

M5000 & M5000X

Service Manual

2nd Edition

t.c. electronic

TC Electronic A/S, Sindalsvej 34, DK-8240 Risskov, DENMARK Telephone: +45 8621 7599 Fax: +45 8621 7598 Email: tc@tcelectronic.com WWW: <http://www.tcelectronic.com>

Table of Contents:

Introduction	3
Quick Trouble Shooting:.....	3
Built-in Test Program:.....	6
Disassembly procedure for main board.....	8
Exchange of Power Supply Module.....	15
Exchange of battery:.....	15
Circuit description:.....	16
LED error codes:.....	Error! Bookmark not defined.
Jumper settings:.....	18
Software Changes:.....	17
Technical Specifications:.....	20
Cable specifications:.....	24
Appendix list:.....	25

2nd Edition

© Copyright 1997, TC Electronic A/S. All rights reserved.

Filename: M5KSMAN2.DOC

Stock number: 605 0120 11

Introduction

The purpose of this manual is to support skilled technicians in repairing the M5000 or M5000X Mainframe only.

For repairing modules i.e ADA, DSP , please refer to other service manuals.

The service manual contains information on two types of M5000 Mainframes.

The first type is named M5000F10 on the back panel. This type has black side panels and black back panel. The power supply consist of a toroidal transformer and a board with some power regulation circuits. The input voltage selector has 4 different settings.

The second type is named M5000F20 on the back panel. This type has "gold" side panels and "gold" back panel. The power supply is a switch mode power supply and the input voltage setting is automatic. Type M5000F20 is also fitted with a ground lift switch.

Both mainframe types consist of a chassis, a power supply, a CPU board, a floppy disc drive, a buss board and a front board.

The mainframe type M5000F20 is available in two versions; as M5000 or as M5000X. The M5000X is a satellite version without front board. Hence it must be operated from a Remote control.

The manual begins with a Quick Trouble Shooting table and an Upgrade List table. Here, hints, advice and possible problems are described.

If the problem is more serious, the next step is to use the Built-in Test Program. With this program the problem can often be narrowed down to a specific board, section or even component.

The next section consist of disassembly and exchange procedures. Please be aware of warranty rights before disassembling. See the warranty card.

Circuit description is a brief description of the circuits on the different boards.

The Circuit description is followed by a complete list with test point values, a list with LED error codes and Jumper settings.

Finally the specifications are stated.

Appendix contains schematics, part lists, layouts etc.

Schematics start with a main sheet, where sub sheets are shown as blocks. Even sub sheets might have sub sheets. In the Schematics some connections have label names to help the reader. If a label name is framed, it means that it is "connected" to another sheet. Label names followed by the symbol "*" mean that the signal is active low, i.e. RESET*: the reset function takes place when the signal is low.

This service manual does not contain schematics for the power supply module in Mainframe type M5000F20, because any attempt to repair the power supply module must be completed with some safety tests such as high voltage and EMC tests. Hence, it is strongly recommended that the entire power supply module is replaced in case of malfunction.

Part lists contain a column called TCcode. Use this code when ordering spare parts. If the TCcode field is empty; it means the component cannot be ordered separately. The coordinates in the column Pos. refer to the PCB layout page. The column named Page refers to page no. in the schematics. In column comments a short explanation of the function is stated. For some components, alternative types are mentioned.

PCB layouts are made as gatefolds.

Finally appendix contains a spare part list for mechanical parts.

Quick Trouble Shooting:

Use this table to solve problems or find out what to do next.

Symptom	Comments / Action:
Distortion	If SAMPLE RATE is set to DI, when using analog input, distortion will appear. Set SAMPLE RATE to 44.1 or 48 or connect an external device to digital input. If SAMPLE RATE is set to 44.1kHz and the digital input signal is 48kHz (or vice versa), distortion will appear. The M5000/X cannot do real sample rate conversion!
The message "BIOS LOADED" appears constantly or randomly.	Clean the connector CN2 at the power supply board or even better, solder the power supply wires directly into the board. Please refer to service note no. 712 10 05 11. or 712 10 05 15 in appendix
The message "SERIAL INFORMATION MISMATCH" appears at power on.	The RAM has lost data. Press as noted DO and write down the 16 character code and the M5000/X frame serial no. and contact TC Electronic. In a tight situation you can press UNDO instead of DO to run the standard software (BIOS higher than 1.08). Installed option codes are deleted t and must be re-entered .
Blank display or random characters in the display. Cannot run application software.	Enter the SETUP UTILITY MENU, by keeping BYPASS button pressed at power on. Reload the application software and press UNDO when the question "KEEP PREVIOUS SETTINGS" appears.
Cannot connect to ATAC. Locked during startup sequence	Are the DIP switches at the ATAC set correctly? See the ATAC manual. Is the power up sequence correct? Powering up the ATAC and M5000/X at the same time may cause problems. Here is the correct power up sequence: 1. Connect ATAC to the M5000/X or to the MULTAC. 2. If MULTAC is used connect this to M5000, otherwise goto step 3 3. Turn on M5000/X. Wait 5 seconds. 4. Turn on the ATAC. Check M5000/X internal fuse. The fuse F1 is located inside the M5000/X, at the CPU board close to the Remote connector. Fuse size: T 630mA. The M5000/X software must be version 1.14 or higher. The M5000 BIOS version must be 2.00 or higher. The M5000X BIOS version must be 3.00 or higher.
Lines or spots in display Backlight is blinking	Make sure the environment has no influence to the display, i.e. magnetic fields, hot air, or try to adjust the VIEWING ANGLE knob. If the picture is still distorted, replace the display. If the backlight is bad or blinking; check the soldering on the display itself.

.... continued at next page.

Bad LED's, keys or Dial knobs.	See section "Built-in Test program for front board".
Analog in/out fails	Try with other cables or another ADA module. Note: When analog in/out is connected to unbalanced equipment, XLR pin 3 must be connected to pin 1.
Digital in/out fails	Try with other cables or another DSP module.
Midi in/out fails	Try with other cables or read section "Built-in Test program for CPU board".
No DSP modules are detected in the Built-in Test Program	The "Detect Cards" function in BIOS version 3.00 or lower can only detect old DSP-modules. It is not able to detect DSP-modules

	named DSP-1+ and DSP-2+, the “plus” sign indicates newer type of DSP-module.
Program Number read E01	EPROM checksum error (IC 31 & IC 32). The BIOS EPROMs may be defective or badly installed in the socket.
Program Number read E02	DYNRAM error (IC 24,25, 26, 27). The DYN RAM may be defective .
Program Number read E03	No communication between CPU board and Display. Check the ribbon cables and the solderings at the display connector. Make sure that viewing angle knob is not in position counter clock wise, refer to service note no. 712 10 05 09
Program Number read E04	Internal error trap. Possible reasons are: 1. a heavy line transient , try to turn power off and on to continue 2. corrupted software, try to reload the application software 3. defective module, try to dismount the modules one by one to narrow down the problem 4. heat, please refer to service note no. 712 10 05 10 5. defective component somewhere in the frame.
Program Number read E05	Stack overflow in CPU (IC5).
Program Number read E06	Multitask overflow in CPU (IC5)

Built-in Test Program for CPU board:

The M5000 has two Built-in Test Programs. One for testing the CPU board and one for testing the Front board.

To run the CPU board test program; Press the EDIT and BYPASS buttons while powering on. Follow the instructions on the display.

The tests runs in an automatic sequence. To select the tests manually; press the 3 buttons PROGRAM, EDIT and BYPASS while powering on.

Turn off power to leave the Test Program.

M5000 CPU-Test Program (BIOS version 1.04 to3.00) has following tests:

TEST	Function
DYN RAM	Tests the DYNAMIC RAM to some extend. In case of an error check IC24, 25, 26, 27, 28, 29 or 30
JEIDA	Tests the interface and the connector to JEIDA (PCMCIA). An empty card has to be inserted. In case of error check IC 18 or IC21.
EEPROM TEST R	Tests if the read signals to IC4 are ok. NOTE: IC4 must only be replaced at TC's main service centre, while it contains the serial no. information.
EXT INT	Tests the external interrupt signals to the CPU, IC5.
MIDI PORT	A midi signal is generated on midi output. When connected to the midi input the display reads Test OK if the signal is correct. If Midi Error; try with another midi cable or check solderings/components in the midi circuit. Press the UNDO button to generate Midi signals while trouble shooting
DISK TEST	Tests the floppy disk drive. Creates, reads and deletes a file called TC0001. An empty disk is recommended for this test.
FLASH SUPPLY	Activates the flash voltage for IC23 pin 1. Must be measured manually with a DCmultimeter.
BUS CLOCK	Activates some clock frequencies at IC37 pin 18 and pin 16. Must be measured manually with a frequency counter.
SMPTE	Tests if the CPU is able to read the SMPTE input. Connect a 2KHz square wave to the tip of the SMPTE input and the display must show the frequency.
PEDAL	Tests the status on the PEDAL socket. When no or an open jack plug is inserted the result must be "High". Connect the tip of the jack to ground, and the result must be "Low".
DETECT CARDS	Tests which cards that are inserted and the corresponding address. BUT the "Detect Cards" can only detect old DSP-modules. It is not able to detect DSP-modules named DSP-1+ and DSP-2+, the "plus" sign indicates new type of DSP-module.
RUN SERVICE CARD	Use this function to run special M5000 programs directly from a PCMCIA card, i.e. the program is not burned into the Flash.

Built-in Test Program for Front board:

To run the Front Test Program; Press the PROGRAM and BYPASS buttons while powering on. Follow the instructions on the display.
Turn off power to leave the Test Program.

M5000 Front Test Program Program (BIOS version 1.04 to 3.00) has following tests:

TEST	Function
LCD dots	Tests all dots in the display. If any dots are missing; replace the display.
LCD backlight/ viewing angle	If the backlight is bad or blinking; check the soldering on the display itself, especially the two connections going to the upper of the display.
LED's single	Tests the LED's at the front panel one by one. If no light; check soldering at the LED and ribbon cable to the front board.
LED's all	Tests all the LED's at the same time.
Encoders	Tests the steps of the five encoders. Each step is counted at the display, if not; check soldering at encoder and front connector, or replace the encoder.
Keys	Test the keys at the front panel one by one.

Self Test Procedure:

Each time the M5000 or the M5000X is powered on, a quick test is done.

The test in BIOS version 1.07, 2.00 and 2.01 consist of these steps:

- All 4 LEDs on the CPU board are turned on.
- Check BIOS EPROM checksum, if the checksum is bad LD1 on the CPU-board will turn on, and if the front panel is working then the preset LED's will show 'E01'. The M5000 will then halt.
- Part of the dynamic RAM is tested, if the RAM is bad LD2 on the CPU-board will turn on, and if the front panel is working then the preset LED's will show 'E02'. The M5000 will then halt.
- Contact to the LCD display is tested, if no contact is established LD1 and LD2 on the CPU-board will turn on, and if the front panel is working then the preset LEDs will show 'E03'. The M5000 will then halt.
- LD4 on the CPU-board will stay on showing power is on.

LED error codes for M5000 only:

LD1	LD2	LD3	LD4	Comments
on	on	on	on	init.
off	off	off	on	test ok
on	off	off	on	E01, BIOS Eprom checksum error
off	on	off	on	E02, Dynamic RAM error (IC24-27)
on	on	off	on	E03, LCD not found
off	off	on	on	E04, Unexpected interrupt

- Both LEDs on the CPU board are turned on.
- Check BIOS EPROM checksum, if the checksum is bad LD1 on the CPU-board will turn on. The M5000X will then halt.
- Part of the dynamic RAM is tested, if the RAM is bad LD2 on the CPU-board will turn on. The M5000X will then halt.

LED error codes for M5000X only:

LD1	LD2	Front LED	Comments
on	on	orange	init.
off	off	red	test ok
off	off	green	software runs
off	off	blinking red/orange	Programming Flash
on	off	red blink	E01, BIOS Eprom checksum error
off	on	red blink	E02, Dynamic RAM error (IC24-27)
on	on	red blink	E03, LCD not found
off	off	red blink	E04, Unexpected interrupt

The test in the M5000X (BIOS version 3.00) consist of these steps:

Upgrade list for M5000 only

This list gives a quick view of updates on the M5000 Mainframe.

No	Modification ONLY concerns these serial no.	Possible symptoms before modification	Modification	Service note no.
1	280000 -280258	Extremely hot	Heat sink modification	501
2	280000 -280651	Bad connection between Modules and Bus board	8 x Toothwashers mounted between BUS-board and stand offs	none
3	280000 -280903	Error on digital in/out signals	At PSU: Schottky-diode(D2) = isolated case	none
4	280000 - approx. 281000	"Not enough memory"	Mount 2M FLASH	see appendix L
5	281116 - 281467	Serial no. in Setup Utility = 0	Replace D2 at CPU board with a 4K7 5% resistor	none
6	280000 -281720	Error 04 when warm	IC6 + IC7 pin11 connected instead to IC9 pin4	712 10 0510
7	approx. 281505 - 281775	E03 when wiew angle = CCW	Front PCB: R6=680ohm connected to top of R4=680ohm	712 10 0509
8	281116 - 281922	Remote communication slow	CPU board ver. M5000-5: C79 and C84 switched around=RS232 ok	none

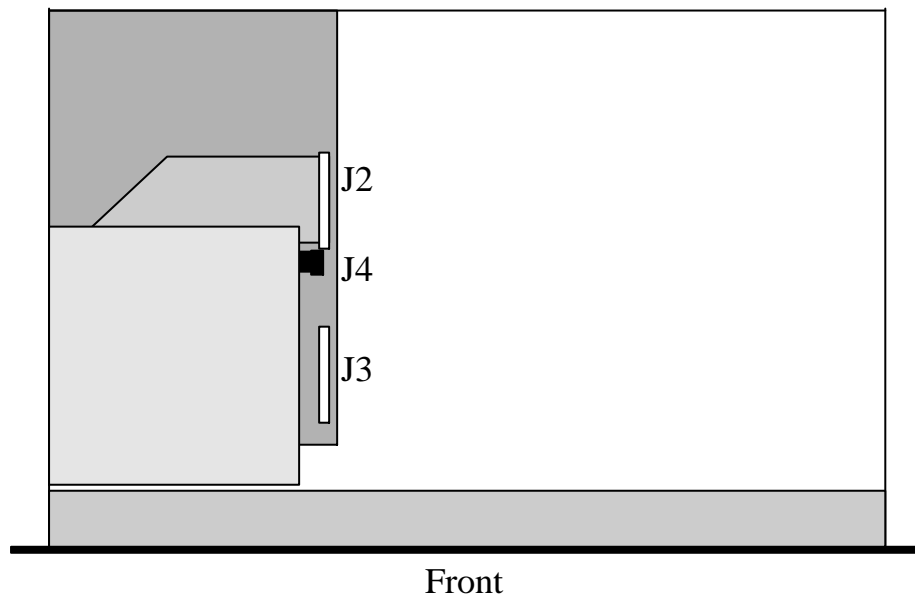
Disassembly procedure for CPU board

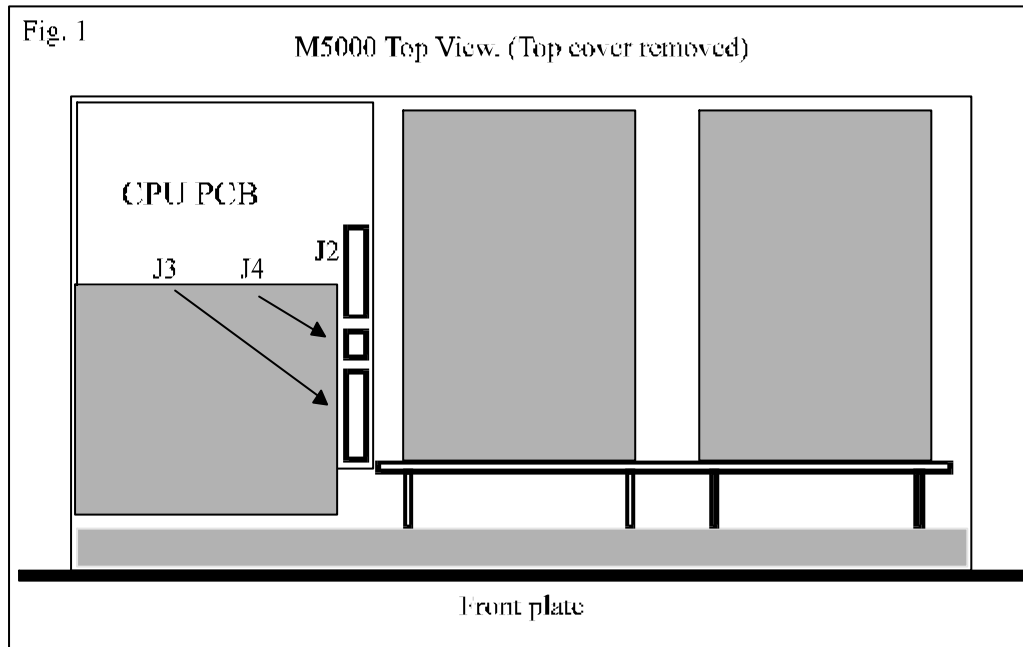
Make a backup of the user presets.

Disconnect power

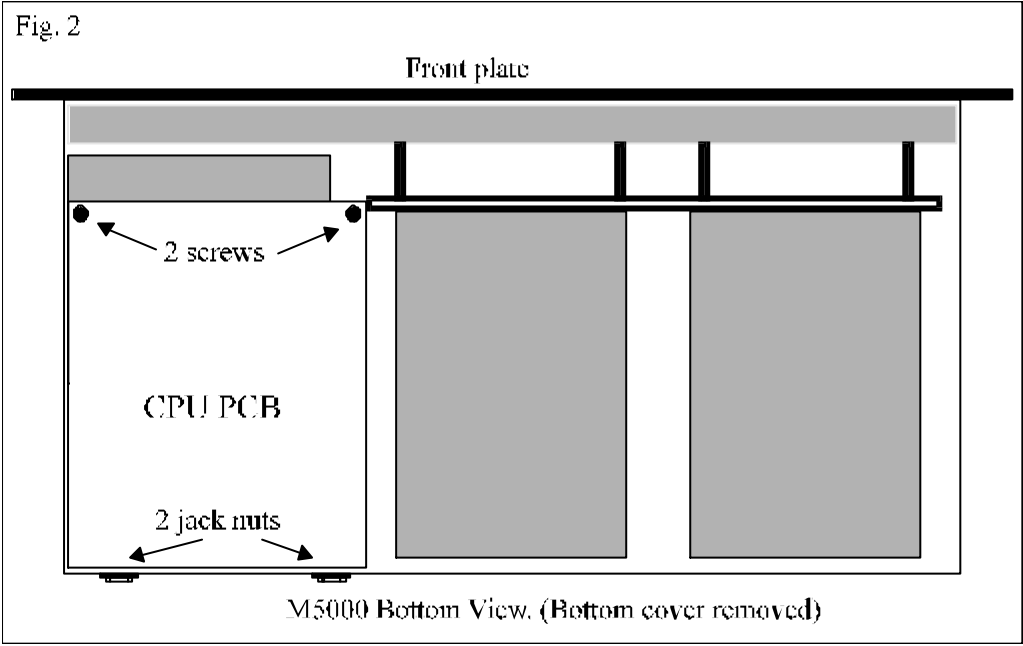
Remove the top cover and the bottom cover.

Remove the 3 cables to the CPU-PCB. The 3 cables are connected to J2, J3 and J4. See fig. 1.





Remove the CPU PCB by unscrewing 2 screws on the solder side of the PCB and by unscrewing the 2 jack nuts. See fig. 2.



Disassembly procedure for Front section:

Make a backup of the user presets.

Disconnect power

Remove the top cover.

Unscrew 4 screws, 2 in each side of the front panel

Unscrew 1 little screw placed in the middle of the front panel.

Note the placement of the wires at the power switch and then disconnect the wires.

Remove the front panel.

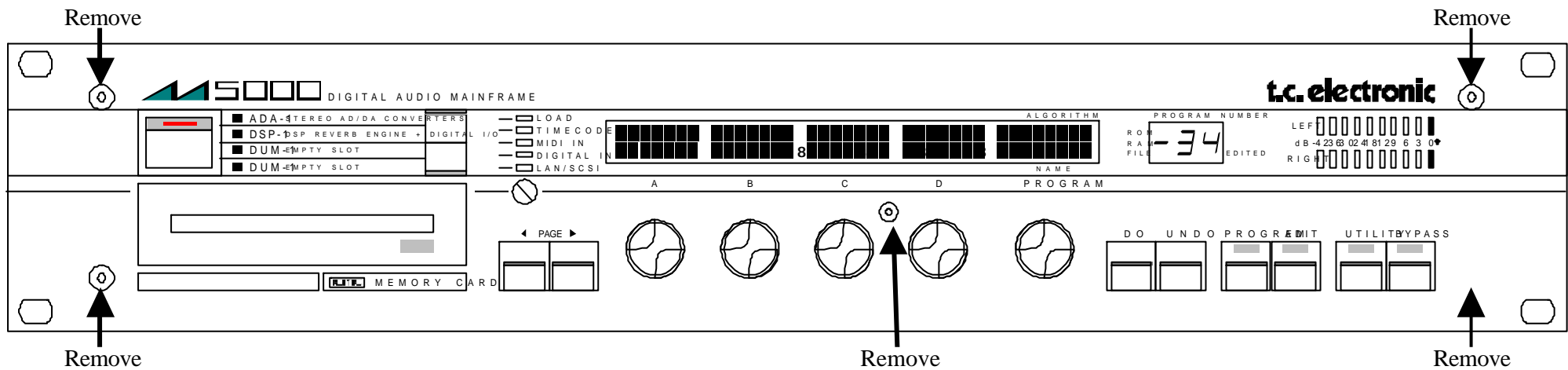


Fig. xx, Removing M5000 Front panel

Disconnect ribbon cable

Dismount the front board by removing 10 screws and 1 spacer. See fig.

Do not remove the 4 screws at MT12, MT13, MT14 and MT15. These screws fits the display to the front board.

Remove front board.

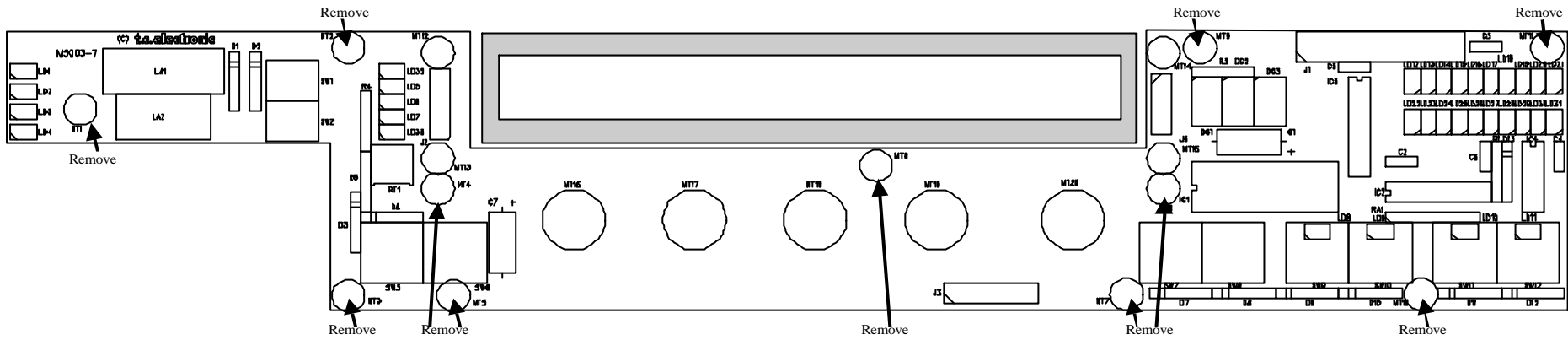


Fig. xx, Removing M5000 Front board.

Replacing battery:

CAUTION:

DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER. DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURERS INSTRUCTIONS.

WARNING:

Felaktigt batteri byte kan medföra fara för explosion. Använd därför endast samma typ eller likvärdig typ enligt apparattillverkarens rekommendation.

Kassera förbrukade batterier enligt tillverkarens anvisning

ADVARSEL:

Lithiumbatteri. Eksplosionsfare ved fejlagtig håndtering. Må kun udskiftes med batteri af samme fabrikat og type.

Lever det brugte batteri tilbage til leverandøren.

Recommended battery type: CR2032.

TC stock no. (TCcode) for battery: 342 0000 11

Replace procedure:

- 1. Turn Off Power and Disconnect Power Cord.**
2. Remove top and bottom cover.
3. Locate the battery on the CPU board.
3. Desolder the old battery by warming up each terminal one by one. Avoid any short circuit of the terminals. Be careful not to damage the wiring on the board.
4. Insert new battery and solder the terminals one by one. Avoid any short circuit of the terminals.
5. The voltage measured directly across the terminals of the new battery should be higher than 3.0VDC.
6. Do not discard the old battery. Hand it over to a recycling company or your dealer.

Replacing Power Supply Module

Please refer to service note no. 712 10 05 14 in Appendix for replacing power supply module in Mainframe type M5000F20 (serial no. higher than 281447),

Please refer to Appendix I (Power Supply Upgrade) for replacing power supply in mainframe type M5000F10.

Circuit descriptions:

The M5000/X Mainframe consist of; power supply, CPU board, floppy disc drive, bus board and front board.

Power Supply:

The power supply in Mainframe Type M5000F10 (black chassis) has a toroidal transformer. This transformer has 2 secondary windings of 20 - 0 - 20V.

These voltages are regulated on the power supply board to +/-20VDC, and a switch mode circuit produces +5.1VDC and -5VDC.

The frequency in the switch mode circuit can be controlled by the sample frequency via IC3, however - IC3 is removed on some boards while this control facility is unnecessary..

The power supply in Mainframe Type M5000F20 (gold chassis) is a switch mode power supply with automatic setting for ac input. It produces +/-18VDC and +/-5VDC.

This service manual does not contain schematics for the power supply module in Mainframe type M5000F20, because any attempt to repair the power supply module must be completed with some safety tests such as high voltage and EMC tests. Hence, it is strongly recommended that the entire power supply module is replaced in case of malfunction.

CPU board, ver. M5000-x:

CPU board has following sections; CPU section, Jeida connector, Memeory section, Bus interface, Floppy disk interface, SMPTE/Midi/Pedal interface.

CPU section consist of the CPU, IC5 and the address latches IC6 + 7. IC2 and IC10 (PAL) makes all the Chip Select signals. IC11 and IC8 are latches for control signals.

The jeida connector is connected to the data and address signals. IC21 is an interface for incomming control signals. IC18 (PAL) is interface for outgoing control signals.

The memory section has an multiplexer (IC28+29+30) for the Dynamic RAM (IC24+25+26+27). The SRAM (IC22) is working memory for the CPU. The SRAM has battery back up. The two EPROMs (IC31+32) contain the BIOS software. The Flash (IC23) contains the application software. A DC/DC converter (IC33) produces burning voltage for the Flash at time of loading application software. The EEPROM (IC4) contain serial no. information. IC4 can only be replaced at TC Electronic main service center!

The Bus Interface has interface circuits (IC37+38+39+40+41) for control -, data - and address signals. Located here is also the circuit (IC15+X1+X2) which generate the sample rates. Reset circuit is IC3.

Floppy disk Interface simply consist of IC35 and X3.

SMPTE/Midi/Pedal interface: IC36 receives the SMPTE input signals. IC13 receives Midi in signals. IC 1A+B sends Midi signals to Midi thru and Midi out. IC12 receives Remote signals. IC1C sends Remote signals. IC 45 is always disabled! Pedal In signals goes via R13 directly to the CPU.

Floppy disc drive:

This service manual does not contain schematics for the floppy disc drive. Hence, it is recommended that the entire floppy disc drive is replaced in case of malfunction.

Bus board:

The components on the bus board are mainly connectors, pull up/down resistors and decoupling capacitors. R3+R5+C18 are for ground lift.

Front board for M5000:

Signals to and from the LCD comes directly from the Bus Interface on the CPU board. IC1 make a 8x8 matrix which actives all the LEDs and 7-segments. IC2+3 make a 8x4 matrix which scannes all the keys and encoders.

Front board for M5000X:

The board has only one dual color LED and two resistors. See section LED error codes for decoding the LED color.

Software Changes:

Software changes from version 1.15 to 2.00:

Please refer to service note no. 712 10 05 12 in appendix.

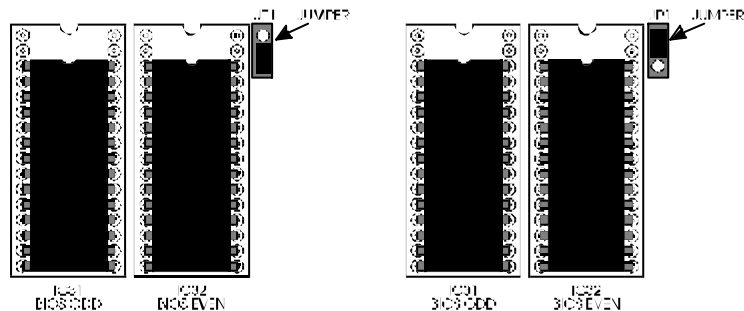
Test Point values:

Test point values for CPU board version M5000-5 and M5000-6.

TP	Value	Pos.	Page	Conditions/comments
1	-10mVDC +/- 10mV	C1	3	Indicates the standby current when Power is off
2	min. +2.8VDC (power off), +5VDC +/-0.1V (power on)	D1	3	Indicates the battery voltage
3	+5VDC +/- 0.1V (normal), +12VDC +/-0.2V(burning)	F2	3	Programming voltage for Flash
4	+5VDC +/- 0.1V (normal), +12VDC +/-0.2V(burning)	A6	2	Programming voltage for memory card

Jumper settings:

Jumper settings on CPU board version M5000-3:



BIOS version 1.04 or lower (256K Eprom)

BIOS version 1.07 or higher (512K Eprom)

Jumper settings on BUS board version M5004-3:

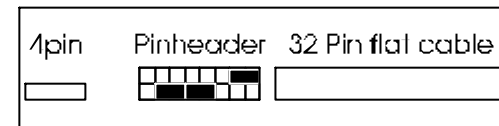
The jumper JP1 is for ground lift.

JP1 mounted: Ground lift OFF.

JP1 removed: Ground lift ON

Jumper settings on Disc Drives:

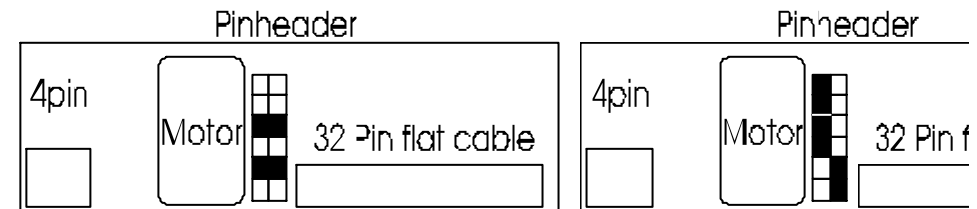
Jumper setting for Epson types:



Jumper setting for (Newtronics) Mitsumi types:

old Mitsumi version

new Mitsumi version



M5000 options:

Buying a MD-2 license gives you a MD-2 license **level 1**.

MD2 license **level 1** means that preset 200-214 only can be used at **one** DSP-module at a time.

If the M5000 has MD2 license **level 2**, it means that preset 200-214 can be used at **two** DSP-modules at a time. And so on.

BUT ! - Running preset 214 (Toolbox) at one DSP-module, and preset 01-213 at a second DSP-module only requires MD-2 license **Level 1!** This specific situation is intended for the **MultiBus feature**:

*The MultiBus feature enables the user to insert a second DSP internally, while running the Digital Toolbox™. It is hence possible to make use of **all** the features in the MD2 **simultaneously!** in the same signal path.*

Note:

DSP-1 modules with serial numbers lower than **631800** and

DSP-2 modules with serial numbers lower than **610775**

do not have the MultiBus feature installed. Without the MultiBus Feature it will not be possible to set the parameter INSERT to ON.

You can check for the MultiBus Feature in this way:

1. Press UTILITY button
2. Select MENU CONFIG and select SHOW CONFIG, then press DO.
3. Now the display shows the module configuration for the selected device. The DSP-module is displayed in one of these six ways:

DSP-1, DSP-1+, DSP-1+B, DSP-2, DSP-2+, DSP-2+B

Only the two combinations with the letter B (DSP-1+B, DSP-2+B) means the MultiBus Feature is installed.

4. Press UNDO to leave the SHOW CONFIG page.

Installations of MultiBus Features only takes place at TC Electronic, Denmark.

Here is a description for using the MultiBus Feature:

1. Select preset 214 at the DSP-module set to address 1.
2. Press the EDIT button.
3. Press the PAGE right button until the parameter INSERT shows up.
4. Set the parameter INSERT to ON.
5. Press the device selector button to select the DSP-module set to address 2.
6. Select (for instance) preset 202 at this DSP-module.
7. Press the UTILITY button.
8. Dial PROGRAM wheel until MENU I/O shows up.
9. Dial wheel A until parameter I/O reads INSERT.

Now the DSP-module at address 2 is internally inserted into the signal path on the DSP-module at address 1. (See TOOLBOX algorithm description in the M5000 Owners Manual, BASIC ALGORITHM section).

Note: The DSP-module at address 2 can only be inserted in the DSP-module at address 1 and vice versa. The DSP-module at address 4 can only be inserted in the DSP-module at address 3 and vice versa.

Technical Specifications:

A/D delay, processing delay, D/A delay, Sample and trig times: Please refer to service note no 712 10 0517 in appendix

Specs for ADA-1 STEREO ANALOG IN/OUT.

Max. Input Level	@ - 8 dB gain, + 21,8 dBu @ 0 dB gain, + 14,8 dBu @ 12 dB gain, + 2,8 dBu
Input Impedance	20 KOhm, electronically balanced, pin 2+, 3-
Input Gain	± 12 dB
Input CMRR	DC - 1 KHz, > 60 dB 1 KHz - 20 KHz, > 40 dB
Max. Output Level	+ 20.8 dBu
Output Signal Balance	>40 dB @ 1 KHz (BBC method)
Output Impedance	100 Ohm, electronically balanced, floating type, pin 2+, 3-
Output Gain	-18 dB to + 12 dB
Frequency Response	10-22 KHz, +0 -1 dB, Fs=48.0KHz 10-20 KHz, +0 -1 dB, Fs=44.1KHz 10-15 KHz, +0 -0.5 dB, Fs=32.0KHz
Total Harmonic Dist.	< 0.03 %, 1 KHz, 0 dBu
Inter modulation Dist.	< 0.03 %
Dynamic Range	> 98 dB
Crosstalk	< -80 dB @ 1 KHz
Group Delay Linearity	< 5 µS
Phase Linearity	Better than 5°
Digital Conversion	Input: Delta Sigma 64x oversampling, 18 bit Output: Linear 8x oversampling, 20 bit .

Specs for ADA-2 STEREO ANALOG IN/OUT.

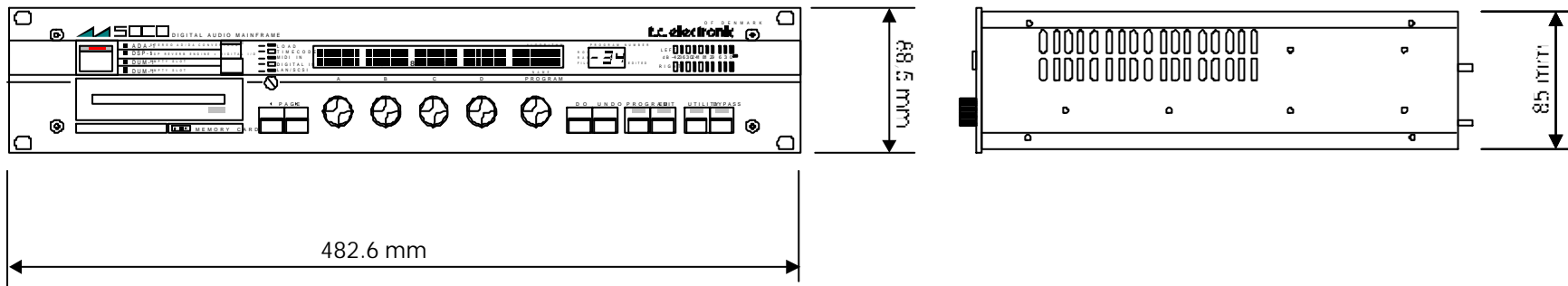
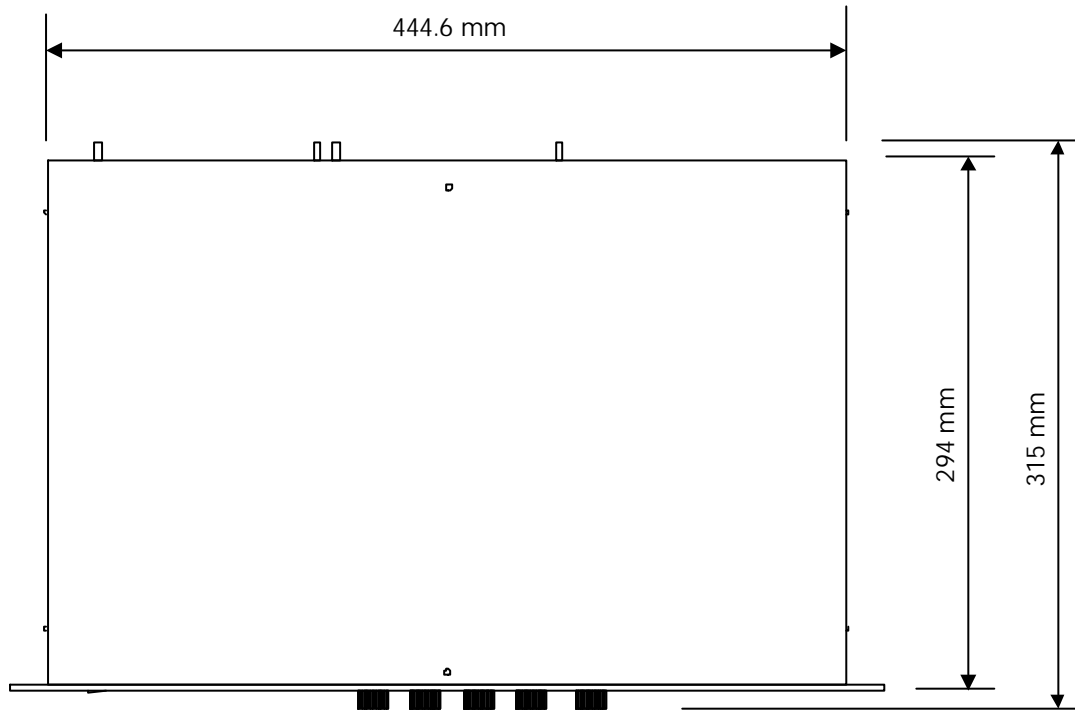
Max. Input Level	@ - 8 dB gain, + 21,8 dBu	@ 0 dB gain, + 14,8 dBu	@ 12 dB gain, + 2,8 dBu
Input Impedance	20 KOhm, electronically balanced, pin 2+, 3-		
Input Gain	± 12 dB		
Input CMRR	DC - 1 KHz, > 60 dB 1 KHz - 20 KHz, > 40 dB		
Max. Output Level	+ 20.8 dBu		
Output Signal Balance	>40 dB @ 1 KHz (BBC method)		
Output Impedance	100 Ohm, electronically balanced, floating type, pin 2+, 3-		
Output Gain	-18 dB to + 12 dB		
Frequency Response	10-22 KHz, +0 -1 dB, Fs=48.0KHz 10-20 KHz, +0 -1 dB, Fs=44.1KHz 10-15 KHz, +0 -0.5 dB, Fs=32.0KHz		
Total Harmonic Dist.	< 0.01 %, 1 KHz, +10 dBu		
Inter modulation Dist.	< 0.01 %, 1 KHz, +10 dBu		
Dynamic Range	> 98 dB		
Crosstalk	< -80 dB @ 1 KHz		
Group Delay Linearity	< 5 µS		
Phase Linearity:	Better than 5°		
Digital Conversion	Input: Delta Sigma 64x oversampling, 20 bit Output: Linear 8x oversampling, 20 bit.		

Technical Specifications for Mainframe type M5000F10:

Sampling Rate	48.0 KHz, 44.1 KHz, 32.0 KHz
Environment	Operating 0° to 50°, storage -20° to 60°
Power Requirements	selectable 100/120/220/240 Vac, 50-60 Hz, 20 to 50 watts
Dimensions:	3 1/2 x 19 x 12 inches
Finish:	Black anodized aluminum face plate. Painted and plated steel chassis
Net Weight:	19 lbs. (8.6kg)

Technical Specifications for Mainframe type M5000F20:

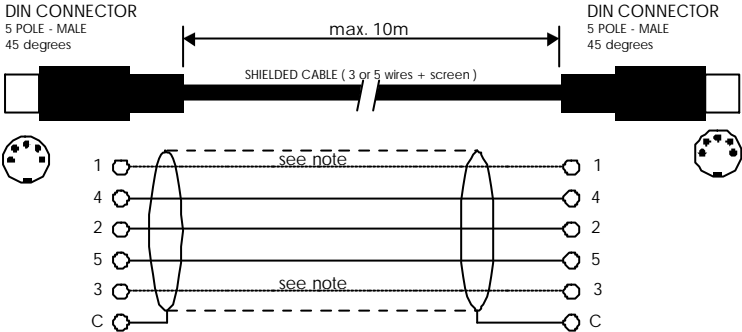
Sampling Rate	48.0 KHz, 44.1 KHz, 32.0 KHz
Environment	Operating 0° to 50°, storage -20° to 60°
Power Requirements	100 - 240 Vac, 50-60 Hz, 20 to 50 watts, autoselect
Dimensions:	3 1/2 x 19 x 12 inches
Finish:	Black anodized aluminum face plate. Electroplated cadmium coating steel chassis
Net Weight:	19 lbs. (8.6kg)



Note: All specifications are subject to change without notice

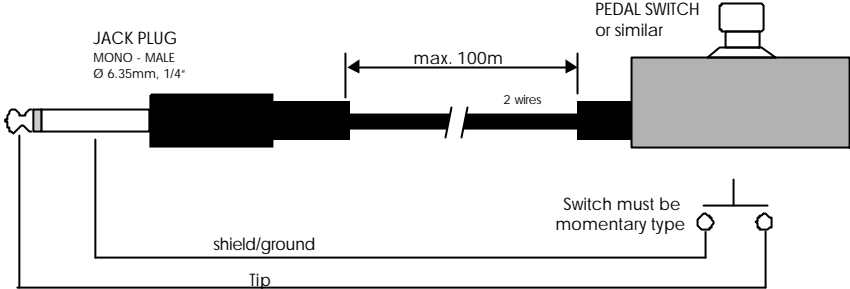
Cable specifications:

MIDI CABLE



Note: Pin 1 and 3 at the Finalizer are reserved for optional RS485 interface
Therefore, use only 3-wires if the Finalizer is connected to other equipment that use these pins

PEDAL CABLE



Appendix list:

Service Note no. 712 10 05 01, New Heat Sink	1
Service Note no. 712 10 05 02, Temp. Stability on SUM-PCB	1
Service Note no. 712 10 05 04, How to Check Battery Voltage	1
Service Note no. 712 10 05 06, Modification for ADA-PCB	1
Service Note no. 712 10 05 07, Improve Mains Stability on ADA-PCB	1
Service Note no. 712 10 05 09, Modification to avoid E03	1
Service Note no. 712 10 05 10, Modification to avoid E04	2
Service Note no. 712 10 05 11, Cleaning of Power Supply Connector	1
Service Note no. 712 10 05 12, Software Changes for ver. 2.00	2
Service Note no. 712 10 05 13, Replace Capacitor in Reset Circuit	1
Service Note no. 712 10 05 14, Replacing the Power Supply	1
Service Note no. 712 10 05 15, Removing Power Supply Connector	1
Service Note no. 712 10 05 16, Copy Disk to PCMCIA and Vice Versa	1
Service Note no. 712 10 05 17, Sample/trig times with ADA-1	4
Appendix H, Disc Drive Mounting Kit	3
Appendix I, Power Supply Upgrade	2
Appendix J, High Memory Installation	2
Appendix K, Bios Exchange	2
Appendix L, Flash Exchange	2
Appendix M, Bios and Flash minimum Requirements	1
Fast trig Option installation	3
Copy of "Certificate of Conformity"	1

Schematics for CPU board ver. M5000-6	
Part list for CPU board ver. M5000-6	
PCB layout for CPU board ver. M5000-6	1
Schematics for CPU board ver. M5000-5	
Part list for CPU board ver. M5000-5	
PCB layout for CPU board ver. M5000-5	1
Schematics for CPU board ver. M5000-3	
Part list for CPU board ver. M5000-3	
PCB layout for CPU board ver. M5000-3	1
Schematics for BUS board ver. M5004-5	
Part list for BUS board ver. M5004-5	
PCB layout for BUS board ver. M5004-5	1
Schematics for BUS board ver. M5004-3	
Part list for BUS board ver. M5004-3	
PCB layout for BUS board ver. M5004-3	1
Schematics for FRONT board ver. M5003-7	
Part list for FRONT board ver. M5003-7	
PCB layout for FRONT board ver. M5003-7	1
Schematics for FRONT board ver. M5003-6	
Part list for FRONT board ver. M5003-6	
Schematics for FRONT board ver. M5003-4	
Part list for FRONT board ver. M5003-4	
Schematics for POWER SUPPLY board ver. M5005-3	1
Part list for POWER SUPPLY board ver. M5005-3	

PCB layout for POWER SUPPLY board ver. M5005-3	1
Mechanical parts in M5000 TYPE M5000F10, Black chassis	2

Mechanical parts in M5000 TYPE M5000F20, Gold chassis	2
---	---