013
U203	IC. DIGITAL 74HC138	1006480013
U204	IC. DIGITAL 74HC04	1010280023
U205	IC. DIGITAL 74HC74	1008000019
U206	IC. DIGITAL 74HC244	1006460039
U207	IC. LINEAR MC34072	1011440032
U208	IC. DIGITAL, 12 BIT A/D W/MUX	1013380029
U302	IC. DIGITAL, RAM 551001	1012600009
U303	IC. DIGITAL 28C64	1010660004
U304	IC,DIGITAL, UCN5842A	1012530035
U401	IC. DIGITAL UCN-5801A	1011800021
U402	IC. DIGITAL UCN-5801A	1011800021
U403	IC. DIGITAL UCN-5801A	1011800021
U404	IC. DIGITAL 74HC374	1006450033
U405	IC. DIGITAL MC14504	1006090037
U501	IC,DIGITAL, UCN5842A	1012530035
U502	IC,DIGITAL, UCN5842A	1012530035
U503	IC,DIGITAL, UCN5842A	1012530035
U504	IC,DIGITAL, UCN5842A	1012530035
U601	IC. DIGITAL 74HC688	1009050001
U602	IC. DIGITAL 74HC14	1006490027
U603	IC. DIGITAL 74HC14	1006490027
U604	IC. DIGITAL 74HC374	1006450033
U605	IC. DIGITAL 74HC244	1006460039
U606	IC. LINEAR LM340T5	0448600005
U607	IC. LINEAR LM340/7812	1003410022
XQ401	MOLDED TRANSIST0R MOUNT,TO-220	1013410025
XQ402	MOLDED TRANSIST0R MOUNT,TO-220	1013410025
XQ403	MOLDED TRANSIST0R MOUNT,TO-220	1013410025
XQ404	MOLDED TRANSIST0R MOUNT,TO-220	1013410025
XU103	SOCKET, IC, 84 PIN PLCC	1012640001
XU105	SOCKET, IC. 24 PIN SKINNY DIP	1013390024
XU301	SOCKET, IC, 32 PIN TAILLESS	1012530001
XU303	SOCKET, IC, 28 PIN TAILLESS	1006620001
Y101	CRYSTAL, 14.7456MHZ 50PPM	1013480015
	WASHER, SPLIT #4	0500020001
	SCREW, PH 4-40 X 1/4 LG.	0500850046
	SCREW, PH 4-40 X 5/16 LG.	0500850054
	WASHER, FLAT #4 .219 OD	0502560002
	BACKPLANE, CPU	8120031601

Figure 5.7-7. PC Assembly, CPU, 1A1A3
(Page 3 of 10)

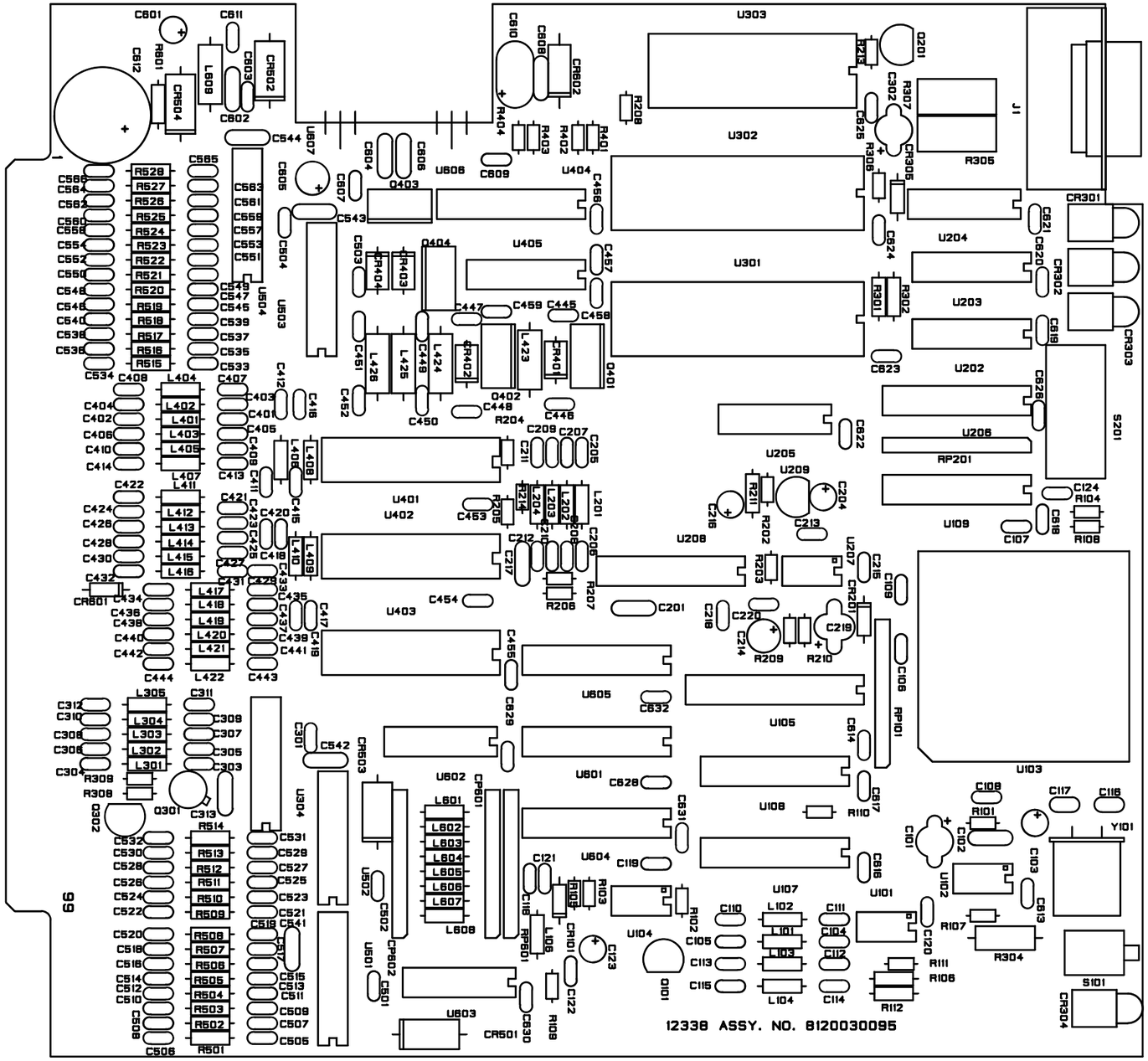
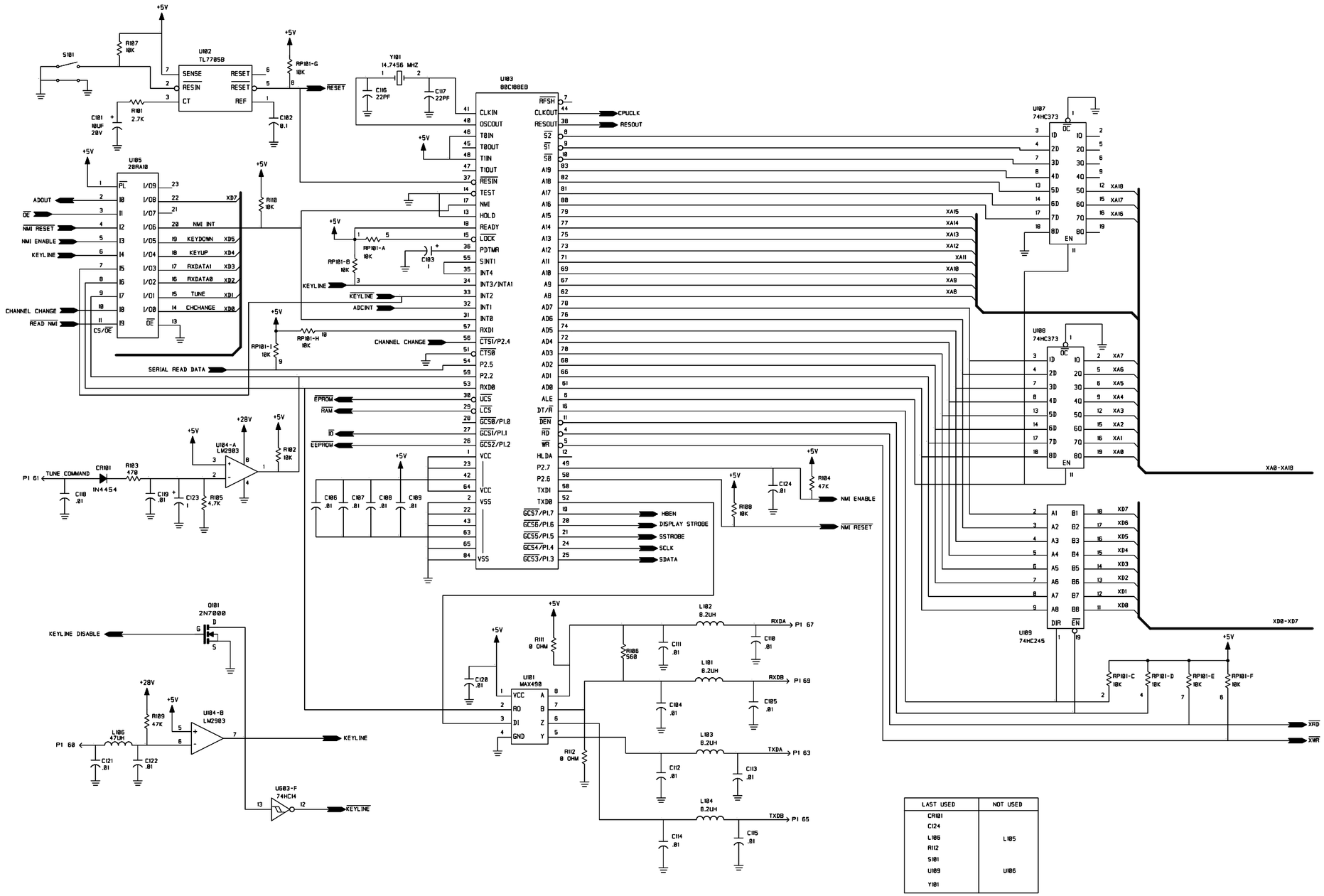


Figure 5.7-7. PC Assembly, CPU, 1A1A3
(Page 4 of 10)



LAST USED	NOT USED
CR101	
C124	
L105	L105
R112	
S101	
U109	U106
Y101	

Figure 5.7-7. PC Assembly, CPU, 1A1A3
(Page 5 of 10)

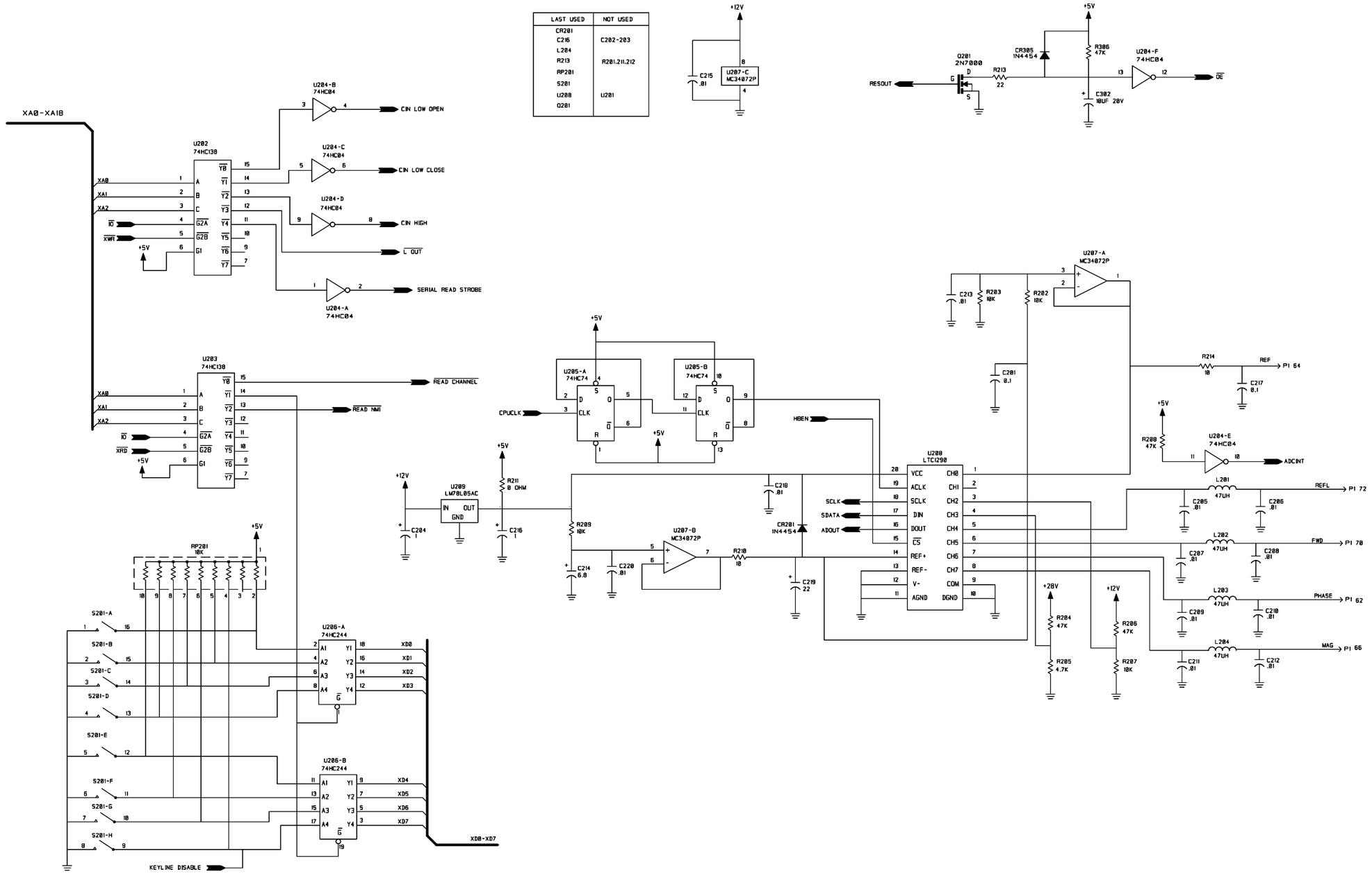
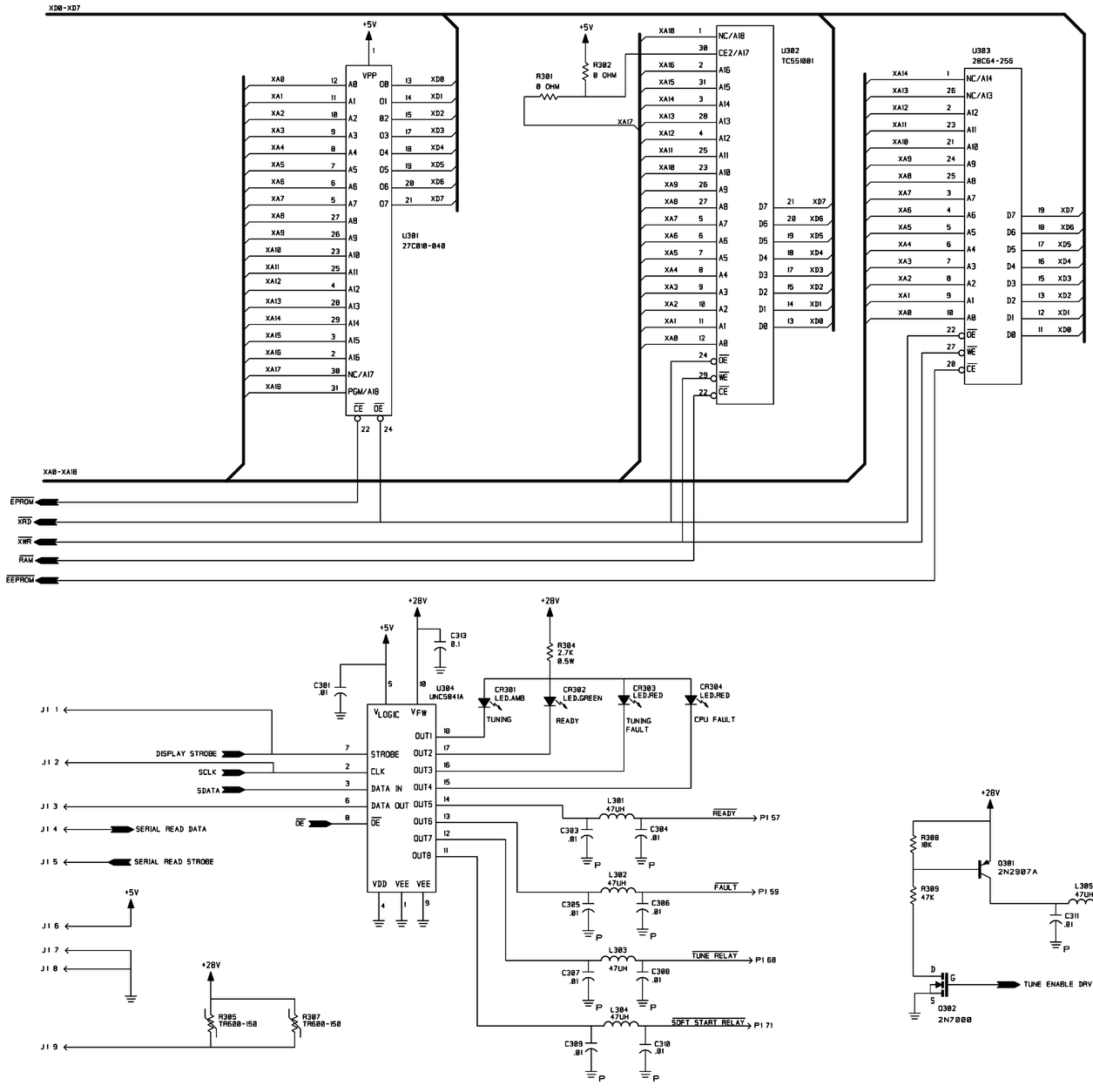
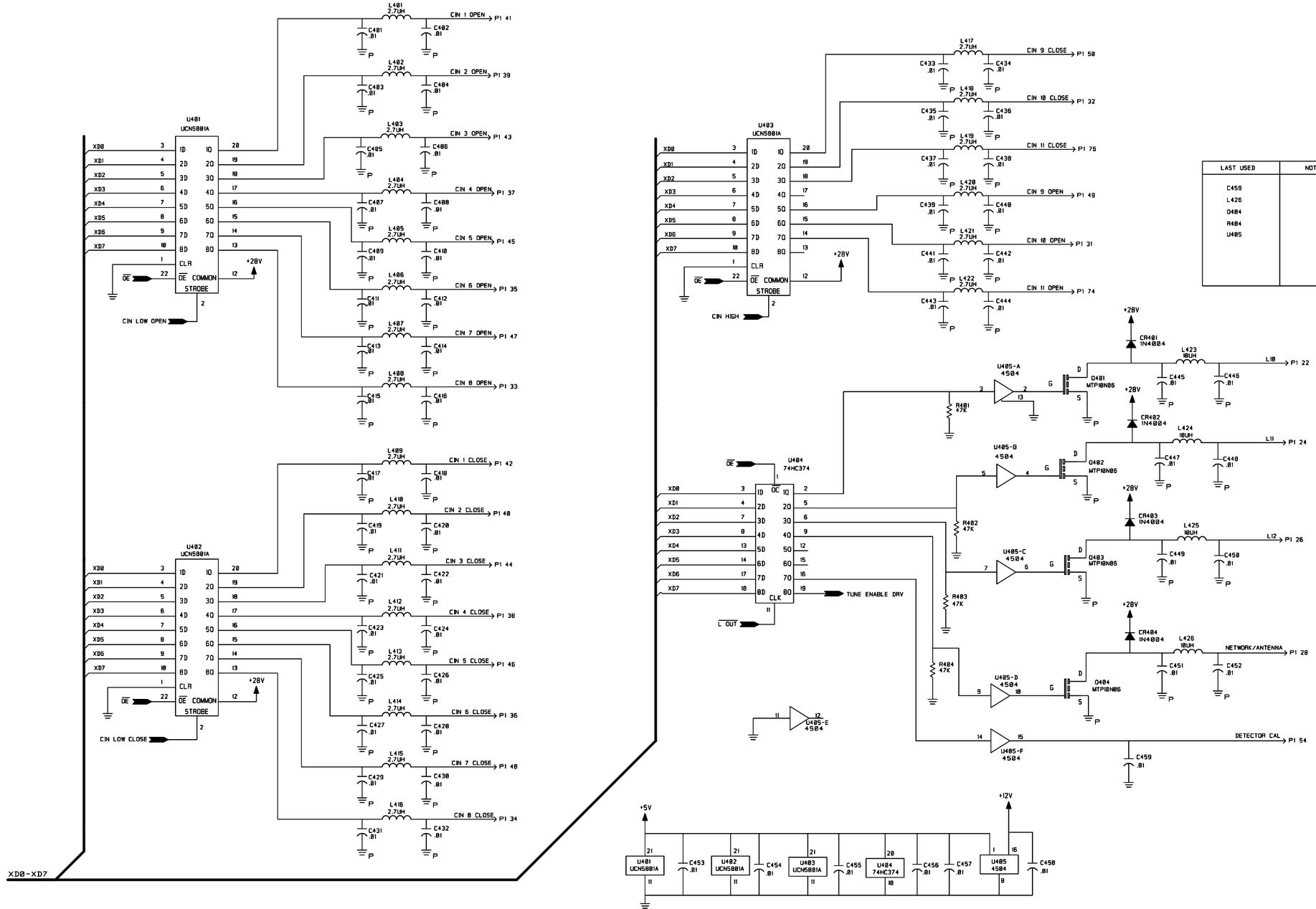


Figure 5.7-7. PC Assembly, CPU, 1A1A3
(Page 6 of 10)



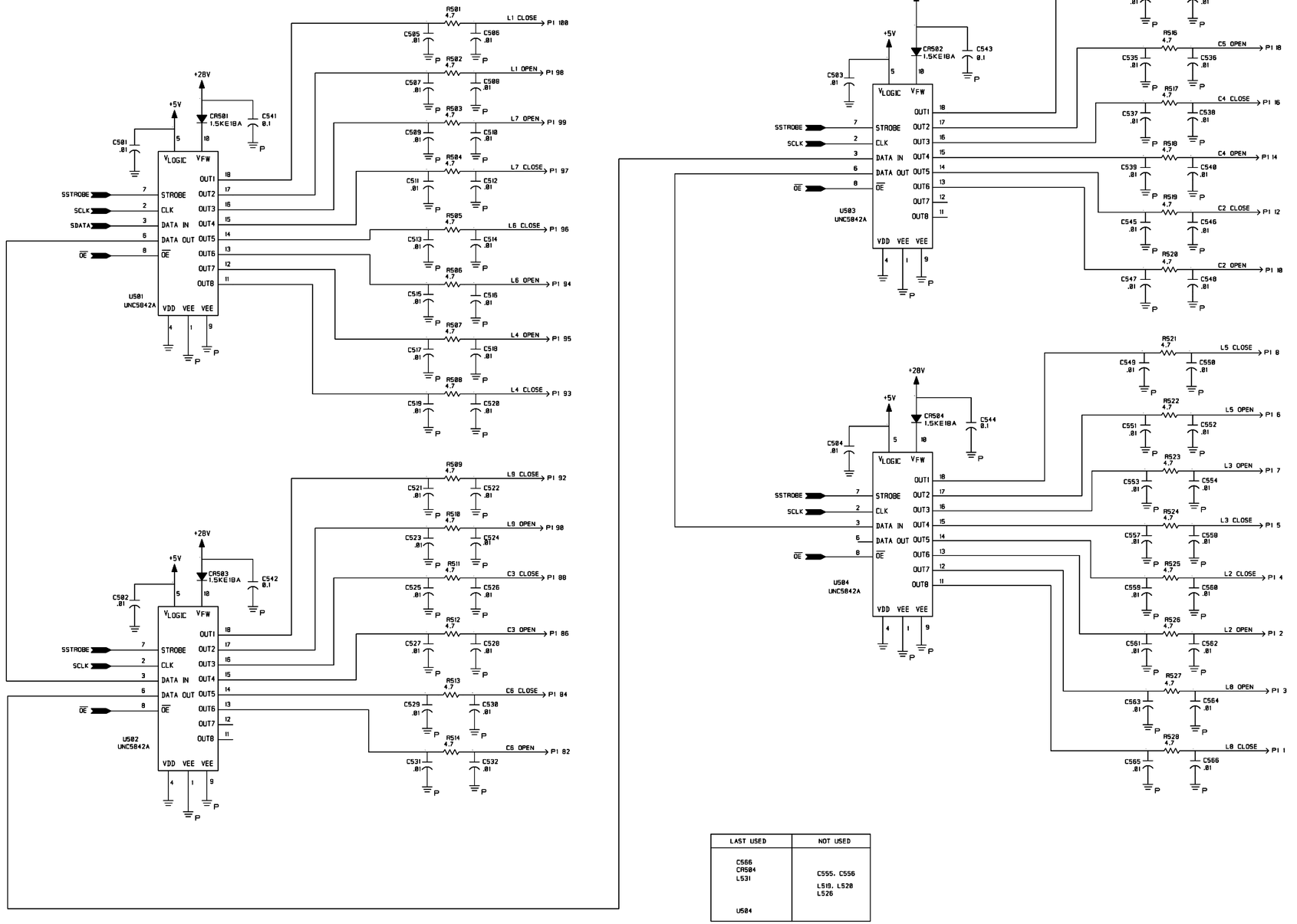
LAST USED	NOT USED
C313	
L305	
Q302	
R309	R303
U304	

Figure 5.7-7. PC Assembly, CPU, 1A1A3
(Page 7 of 10)



LAST USED	NOT USED
C459	
L426	
Q404	
R404	
U405	

Figure 5.7-7. PC Assembly, CPU, 1A1A3
(Page 8 of 10)



LAST USED	NOT USED
C566 CR504 L531 U504	C555. C556 L519. L520 L526

Figure 5.7-7. PC Assembly, CPU, 1A1A3
(Page 9 of 10)

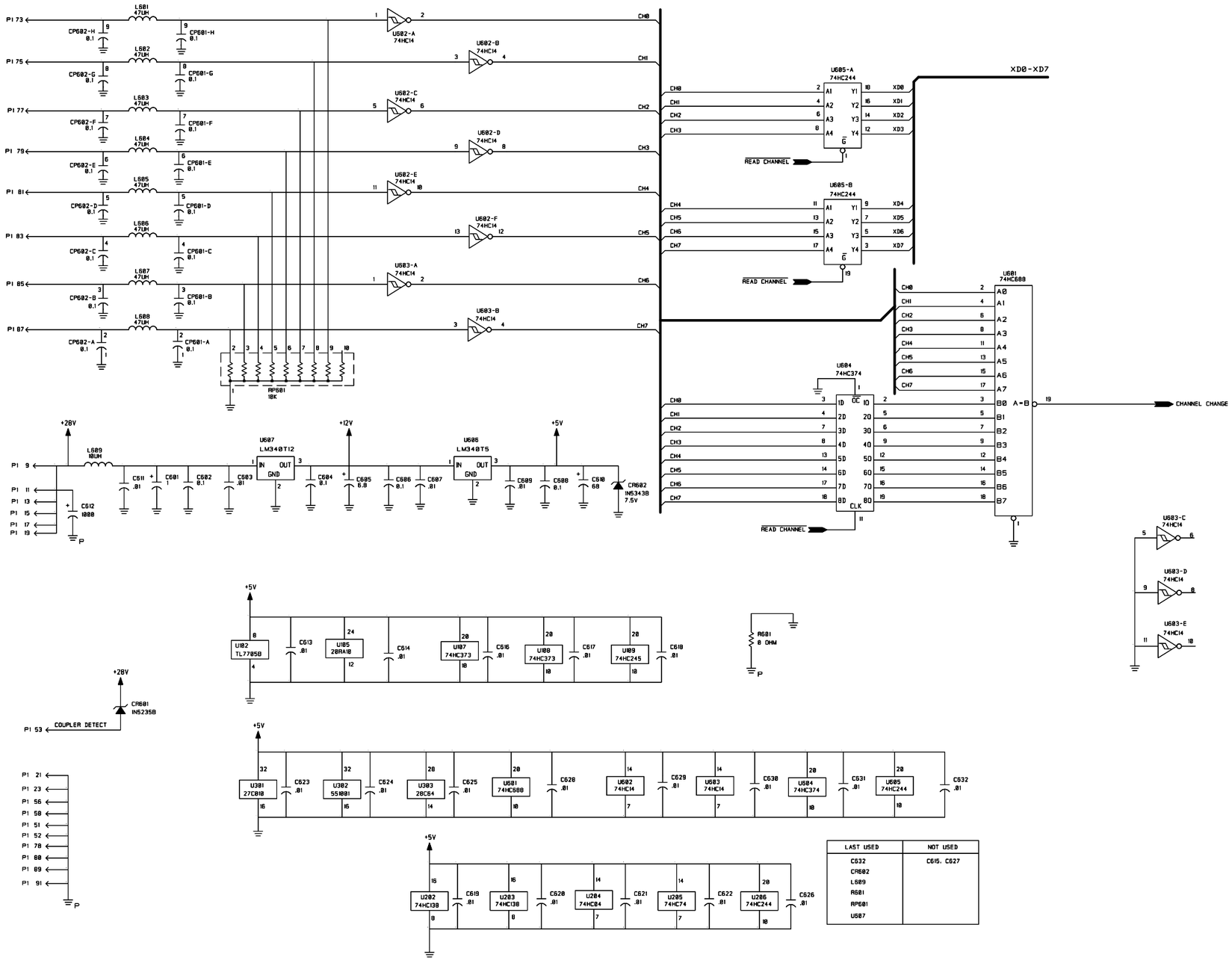


Figure 5.7-7. PC Assembly, CPU, 1A1A3
(Page 10 of 10)

PC ASSEMBLY, RF DETECTOR, 1A1A4A1

	PC ASSY, RF DETECTOR	8120020090
C1	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C2	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C3	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C4	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C5	CAP. 12PF, 200V NPO 5%	1012901203
C6	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C7	CAP. 0.47UF, 50V, X7R, 20%	0283377771
C8	CAP. 5.5-18PF, 500V	1010020021
C9	CAP. 300PF, 500V, DM15, 2%	0282330003
C10	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C11	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C12	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C13	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C14	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C15	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C16	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C17	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C18	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C19	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C20	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C21	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C22	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C23	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C24	CAP. 0.001UF, 100V, X7R, 20%	0281630003
C25	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C26	CAP. 0.01UF, 50V, X7R, 20%	0281730008
CR1	DIODE, RECTIFIER 1N4004	0405180004
CR2	DIODE, SIGNAL, SIL. 1N4454	0405270003
CR3	DIODE, SIGNAL, SIL. 1N4454	0405270003
CR4	DIODE, HOT CARRIER 1N6263	0405610009
CR5	DIODE, HOT CARRIER 1N6263	0405610009
CR6	DIODE, HOT CARRIER 1N6263	0405610009
CR7	DIODE, HOT CARRIER 1N6263	0405610009
CR8	DIODE, RECTIFIER 1N4004	0405180004
CR9	DIODE, HOT CARRIER 1N6263	0405610009
CR10	DIODE, LED, AMBER 550-2305	1011480000
CR11	DIODE, ZENER 1N5231B	0405390009
CR12	DIODE, RECTIFIER 1N4004	0405180004
CR13	DIODE, RECTIFIER 1N4004	0405180004
J1	CONNECTOR, RF, BNC	0753490005
K1	RELAY, SPDT, 24VDC, 10 AMP	1008290009
K2	RELAY, SPDT, 24VDC, 10 AMP	1008290009
K3	RELAY 1 FORM A 1 FORM B 24V	1012540022
L1	INDUCTOR, MOLDED, 0.47UH, 5%	0649410009
L2	INDUCTOR, MOLDED, 1000UH, 5%	0643310002
L3	INDUCTOR, MOLDED, 1000UH, 5%	0643310002
L4	INDUCTOR, MOLDED, 1000UH, 5%	0643310002
L5	INDUCTOR, MOLDED, 1000UH, 5%	0643310002
L6	INDUCTOR, MOLDED, 1000UH, 5%	0643310002
L7	INDUCTOR, MOLDED, 1000UH, 5%	0643310002
L8	INDUCTOR, MOLDED, 0.22UH, 10%	0650740009
L9	INDUCTOR, MOLDED, 47UH, 5%	0652680003
Q1	TRANSISTOR, N-CH, FET 2N7000	1011050013
Q2	TRANSISTOR, N-CH, FET 2N7000	1011050013
R1	RESISTOR, 300, 1%, 50W	1012530027
R2	RESISTOR, 9, 1%, 50W	1012520021
R3	RESISTOR, 9, 1%, 50W	1012520021
R4	RESISTOR, 300, 1%, 50W	1012530027
R5	RESISTOR 10K, 10%, 2W	0176010009
R6	RESISTOR 10K, 10%, 1/4W	0170410005
R7	RESISTOR 33, 10%, 1/2W	0171700007
R8	POT. 10K, 10%, 1/2W, 25 TURNS	1004880014
R9	RESISTOR 33, 10%, 1/2W	0171700007
R10	RESISTOR 12K, 10%, 1/4W	0183180003
R11	RESISTOR 18, 5%, 1/2W	0184730007
R12	RESISTOR 12K, 10%, 1/4W	0183180003
R13	RESISTOR 2.7K, 10%, 1/2W	0165780002
R14	RESISTOR 1K, 10%, 1/2W	0167480006
R15	RESISTOR, 50, 1%, 50W	1013420021
R16	RESISTOR 10K, 10%, 1/4W	0170410005
R17	RESISTOR 10K, 10%, 1/4W	0170410005
R18	RESISTOR 47K, 5%, 1/8W	1010804731
R19	RESISTOR 10K, 5%, 1/8W	1010801031
R20	RESISTOR 4.7K, 5%, 1/8W	1010804723
R21	RESISTOR 4.7K, 5%, 1/8W	1010804723
T1	TRANSFORMER, PHASE DETECTOR	6035040900
T2	TRANSFORMER, AMPL. DETECTOR	6035040802
TP1	TEST POINT, WHITE	0753640007
TP2	TEST POINT, WHITE	0753640007
TP3	TEST POINT, WHITE	0753640007
TP4	TEST POINT, WHITE	0753640007
TP5	TEST POINT, WHITE	0753640007
TP6	TEST POINT, WHITE	0753640007
U1	IC. LINEAR LM2903	1011410036
	WASHER, SPLIT #4	0500020001
	WASHER, FLAT #4 .281 OD	0500180008
	SCREW, PH 4-40 X 5/16 LG.	0500850054
	BACKPLANE,RF DETECTOR	8120021606

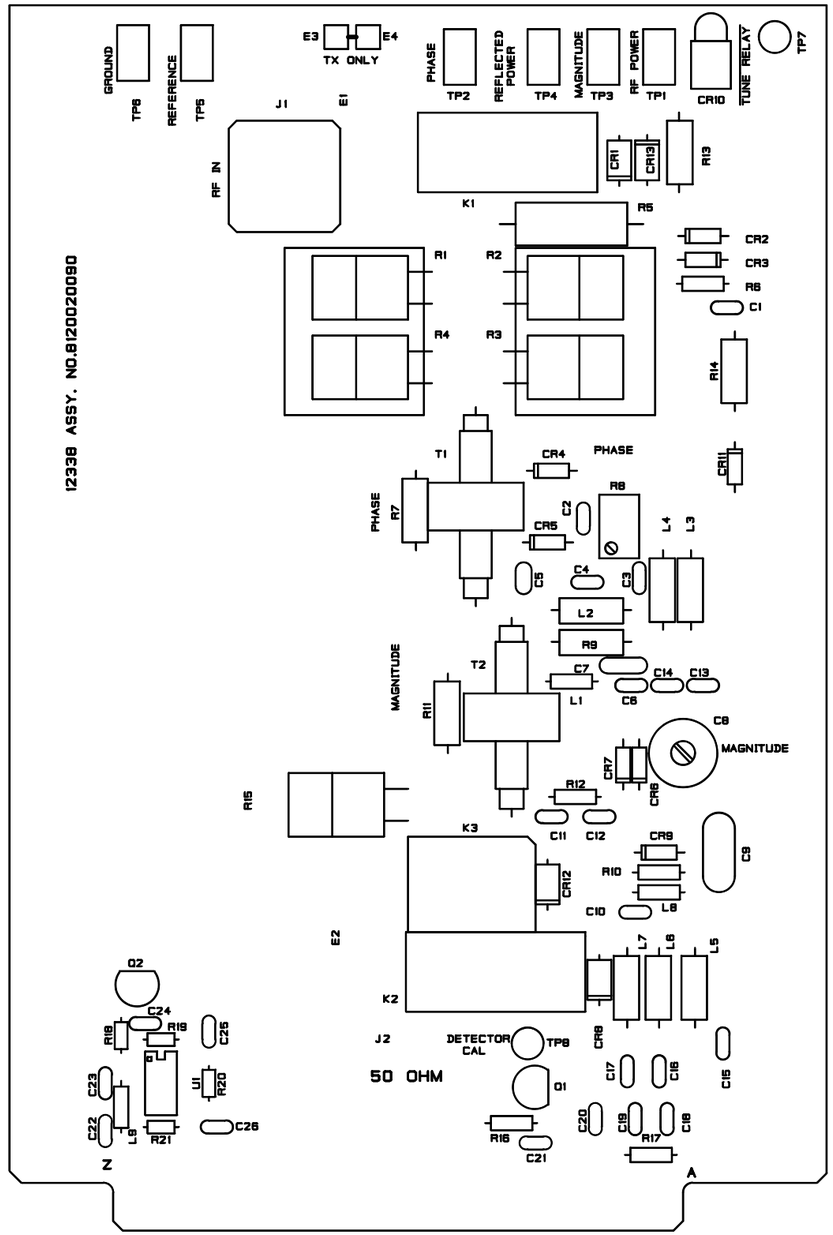


Figure 5.7-8. PC Assembly, RF Detector, 1A1A4A1
(Page 1 of 2)

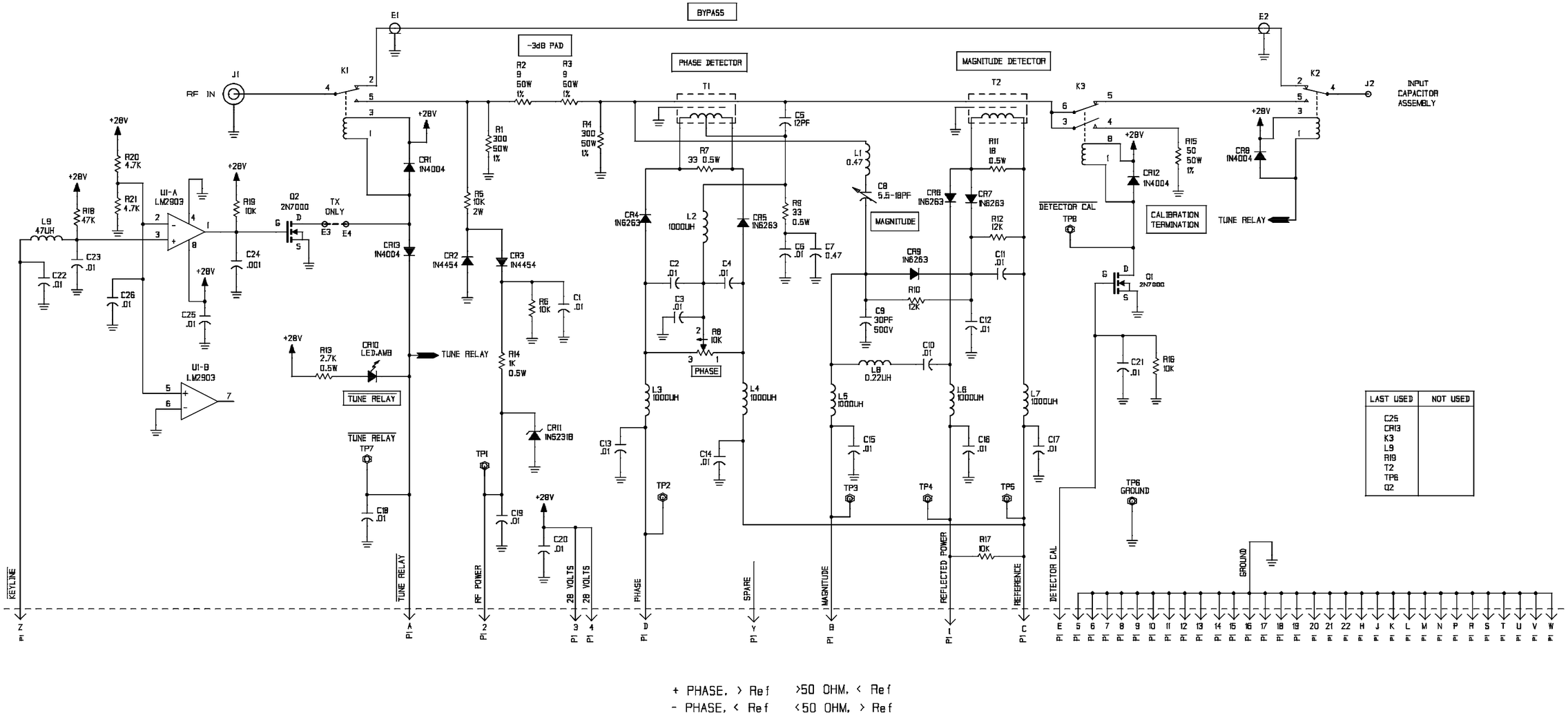


Figure 5.7-8. PC Assembly, RF Detector, 1A1A4A1
(Page 2 of 2)

PC ASSEMBLY, INPUT CAPACITOR, 1A1A4A2

	PC ASSY, INPUT CAPACITOR	8120042093
C1	5.6 PF 3.6 KV	1013010027
C2	10 PF 3.6 KV	1013020022
C3	22PF 3.6 KV	1013030028
C4	39 PF 3.6 KV	1013050029
C5	82 PF 3.6 KV	1013070020
C6A	10 PF 3.6 KV	1013020022
C6B	150 PF 3.6 KV	1013090021
C7A	100 PF 3.6 KV	1013080025
C7B	220 PF 3.6 KV	1013100026
C8A	560 PF 2.5 KV	1013120027
C8B	82 PF 3.6 KV	1013070020
C9A	680 PF 2.5 KV	1013130022
C9B	560 PF 2.5 KV	1013120027
C9C	39 PF 3.6 KV	1013050029
C10A	1000 PF 1.0 KV	1013140028
C10B	56 PF 3.6 KV	1013060024
C10C	1500 PF 1.0 KV	1013150023
C11A	2200 PF 1.0 KV	1013160029
C11B	330 PF 3.6 KV	1013110021
C11C	27 PF 3.6 KV	1013180020
C11D	2200 PF 1.0 KV	1013160029
C11E	330 PF 3.6 KV	1013110021
C11F	33PF 3.6 KV	1013040023
C13	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C14	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C15	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C16	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C17	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C18	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C19	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C20	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C21	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C22	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C23	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C24	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C25	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C26	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C27	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C28	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C29	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C30	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C31	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C32	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C33	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C34	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C35	CAP. 0.01UF, 50V, X7R, 20%	0281730008
K1	RELAY,DK 1AE L2 24V	1013170024
K2	RELAY,DK 1AE L2 24V	1013170024
K3	RELAY,DK 1AE L2 24V	1013170024
K4	RELAY,DK 1AE L2 24V	1013170024
K5	RELAY,DK 1AE L2 24V	1013170024
K6	RELAY,DK 1AE L2 24V	1013170024
K7	RELAY,DK 1AE L2 24V	1013170024
K8	RELAY,DK 1AE L2 24V	1013170024
K9A	RELAY,DK 1AE L2 24V	1013170024
K9B	RELAY,DK 1AE L2 24V	1013170024
K10A	RELAY,DK 1AE L2 24V	1013170024
K10B	RELAY,DK 1AE L2 24V	1013170024
K11A	RELAY,DK 1AE L2 24V	1013170024
K11B	RELAY,DK 1AE L2 24V	1013170024
ZS1	SPARK GAP, 1-2KV	1012520030
	WASHER, SPLIT #6	0500040001
	WASHER, FLAT #6 .312 OD	0500200009
	NUT, HEX 6-32 X 5/16 AF	0501900004
	L BRACKET, CIN ASSY, CU-9150	8120042301

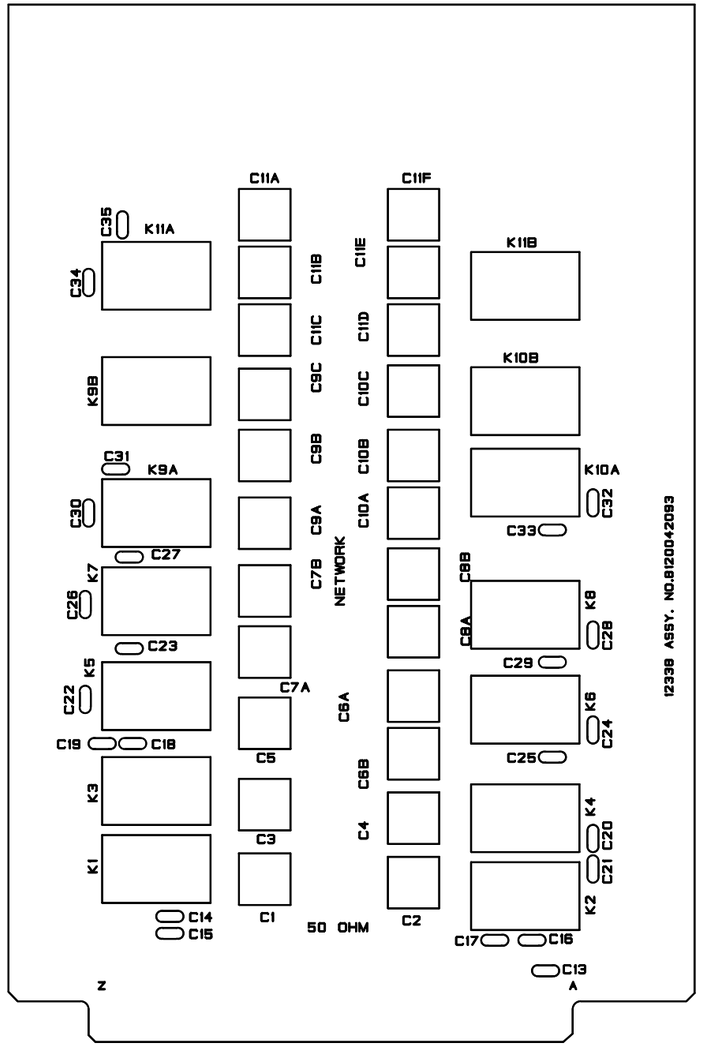


Figure 5.7-9. PC Assembly, PC Assembly, Input Capacitor, 1A1A4A2
(Page 1 of 2)

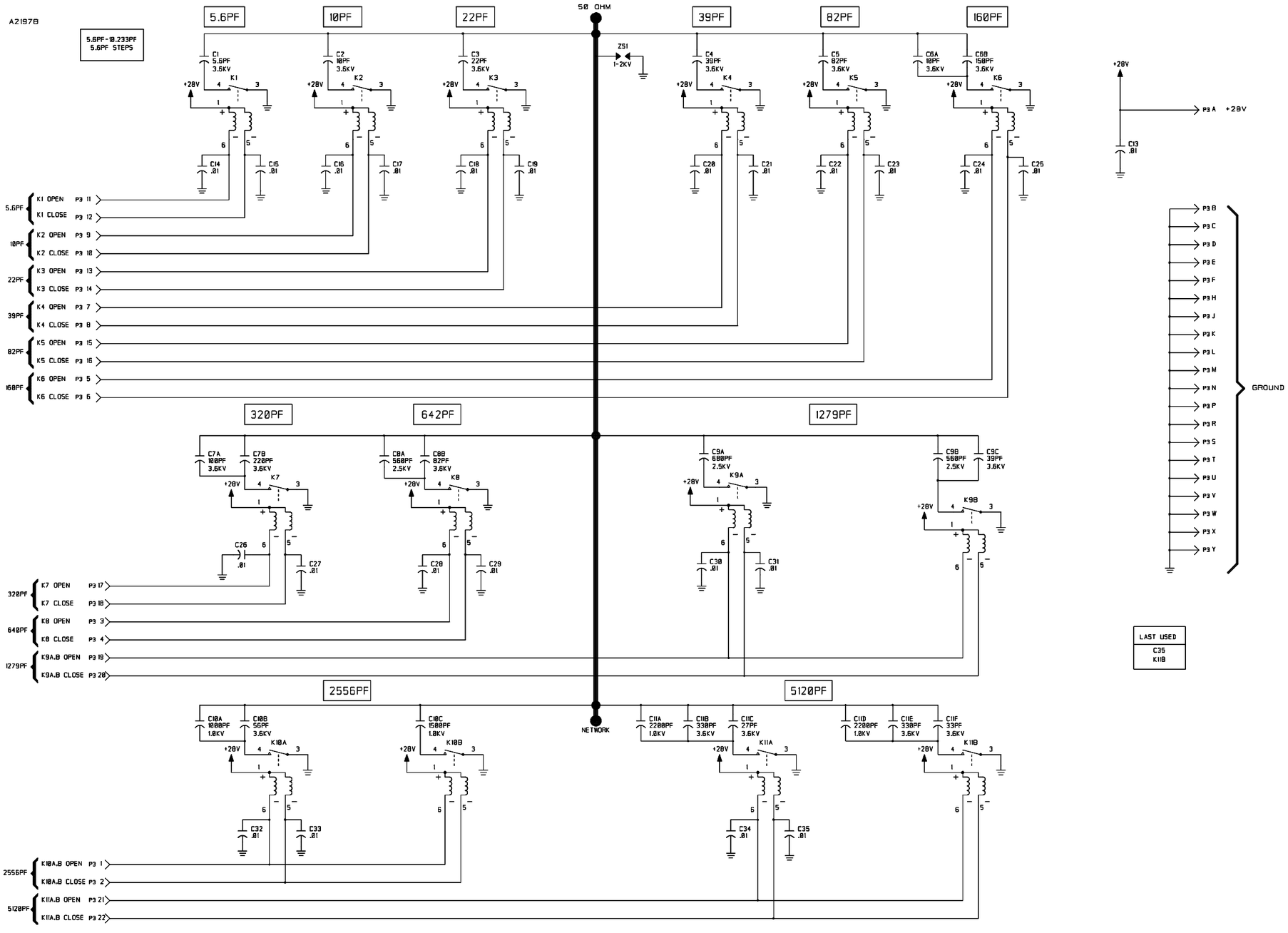


Figure 5.7-8. PC Assembly, Input Capacitor, 1A1A4A2
(Page 2 of 2)

SECTION VI – Options

6.0 Options

6.1 Diagnostic Test Set

6.1.1 General Information

6.1.1.1 Scope of Option Section

This section contains information necessary to utilize the TS-9150 Diagnostic Test Set to isolate faults in a CU-9150/CU-9100A Kilowatt Antenna Coupler.

6.1.1.2 Purpose of Equipment

The TS-9150 Diagnostic Test Set provides the tools required to diagnose and isolate faults in a CU-9150/CU-9100A Kilowatt Antenna Coupler. Three separate functions are provided:

- Coupler CPU board level test capability
- Display of coupler state and the ability to modify that state
- Display of coupler tuning history

6.1.1.3 Equipment Supplied

Table 6.1-1 provides a list of equipment, with appropriate Sunair part numbers, supplied as the TS-9150 Diagnostic Test Set.

Table 6.1-1 Equipment Supplied

Sunair Part No.	Description
1012890031	Cable Assembly, DB-9 Male to DB-9 Female
1012900037	Cable Assembly, DB-25 Male to DB-9 Female
8092500096	Cable Assembly, LPA-9600 to Coupler
8120030036	Kilowatt Coupler CPU Test Fixture
8120034091	EPROM with Test Fixture Software
8120037189	Software, TuneView, on disk
8120037391	Tested Serial Breakout Board
8120039394	Tested Display Board
8120907604	Carrying Case, Black Plastic
8120907701	Bracket, Panel Support
8120907892	Cable Assembly, CU-9150 to DTS (DB9 Male to Male)

The following sections detail the operation of the different functions of the TS-9150. Table 6.1-2 explains the terms as they are used to describe coupler operation.

Table 6.1-2 Coupler Operation Terms

Term	Definition
Network	A combination of input capacitance (Cin), series inductance (Lseries), output capacitance (Cout), and output inductance (Lout) which comprise a matching circuit between the antenna terminal and the RF input connector.
Network Element	One of the four reactive matching elements. These elements are Cin, Lseries, Cout, and Lout. Each network element is made up of many network components.
Network Component	One of the discrete reactive components in the coupler. For example, C1 on the Input Capacitor board is a network component

6.1.2 Test Set Operation

6.1.2.1 CPU Test Fixture Operation

In order to perform a board level test of the 8120030095 Coupler CPU assembly, the components listed in Table 6.1-3 are required. All of the items that have Sunair part numbers are included with the 8120907591 Diagnostic Test Set.

Table 6.1-3. Board Level Test Components Required

Sunair Part No.	Description
1012890031	Cable Assy, DB-9 Male to DB-9 Female
8120030036	Kilowatt Coupler CPU Test Fixture
8120034091	EPROM with Test Fixture Software
8120907892	Cable Assy, CU-9150 to DTS (DB9 Male to Male)
CFE	DC Power Supply, 28V at 2A
CFE	PC or Terminal

To perform a board level test:

1. Remove the EPROM from the U301 position of the board under test.
2. Install the Test EPROM PN 8120034091 in the U301 position.
3. Remove PAL W/CU-9150-H software from U105 position.
4. Install PN 8120033698 PAL W/CU-9150 software in U105 position.

5. Set S1 on the test fixture to its **OFF** (down) position.
6. Set all of the switches on S201 of the board under test to the **OFF** (down) position.
7. Set S601 on the test fixture to **RUN EEPROM TEST**.

Configure the PC or terminal serial communications parameters for 8 bits, no parity, one stop bit, at 9600 bps. Choose ASCII if more than one character set is supported by the terminal or program. No special escape codes are utilized by the test software, so most terminal emulation modes will work fine. VT-100 terminal emulation works well and is supported by most PC terminal programs.

If Hyperterminal is being used in a Windows 95 environment, the communications setup can be accomplished as follows:

1. Open the Hyperterminal folder by clicking **Start** in the lower left hand corner, clicking **Accessories**, and **Hyperterminal**.
2. Start Hyperterminal by clicking on the Hypertrm.exe icon.
3. Choose a name for the new "connection" being created. The "connection" is really just a collection of serial communications parameters which can be stored for later use.
4. Choose an icon for the connection and click **OK**.
5. On the next dialog box, select the desired COM port under the "Connect using". Most users will need to select either **Direct to Com 1** or **Direct to Com 2**. Click **OK**.

   The next dialog box is where the actual communication parameter setup takes place.
6. Set the **Bits per second** list box to **9600**.
7. Set the **Data bits** list box to **8**.
8. Set the **Parity** list box to **None**.
9. Set the **Stop bits** list box to **1**.
10. Set the **Flow control** list box to **None**.
11. Click **OK**.

The Hyperterminal main screen now appears, and is ready to display the test fixture output. When the test session is complete and Hyperterminal is closed, it will ask if the session should be saved. Answer **Yes** to this question so that Hyperterminal will save the connection, and create a new icon in the Hyperterminal folder. In the future, Hyperterminal should be started by clicking on this new icon so that the communications parameters do not have to be set up for every test session.

1. Connect P1 (TO PC) on the test fixture to the PC or terminal serial port. Plug the CPU to be tested into the fixture. Note that the component side the board should be facing the front of the fixture. The front of the fixture is labeled **FRONT OF BOARD**. This is important, as it is possible to plug the CPU into the fixture backwards.

   CAUTION Carefully observe the orientation of the board under test with respect to the test fixture. Make sure that the component side of the board under test faces toward the front of the test fixture (labeled **FRONT OF BOARD**). Failure to do so can result in damage to the fixture and the board under test.

2. Connect P2 (TO BOARD UNDER TEST) to J1 of the CPU assembly being tested using cable PN 8120907892.
3. Set the power supply output voltage to 28V. Turn the power supply off and connect it to J3 on the test fixture.
4. Turn on the power supply.
5. Turn on the fixture power supply using S1.
6. Follow the instructions that appear on the terminal screen.

If the board under test is good, the last line displayed on the terminal at the completion of the test will be **PASSED**. Otherwise **FAILED** will be displayed.

When a test fails, a message describing the failure will be displayed on the terminal and the program will not continue until the **CONTINUE** button is pressed on the test fixture.

To restart the test, press the reset switch (S101) on the board under test.

Since the EEPROM test takes quite a while to complete, it can be bypassed during troubleshooting by setting S602 on the test fixture to **BYPASS EEPROM TEST** and pressing the reset switch (S101 on the board under test). In this case, the program will always display ***** TEST FAILED ***** at the end of the test.

At the end of the test, all four LEDs at the top of the board under test should be lighting in sequence.

Before installing the CPU board back in a coupler, remove the test EPROM and put the standard EPROM PN 8120033299 back into the U301 position.

Remove PN 8120033698 from U105 position and reinstall PN 8120810198 into position U105.

6.1.2.2 Display Board Operation

The display board allows the user to view and modify the state of the relays in the coupler. The display board is little more than a collection of displays and switches that can be addressed serially by the coupler CPU. The display board occupies the right side of the Diagnostic Test Set case.

In order for the display board to be utilized, DIP switch number 7 of S201 on the coupler CPU must be in the UP (ON) position. However, with the switch in this position, the CPU clock is active at all times, and is easily heard by the radio receiver. For this reason, DIP switch number 7 of S201 should only be in the UP position during coupler diagnostics, and should be in the DOWN position during normal operation.

Turn the radio set off. Remove the coupler cover. Remove the inner cover. Set DIP switch number 7 of S201 on the coupler CPU to its UP position. Connect cable PN 8120907892 (DB9 Male to Male) between J1 of the CPU board (labeled **DISPLAY** on the inner cover) and J1 on the display board (labeled **TO COUPLER CPU**). Set the ON/OFF switch on the display board to **ON**. Turn the radio set on.

The display board now indicates the state of each relay in the coupler. It also shows the sum total capacitance or inductance values for each of the network elements.

At this point, the value of any network element can be modified by pressing the up or down buttons for that element. For instance, pressing **C IN UP** will add one increment of capacitance (about 5 pF) to the amount of Cin that is already active. Pressing the **C IN UP** button and holding it down will cause capacitance to be added to Cin continuously. The buttons for Lseries, Cout, and Lout work in a similar manner.

The red LEDs for each network component correspond to a relay. When a LED is lit, it indicates that the component associated with that relay is in use in the network. If the component is a capacitor, then the relay is closed. If the component is an inductor, then the relay is open unless it is the Lout bypass relay. The Lout bypass relays (K15 and K19 on the chassis) are in the bypass state (connected to the Normally Closed contact) when the **LOUT BYPASS** LED is illuminated.

The **HOME** button causes the coupler to go to a state in which all network elements are 0 pf or 0 µH.

The **TUNE/KW** button causes the coupler to switch the state of the RF detector. When the red **TUNE** LED is lit, the detector is switched into the RF path and the readings from the magnitude and phase detectors are displayed on the display board.

CAUTION	Never apply more than tune power to the coupler when the red **TUNE LED** is lit on the display board. Tune power is AM carrier power and is roughly 40 watts. Higher power levels will destroy the RF detector components.

A network solution can be arrived at by hand when the red **TUNE LED** is lit, and AM carrier power is applied by keying the radio in AM mode (*with the LPA-9600 kilowatt amplifier turned off*). When the magnitude and phase displays are as close to zero as possible, then the coupler is tuned.

The magnitude and phase displays show the magnitude and phase detector output values in millivolts.

When the green **KW** LED is lit, the RF detector is switched out of the RF path. The magnitude and phase detectors are no longer active, so the display board simply indicates "-----" on the magnitude and phase displays. It is safe to transmit at the 1000 watt power level in this state.

The **SAVE** and **RECALL** keys work in conjunction with the **CHANNEL** indicator on the display board. ***Note that the channel indicator does not indicate the channel the radio is on***. The channel indicator provides access to the coupler channel memory. To save a network solution for later use, dial in a channel number using the knobs below the channel indicator and press the **SAVE** button. This will save the network in that channel location in the coupler's memory. The network solution can be recalled at a later time in two ways. The first method is to set the radio to the desired channel number. The other method is to use the knobs below the channel indicator to dial in the desired channel, and then press the **RECALL** button.

The **CPU TUNE START** and **CPU TUNE STEP** keys are reserved for future use and are disabled.

6.1.2.3 Serial Breakout Board Operation

The Serial Breakout Board provides the user with the ability to see the steps the coupler took in arriving at a network solution. The Serial Breakout Board is installed on the left side of the Diagnostic Test Set case.

Table 6.1-4 lists the equipment to use the Serial Breakout section of the test set.

Table 6.1-4 Serial Breakout Equipment Required

Sunair Part No.	Description
1012900037	Cable Assy, DB25 Male to DB9 Female
8092500096	Cable Assy, LPA-9600 to Coupler
8120037189	Software, TuneView
CFE	PC running Windows 3.1 or later with an available serial port

This list assumes that there is an existing cable between the LPA-9600/LPA-9500 and the antenna coupler.

The TuneView software can be run directly from the distribution floppy, but it is preferable to have it resident on the hard drive. To install TuneView:

1. Insert the TuneView diskette into the floppy drive
2. Open a DOS window
3. Create a new directory (md\TuneView)
4. Change to that directory (cd\TuneView)
5. Copy the TuneView executable (copy a:TuneView.exe .)
6. Close the DOS window (exit)
7. Create a shortcut to the TuneView executable on the desktop.

Disconnect the control cable between the linear amplifier and the coupler at the amplifier end (J4 on the amplifier rear panel). Connect this cable to J2 on the Diagnostic Test Set (labeled **TO KILOWATT COUPLER**). Connect the other control cable (PN 8092500096) between J1 of the Diagnostic Test Set and J4 of the amplifier. Using the DB25 to DB9 cable PN 1012900037, connect the 25-pin end to J5 of the Diagnostic Test Set Serial Breakout Board. Connect the other end to the serial port of the PC running TuneView.

Start TuneView. The first time TuneView is run, it must be configured to use the COM port connected to the Serial Breakout Board. On the menu, click on **Settings**, and then on **Com Port**. This will bring up a dialog box that allows selection of the desired COM port. This information is stored on disk so that the correct COM port is selected the next time TuneView is run.

The TuneView main screen displays several parameters describing the most recent tune. These are listed in Table 6.1-5.

The magnitude and phase values for each network are plotted on the chart as a small red square. The center of the chart is magnitude=0 mV, phase=0 mV. This corresponds to a network input impedance of 50 ohms at 0 degrees. Positive phase values are plotted in the top half of the chart. Negative magnitude values are plotted on the right hand side of the chart. This is because the magnitude detector output is negative for impedances which have a magnitude greater than 50 ohms, and positive for impedances

which have a magnitude less than 50 ohms. Using this convention, the plot produced is similar to a Smith chart.

Table 6.1-5. TuneView Parameters

Term	Definition
Channel	The radio channel that was tuned.
Freq	The radio frequency that was tuned. This frequency is truncated to display megahertz only. For example, if the radio frequency was 6.99999 MHz, TuneView would show **6** under **Freq**.
Magoffset	The output of the magnitude detector in millivolts when the 50 ohm calibration load is switched in. This number is subtracted from all future readings of the detector, so minor detector imbalances over time, temperature, and frequency do not affect the network solution. If this number is greater than 250 or less than -250, the RF detector board should be adjusted to null the magnitude detector.
Phaseoffset	The output of the phase detector in millivolts when the 50 ohm calibration load is switched in. This number is subtracted from all future readings of the detector, so minor detector imbalances over time, temperature, and frequency do not affect the network solution. If this number is greater than 250 or less than -250, the RF detector board should be adjusted to null the phase detector.
Network #	This is the number of the attempt by the coupler to arrive at a network solution. Each network consists of a value of Cin, Lseries, Cout, and Lout. The magnitude and phase readings corresponding to this network are also displayed. The larger the network number, the later in the tune cycle that it occurred.
Cin	The input capacitance of the currently selected network. Each bit in the top number corresponds to a relay. If the bit is 1, then the corresponding relay is closed, making its associated Cin component active in the network. The bottom number is Cin in picofarads.
Lseries	The series inductance of the currently selected network. Each bit in the top number corresponds to a relay. If the bit is 1, then the corresponding relay is open, making its associated Lseries component active in the network. The bottom number is Lseries in microhenrys.
Cout	The output capacitance of the currently selected network. Each bit in the top number corresponds to a relay. If the bit is 1, then the corresponding relay is closed, making its associated Cout component active in the network. The bottom number is Cout in picofarads.
Lout	The output inductance of the currently selected network. If the bit is 1, then the corresponding relay is open, making its associated Lout component active in the network. The bottom number is Lout in microhenrys. If lout=0, then the Lout bypass relays (K15 and K19 on the chassis) are in the bypass state (connected to the Normally Closed contact).

The arrow keys control which network is displayed. The currently selected network is shown on the chart as the single blue square. All of the other attempts are shown as red squares. Pressing the **UP**

ARROW key moves to networks earlier in the tune cycle. Pressing the **DOWN ARROW** key moves to networks later in the tune cycle.

The **PAGE UP** key performs the same function as the **UP ARROW** key. The **PAGE DOWN** key performs the same function as the **DOWN ARROW** key.

The box at the bottom of the screen shows a log of the tuning attempts for the current session. For each tune attempt, a line is added showing the channel number and whether or not the tune was successful.

The currently displayed tune history can be saved to a file using the menu item **File**, and then **Save As**. This file can later be loaded by clicking **File**, then **Open**, and selecting the desired file.

6.1.2.4 BITE

The built in test function (BITE) of the coupler is initiated under the BITE menu on the radio, by the **CU-BITE** softkey. Pressing **CU-BITE** causes the radio to tune the coupler on four dedicated BITE channels, shown below:

Channel	Frequency
250	1.75 MHz
251	5.75 MHz
252	16.75 MHz
253	29.75 MHz

The coupler is aware that a BITE test should be performed because these channels are only used for BITE.

After a tune solution is found, but before sending a READY signal back to the radio, the coupler checks a portion of the relays. This check consists of changing the state of each relay, one at a time, and determining if this change makes a sufficient difference in the readings of the magnitude and phase detectors.

If the coupler does not detect a large enough change in the magnitude and phase detector readings as it changes the state of each relay, it reports a tuning FAULT signal back to the radio. If the coupler does detect a large enough change in the magnitude and phase detector readings, it reports a READY signal back to the radio.

When a CU-BITE failure occurs, it is necessary to use TuneView and the Serial Breakout Board to find out which components the coupler determined to be faulty. Connect the Serial Breakout Board and start TuneView as detailed in Section 6.1.2.3. Run the CU-BITE test again. The list box at the bottom of the TuneView screen will indicate which components need attention.

The list box also contains information about each relay check. The state of all of the relays in shown along with the magnitude and phase difference that was generated by toggling the state of one relay.

The small value components are not checked individually. Rather, the three smallest Cin values (C1, C2, and C3 on the Input Capacitor board) are checked as a group and the three smallest Lseries values (L9, L1, and L2 on the chassis) are checked as a group. The coupler switches the three smallest Cin components out of the network and takes a magnitude and phase reading. It then switches the three smallest components into the network and takes another magnitude and phase reading. As long as these two readings have a large enough difference between them, all of the components in the group are assumed to be working properly. The three smallest Lseries values are checked in the same way.

PC ASSEMBLY, TEST FIXTURE, CU-9150 CPU

	TEST FIXTURE, CU-9150 CPU	8120030036
C1	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C2	CAP. 22UF, 15V	0281690006
C3	CAP. 22UF, 15V	0281690006
C4	CAP. 47UF, 20V	0281700001
C5	CAP. 10UF, 20V	1007290005
C6	CAP. 47UF, 20V	0281700001
C7	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C8	CAP. 1UF, 35V	0281660000
C9	CAP. 0.1UF, 50V, X7R	1011180014
C10	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C11	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C12	CAP. 0.1UF, 50V, X7R	1011180014
C13	CAP. 68UF, 15V	0296540005
C201	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C202	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C203	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C309	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C310	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C401	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C402	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C403	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C404	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C501	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C502	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C601	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C602	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C603	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C604	CAP. 0.01UF, 50V, X7R, 20%	0281730008
CR1	DIODE, LED, RED MV5754A	1004350023
CR2	DIODE, RECTIFIER 1N4004	0405180004
CR3	DIODE, RECTIFIER 1N4004	0405180004
F1	FUSE, MDL, 3 AMP, 32V	0896660001
J1	CONNECTOR, PCB, 100 PIN	1013190025
J2	CONNECTOR, DB-9, FEMALE RT ANG	1012550028
J3	CONNECTOR, PC, 2 PIN HEADER	1008060011
K201	RELAY, PHOTOMOS, 40V,2A	1012550036
K202	RELAY, PHOTOMOS, 40V,2A	1012550036
K203	RELAY, PHOTOMOS, 40V,2A	1012550036
K204	RELAY, PHOTOMOS, 40V,2A	1012550036
K205	RELAY, PHOTOMOS, 40V,2A	1012550036
K206	RELAY, PHOTOMOS, 40V,2A	1012550036
K207	RELAY, PHOTOMOS, 40V,2A	1012550036
K208	RELAY, PHOTOMOS, 40V,2A	1012550036
K209	RELAY, PHOTOMOS, 40V,2A	1012550036
K210	RELAY, PHOTOMOS, 40V,2A	1012550036
K211	RELAY, PHOTOMOS, 40V,2A	1012550036
K212	RELAY, PHOTOMOS, 40V,2A	1012550036
K213	RELAY, PHOTOMOS, 40V,2A	1012550036
K214	RELAY, PHOTOMOS, 40V,2A	1012550036
K215	RELAY, PHOTOMOS, 40V,2A	1012550036
K216	RELAY, PHOTOMOS, 40V,2A	1012550036
K301	RELAY, PHOTOMOS, 40V,2A	1012550036
K302	RELAY, PHOTOMOS, 40V,2A	1012550036
K303	RELAY, PHOTOMOS, 40V,2A	1012550036
K304	RELAY, PHOTOMOS, 40V,2A	1012550036
K305	RELAY, PHOTOMOS, 40V,2A	1012550036
K306	RELAY, PHOTOMOS, 40V,2A	1012550036
K307	RELAY, PHOTOMOS, 40V,2A	1012550036
K308	RELAY, PHOTOMOS, 40V,2A	1012550036
K309	RELAY, PHOTOMOS, 40V,2A	1012550036
K310	RELAY, PHOTOMOS, 40V,2A	1012550036
K311	RELAY, PHOTOMOS, 40V,2A	1012550036
K312	RELAY, PHOTOMOS, 40V,2A	1012550036
K313	RELAY, PHOTOMOS, 40V,2A	1012550036
K314	RELAY, PHOTOMOS, 40V,2A	1012550036
K315	RELAY, PHOTOMOS, 40V,2A	1012550036
K316	RELAY, PHOTOMOS, 40V,2A	1012550036
K401	RELAY, PHOTOMOS, 40V,2A	1012550036
K402	RELAY, PHOTOMOS, 40V,2A	1012550036
K403	RELAY, PHOTOMOS, 40V,2A	1012550036
K404	RELAY, PHOTOMOS, 40V,2A	1012550036
K405	RELAY, PHOTOMOS, 40V,2A	1012550036
K406	RELAY, PHOTOMOS, 40V,2A	1012550036
K407	RELAY, PHOTOMOS, 40V,2A	1012550036
K408	RELAY, PHOTOMOS, 40V,2A	1012550036
K409	RELAY, PHOTOMOS, 40V,2A	1012550036
K410	RELAY, PHOTOMOS, 40V,2A	1012550036
K411	RELAY, PHOTOMOS, 40V,2A	1012550036
K412	RELAY, PHOTOMOS, 40V,2A	1012550036
K413	RELAY, PHOTOMOS, 40V,2A	1012550036
K414	RELAY, PHOTOMOS, 40V,2A	1012550036
K415	RELAY, PHOTOMOS, 40V,2A	1012550036
K416	RELAY, PHOTOMOS, 40V,2A	1012550036
K417	RELAY, PHOTOMOS, 40V,2A	1012550036
K418	RELAY, PHOTOMOS, 40V,2A	1012550036
K419	RELAY, PHOTOMOS, 40V,2A	1012550036
K420	RELAY, PHOTOMOS, 40V,2A	1012550036
K421	RELAY, PHOTOMOS, 40V,2A	1012550036
K422	RELAY, PHOTOMOS, 40V,2A	1012550036
K423	RELAY, PHOTOMOS, 40V,2A	1012550036
K424	RELAY, PHOTOMOS, 40V,2A	1012550036
K501	RELAY, PHOTOMOS, 40V,2A	1012550036
K502	RELAY, PHOTOMOS, 40V,2A	1012550036
K503	RELAY, PHOTOMOS, 40V,2A	1012550036
K504	RELAY, PHOTOMOS, 40V,2A	1012550036
K505	RELAY, PHOTOMOS, 40V,2A	1012550036
K506	RELAY, PHOTOMOS, 40V,2A	1012550036
K507	RELAY, PHOTOMOS, 40V,2A	1012550036
K508	RELAY, PHOTOMOS, 40V,2A	1012550036
K601	RELAY, PHOTOMOS, 40V,2A	1012550036
K602	RELAY, PHOTOMOS, 40V,2A	1012550036
K603	RELAY, PHOTOMOS, 40V,2A	1012550036
K604	RELAY, PHOTOMOS, 40V,2A	1012550036
K605	RELAY, PHOTOMOS, 40V,2A	1012550036
K606	RELAY, PHOTOMOS, 40V,2A	1012550036
K607	RELAY, PHOTOMOS, 40V,2A	1012550036
K608	RELAY, PHOTOMOS, 40V,2A	1012550036
P1	CONNECTOR, DB-9, FEMALE RT ANG	1012550028
R1	RESISTOR 4.7K, 5%, 1/4W	0170770001
R2	RESISTOR 1K, 5%, 1/8W	1010801023
R3	RESISTOR 27K, 5%, 1/8W	1010802739
R4	RESISTOR 27K, 5%, 1/8W	1010802739
R5	RESISTOR 2.2K, 5%, 1/8W	1010802224
R6	RESISTOR 22K, 5%, 1/8W	1010802232
R7	RESISTOR 3.9K, 5%, 1/8W	1010803921
R201	RESISTOR 680, 5%, 1/8W	1010806815
R202	RESISTOR 680, 5%, 1/8W	1010806815
R203	RESISTOR 680, 5%, 1/8W	1010806815
R204	RESISTOR 680, 5%, 1/8W	1010806815
R205	RESISTOR 680, 5%, 1/8W	1010806815
R206	RESISTOR 680, 5%, 1/8W	1010806815
R207	RESISTOR 680, 5%, 1/8W	1010806815
R208	RESISTOR 680, 5%, 1/8W	1010806815
R209	RESISTOR 680, 5%, 1/8W	1010806815
R210	RESISTOR 680, 5%, 1/8W	1010806815
R211	RESISTOR 680, 5%, 1/8W	1010806815
R212	RESISTOR 680, 5%, 1/8W	1010806815
R213	RESISTOR 680, 5%, 1/8W	1010806815
R214	RESISTOR 680, 5%, 1/8W	1010806815
R215	RESISTOR 680, 5%, 1/8W	1010806815
R216	RESISTOR 680, 5%, 1/8W	1010806815
R217	RESISTOR 470, 10%, 2W	0163580006
R218	RESISTOR 10K, 5%, 1/8W	1010801031

Figure 6.1-1. PC Assembly, Test Fixture, CU-9150 CPU
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PC ASSEMBLY, TEST FIXTURE, CU-9150 CPU (Continued)

R219	RESISTOR10K, 5%, 1/8W	1010801031
R220	RESISTOR470, 10%,2W	0163580006
R221	RESISTOR470, 10%,2W	0163580006
R222	RESISTOR470, 10%,2W	0163580006
R223	RESISTOR470, 10%,2W	0163580006
R224	RESISTOR470, 10%,2W	0163580006
R225	RESISTOR470, 10%,2W	0163580006
R301	RESISTOR680, 5%, 1/8W	1010806815
R302	RESISTOR680, 5%, 1/8W	1010806815
R303	RESISTOR680, 5%, 1/8W	1010806815
R304	RESISTOR680, 5%, 1/8W	1010806815
R305	RESISTOR680, 5%, 1/8W	1010806815
R306	RESISTOR680, 5%, 1/8W	1010806815
R307	RESISTOR680, 5%, 1/8W	1010806815
R308	RESISTOR680, 5%, 1/8W	1010806815
R309	RESISTOR680, 5%, 1/8W	1010806815
R310	RESISTOR680, 5%, 1/8W	1010806815
R311	RESISTOR680, 5%, 1/8W	1010806815
R312	RESISTOR680, 5%, 1/8W	1010806815
R313	RESISTOR680, 5%, 1/8W	1010806815
R314	RESISTOR680, 5%, 1/8W	1010806815
R315	RESISTOR680, 5%, 1/8W	1010806815
R316	RESISTOR680, 5%, 1/8W	1010806815
R401	RESISTOR680, 5%, 1/8W	1010806815
R402	RESISTOR680, 5%, 1/8W	1010806815
R403	RESISTOR680, 5%, 1/8W	1010806815
R404	RESISTOR680, 5%, 1/8W	1010806815
R405	RESISTOR680, 5%, 1/8W	1010806815
R406	RESISTOR680, 5%, 1/8W	1010806815
R407	RESISTOR680, 5%, 1/8W	1010806815
R408	RESISTOR680, 5%, 1/8W	1010806815
R409	RESISTOR680, 5%, 1/8W	1010806815
R410	RESISTOR680, 5%, 1/8W	1010806815
R411	RESISTOR680, 5%, 1/8W	1010806815
R412	RESISTOR680, 5%, 1/8W	1010806815
R413	RESISTOR680, 5%, 1/8W	1010806815
R414	RESISTOR680, 5%, 1/8W	1010806815
R415	RESISTOR680, 5%, 1/8W	1010806815
R416	RESISTOR680, 5%, 1/8W	1010806815
R417	RESISTOR680, 5%, 1/8W	1010806815
R418	RESISTOR680, 5%, 1/8W	1010806815
R419	RESISTOR680, 5%, 1/8W	1010806815
R420	RESISTOR680, 5%, 1/8W	1010806815
R421	RESISTOR 680, 5%, 1/8W	1010806815
R422	RESISTOR 680, 5%, 1/8W	1010806815
R423	RESISTOR 680, 5%, 1/8W	1010806815
R424	RESISTOR 680, 5%, 1/8W	1010806815
R425	RESISTOR 470, 10%, 2W	0163580006
R426	RESISTOR 10K, 5%, 1/8W	1010801031
R427	RESISTOR 10K, 5%, 1/8W	1010801031
R428	RESISTOR 470, 10%, 2W	0163580006
R429	RESISTOR 470, 10%, 2W	0163580006
R501	RESISTOR 680, 5%, 1/8W	1010806815
R502	RESISTOR 680, 5%, 1/8W	1010806815
R503	RESISTOR 680, 5%, 1/8W	1010806815
R504	RESISTOR 680, 5%, 1/8W	1010806815
R505	RESISTOR 680, 5%, 1/8W	1010806815
R506	RESISTOR 680, 5%, 1/8W	1010806815
R507	RESISTOR 680, 5%, 1/8W	1010806815
R508	RESISTOR 680, 5%, 1/8W	1010806815
R509	RESISTOR 680, 5%, 1/8W	1010806815
R510	RESISTOR 680, 5%, 1/8W	1010806815
R511	RESISTOR 680, 5%, 1/8W	1010806815
R512	RESISTOR 680, 5%, 1/8W	1010806815
R513	RESISTOR 680, 5%, 1/8W	1010806815
R514	RESISTOR 680, 5%, 1/8W	1010806815
R515	RESISTOR 680, 5%, 1/8W	1010806815
R516	RESISTOR 680, 5%, 1/8W	1010806815
R517	RESISTOR 10K, 5%, 1/8W	1010801031
R518	RESISTOR 10K, 5%, 1/8W	1010801031
R519	RESISTOR 10K, 5%, 1/8W	1010801031
R520	RESISTOR 10K, 5%, 1/8W	1010801031
R601	RESISTOR 680, 5%, 1/8W	1010806815
R602	RESISTOR 680, 5%, 1/8W	1010806815
R603	RESISTOR 680, 5%, 1/8W	1010806815
R604	RESISTOR 680, 5%, 1/8W	1010806815
R605	RESISTOR 680, 5%, 1/8W	1010806815
R606	RESISTOR 680, 5%, 1/8W	1010806815
R607	RESISTOR 680, 5%, 1/8W	1010806815
R608	RESISTOR 680, 5%, 1/8W	1010806815
R609	RESISTOR 1.8K, 5%, 1/8W	1010801821
R610	RESISTOR 1K, 5%, 1/8W	1010801023
R611	RESISTOR 5.6K, 5%, 1/8W	1010805622
R612	RESISTOR 1K, 5%, 1/8W	1010801023
R613	RESISTOR 1K, 5%, 1/8W	1010801023
R614	RESISTOR 0.0, 0%, 1/4W	1011600021
R615	RESISTOR 0.0, 0%, 1/4W	1011600021
R616	RESISTOR 0.0, 0%, 1/4W	1011600021
R617	RESISTOR 0.0, 0%, 1/4W	1011600021
R618	RESISTOR 0.0, 0%, 1/4W	1011600021
R619	RESISTOR 0.0, 0%, 1/4W	1011600021
R620	RESISTOR 0.0, 0%, 1/4W	1011600021
R621	RESISTOR 0.0, 0%, 1/4W	1011600021
R622	RESISTOR 0.0, 0%, 1/4W	1011600021
R623	RESISTOR 4.7K, 5%, 1/8W	1010804723
R624	RESISTOR 4.7K, 5%, 1/8W	1010804723
S116	SWITCH, TOGGLE, SPDT	1011790033
S601	SWITCH, TOGGLE, SPDT	1011790033
S602	SWITCH, PUSH BUTTON, SQUARE	1013270029
U1	IC DIGITAL, MAX 490	1013240022
U2	IC. DIGITAL, ICL232	1010510011
U201	IC,DIGITAL, UCN5842A	1012530035
U202	IC,DIGITAL, UCN5842A	1012530035
U203	IC. LINEAR, LM2903	1011410036
U301	IC,DIGITAL, UCN5842A	1012530035
U302	IC,DIGITAL, UCN5842A	1012530035
U401	IC. LINEAR, LM2903	1011410036
U402	IC,DIGITAL, UCN5842A	1012530035
U403	IC,DIGITAL, UCN5842A	1012530035
U404	IC,DIGITAL, UCN5842A	1012530035
U501	IC,DIGITAL, UCN5842A	1012530035
U502	IC,DIGITAL, UCN5842A	1012530035
U601	IC,DIGITAL, UCN5842A	1012530035
U602	IC DIGITAL 74HC589	1013250028
U603	IC DIGITAL 74HC589	1013250028
U604	IC. DIGITAL 74HC04	1010280023
U606	IC. LINEAR LM340T5	0448600005
XJ3	CONNECTOR, BLOCK, 2 PIN FEM	1008060038
	FUSECLIP, PC MOUNT	0534610005
	BACKPLANE, CU-9150 CPU FIXTURE	8120031806
	EPROM W/CU9150 CPU TF SOFTWARE	8120034091

Figure 6.1-1. PC Assembly, Test Fixture, CU-9150 CPU
(Page 2 of 9)

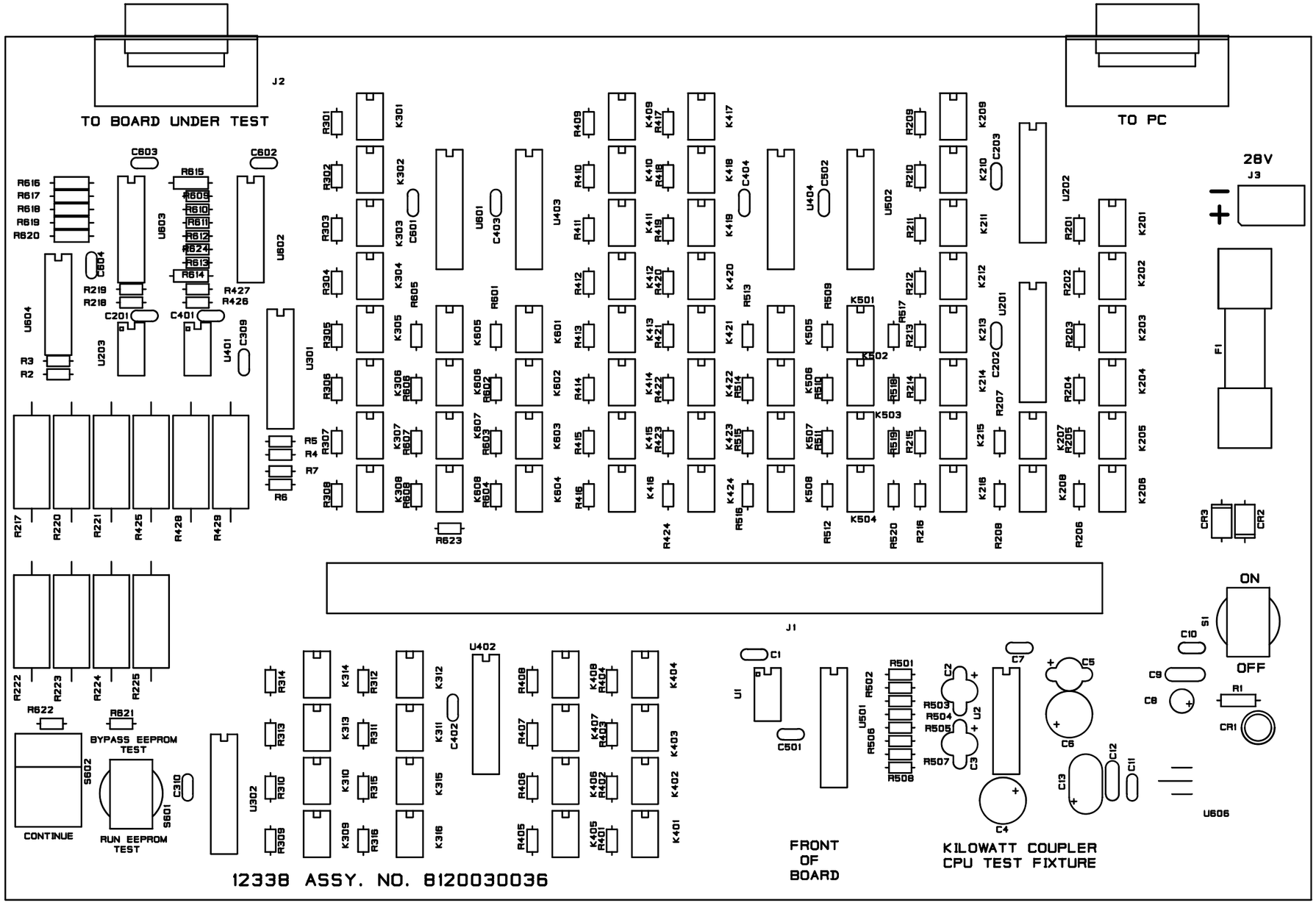

Figure 6.1-1. PC Assembly, Test Fixture, CU-9150 CPU
(Page 3 of 9)

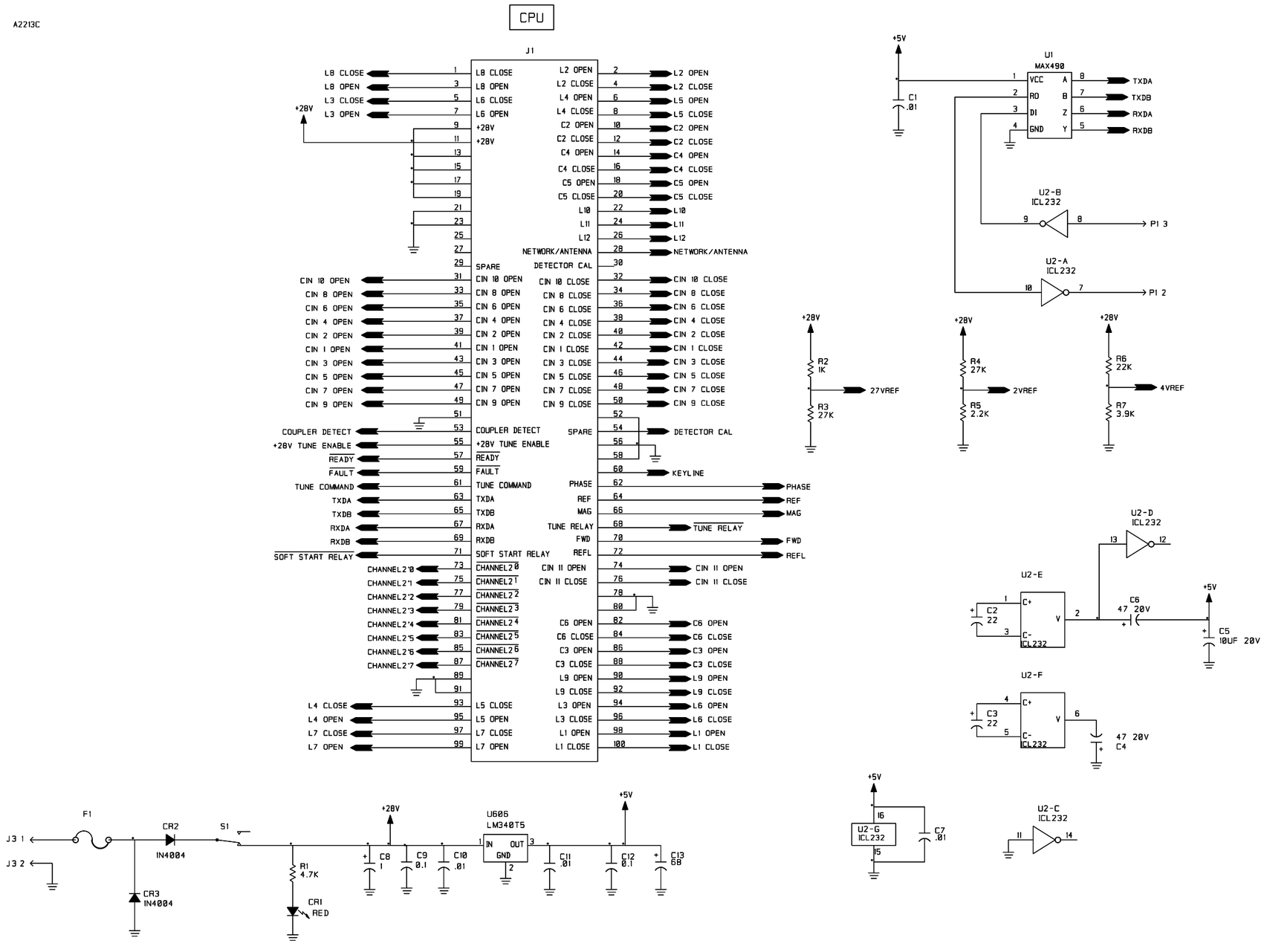

Figure 6.1-1. PC Assembly, Test Fixture, CU-9150 CPU
(Page 4 of 9)

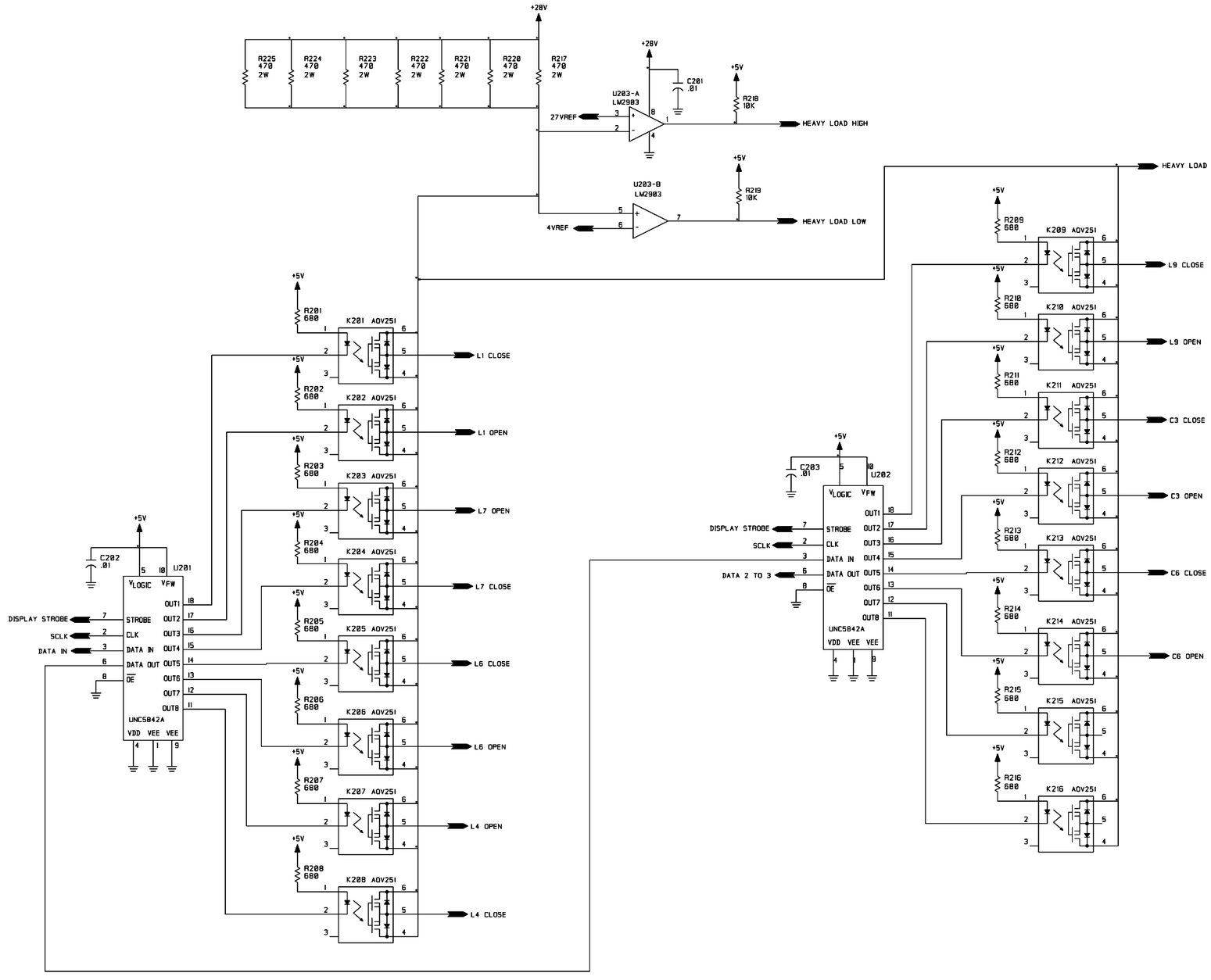

Figure 6.1-1. PC Assembly, Test Fixture, CU-9150 CPU
(Page 5 of 9)

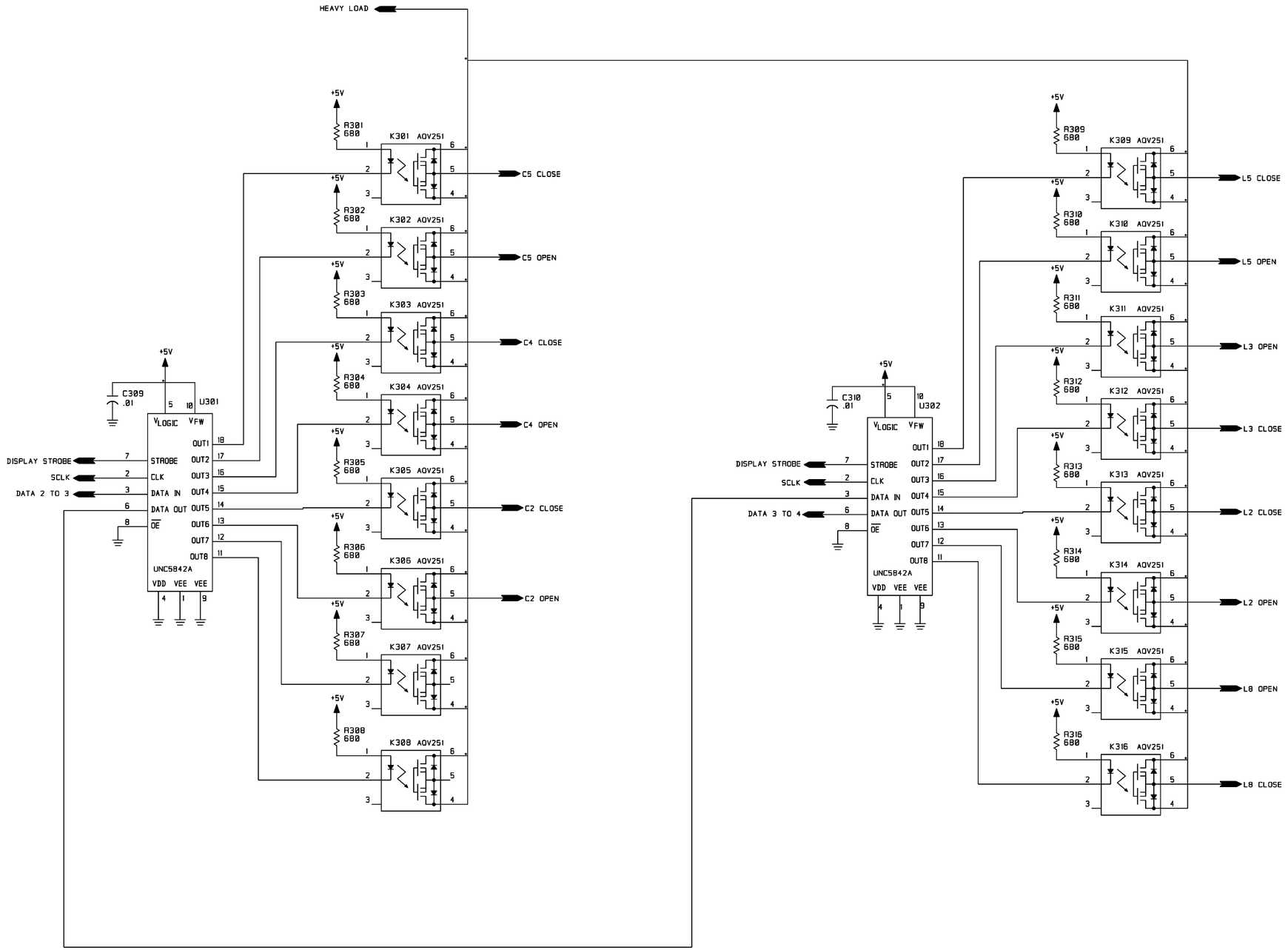

Figure 6.1-1. PC Assembly, Test Fixture, CU-9150 CPU
(Page 6 of 9)

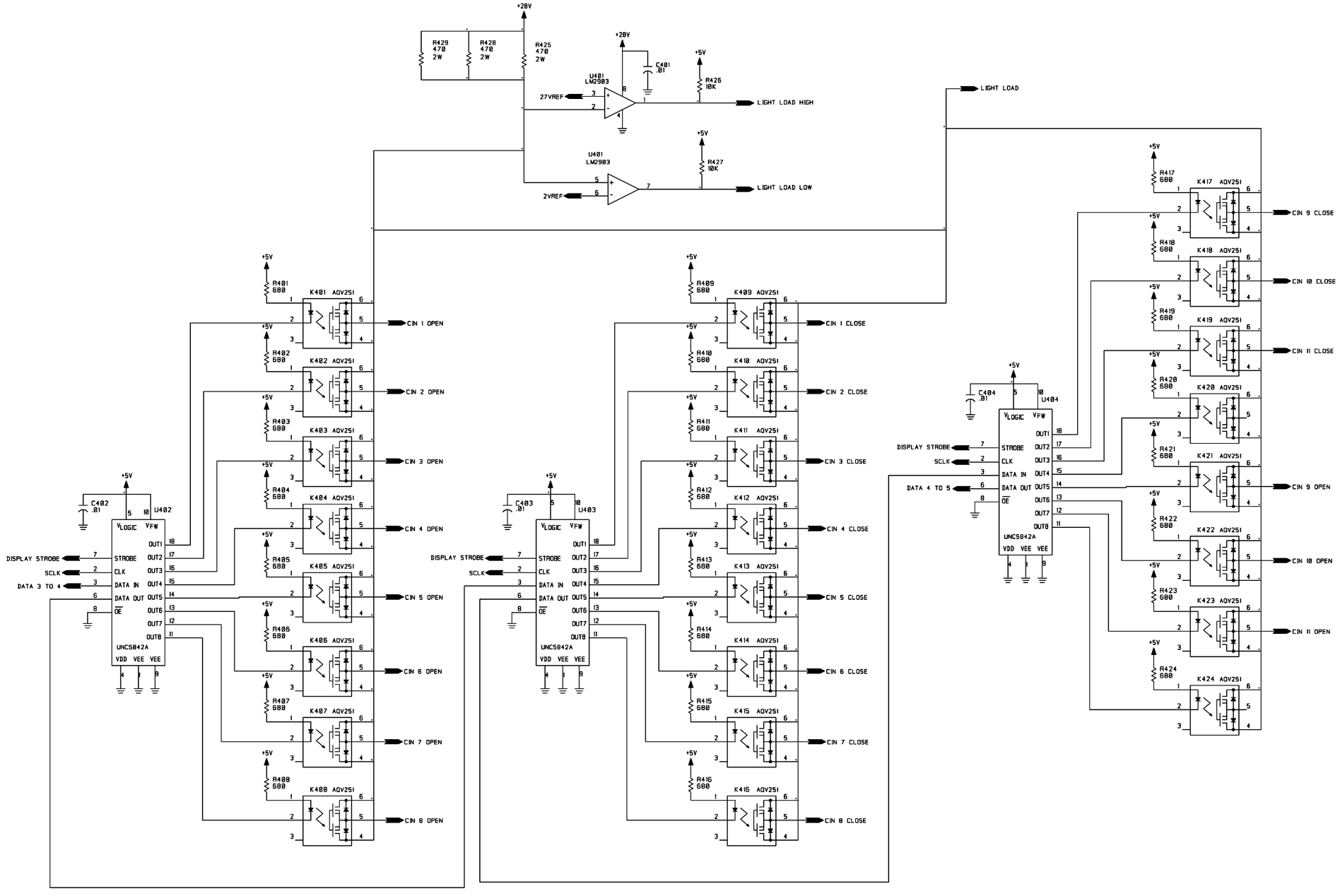

Figure 6.1-1. PC Assembly, Test Fixture, CU-9150 CPU
(Page 7 of 9)

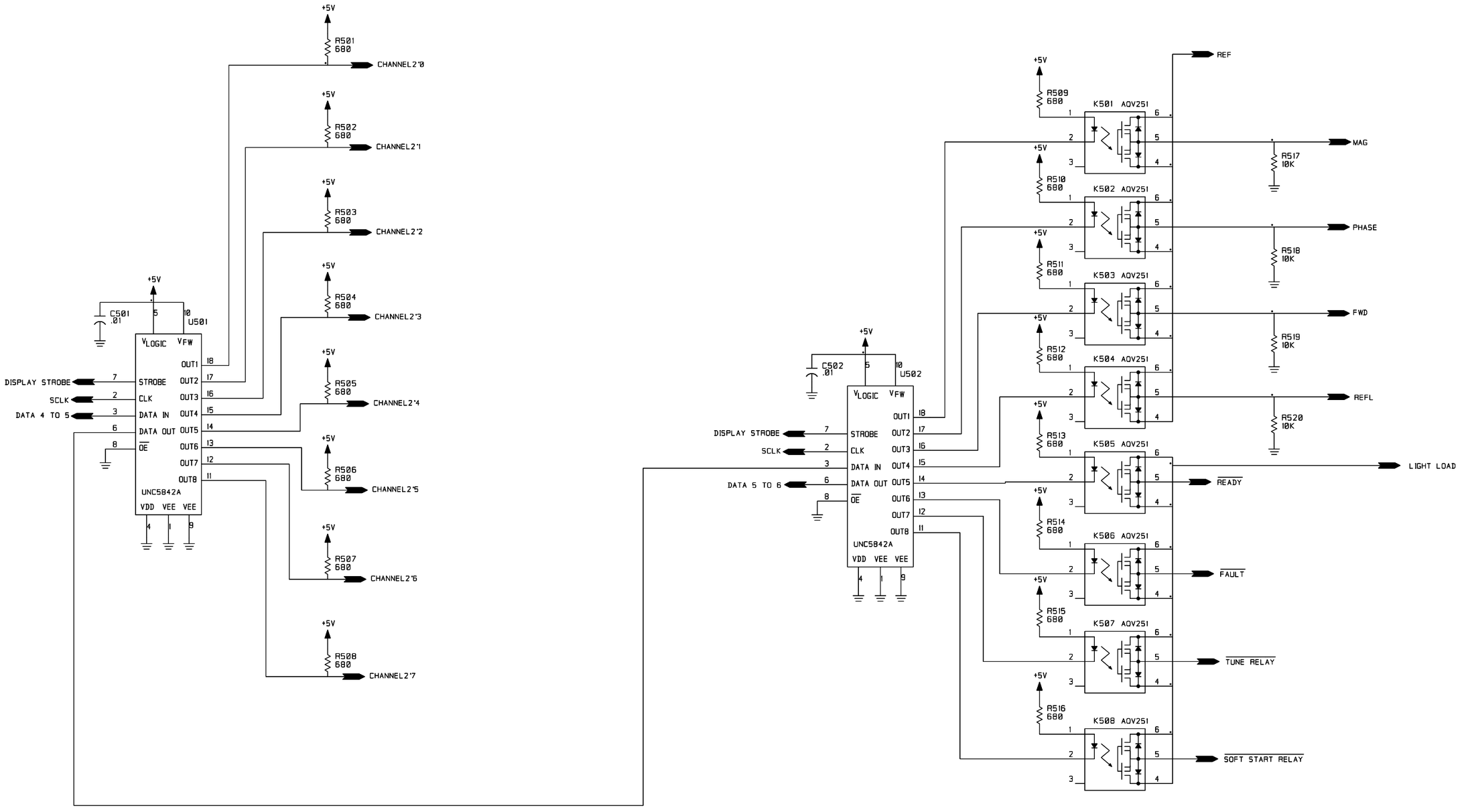

Figure 6.1-1. PC Assembly, Test Fixture, CU-9150 CPU
(Page 8 of 9)

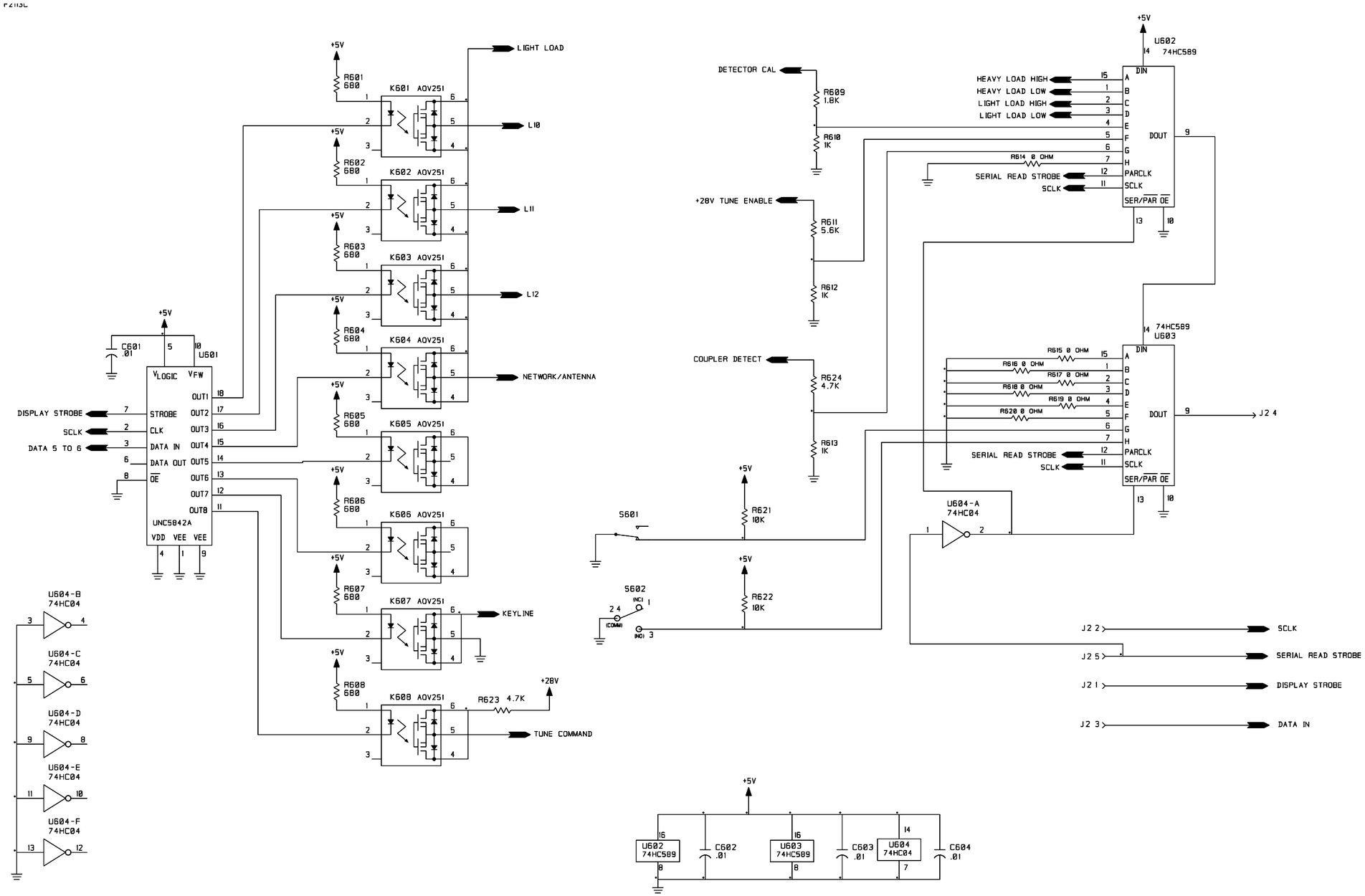

Figure 6.1-1. PC Assembly, Test Fixture, CU-9150 CPU
(Page 9 of 9)

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PC ASSEMBLY, SERIAL BREAKOUT BOARD

	PC ASSY,SERIAL BREAKOUT	8120037090
C1	CAP. 1UF, 35V	0281660000
C2	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C3	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C4	CAP. 68UF, 15V	0296540005
C5	CAP. 22UF, 15V	0281690006
C6	CAP. 47UF, 20V	0281700001
C7	CAP. 10UF, 20V	1007290005
C8	CAP. 22UF, 15V	0281690006
C9	CAP. 47UF, 20V	0281700001
C10	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C11	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C12	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C13	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C14	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C15	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C16	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C17	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C18	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C19	CAP. 0.01UF, 50V, X7R, 20%	0281730008
J1	CONNECTOR, POWER, 37 PIN ROUND	1009330004
J2	CONNECTOR, POWER, 24 PIN ROUND	1008320013
J3	CONNECTOR, POWER, 39 PIN FEM	1012920038
J5	CONNECTOR, DB-25 STRAIGHT, FEM	1012780031
L1	INDUCTOR, MOLDED, 10UH, 5%	0650240006
L2	INDUCTOR, MOLDED, 8.2UH, 5%	0652060005
L3	INDUCTOR, MOLDED, 8.2UH, 5%	0652060005
L4	INDUCTOR, MOLDED, 8.2UH, 5%	0652060005
L5	INDUCTOR, MOLDED, 8.2UH, 5%	0652060005
R1	RESISTOR 560, 5%, 1/8W	1010805614
U1	IC. LINEAR LM340T5	0448600005
U2	IC DIGITAL, MAX 490	1013240022
U3	IC. DIGITAL ICL232	1010510011

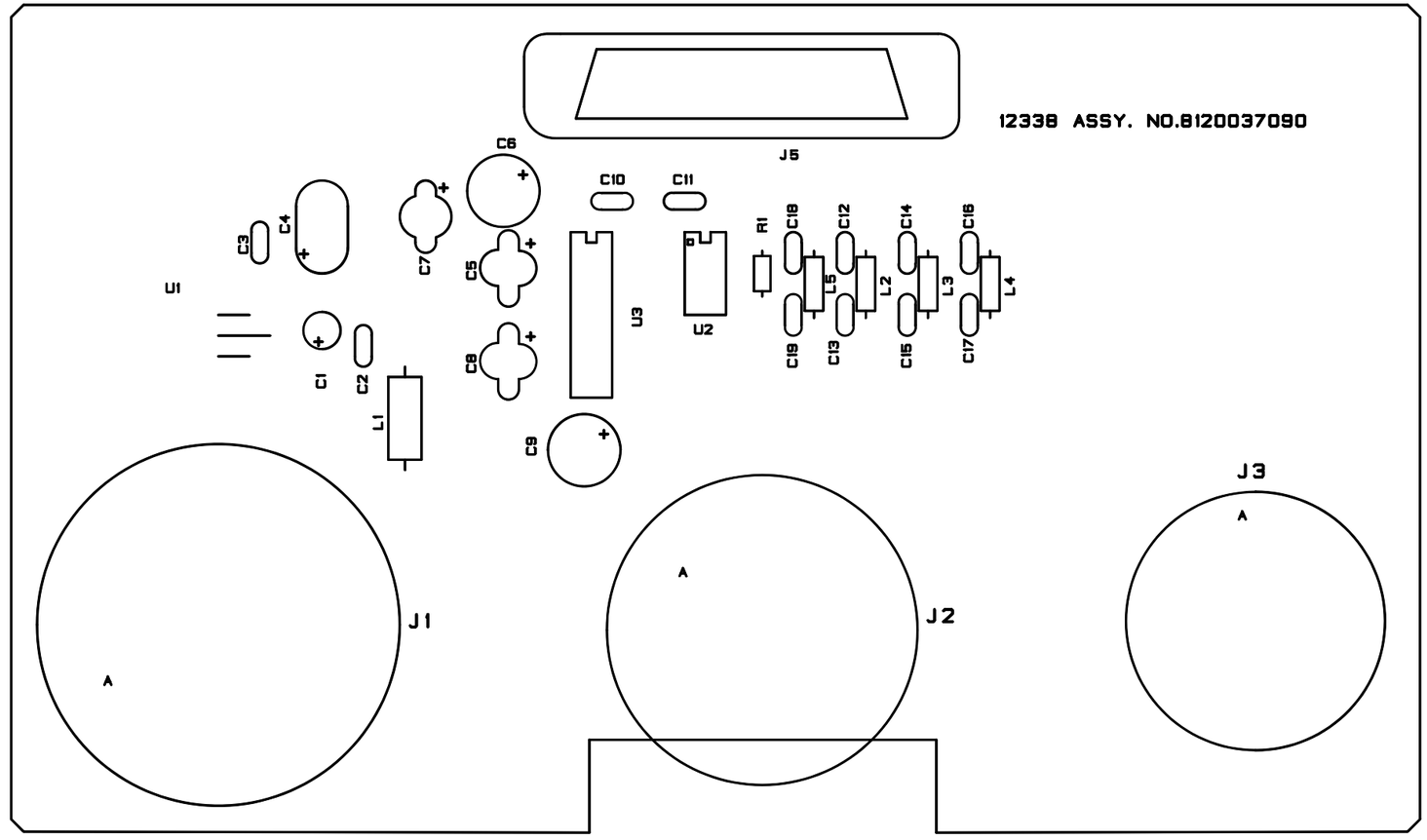

Figure 6.1-2. PC Assembly, Serial Breakout Board
(Page 1 of 2)

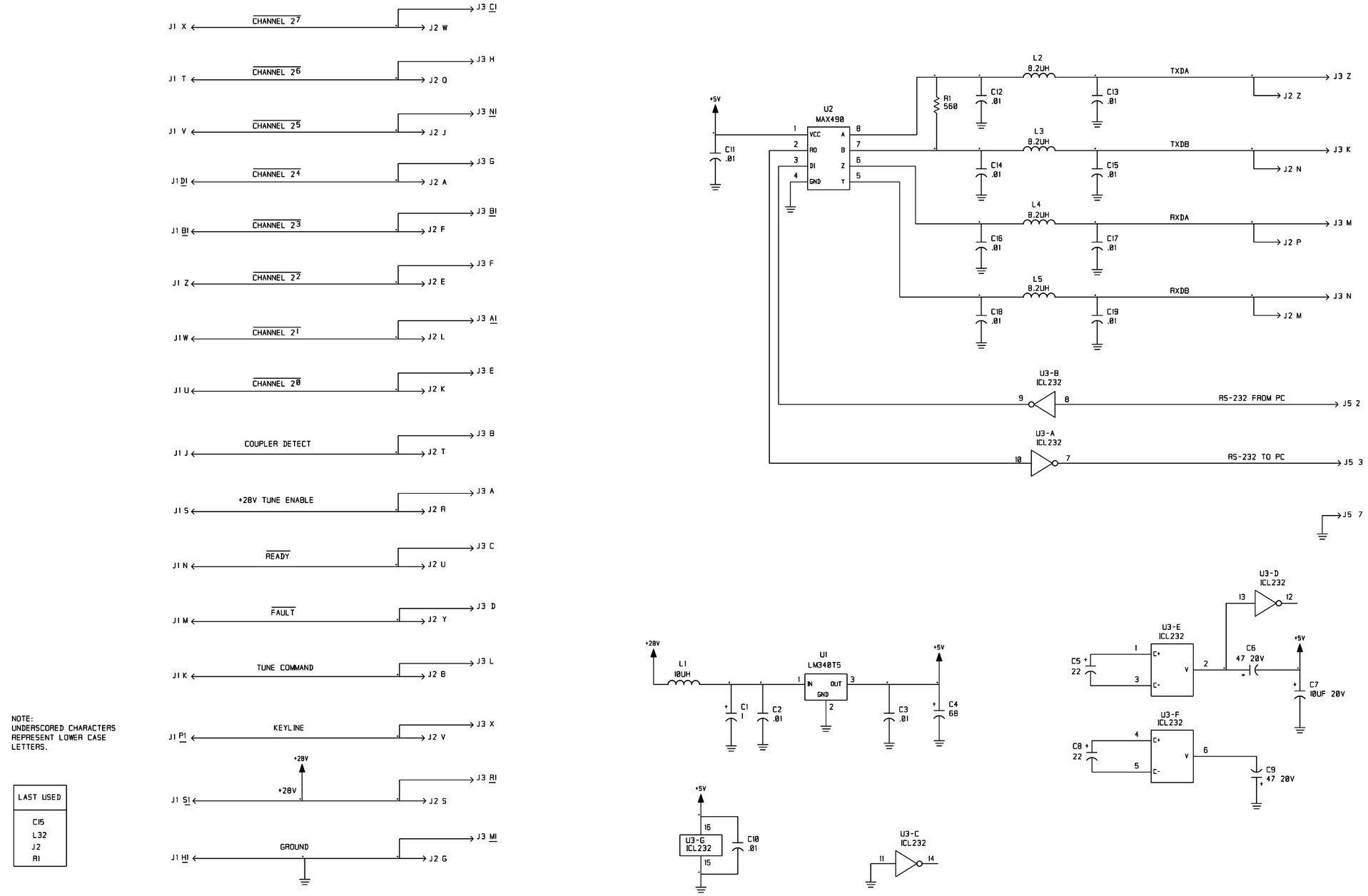

Figure 6.1-2. PC Assembly, Serial Breakout Board
(Page 2 of 2)

PC ASSEMBLY, DISPLAY BOARD

	PC ASSY, DISPLAY BOARD	8120039092
C101	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C102	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C103	CAP. 0.1UF, 50V, X7R	1011180014
C104	CAP. 0.1UF, 50V, X7R	1011180014
C113	CAP. 47UF, 35V	0282190007
C114	CAP. 1000UF, 35V, 105C	1011420031
C115	CAP. 0.1UF, 50V, X7R	1011180014
C118	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C119	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C120	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C121	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C122	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C123	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C201	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C202	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C203	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C204	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C205	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C206	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C207	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C301	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C302	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C303	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C304	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C305	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C306	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C401	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C402	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C403	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C404	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C501	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C502	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C503	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C504	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C601	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C602	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C603	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C604	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C605	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C701	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C702	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C703	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C704	CAP. 0.01UF, 50V, X7R, 20%	0281730008
C705	CAP. 0.01UF, 50V, X7R, 20%	0281730008
CR101	DIODE, RECTIFIER 1N5822	1010630032
CR102	DIODE, ZENER 1N5343B	1003060005
CR201	DIODE, LED, RED MV5754A	1004350023
CR202	DIODE, LED, RED MV5754A	1004350023
CR203	DIODE, LED, RED MV5754A	1004350023
CR204	DIODE, LED, RED MV5754A	1004350023
CR205	DIODE, LED, RED MV5754A	1004350023
CR206	DIODE, LED, RED MV5754A	1004350023
CR207	DIODE, LED, RED MV5754A	1004350023
CR208	DIODE, LED, RED MV5754A	1004350023
CR209	DIODE, LED, RED MV5754A	1004350023
CR210	DIODE, LED, RED MV5754A	1004350023
CR211	DIODE, LED, RED MV5754A	1004350023
CR301	DIODE, LED, RED MV5754A	1004350023
CR302	DIODE, LED, RED MV5754A	1004350023
CR303	DIODE, LED, RED MV5754A	1004350023
CR304	DIODE, LED, RED MV5754A	1004350023
CR305	DIODE, LED, RED MV5754A	1004350023
CR306	DIODE, LED, RED MV5754A	1004350023
CR307	DIODE, LED, RED MV5754A	1004350023
CR308	DIODE, LED, RED MV5754A	1004350023
CR309	DIODE, LED, RED MV5754A	1004350023
CR401	DIODE, LED, RED MV5754A	1004350023
CR402	DIODE, LED, RED MV5754A	1004350023
CR403	DIODE, LED, RED MV5754A	1004350023
CR404	DIODE, LED, RED MV5754A	1004350023
CR405	DIODE, LED, RED MV5754A	1004350023
CR406	DIODE, LED, RED MV5754A	1004350023
CR407	DIODE, LED, GREEN MV5454A	1004350015
CR501	DIODE, LED, RED MV5754A	1004350023
CR502	DIODE, LED, RED MV5754A	1004350023
CR503	DIODE, LED, RED MV5754A	1004350023
CR504	DIODE, LED, RED MV5754A	1004350023
DSP101	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP102	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP201	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP202	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP203	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP204	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP205	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP301	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP302	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP303	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP304	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP401	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP402	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP403	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP501	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP502	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP503	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP601	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP602	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP603	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP604	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP605	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP701	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP702	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP703	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP704	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
DSP705	DIODE, LED, 7 SEGMENT, .4 IN	1013300025
J1	CONNECTOR, DB-9, STRAIGHT, FEM	10127770036
L102	INDUCTOR, MOLDED, 1.0UH, 5%	0648360008
L107	INDUCTOR, TOROID, 150UH	1010650033
L108	INDUCTOR, MOLDED, 0.12UH, 5%	1011500027
R101	RESISTOR 1.65K, 1%, 1/8W	1008490032
R102	RESISTOR 1K, 1%, 1/8W	1011380005
RP201	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP202	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP203	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP204	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP205	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP206	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP207	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP208	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP209	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP210	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP211	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP212	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP213	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP214	RES NTWK 10 PIN SIP 10K COM	1006130021
RP215	RES NTWK 10 PIN SIP 10K COM	1006130021
RP216	RES NTWK 10 PIN SIP 10K COM	1006130021
RP217	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP218	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP219	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP220	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP301	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP302	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP303	RES NTWK 8 PIN SIP 68 ISO	1006580026

Figure 6.1-3. PC Assembly, Display Board
(Page 1 of 10)

PC ASSEMBLY, DISPLAY BOARD (Continued)

RP304	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP305	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP306	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP307	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP308	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP309	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP310	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP311	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP401	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP402	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP403	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP404	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP405	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP406	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP407	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP408	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP501	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP502	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP503	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP504	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP505	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP506	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP507	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP601	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP602	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP603	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP604	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP605	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP606	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP607	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP608	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP609	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP610	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP701	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP702	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP703	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP704	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP705	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP706	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP707	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP708	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP709	RES NTWK 8 PIN SIP 68 ISO	1006580026
RP710	RES NTWK 8 PIN SIP 68 ISO	1006580026

S101	SWITCH, PUSH BUTTON, SQUARE	1013270029
S102	SWITCH, PUSH BUTTON, SQUARE	1013270029
S103	SWITCH, PUSH BUTTON, SQUARE	1013270029
S104	SWITCH, PUSH BUTTON, SQUARE	1013270029
S105	SWITCH, PUSH BUTTON, SQUARE	1013270029
S106	SWITCH, PUSH BUTTON, SQUARE	1013270029
S107	SWITCH, PUSH BUTTON, SQUARE	1013270029
S108	SWITCH, PUSH BUTTON, SQUARE	1013270029
S109	SWITCH, PUSH BUTTON, SQUARE	1013270029
S110	SWITCH, PUSH BUTTON, SQUARE	1013270029
S111	SWITCH, PUSH BUTTON, SQUARE	1013270029
S112	SWITCH, PUSH BUTTON, SQUARE	1013270029
S113	SWITCH, PUSH BUTTON, SQUARE	1013270029
S114	SWITCH, ROTARY, BCD OUTPUT	1013280024
S115	SWITCH, ROTARY, BCD OUTPUT	1013280024
S116	SWITCH, TOGGLE, SPDT	1011790033
S117	SWITCH, PUSH BUTTON, SQUARE	1013270029
U101	IC. LINEAR LM2576-ADJ	1010610031
U102	IC DIGITAL 74HC589	1013250028
U103	IC,DIGITAL, UNC5841A	1012990028
U104	IC,DIGITAL, UNC5841A	1012990028
U105	IC DIGITAL 74HC589	1013250028
U106	IC DIGITAL 74HC589	1013250028
U107	IC. DIGITAL 74HC04	1010280023
U201	IC,DIGITAL, UNC5841A	1012990028
U202	IC,DIGITAL, UNC5841A	1012990028
U203	IC,DIGITAL, UNC5841A	1012990028
U204	IC,DIGITAL, UNC5841A	1012990028
U205	IC,DIGITAL, UNC5841A	1012990028
U206	IC,DIGITAL, UNC5841A	1012990028
U207	IC,DIGITAL, UNC5841A	1012990028
U301	IC,DIGITAL, UNC5841A	1012990028
U302	IC,DIGITAL, UNC5841A	1012990028
U303	IC,DIGITAL, UNC5841A	1012990028
U304	IC,DIGITAL, UNC5841A	1012990028
U305	IC,DIGITAL, UNC5841A	1012990028
U306	IC,DIGITAL, UNC5841A	1012990028
U401	IC,DIGITAL, UNC5841A	1012990028
U402	IC,DIGITAL, UNC5841A	1012990028
U403	IC,DIGITAL, UNC5841A	1012990028
U404	IC,DIGITAL, UNC5841A	1012990028
U501	IC,DIGITAL, UNC5841A	1012990028
U502	IC,DIGITAL, UNC5841A	1012990028
U503	IC,DIGITAL, UNC5841A	1012990028

U504	IC,DIGITAL, UNC5841A	1012990028
U601	IC,DIGITAL, UNC5841A	1012990028
U602	IC,DIGITAL, UNC5841A	1012990028
U603	IC,DIGITAL, UNC5841A	1012990028
U604	IC,DIGITAL, UNC5841A	1012990028
U605	IC,DIGITAL, UNC5841A	1012990028
U701	IC,DIGITAL, UNC5841A	1012990028
U702	IC,DIGITAL, UNC5841A	1012990028
U703	IC,DIGITAL, UNC5841A	1012990028
U704	IC,DIGITAL, UNC5841A	1012990028
U705	IC,DIGITAL, UNC5841A	1012990028

Figure 6.1-3. PC Assembly, Display Board
(Page 2 of 10)

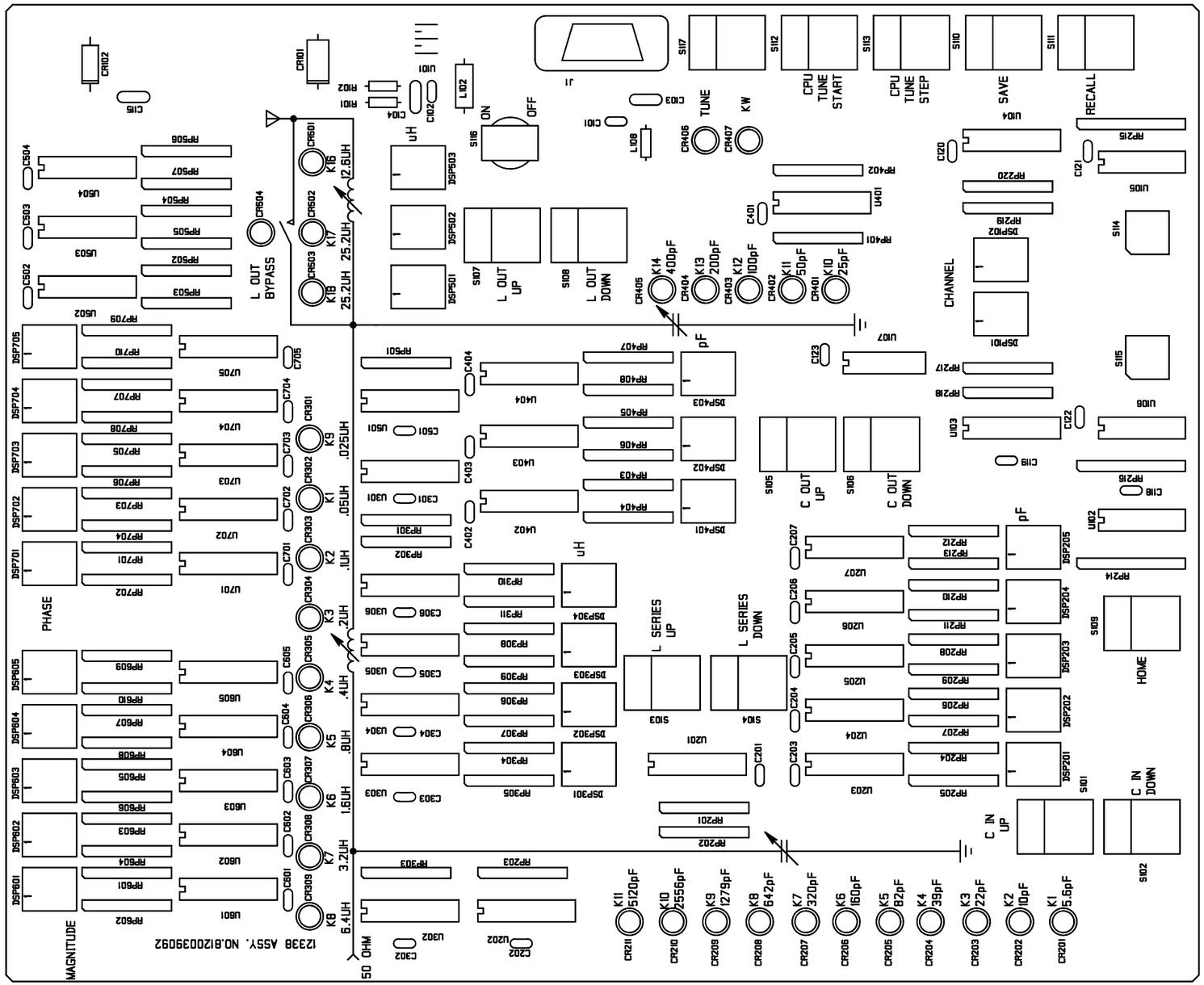

Figure 6.1-3. PC Assembly, Display Board
(Page 3 of 10)

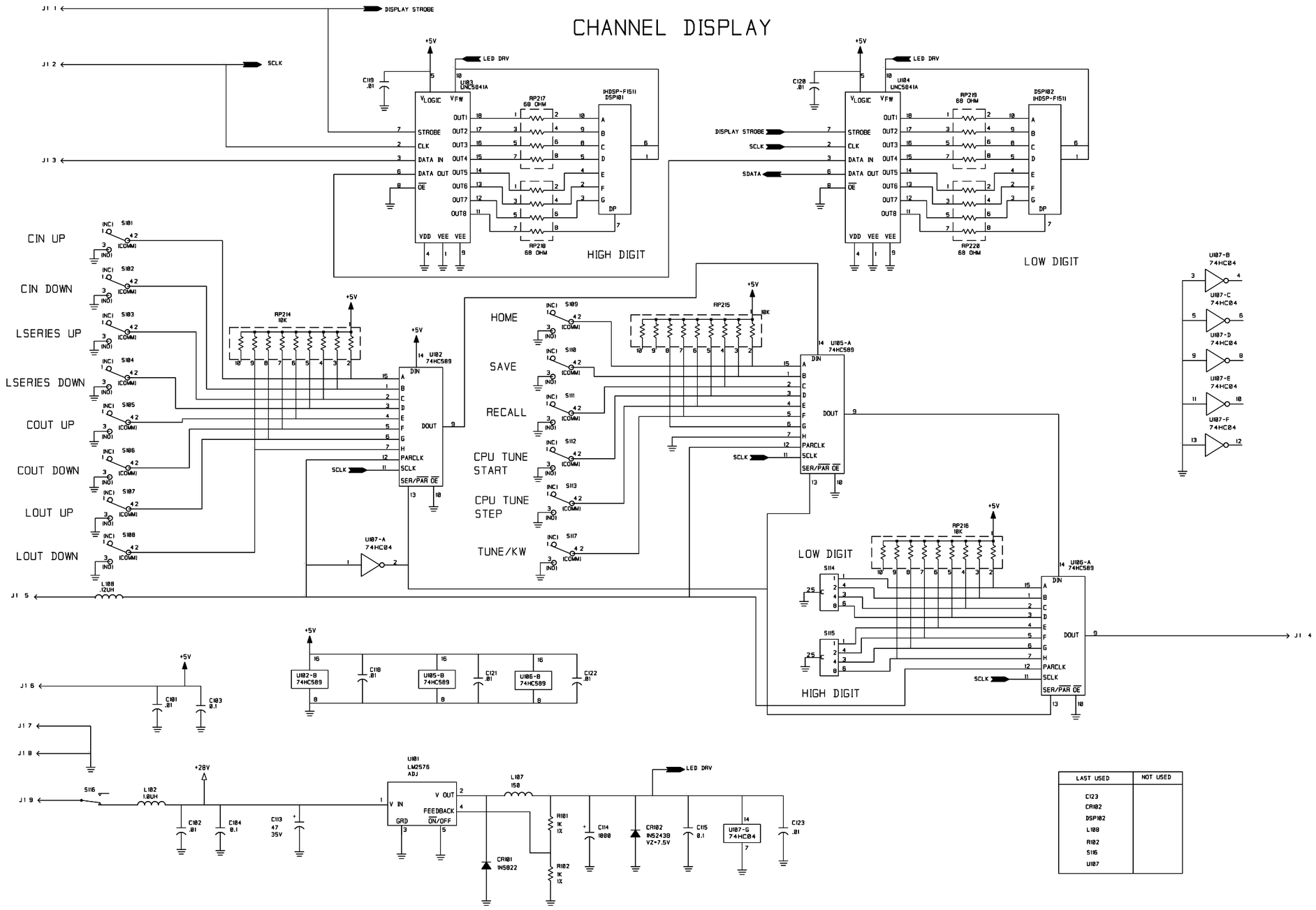

Figure 6.1-3. PC Assembly, Display Board
(Page 4 of 10)

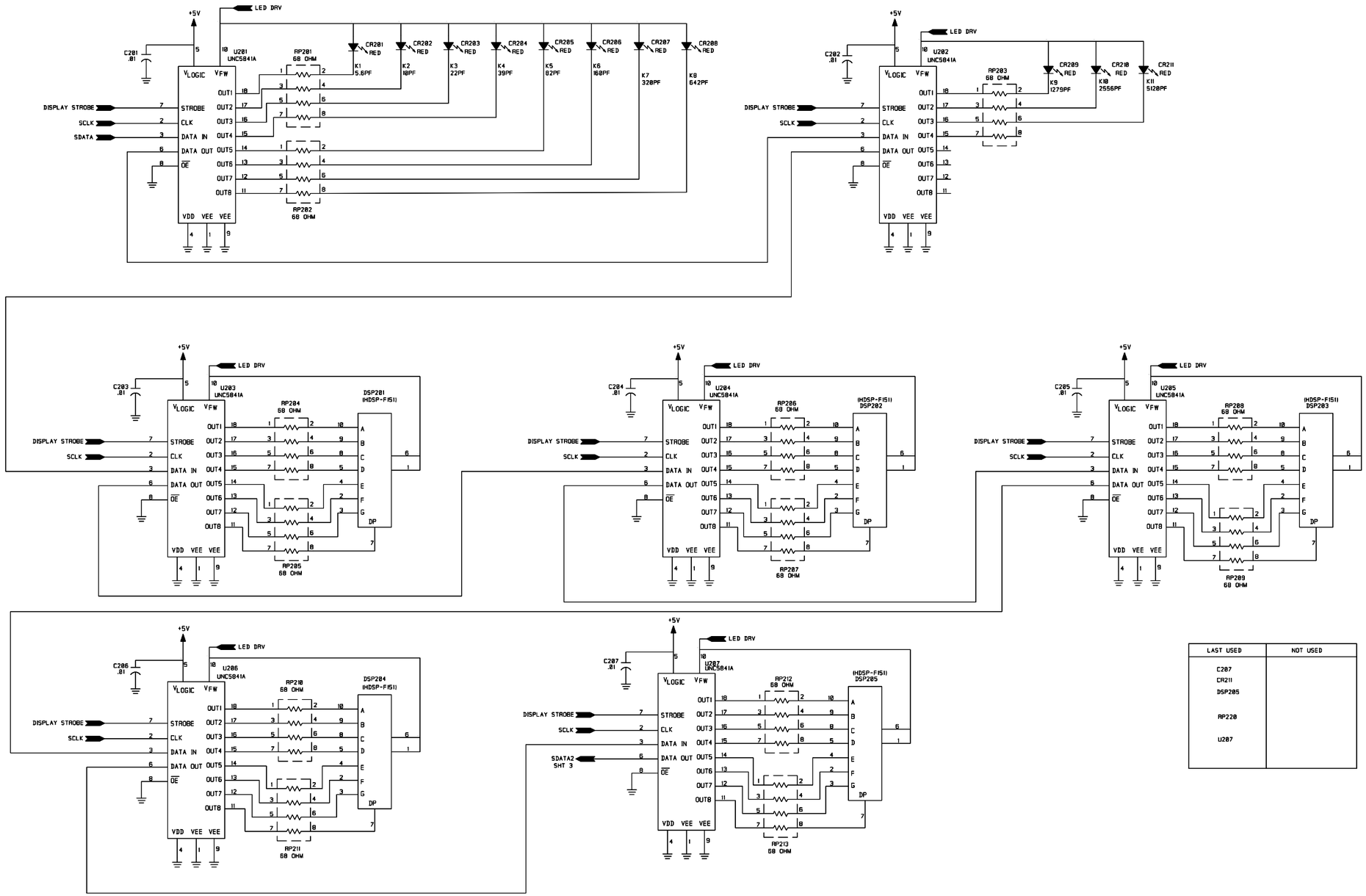

Figure 6.1-3. PC Assembly, Display Board
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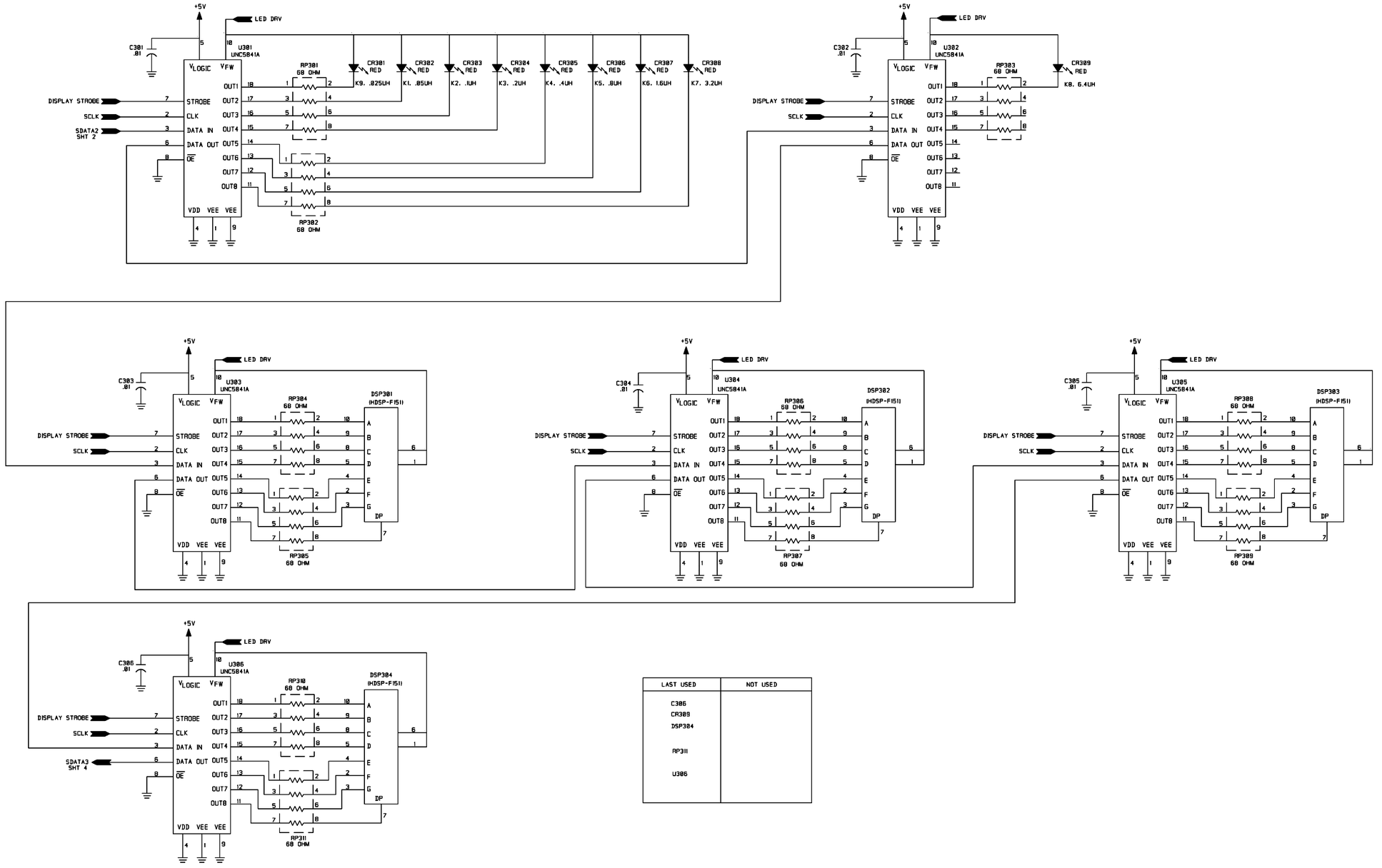
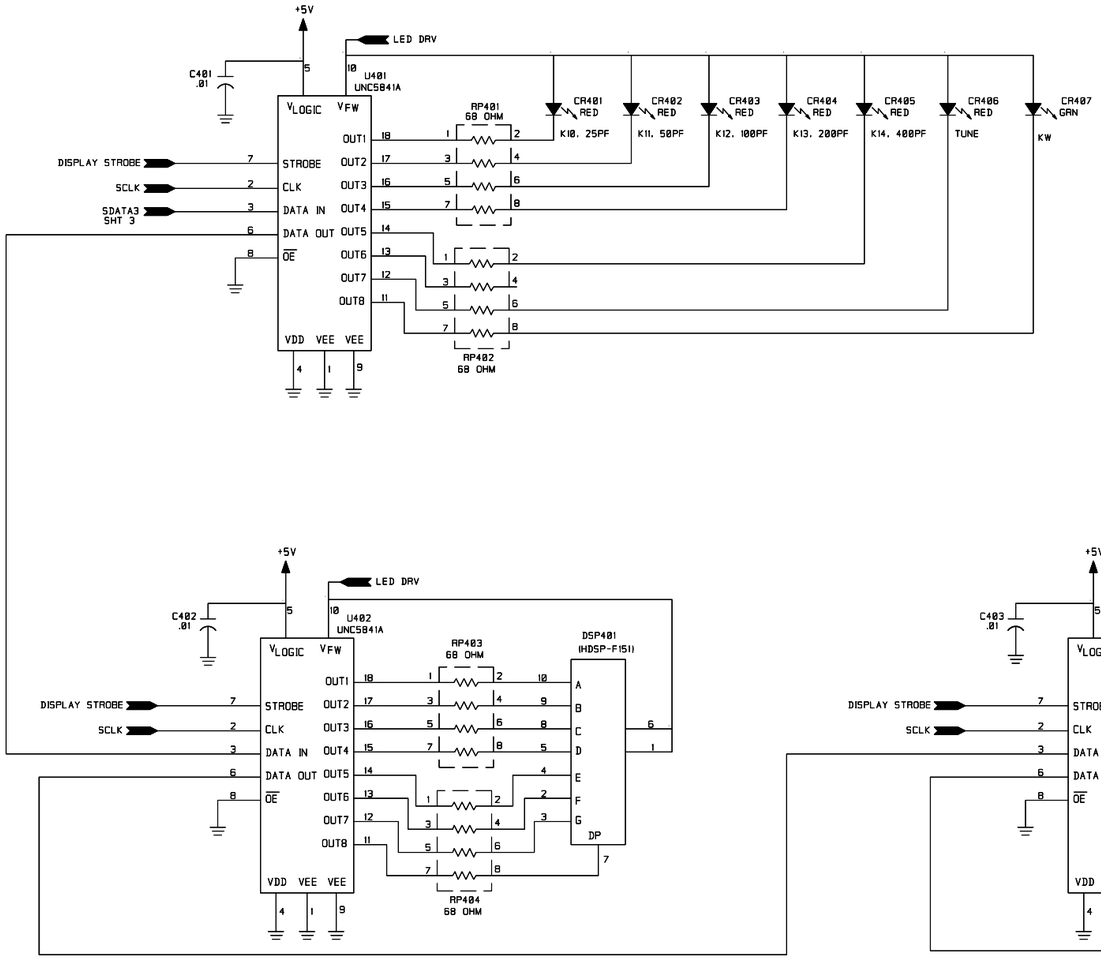
LSERIES DISPLAY



LAST USED	NOT USED
C306 CR309 DSP304 RP311 U306	

Figure 6.1-3. PC Assembly, Display Board
(Page 6 of 10)

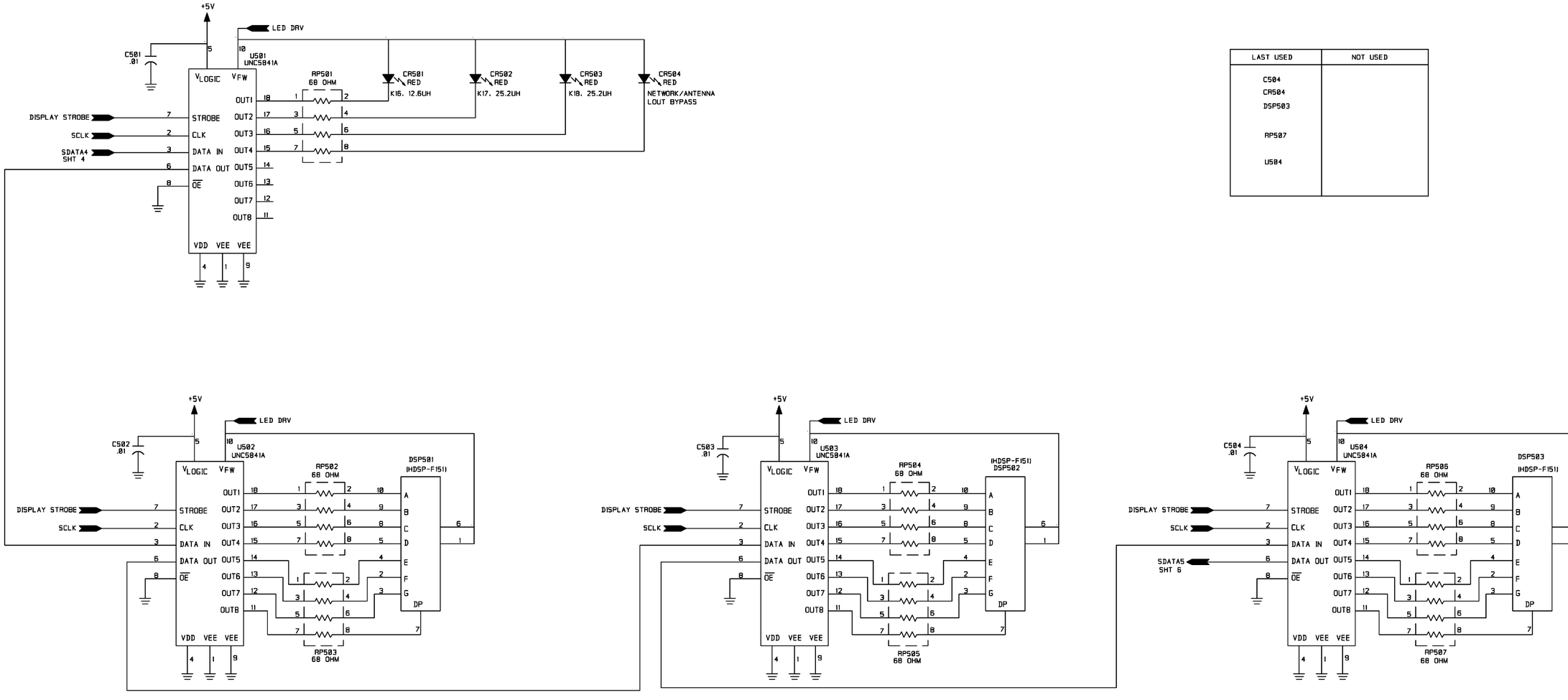
COUT DISPLAY



LAST USED	NOT USED
C404 CR405 DSP403 RP408 U404	

Figure 6.1-3. PC Assembly, Display Board
(Page 7 of 10)

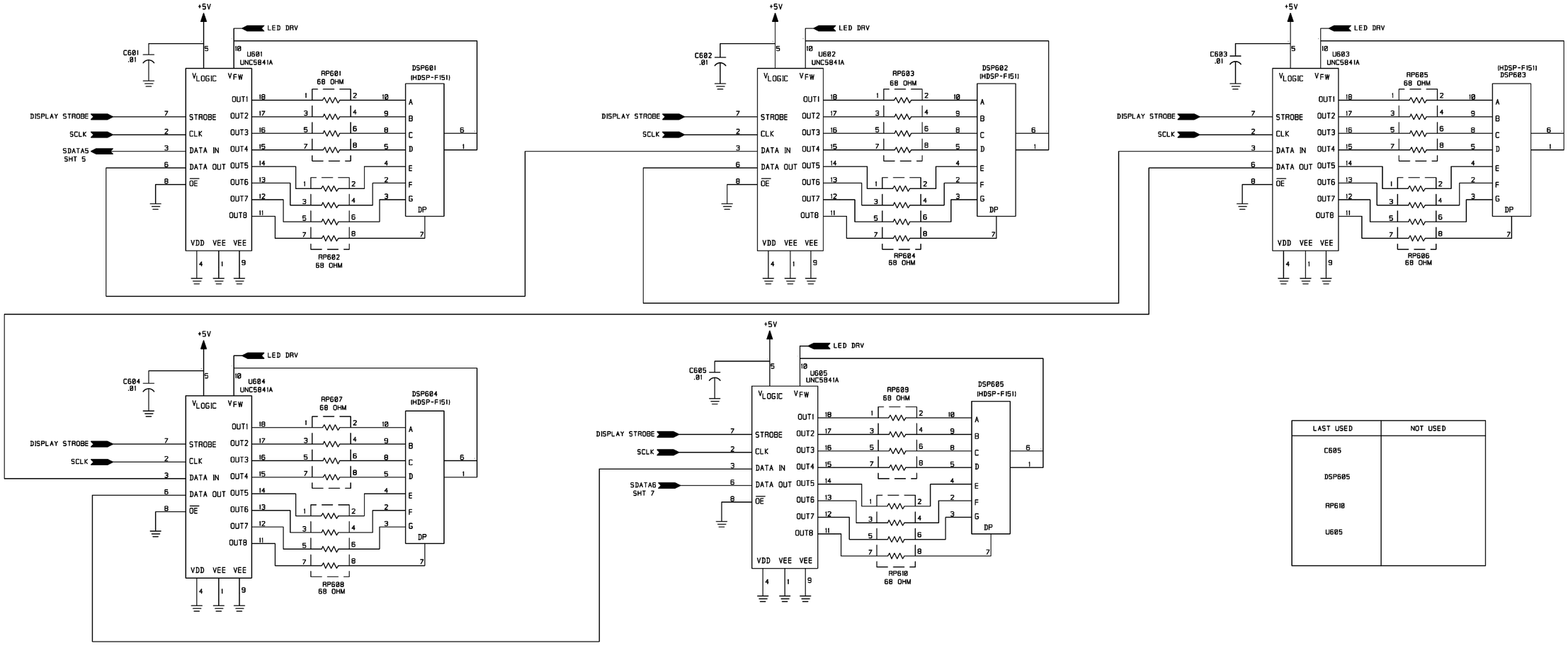
LOUT DISPLAY



LAST USED	NOT USED
C504 CR504 DSP503 RP507 U504	

Figure 6.1-3. PC Assembly, Display Board
(Page 8 of 10)

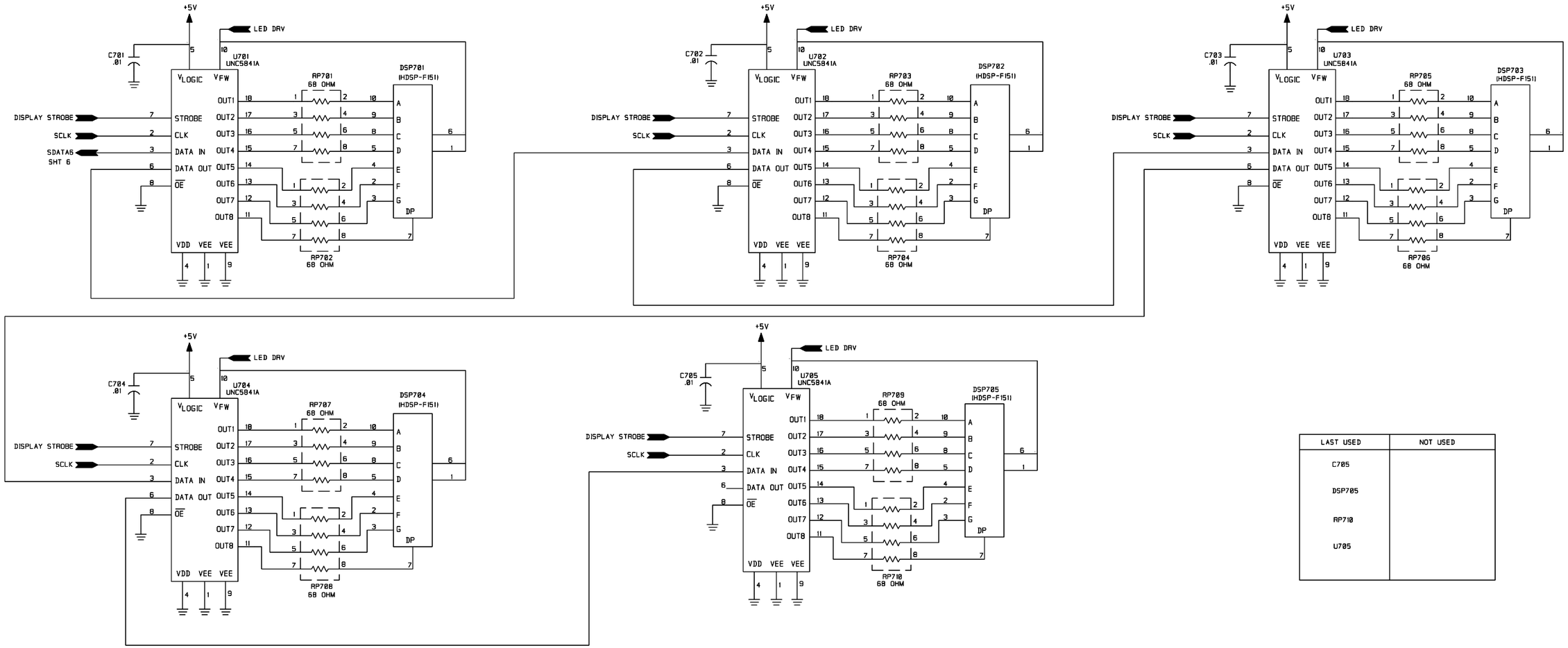
MAGNITUDE DISPLAY



LAST USED	NOT USED
C605	
DSP605	
RP610	
U605	

Figure 6.1-3. PC Assembly, Display Board
(Page 9 of 10)

PHASE DISPLAY



LAST USED	NOT USED
C705	
DSP705	
RP710	
U705	

Figure 6.1-3. PC Assembly, Display Board
(Page 10 of 10)

6.2 CU-9150H Serial Control Upgrade

6.2.1 General Information

6.2.1.1 Scope of Option Section

This section contains information necessary to upgrade from a CU-9150, which uses a parallel control interface, to a CU-9150H using an RS-422 serial control interface.

6.2.1.2 Equipment Supplied

Table 6.2-1 lists equipment, with appropriate Sunair part numbers, supplied with the 8120810091 CU-9150H Conversion Kit:

Table 6.2-1. CU-9150H Conversion Kit

Sunair P/N	Description	Reference Designator	Quantity
0652060005	Inductor, Molded, 8.2 UH, 5%	L101,L102	2
1010801210	Resistor, 120, 1/8W, 5%	R106	1
1013920007	IC. Digital, AT28C256F	U303	1
8120810198	EPROM with CU-9150H SOFTWARE	U301	1
8120810295	PAL with CU9150-H Software	U105	1
8120810309	Options Section, CU-9150H Manual		1

6.2.2 Installation

6.2.2.1 Conversion Kit Installation

1. Remove the coupler top cover and the inner cover over the (1A1A3) CPU. Refer to Section 5.2.1 for more detailed cover removal information.
2. Remove the (1A1A3) CPU. Refer to Section 5.2.2.
3. Remove the CPU backplate.
4. Replace U301 with the supplied IC 8120810198.
5. Replace U105 with the supplied IC 8120810295.
6. Replace U303 with the supplied IC 1013920007 (AT28C256F).
7. Cut and remove the 0 ohm resistors at R111 and R112.
8. Install the 120 ohm resistor 1010801210 at R106.
9. Install the 8.2 µH inductors, 0652060005, at L101 and L102.
10. Install the CPU backplate. Install the CPU in the coupler. Install the inner cover and the top cover.

6.2.2.2 Control Cable

The CU-9150H control cable requires 6 conductors (refer to Table 6.2-2). These are a subset of the conductors required by the standard control cable shown in Figure 2.11-1.

Table 6.2-2. CU-9150H Control Cable Signals

Signal	Pin
GROUND	h
RXDB (DATA TO COUPLER)	n
TXDB (DATA FROM COUPLER)	g
RXDA (DATA TO COUPLER)	c
+28 VDC	s
TXDA (DATA FROM COUPLER)	L

If the **TX ONLY** function is required (refer to Sections 2.8 and 4.6.6), then the **KEYLINE ACCESSORY** signal at pin p must also be supported.

6.2.3 Operation

The CU-9150 is operated via serial commands according to the following protocol.

9150H Interface

The CU-9150H is controlled via an RS-422 serial interface. The interface parameters are 9600 bps, 8 bits, odd parity, and 1 stop bit.

9150H Commands

Commands to the CU-9150H start with 6 0xFF characters, followed by the STX character (0x02). The leading 0xFF characters are required to "wake up" the coupler CPU from its powerdown mode. In the powerdown mode, the CPU oscillator is turned off. This prevents the CPU from introducing spurious signals which can be heard by the radio. The CPU board includes hardware which will generate a Non-Maskable Interrupt (NMI) on receipt of a serial character. This NMI signal causes the CPU to come out of its powerdown mode. Since the oscillator is crystal based, a significant amount of time is required to allow the oscillator to stabilize before the processor can safely execute instructions. The CPU requires 3ms (typical) to respond to the NMI and be ready for valid serial data.

Commands are terminated with a checksum followed by CR (0x04). The checksum is the sum all command characters modulo 256. If the result of this operation is smaller than 14, then 14 is added to the checksum to avoid codes within the control characters.

All characters within the command field are greater than 13 when coupler diagnostics are disabled (refer to the DI command). When coupler diagnostics are enabled, any character may be present in the command field. Note that coupler diagnostics are disabled by default.

The packet structure is then:
<0xFF> **<0xFF>** **<0xFF>** **<0xFF>** **<0xFF>** **<0xFF>** **<STX>** *b b p..p* **<CHECKSUM>** **<CR>**

Where:

b b = Two character command

p..p = variable number of parameters

Example for a status request:

0xFF 0xFF 0xFF 0xFF 0xFF 0xFF STX	**S**	**T**	**?**	**CS**	**CR**
0xFF 0xFF 0xFF 0xFF 0xFF 0xFF 0x02	**0x53**	**0x54**	**0x3F**	**0xE6**	**0x0D**

Commands responses from the CU-9150 are of a similar format. However, the leading 0xFF characters are not transmitted. A trailing 0xFF character is transmitted.

The time between the first and last character of a command must not exceed 100ms. If this time is exceeded, the coupler will go back to its powerdown mode, and the partial command will be discarded.

On power up, the coupler defaults to channel 0000.

Command **ST?**
Function **Status Request**
Reply **ST***nm*

Where:

n=fault indication
0=no faults
1=tuning fault

m=tune indication
0=coupler is not tuning
1=coupler is tuning

Note: Use of this command is not recommended during receive. It will wake up the coupler and cause receiver spurs.

Command **BI?**
Function **Request BITE Test Result**
Reply **BI***aa..aa***X**

Where:

aa=error code from 01 to 99
00=no errors
01=12V Power supply voltage is lower than 10.8 volts
02=28V Power supply voltage is lower than 22 volts
09=Tune cycle in progress, BITE can not be executed

Note: Before the measurement of the 28V supply, all of the latching relays and the three Lout relays are driven for 20ms. This loads the supply in the worst case manner.

RF power must not be applied during the BITE test. This would result in the relays being hot switched.

Command	**CH?**
Function	**Request Coupler Channel**
Reply	**CH***nnnn*
Where:	
	nnnn=current coupler channel as ASCII printable characters

Command	**CH** *nnnn*
Function	**Set coupler channel**
Reply	**CH** *nnnn* or **CH***XXXX*

Where:

nnnn =current coupler channel as ASCII printable characters
Valid "normal" channels are in the range 0..3999.

Channel 4000 sets the coupler to bypass mode. In this mode, all network elements are set to their minimum values.

Channels greater than 4000 will generate a "**CH***XXXX*" reply. The current coupler channel will not be changed.

If a previously received **CH***nnnn* command is being acted upon, the second channel command will be delayed until the first is complete, at which time the second command will be executed.

If a tune cycle is in progress, the coupler will respond with **TE2**.

Command	**TU***nnnnff*
Function	**Start a tune cycle**
Reply	**TP***n* **TE***n* **TF***n*

Where:

nnnn =current coupler channel as ASCII printable characters
ff=frequency of the channel in MHz. 01..30.

Valid "normal" channels are in the range 0..3999.

Channel 4000 sets the coupler to bypass mode. Tuning is not allowed on this channel. The coupler will reply with **TE3**.

Channel 4001 is used for BITE at 1.75 MHz.
Channel 4002 is used for BITE at 5.75 MHz.
Channel 4003 is used for BITE at 16.75 MHz.
Channel 4004 is used for BITE at 29.75 MHz.

Refer to Section 6.1.2.4 for a general discussion of how the CU-9150 BITE channels are used.

Where for **TP***n*:

TP1=indicates that the coupler is ready for RF on
TP0=indicates that the coupler is ready for RF off

Where for **TE***n*:

TE0=tuning fault

TE1=successful tune **TE2**=response to TU or CH commands during a tune cycle **TE3**=tune attempt on an invalid channel Where for TF*n:* TF0=timeout during tune cycle
Command **DI***n* Function Turn on or turn off coupler diagnostic messages Reply **DI***n* Where: **DI0**=disable diagnostics **DI1**=enable diagnostics When diagnostics are enabled, spontaneous messages from the coupler will be generated during tune cycles and BITE tests. These messages are of the form: **DI***nss.....ss* Where: *n*=the number of characters in the string *ss..ss*=a variable length string of characters At power up, diagnostics are turned off.

6.2.4 Theory

6.2.4.1 General

This section describes the theory of operation of the CU-9150H antenna coupler. Only those aspects that differ from the theory of operation of the standard CU-9150 are covered.

6.2.4.2 Serial Communication

This section supersedes Section 4.5.3.

Communication between the microprocessor and the radio is mainly accomplished by U101. U101 is a MAX490 RS-422 interface chip. This provides a full duplex serial link between the radio and the coupler.

6.2.4.3 Channel Change and Tune Command Detectors

This section supersedes Section 4.5.5.

Since all control of the coupler is via the RS-422 serial link, the channel change and tune command detector outputs are no longer used by the CPU. The CPU responds only to serial commands.

6.2.5 Troubleshooting

6.2.5.1 General

This section describes the troubleshooting procedures for the CU-9150H antenna coupler. Only those aspects that differ from the procedures of the standard CU-9150 are covered.

6.2.5.2 Coupler Tunes But Memory Does Not Work

This section supersedes Section 5.6.4.

Section 5.6.4 is no longer applicable to the CU-9150H. Barring major CPU bus problems, the coupler memory should always be functional.