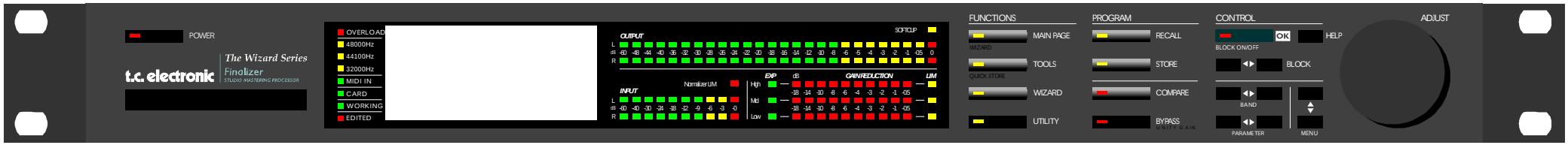
FINALIZER

Service Manual

2nd Edition



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2nd Edition

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Introduction

The purpose of this manual is to support skilled technicians in repairing the Finalizer

The manual begins with a Quick Trouble Shooting 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 section, channel or even component.

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

The Block diagram for the signal flow in the Finalizer shows the order of all the effects.

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

A more detailed description can be found in the section Startup Sequence. In a table the Startup Sequence is described step by step and certain test points are referred to.

The Startup Sequence 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 Flow Charts, Schematics, Part lists, and PCB Layouts.

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, 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 (fold-out page).

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 clock 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 Finalizer cannot do real sample conversion!
Cannot turn power off with power switch at front	The switch must be pressed for at least 1 second to turn off power. The delay provide unintended power off.
Blank display. Cannot run application software.	Enter the SOFTWARE BOOT menu, by keeping HELP button pressed at power on. Dial option to INFO and press OK to check the application software. If corrupted; load the application software again.
Picture on display "frozen"	Normally caused by electric shock. Turn power off and on. Automatic re-initialization of the display is implemented in software ver. 1.08 or higher, meaning that frozen condition only takes place for about 5 seconds.
Lines or spots in display Backlight is blinking	Make sure no external equipment is influencing the display, i.e. magnetic fields, hot fields. If the picture is still distorted, replace the display. If the backlight is bad or blinking; check the soldering on the display itself, especially the two connections going to the upper part of the display.
Message: "Preset Error"	Appears normally at first power up after RAM memory was corrupted. All Presets are set to factory default!
Message: "RAM corrupted"	Check BATTERY with Built-in Test program. See "Built-in Test program".
Message: "DSP Error"	Check SYSTEM with Built-in Test program. See "Built-in Test program".
Bad LED's, keys or ADJUST wheel.	See section "Built-in Test program".
Analog in/out fails	Try with other cables or read section "Built-in Test program". Notice: When analog in/out is connected to unbalanced equipment, XLR pin 3 must be connected to pin 1.
Digital or Midi in/out fails	Try with other cables or read section "Built-in Test program".

Built-in Test Program:

The Finalizer has a Built-in Test Program. To run the program; Press the BYPASS button while powering on. Use the cursor to select RUN TEST PROGRAM. Press OK and follow the instructions on the display. To leave the Built-in Test Program; turn off the power.

Finalizer Built-in-Test Program has following tests:

TEST	Function
Keys	Tests the keys at the front panel one by one. If a key hasn't been pushed a warning message will appear when leaving the test
ADJUST wheel	Tests the steps of the encoder. Each step is counted at the display, if not; check soldering at encoder and front connector.
LED's	Tests the LED's at the front panel one by one. If no light; check soldering at the LED and at flat cables between the front boards.
Display	Tests all dots in the display. If any missing; replace the display. 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.
Analog I/O	A sine wave is generated on both analog outputs. When connected to one of the analog inputs the display reads OK if the level is correct. In this way a problem might be narrowed down to a specific input or output.
Digital I/O	A digital signal is generated on both digital outputs. When connected to one of the digital inputs the display reads OK if the level is correct. In this way a problem might be narrowed down to a specific input or output.
Midi I/O	A midi signal is generated on output. When connected to the input the display reads OK if the signal is correct. The midi signal from input is sent on to MIDI THRU. If not OK; try with another midi cable or check soldering and components in the midi circuit.
Pedal socket	Tests the status on the PEDAL IN. When no jack plug is inserted the tip of the jack socket is connected to ground, this is the reason for showing OK without jack plug.
PCMCIA	Tests whether programming, reading or deleting are OK. NOTE: All data on PCMCIA card will be destroyed.
Battery	Tests the DC voltage at the Back up battery. If low; check battery voltage with a multimeter and check also the standby current by measuring the voltage across R135; max. 20mV (numerical value). If the voltage is higher; replace IC30. When replacing battery, please refer to section "exchange of battery"
System.	Tests the MPU, DSP, ASIC, DUAL PORT and SOUND RAM to some extent. If not OK; see section "startup sequence".

Disassembly Procedure for Main Board

1. **Turn Off Power and Disconnect Power Cord.**
2. Loosen 5 screws, see fig. 1, and remove the top cover.
3. Disconnect front connection, J2, see fig. 2.
4. Remove screws at MT7, MT8, MT2 on the main board, see fig. 2.
5. Remove screws at the XLR connectors on the back panel, see fig. 3.
6. Remove screw at SPDIF in/out connector, see fig. 3.
7. Remove jack nut at PEDAL IN, see fig. 3.
8. Push the main board into the front profile a little to free the connectors from the back panel, then lift out the board.
9. Desolder the seven wires from power supply.

Fig. 1: Screws at top lid

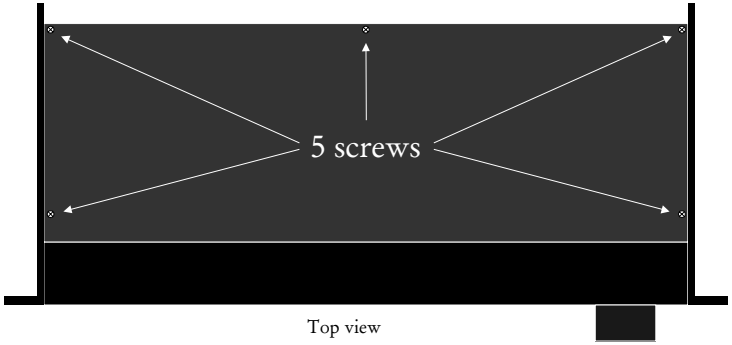


Fig. 2: Screws and front connector at main board

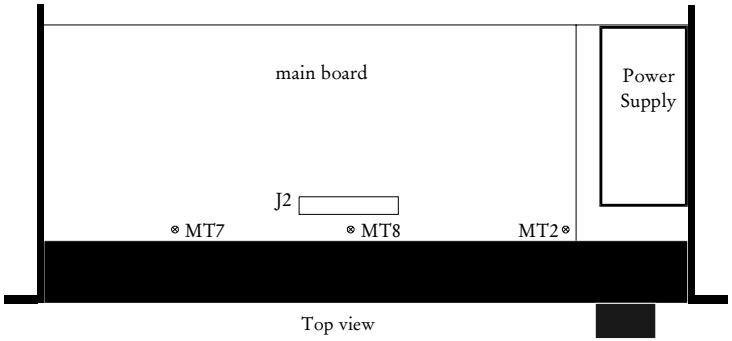
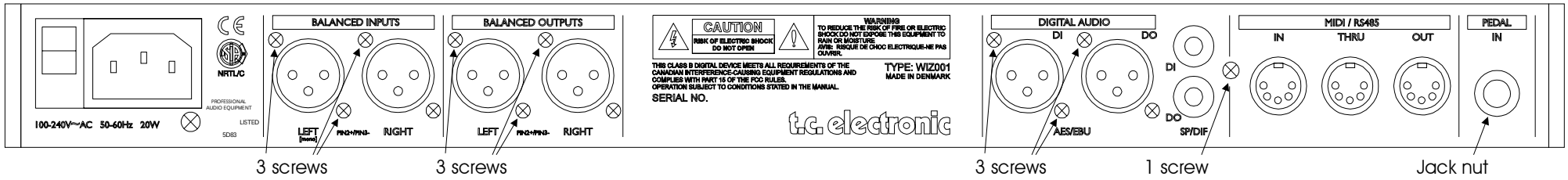


Fig. 3: Screws at back panel.



Disassembly Procedure for Front Section:

1. **Turn Off Power and Disconnect Power Cord.**
2. Loosen 5 screws, see fig. 1, and remove the top cover.
3. Disconnect front connector J2, see fig. 2.
4. Remove side panels by unscrewing 4 screws at each side, see fig. 4.

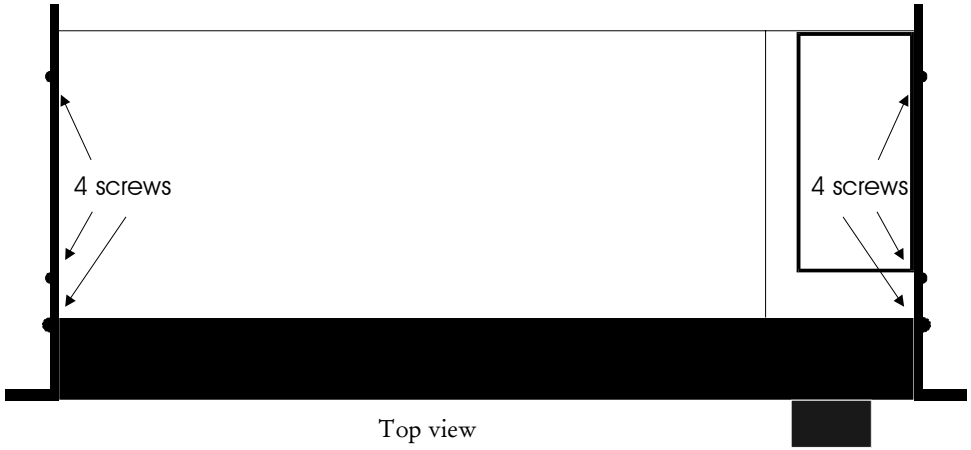


Fig. 4: Screws at side panels.

5. Remove the front section.
6. Pull off the ADJUST knob by hand or work it loose with a small screw driver. Place the screw driver in the gap between big nut and encoder, see fig. 5.
7. Place the front profile horizontally with the buttons facing down. Place the profile on some stand-off to avoid any pressure on the push buttons.
8. At the end with ADJUST , pull out the two white front board guides. Opening up the profile a little will lighten the pressure at the guides, see fig. 5.

Note: All push buttons are loose in the profile after removing the guides.

9. Use the ribbon cable to lift up the front board assembly a little and then slide it out gently at the end with ADJUST encoder. The shaft of the encoder can just exactly come out in this way.

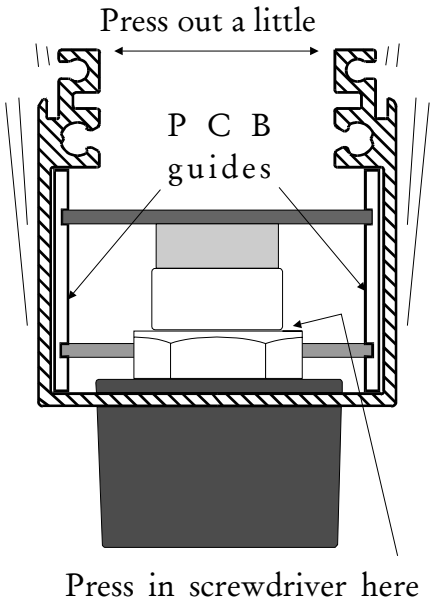


Fig. 5: Front profile shown from ADJUST end.

Exchange of Power Supply Module

1. **Turn Off Power and Disconnect Power Cord.**
2. Loosen 5 screws, see fig. 1, and remove the top cover.
3. Disconnect the front connector J2, see fig. 2.
4. Loosen the front section by removing two small screws at each side panel, see fig. 6.

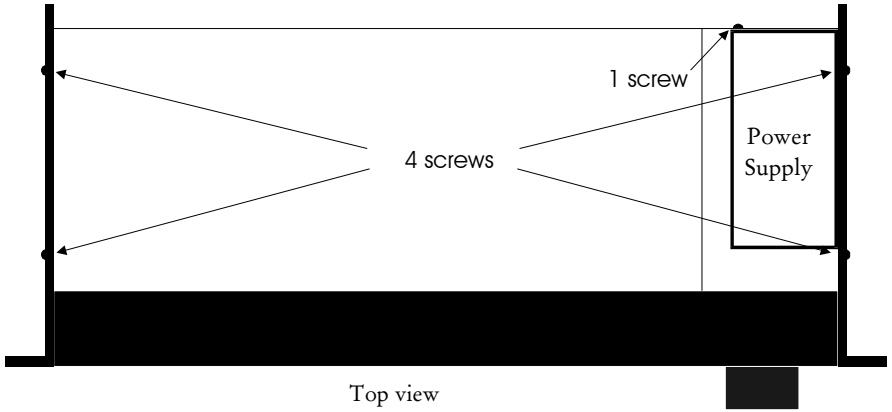


Fig. 6: Screws at side panels.

5 Press out the side panels a little and push gently out the front section.

6 Desolder all seven power supply wires from the main board.

7. Remove the power supply by removing one screw at the back panel, just below the mains plug, see fig. 6.
8. Mount the new power supply with the screw at the back panel.
9. Solder the seven wires to the main board. Make sure they are correctly placed.

   TAKE CARE: The wire ends must not touch the bottom panel!
10. Remount the front section with two screws in each side panel.

    Make sure the edge of the bottom panel is pressed into the front profile.
11. Connect the front connector J2.

12 Mount the top lid with five screws.

13. Connect power cord and turn on power.

If the unit has a malfunction; turn off power and check the following:

Is the front connector mounted correctly?

Are the power supply wires correctly placed?

Do the wire ends short circuit to the bottom panel?

Exchange of 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.

VARNING:

Felaktigt batteribyte kan medfora fara for explosion. Anvand darfor endast samma typ eller likvardig typ enligt apparattillverkarens rekommendation.

Kassera forbrukade 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

Exchange procedure

1. **Turn Off Power and Disconnect Power Cord.**
2. Loosen 5 screws, see fig. 1, and remove the top cover.
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.

Block Diagram:

The block diagram in figure 7 gives a quick view of the signal flow in the Finalizer.
As the block diagram shows the input and output sections will always be active, even in Bypass mode.
The AES/EBU and the SPDIF inputs are connected internally. Therefore, do not connect cables to both AES/EBU and the SPDIF inputs at the same time.
Signals are present on all outputs, all of the time. To make dithering circuit work, the system must know whether the analog or AES/EBU or SPDIF output is main output.

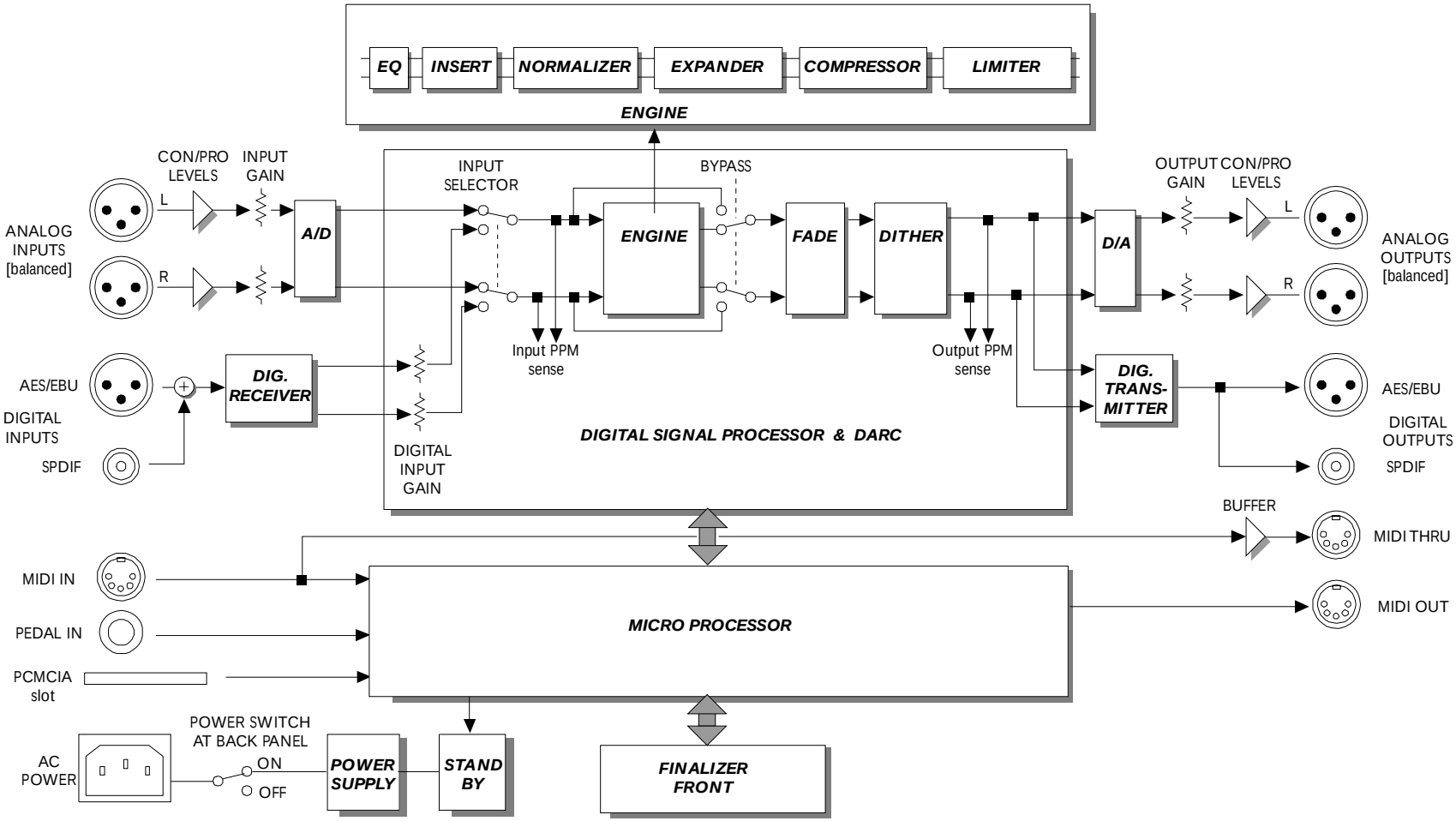


Fig. 7: Block diagram for the Finalizer

Circuit Description:

The Finalizer consist of a front, a digital, an analog and a power supply section. Here is a brief description of the sections:

Front section consist of three boards and a display, all placed in the front profile. The big board has two matrix circuits; one for LED's and one for keys. The EEPROM with serial no. information for the unit is also located here.

The small boards are for LED's and key switches.

Digital section is placed mainly in the middle and in the left side of the main board.

This section contains the Reset, MPU, SRAM, DSP, Dual Port RAM, DARC, Sound RAM, Digital I/O, PLL, FLASH and Interfaces.

Reset controls the MPU, Digital receiver chip and the DA.

The Software for MPU is placed in FLASH. The MPU controls DSP, SRAM, Jeida, Front, MIDI, Pedal in and analog gain settings.

The major task for DSP is to "calculate" sound. It also generates the 80MHz clock for the DARC chip.

The DARC chip controls sound data to and from; DSP, Sound RAM, digital in/outputs and AD/DA converters.

The PLL circuit makes a very stable frequency at 256 x sample rate , this frequency is divided down to 64 x sample rate and to 1 x sample rate by the DARC. The PLL has its own power regulation.

Interface for MIDI and Pedal In consist almost of discrete components.

Interface for Jeida is simplified by using a PAL.

The interface for the front has an integrator, which converts a 3.3kHz square wave to a negative DC voltage for the display contrast. By changing the duty cycle of the square wave the DC voltage and thereby contrast will also change. An attenuator allows the MPU to measure the contrast voltage.

Analog section is placed mainly on the right side of the main board.

The analog input is balanced, thus pin 3 should be connected to pin 1 when used with unbalanced equipment.

Input levels are controlled by digital potentiometers. These potentiometers are contained in a single chip, which controls the two analog input levels and the two analog output levels.

The A/D converter is a 20bit converter and it is split into two chips. It has some external filter capacitors, which are very sensitive. The A/D and D/A converter have also their own power regulation.

The D/A converter is also 20bit. Be aware that the left & right signal output at the converter contain an applied DC voltage.

After the D/A comes a 2nd. order filter, then the output level and then a 1st. order filter.

An electronic balanced circuit perform the output stage. Again XLR pin 3 should be connected to pin 1 when used with unbalanced equipment.

Power supply section consist of a separate Module and some regulation circuits on the main board.

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

One regulation circuit has electronic switch for the +/-15V. The electronic switch for the +5V is in the Power Supply Module. The switches are controlled by the Stand By circuit. The Stand By circuit has it's own separate power wire from the Power Supply Module.

Power On Sequence:

The table below shows the Power On Sequence for main board version PC12001-3, when the Finalizer is switched on by using the power switch at the back panel. Equal sequence numbers mean that the events are independent of each other. Column Trouble Shooting has hints about what to check if the event fails.
The Power On Sequence is also made as flow chart, see appendix.

No	Event	Trouble shooting
1a	SB_VCC (POWER_SB, Violet wire) goes to approx. 5VDC and supplies IC44.	Power cord, DZ1, IC44 or power supply.
1b	+15V (POWER_+15V, Orange wire) goes to approx. +15VDC.	power supply, load (normal current load is approx. 70mA)
1c	-15V (POWER_-15V, Yellow wire) goes negative to approx. -15VDC.	power supply, load (normal current load is approx. 70mA)
2	TP5 goes to +4.7VDC. C149 is discharged and keeps IC44 pin 13 low and subsequently IC44 pin 8 goes high.	IC44, DZ1
3a	+5VSB, (+5V_STANDBY*, Brown wire) goes to approx. +3.2VDC	R213
3b	Q10 and Q11 turns on IC47	Q10, Q11, IC47
4a	+5V (POWER +5V, Red wire) goes high.	power supply, load (normal current load is approx. 0.6A)
4b	TP1, +15V starts up.	IC47
4c	TP2, -15V starts up.	IC47
5a	Display backlight turns on	Ribbon cable at Front connector J2, two solderings at display for back light.
5b	TP12, power for PLL goes high.	IC24, IC27
5c	TP9, CPU clock starts up, 14.112MHz	IC26 + soldering
5d	TP13, 256FS starts up	IC28, IC26 + soldering, If CPU clock is missing the frequency is undefined.
5e	TP3, +5VAD starts up.	IC11, Q8
5f	TP4, -5VAD starts up.	IC11, Q9
6a	TP10, DSP clock starts up, 44.100KHz	IC25 + soldering
6b	TP14, ADA_64FS starts up	IC25 + soldering
6c	TP15, ADA_1FS starts up	IC25 + soldering
6d	LD4 and LD5 flashes and stays on. Often the intensity of LD5 is a little higher than the intensity of LD4.	The intensity depends on the in/output level settings. Oscillation in analog section gives constant high intensity. If so, check C172, C173, C174, C175,

Power On Sequence, continued:

No	Event	Trouble shooting
7a	TP16, DA_DATA starts up	IC23
7b	TP17, AD_DATA starts up	IC18
7c	TP26 goes to -3V	LD5, IC12 + soldering
7d	TP27 goes to +3V	LD4, IC12 + soldering
8	TP6, Reset signal goes high.	Battery connections, IC30
9	MPU, IC29 checks Checksum in Flash	If OK LD1, LD2, LD3 blink once. If not OK, the LED's stays on. Reload Boot Sector or replace the Flash, IC35 .
10	MPU checks if TAP button is pressed	If pressed; Boot menu appears. Check D11 if no picture.
11	MPU tests SRAM	If not OK; message appears: "RAM is corrupted, Settings cleared" . Check IC34, IC30 or battery.
12	MPU checks header in application software.	If not OK; Boot menu appears. Reload application software
13	MPU checks if any BYPASS button is pressed	If pressed; Reset menu appears.
14	MPU tests Preset information in SRAM	If not OK; message appears: "Preset Error". Check IC34, IC30 or battery.
15	MPU, IC29 pin 107 goes high, (DSP RESET*)	IC29 + soldering, see sequence picture in schematics for main board
16a	MPU tests DSP	If not OK; message appears: "DSP not OK"
16b	TP11, ASIC clock starts up, 80MHz	IC10 + soldering
17	Picture with user information and software version appears on the display.	Front connection, display,
18	RECALL picture appears on the display.	Application software,

Test Point Values:

Test point values for Main board version PC12001-3.

TP	Value	Pos.	Page	Name	Conditions/comments
1	+14.8VDC +/- 0.3 V	L4	1	+15V	
2	-14.8VDC +/- 0.3 V	K4	1	-15V	
3	+4.8VDC +/- 0.1 V	M4	6	+4,5V	The same as TP4 (+/- 50mV), except positive.
4	-4.8VDC +/- 0.1 V	M4	6	-4,5V	The same as TP3 (+/- 50mV), except negative.
5	Standby: 0VDC Power on: 4.7VDC +/- 0.1VDC	K4	14		Standby circuit status.
6	low = reset, high = running	C4	9	RESET*	Stays low if battery is missing.
7	> +3.0VDC.	D4	9	Battery voltage.	
8	-6 to -9.5VDC. Typ.: -8VDC.	L5	13	Contrast voltage.	Controlled by parameter VIEWING ANGLE
9	14.112MHz.	H4	4	X-tal.	
10	44100Hz.	H4	4	44100Hz.	Output from DARC. 14.112MHz divide by 320.
11	80MHz.	G3	4	80MHz.	Come from DSP. Be aware of probe load!
12	+5 VDC +/-0.3V	I4	4		PLL power supply.
13	11,2896MHz, sample rate = 44.1KHz 12,288MHz, sample rate = 48KHz	J3	6	256FS.	
14	2,8224MHz, sample rate = 44.1KHz 3.072MHz, sample rate = 48KHz	J3	6	64FS.	
15	44100Hz or 48000Hz.	J3	6	1FS	
16	Data signal	J3	6	DA-data.	
17	Data signal	K3	6	AD-data.	
18	10Vpp, 0VDC	N2	7	Left input amp.	Running Built-in Test program, Option: analog
19	10Vpp, 0VDC	N2	7	Right input amp.	Running Built-in Test program, Option: analog

Test Point Values, continued..:

TP	Value	Pos.	Page	Name	Conditions/comments
20	1,9Vpp, 0VDC	M3	7	Left input gain.	Running Built-in Test program, Option: analog
21	1,9Vpp, 0VDC	N2	7	Right input gain.	Running Built-in Test program, Option: analog
22	+2,4VDC and 2.7Vpp	M4	8	Left DA-output.	Running Built-in Test program, Option: analog
23	+2,4VDC and 2.7Vpp	M4	8	Right DA-output.	Running Built-in Test program, Option: analog
24	10Vpp, max. 10mVDC	L3	8	Left output amp	Running Built-in Test program, Option: analog
25	10Vpp, max. 10mVDC	L3	8	Right output amp	Running Built-in Test program, Option: analog
26	-3.1VDC	M3	6	GAIN-GND	
27	+3.1VDC	M3	6		
L out	10Vpp, balanced, max. 10mVDC, THD+N: <0.01%	L1	6	Left output connector	Running Built-in Test program, Option: analog
R out	10Vpp, balanced, max. 10mVDC THD+N: <0.01%	K1	6	Right output connector	Running Built-in Test program, Option: analog

LED Error Codes:

In case of error three LED's at the main board version PC12001-3 (LD1, LD2, LD3) might show an error code.

LD1	LD2	LD3	Code explanation	Comment
off	off	off	The MPU is running OK	All LED's must blink once at power up
on	on	on	The program encountered an error while checking its own code	Boot sector in Flash is corrupted. Reload boot or replace Flash

Jumper settings:

Jumper settings on main board version PC12001-3: JP2 unused. JP4 & JP5 controls boot mode:

JP4

JP5

Boot from Flash (normal mode)

JP4

JP5

Boot from PCMCIA (only used at factory)

Software Changes:

Listed below are changes in the application software for the Finalizer.

Filename for application software is FINvxxx.wiz (xxx represents the version no.)

Changes from version 1.05 to 1.08:

Updating from 1.05 to 1.08 will not affect the presets.

1. exp range controllable by midi (now using #defines for number of exp params)
2. threadSleep(2) inserted after midi exc dump head
3. handling “MAX 20 BITS”, “MAX 24 BITS” and “NONE - PROF” (“16BIT” etc. changed to “16 BITS)”
4. no limit on rom/ram bank in output in dumpExclPreset() explicit return in midiEndBulkSend() limit of midi values with 0x7f in dumpExclPars()
5. automatic re-initialization of the display implemented
6. accelerator on security PIN code
7. new compiler has reduced hi-shelve filter problem around 20kHz (no more oscillation)
8. finv106 was with dspprobe, now Compare is back.
9. Analog gain before AD -2dB to compensate for AD error. Now analog gain thru the unit should be close to 0dB.
10. Midi control (CTRL and SysEx) of MID and HI parameters in EXP, COM and LIM block was not updated when changed from MIDI.

Technical Specifications:

Analog Input

Connectors:	XLR balanced (pin 2 hot)
Impedance:	15 kOhm
Max. Input Level:	+22 dBu
Sensitivity:	@ 12 dB headroom: -22 dBu - 10 dBu
A to D Conversion:	20 bit (4 bit, 64 times oversampling)
Dynamic Range:	> 105 dB
THD:	< 0.003% @ 1 kHz, +10dB
Frequency Response:	10 Hz - 20 kHz: +0, - 0.2 dB
Crosstalk:	< -60 dB max, 10 Hz - 20 khz

Analog Output

Connectors:	XLR balanced (pin 2 hot)
Impedance:	100 Ohm (active transformer)
Max Output Level:	+22 dBu
Output Gain Range:	0 to -32 dB
D to A Conversion:	20 bit (4 bit 64 times oversampling)
Dynamic Range:	> 96 dB
THD:	< 0.008% @ 1 kHz, +10 dB
Frequency Response:	10 Hz - 20 kHz: +0, - 0.2 dB
Crosstalk:	< -60 dB max, 10 Hz - 20 kHz

Digital Inputs and Outputs

AES/EBU In/Out:	XLR
S/PDIF In/Out:	Coaxial, RCA Type
Formats:	EIAJ CP-340, IEC 958, S/PDIF (20 bit) AES/EBU (24 bit)
Sample Rates:	32 kHz, 44.1 kHz, 48 kHz

PC-CARD Interface

Connector:	PC-CARD Type 1 cards
Standards:	PC-CARD 2.0, JEIDA 4.0
Card Format:	Supports up to 2 MB SRAM

Control Interface

MIDI:	In/Out/Thru: 5 Pin DIN
Pedal:	1/4 inch phone jack

General

Finish:	Black anodized aluminum face plate Painted and plated steel chassis
Dimensions:	19” x 1.75” x 8.2”
Weight:	5.2 lbs (2.35 kgs)
AC Power:	90 - 240 VAC without switch settings 3 Pin IEC power connector
Battery Life:	>10 years

Radio Frequency Immunity/Interference

RFI/ESD:	Conforms to FCC Class B, EN55103-1 (CE), EN55103-2 (CE)

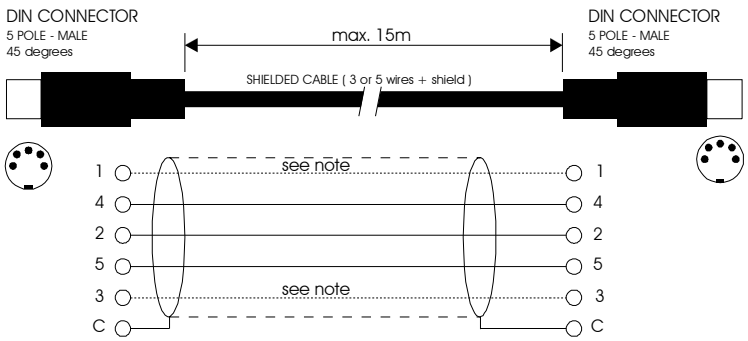
Environment

Operating Temperature:	32 °F to 122 °F (0 °C to 50 °C)
Storage Temperature:	-22 °F 167 °F (-30 °C to 70 °C)
Humidity:	Max. 95% non-condensing

Note: All specifications are subject to change without notice

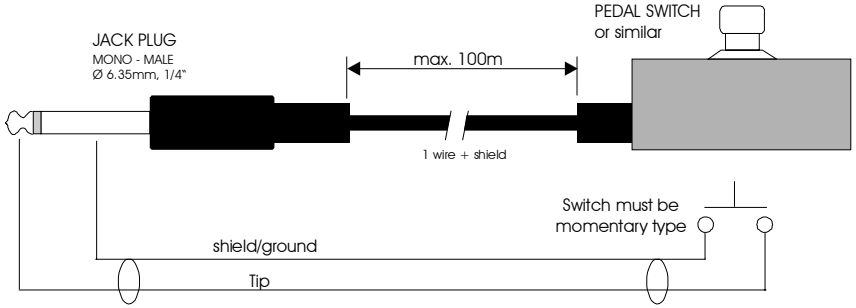
Cable Specifications:

MIDI CABLE

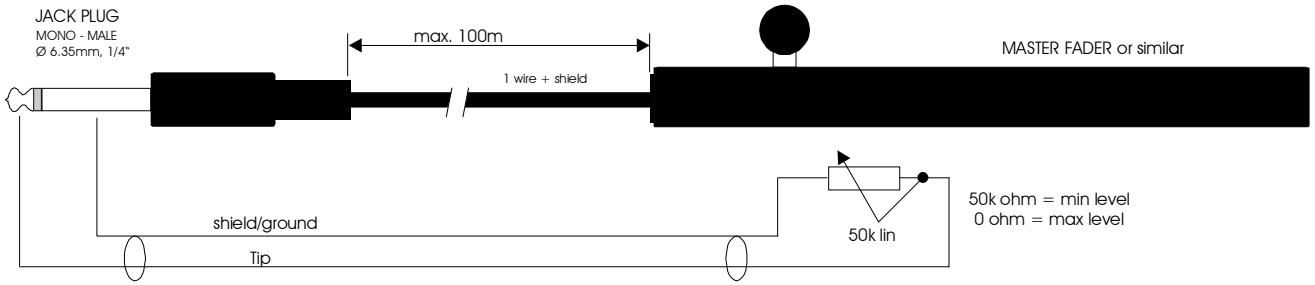


Note: Pin 1 and 3 at the Finalizer are reserved for optional RS485 interface
Therefore, use only 3-wires if the Finalizer is connected to other equipment that use these pins

PEDAL CABLE



FADER CABLE



Appendix list: Flow chart, Schematics, Part lists, PCB Lay-out

The list below show the contents and the order of appendix.

Flow chart for Power On Sequence	2 pages
Schematic for Main board ver. PC12001-3	14 pages
Part list for Main board ver. PC12001-3	13 pages
PCB lay-out for Main board ver. PC12001-3	1 page
Schematic for Front boards ver. PC12502-2	3 pages
Part list for Front boards ver. PC12502-2	6 pages
Schematic for Front boards ver. PC12502-3	3 pages
Part list for Front boards ver. PC12502-3	6 pages
PCB lay-out for Front boards ver. PC12502-2 & PC12502-3	1 page
Part list for mechanical parts in Finalizer	2 pages