PICOTEST®

M3500A

6.5 Digit Digital Multimeter

Service Manual

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1 General Information

1.1 Warranty Information

- **Warranty:** PICOTEST CORP. guarantees that this product meets its published specifications at the time of shipment from the factory. Under proper installation it should work as expected.
- **Warranty Period:** This equipment is warranted against defects in material and manufacturing for a period of one year from the date of shipment. During the warranty period, PICOTEST is responsible for necessary repairs as long as the product can be proved to be defective. For warranty service or repair this product must be returned to a service facility designated by PICOTEST. Please contact your local service representative.
- **Excluded Items:** This warranty does not include consumptive parts such as fuses, buttons and relays. Neither does this warranty cover defects caused by improper installation, improper or insufficient maintenance, unauthorized modification, and improper operation, ignorance of environmental specifications or improper software or interfacing.
- **Remarks:**
  1. No other warranty is expressed or implied, except for the above mentioned.
  2. The remedies provided herein are the buyer's sole and exclusive remedies. PICOTEST shall not be liable for any direct, indirect, special, incidental or consequential damages.

1.2 Limitation of Warranty

- Our warranties do not cover any damage resulting from unauthorized modification or misuse.
- Unless mentioned elsewhere in this document, our warranty does not apply to fuses, probes, and problems arising from normal wear or user's failure to follow instructions.
- Our warranties do not apply on any direct, incidental, special, or consequential damages.
- The above warranties are exclusive and no other warranty is expressed or implied. PICOTEST disclaims any implied warranties of MERCHANTABILITY, SATISFACTORY QUALITY, and FITNESS for any particular reasons.

1.3 Precaution of Operation

- Please carefully read the manual before operating this device.
- This manual is for reference only. Please consult your local service representative for further assistance.
- The contents of this manual may be amended by the manufacturer without notice.
- Never dismantle the equipment by any unauthorized personnel, or equipment may be damaged.
- The equipment has been strictly tested for quality before delivery from our factory. However, this equipment must not be used in dangerous situations or damage may result.
- This product should be placed in a safe area in case of unpredictable personnel use.
- The rear protective conduct terminal needs to be connected to the actual earth ground or electric shock may occur.
- The patent and related documents for the equipment belong to PICOTEST CORP. and they aren't allowed to be used by others without permission.

1.4 Maintenance of M3500A

- Although M3500A multimeter is very durable and weather resistant, care should be taken not to expose it to severe impact or pressure.
- Keep M3500A far from water and damp environment.
- Calibration should be taken every year. Please contact with your local service representative for more information.
- If the incorrect display or abnormal beeps occurred you should stop using the equipment at once.
- Do not use the Meter around explosive gas or inflammable vapor.
- Wipe the surface of M3500A multimeter with a piece of dry and clean cloth.

1.5 Safety Information

Warning! Please read through the following safety information before using the product.

To avoid possible electric shock or personal injury, please read and follow these guidelines carefully:

- Follow the guidelines in this manual and DO NOT use the Meter if the case is damaged. Check the Meter case and terminals, and make sure all the devices are in the proper positions.
- Do not apply excessive voltage to the Multimeter. Apply voltage within the rated range only.
- Use caution when measuring voltages above 30 V RMS, 42 V peak, or 60 V DC. These voltages pose an electric shock hazard.
- When using the probes, always keep your fingers behind the finger guards.
- Always connect the common test leads (black) before connecting the live test leads (red), and disconnect the live test leads (red) before disconnecting the common test leads (black). This will reduce the chance of an electric shock.

- Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes or capacitance.
- If you need to open the Meter case or replace any parts, read the instruction in this manual first. Do not perform these actions unless you are qualified to do so.
- When replacing fuses, use only the same type and same rating as specified.
- Do not try to operate the Meter if it is damaged. Disconnect the power from the equipment and consult the local service representative. Return the product to PICOTEST service department if necessary.

1.6 Symbols and Terms

This symbol indicates hazards that may cause damages to the instrument or even result in personal injury.

This symbol indicates high voltage may be present. Use extra caution before taking any action.

This symbol indicates the frame or chassis terminal presented need to be connected to the actual earth ground.

This symbol indicates “Protective Conductor Terminal”.

This symbol indicates earth (ground) terminal.

This symbol indicates this product complies with the essential requirements or the applicable European laws or directives with respect to safety, health, environment and consumer protections.

2 General Maintenance

2.1 Setting Line Voltage and Replacing Fuse

Before turning on the multimeter, you should check the Line voltage setting and the power-line fuse. If the line voltage setting is not properly, correct it. If the power–line fuse is not good, replace a new one in the same type. The following sections will show you how to do.

⚠ Warning! Before changing the line voltage setting or replacing the power line fuse, make sure the multimeter is disconnected from the AC power and remove all the test leads connected to it. An incorrect voltage setting may cause severe damage to your instrument.

2.1.1 Voltage Selector

Normally, the line voltage is selected for your country properly when the multimeter is shipped from the factory. Refer to your local power utility voltage to see if the setting is correct. Follow the steps below to select a properly line voltage for your instrument if the setting is not fit your requirement.

NOTE: In some areas, the power utility voltage is 240V or 120V; in others, it is 220 V or 100 V. The equipments are set properly according to users' requirements when they are shipped from the factory. For more information, please refer to section **2.1.2**.

[Step 1]
Verify current line voltage setting from the window. If it is incorrect, you must change it to a properly value. The position of the window is shown in **Figure 2-1.**

[Step2]

Turn off the power and disconnect the line cord from your multimeter as shown in **Figure 2-1**. Also, you should remove all the leads connected to it.

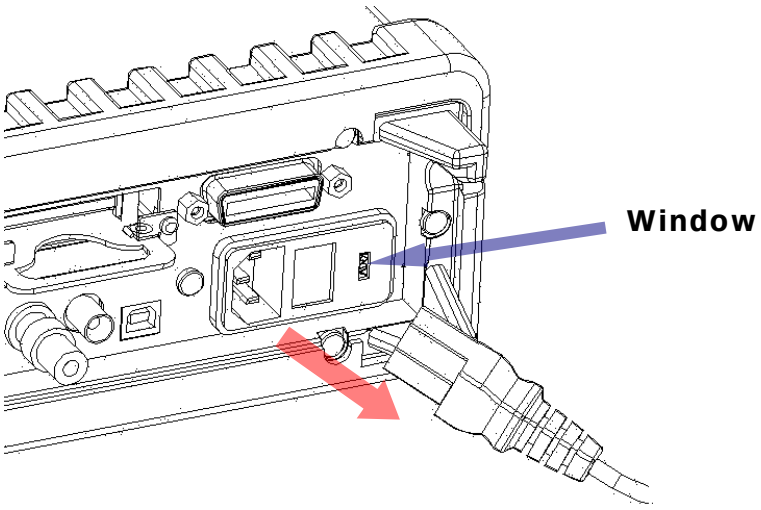


Figure 2-1

[Step 3]

Open the cap and remove the voltage setting selector from the right middle seam as shown in **Figure 2-2**. (You might need a flat-blade screwdriver to do so.)

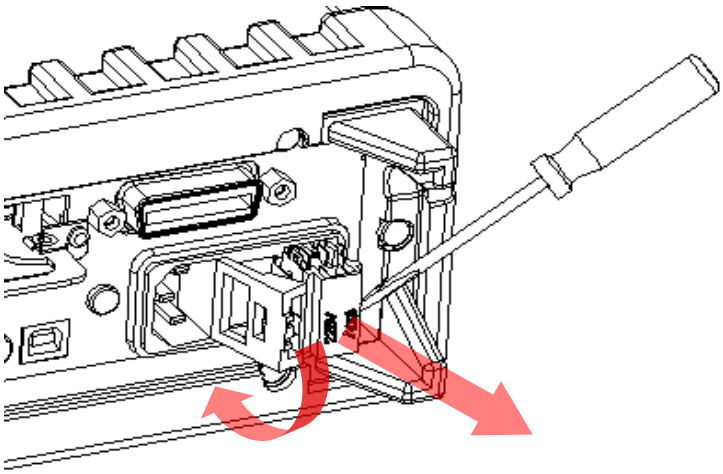


Figure 2-2

[Step 4]
Turn the voltage selector over, the value you want to set must in the right side.

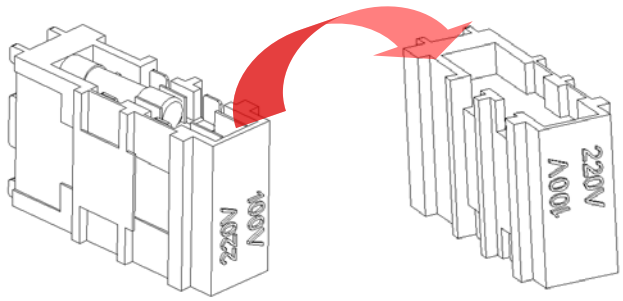


Figure 2-3

[Step 5]
Insert the voltage setting selector back into the socket and close the cap as shown in **Figure 2-4**. Check the setting from the window again.

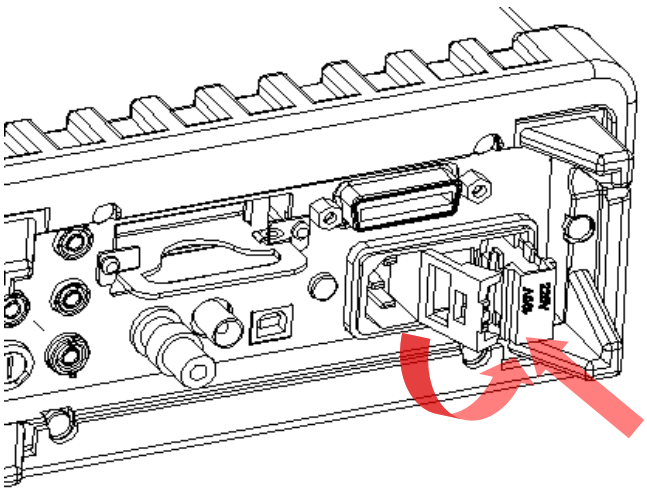


Figure 2-4

NOTE: Before re-connecting the power line cord to your multimeter, make sure that power switch is in the “POWER OFF” state.

2.1.2 Transformer

Usually you can change the line voltage setting by voltage selector as the shown in section **2.1.1**. If the voltages shown in the selector do not fit your requirement, you may change the transformer connections to change the line voltage setting selections. The voltages can be set for M3500A are 100, 120, 220, 240 Vac.

⚠ Warning! Do not perform this action unless you are qualified to do so. For more information, please contact your local service representative.

[Step 1]
Turn off the power and disconnect the line cord from your multimeter as shown in **Figure 2-5**. Also, you should remove all the leads connected to it.

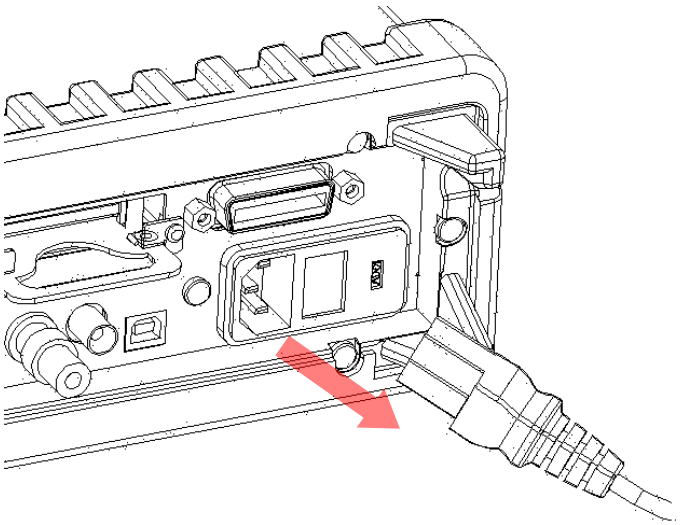


Figure 2-5

[Step 2]
Remove the handle and then the metal cover. Please refer to section **4.2** for more detail.

⚠ Warning! Do not open the case unless disconnecting the AC line cord and all test leads. Do not perform this action unless you are qualified to do so.

[Step 3]

There are four wires in different colors on the transformer. Two of them connect to the power entry according to the regular line voltage selections for your country as shown in **Figure 2-8**.

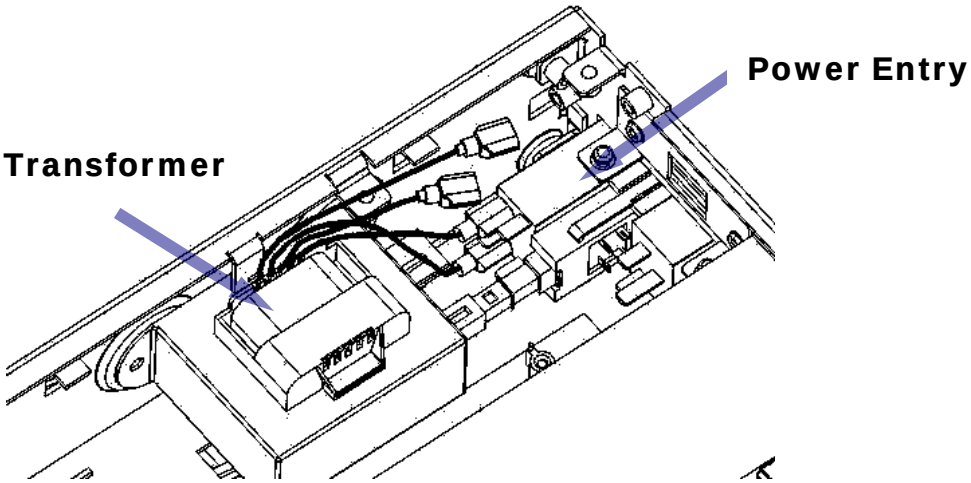


Figure 2-8

[Step 4]

Please refer to the **Table 2-1** to connect the wires for your need.

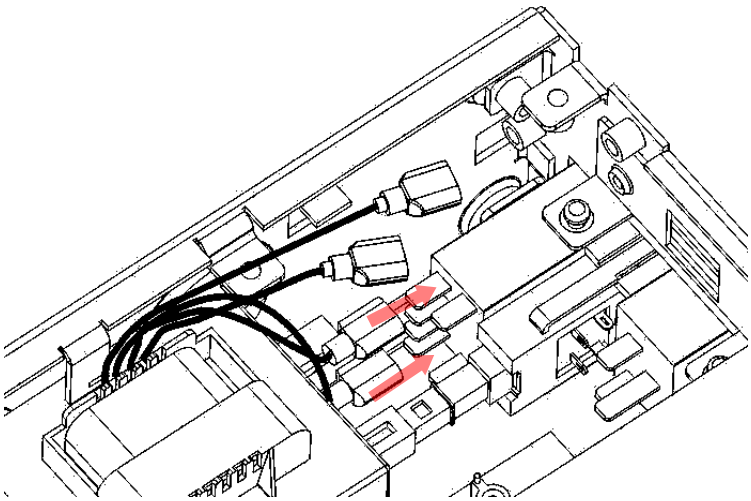


Figure 2-9

Power Line Voltage	**Wire color**
100 Vac	Brown
120 Vac	Red
220 Vac	Orange
240 Vac	Yellow

Table 2-1

[Step 5]
Recover the case of the multimeter and then follow the steps in section **2.1.1** to set the desired line voltage.

NOTE: After transformer wiring modification, you should change the sticker on voltage setting selector also. PICOTEST will provide the stickers for free. Please contract your local service representative for the stickers for your requirement.

2.1.3 Power Line Fuse

A power-line fuse located next to the AC receptacle (in the line voltage selector) protects the power line input of the instrument. Verify that the power-line fuse is good and replace a new one if it is damaged. The multimeter is shipped from the factory with a fuse 0.25 A / 250 V, slow-blow, 5 × 20 mm (Picotest part number: 024-001-000004, the reference number: FS102) installed. This is the correct fuse type for all line voltage settings. Please follow the steps below to change the fuse.

[Step 1]
Turn off the multimeter and disconnect the line cord as shown in **Figure 2-9**. Also, you should remove all the test leads that connected to your instrument.

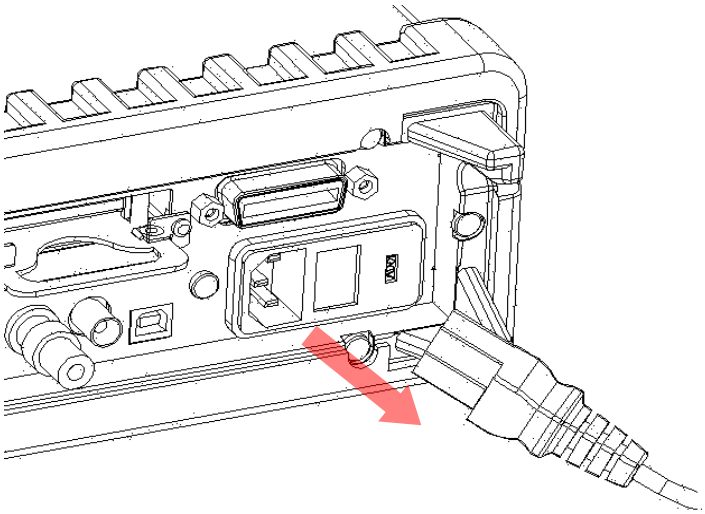


Figure 2-9

[Step 2]
Open the cap and remove the voltage setting selector from the right middle seam as shown in **Figure 2-10**. (You might need a flat-blade screwdriver to do so.)

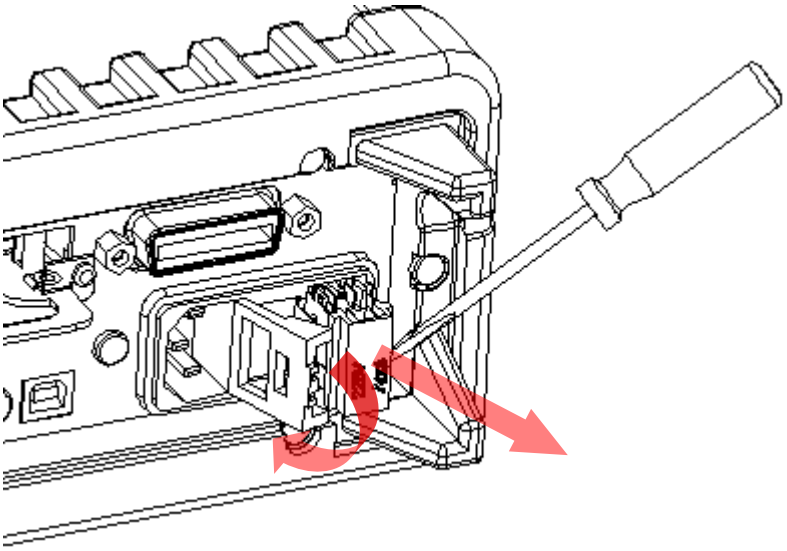


Figure 2-10

⚠ Warning! For continued protection against fire or instrument damage, only replace fuse with the same type and rating. If the instrument repeatedly blows fuses, locate and correct the cause of the trouble before replacing the fuse.

[Step 3]
Remove the broken fuse from the selector and replace a new one as shown in **Figure 2-11**. You must replace the fuse with the same type or same rating.

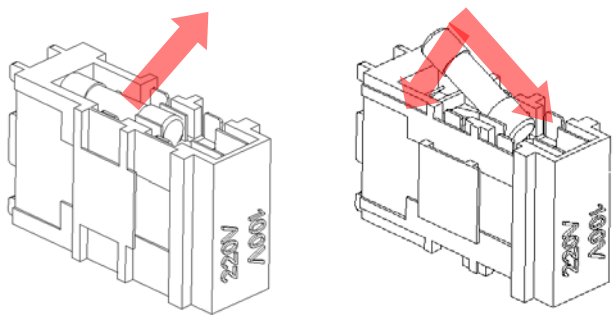


Figure 2-11

[Step 4]
Insert the voltage setting selector back into the socket and close the cap as shown in **Figure 2-12**.

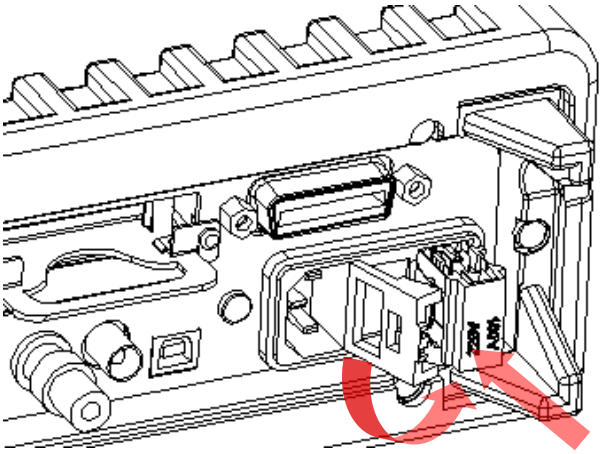


Figure 2-12

⚠ Warning! Before re-connecting the power line cord to your multimeter, make sure that power switch is in the “POWER OFF” state. Verify if the line voltage setting is correct before you turn on your instrument.

2.2 Current Input Fuse – 3.15 A

There are two fuses located in the front and rear current input terminals to protect your multimeter against damage of strong current pulse. The front and rear current input fuses used in M3500A are the type 3.15A, 250 V, 5 × 20 mm, fast acting, HBC and Ceramic Tube with high breaking character (Picotest part number: 024-001-000007, the reference number: FS101). If you need to replace them, please follow the steps shown below.

⚠ Warning! For continued protection against fire or instrument damage, only replace fuse with the same type and rating. If the instrument repeatedly blows fuses, locate and correct the cause of the trouble before replacing the fuse.

[Step 1]

Turn off the multimeter and disconnect the power line cord as shown in **Figure 2-13**. Also, you should remove all the test leads that connected to your instrument.

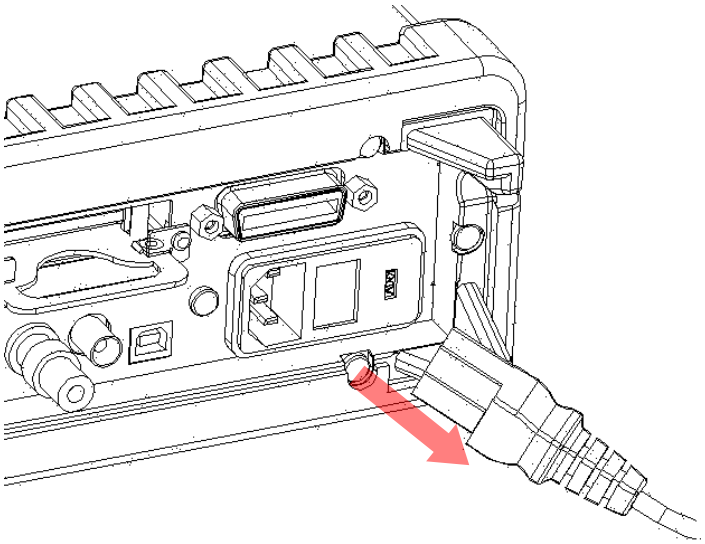


Figure 2-13

[Step 2]

Push the current input terminal and turn it right as shown in Figure 2-14 .

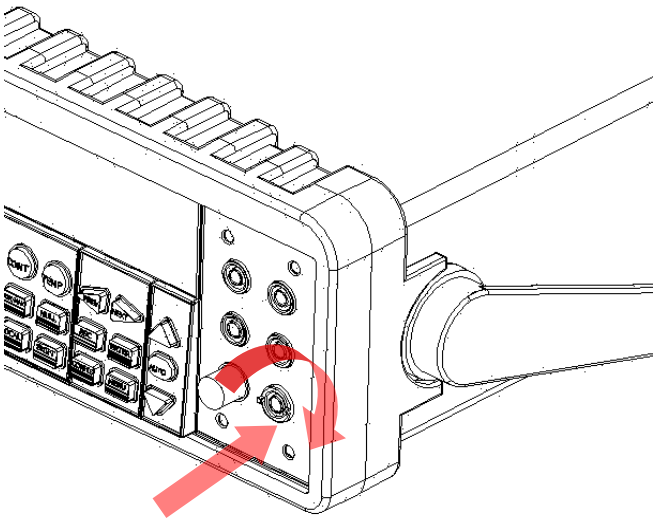


Figure 2-14

[Step 3]

Pull out the terminal (fuse holder) gently and you will find the current input

fuse as shown in **Figure 2-15**.

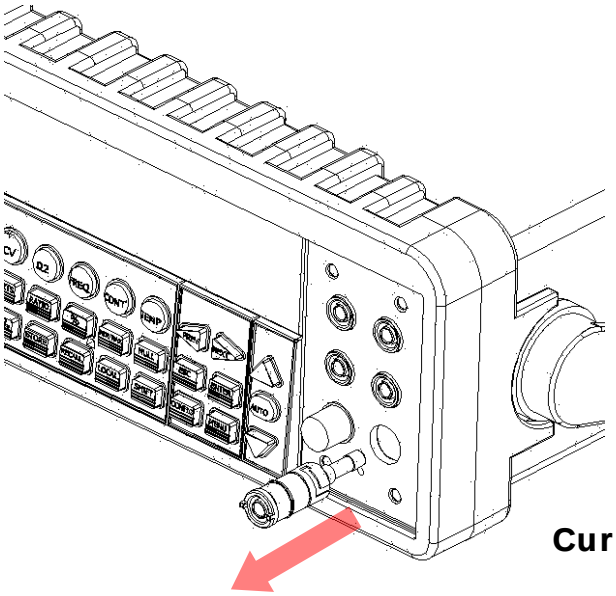


Figure 2-15

[Step 4]
Remove the broken fuse and replace a new one with the same type or same rating as shown in **Figure 2-16**.

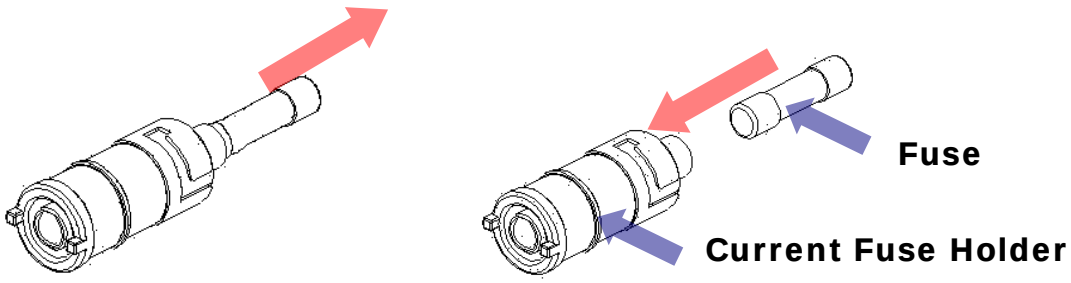


Figure 2-16

[Step 5]
Insert the fuse holder back and turn it left as shown in **Figure 2-17**. Make sure the fuse holder is properly seated and secured.

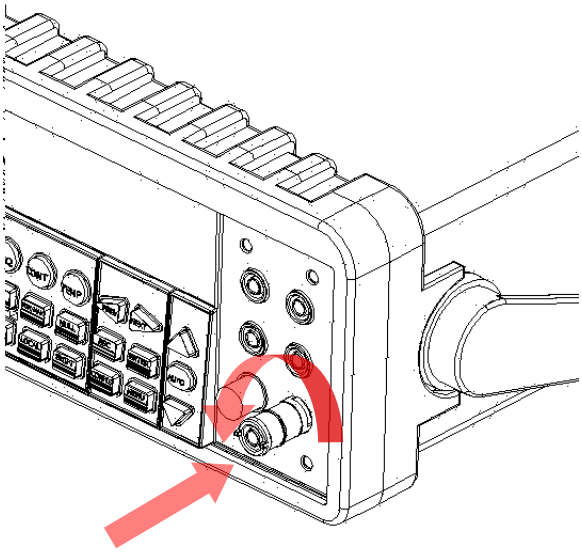


Figure 2-17

Warning! Before re-connecting the power line cord to your multimeter, make sure that power switch is in the “POWER OFF” state.

NOTE: The rear current input fuse can be replaced by the same method as the front one.

2.2.1 Current Input Fuse – 7 A

The current input Fuse provides an additional level of current protection (The diagram in the below **Figure 2-18** would let you know the function more clearly). The fuse in M3500A is the type 7A, 5 x 20 mm, fast acting and Ceramic Tube (Picotest part number: 024-001-000006, the reference number: FS103). To replace the fuse, you have to release a holder by a flat-blade screwdriver as shown in the following.

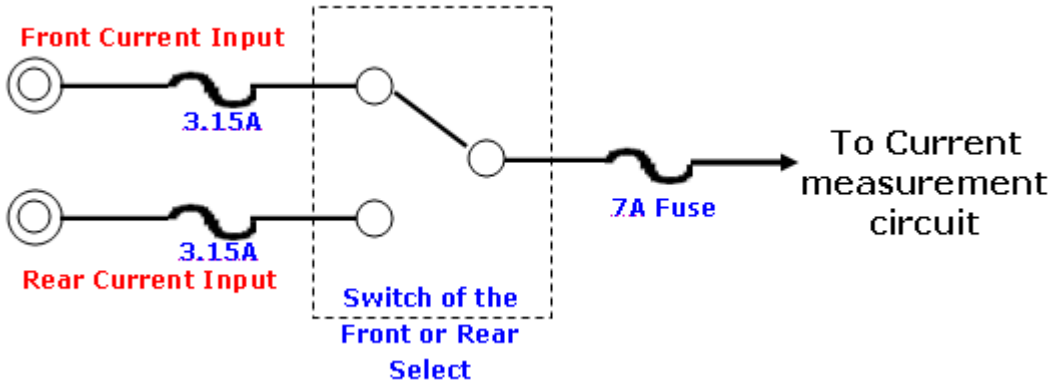


Figure 2-18

[Step 1]

Turn off the multimeter and disconnect the power line cord as shown in **Figure 2-19**. Also, you should remove all the test leads that connected to your instrument.

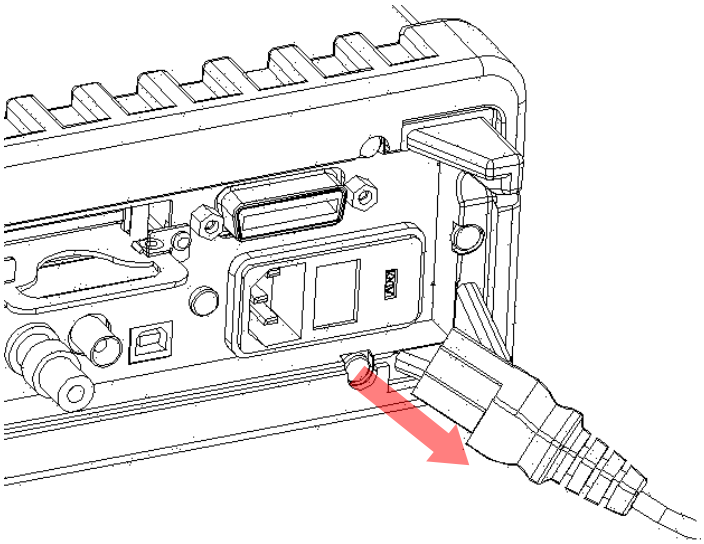


Figure 2-19

[Step 2]

Please use a flat-blade screwdriver with a suitable pushing strength to turn it left for releasing the holder.

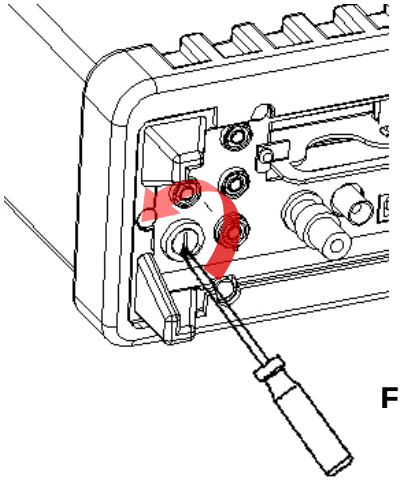
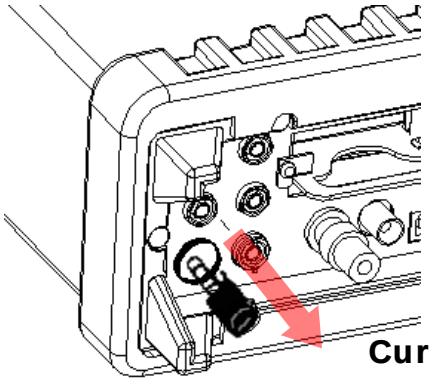


Figure2-20

[Step 3]

Pull out the terminal (fuse holder) gently and you will find the current input fuse as shown in **Figure 2-21**.



Current input Fuse

Figure 2-21

[Step 4]

Remove the broken fuse and replace a new one with the same type or same rating as shown in **Figure 2-22**.

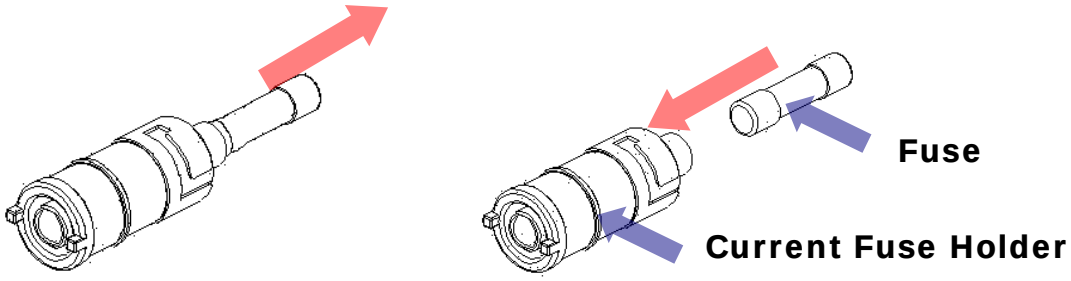


Figure 2-22

[Step 5]
Insert the fuse holder back and turn it right as shown in **Figure 2-23**. Make sure the fuse holder is properly seated and secured.

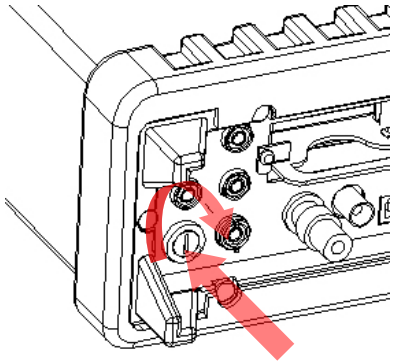


Figure 2-23

2.3 Pass/Fail Output From USB Connector

The USB connector on the rear panel of M3500A is a series “B” connector. When the USB interface is **disabled** (IEEE-488 interface is selected), the internal pass and fail TTL output signals (limit testing) will be connected to the USB connector.

The pass and fail signals are low true and indicate the Math Pass/Fail Limit Test result for the ***next*** reading to be output to the GPIB interface. The signals are active low for approximately 2ms (±100 μsec) for each reading taken. **Figure 2-24** shows the USB connector (series “B”).

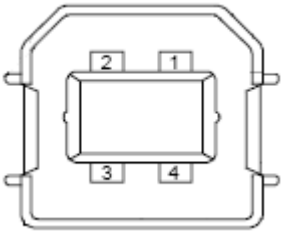


Figure 2-24

Contact Number	Signal Name	Typical Wiring Assignment	Description
1	VBUS	Red	Floating
2	D-	White	Limit Test Pass
3	D+	Green	Limit Test Fail
4	GND	Black	GND

Table 2-2

If you disable the USB interface, the Pass/Fail output function will enable automatically. Please follow the procedure below to enable/disable this function.

Procedure: MENU → INTERFACE → USB → ENABLE / DISABLE

Or you can do this by the other way:

Procedure: CONFIG+SHIFT+RATIO → OUTPUT → ENALBLE / DISABLE

⚠ Warning! You can't use the USB interface if you want to enable the Pass/Fail signal output. You must use the GPIB interface for remote control. Please disconnect the USB cable from you multimeter. The signal from the USB cable may make the Pass/Fail signal output abnormal.

2.4 MCUs & DSP Firmware Upgrade

M3500A has three microprocessors, DSP processor, Panel processor, and Front-end processor, for various internal systems. PICOTEST allows users to

upgrade their multimeter by update firmware of these microprocessors. Firmware updating will support more stability or functions for your multimeter. To upgrade your M3500A, please follow the steps below.

[Step 1]
Link to PICOTEST homepage: http://www.picotest.com.tw/ by your browser. Click the banner “Support” and login to enter the support page. If you are visit the site first time, please register for more service. Download the latest firmware file for your instrument.

[Step 2]
Unzip the downloaded file, you will find the files as shown in **Figure 2-25**. Please read the document include in the downloaded zip file for detail.

Figure 2-25

***NOTE**: You can select the firmware file for the MCU that you want to upgrade only. Please refer to **Table 2-3** to choose the firmware file you need. The code “x” at last of the file name indicates the version. For more information, please contract your local service representative.*

Microprocessor	**File name**
DSP	DATA_X1_xxx.bin
Panel Processor	DATA_X3_x.bin
Front-end Processor	DATA_X4_x.bin

Table 2-3

[Step 3]

Connect your M3500A to PC via USB cable. Execute **DmmUpdate.exe**, and a window as **Figure 2-26a** will show. Click the “Update” button and choose the firmware file that you want to update, for example DATA_X1_10A.bin, as shown in **Figure 2-26b** and open it.

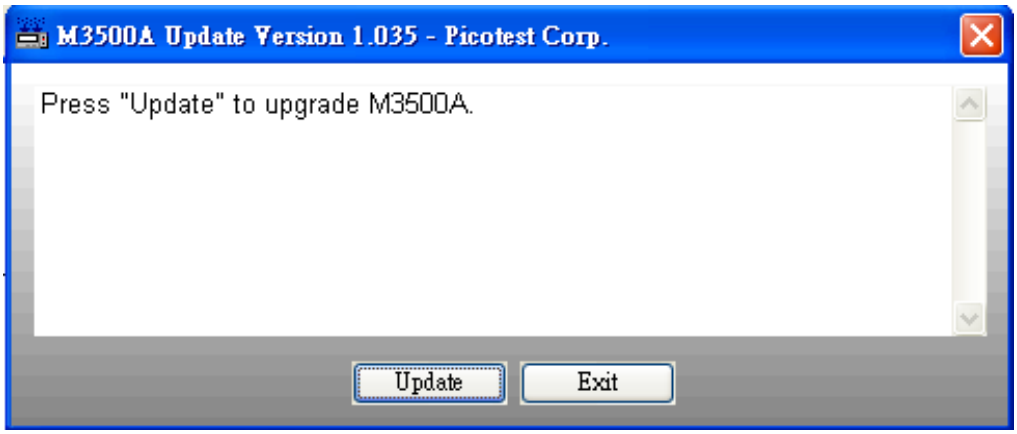


Figure 2-26a

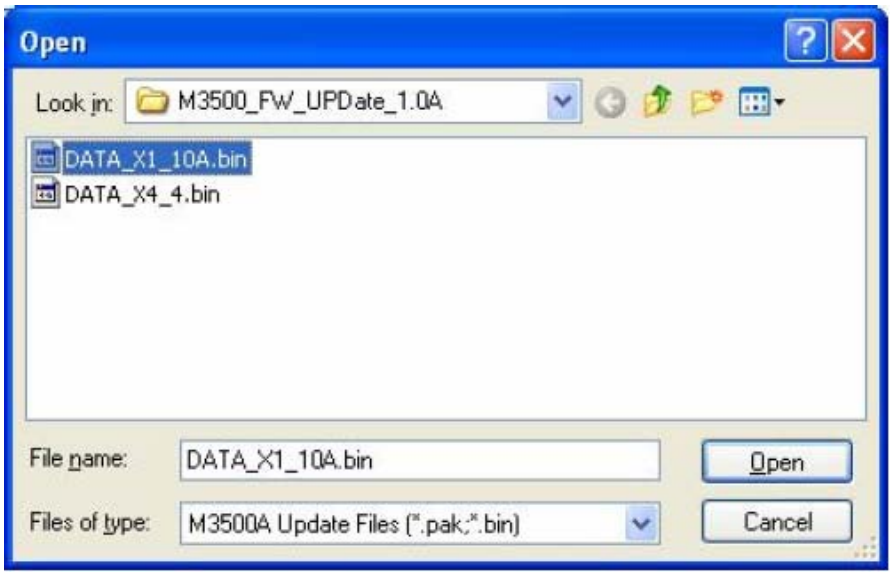


Figure 2-26b

[Step 4]

Restart your multimeter when the window as **Figure 2-27** shows up. Please ***ignore*** the “ERR” annunciator on the panel if it is lit after you restart your instrument. It will disappear after you complete whole installation.

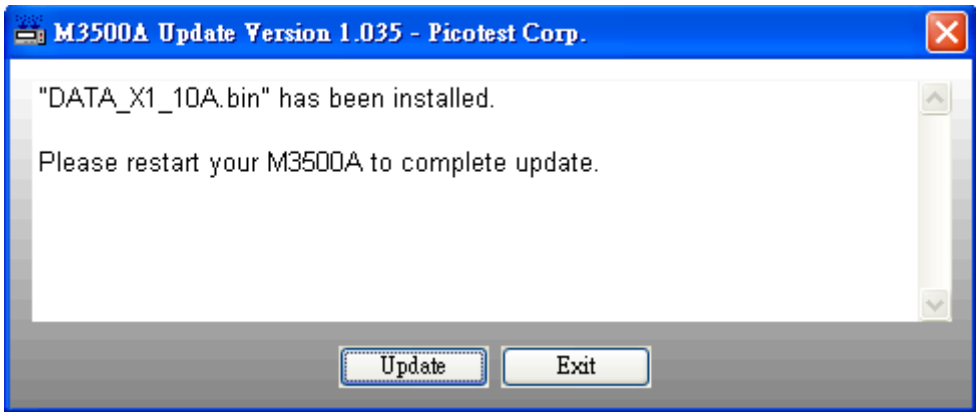


Figure 2-27

[Step 5]

Click “Update” bottom again after you restart your multimeter for installing the other firmware, or click “Exit” to exit the program and complete whole installation.

[Step 6]

To confirm the updating is successful, follow the procedure below to check the system version.

Procedure: MENU→SYSTEM→SYSTEM VER.

The system version will show in the format of “xx.xx-xx-xx”. The first code “xx.xx” is the firmware version of the DSP (Digital Signal Processor); the second code “xx” is for the panel microprocessor and the last one indicates the front-end MCU’s firmware version. If the result is incorrect, update it again.

Also, you can check the firmware version of DSP by pressing “DISPLAY-NEXT/PREV” button. The DSP’s firmware version will show on the lower-raw display panel by the form “**DSP VER.: xx.xx**”. It will be the same as the version shown in the MENU.

NOTE: If you have any trouble when you upgrading the firmware, please contact your local service representative.

3 Troubleshooting

3.1 Introduction

The information provide in this section will assist you in troubleshooting the M3500A. This section is arranged as follows:

- Introduction – Introduce what is provided in this section includes some considerations that should be noted before making any repairs to the M3500A.
- System function block – Provides brief descriptions about the principles of operation in M3500A.
- Front panel module – Provides the procedure to test the functionality of the front panel module.
- Main board module – Provides the test procedures and brief operation theories of the main board module, includes power supply circuitry, analog front-end circuitry, DSP & MCU, and main control circuitry.
- Self-Test – Explain to the self-test procedures built in M3500A.

⚠ Warning! Some procedures in this section may expose you to hazardous voltage or damage your instrument. Do not perform these procedures unless you are qualified to do so.

Be sure to read the following considerations before making any repairs to the M3500A.

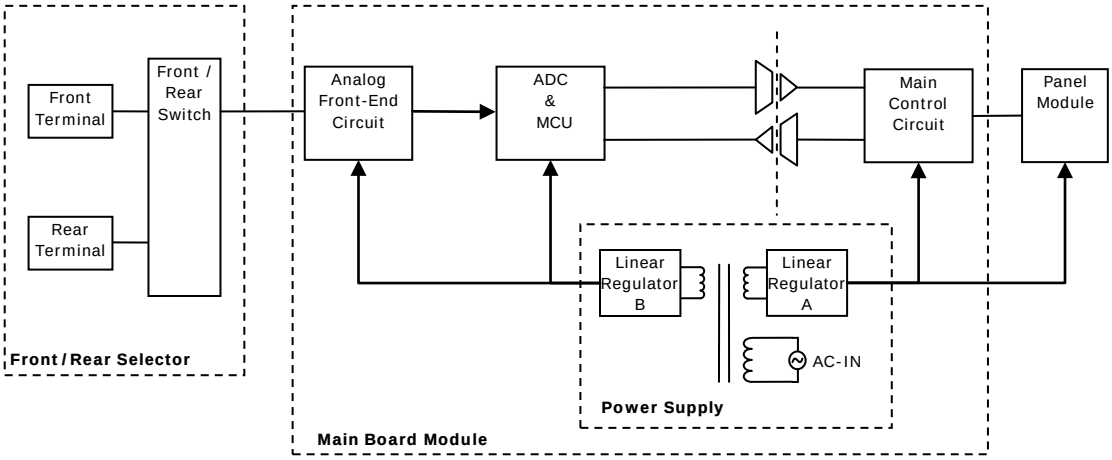
- Repairs will require various degrees of disassembly. Please refer to the section 4 of this manual for detail disassembly instructions of M3500A. It is recommended performing self-test procedure prior to any disassembly.
- Do not make repairs to the PC-board unless you are equipped and/or qualified to do so. Without proper equipment and training, you could damage a surface mount PC-board before repair. It is recommended

that sending your unit back to the factory for repairs or only replace the PC-board if you are not equipped or qualified.

- There are many CMOS devices installed in M3500A. CMOS devices are static sensitive and can be destroyed by electrostatic discharge during handling. Handle these devices with following precautions to avoid damaging them:
  1. Transport and handle ICs only in containers designed to prevent static charge.
  2. Disassemble instruments only in a static-free area.
  3. Ground yourself with a suitable wrist strap.
  4. Handle the devices only at a properly grounded work station.
  5. Minimize handling and do not touch the pins during handling the devices.
  6. Remove all plastic, styrofoam, vinyl, paper and other materials that may generate static from your work station.
  7. Only use grounded tip solder irons and anti-static type solder suckers.
- If a circuit board is removed during repair or a component is replaced, the M3500A must be recalibrated for accuracy.

3.2 System Function Blocks

Figure 3-1 shows the main system function blocks of M3500A multimeter.



System Function Blocks of M3500A

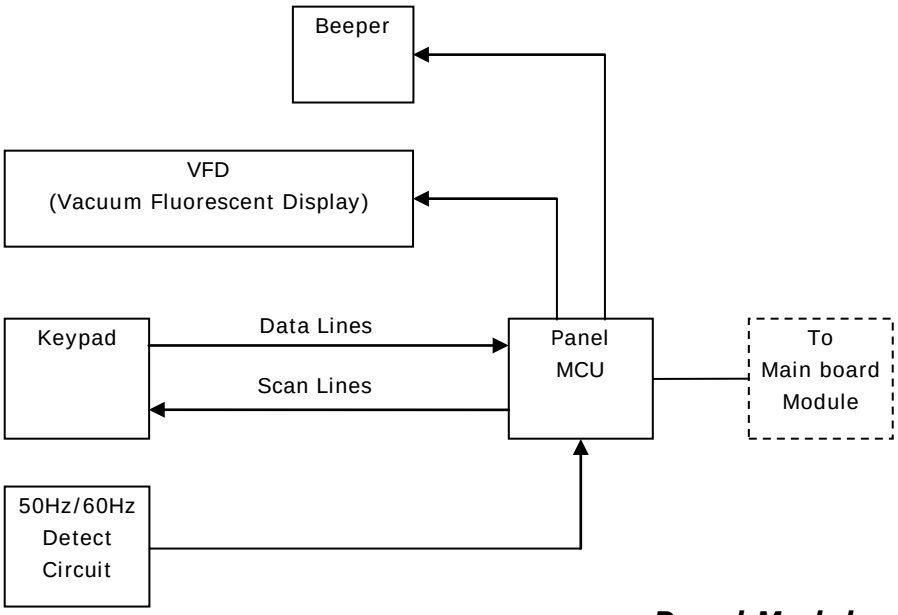
Figure 3-1

As shown in **Figure 3-1**, the system consists of Front/Rear Selector, Main Board Module, and Panel Module. In this section, the discussion of the front/rear selector is provided. The detail of the panel module is provided in section **3.3**, and the main board module is discussed in section **3.4**.

The front/rear selector is used to select either the front terminals or the rear terminals. The front terminals and the rear terminals have the same functions and users can choose one of them for their convenience. Both front and rear terminal have a fused current input terminal (Input-I) to protect against potential catastrophic damage caused by accidental input connection. The current input fuses used in M3500A is the type 3.15A, 250 V, 5 × 20 mm, fast acting, ceramic tube with a high breaking character (Picotest part number: 024-001-000008, the reference number: FS101). For more detail about current input fuses, please refer to section **2.2**.

3.3 Panel Module

The panel module consists of VFD control, keypad scanning, and beeper control. **Figure 3-2** shows the block diagram of the panel module of M3500A.



Panel Module

Figure 3-2

Panel MCU U3 controls the functions of panel module. Communication between the panel module and the main board module is accomplished through a 4-wire bidirectional serial interface. The panel MCU sends a key scanning signal sequentially to the keypad via scan lines to detect the status of keys. In a similar manner, the key data are sent back sequentially through data lines.

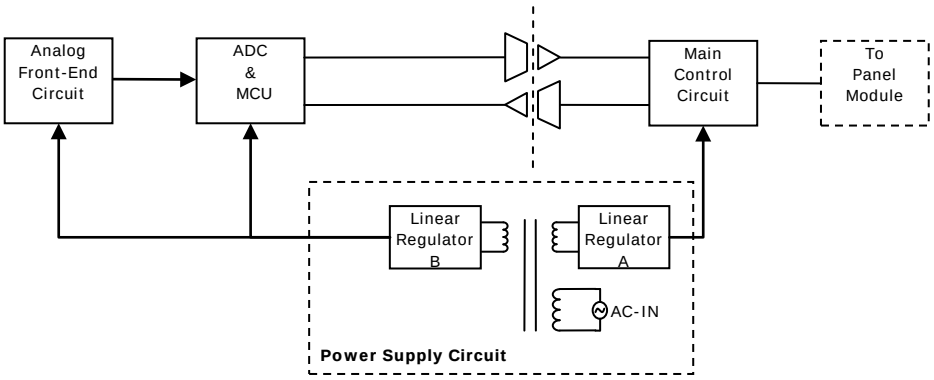
If any key is pressed, a key down parameter will be sent to panel MCU. Panel MCU U3 interprets the key down data and sends the data to the main controller on the main board module. Main controller U1601 will operate according to the received data, and then return the result to U3. According to the result from U1601, U3 sends control signals to the VFD (vacuum fluorescent display) for correct display and to beeper to generate a beep.

Filament voltage for the VFD is derived from the power supply transformer. A 50Hz/60Hz detecting circuit consists of comparator U4 detects the

frequency of supply voltage AC2 from the transformer and then informs main controller to set PLC (Power Line Cycle) parameters. Panel MCU will response automatically according to the detecting result to make the VFD operating properly.

3.4 Main Board Module

The main board module of M3500A consists of power supply circuit, analog front-end circuit, ADC and MCU, and main control circuit. The block diagram is shown in **Figure 3-3**.



Main Board Module

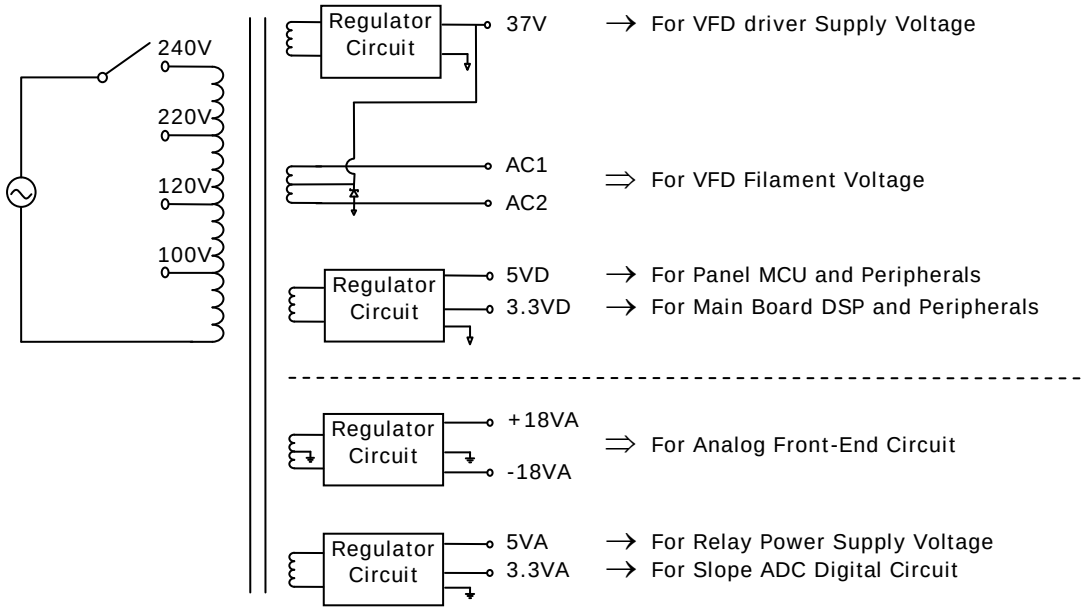
Figure 3-3

As shown in **Figure 3-3**, input signals routed through analog front-end circuit and then convert to digital signal by the ADC. Digital signals are sent to main control circuit via opto-couplers. The calculated data will send to panel module and display the result on VFD. The powers needed in these circuits are supplied by the power supply circuit.

The discussion about power supply circuit is provided in section **3.4.1**; the circuitry theories of the analog front-end circuit and ADC & front-end processor are shown in section **3.4.2** and **3.4.3** respectively, and section **3.4.4** provides the discussion about the main control circuit of M3500A.

3.4.1 Power Supply Circuitry

In this section, a basic circuit theory that can help you to troubleshoot the power supply circuit of M3500A is provided. The power supply circuit transforms the AC line voltage to required voltage (AC or DC) for various internal circuits. The block diagram of power supply circuit is shown in **Figure 3-4**.



Power Supply Circuit

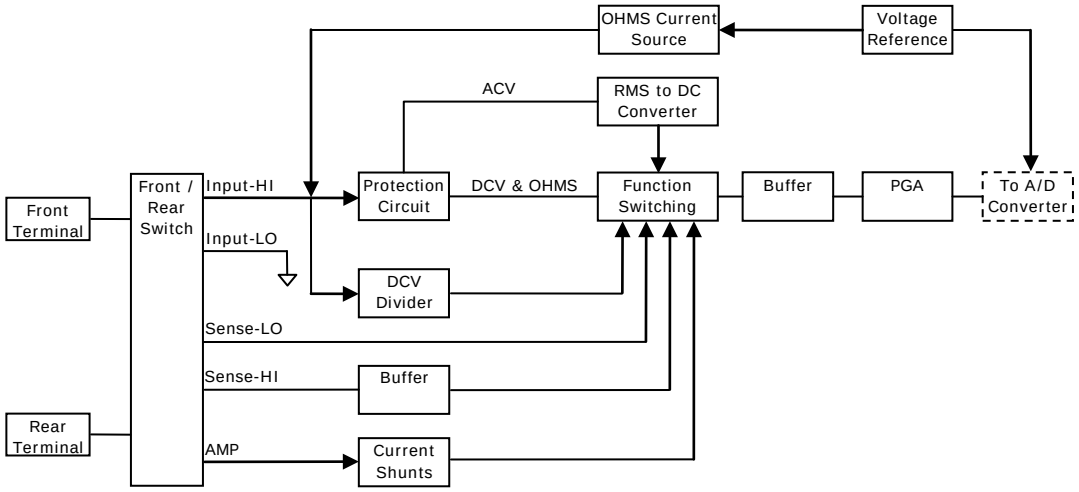
Figure 3-4

As shown in **Figure 3-4**, AC power is applied through the line voltage selector to power transformer. There are four selections of line voltage (240, 220, 120, and 100 Vac) can be applied to M3500A. You must choose a correct line voltage for your multimeter according to your local power utility voltage or damage may occur.

The power transformer has a total five secondary windings to produce AC and DC voltages for M3500A. AC voltage is used to provide the VFD filament voltage, and each DC supply uses a regulator circuit for various purposes. Please refer to **Figure 3-4** to check the purpose of each supplied voltage.

3.4.2 Analog Front-end Circuitry

The purpose of the analog front-end circuit is to converter the input signals from the front or rear terminal to ADC (analog-to-digital converter) input. The block diagram of the analog front-end circuit of M3500A is shown in **Figure 3-5**.



Analog Front-End Circuit

Figure 3-5

The purpose of the function switching circuit is to connect the input terminal to the various functions. All measurement signals are changed to a DC voltage and then sent to the function switching circuit. The amplifier in the function switching circuit converts the voltage to a properly value according to the function which is selected and then send it to the A-to-D converter through the PGA circuit.

The PGA circuit switches the various signals for measurement. In addition to the input signal, it also switches among reference and zero signals at various phases of the measurement cycle.

DC input signals from Input-HI terminal are routed via a protection circuit to the function switching circuit. If an overload condition occurs, the protection circuit will disconnect the analog input signal from the rest of the analog circuit. For the 100 VDC and 1000 VDC ranges, the protection circuit is open and input DC voltage is through a DCV divider R204 to the function switching

circuit.

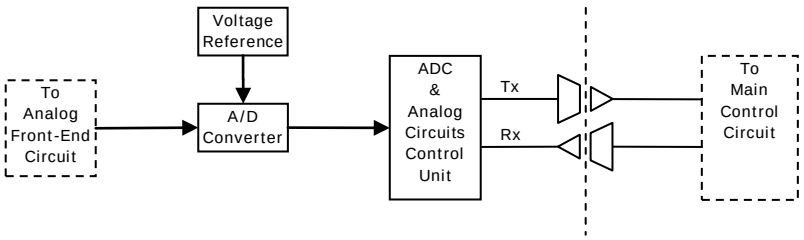
The ACI or DCI input signal is applied to the current shunt circuit from the Input-I terminal and a relay is used to select shunts. For 10mA DC and 100mA DC ranges, a 5.1Ω resistance is shunted across the input. For the other DCI and all ACI ranges, a 0.1Ω shunt is used. Since the shunt resistance is known, a voltage proportional to the input current is generated and measured by the function switching circuit.

Resistance measurements are made by applying a known current through an unknown resistance. The current from OHMS current source makes a voltage drop across the unknown resistance. The resulting voltage drop is then routed through the protection circuit and measured by the function switching circuit. For 4-wire ohms measurements, Sense-HI and Sense-LO are connected to the function switching circuit, too.

AC input voltage from the Input-HI terminal is sent to a RMS to DC converter via protection circuit. RMS to DC converter changes the input AC voltage to a DC voltage and then sends it to the function switching circuit. All voltage ranging is performed in the converter circuit so that the input of the function switching circuit is nominally 2 VDC for a full scale AC input.

3.4.3 ADC & MCU

Figure 3-6 shows the block diagram of the A-to-D convert circuit of M3500A.



ADC & MCU

Figure 3-6

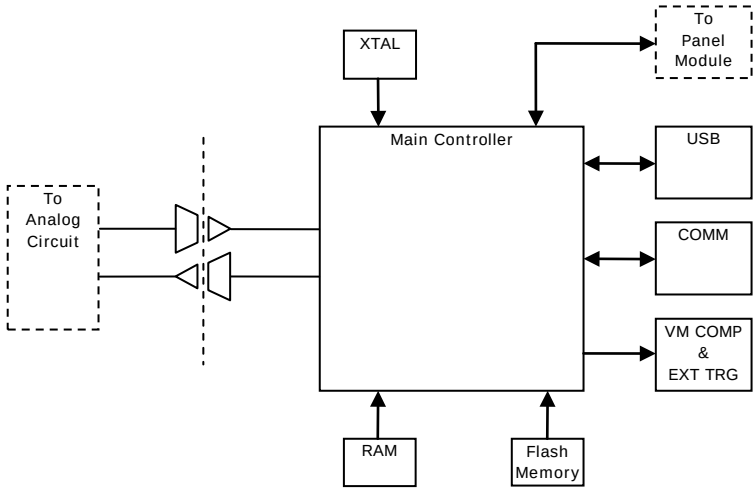
The analog-to-digital converter (ADC) is used to change dc voltage into digital information. The digital signals are then sent to the main controller on the main board module through opto-couplers to calculate readings. The voltage reference circuit is used to provide precision voltage reference for the multimeter.

A microprocessor (front-end processor), U2001, controls the functions of ADC and the analog front-end circuit to make sure the analog-to-digital conversions are performed properly. The output data of the ADC circuit are then sent to the main controller on the main board module through the Tx lines via opto-couplers.

When the multimeter is triggered, an analog-to-digital conversion is performed. The ADC starts by clearing the integrator slope count in the front-end MCU, and the slope count is latched at the end of the integration period. The slope count provides the most significant bits of the input voltage conversion.

3.4.4 Main Control Circuitry

The main control circuit controls operations of the entire instrument. **Figure 3-7** shows the block diagram of the main control circuit.



Main Control Circuit

Figure 3-7

All measurement control and bus command interpretation is performed in the main controller (DSP) U1601, and the panel processor U3 and front-end processor U2001 operate as slaves to the DSP. The main controller (DSP) is a 16-bit fixed-point Digital Signal Processor. It has parallel and serial ports to control various circuits, such as USB and COMM interface.

A conventional address/data bus is used to transfer data between the DSP and the external RAM U1701 and flash memory. The flash memory is used to store the firmware for M3500A operation and calibration data, and the external RAM provides temporary operating storage.

The clock frequency of the DSP is controlled by an oscillating circuit consists of a 10 MHz crystal.

3.5 Self-test

Self-test procedures are built in M3500A for checking that the logic and measurement hardware are functioning properly. Every time when the multimeter is powered on, a set of test procedures is performed to make sure the basic function of the multimeter works properly. If any error occurs during self-test procedures, it indicates that parts of the multimeter are not operating properly and need to be serviced.

 Warning! Erroneous self-test failures may occur if the setting of power line voltage is incorrect. Errors may also occur because of signals present on the input terminal (front and rear) during self-test procedure. Long test leads can act as an antenna causing pick-up of ac signals.

Or users may execute a complete self-test by front panel operation. This test procedure provides more tests for the hardware of M3500A than the power-on tests. Please follow the procedure below to perform the complete self-test.

Procedure: MENU → SYSTEM → SELF TEST

After self-test procedure, the result, PASS or FAIL, will be shown. If the result is FAIL, the "ERR" annunciator on the display panel will be lit, and error codes will be stored. You can check the error codes by the following procedure.

Procedure: MENU→SYSTEM→ERROR

The descriptions of self-test procedures are listed below including test number, purpose, test setup, and failure criteria.

601 Front panel does not respond The main CPU U1601 attempts to establish serial communications with the front panel processor U3. Communication must function in both directions for this test to pass.

602 RAM read/write failed This test writes and reads a 55h and AAh checker board pattern to each address of ram U1701. Any incorrect read back will cause a test failure. This error is only readable from the remote interface.

603 Front-End MCU does not respond The main CPU U1601 attempts to establish serial communications with the *front-end* processor U2001. Communication must function in both directions for this test to pass.

604 A/D noisy test failed This test configures to the 10V dc range with the internal 0V. A 20ms ADC measurement is performed and the result is checked against a limit of 0V±20uV

605 N2 calibration parameter failed This error message indicates that N2 calibration parameter is out of range.

606 N3 calibration parameter failed This error message indicates that N3 calibration parameter is out of range.

607 Buffer1 offset out of range This procedure is to test the offset of buffer U507. The result is checked against a limit of 0±0.1mV

608 Buffer2 offset out of range This procedure is to test the offset of buffer U508. The result is checked against a limit of 0±0.1mV

609 DC gain x1 failed This procedure is to test the tolerance of DC gain×1 amplifier. The limit of gain tolerance is ±0.005.

610 DC gain x10 failed This procedure is to test the tolerance of DC gain×10 amplifier. The limit of gain tolerance is ±0.05.

611 DC gain x100 failed This procedure is to test the tolerance of DC gain×100 amplifier. The limit of gain tolerance is ±0.5.

612 Ohms 500 nA source failed This test configures to the 10V dc range with the internal 10M 100:1 divider R204 connected across the input. The 500nA ohms current source is connected to produce a nominal 5V signal. A 20ms ADC measurement is performed and the result is checked against a limit of 5V±1V.

613 Ohms 5 uA source failed This test configures to the 1000V dc range with the internal 10M 100:1 divider R204 connected across the input. The 5 μA ohms current source is connected. The compliance limit of the current source is measured. A 20ms ADC measurement is performed and the result is checked against a limit of 0.12V±0.01V.

614 DC 1000V zero failed This test configures to the 1000V dc range with no input applied. A 20ms ADC measurement is performed and the result is checked against a limit of 0V±5 mV.

615 Ohms 10 uA source failed This test configures to the 1000V dc range with the internal 10M 100:1 divider R204 connected across the input. The 10 μA ohms current source is connected. The compliance limit of the current source is measured. A 20ms ADC measurement is performed and the result is checked against a limit of 0.12V±0.01V.

616 DC current sense failed This test configures to the 3A dc range. A 20ms ADC measurement is performed and the result is checked against a limit of 0A±5A. This test confirms that the dc current sense path is functional. The test limit is set wide because K303 does not open the current input during self-test. This test should catch a dc current sense failure without causing false failures when current inputs are applied during self-test.

617 Ohms 100 uA source failed This test configures to the 1000V dc range with the internal 10M 100:1 divider R204 connected across the input. The 100 μA ohms current source is connected. The compliance limit of the current source is measured. A 20ms ADC measurement is performed and the result is checked against a limit of 0.12V $\pm$ 0.01V.

618 DC high voltage attenuator failed This test configures to the 1000 V dc range. The 500nA ohms current source is connected to produce a nominal 5V signal. A 20ms ADC measurement is performed and the result is checked against a limit of 5V $\pm$ 1V.

619 Ohms 1 mA source failed his test configures to the 1000V dc range with the internal 10M 100:1 divider R204 connected across the input. The 1mA ohms current source is connected. The compliance limit of the current source is measured. A 20ms ADC measurement is performed and the result is checked against a limit of 0.12V $\pm$ 0.01V.

620 AC rms zero failed This test configures for the 100mV ac range with the ac input grounded. The internal residual noise of the ac section is measured and checked against a limit of -10mV to 70mV at the output of the rms-to-dc converter.

621 AC rms full scale failed This test configures for the 100mV ac range. The 1mA ohms current source is switched on to charge the ac input capacitor C614. This produces a pulse on the output of the rms-to-dc converter which is sampled 100ms after the current is applied. A 20ms A/D measurement is performed and checked against a limit of 2V to 13V into the ADC.

622 10V reference failed This test configures to the 10V dc range with the internal 5V. The result is checked against a limit of 4.55V ± 0.15V。

624 Unable to sense line frequency The supplied voltage AC2 is routed through a comparator U4 to generate a logic input signal. This test checks that the logic input from U4 to panel MCU U3 is toggling. If no logic input is detected, the instrument will assume 50Hz line operation for all future measurements.

4 Disassembly & Re-assembly

4.1 Introduction

This section explains how to disassemble and reassemble the M3500A multimeter. This section provides the procedure to assist in case cover removal, main board removal, and front panel disassembly. Also, there are mechanical drawings in this section to assist in the disassembly and re-assembly of the M3500A.

⚠ Warning! Do not disassemble the M3500A multimeter unless you are qualified to do so.

4.2 Case Cover Removal

If you need to remove the case cover when you are troubleshooting your multimeter or you want to replace a component, this section will show you how to do.

⚠ Warning! Do not remove the case cover before you disconnect the line cord and all the test leads connecting to the multimeter, or electric shock may occur.

NOTE: When you want to re-install the case cover, please reverse the steps shown below. Make sure all the parts are properly seated and secured.

[Step 1]

Turn the handle up to 90° with the multimeter, and pull it out as shown in **Figure 4-1**.

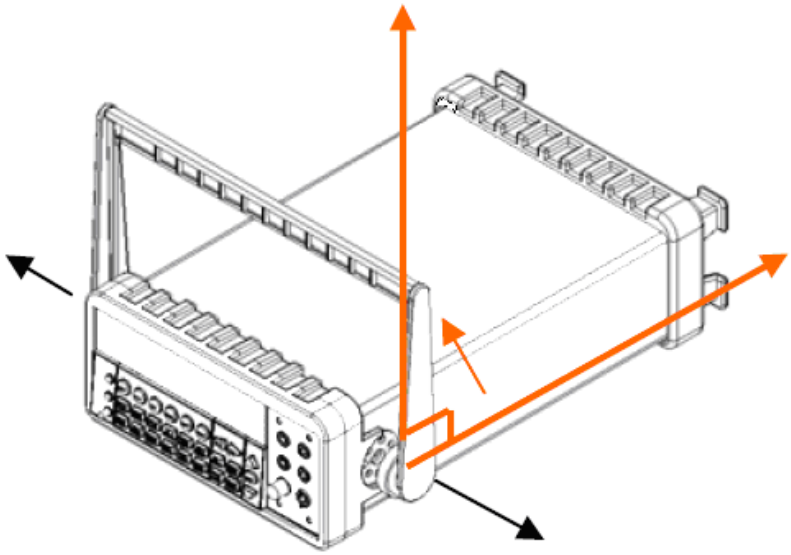


Figure 4-1

[Step 2]

Pull the front mounting ear out as shown in **Figure 4-2**.

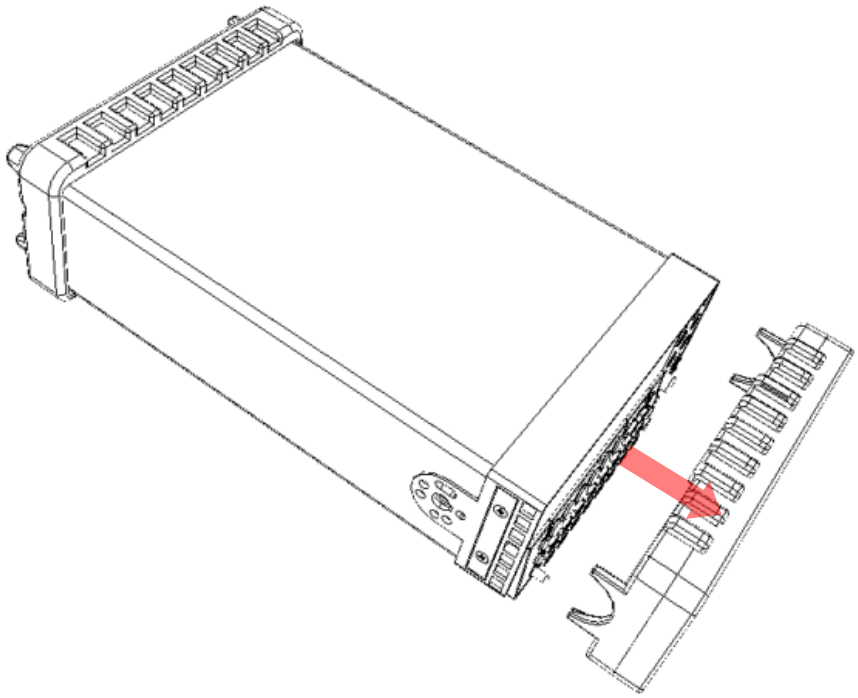


Figure 4-2

NOTE: When re-installing the front mounting ear, make sure the ear is in the correct direction.

[Step 3]

Remove the six fastening screws securing the rear bezel on the chassis as **Figure 4-3** shown. Pull the bezel and the rear mounting ear out together.

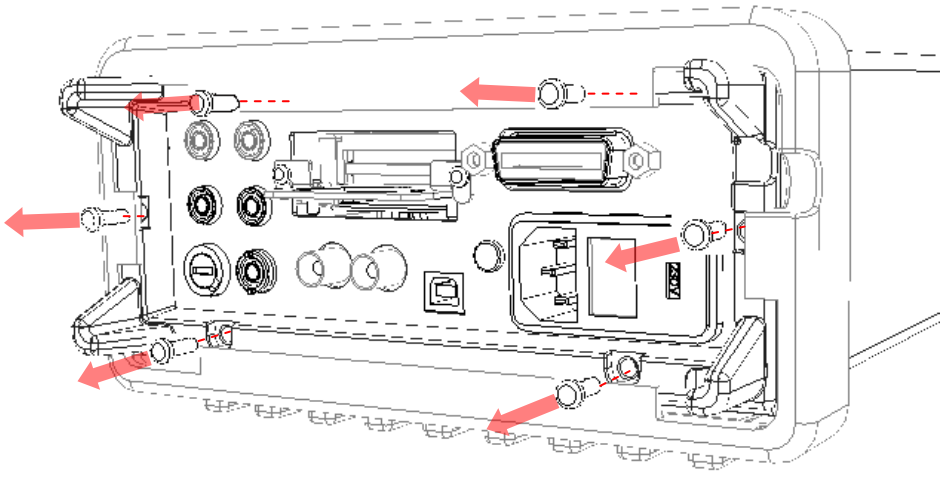


Figure 4-3

[Step 4]

Remove one screw that secures the metal cover on the chassis. The screw is on the bottom as shown in **Figure 4-4**.

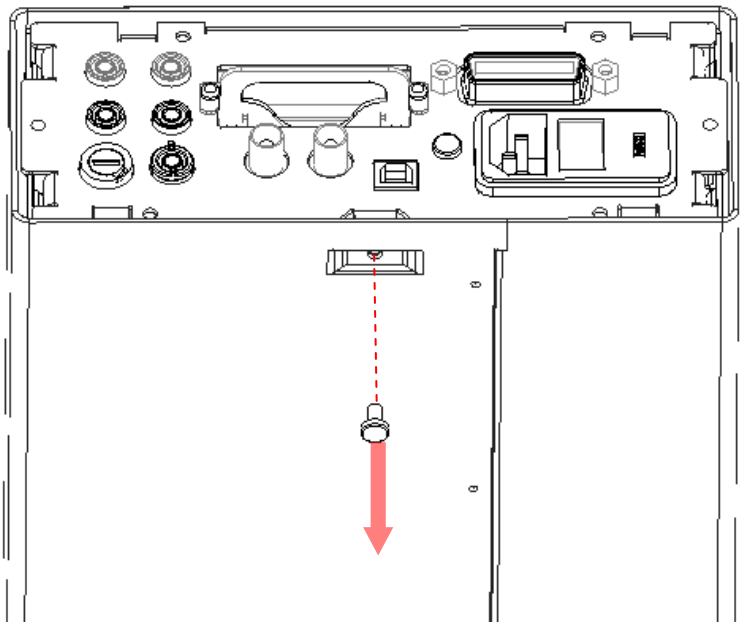


Figure 4-4

[Step 5]
Slide the metal cover out of the chassis as shown in **Figure 4-5** and complete the cover removal.

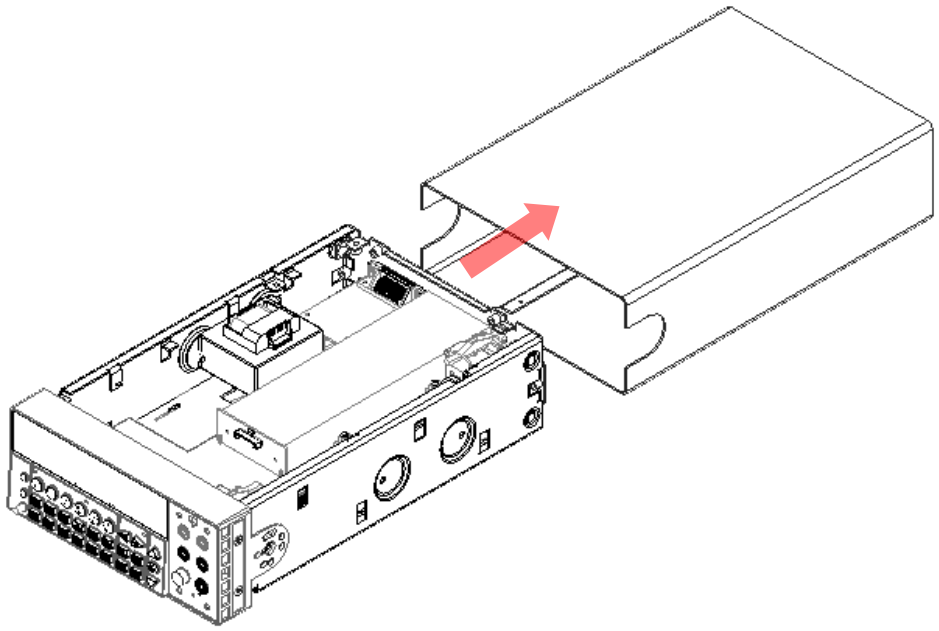


Figure 4-5

4.3 Main Board Removal

Follow the steps below to remove the main board. Of course, you must complete the metal cover removal first.

[Step 1]
Remove the scanner card and GPIB card. If there are no scanner card and GPIB card installed in your instrument, please skip this step.

- Remove two fasteners of GPIB card and two captive screws that secure the scanner card on the rear panel as shown in **Figure 4-6**. Pull out the scanner card gently.

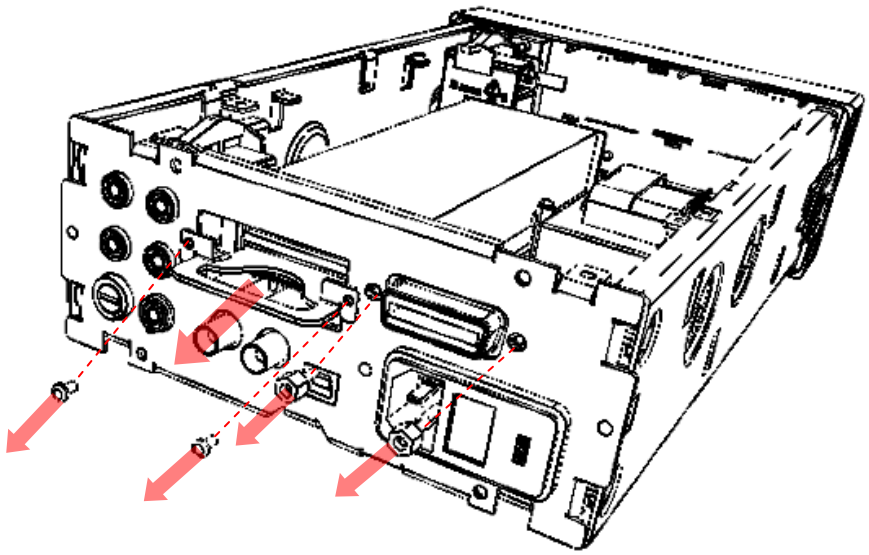


Figure 4-6

- Loose the screw that secures the GPIB card on the plastic cylinder, and remove the GPIB card carefully.

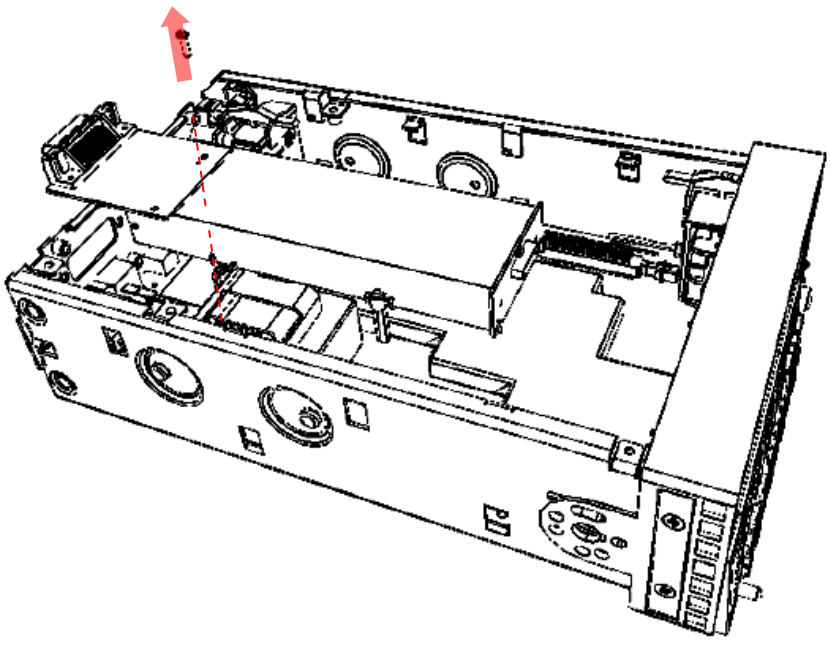


Figure 4-7

- Disconnect the cable from GPIB card to the connector J1605 on the main board.

[Step 2]

Remove the rear panel module.

- Disconnect the three connectors from the transformer to power entry as shown in **Figure 4-8**.

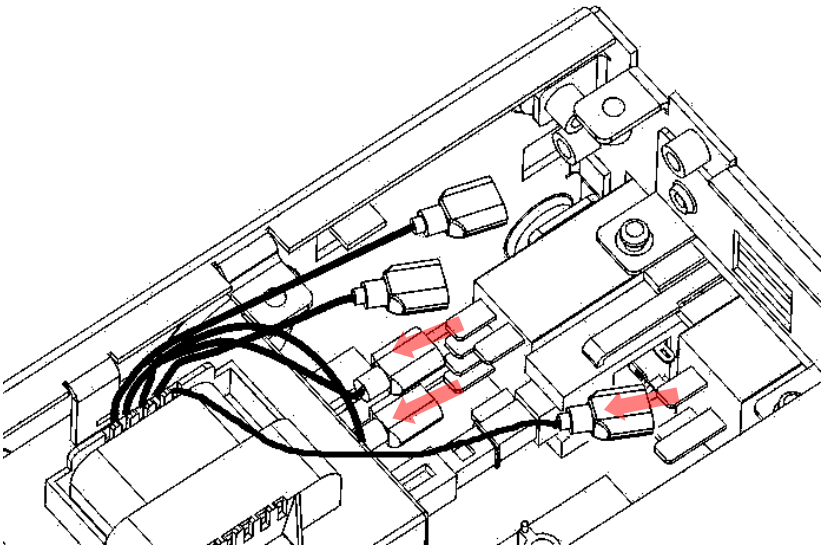


Figure 4-8

Warning! Make sure the connection is correct when you re-connect the connectors between the transformer and power entry. An incorrect connection will make the power supplied to the multimeter improperly and cause damage to your instrument. For more information about the power transformer, please refer to section **2.1.2**.

- To remove the power switch rod from power entry, turn the multimeter to the bottom. Place the edge of a flat-blade screwdriver in the notch on the pushrod, and twist the driver gently while pulling the rod from the shaft as shown in **Figure 4-9**.

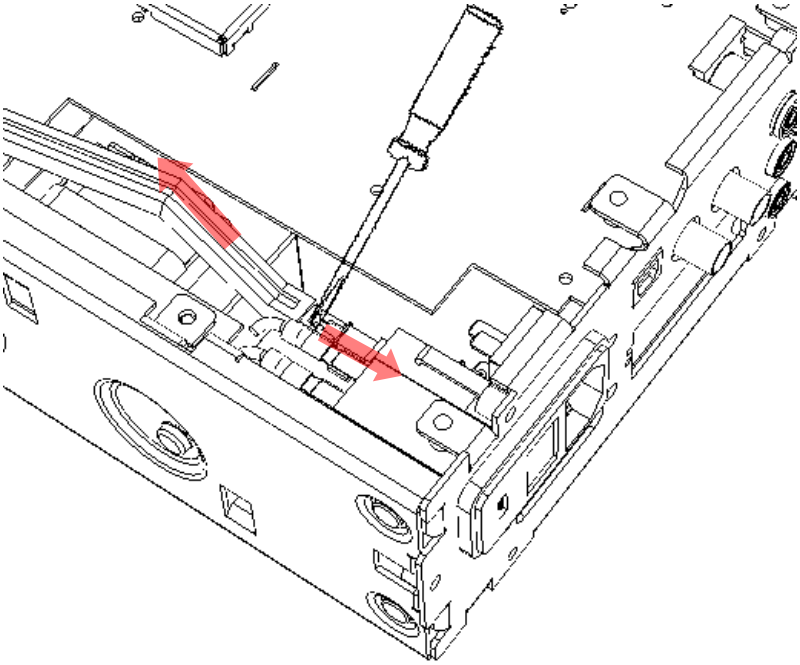


Figure 4-9

- Remove the six screws as shown in **Figure 4-10**.

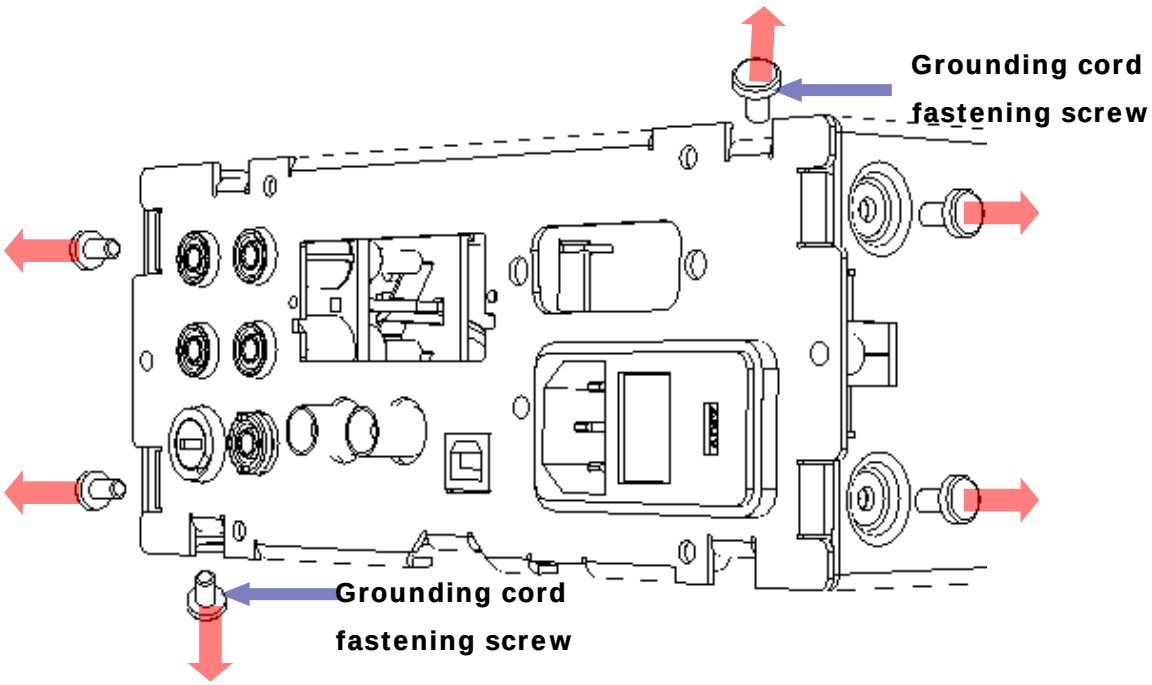


Figure 4-10

Warning! Two grounding cords that connect between the rear panel and the left and right chassis are fastened by the screws pointed by blue arrows in **Figure 4-10**. Make sure the connections are correct when you re-install the rear panel.

- Remove the fastener of the rear terminal set as shown in **Figure 4-11**, and pull the rear panel out from the chassis. Remove the fastener of the front terminal set by the same way.

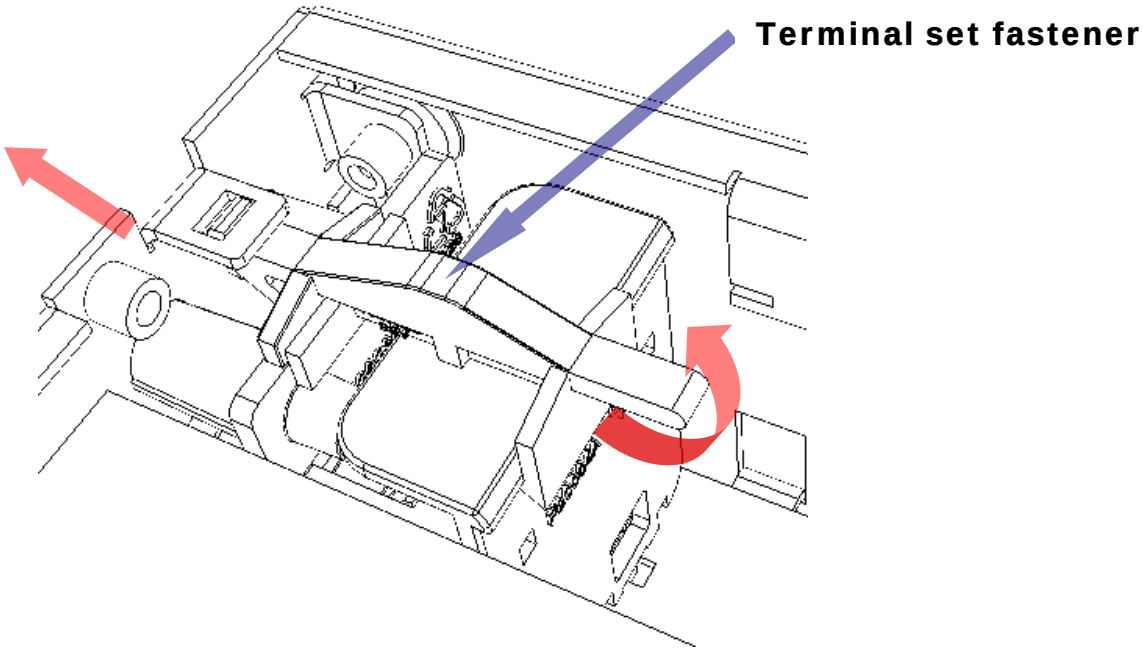


Figure 4-11

[Step 3]

Remove the transformer.

- Loose the tow fastening screws as shown in **Figure 4-12**.

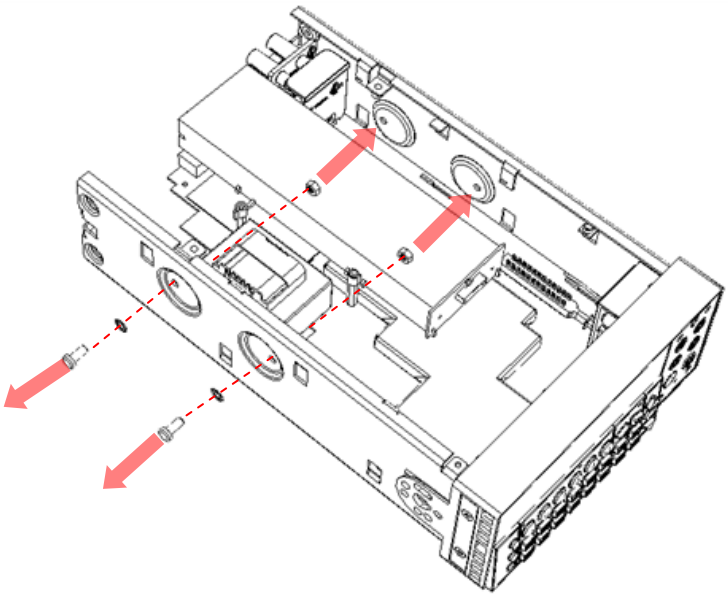


Figure 4-12

- Unplug the three cables to the connectors J2201, J2202, and J2203, and then remove the transformer.

[Step 4]

To remove the front/rear switch rod, place the edge of a flat-blade screwdriver in the notch on the pushrod, and twist the driver gently while pulling the rod from the shaft as shown in **Figure 4-13**.

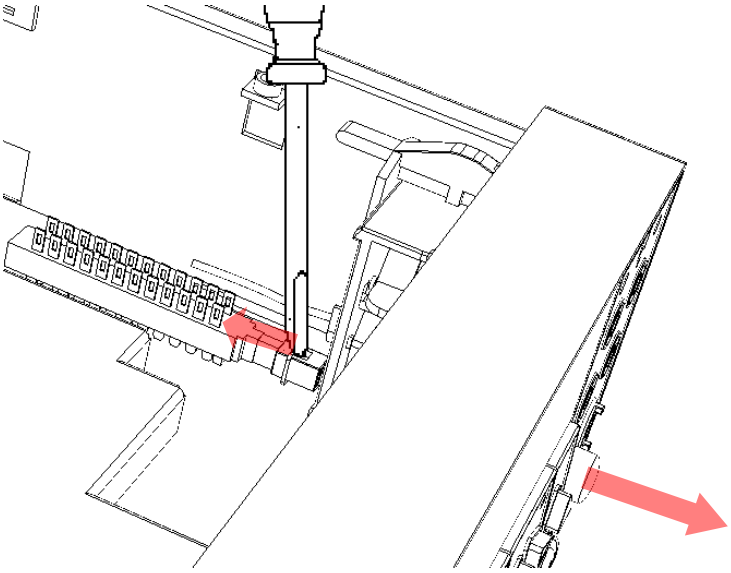


Figure 4-13

[Step 5]

Unplug the ribbon cable from the display panel to the connector J1604, and then remove the screw that secure the main board on the chassis as shown in **Figure4-14**.

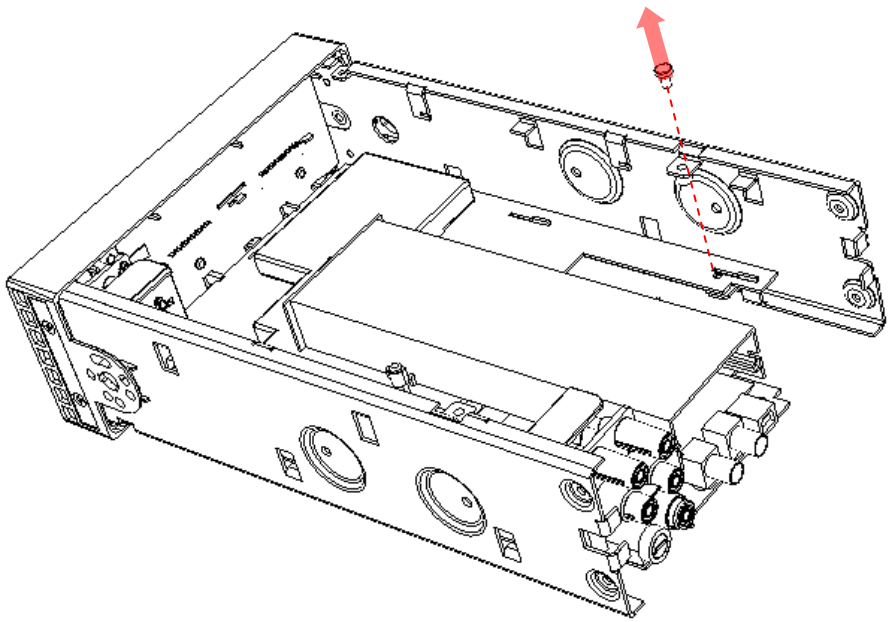


Figure 4-14

[Step 6]
Pull the main board gently to make the fixed points leaving their positions. Raise the board a little bit and then pull it out carefully as **Figure 4-15**.

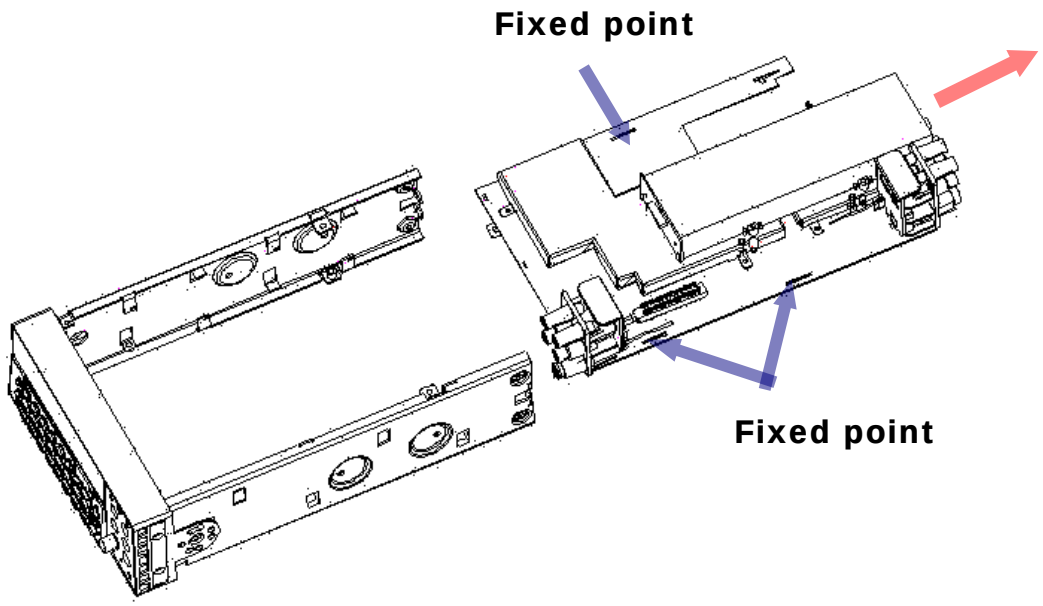


Figure 4-15

NOTE: When you want to re-install the main board, please reverse the steps shown above. Make sure all the parts are properly seated and secured.

4.4 Front Panel Disassembly

Follow the steps below to remove the front panel. This procedure assumes that you removed the metal cover and main board already.

[Step 1]
Unscrew the input terminal heat conducting header and remove it as shown in **Figure 4-16**.

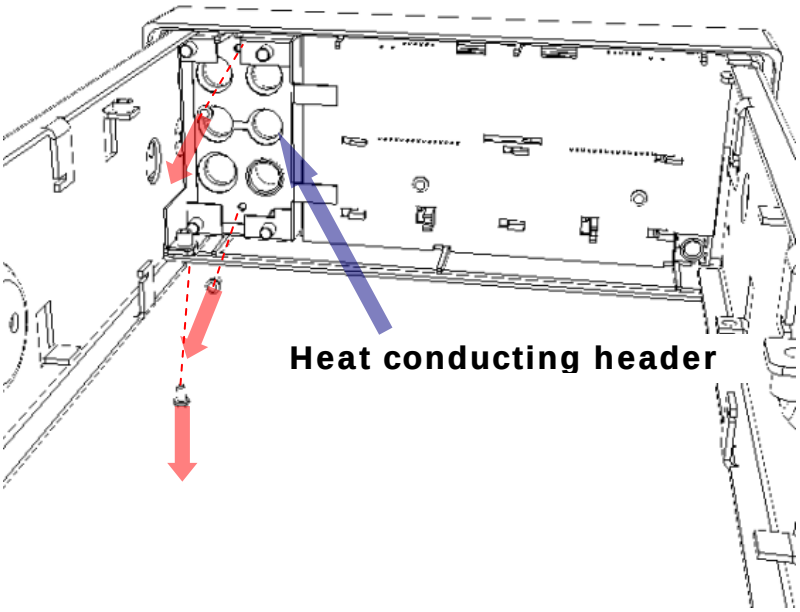


Figure 4-16

[Step 2]

Remove the fasteners of the right/left chassis as shown in **Figure 4-17**, and then remove the chassis.

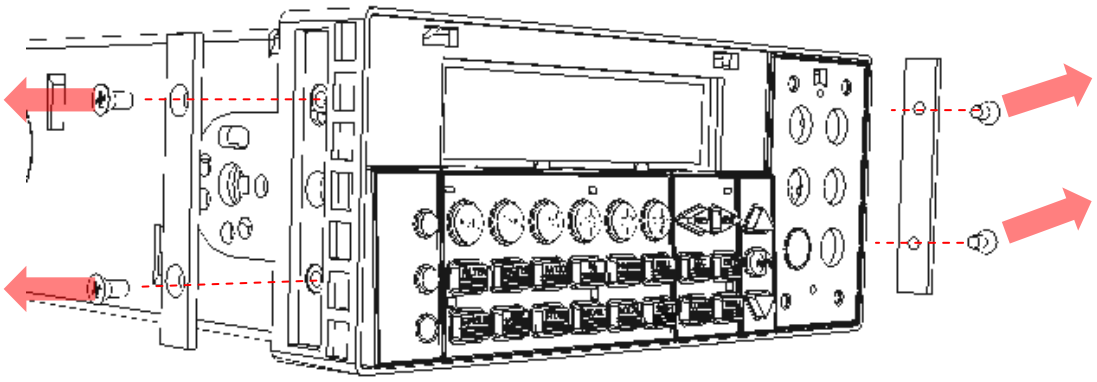


Figure 4-17

[Step 3]

Remove the two fastening screws that secure the front panel PCB board as **Figure 4-18**. Slide the front panel board to the right carefully to leave the fixed points, and then remove the front panel board

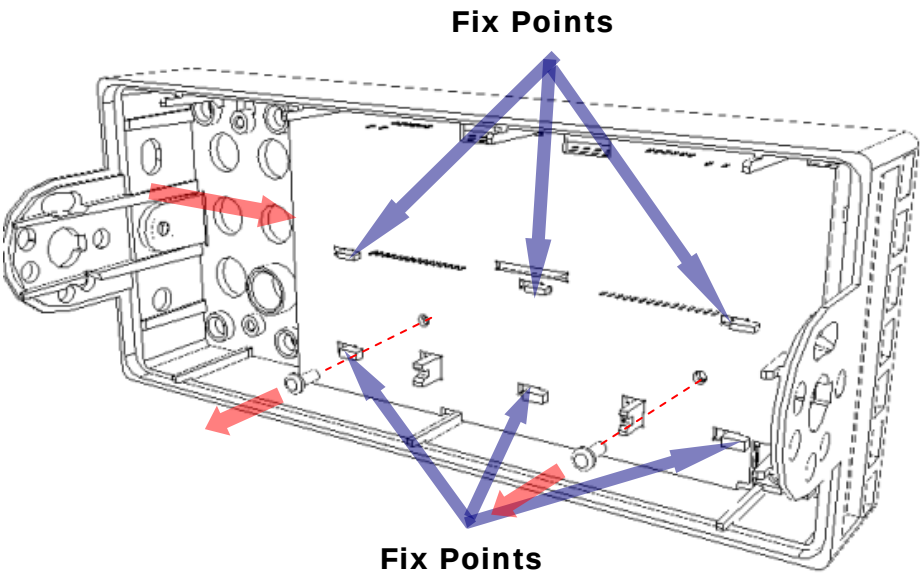


Figure 4-18

[Step 4]

Now you can remove the conductive keypad module easily as shown in **Figure4-19**.

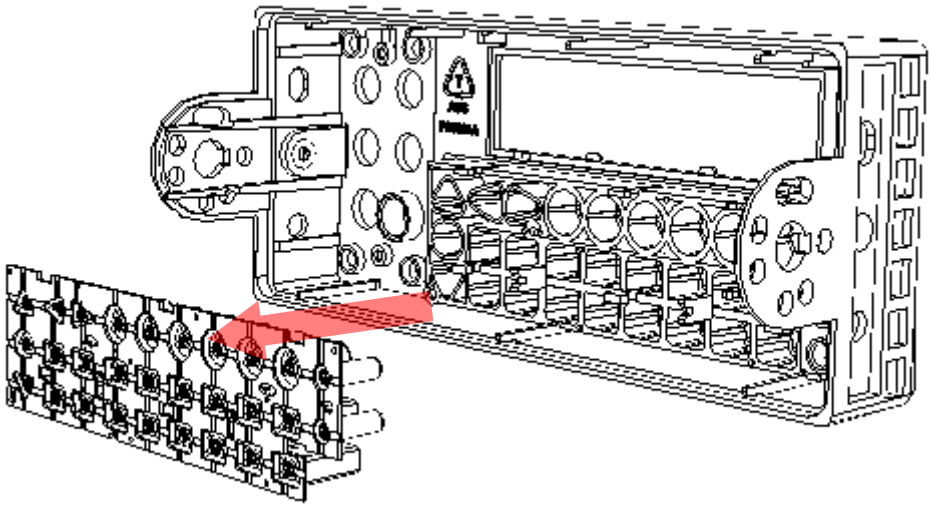


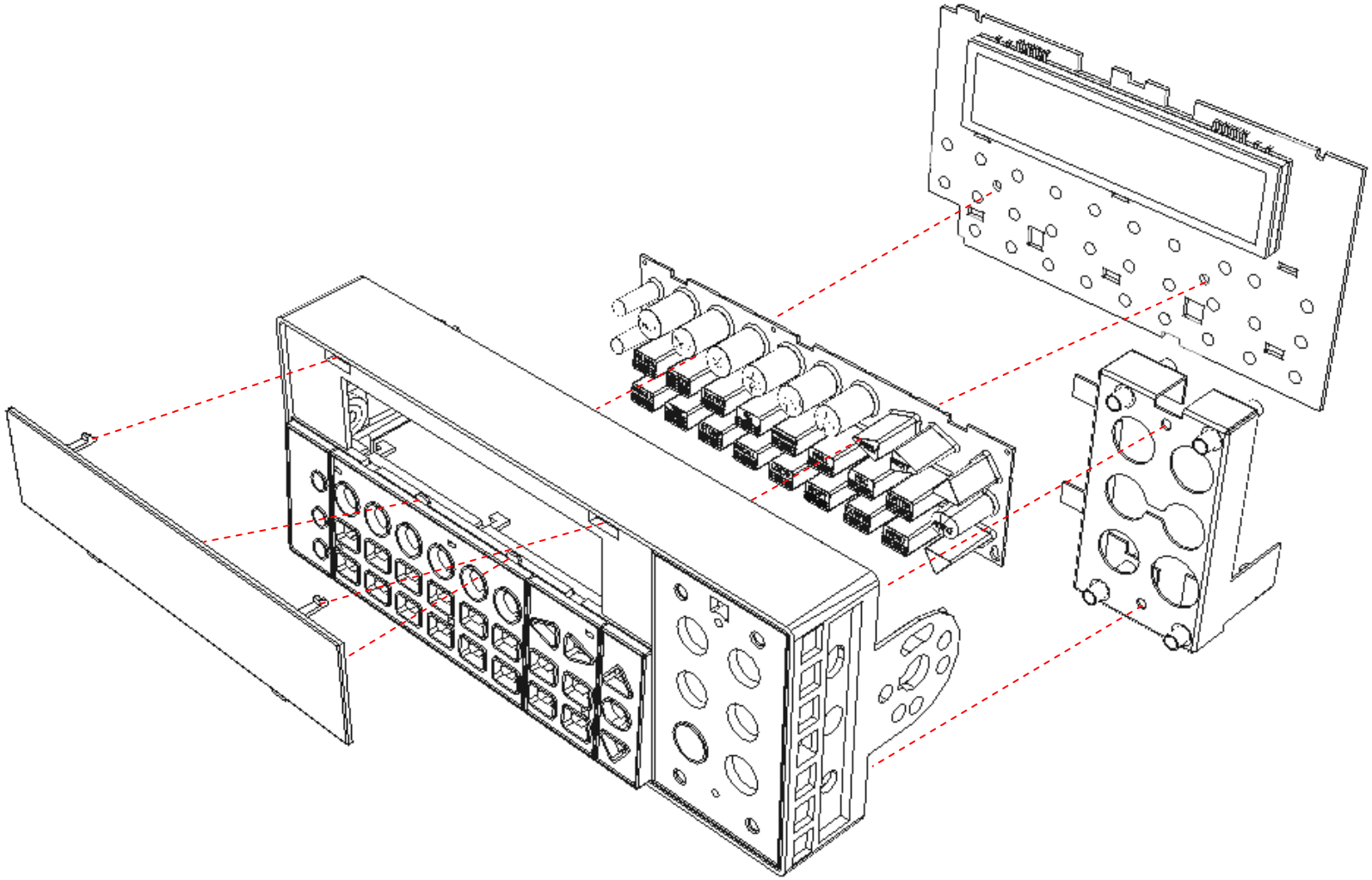
Figure 4-19

NOTE: When you want to re-install the front panel, please reverse the steps shown above. Make sure all the parts are properly seated and secured.

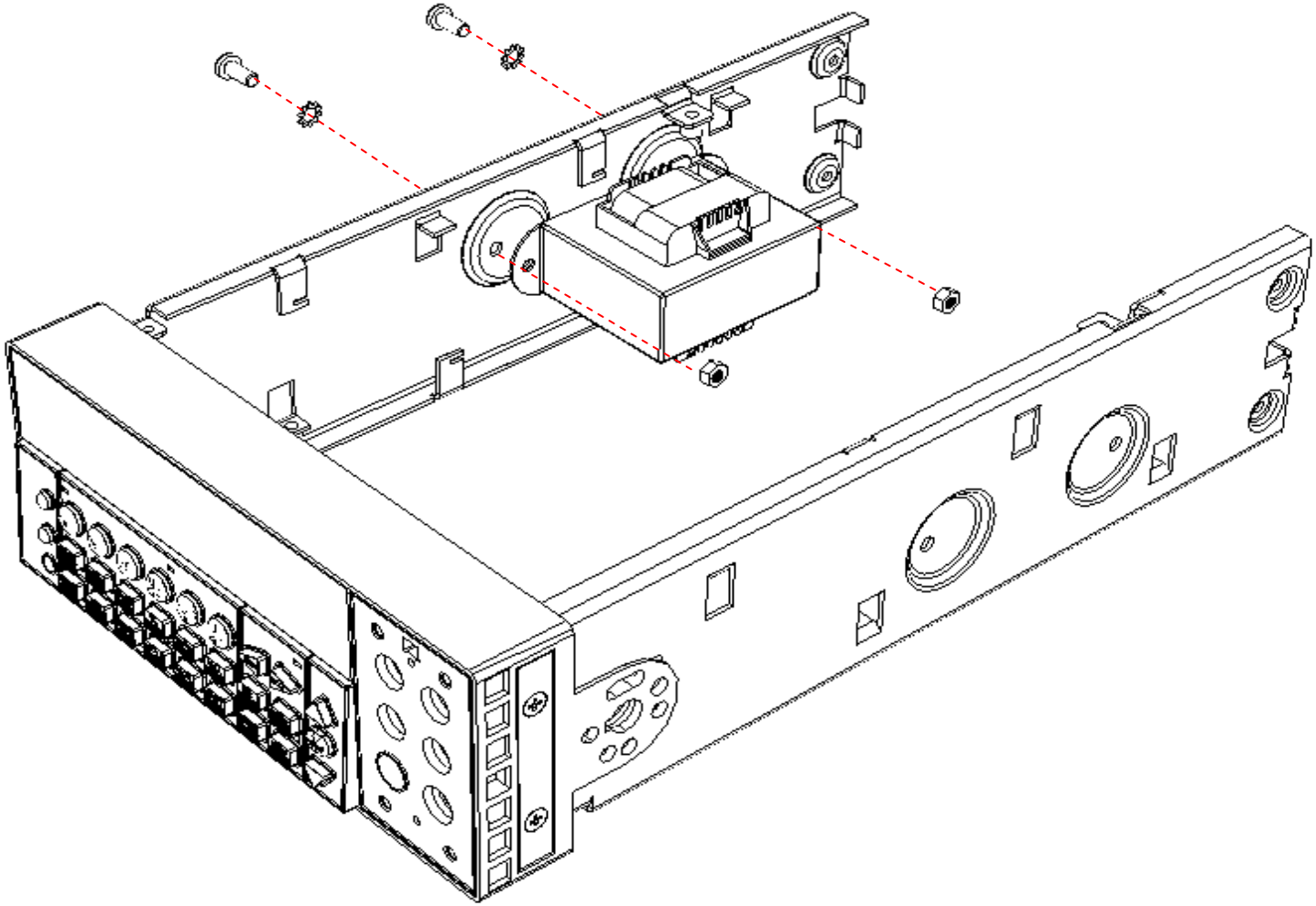
4.5 Assembly Drawings

The mechanical drawings provided in this section will help you to disassemble and re-assemble the M3500A multimeter quickly. Section **4.5.1** shows the *front panel assembly*, section **4.5.2** shows the *chassis and transformer assembly*, section **4.5.3** is the *main board assembly*, and section **4.5.4** provides the *chassis assembly* drawings.

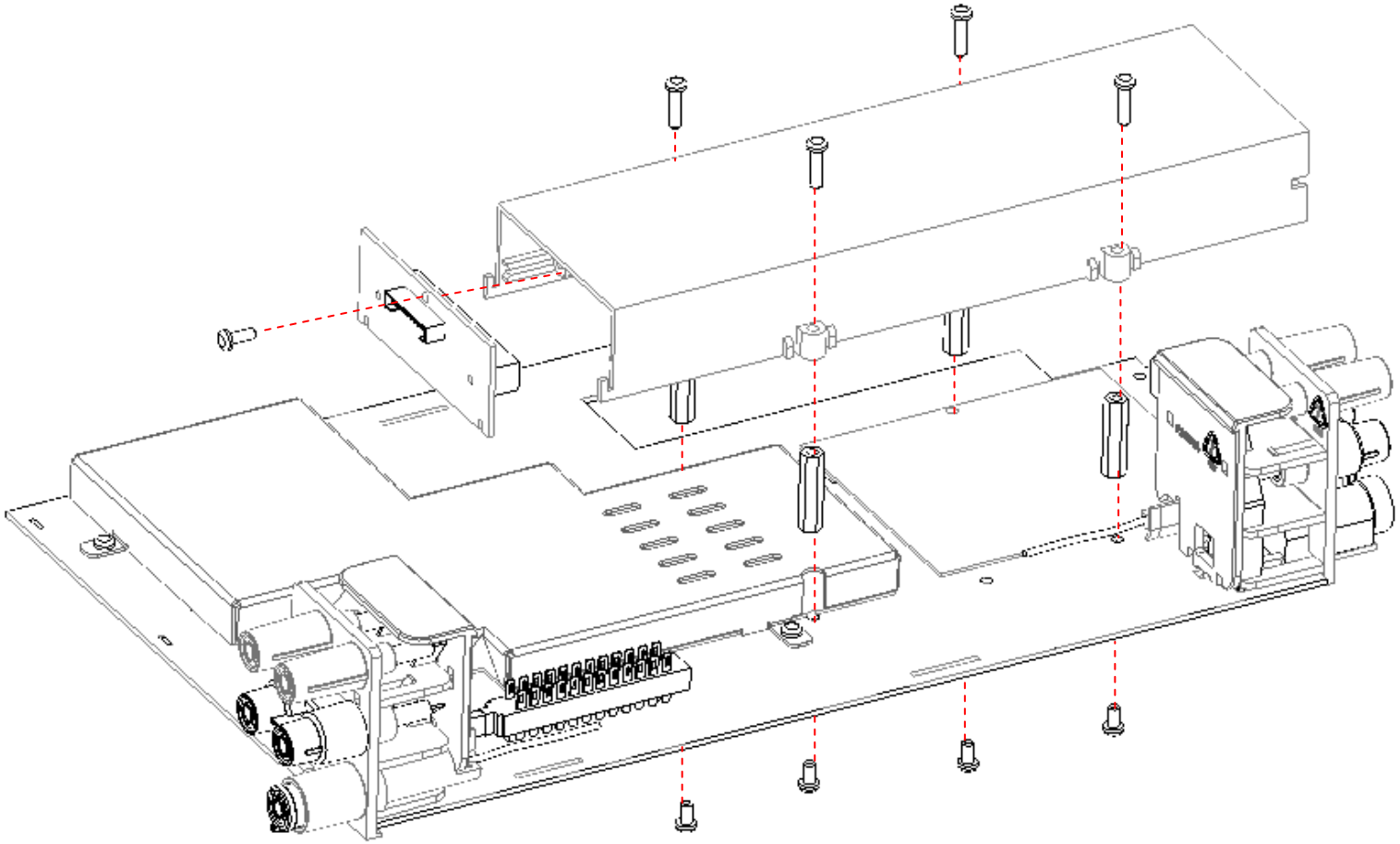
4.5.1 Front Panel Assembly

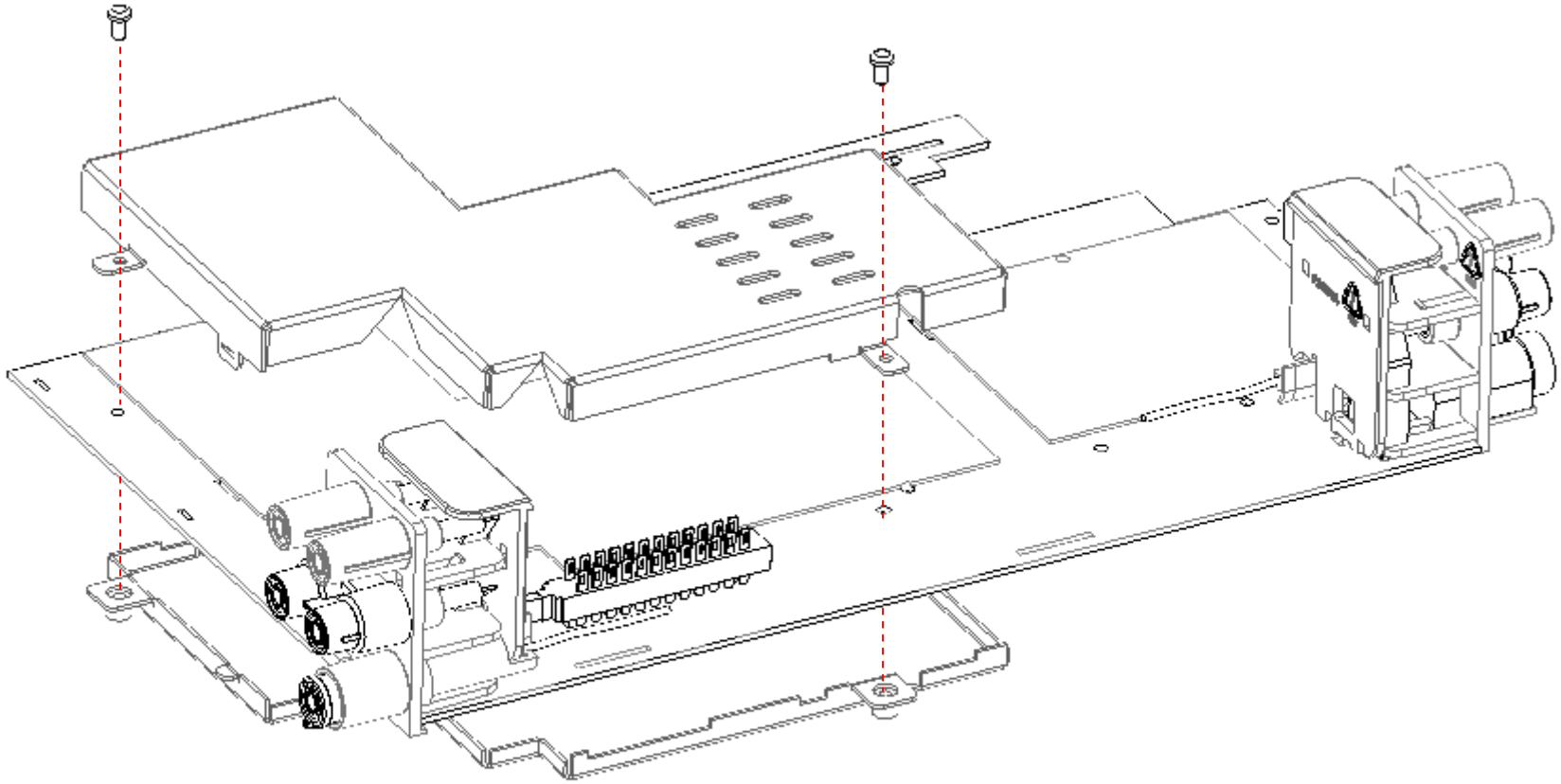


4.5.2 Chassis and Transformer Assembly

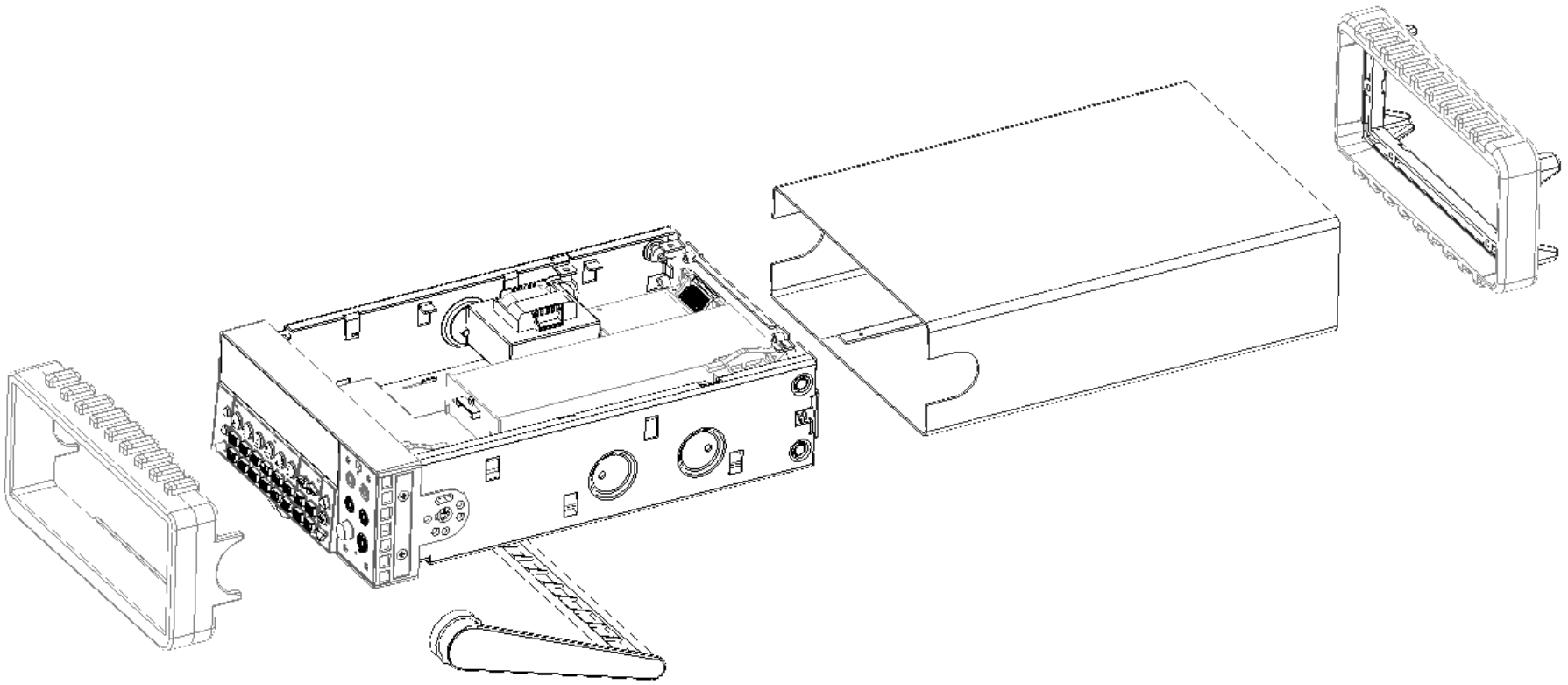


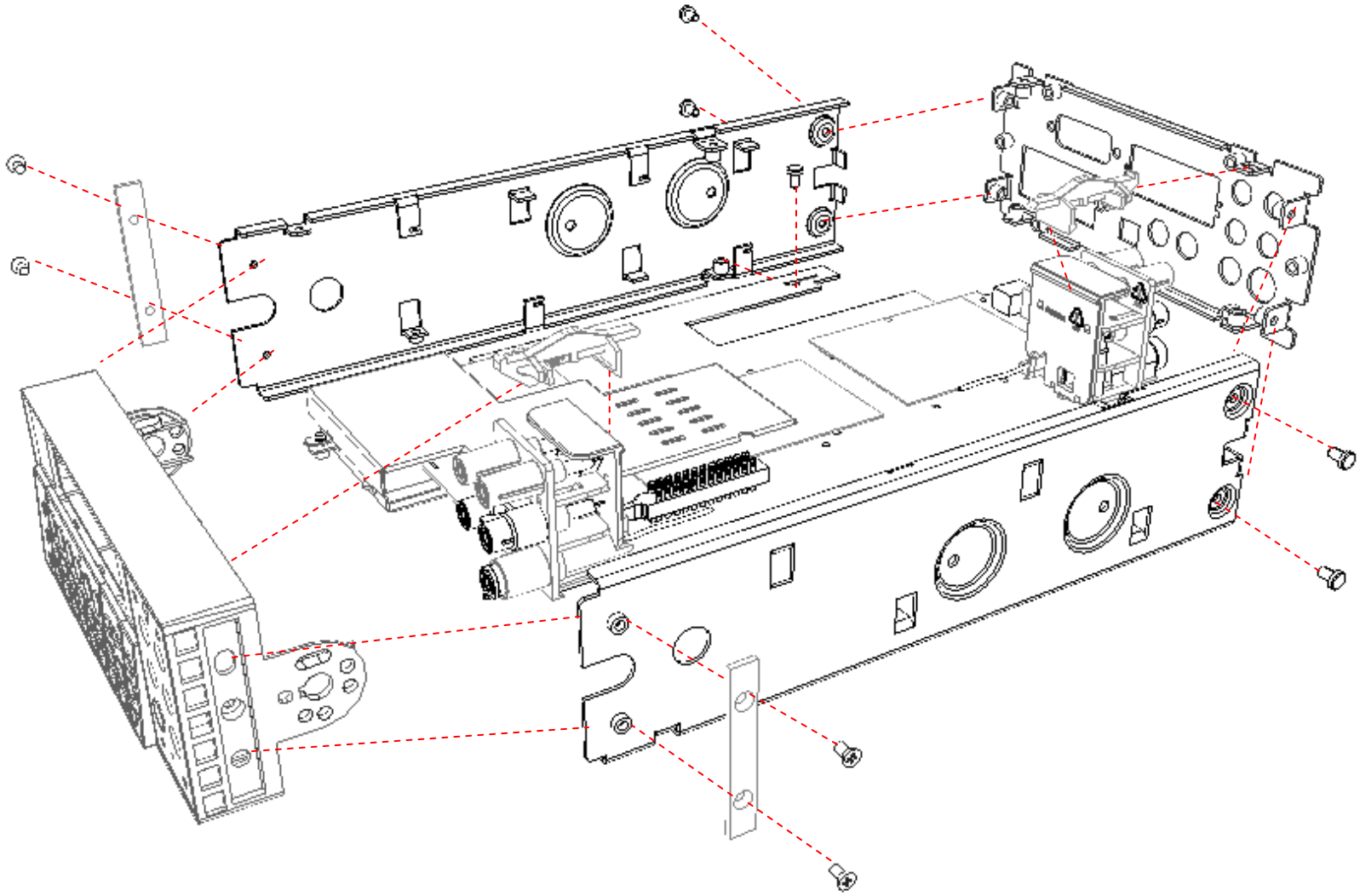
4.5.3 Main Board Assembly





4.5.4 Chassis Assembly

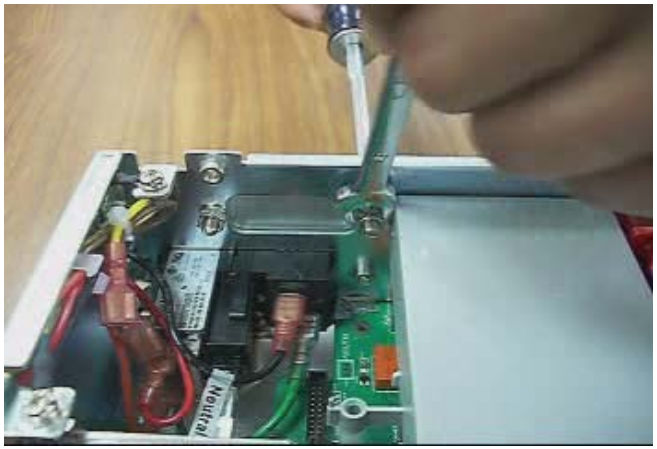




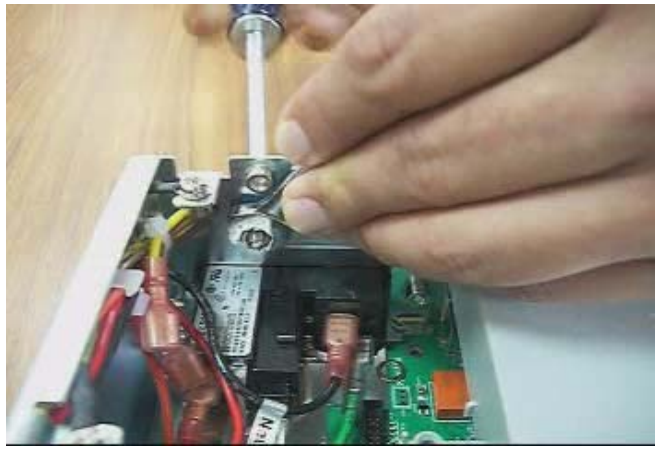
4.5.5 GPIB Assembly

Before assembling the GPIB, operators have to disassemble the M3500A's case cover. For more information about case cover removal, please refer to the Section 4.2 Case Cover Removal. Then the GPIB assembly in the following just can proceed.

[Step 1]
Remove the screws by available tools.



[Step 2]
Remove the screws on the other side by available tools.



[Step 3]
Remove the GPIB OPTION cover.

[Step 4]
Connect the GPIB cord to the socket of the main board.

[Step 5]
Adjust the card to a proper position.

[Step 6]
Fasten the card with a screw by a screwdriver.

[Step 7]
Fasten the terminal by hand's assistance.

[Step 8]
Do it again on the other side.

[Step 9]
Fasten the terminal by tool's assistance.

[Step 10]
Do it again on the other side. And finished!

5 Replaceable Parts

5.1 Introduction

This section contains replacement parts information and components layout drawings for the M3500A. Section **5.2** shows the parts lists for the main board and panel board of M3500A, and the components layout drawings of the main board PCB and panel PCB are shown in section **5.3**. **Table 5-1** lists the components of M3500A main board, and the components used in panel board of M3500A are listed in **Table 5-2**. **Figure 5-1** and **Figure 5-2** show the components layout of main board of M3500A. **Figure 5-1** shows the top layer, and **Figure 5-2** is bottom layer. The panel board components layouts are shown in **Figure 5-3** and **Figure 5-4**. **Figure 5-3** shows the top layer, and **Figure 5-4** shows the bottom layer.

5.2 Parts List

Parts list of M3500A main board

Picotest Part NO.	Description	Part Reference
056-001-000001	220pF-1206 NPO,200V,5%	C101
056-001-000001	220pF-1206 NPO,200V,5%	C103
056-001-000001	220pF-1206 NPO,200V,5%	C511
056-001-000003	100nF-0603 X7R,50V,10%	C1003
056-001-000003	100nF-0603 X7R,50V,10%	C1004
056-001-000003	100nF-0603 X7R,50V,10%	C1005
056-001-000003	100nF-0603 X7R,50V,10%	C1006
056-001-000003	100nF-0603 X7R,50V,10%	C1101
056-001-000003	100nF-0603 X7R,50V,10%	C1102
056-001-000003	100nF-0603 X7R,50V,10%	C1103
056-001-000003	100nF-0603 X7R,50V,10%	C1104
056-001-000003	100nF-0603 X7R,50V,10%	C1201
056-001-000003	100nF-0603 X7R,50V,10%	C1202
056-001-000003	100nF-0603 X7R,50V,10%	C1204
056-001-000003	100nF-0603 X7R,50V,10%	C1205
056-001-000003	100nF-0603 X7R,50V,10%	C1207
056-001-000003	100nF-0603 X7R,50V,10%	C1208
056-001-000003	100nF-0603 X7R,50V,10%	C1210
056-001-000003	100nF-0603 X7R,50V,10%	C1211

056-001-000003	100nF-0603 X7R,50V,10%	C1301
056-001-000003	100nF-0603 X7R,50V,10%	C1302
056-001-000003	100nF-0603 X7R,50V,10%	C1303
056-001-000003	100nF-0603 X7R,50V,10%	C1304
056-001-000003	100nF-0603 X7R,50V,10%	C1305
056-001-000003	100nF-0603 X7R,50V,10%	C1306
056-001-000003	100nF-0603 X7R,50V,10%	C1307
056-001-000003	100nF-0603 X7R,50V,10%	C1308
056-001-000003	100nF-0603 X7R,50V,10%	C1313
056-001-000003	100nF-0603 X7R,50V,10%	C1401
056-001-000003	100nF-0603 X7R,50V,10%	C1402
056-001-000003	100nF-0603 X7R,50V,10%	C1403
056-001-000003	100nF-0603 X7R,50V,10%	C1501
056-001-000003	100nF-0603 X7R,50V,10%	C1502
056-001-000003	100nF-0603 X7R,50V,10%	C1504
056-001-000003	100nF-0603 X7R,50V,10%	C1506
056-001-000003	100nF-0603 X7R,50V,10%	C1508
056-001-000003	100nF-0603 X7R,50V,10%	C1510
056-001-000003	100nF-0603 X7R,50V,10%	C1515
056-001-000003	100nF-0603 X7R,50V,10%	C1601
056-001-000003	100nF-0603 X7R,50V,10%	C1607
056-001-000003	100nF-0603 X7R,50V,10%	C1608
056-001-000003	100nF-0603 X7R,50V,10%	C1609
056-001-000003	100nF-0603 X7R,50V,10%	C1610
056-001-000003	100nF-0603 X7R,50V,10%	C1611
056-001-000003	100nF-0603 X7R,50V,10%	C1612
056-001-000003	100nF-0603 X7R,50V,10%	C1613
056-001-000003	100nF-0603 X7R,50V,10%	C1614
056-001-000003	100nF-0603 X7R,50V,10%	C1615
056-001-000003	100nF-0603 X7R,50V,10%	C1616
056-001-000003	100nF-0603 X7R,50V,10%	C1617
056-001-000003	100nF-0603 X7R,50V,10%	C1618
056-001-000003	100nF-0603 X7R,50V,10%	C1622
056-001-000003	100nF-0603 X7R,50V,10%	C1701
056-001-000003	100nF-0603 X7R,50V,10%	C1702
056-001-000003	100nF-0603 X7R,50V,10%	C1703
056-001-000003	100nF-0603 X7R,50V,10%	C1801
056-001-000003	100nF-0603 X7R,50V,10%	C1802
056-001-000003	100nF-0603 X7R,50V,10%	C1803
056-001-000003	100nF-0603 X7R,50V,10%	C1902

056-001-000003	100nF-0603 X7R,50V,10%	C1905
056-001-000003	100nF-0603 X7R,50V,10%	C2001
056-001-000003	100nF-0603 X7R,50V,10%	C201
056-001-000003	100nF-0603 X7R,50V,10%	C202
056-001-000003	100nF-0603 X7R,50V,10%	C2101
056-001-000003	100nF-0603 X7R,50V,10%	C2207
056-001-000003	100nF-0603 X7R,50V,10%	C2208
056-001-000003	100nF-0603 X7R,50V,10%	C2219
056-001-000003	100nF-0603 X7R,50V,10%	C2220
056-001-000003	100nF-0603 X7R,50V,10%	C2226
056-001-000003	100nF-0603 X7R,50V,10%	C2229
056-001-000003	100nF-0603 X7R,50V,10%	C2230
056-001-000003	100nF-0603 X7R,50V,10%	C2231
056-001-000003	100nF-0603 X7R,50V,10%	C2232
056-001-000003	100nF-0603 X7R,50V,10%	C2233
056-001-000003	100nF-0603 X7R,50V,10%	C2252
056-001-000003	100nF-0603 X7R,50V,10%	C2253
056-001-000003	100nF-0603 X7R,50V,10%	C301
056-001-000003	100nF-0603 X7R,50V,10%	C303
056-001-000003	100nF-0603 X7R,50V,10%	C402
056-001-000003	100nF-0603 X7R,50V,10%	C403
056-001-000003	100nF-0603 X7R,50V,10%	C404
056-001-000003	100nF-0603 X7R,50V,10%	C405
056-001-000003	100nF-0603 X7R,50V,10%	C501
056-001-000003	100nF-0603 X7R,50V,10%	C502
056-001-000003	100nF-0603 X7R,50V,10%	C503
056-001-000003	100nF-0603 X7R,50V,10%	C504
056-001-000003	100nF-0603 X7R,50V,10%	C505
056-001-000003	100nF-0603 X7R,50V,10%	C506
056-001-000003	100nF-0603 X7R,50V,10%	C507
056-001-000003	100nF-0603 X7R,50V,10%	C508
056-001-000003	100nF-0603 X7R,50V,10%	C509
056-001-000003	100nF-0603 X7R,50V,10%	C510
056-001-000003	100nF-0603 X7R,50V,10%	C513
056-001-000003	100nF-0603 X7R,50V,10%	C515
056-001-000003	100nF-0603 X7R,50V,10%	C516
056-001-000003	100nF-0603 X7R,50V,10%	C517
056-001-000003	100nF-0603 X7R,50V,10%	C518
056-001-000003	100nF-0603 X7R,50V,10%	C519
056-001-000003	100nF-0603 X7R,50V,10%	C602

056-001-000003	100nF-0603 X7R,50V,10%	C603
056-001-000003	100nF-0603 X7R,50V,10%	C604
056-001-000003	100nF-0603 X7R,50V,10%	C605
056-001-000003	100nF-0603 X7R,50V,10%	C606
056-001-000003	100nF-0603 X7R,50V,10%	C607
056-001-000003	100nF-0603 X7R,50V,10%	C608
056-001-000003	100nF-0603 X7R,50V,10%	C609
056-001-000003	100nF-0603 X7R,50V,10%	C610
056-001-000003	100nF-0603 X7R,50V,10%	C611
056-001-000003	100nF-0603 X7R,50V,10%	C620
056-001-000003	100nF-0603 X7R,50V,10%	C621
056-001-000003	100nF-0603 X7R,50V,10%	C622
056-001-000003	100nF-0603 X7R,50V,10%	C623
056-001-000003	100nF-0603 X7R,50V,10%	C803
056-001-000003	100nF-0603 X7R,50V,10%	C805
056-001-000003	100nF-0603 X7R,50V,10%	C808
056-001-000003	100nF-0603 X7R,50V,10%	C810
056-001-000003	100nF-0603 X7R,50V,10%	C901
056-001-000003	100nF-0603 X7R,50V,10%	C902
056-001-000003	100nF-0603 X7R,50V,10%	C906
056-001-000003	100nF-0603 X7R,50V,10%	C907
056-001-000004	1nF-0805 X7R,200V,10%	C302
056-001-000005	220pF-0603 NPO,5%,50V	C401
056-001-000006	47pF-0603 NPO,5%,50V	C1311
056-001-000006	47pF-0603 NPO,5%,50V	C512
056-001-000006	47pF-0603 NPO,5%,50V	C806
056-001-000006	47pF-0603 NPO,5%,50V	C807
056-001-000007	470pF-0603 NPO,50v,5%	C1621
056-001-000007	470pF-0603 NPO,50v,5%	C1706
056-001-000007	470pF-0603 NPO,50v,5%	C1904
056-001-000009	680pF-0603 NPO,50V,1%	C613
056-001-00000B	10nF-0603 X7R,50V,10%	C1007
056-001-00000B	10nF-0603 X7R,50V,10%	C1008
056-001-00000B	10nF-0603 X7R,50V,10%	C1514
056-001-00000B	10nF-0603 X7R,50V,10%	C2002
056-001-00000B	10nF-0603 X7R,50V,10%	C804
056-001-00000B	10nF-0603 X7R,50V,10%	C812
056-001-00000D	3.3nF-0603 X7R,50V,10%	C1903
056-001-00000D	3.3nF-0603 X7R,50V,10%	C617
056-001-00000E	68pF-0603 NPO,50V,5%	C2250

056-001-00000F	1.8nF-0603 X7R,50V,10%	C624
056-001-00000H	100pF-0603 NPO,50V,5%	C1310
056-001-00000H	100pF-0603 NPO,50V,5%	C1623
056-001-00000H	100pF-0603 NPO,50V,5%	C1624
056-001-00000H	100pF-0603 NPO,50V,5%	C1625
056-001-00000H	100pF-0603 NPO,50V,5%	C1626
056-001-00000H	100pF-0603 NPO,50V,5%	C1627
056-001-00000H	100pF-0603 NPO,50V,5%	C1628
056-001-00000H	100pF-0603 NPO,50V,5%	C1629
056-001-00000H	100pF-0603 NPO,50V,5%	C1630
056-001-00000H	100pF-0603 NPO,50V,5%	C1631
056-001-00000H	100pF-0603 NPO,50V,5%	C1632
056-001-00000H	100pF-0603 NPO,50V,5%	C1633
056-001-00000H	100pF-0603 NPO,50V,5%	C1634
056-001-00000H	100pF-0603 NPO,50V,5%	C1635
056-001-00000H	100pF-0603 NPO,50V,5%	C1636
056-001-00000H	100pF-0603 NPO,50V,5%	C1637
056-001-00000H	100pF-0603 NPO,50V,5%	C1638
056-001-00000H	100pF-0603 NPO,50V,5%	C1639
056-001-00000H	100pF-0603 NPO,50V,5%	C1640
056-001-00000H	100pF-0603 NPO,50V,5%	C1641
056-001-00000H	100pF-0603 NPO,50V,5%	C1642
056-001-00000H	100pF-0603 NPO,50V,5%	C1643
056-001-00000H	100pF-0603 NPO,50V,5%	C1644
056-001-00000H	100pF-0603 NPO,50V,5%	C1906
056-001-00000H	100pF-0603 NPO,50V,5%	C1907
056-001-00000H	100pF-0603 NPO,50V,5%	C1908
056-001-00000H	100pF-0603 NPO,50V,5%	C1909
056-001-00000H	100pF-0603 NPO,50V,5%	C2104
056-001-00000H	100pF-0603 NPO,50V,5%	C2105
056-001-00000H	100pF-0603 NPO,50V,5%	C2244
056-001-00000H	100pF-0603 NPO,50V,5%	C2245
056-001-00000H	100pF-0603 NPO,50V,5%	C2246
056-001-00000H	100pF-0603 NPO,50V,5%	C2247
056-001-00000H	100pF-0603 NPO,50V,5%	C2248
056-001-00000H	100pF-0603 NPO,50V,5%	C903
056-001-00000H	100pF-0603 NPO,50V,5%	C904
056-001-00000H	100pF-0603 NPO,50V,5%	C905
056-001-00000I	2.2uF-0805 Y5V,16V,Z%	C1212
056-001-00000j	2.2nF-0603 X7R,50V,10%	C1312

056-001-00000K	10pF-0603 NPO,50V,5%	C1503
056-001-00000K	10pF-0603 NPO,50V,5%	C1505
056-001-00000K	10pF-0603 NPO,50V,5%	C1507
056-001-00000K	10pF-0603 NPO,50V,5%	C1509
056-001-00000K	10pF-0603 NPO,50V,5%	C1511
056-001-00000K	10pF-0603 NPO,50V,5%	C638
056-001-00000M	33pF-0603 NPO,50V,5%	C1105
056-001-00000M	33pF-0603 NPO,50V,5%	C1619
056-001-00000M	33pF-0603 NPO,50V,5%	C1620
056-001-00000M	33pF-0603 NPO,50V,5%	C627
056-001-00000N	10uF-0805 X5R,10V,10%	C1512
056-001-00000N	10uF-0805 X5R,10V,10%	C1513
056-001-00000N	10uF-0805 X5R,10V,10%	C1704
056-001-00000N	10uF-0805 X5R,10V,10%	C1705
056-001-00000O	4.7nF-0603 X7R,50V,10%	C1901
056-001-00000P	56pF-0603 NPO,50V,5%	C2102
056-001-00000P	56pF-0603 NPO,50V,5%	C2103
056-001-00000q	100nF-0805 X7R,50V,10%	C2201
056-001-00000q	100nF-0805 X7R,50V,10%	C2209
056-001-00000q	100nF-0805 X7R,50V,10%	C2237
056-001-00000S	33nF-0603 X7R,16V,10%	C1009
056-001-00000S	33nF-0603 X7R,16V,10%	C1011
056-001-00000U	10nF-1812 X7R,1kV,10%	C2238
056-001-00000U	10nF-1812 X7R,1kV,10%	C2239
056-001-00000U	10nF-1812 X7R,1kV,10%	C2240
056-001-00000U	10nF-1812 X7R,1kV,10%	C2241
056-001-00000U	10nF-1812 X7R,1kV,10%	C2242
056-001-00000U	10nF-1812 X7R,1kV,10%	C2243
056-001-00000W	3.9pF-0603 NPO,50V,tolerance:0.1P	C625
056-001-00000X	4.7pF-0603 NPO,50V,tolerance:0.1P	C612
056-001-00000X	4.7pF-0603 NPO,50V,tolerance:0.1P	C616
056-001-00000Z	68pF-0603 NPO,50V,1%	C619
056-001-000010	220pF-0603 NPO,50V,1%	C629
056-001-000011	470pF-0603 NPO,50V,1%	C601
056-001-000012	24pF-0603 NPO,50V,1%	C628
056-001-000013	68nF-0603 X7R,25V,10%	C1010
056-001-000014	1uF-0805 Y5V,50V,Z%	C2236
056-001-000016	1uF-0603 25V/X5R/10%	C1203
056-001-000016	1uF-0603 25V/X5R/10%	C1206
056-001-000016	1uF-0603 25V/X5R/10%	C1209

056-001-000016	1uF-0603 25V/X5R/10%	C1309
056-001-000016	1uF-0603 25V/X5R/10%	C801
056-001-000016	1uF-0603 25V/X5R/10%	C802
056-003-000001	1.8pF-1206 1000V	C615
056-019-000001	TF811	U701
056-019-000002	TF812	U403
056-032-000002	10uF 10V,A-CASE	C2204
056-032-000002	10uF 10V,A-CASE	C2225
056-032-000002	10uF 10V,A-CASE	C2228
056-032-000002	10uF 10V,A-CASE	C2234
057-001-000001	GSNL453232-102K	L301
057-001-000001	GSNL453232-102K	L302
057-001-000004	BLM31PG391SN1L 1206	L2201
057-001-000004	BLM31PG391SN1L 1206	L2202
057-001-000004	BLM31PG391SN1L 1206	L2203
057-001-000004	BLM31PG391SN1L 1206	L2204
057-001-000005	GSNL453232-220K	L303
057-003-000001	985BH-1007	L2101
057-009-000001	BLM18AG102SN1D 0603	L1301
057-009-000001	BLM18AG102SN1D 0603	L801
057-009-000001	BLM18AG102SN1D 0603	L802
057-009-000002	BLM18BD601SN1D 0603	L1201
057-009-000002	BLM18BD601SN1D 0603	L1202
057-009-000002	BLM18BD601SN1D 0603	L1203
057-009-000002	BLM18BD601SN1D 0603	L1204
057-009-000002	BLM18BD601SN1D 0603	L1205
057-009-000002	BLM18BD601SN1D 0603	L1206
057-009-000002	BLM18BD601SN1D 0603	L1207
057-009-000002	BLM18BD601SN1D 0603	L1208
057-009-000002	BLM18BD601SN1D 0603	L1401
057-009-000002	BLM18BD601SN1D 0603	L1402
057-009-000002	BLM18BD601SN1D 0603	L1403
057-009-000002	BLM18BD601SN1D 0603	L2104
057-009-000003	BLM21BD601SN1D 0805	L1901
057-009-000003	BLM21BD601SN1D 0805	L1902
057-009-000003	BLM21BD601SN1D 0805	L2102
057-009-000003	BLM21BD601SN1D 0805	L2103
057-018-000001	PESD5V0S1BA	D1904
057-018-000001	PESD5V0S1BA	D1905
057-018-000001	PESD5V0S1BA	D2103

057-018-000001	PESD5V0S1BA	D2104
057-018-000001	PESD5V0S1BA	D2105
057-018-000001	PESD5V0S1BA	D2214
057-018-000001	PESD5V0S1BA	D2215
060-002-000001	24K-2512 tolerance:1%,1W	R101
060-002-000001	24K-2512 tolerance:1%,1W	R102
060-002-000001	24K-2512 tolerance:1%,1W	R103
060-002-000001	24K-2512 tolerance:1%,1W	R104
060-002-000001	24K-2512 tolerance:1%,1W	R105
060-002-000001	24K-2512 tolerance:1%,1W	R106
060-002-000001	24K-2512 tolerance:1%,1W	R107
060-002-000001	24K-2512 tolerance:1%,1W	R110
060-002-000001	24K-2512 tolerance:1%,1W	R111
060-002-000001	24K-2512 tolerance:1%,1W	R112
060-002-000001	24K-2512 tolerance:1%,1W	R113
060-002-000001	24K-2512 tolerance:1%,1W	R114
060-002-000001	24K-2512 tolerance:1%,1W	R115
060-002-000001	24K-2512 tolerance:1%,1W	R116
060-002-000002	1M-1206 tolerance:1%,1/4W	R108
060-002-000002	1M-1206 tolerance:1%,1/4W	R109
060-002-000003	10K-0603 tolerance:1%,1/10W	R1106
060-002-000003	10K-0603 tolerance:1%,1/10W	R119
060-002-000003	10K-0603 tolerance:1%,1/10W	R1306
060-002-000003	10K-0603 tolerance:1%,1/10W	R1614
060-002-000003	10K-0603 tolerance:1%,1/10W	R1615
060-002-000003	10K-0603 tolerance:1%,1/10W	R1616
060-002-000003	10K-0603 tolerance:1%,1/10W	R1617
060-002-000003	10K-0603 tolerance:1%,1/10W	R1618
060-002-000003	10K-0603 tolerance:1%,1/10W	R1620
060-002-000003	10K-0603 tolerance:1%,1/10W	R1901
060-002-000003	10K-0603 tolerance:1%,1/10W	R2107
060-002-000003	10K-0603 tolerance:1%,1/10W	R2108
060-002-000003	10K-0603 tolerance:1%,1/10W	R2204
060-002-000003	10K-0603 tolerance:1%,1/10W	R2218
060-002-000003	10K-0603 tolerance:1%,1/10W	R515
060-002-000003	10K-0603 tolerance:1%,1/10W	R516
060-002-000003	10K-0603 tolerance:1%,1/10W	R901
060-002-000003	10K-0603 tolerance:1%,1/10W	R908
060-002-000005	470R-1206 tolerance:1%,1/4W	R120
060-002-000005	470R-1206 tolerance:1%,1/4W	R121

060-002-000006	1K-0603 tolerance:1%,1/10W	R1502
060-002-000006	1K-0603 tolerance:1%,1/10W	R1503
060-002-000006	1K-0603 tolerance:1%,1/10W	R1504
060-002-000006	1K-0603 tolerance:1%,1/10W	R1505
060-002-000006	1K-0603 tolerance:1%,1/10W	R1506
060-002-000006	1K-0603 tolerance:1%,1/10W	R1619
060-002-000006	1K-0603 tolerance:1%,1/10W	R1905
060-002-000006	1K-0603 tolerance:1%,1/10W	R201
060-002-000006	1K-0603 tolerance:1%,1/10W	R2011
060-002-000006	1K-0603 tolerance:1%,1/10W	R2216
060-002-000006	1K-0603 tolerance:1%,1/10W	R305
060-002-000006	1K-0603 tolerance:1%,1/10W	R306
060-002-000006	1K-0603 tolerance:1%,1/10W	R308
060-002-000006	1K-0603 tolerance:1%,1/10W	R309
060-002-000006	1K-0603 tolerance:1%,1/10W	R310
060-002-000006	1K-0603 tolerance:1%,1/10W	R320
060-002-000006	1K-0603 tolerance:1%,1/10W	R507
060-002-000006	1K-0603 tolerance:1%,1/10W	R509
060-002-000006	1K-0603 tolerance:1%,1/10W	R531
060-002-000006	1K-0603 tolerance:1%,1/10W	R804
060-002-000006	1K-0603 tolerance:1%,1/10W	R818
060-002-000006	1K-0603 tolerance:1%,1/10W	R903
060-002-000007	100K-0603 tolerance:1%,1/10W	R2009
060-002-000007	100K-0603 tolerance:1%,1/10W	R203
060-002-000007	100K-0603 tolerance:1%,1/10W	R205
060-002-000007	100K-0603 tolerance:1%,1/10W	R2213
060-002-000007	100K-0603 tolerance:1%,1/10W	R501
060-002-000007	100K-0603 tolerance:1%,1/10W	R504
060-002-000007	100K-0603 tolerance:1%,1/10W	R505
060-002-000007	100K-0603 tolerance:1%,1/10W	R506
060-002-000007	100K-0603 tolerance:1%,1/10W	R511
060-002-000007	100K-0603 tolerance:1%,1/10W	R514
060-002-000007	100K-0603 tolerance:1%,1/10W	R517
060-002-000009	3.24K-1206 tolerance:1%,1/4W	R311
060-002-000009	3.24K-1206 tolerance:1%,1/4W	R312
060-002-00000A	200K-2010 tolerance:1%,2W	R313
060-002-00000A	200K-2010 tolerance:1%,2W	R314
060-002-00000A	200K-2010 tolerance:1%,2W	R315
060-002-00000A	200K-2010 tolerance:1%,2W	R316
060-002-00000D	10K-0603(01%) TCR:25ppm	R1312

060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1203
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1204
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1205
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1303
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1601
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1604
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1606
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1607
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1608
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1609
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1611
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1612
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1621
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1622
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1623
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1702
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1703
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1704
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1705
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1706
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1707
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1708
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1709
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1710
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R1711
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R2101
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R2104
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R2105
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R2106
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R319
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R326
060-002-00000G	4.75K-0603 tolerance:1%,1/10W	R406
060-002-00000H	3.32K-0603 tolerance:1%,1/10W	R503
060-002-00000L	100R-0603 tolerance:1%,1/10W	R1201
060-002-00000L	100R-0603 tolerance:1%,1/10W	R1202
060-002-00000L	100R-0603 tolerance:1%,1/10W	R1307
060-002-00000L	100R-0603 tolerance:1%,1/10W	R1401
060-002-00000L	100R-0603 tolerance:1%,1/10W	R1602
060-002-00000L	100R-0603 tolerance:1%,1/10W	R2201
060-002-00000L	100R-0603 tolerance:1%,1/10W	R525

060-002-00000L	100R-0603 tolerance:1%,1/10W	R530
060-002-00000L	100R-0603 tolerance:1%,1/10W	R902
060-002-00000L	100R-0603 tolerance:1%,1/10W	R905
060-002-00000M	4.87K-0603 tolerance:1%,1/10W	R1107
060-002-00000M	4.87K-0603 tolerance:1%,1/10W	R518
060-002-00000M	4.87K-0603 tolerance:1%,1/10W	R519
060-002-00000O	75K-0603 tolerance:1%,1/10W	R1003
060-002-00000O	75K-0603 tolerance:1%,1/10W	R604
060-002-00000P	21.5K-0603 tolerance:1%,1/10W	R1001
060-002-00000P	21.5K-0603 tolerance:1%,1/10W	R1904
060-002-00000P	21.5K-0603 tolerance:1%,1/10W	R607
060-002-00000Q	215R-0603 tolerance:1%,1/10W	R608
060-002-00000Q	215R-0603 tolerance:1%,1/10W	R613
060-002-00000S	1.78K-0603 tolerance:1%,1/10W	R612
060-002-00000S	1.78K-0603 tolerance:1%,1/10W	R614
060-002-00000U	15K-0603 tolerance:1%,1/10W	R1101
060-002-00000U	15K-0603 tolerance:1%,1/10W	R616
060-002-00000V	80.6K-0603 tolerance:1%,1/10W	R621
060-002-00000W	240K-0603 tolerance:1%,1/10W	R618
060-002-00000X	68.1K-0603 tolerance:1%,1/10W	R619
060-002-00000Y	56.2K-0603 tolerance:1%,1/10W	R620
060-002-00000Z	422R-0603 tolerance:1%,1/10W	R801
060-002-00000Z	422R-0603 tolerance:1%,1/10W	R815
060-002-000010	4.99K-0603 tolerance:1%,1/10W	R1008
060-002-000010	4.99K-0603 tolerance:1%,1/10W	R802
060-002-000010	4.99K-0603 tolerance:1%,1/10W	R813
060-002-000011	3.57K-0603 tolerance:1%,1/10W	R803
060-002-000011	3.57K-0603 tolerance:1%,1/10W	R817
060-002-00001A	392R-0603 tolerance:1%,1/10W	R906
060-002-00001B	3.83K-0603 tolerance:1%,1/10W	R1002
060-002-00001D	200R-0603 tolerance:1%,1/10W	R2005
060-002-00001D	200R-0603 tolerance:1%,1/10W	R2006
060-002-00001F	49.9K-0603 tolerance:1%,1/10W	R1310
060-002-00001F	49.9K-0603 tolerance:1%,1/10W	R2211
060-002-00001G	34K-0603 tolerance:1%,1/10W	R1302
060-002-00001H	2.21K-0603 tolerance:1%,1/10W	R1103
060-002-00001H	2.21K-0603 tolerance:1%,1/10W	R1304
060-002-00001H	2.21K-0603 tolerance:1%,1/10W	R1305
060-002-00001J	221R-0603 tolerance:1%,1/10W	R1309
060-002-00001J	221R-0603 tolerance:1%,1/10W	R1903

060-002-00001L	47.5K-0603 tolerance:1%,1/10W	R2001
060-002-00001L	47.5K-0603 tolerance:1%,1/10W	R2002
060-002-00001M	100R-1206 tolerance:1%,1/4W	R1902
060-002-00001M	100R-1206 tolerance:1%,1/4W	R2109
060-002-00001M	100R-1206 tolerance:1%,1/4W	R2110
060-002-00001O	1K-1206 tolerance:1%,1/4W	R1906
060-002-00001P	22.1K-0603 tolerance:1%,1/10W	R2003
060-002-00001P	22.1K-0603 tolerance:1%,1/10W	R2004
060-002-00001Q	165R-0603 tolerance:1%,1/10W	R2007
060-002-00001Q	165R-0603 tolerance:1%,1/10W	R2008
060-002-00001R	18R-0603 tolerance:1%,1/10W	R2102
060-002-00001R	18R-0603 tolerance:1%,1/10W	R2103
060-002-00001S	340R-0603 tolerance:1%,1/10W	R2203
060-002-00001T	453R-0603 tolerance:1%,1/10W	R1308
060-002-00001T	453R-0603 tolerance:1%,1/10W	R1314
060-002-00001U	33.2K-0603 tolerance:1%,1/10W	R2207
060-002-000029	73.2K-0603 tolerance:1%,1/10W	R1004
060-002-000029	73.2K-0603 tolerance:1%,1/10W	R1005
060-002-00002B	348R-0603 tolerance:1%,1/10W	R1104
060-002-00002D	56R-0603 tolerance:1%,1/10W	R1109
060-002-00002E	75R-0603 tolerance:1%,1/10W	R1301
060-002-00002G	5.1K-0603 tolerance:1%,1/10W	R1313
060-002-00002I	1R-1206 tolerance:1%,1/4W	R2205
060-002-00002I	1R-1206 tolerance:1%,1/4W	R2206
060-002-00002J	47K-0603 tolerance:1%,1/10W	R2214
060-002-00002J	47K-0603 tolerance:1%,1/10W	R2215
060-002-00002Q	1M-0603 tolerance:1%,1/10W	R1613
060-002-00002Q	1M-0603 tolerance:1%,1/10W	R609
060-002-00003E	301R-0603 tolerance:1%,1/10W	R307
060-002-00003E	301R-0603 tolerance:1%,1/10W	R325
060-002-00003W	150R-0603 tolerance:1%,1/10W	R526
060-002-00003W	150R-0603 tolerance:1%,1/10W	R527
060-002-00003W	150R-0603 tolerance:1%,1/10W	R528
060-002-00003W	150R-0603 tolerance:1%,1/10W	R529
060-002-00004B	475R-0603 tolerance:1%,1/10W	R520
060-002-00004B	475R-0603 tolerance:1%,1/10W	R521
060-002-00004B	475R-0603 tolerance:1%,1/10W	R522
060-002-00004B	475R-0603 tolerance:1%,1/10W	R523
060-002-00004B	475R-0603 tolerance:1%,1/10W	R524
060-002-00004V	806R-0603 tolerance:1%,1/10W	R615

060-002-00006Q	4.64K-0603 tolerance:1%,1/10W	R622
060-002-00006W	5.62K-0603 tolerance:1%,1/10W	R1102
060-002-000070	6.65K-0603 tolerance:1%,1/10W	R2209
060-002-000076	7.87K-0603 tolerance:1%,1/10W	R603
060-002-00007C	9.53K-0603 tolerance:1%,1/10W	R1006
060-002-00007C	9.53K-0603 tolerance:1%,1/10W	R1007
060-002-000088	24.3K-0603 tolerance:1%,1/10W	R617
060-002-00008D	27.4K-0603 tolerance:1%,1/10W	R2217
060-002-00008G	29.4K-0603 tolerance:1%,1/10W	R2210
060-002-00008G	29.4K-0603 tolerance:1%,1/10W	R2212
060-002-00008H	30.1K-0603 tolerance:1%,1/10W	R2010
060-002-00008S	43.2K-0603 tolerance:1%,1/10W	R1105
060-002-00009L	2K-1206 tolerance:1%,1/4W	R321
060-002-00009M	3K-1206 tolerance:1%,1/4W	R322
060-002-00009N	4.7R-121 tolerance:1%,1/2W	R1624
060-002-00009Q	560K-0603 tolerance:1%,1/10W	R1108
060-002-0000A6	10R-0603 1/10W/1%	R1625
060-002-0000A6	10R-0603 1/10W/1%	R1626
060-002-0000A6	10R-0603 1/10W/1%	R1627
060-002-0000A6	10R-0603 1/10W/1%	R1628
060-002-0000A6	10R-0603 1/10W/1%	R1629
060-002-0000A6	10R-0603 1/10W/1%	R1630
060-002-0000A6	10R-0603 1/10W/1%	R1631
060-002-0000A6	10R-0603 1/10W/1%	R1632
060-002-0000A6	10R-0603 1/10W/1%	R1801
060-002-0000A6	10R-0603 1/10W/1%	R1802
060-002-0000A6	10R-0603 1/10W/1%	R1803
060-004-000001	1K/9K tolerance:1%,SOT23	R610
060-004-000001	1K/9K tolerance:1%,SOT23	R611
060-005-000006	9.09K-0603(0.1%) TCR:25ppm	R508
060-005-000008	100R-0603(0.1%) TCR:25ppm	R513
060-005-000009	909R-0603(0.1%) TCR:25ppm	R512
061-001-000001	GF10Y	D301
061-001-000003	MMSZ3V9T1	D401
061-001-000004	MMSZ5V1T1	D402
061-001-000005	MMSZ6V8T1	D501
061-001-000005	MMSZ6V8T1	D502
061-001-000005	MMSZ6V8T1	D503
061-001-000005	MMSZ6V8T1	D504
061-001-000005	MMSZ6V8T1	D801

061-001-000005	MMSZ6V8T1	D802
061-001-000006	HSMS-2822	D1301
061-001-000007	MMSZ5226BT1	D601
061-001-000007	MMSZ5226BT1	D602
061-001-000007	MMSZ5226BT1	D603
061-001-000007	MMSZ5226BT1	D604
061-001-000007	MMSZ5226BT1	VR306
061-001-000007	MMSZ5226BT1	VR307
061-001-000008	CMPD7000	D1901
061-001-000008	CMPD7000	D1902
061-001-000008	CMPD7000	D1903
061-001-000008	CMPD7000	D2101
061-001-000008	CMPD7000	D2102
061-001-000009	SMAJ36CA	D2203
061-001-000009	SMAJ36CA	D2212
061-001-00000A	SMAJ14CA	D2202
061-001-00000A	SMAJ14CA	D2206
061-001-00000B	SMBJ70CA	D2201
061-001-00000B	SMBJ70CA	D2204
061-001-00000C	1SMB5920BT3	D2208
061-001-00000D	MMSZ11T1	VR301
061-001-00000D	MMSZ11T1	VR302
061-001-00000D	MMSZ11T1	VR303
061-001-00000D	MMSZ11T1	VR305
061-001-00000E	BZX84C6V2LT1	VR304
061-001-00000G	1SMA5917BT3	D2205
061-001-00000G	1SMA5917BT3	D2207
061-001-00000H	MMSZ5243BT1	D403
061-003-000001	MMBF4393LT1	Q202
061-003-000001	MMBF4393LT1	Q203
061-003-000001	MMBF4393LT1	Q204
061-003-000001	MMBF4393LT1	Q402
061-003-000001	MMBF4393LT1	Q501
061-003-000001	MMBF4393LT1	Q503
061-003-000001	MMBF4393LT1	Q504
061-003-000001	MMBF4393LT1	Q505
061-003-000001	MMBF4393LT1	Q506
061-003-000001	MMBF4393LT1	Q507
061-003-000001	MMBF4393LT1	Q508
061-003-000001	MMBF4393LT1	Q509

061-003-000001	MMBF4393LT1	Q510
061-003-000001	MMBF4393LT1	Q511
061-003-000001	MMBF4393LT1	Q512
061-003-000001	MMBF4393LT1	Q513
061-003-000001	MMBF4393LT1	Q514
061-003-000001	MMBF4393LT1	Q515
061-003-000003	SST4117-T1	Q311
061-004-000002	SI2301BDS-T1	Q2201
061-004-000002	SI2301BDS-T1	Q2202
061-004-000003	2N7002E-T1	Q1001
061-004-000003	2N7002E-T1	Q1301
061-004-000003	2N7002E-T1	Q1302
061-004-000003	2N7002E-T1	Q1303
061-004-000003	2N7002E-T1	Q1304
061-004-000003	2N7002E-T1	Q403
061-004-000003	2N7002E-T1	Q404
061-006-000001	DB104S	CR2201
061-006-000001	DB104S	CR2202
061-006-000001	DB104S	CR2203
061-006-000001	DB104S	CR2204
061-007-000001	MMBT3904LT1	Q312
061-007-000002	MMBT5089LT1	Q801
061-007-000003	MMBT5087LT1	Q802
061-007-000004	MMBT3906LT1	Q2001
061-007-000004	MMBT3906LT1	Q2002
061-007-000004	MMBT3906LT1	Q313
061-007-000005	MMBFJ177LT1	Q401
061-007-000007	MMBT6520LT1	Q303
061-007-000007	MMBT6520LT1	Q304
061-007-000007	MMBT6520LT1	Q305
061-007-000007	MMBT6520LT1	Q306
061-007-000007	MMBT6520LT1	Q307
061-007-000007	MMBT6520LT1	Q308
061-007-000007	MMBT6520LT1	Q309
061-007-000007	MMBT6520LT1	Q310
063-001-000001	LF356MX	U603
063-001-000001	LF356MX	U606
063-001-000002	OP282GS	U201
063-001-000002	OP282GS	U504
063-001-000003	AD706JR	U402

063-001-000003	AD706JR	U801
063-001-000004	LM339MX	U501
063-001-000004	LM339MX	U503
063-001-000004	LM339MX	U506
063-001-000005	BA4558	U505
063-001-000006	OP37GS	U604
063-001-000007	AD825AR	U605
063-001-000008	TLE2081ACD	U607
063-001-000009	OPA2277UA	U608
063-001-00000A	AD711JR	U1302
063-001-00000A	AD711JR	U901
063-001-00000D	OP177	U1301
063-001-00000E	OP27GS	U1303
063-001-00000F	LM311MX	U1304
063-001-00000G	LM393MX	U1101
063-001-00000H	OP97FS	U903
063-001-00000I	LTC1050CS8	U507
063-001-00000I	LTC1050CS8	U508
063-001-00000J	AD637JR	U1001
063-002-000001	ULN2003ADR	U1505
063-002-000001	ULN2003ADR	U2102
063-003-000001	PDIUSBD12PW TSSOP	U2101
063-004-000002	LM317LMX	U2209
063-004-00000A	TK71733SCL-G	U1507
063-004-00000F	TPS70102PWP	U2208
063-004-00000G	LP3964EMP-ADJ	U2202
063-006-000001	CY7C1021CV33-10ZC	U1701
063-006-000002	MX29LV400TTC-70 512KB,70ns,Boot Top	U1702
063-007-000001	XC95144XL-10TQ100C	U1201
063-007-000002	SN74HC175DR	U1401
063-007-000003	SN74HC02DR	U1402
063-007-000003	SN74HC02DR	U1403
063-007-000006	XC9572XL-10VQ44C	U1801
063-007-000007	SN74HC244DBR	U1901
063-007-000008	SN74LVC14ADBR	U1902
063-007-00000D	MC14094BDR2	U1501
063-007-00000D	MC14094BDR2	U1502
063-007-00000D	MC14094BDR2	U1503
063-007-00000D	MC14094BDR2	U1504
063-007-00000D	MC14094BDR2	U1506

063-007-00000G	SN74LVC07ADBR	U1603
063-008-000001	MAX4605CSE	U601
063-008-000002	DG408CY	U502
063-008-000003	DG212CSE	U602
063-008-000004	SD5400CY	U803
063-008-000005	DG211CSE	U902
063-009-000001	MSP430F1232IPW	U2001
063-010-000002	TMS320VC5407PGE	U1601
063-011-000001	12MHz SOL52 12.0M 3.3V +/-100PPM	Y1201
063-016-000001	MAX4662EAE-T Analog Switch	U401
012-001-000006	CON20P/2.0-black 180°,male plug,10*2	J1605
012-001-000009	CON10P/2.0,male plug,180°	J1606
012-001-00000A	CON7P/2.0 180°,male plug	J1604
012-003-000001	CON3P/3.96(male plug) 180°	J2201
012-003-000002	CON2P/3.96(male plug) 180°	J2202
012-003-000003	CON8P/3.96(male plug) 180°	J2203
014-001-000001	BNC 50 OHM	J1602
014-001-000001	BNC 50 OHM	J1603
015-002-000001	USBBR-F104SB025SW USB receptacle	J2103
016-001-000001	G20006A HEADER1(TEST PIN)	J103
017-001-000002	FP2D3063	K2101
017-001-000002	FP2D3063	K301
017-001-000002	FP2D3063	K302
017-001-000002	FP2D3063	K303
024-002-000001	Fuse Holder	F103
024-002-000004	Fuse (0.25A, 250V, 5 x 20 mm, Slow Blow) located in the voltage setting selector of the rear panel	
024-002-000006	Fuse (7A, 250V, 5 x 20 mm, Fast Acting) located on the rear panel	
024-002-000008	Fuse (3.15A, 250V, 5 x 20 mm, Fast Acting, HBC) located on the front panel	
049-001-000002	E-Switch(T-S8FLN4-2)	S101
056-002-000003	22uF/63V size:6.3*11	C2235
056-002-000004	100uF/25V(MIN) size:6.3*7	C634
056-002-000004	100uF/25V(MIN) size:6.3*7	C635
056-002-000004	100uF/25V(MIN) size:6.3*7	C636
056-002-000004	100uF/25V(MIN) size:6.3*7	C637
056-003-000004	220nF/63V tolerance:10%	C1002
056-003-000004	220nF/63V tolerance:10%	C618
056-003-000005	1uF/63V tolerance:10%	C1001
056-003-000009	0.22uF/400V tolerance:5%	C614
056-005-000001	10nF/1kV	C102

056-006-000001	2.2nF/50V tolerance:5%	C1314
056-011-000002	470uF/35V size:10*17	C2202
056-011-000002	470uF/35V size:10*17	C2210
056-011-000003	10uF/25V	C1106
056-011-000003	10uF/25V	C1107
056-011-000003	10uF/25V	C2205
056-011-000003	10uF/25V	C2218
056-011-000003	10uF/25V	C2251
056-011-000003	10uF/25V	C2254
056-011-000003	10uF/25V	C630
056-011-000003	10uF/25V	C631
056-011-000003	10uF/25V	C632
056-011-000003	10uF/25V	C633
056-011-000005	1000uF/16V size:10*17	C2217
056-011-000005	1000uF/16V size:10*17	C2227
056-011-000005	1000uF/16V size:10*17	C2249
056-011-000005	1000uF/16V size:10*17	C2255
057-002-000001	CG3-1.5L	D101
057-002-000001	CG3-1.5L	D103
057-017-000001	BK-101KD07(ENC101D-07A)	RV2201
057-017-000001	BK-101KD07(ENC101D-07A)	RV2204
057-017-000002	BK-470KD07(ENC470D-07B)	RV2202
057-017-000002	BK-470KD07(ENC470D-07B)	RV2203
057-017-000002	BK-470KD07(ENC470D-07B)	RV2205
057-017-000003	ERZV14D112	RV101
057-017-000003	ERZV14D112	RV102
057-017-000003	ERZV14D112	RV103
058-001-000001	6N137	ISO1101
058-001-000001	6N137	ISO2001
058-001-000001	6N137	ISO2002
058-001-000002	PS2505-1L	U303
058-001-000002	PS2505-1L	U304
058-001-000003	TLP591B	U301
058-001-000004	PC817C	ISO2201
058-001-000005	PS2506-1L	U302
060-002-00001W	20K tolerance:0.1%,10PPM	R408
060-002-00001X	200K tolerance:0.1%,5PPM	R407
060-002-00001X	200K tolerance:0.1%,5PPM	R602
060-002-00001Y	1.87K tolerance:0.1%,5PPM	R601
060-002-00001Z	500K tolerance:0.1%,5PPM	R605

060-002-00001Z	500K tolerance:0.1%,5PPM	R606
060-002-00009K	RN6008 TCK10-.1-1%-10PPM-LOWEMF Thermal EMF <= +-0.5uV/k TCR <= +-10ppm/k	R323
060-006-000001	MAX10R000B	R317
060-006-000001	MAX10R000B	R324
060-008-000001	USVD2-B10M-025-02	R204
061-003-000004	MPF4392	Q601
061-004-000001	2SK1412LS	Q301
061-004-000001	2SK1412LS	Q302
061-006-000002	KBL04 Bridge rectifier	D102
062-001-000001	317-037 U type heat sinker with pin	U2201
062-001-000001	317-037 U type heat sinker with pin	U2203
062-001-000001	317-037 U type heat sinker with pin	U2205
062-001-000001	317-037 U type heat sinker with pin	U2207
063-004-000003	VRE310JD	U802
063-004-000007	MC7818CT	U2201
063-004-000009	MC7918CT	U2203
063-004-00000B	LM1117T-5V	U2207
063-004-00000C	LM1117T-3.3V	U2205
063-011-000002	10MHz	Y1601
063-011-000003	6MHz	Y2101

Table 5-1

Parts list of M3500A panel board

Picotest Part NO.	Description	Circuit Design
056-001-000003	100nF-0603 X7R,50V,10%	C1
056-001-000003	100nF-0603 X7R,50V,10%	C11
056-001-000003	100nF-0603 X7R,50V,10%	C15
056-001-000003	100nF-0603 X7R,50V,10%	C22
056-001-000003	100nF-0603 X7R,50V,10%	C3
056-001-000003	100nF-0603 X7R,50V,10%	C4
056-001-000003	100nF-0603 X7R,50V,10%	C5
056-001-000003	100nF-0603 X7R,50V,10%	C7
056-001-000003	100nF-0603 X7R,50V,10%	C8
056-001-00000B	10nF-0603 X7R,50V,10%	C14
056-001-00000B	10nF-0603 X7R,50V,10%	C18
056-001-00000B	10nF-0603 X7R,50V,10%	C19
056-001-00000H	100pF-0603 NPO,50V,5%	C17
056-001-00000L	1nF-0603 X7R,50V,tolerance:10%	C16

056-001-00000L	1nF-0603 X7R,50V,tolerance:10%	C6
056-001-00000Q	100nF-0805 X7R,50V,10%	C2
056-001-00000S	33nF-0603 X7R,16V,10%	C13
056-001-00000T	20pF-0603 NPO,50V,5%	C10
056-001-00000T	20pF-0603 NPO,50V,5%	C9
057-009-000002	BLM18BD601SN1D 0603	L1
057-009-000002	BLM18BD601SN1D 0603	L2
060-002-000003	10K-0603 tolerance:1%,1/10W	R10
060-002-000003	10K-0603 tolerance:1%,1/10W	R11
060-002-000003	10K-0603 tolerance:1%,1/10W	R16
060-002-000003	10K-0603 tolerance:1%,1/10W	R2
060-002-000003	10K-0603 tolerance:1%,1/10W	R27
060-002-000003	10K-0603 tolerance:1%,1/10W	R30
060-002-000003	10K-0603 tolerance:1%,1/10W	R31
060-002-000003	10K-0603 tolerance:1%,1/10W	R32
060-002-000003	10K-0603 tolerance:1%,1/10W	R39
060-002-000003	10K-0603 tolerance:1%,1/10W	R4
060-002-000003	10K-0603 tolerance:1%,1/10W	R40
060-002-000003	10K-0603 tolerance:1%,1/10W	R6
060-002-000006	1K-0603 tolerance:1%,1/10W	R28
060-002-000007	100K-0603 tolerance:1%,1/10W	R21
060-002-000007	100K-0603 tolerance:1%,1/10W	R22
060-002-000007	100K-0603 tolerance:1%,1/10W	R23
060-002-000007	100K-0603 tolerance:1%,1/10W	R24
060-002-000007	100K-0603 tolerance:1%,1/10W	R25
060-002-000007	100K-0603 tolerance:1%,1/10W	R26
060-002-000007	100K-0603 tolerance:1%,1/10W	R35
060-002-000007	100K-0603 tolerance:1%,1/10W	R36
060-002-000007	100K-0603 tolerance:1%,1/10W	R37
060-002-000007	100K-0603 tolerance:1%,1/10W	R38
060-002-00000H	3.32K-0603 tolerance:1%,1/10W	R17
060-002-00000H	3.32K-0603 tolerance:1%,1/10W	R34
060-002-00000L	100R-0603 tolerance:1%,1/10W	R3
060-002-000017	20K-0603 tolerance:1%,1/10W	R15
060-002-00002A	2.2K-0603 tolerance:1%,1/10W	R8
060-002-00002J	47K-0603 tolerance:1%,1/10W	R5
060-002-00002L	39K-0603 tolerance:1%,1/10W	R12
060-002-00002M	8.2K-0603 tolerance:1%,1/10W	R13
060-002-00002N	9.1K-0603 tolerance:1%,1/10W	R14
060-002-00002O	10M-0603 tolerance:1%,1/10W	R18

060-002-00002P	220K-0603 tolerance:1%,1/10W	R19
060-002-00002Q	1M-0603 tolerance:1%,1/10W	R20
060-002-00002S	22R-0603 tolerance:1%,1/10W	R1
060-002-00006B	3.01K-0603 tolerance:1%,1/10W	R33
060-002-00006B	3.01K-0603 tolerance:1%,1/10W	R41
060-002-00006B	3.01K-0603 tolerance:1%,1/10W	R42
060-002-00006B	3.01K-0603 tolerance:1%,1/10W	R43
060-002-00006B	3.01K-0603 tolerance:1%,1/10W	R44
060-002-00006B	3.01K-0603 tolerance:1%,1/10W	R45
060-002-00006B	3.01K-0603 tolerance:1%,1/10W	R46
060-002-00006B	3.01K-0603 tolerance:1%,1/10W	R9
061-001-00000A	SMAJ14CA	D3
061-001-00000A	SMAJ14CA	D4
061-001-00000B	SMBJ70CA	D2
061-001-00000F	MMSZ39T1	D1
061-007-000008	BC856ALT1	Q1
061-007-000009	2SC2412K	Q2
061-007-000009	2SC2412K	Q3
063-001-00000G	LM393MX	U4
063-007-00000B	MC74HC165ADR2	U5
063-009-000002	MC68HC908GR4CFA	U3
012-001-000009	CON10P/2.0 male plug,180°	J1
044-001-000001	HCM1206EN	LS1
056-011-000001	47uF/25V size:5*11	C12
058-002-000001	17BT18GIN(VFD-CIG)	U1
063-011-000004	32.768KHz	Y1

Table 5-2

5.3 Layout Drawings

Main board PCB components layout (top layer)

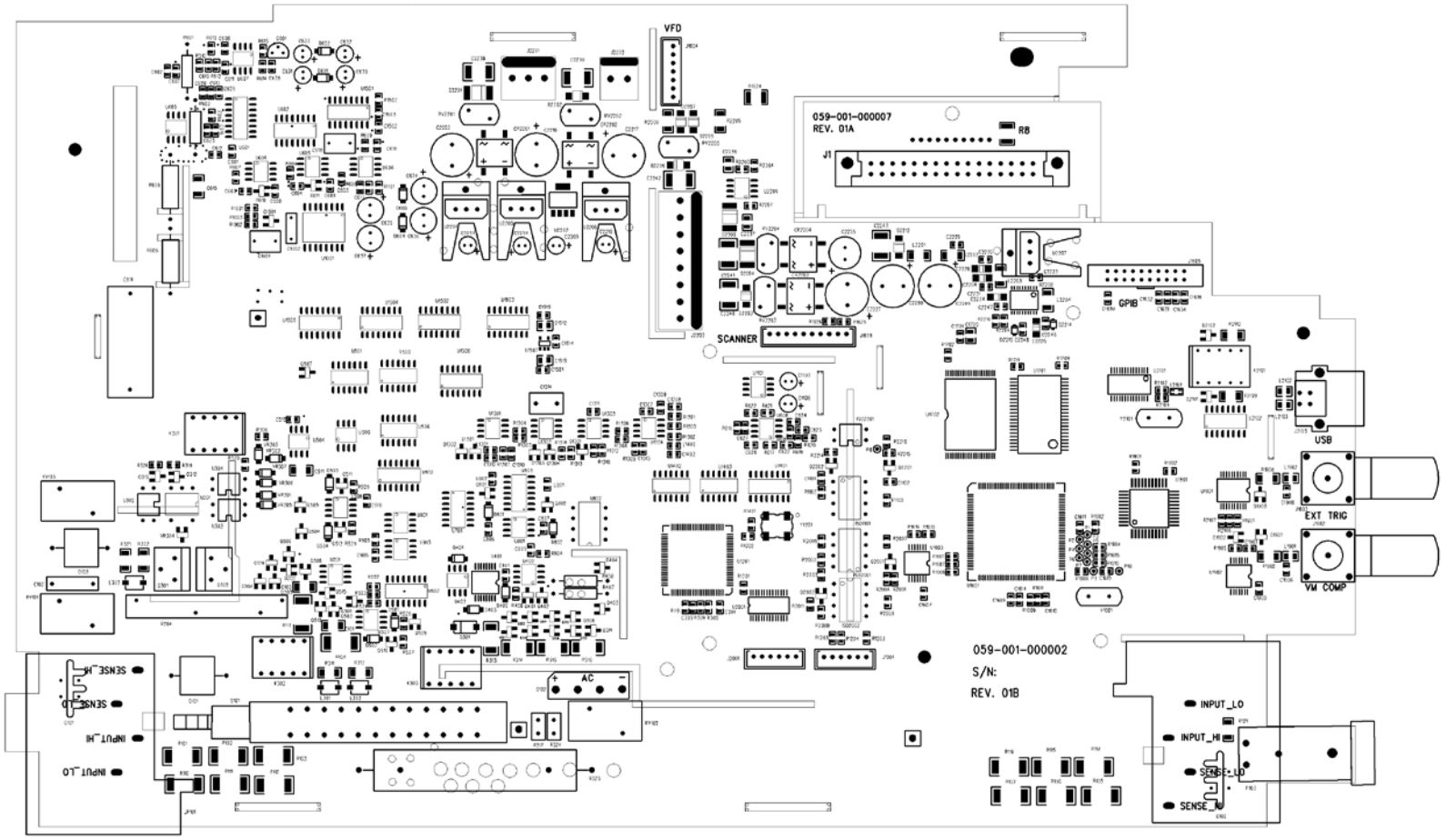


Figure 5-1

Main board PCB components layout (bottom layer)

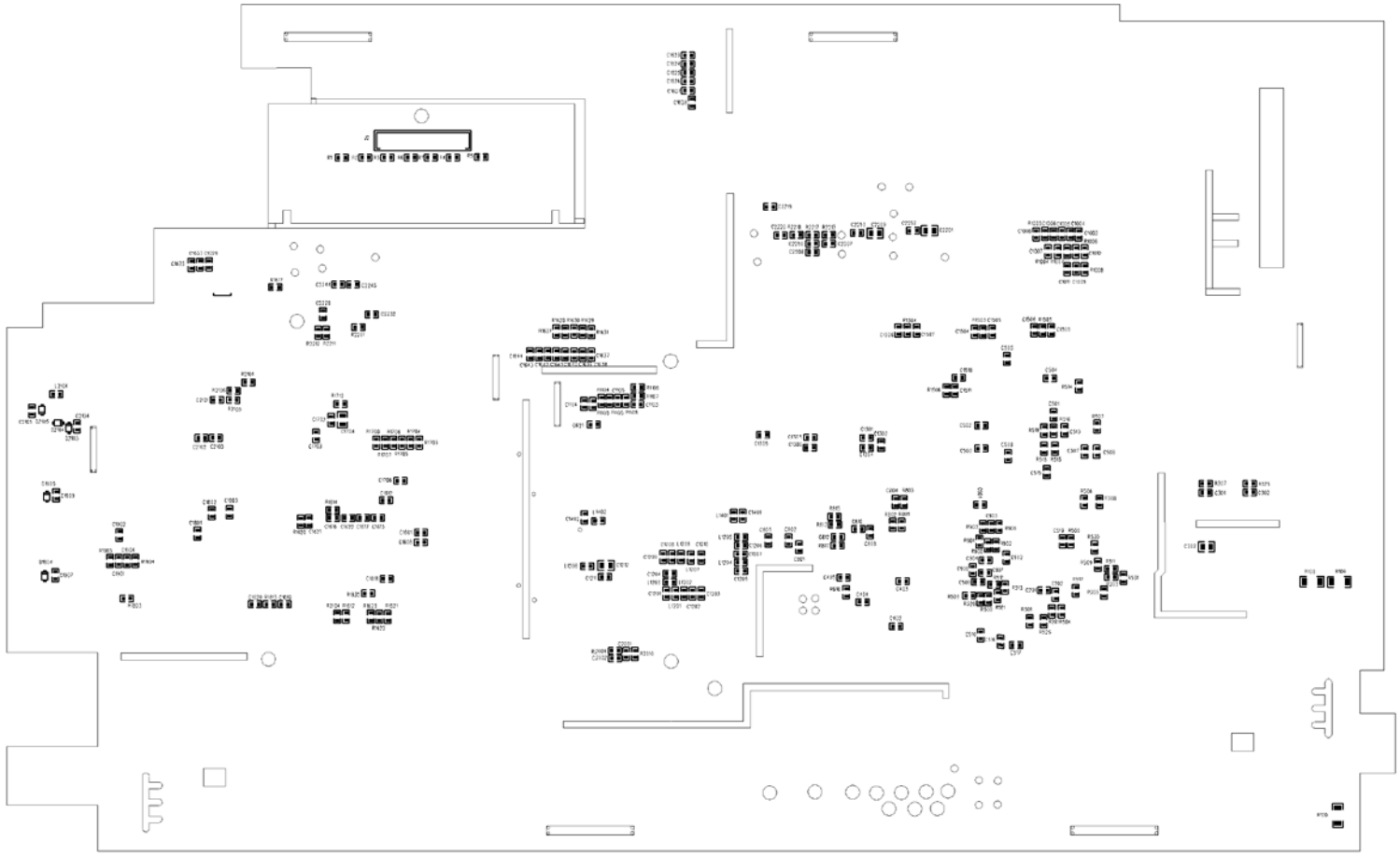


Figure 5-2

Panel PCB components layout (top layer)

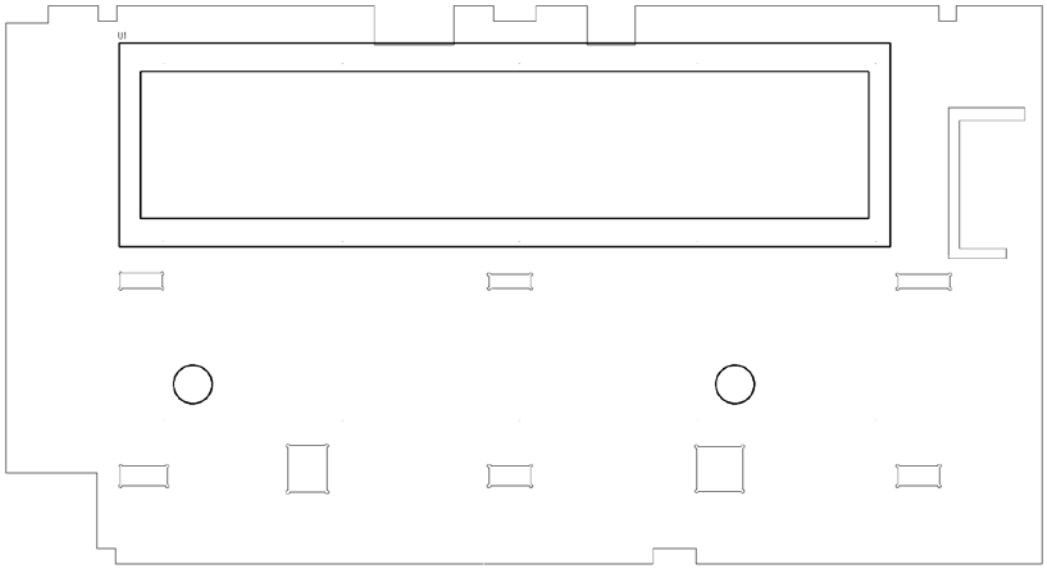


Figure 5-3

Panel PCB components layout (bottom layer)

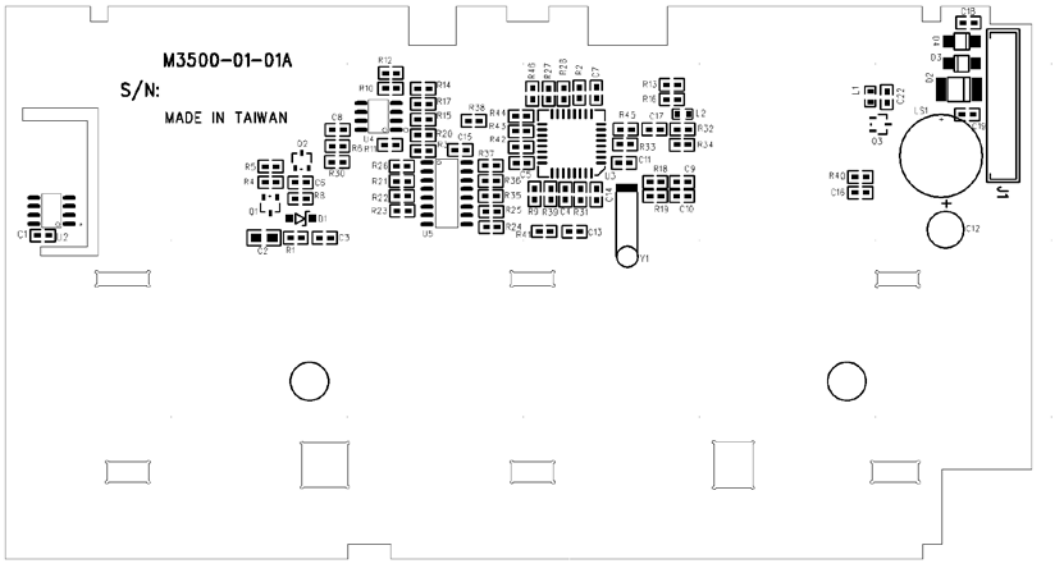


Figure 5-4

6 Simple Calibration Procedures

If users' multimeters need detailed calibration service, contact Picotest Corp for more information. If users only want to do the basic calibration for Zero & Gain adjustments, please follow the procedures below.

6.1 The Calibration Security Code

To prevent from unauthorized or abusive calibrations, generally, the M3500A is secured by a specific code. As an M3500A needs calibration, operators have to input a security code. Then, the M3500A would just enter the calibration mode. The decoding procedures are in the following.

MENU > PREV > CAL MENU > ENTER > SECURED > ENTER > CODE > ENTER > input 123456 (by using the UP button in the Range area & NEXT button) > ENTER

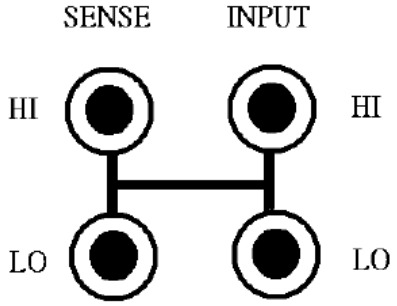
Users can execute the calibration/adjustment procedures by entering UNSECURED > NEXT > CALIBRATE > ENTER.

- Note 1: The factory default is "123456", which is burned in the permanent memory of the M3500A. If the default needs to be defined for purposes, please use PT-SET software.

6.2 The Zero Adjustment

Please follow the procedures A, B and C to do the Zero adjustment.

A. Use the CALIBRATE SHORT PIN as shown below to plug into the front panel terminals of the M3500A. Then, warm it up in 3 minutes as the M3500A is given power.



B. After lifting the security, please do the Zero adjustment by the operation procedures, such as UNSECURED > NEXT > CALIBRATE > ENTER (The display will show "input full scale")> input +0.000000E-1 (by using the

UP button in the Range area & NEXT button)> ENTER. At the moment, the DISPLAY will show “calibrating”. Please note that if the operation procedures are failed, the Calibrate Short isn’t inserted or the input setting value is not +0.000000E-1, an Error message will appear (refer to Table-2).

C. When it’s done for the Zero Test, the Display of the M3500A will show Cali OK. Users can press ESC to exit.

6.3 The Gain Adjustment for DCV, DCI, 4W & FREQ

Please follow the procedures A, B and C to do the adjustment.

A. Connect a standard source and select a specific function and range for adjustment, and set the Resolution into SLOW 6 1/2 by pressing CONFIG > ENTER > RESOLUTION > NEXT > SLOW 6 1/2. The standard source value has to correspond to the specific function and range with full scale on the M3500A, i.e. multiply 0.9 to 1.1 with full scale. For instance, the DC full scale’s value is 100 mV, the standard output value should be from 90 to 110 mV (refer to Table-1).

B. After lifting the security by pressing UNSECURED > NEXT > CALIBRATE > ENTER > By using the UP button in the Range area & NEXT button to input a value which should be the one multiplying 0.9 to 1.1 with full scale (The display will show “input full scale”), such as the range value of the DC 100 mV should be between +0.900000E-01 and +1.100000E-01 (refer to table-1) > ENTER to do the adjustment. Please note that if the operation procedures are failed or the output source value and the setting value overflow the range, an Error message will appear (refer to Table-2).

C. When it’s done, the Display of the M3500A will show Cali OK. Users can press ESC to exit. In addition, users have to note that…
   - When the resistance function is under adjustment, it’s available that users only execute the 4W adjustment because the value on 4W is the same as the value on 2W. In addition, the adjustment for the range 100MΩ is not supported.
   - When the DCI function is under adjustment, the adjustment for the range 3A is not supported.
   - When the FREQ function is under adjustment, the input voltage has to be greater than 100 mV.
   - When the DCV range 1000V is selected, the full scale value after multiplying 0.9 to 1.1 only can tolerate the voltage from 900 to 1050V at most.

6.4 The Gain Adjustment for ACV

Please follow the procedures A and B to do the adjustment.

A. To do ACV adjustment, the standard source with a required setting 1 KHz needs to be connected, and the BAND WIDTH 20 Hz has to be selected by pressing SHIFT > ACV > BAND WIDTH > NEXT > 20 Hz > ENTER. Then, choose a specific range. And follow the next procedures to operate.
   - Set the standard input voltage at source side in 10 % relative to a range with full scale on the M3500A, and the 10% value of the full scale must be between the value multiplying 0.9 and 1.1. (For instance, when users adjust the M3500A's AC range to 100 mV, the output voltage of the standard source must be between 9 to 11 mV. And the frequency must be 1 KHz.) Then lift the security by pressing UNSECURED > NEXT > CALIBRATE > ENTER > And by using the UP button in the Range area & NEXT button to input a value which must be between the value multiplying 0.9 to 1.1 with full scale. After that the M3500A will show a 10% value with full scale. (For instance, the setting must be between +0.900000E-02 and +1.100000E-02 at the AC range 100 mV.) > ENTER to do the adjustment.
   - After executing the adjustment of the 10% with full scale on the M3500A, the display will show "input full scale". Please set the standard input voltage at source side in 100 % relative to a range with full scale on the M3500A, and the 100% value of the full scale must be between the value multiplying 0.9 and 1.1. (For instance, when users adjust the M3500A's AC range to 100 mV, the output voltage of the standard source must be between 90 and 110 mV. And the frequency must be 1 KHz.) Then by using the UP button in the Range area & NEXT button to input a demand value which must be 100% with full scale, and its value must be between multiplying 0.9 and 1.1. (For instance, the setting must be between +0.900000E-01 and +1.100000E-01 at the AC range 100 mV.) > ENTER to do the adjustment.

B. When it's done, the Display of the M3500A will show Cali OK. Users can press ESC to exit. In addition, users have to note that…
   - When the ACV range 750V is selected, the 10% value of the full scale multiplying 0.9 to 1.1 is between 67.5V and 82.5V. But the 100% value of the full scale multiplying 0.9 to 1.1 is only between 675V and 770V at most.
   - The ACI function adjustment is not supported.

Function	Range	Input Value from Source	Setting Value on M3500A
VDC	100mV to 100V	0.9 to 1.1 * full scale	0.9 to 1.1 * full scale
	1000V	900V to 1050V	900V to 1050V
DCI	10mA to 1A	0.9 to 1.1 * full scale	0.9 to 1.1 * full scale
4WΩ	100Ω to 100MΩ	0.9 to 1.1 * full scale	0.9 to 1.1 * full scale

ACV	100mV to 100V	0.9 to 1.1 * 10% * full scale 0.9 to 1.1 * 100% * full scale	0.9 to 1.1 * 10% * full scale 0.9 to 1.1 * 100% * full scale
	750V	0.9 to 1.1 * 10% * full scale 675V to 770V	0.9 to 1.1 * 10% * full scale 675V to 770V
FREQ	Any	Any input > 100 mV 1K to 300K	Any input > 100 mV 1K to 300K

Table-1

6.5 Calibration Count

The calibration count will be increased from finishing calibration each time. According to the calibration procedures on various points, a full calibration will generate the count number more than one, and it will be recorded in the permanent memory of the M3500A.

- Note 2: The factory default for each M3500A is 0. If the count number exceeds 32767. The number will turn into 0.

6.6 Calibration Date

The M3500A will record a calibrated and a future calibration dates as the factory default. Please note that the dates are not allowed to be revised.

6.7 The Calibration Error Messages

Please take a look at the following messages (Table-2) as calibration errors occur.

Calibration Error Messages	
701	Cal security disabled
702	Cal secured
703	Invalid secure code
705	Cal aborted
706	Cal value out of range
707	Cal measurement out of range
709	No cal for this function or range

Table-2

Appendix

A. Specification List

DC Characteristics

Function	Range	Input Resistance	24 hours accuracy ± (% of reading + % of range)(23 °C ± 1 °C)	1 year accuracy ± (% of reading + % of range)(23 °C ± 5 °C)
DCV (DC Voltage)	100.0000 mV	>10 GΩ	0.0030+0.0030	0.0050+0.0035
	1.000000 V	>10 GΩ	0.0020+0.0006	0.0040+0.0007
	10.00000 V	>10 GΩ	0.0015+0.0004	0.0035+0.0005
	100.0000 V	10 MΩ	0.0020+0.0006	0.0045+0.0006
	1000.000 V	10 MΩ	0.0020+0.0006	0.0045+0.0010

Function	Range	Shunt Resistance	24 hours accuracy ± (% of reading + % of range)(23 °C ± 1 °C)	1 year accuracy ± (% of reading + % of range)(23 °C ± 5 °C)
DCI (DC Current)	10.00000 mA	10.1 Ω	0.005+0.010	0.050+0.020
	100.0000 mA	10.1 Ω	0.01+0.004	0.050+0.005
	1.000000 A	0.1 Ω	0.05+0.006	0.100+0.010
	3.00000 A	0.1 Ω	0.10+0.020	0.120+0.020

DC Characteristics (continued)

Function	Range	Test Current	24 hours accuracy ± (% of reading + % of range) (23 °C ± 1 °C)	1 year accuracy ± (% of reading + % of range) (23 °C ± 5 °C)
Resistance (Specifications are for both 2W and 4W when a NULL operation is used)	100.0000 Ω	1 mA	0.0030+0.0030	0.010+0.004
	1.000000 KΩ	1 mA	0.0020+0.0005	0.010+0.001
	10.00000 KΩ	100 μA	0.0020+0.0005	0.010+0.001
	100.0000 KΩ	10 μA	0.0020+0.0005	0.010+0.001
	1.000000 MΩ	5 μA	0.002+0.001	0.010+0.001
	10.00000 MΩ	500 nA	0.015+0.001	0.040+0.001
	100.0000 MΩ	500 nA//10 MΩ	0.300+0.010	0.800+0.010
Diode Test	1.0000 V	1 mA	0.002+0.010	0.010+0.020
Continuity	1000.00 KΩ	1 mA	0.002+0.010	0.010+0.020

Period (Frequency) Characteristics

Function	Range	Frequency (Hz)	24 hours accuracy ± (% of reading + % of range) (23 °C ± 1 °C)	1 year accuracy ± (% of reading + % of range) (23 °C ± 5 °C)
Period	100 mV to 750 V	3 – 5	0.10	0.10
		5 – 10	0.05	0.05
		10 – 40	0.03	0.03
		40 – 300K	0.006	0.01

AC Characteristics

Function	Range	Frequency (Hz)	24 hours accuracy ± (% of reading + % of range)(23 °C ± 1 °C)	1 year accuracy ± (% of reading + % of range)(23 °C ± 5 °C)
ACV (AC RMS Voltage)	100.0000 mV	3 – 5	1.00+0.03	1.00+0.04
		5 – 10	0.35+0.03	0.35+0.04
		10 – 20K	0.04+0.03	0.06+0.04
		20K – 50K	0.10+0.05	0.12+0.05
		50K – 100K	0.55+0.08	0.60+0.08
		100K–300K	4.00+0.50	4.00+0.50
	1.000000 V to 750.000 V	3 – 5	1.00+0.02	1.00+0.03
		5 – 10	0.35+0.02	0.35+0.03
		10 – 20K	0.04+0.02	0.06+0.03
		20K – 50K	0.10+0.04	0.12+0.05
		50K – 100K	0.55+0.08	0.60+0.08
		100K–300K	4.00+0.50	4.00+0.50
ACI (AC RMS Current)	1.000000 A	3 – 5	1.00+0.04	1.00+0.04
		5 – 10	0.30+0.04	0.30+0.04
		10 – 5K	0.10+0.04	0.10+0.04
	3.00000 A	3 – 5	1.10+0.06	1.10+0.06
		5 – 10	0.35+0.06	0.35+0.06
		10 – 5K	0.15+0.06	0.15+0.06

(※Note 1: Specifications are for 2-hour warm-up at 6.5 Digits, slow ac filter with Bandwidth 3Hz, sine wave input.)
(※Note 2: 750Vac range limited to 100 KHz)

B. General Specifications

item	Limitation & description
Power Supply	100V/120V/220V/240V ± 10%
Power Line Frequency	50~60 Hz ± 10%
Power Consumption	25 VA peak (16 W average)
Operating Environment	0 ℃ to 40 ℃
Operating Humidity	Maximum relative humidity 80% for temperature up to 31 ℃ decreasing linearly to 50% relative humidity at 40℃
Storage Temperature	- 40 ℃ to 70 ℃
Operating Altitude	Up to 2000m
Bench Dimensions for Rack (WxHxD)	213.6 x 88.6 x 370.0 mm
Weight	3706 g
Safety	IEC61010-1:2001/EN61010-1:2001 (2nd Edition) Over-Voltage Category CAT II, CAT I 1000V
	UL61010-1:2004 Installation CAT II, Measurement CAT III at max. 1000V
	Pollution Degree 2
EMC	EN61326-1:2006 EN61326-2-1:2006 **EMI:** CISPR 11:1997+A1:1999+A2:2002 Class B IEC61000-3-2:2000 IEC61000-3-3:1994+A1:2001 **EMS:** IEC61000-4-2:1995+A1:1998+A2:2000 IEC61000-4-3:2002 IEC61000-4-4:2004 IEC61000-4-5:1995+A1:2000 IEC61000-4-6:1996+A1:2000 IEC61000-4-8:1993+A1:2000 IEC61000-4-11:1994+A1:2000

※Note: Regarding the Safety, the LO jack is marked with 500Vpk against ground and SENSE HI to LO is only marked with 200Vpk, in opposition to the label of 600V CAT II and/or 1000V CAT I against ground and IEC 61010-1.

Power-ON and Reset State

Function		Default
Function		DCV
Autozero		On
Frequency and Period Source		AC Voltage
Output Format		ASCII
Ratio		Off
AC Bandwidth	Input Frequency	20Hz
Voltage	AC Digits	5 ½
	DC digits	Slow 5 ½ (1 PLC)
	Range	Auto
Current	AC Digits	5 ½
	DC Digits	Slow 5 ½ (1 PLC)
	Range	Auto
Frequency and Period	Digits	5 ½
	Range	AUTO
	Rate	Medium (100ms)
Diode Test	Digits	5 ½
	Range	1mA
	Rate	0.1 PLC
Resistance (2-wire)	Digits	Slow 5 ½ (1 PLC)
	Range	Auto
Temperature	Digits	Slow 6 ½ (10 PLC)
	Thermocouple	Universal Type
Triggers	Source	Immediate
	Delay	Auto
Input Resistance		10MΩ

PICOTEST®

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014

CE

Conformity with the following European Directives:

The product herein conforms with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 2004/108/EC and goes with the CE Marking accordingly.

Conformity with the following product standards:

Manufacturer Name: Picotest Corp.
Manufacturer Address: 5F-1, 286-9, Hsin-Ya Rd, 80673, Kaohsiung, Taiwan
Declaration of Product
Product Name: 61/2 Digit Digital Multimeter
Model Number: M3500A
Product Accessories: This declaration applies to all accessories of the above product(s).

EMC:

EN61326-1:2006
EN61326-2-1:2006

EMI:

CISPR 11:1997+A1:1999+A2:2002 Class B
IEC61000-3-2:2000
IEC61000-3-3:1994+A1:2001

EMS:

IEC61000-4-2:1995+A1:1998+A2:2000
IEC61000-4-3:2002
IEC61000-4-4:2004
IEC61000-4-5:1995+A1:2000
IEC61000-4-6:1996+A1:2000
IEC61000-4-8:1993+A1:2000
IEC61000-4-11:1994+A1:2000

Safety:

IEC61010-1:2001/EN61010-1:2001(2nd Edition)
UL61010-1:2004

儀鼎儀器股份有限公司 統一發票專用章 統一編號 80387244 TEL:8157183 高雄市 前鎮區新衛路286-9號5樓之1

13 Aug. 2009
Date

Mr. Hawk Shang
General Manager

For more information, please contact your local supplier, sales office or distributor.

* **a. Using continuous integrating A/D converter.**
b. Input bias current: less than 30 pA at 25° C.
c. Input protection: 100 V, all range.

* **a. Specifications are for 4-wire ohms. For 2-wire ohms, use Math Null function or add 0.2 ohms for additional uncertainty.**
b. Max. Lead Resistance: 10% of range per lead for 100Ω and 1KΩ ranges; 1kΩ per lead for all other ranges.
c. Input protection: 1000 V, all ranges.

※Note: 24-hour measurement is relative to calibration accuracy.