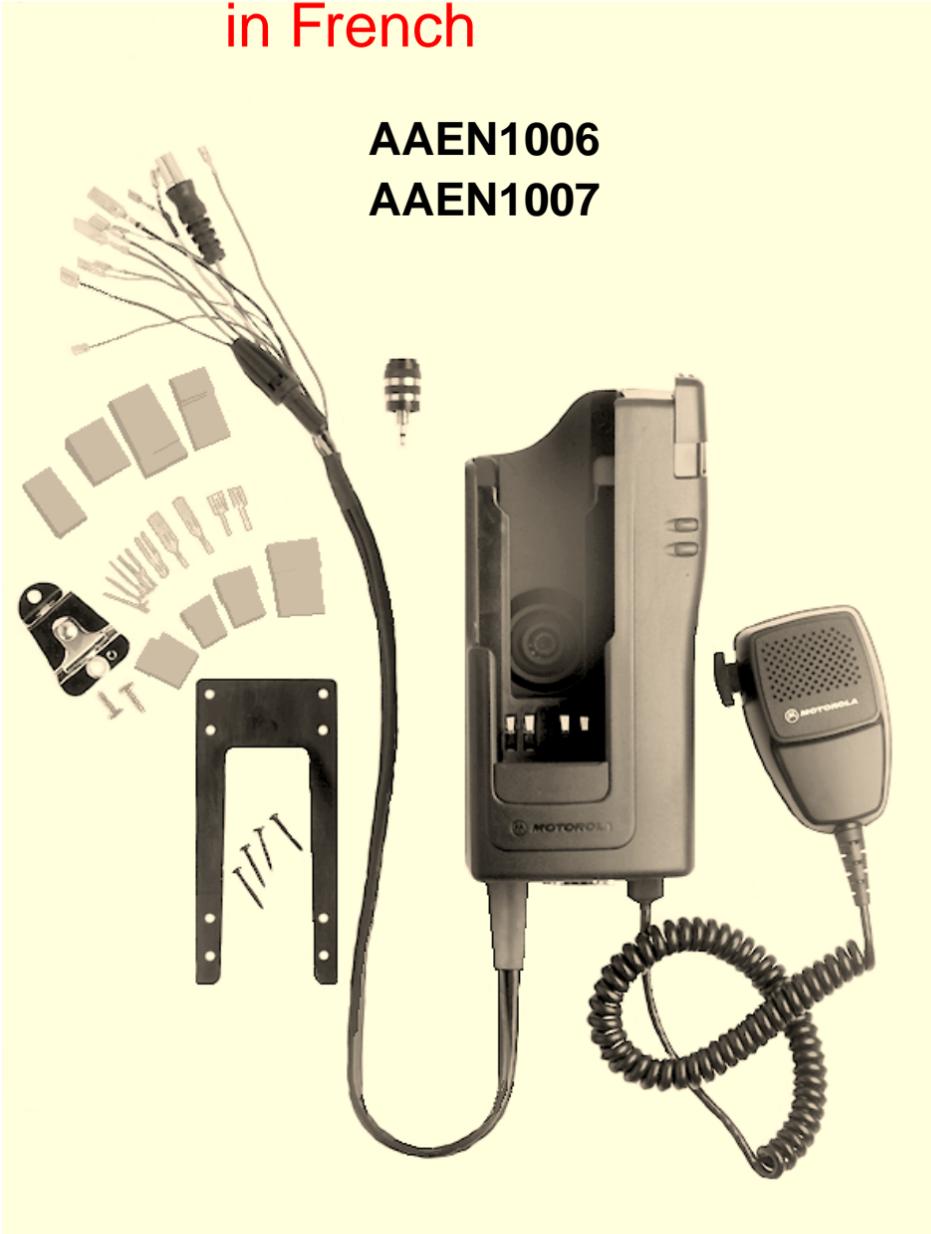




Vehicle Adapter
in Spanish
in Portuguese
in French



Professional Radio



Table of Contents

Important Safety Instructions	v
Safe and Efficient Operation of Motorola Two-way Radios	v

Chapter 1 **INSTALLATION**

1.0 Introduction	1-1
2.0 Installation Planning	1-1
3.0 Microphone Mounting	1-2
4.0 Antenna Installation	1-2
5.0 Vehicle Adapter Installation	1-3
5.1 VA Installation	1-3
5.2 VA Cabling	1-4
5.3 Battery Connections	1-5
5.4 DC Power Cable Installation	1-5
6.0 Optional Speaker Installation	1-7
7.0 Cables and Connectors	1-9
7.1 Flying Cable End Connections	1-9
7.2 Microphone Connector	1-10
7.3 Computer / Service Connector	1-10
8.0 Specifications	1-11

Chapter 2 **SOFTWARE CONFIGURATION TOOL**

1.0 Introduction	2-1
2.0 Installing the Configuration Tool	2-1
2.1 Installing Using Windows 3.1	2-1
2.2 Installing Using Windows 95/98/NT	2-2
2.3 Program Set-up	2-2
3.0 Vehicle Adapter Screen	2-3
3.1 File Menu	2-3
3.2 Options Menu	2-3
3.3 Help Menu and Info	2-4
4.0 Configuring the Vehicle Adapter	2-4
5.0 Using the Settings Screen	2-4
5.1 Settings Screen Functions	2-5
6.0 Using the Service Screen	2-7
6.1 Service Screen Functions	2-7
6.2 Battery Information	2-7
6.3 Charger simulation / "CHARGE" LED Test	2-8
6.4 "RADIO MODE" LED Test	2-9
6.5 PTT, On and Off Buttons	2-9

Chapter 3 MAINTENANCE

1.0	Scope of This Chapter.....	3-1
2.0	Warranty, Service, and Technical Support.....	3-1
3.0	Preventive Maintenance.....	3-2
3.1	Inspection.....	3-2
3.2	Cleaning Procedures.....	3-2
3.3	Diagnostics.....	3-2
4.0	Theory of Operation.....	3-3
4.1	Introduction.....	3-3
4.2	Circuit Functional Elements.....	3-3
4.3	Power Supply Circuit.....	3-3
4.4	Battery Charger Circuit.....	3-5
4.5	Microprocessor Circuit.....	3-6
4.6	Speaker Amplifier.....	3-6
4.7	Accessory Interface.....	3-7
4.8	RS232 Interface.....	3-8
4.9	Computer Programming / Service Connector.....	3-10
4.10	Accessory Interface connection.....	3-10
4.11	Antenna Connections.....	3-12
4.12	Spare Connectors.....	3-12
4.13	Spare Battery Spacers.....	3-12
5.0	Test Equipment.....	3-13
6.0	Programming Cable ENKN4002.....	3-14
6.1	General Information.....	3-14
7.0	Service Cable ENKN4003.....	3-15
7.1	General Information.....	3-15
8.0	RLN4460 Mobile / Portable Test Set.....	3-16
8.1	Items having No Function with the VA.....	3-16
8.2	Items having a Different Function with the VA.....	3-16
8.3	Items having Similar Function with the VA.....	3-16
9.0	Programming.....	3-17
9.1	Configuration of Vehicle Adapter.....	3-17
9.2	Programming / Flashing the Portable Radio.....	3-17
10.0	Schematic Diagrams and Board Overlays.....	3-18
10.1	Safe Handling of CMOS and LDMOS Devices.....	3-18
1.2	RF Adapter PCB.....	3-19
1.3	Battery Contact PCB.....	3-20
1.4	Side Connector PCB.....	3-21
1.5	Sub Board PCB.....	3-22
1.6	Main Board PCB.....	3-26
1.7	RS232 Interface PCB.....	3-33

List of Figures

Figure 1-1	Microphone Bracket.....	1-2
Figure 1-2	Vehicle Adapter Ball Bracket Mounting.....	1-3
Figure 1-3	Flying Cable Connections	1-4
Figure 1-4	Vehicle Adapter Connection Diagram	1-5
Figure 1-5	Battery Connections into Engine Compartment.....	1-6
Figure 1-6	Power Cable Assembly	1-7
Figure 1-7	Speaker Installation	1-8
Figure 2-1	Initial Opening Screen.....	2-2
Figure 2-2	Interface Selection Screen.....	2-3
Figure 2-3	Vehicle Adapter Settings Screen.....	2-5
Figure 2-4	Vehicle Adapter Service Screen.....	2-7
Figure 3-1	Vehicle Adapter Simplified Block Schematic Diagram	3-4
Figure 3-2	Power Connector Pin-out Details.....	3-4
Figure 3-3	Battery Charger Terminals	3-6
Figure 3-4	Speaker Connector Pin-out Details	3-7
Figure 3-5	Accessory Connector Pin-out Details	3-8
Figure 3-6	RS232 Interface.....	3-8
Figure 3-7	CRMS Circuits	3-11
Figure 3-8	Option Connector Pin-out Details	3-12
Figure 3-9	Programming Cable ENKN4002	3-14
Figure 3-10	Service Cable ENKN4003	3-15

List of Schematics and Circuit Board Details

RF Adapter - Schematic	3-19
RF Adapter - PCB	3-19
Battery Contact - Schematic.....	3-20
Battery Contact - PCB.....	3-20
Side Connector - Schematic	3-21
Side Connector - PCB	3-21
Sub Board - Top Side	3-22
1.5Sub Board - Bottom Side	3-23
Sub Board - Power Supply Schematic (1).....	3-24
Sub Board - Charger Schematic (1)	3-25
Sub Board - Audio Amplifier Schematic	3-25
Main Board - Top Side.....	3-26
Main Board - Bottom Side	3-27
1.6Main Board - Power Supply Schematic (2)	3-28
Main Board - Charger Schematic (2)	3-29
Main Board - Microphone Preamp Schematic	3-30
Main Board - Microprocessor Schematic.....	3-31
Main Board - RS232 Interface Schematic (1).....	3-32
RS232 Interface PCB - Bottom Side.....	3-33
RS232 Interface PCB - Top Side	3-33
RS232 Interface - Schematic (2)	3-34

List of Tables

Table A	Motorola Authorized Batteries	v
Table 1-1	Power Connections	1-9
Table 1-2	Speaker Connections	1-9
Table 1-3	Accessory Connections	1-9
Table 1-4	Option Connector	1-9
Table 1-6	Computer/Service Connector Pin-outs	1-10
Table 1-5	Microphone Connector Pin-out	1-10
Table 2-1	Programming Cable Mode Selection.....	2-4
Table 2-2	Battery chemistry and capacity	2-8
Table 2-3	Simulated Charge Indicator Color.....	2-8
Table 2-4	Radio Mode LED Colors.....	2-9
Table 3-1	Power connections.....	3-4
Table 3-2	Battery Terminal Functions.....	3-6
Table 3-3	Speaker Connections	3-7
Table 3-4	Accessory Connections	3-8
Table 3-5	Data Port Operating Modes	3-9
Table 3-6	Computer Service Connector Functions.....	3-10
Table 3-7	Option Connector	3-12
Table 3-8	Antenna Connector.....	3-12
Table 3-9	Recommended Test Equipment.....	3-13
Table 3-10	Programming Cable Mode Selection.....	3-14

Important Safety Instructions

This document contains important safety and operating instructions. Please read these instructions carefully and save them for future reference.

Before using the vehicle adapter, read all the instructions and cautionary markings on (1) the vehicle adapter, (2) the Radio, and (3) the battery fitted to the radio.

Safe and Efficient Operation of Motorola Two-way Radios

Please refer to the user guide for your radio for information and national and international standards and guidelines on exposure to radio frequency electromagnetic energy.

MOTOROLA AUTHORIZED BATTERIES

The batteries listed in Table A are approved for use with the Motorola Professional Radios and the vehicle adapter.

Table A Motorola Authorized Batteries

Kit (part) Number	Battery Chemistry/Description
HNN9008	NiMH/High-Capacity
HNN9009	NiMH/Ultra-High-Capacity
HNN9010	NiMH/Ultra-High-Capacity, Factory Mutual
HNN9011	NiCd/High-Capacity, Factory Mutual
HNN9012	NiCd/High-Capacity
HNN9013	Lithium Ion

OPERATIONAL WARNINGS



WARNING

1. To reduce risk of injury, use the vehicle adapter only with radios fitted with the authorized rechargeable Motorola batteries listed in Table A. Other batteries may explode, causing personal injury and damage.
2. Use of accessories not recommended by Motorola may result in risk of fire, electric shock, or injury.
3. To reduce the risk of fire, electric shock, or injury, do not use the adapter if it has been broken or damaged in any way. Take it to a qualified Motorola service representative.
4. Do not place your vehicle adapter and/or portable radio in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a portable radio is placed in the air bag deployment area and the air bag inflates, the radio may be propelled with great force and cause serious injury to occupants of the vehicle.
 - Installation of vehicle communication equipment should be performed by a professional installer technician qualified in the requirements for such installations. An airbag's size, shape, and deployment area can vary by vehicle make, model, and front compartment configuration (for example, bench seats vs. bucket seats).
 - Contact the vehicle manufacturer's corporate headquarters, if necessary, for specific air bag information for the vehicle make, model and front compartment configuration involved in your communication equipment installation.

Important Note: If a vehicle adapter is installed, verify operation of the adapter before leaving the vicinity of the vehicle.

5. Do not install your radio in the vehicle adapter or remove your radio from the adapter in a potentially explosive atmosphere. It is rare, but contact sparking may occur while installing or removing the radio. Sparks in such areas could cause an explosion or fire, resulting in bodily injury or even death.
Note: Areas with potentially explosive atmospheres include fuelling areas, areas where the air contains chemicals or particles such as grain dust or metal powders and any area where you would normally be advised to turn off a vehicle engine. Areas with potentially explosive atmosphere are often, but not always, posted.
6. Do not install your radio in the vehicle adapter or remove your radio from the adapter in a potentially explosive atmosphere. It is rare, but contact sparking may occur while installing or removing the radio. Sparks in such areas could cause an explosion or fire, resulting in bodily injury or even death.
Note: Areas with potentially explosive atmospheres include fuelling areas, areas where the air contains chemicals or particles such as grain dust or metal powders and any area where you would normally be advised to turn off a vehicle engine. Areas with potentially explosive atmosphere are often, but not always, posted.
7. Do not transport or store flammable gas, flammable liquids or explosives in the compartment of your vehicle that contains your vehicle adapter or accessories.
8. To avoid possible interference with blasting operations, turn your radio off before entering an area where you may be close to electrical blasting caps, in a “blasting area” or in areas posted “Turn off two-way radios”. Obey all signs and instructions.

OPERATIONAL CAUTIONS

CAUTION

1. Remove non-standard labels from the radio and battery that are not shipped with the standard product. Non-standard labels may be peeled off by the action of installing the radio in the vehicle adapter and may also interfere with proper vehicle adapter operation or may damage the vehicle adapter.
2. Remove the accessory connector cover (refer to the User Guide for your radio) before fitting the radio in the vehicle adapter. Failure to remove the accessory connector cover may result in permanent damage to the vehicle adapter.
3. Most modern electronic equipment, typically equipment in ambulances and navigation equipment are shielded from RF energy. RF energy from your radio may however interfere with some equipment. Consult your physician, or the manufacturer of any personal medical devices (such as pacemakers, hearing aids etc.) to determine if they are shielded from external RF energy.
4. Turn your radio OFF in any health care facilities when any regulations posted in these areas instruct you to do so. Always request permission before using your radio or vehicle adapter near to medical equipment.

OPERATIONAL SAFETY GUIDELINES

- This equipment is not suitable for outdoor use. Use only in dry locations. Ensure that rain or snow cannot reach the vehicle adapter through an open vehicle window.
- Replacement fuses fitted in the vehicle adapter installation must comply with the type and rating specified in the equipment instructions.
- Maximum ambient temperature around the vehicle adapter must not exceed 60°C (140°F).
- Prevent foreign objects or fluids from falling into the vehicle adapter.

Chapter 1

INSTALLATION

1.0 Introduction

This Chapter describes the complete installation procedure for the vehicle adapter. The Installation procedure includes.

- planning the installation.
- mounting the vehicle adapter.
- testing the installation.

Read these instructions carefully before installing the vehicle adapter.

NOTE The installation must be carried out by an adequately skilled technician.

2.0 Installation Planning

Before starting the installation, plan the location of the vehicle adapter (VA), microphone, and external speaker (optional). Identify the routing path for the coaxial cable from the VA to the antenna and verify that the length of coaxial cable is sufficient.

Consider the following guidelines when planning the installation:

- DO make full use of available bracket mounting holes.
- DO ensure that unit cables are not placed under stress, are not exposed to weather, and are not subjected to damage due to engine heat.
- DO follow proper supply connections (See Figures 1-5 and 1-6).
- DO retain in-line cable fuses when trimming cables to fit. Locate in-line fuses as close as practical to the supply voltage connection.
- DO use heat-shrink tubing on all splices.
- DON'T attach the units to any part of the vehicle that is not rigid or is subject to excessive vibration.
- DON'T install units in areas where rain or snow can easily get into them, such as next to a vehicle window which may be left open.
- DON'T dress cables over sharp edges that could cause wear or tearing of cable insulation.
- DON'T install units in areas where they might interfere with the vehicle operator or the operating controls.
- DON'T install units where they will be difficult for the operator to reach.

Check the mounting penetrations required. On most vehicles, it is necessary to penetrate the firewall to reach the battery. Check the opposite side of the firewall for cable clearance before drilling holes and protect the cable where it passes through the firewall by using grommets or other similar protective measures. Survey the firewall for existing holes already occupied by vehicle wire harnesses. Often there is an opportunity to route other cables using the same path.

Because of the wide variations in vehicle design, these instructions may be modified to suit each particular installation.

3.0 Microphone Mounting

When possible, mount the microphone bracket on the dash near the operator side of the VA. The location should be within easy reach of the operator, and it should be convenient to remove and hang-up the microphone in its mounting bracket without interfering with any of the vehicle controls.

NOTE The microphone bracket should be mounted on a substantial structure. Otherwise, repeated insertion and removal of the microphone could loosen it.

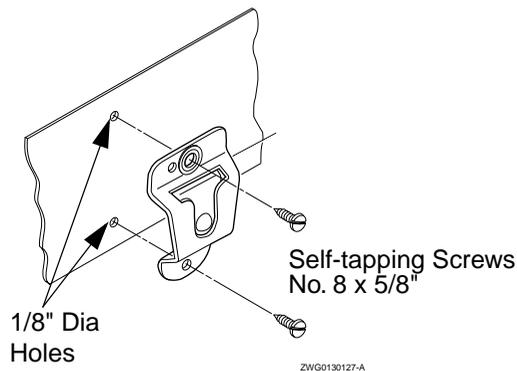


Figure 1-1 Microphone Bracket

Referring to Figure 1-1, use the microphone bracket as a template and drill two 3mm holes. Attach the microphone bracket to the mounting surface with the two self-tapping screws provided. Be sure to leave sufficient room above the bracket for insertion and removal of the microphone.



CAUTION: Do not attach the microphone bracket to the console housing.

4.0 Antenna Installation

Install the antenna and antenna cable as outlined in the installation instructions supplied with the antenna. Information on frequency matching and mounting details are provided with each antenna.

5.0 Vehicle Adapter Installation

The VA is mounted on a ball mounting bracket allowing approximately 15° angular movement. The bracket should ideally be used to mount the VA vertically on the vehicle dash (alternatively it may be mounted off the vehicle floor).

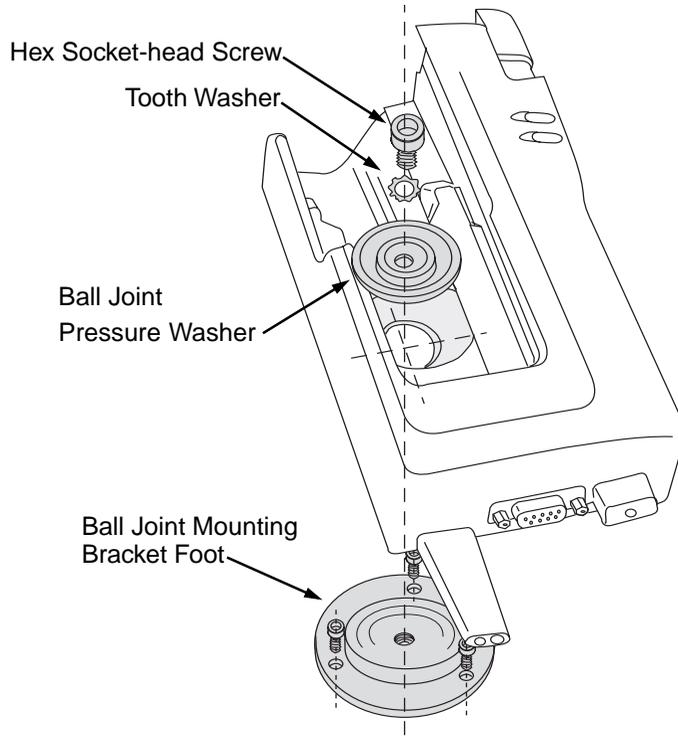


Figure 1-2 Vehicle Adapter Ball Bracket Mounting

With the vehicle adapter on the mounting bracket evaluate the best mounting location. The VA should be mounted to provide:

- 12 inches of clearance above the VA for inserting the radio.
- Easy access to the controls on the radio for the operator.
- A position to allow the microphone coil cable to be used during operation and when on-hook.

5.1 VA Installation

Install the VA by the following procedure or modify the procedure to suit the vehicle type.

1. Remove the hex socket head screw securing the ball bracket to the VA.
2. Using the ball bracket as a template, drill the 3 mounting holes and mount the bracket to the dash using adequate screws.
3. Mount the VA on the ball bracket using the hex socket-head screw previously removed and adjust the angle to the required position.
4. Tighten down the hex socket-head screw to secure the VA.

5.2 VA Cabling

Refer to Figures 1-5 and 1-6, before routing or connecting any VA cabling.



CAUTION: This product is designed for a 12V or 24V DC, negative –ground system.

CAUTION: Remove the fuses from the battery supply and the in-line VA fuse holder before connecting the flying cable.

Determine the best cable route from the VA flying cable to the vehicle battery through the engine compartment firewall.

The best route should include the shortest path to the battery terminals, yet provide the cable with protection from engine heat. Cut off any excess cable.

Be sure to use a grommet or similar protective measure wherever a cable must pass through a hole in a metal panel, such as a firewall.

Route the power cables in a way that protects them from being pinched, chafed, or crushed. Cable fuses (in addition to the 4A fuse fitted at the VA flying cable that protects the VA) must be retained and located as close to the battery as practical to protect against cable or equipment shorts.

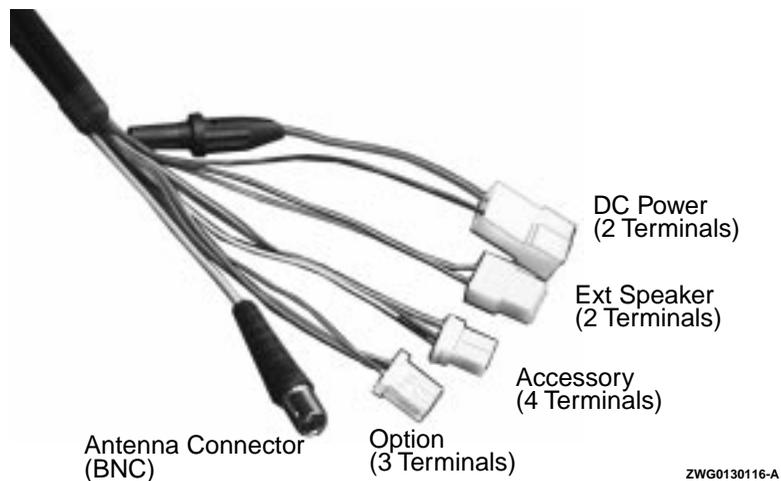


Figure 1-3 Flying Cable Connections

ZWG0130116-A

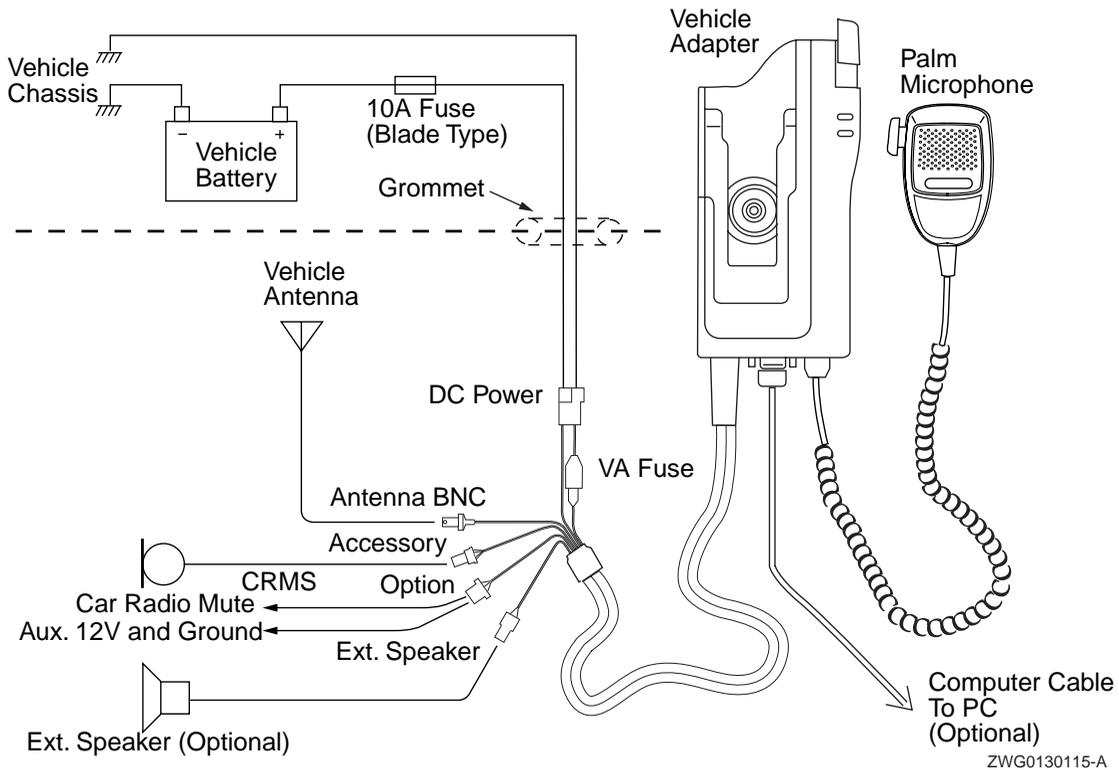


Figure 1-4 Vehicle Adapter Connection Diagram

5.3 Battery Connections

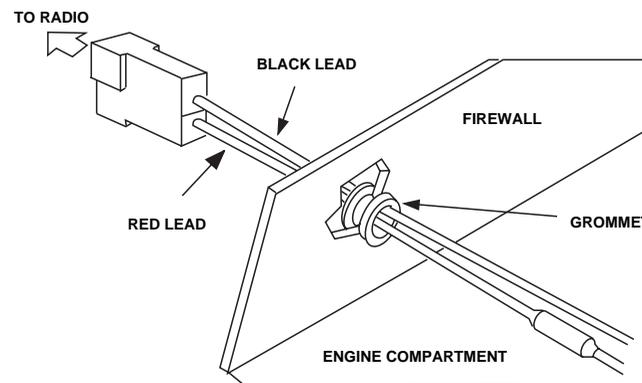
For extending the power connection from the VA flying cable terminals to the vehicle battery use either the DC power cable GKN6270 or produce a similar cable with adequate fuse holder (including 10A fuse). Crimp the 6.25mm female automotive blade contacts (part of delivery) to the red and black DC wires (after the DC connector is removed), push the contacts into the mating plastic housing and connect them to the flying cable.

5.4 DC Power Cable Installation

The VA must be operated only in negative ground electrical systems. Reverse polarity will cause the cable fuse to blow. Check the vehicle ground polarity before you begin installation to prevent wasted time and effort.

The 10-foot DC power cable is long enough for installation in most vehicles. Begin the power cable installation as follows:

1. Determine a routing plan for the power cable with reference to where the VA is to be mounted.
2. Locate an existing hole with a grommet in the vehicle fire wall, or drill a 10 mm access hole at the location for passing the power cable into the engine compartment. Install a grommet with 5 mm inner diameter in the access hole to avoid damage to the cable.



ZWG0130124-0

Figure 1-5 Battery Connections into Engine Compartment



CAUTION: A high degree of care must be exercised to prevent damage to any existing vehicle wires.

3. From inside the vehicle, feed the red and black leads (without lugs attached) through the access hole and into the engine compartment (see Figure 1-5).
4. Locate the nearest available vehicle chassis ground mounting point and shorten the black lead to remove excess cable length.
5. Install ring lugs (supplied) onto the stripped end of the power cable black lead, and onto the stripped end of the red lead.
6. Locate the fuse holder as close to the battery as possible and away from any hot engine component. Mount the fuse holder via the mounting hole and dress wires as necessary. Connect the fuse holder red adaptor lead plug to the mating receptacle on the red lead of the power cable (see Figure 1-6).
7. Connect the power cable black lead directly to the vehicle chassis ground.
8. Connect the power cable red lead from the fuse holder to the positive (+) battery terminal. Make sure the adaptor cable is connected to the main power cable red lead.
9. Plug the fuse into the in-line fuse holder (See Figure 1-6).

NOTE Failure to mount the red lead of the power cable kit directly to the battery may result in severe alternator whine interference.

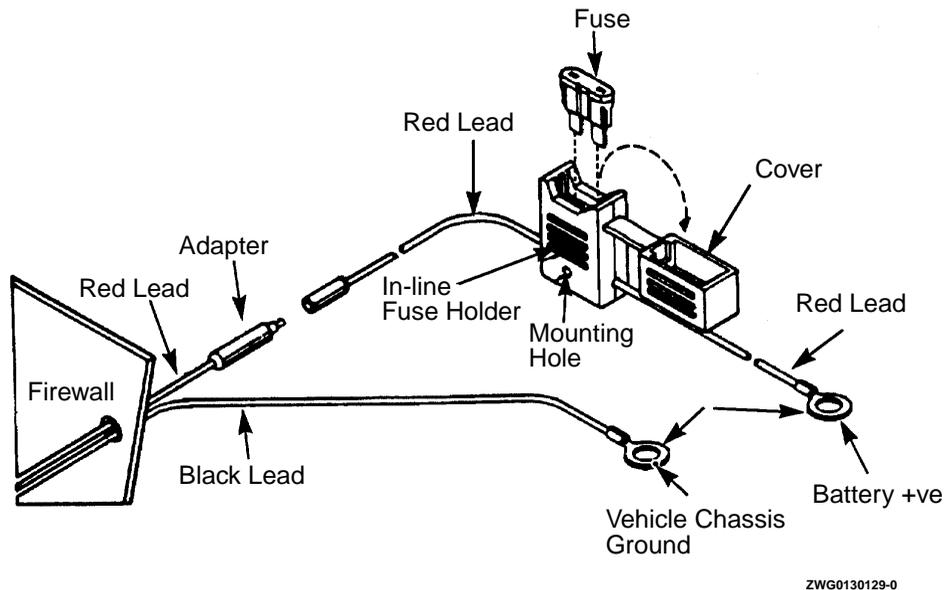


Figure 1-6 Power Cable Assembly

NOTE If the black lead is connected to the battery negative (-) terminal an additional 10A fuse must be fitted in the lead.

6.0 Optional Speaker Installation

Select a location for the speaker that will be neither dangerous to the operator nor damaging to the speaker. The speaker is normally hung under the dash near the right side of the console; however, the speaker may be mounted against a wall or other vertical surface, if desired.

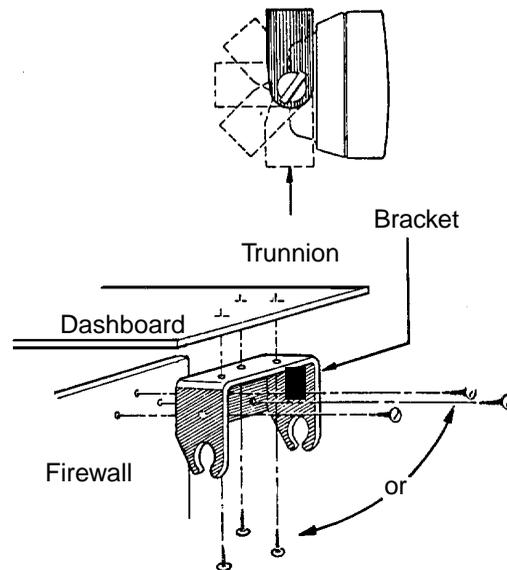
A location close to the operator, such as on a door pillar, will minimize VA volume adjustments that might otherwise be needed when ambient noise conditions worsen (such as when a siren is used). This location is also favorable during low-volume security patrol, when message traffic should not pre-announce the location of the VA operator.



CAUTION: Grounding either of the speaker lines may permanently damage the speaker amplifier in the vehicle adapter.

Install the speaker as follows:

1. Remove the speaker from the trunion bracket by loosening the two wing screws.
2. Using the trunion bracket as a template, mark the locations of the three mounting holes.
3. Center punch and drill a 4 mm hole at each location.
4. Mount the trunion bracket with the screws supplied (Figure 1-7).
5. Insert the speaker into the trunion bracket and tighten the two wing screws.
6. Insert the external speaker accessory plug into the accessory connector of radio.



ZWG0130130-0

Figure 1-7 Speaker Installation

7.0 Cables and Connectors

7.1 Flying Cable End Connections

The ends to the flying cable are suitable for connection to automotive blade connectors. The connections are shown in the Tables below.

7.1.1 Power Connections (0.25 in. automotive blades, male)

Table 1-1 Power Connections

Terminal	Description	Wire color	 DC Ground + ve Supply Connector Front View
DC Ground	Batt. -	black	
Supply	Batt. +	red	

7.1.2 Speaker Connections (0.25 in. automotive blades, female)

Table 1-2 Speaker Connections

Terminal	Description	Wire color	 (2) Speaker (-) (1) Speaker (+) Connector Front View
1	Speaker + output	brown	
2	Speaker - output	blue	

7.1.3 Accessory Connections (0.112 in. automotive blades, female)

Table 1-3 Accessory Connections

Terminal	Description	Wire color	 PTT input (4) (1) Microphone HUB input (3) (2) AF Ground Connector Front View
1	Microphone hot	black	
2	Microphone ground	transparent	
3	Hook	orange	
4	External PTT	violet	

7.1.4 Option Connector (0.112 in. automotive blades, female)

Table 1-4 Option Connector

Terminal	Description	Wire color	 (3) CRMS o/p (2) DC Ground (1) 12V o/p Connector Front View
1	12Vdc switched	red	
2	DC ground	grey	
3	CRMS output	blue	

7.2 Microphone Connector

10-pole modular connector.

Table 1-5 Microphone Connector Pin-out

Pin	Description
0	Not Connected
1	Battery +ve
2	Speaker -ve
3	Hook
4	Ground
5	Microphone Audio
6	PTT
7	Not Connected
8	Speaker +ve
9	Not Connected

7.3 Computer / Service Connector

9-pole "D" type socket with female jacks.

Table 1-6 Computer/Service Connector Pin-outs

Pin	Description
1	External microphone input
2	RX data input
3	TX data input
4	Ground
5	12V DC switched output
6	RX Audio
7	Service select input
8	Boot control
9	MAP27 (not available)

8.0 Specifications

Part Numbers:

EN1006	Vehicle Adapter VHF	(136-174 MHz)
EN1007	Vehicle Adapter UHF	(403-470 MHz)

All units are supplied with RF Switch Adapter and palm microphone

Input voltage:

10.8Vdc to 31.2Vdc negative earth
(typical 12V or 24V car battery range)

In-line Fuse

7.8 x 1.95 in. in-line fuse holder
4A quick-blow fuse

Temperature range:

-22°F to +140°F (operational)
-13°F to +131°F (to specification)
-40°F to +176°F (storage)

Dimensions:
(approximate)

H 9.75 in.; W 3.9 in.; D 3.315 in. (without portable radio)
(H includes anti-kink device but without the 60cm cable tail)
(D includes mounting facility).

Weight:
(approximate)

800g (without portable radio).

Speaker

5 Watts maximum at 4 Ohms

Chapter 2

SOFTWARE CONFIGURATION TOOL

1.0 Introduction

Vehicle Adapter Product Manual/Configuration Tool **ENLN4114** may be used to:

- Configure the vehicle adapter.
- Check the status of the battery fitted to the radio in the vehicle adapter.
- Check the operation of the vehicle adapter battery charger.
- Test the operation of the two indicator LEDs on the vehicle adapter.

The configuration tool must first be installed on the PC and the PC then connected to the vehicle adapter using the Programming Cable ENKN4002.

2.0 Installing the Configuration Tool

2.1 Installing Using Windows 3.1

If you are using a PC with windows 3.1 installed, the minimum hardware specification required is:

- 486 CPU operating at 50MHz.
- 8Mb of RAM.
- 1Mb of available Hard Disk space.
- Microsoft Windows 3.1 or above.
- One free serial port.

2.1.1 Installation

Install the Vehicle Adapter Configuration Tool as follows:

1. Insert the software diskette into drive A.
2. Create a directory on your hard disk with an appropriate name.
3. Copy the files from the distribution disk into this new directory.
4. From within Windows Program Manager, choose 'File,' 'New,' then 'Program Group.'
5. Enter a suitable name in the 'Description:' box and then click OK.
6. Open the new group by choosing 'File,' 'New,' then 'Program Item.'
7. Click the 'Browse' button and when the 'Browse' window opens, navigate to the directory created in Step 2.
8. Click on the '*waris.exe*' file and then click OK.
9. Double clicking on the Vehicle Adapter Icon will start the Configuration Tool.

2.2 Installing Using Windows 95/98/NT

If you are using a PC with windows 95/98/NT4.0 installed, the minimum hardware specification required is:

- 486 CPU operating at 50MHz.
- 8Mb of RAM.
- 1Mb of available Hard Disk space.
- Microsoft Windows 95/98/NT4.0 or above.
- One free serial port.

2.2.1 Installation

1. Insert the software diskette into drive A.
2. Create a directory on your hard disk with an appropriate name.
3. Copy the files from the distribution disk into this new directory.
4. Create a Shortcut to the 'waris.exe' file and copy it to the Desktop.
5. Double clicking on the Vehicle Adapter Icon on the Desktop will start the Configuration Tool.

2.3 Program Set-up

When the program is first run the opening Vehicle Adapter screen is displayed as shown in Figure 2-1 below:

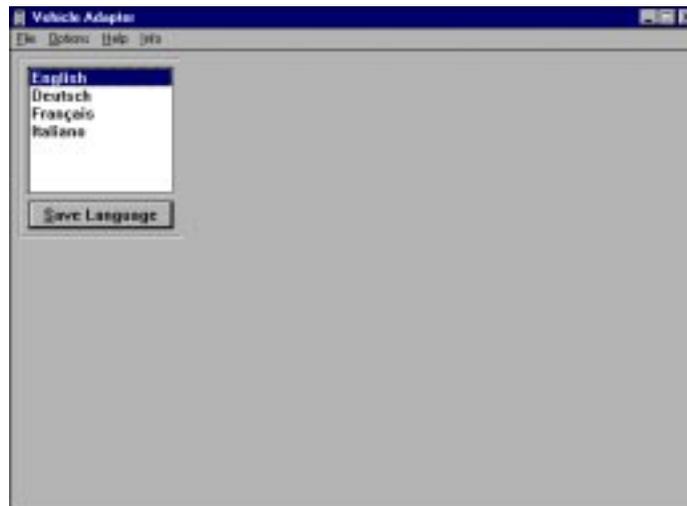


Figure 2-1 Initial Opening Screen

Set up the Configuration Tool to your requirements as follows:

1. Click on the button for the language you require the program to open with in future.
2. Click the 'Save language' button.

NOTE The language selection box will not appear again on the opening screen. If you require to choose a different language select 'Language' from the 'Options' menu.

3. Select 'Interface' from the 'Options' menu and from the 'Interface' screen (Figure 2-2) click on the serial port (COM 1 to 4) you wish to use.
4. Click on the 'Close' button.

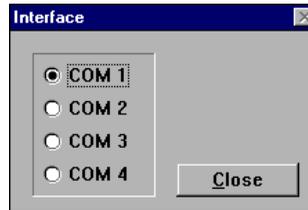


Figure 2-2 Interface Selection Screen

3.0 Vehicle Adapter Screen

The menu options on the Vehicle Adapter screen are shown below:

3.1 File Menu

- New :** Opens a new 'Settings' screen, the fields will contain the default VA settings.
- Open:** Opens the 'File Open' dialogue box allowing you to navigate and open a previously saved settings file.
- Read VA:** Reads the settings parameters programmed into the vehicle adapter and displays them in the 'Settings' screen.
- Save:** Re-saves the current settings to the currently open file.
- Save as:** Opens the 'File Save' dialogue box allowing you to name the file you are about to save and navigate to the preferred save location.
- Close:** Closes the current window without exiting the application.
- Exit:** Exits the application.

3.2 Options Menu

- Interface:** Opens the 'Interface' screen (Figure 2-2) click on the serial port (COM 1 to 4) you wish to use. Clicking the 'Close' button saves the setting.
- Service:** Opens the 'Service' screen (Figure 2-4) described later.
- Language:** Opens the language box (Figure 2-1). Select the language you require the program to open with in future and then click the 'Save language' button.

3.3 Help Menu and Info

The 'Help' option displays a single page of help describing the use of the functions within the 'Settings' screen. The 'Info' option displays the Version Number and a copyright statement for the Vehicle Adapter configuration tool.

4.0 Configuring the Vehicle Adapter

The vehicle adapter is configured via the Programming Cable ENKN4002 (Refer to the Maintenance chapter of this manual for details of this cable). The cable incorporates a switch which allows the mode of testing or programming to be selected. The modes are shown in Table 2-1 below:

To configure the vehicle adapter proceed as follows:

1. Connect the vehicle adapter to the computer with the Programming Cable ENKN4002.
2. Select the 'Vehicle Adapter Configuration and Service' position (Position 1) on the MODE switch.

Table 2-1 Programming Cable Mode Selection

Switch Position	Mode
1	Vehicle Adapter Configuration
2	Radio Flash
3	Radio Service
4	MAP 27 (not available)

3. On the Vehicle Adapter screen, select the 'File' menu.
4. From the 'File' menu select 'Read VA,' 'New' or 'Open' to open the 'Settings' screen (Figure 2-3).

5.0 Using the Settings Screen

The 'Settings' screen permits the configuration of the vehicle adapter to be carried out to customer requirements.

The 'Car Radio Mute Signal' and an external speaker (optional) can be enabled and the function of the microphone hook switches can be configured as required. The Car Radio Mute Signal delay and the microphone gain can be set.

The 'Settings' screen functions are described below and shown in Figure 2-3:

5.1 Settings Screen Functions

Use the functions of the 'Settings' as follows:

Write VA: Writes the settings displayed on the 'Settings' screen into the vehicle adapter.

Default: Returns all the parameters in the 'Settings' screen to the factory defaults shown in Figure 2-3.

Close: Closes the 'Settings' screen without exiting the application.

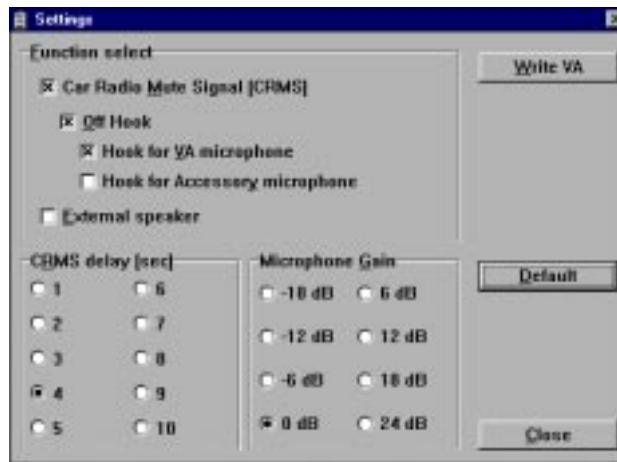


Figure 2-3 Vehicle Adapter Settings Screen

NOTE Figure 2-3 shows the default values for the 'Settings' screen.

Function Select Box

Car Radio Mute Signal enable (CRMS)

The vehicle adapter contains a function that will mute a broadcast receiver or entertainment system fitted into the vehicle. When enabled the mute function operates when:

1. The portable radio squelch is open.
2. The radio PTT is activated by the vehicle adapter.
3. A microphone connected to the vehicle adapter is OFF HOOK (optional).

Checking the 'Car Radio Mute Signal enable' box enables the CRMS function with one of the following:

Off Hook Enable

Checking the 'Off Hook Enable' box adds the OFF HOOK function to the CRMS function.

NOTE When selected one of the hook switches must also be selected to allow the function to work.

Hook for VA microphone

Checking the 'Hook for VA microphone' box adds the hook switch of the microphone plugged into the base of the vehicle adapter, into the CRMS function.

Hook for Accessory microphone

Checking the 'Hook for Accessory microphone' box adds the hook switch of the microphone connected to the accessory connector, located at the end of the VA flying cable, into the CRMS function.

External speaker enable

The vehicle adapter can be fitted with an optional external speaker. To enable the external speaker check the 'External speaker enable' box.

Car Radio Mute Signal delay [sec]

When the CRMS function is active it is desirable to continue muting for a short time after the enabling signals have gone. This is achieved by introducing a delay after the mute signal is removed.

The delay should be long enough to permit a user to respond to a received message or to start a new call. Also in areas of poor signal strength, where the squelch may be repeatedly opening and closing, the delay holds the mute on.

The delay may be set to between 1 and 10 seconds in steps of 1 second.

Check the button corresponding to the delay required.

Microphone gain

The microphone gain can be adjusted over a wide range to allow for different types of microphone, acoustic environments and user requirements. The gain may be set in 6dB steps from -18dB to +24dB.

Check the button corresponding to the gain required.

6.0 Using the Service Screen

The 'Service' screen permits the battery status to be checked and the vehicle adapter charging circuits to be dynamically tested. The operation of the vehicle adapter LEDs may also be checked. The Service screen is shown in Figure 2-4 below with typical values displayed.

To display the 'Service' screen, select the 'Options' menu from the Vehicle Adapter Screen (Figure 2-2) then select the 'Service' function from the 'Options' menu to open the 'Service' screen (Figure 2-4).



Figure 2-4 Vehicle Adapter Service Screen

6.1 Service Screen Functions

Use the functions of the Service screen as follows:

6.2 Battery Information

When the Radio with battery attached is inserted into the vehicle adapter, information held in the battery memory is displayed on the Service Screen to check on the battery status.

The information displayed is that held in the vehicle adapter memory at the time the 'Service' screen is enabled. If the battery in the vehicle adapter is changed the 'Service' screen must be closed and re-enabled to display the updated information.

Type

Displays the battery chemistry, either Ni for Nickel Cadmium and Nickel Metal Hydride or Li for Lithium Ion.

Capacity

Displays battery capacity as shown in Figure 2-3 below:

Table 2-2 Battery chemistry and capacity

Kit (part) Number	Battery Chemistry / Description	Display
HNN9008	Nickel Metal Hydride - High Capacity	high
HNN9009	Nickel Metal Hydride - Ultra High Capacity	ultra-high
HNN9010	Nickel Metal Hydride - Ultra High Capacity FM	ultra-high
HNN9011	Nickel Cadmium - High Capacity FM	high
HNN9012	Nickel Cadmium - High Capacity	high
HNN9013	Lithium Ion	standard

Firmware version

Displays the firmware version of the VA.

Charger currents

Displays the charge currents for the battery type fitted to the radio in the vehicle adapter. The values are the actual current values stored in the battery memory and it is these values that are used to test the performance of the vehicle adapter charging circuit.

6.3 Charger simulation / “CHARGE” LED Test

The currents displayed here should match the currents displayed in the 'Info' screen described above.

The small rectangle in the top right hand corner of the 'Charger simulation / “CHARGE” LED Test' box should be the same color as the “CHARGE” status LED on the vehicle adapter for the charge mode selected.

Fast, Top Off, Maint and Off Buttons

Clicking one of these buttons will terminate normal charging and set the battery charge current to the appropriate value for the battery type fitted into the vehicle adapter and the simulated charge selected. Both the “CHARGE” status LED on the VA and the colored rectangle on the screen should indicate the color stated in the table below.

Table 2-3 Simulated Charge Indicator Color

Simulated Charge Button	Charge Color
Fast	Red
TopOff	Yellow
Maintenance (Trickle)	Green
Off	None

Charge current, Battery voltage and Battery temperature Boxes

These three boxes display the actual measured parameters from the vehicle adapter.

The measured 'Charge current' should correspond closely to that stated in the 'Info' box for the current charge state thus demonstrating the correct capability of the charger circuit.

The 'Battery voltage' indicated should be between 6 and 10 volts. Values below 6 volts indicate a completely discharged or faulty battery. Completely discharging a battery will adversely affect its cycle life, and so should be avoided. Values of battery voltage above 10.5 volts indicate a faulty battery.

To update the information in these boxes click on the 'Read status' button.

Read status

Clicking on this button updates the information in the 'Charge current,' 'Battery voltage' and 'Battery temperature' boxes.

6.4 "RADIO MODE" LED Test

The small rectangle in the top right hand corner of the "RADIO MODE" LED Test box should be the same color as the "RADIO MODE" status LED on the vehicle adapter for the radio mode selected.

6.5 PTT, On and Off Buttons

Clicking one of these buttons will set both the "RADIO MODE" LED on the vehicle adapter and the colored rectangle on the screen to the 'Mode Color' stated in Table 2-4 below.

Table 2-4 Radio Mode LED Colors

Radio Mode Button	Mode Color
PTT	Red
MAP 27	(Not available)
On	Green
Off	None

Chapter 3

MAINTENANCE

1.0 Scope of This Chapter

This chapter is intended for use by service technicians familiar with similar types of equipment. It contains service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date may be incorporated by a complete Manual revision or alternatively as additions.

NOTE Before operating or testing the vehicle adapter, please read the Safety Information Section in the front of this manual.

The chapter provides details about the following:

- Preventive maintenance (inspection and cleaning).
- Service and Diagnostic Information.
- Test Equipment and Service tools.
- Programming and Configuration Information.
- Safe handling of CMOS and LDMOS devices.

2.0 Warranty, Service, and Technical Support

Other than cleaning all metal contacts and pins and dusting the unit with a clean, dry cloth, any maintenance, troubleshooting, service, or repair of the vehicle adapter should be performed only by an authorized Motorola service provider. During the warranty period, contact the Accessories and Aftermarket Division (AAD) at 1-800-422-4210 for warranty return authorizations. After the warranty period, contact the Motorola Radio Support Center at 1-800-227-6772 for limited repair information. For technical assistance with this product, please contact Product Services at 1-800-927-2744 prompt 3 followed by prompt 1.

3.0 Preventive Maintenance

The vehicle adapter does not require a scheduled preventive maintenance program; however, periodic visual inspection and cleaning is recommended.

3.1 Inspection

- Check that the external surfaces of the vehicle adapter are clean.
- Check that all metal contacts are clean and that the connectors are undamaged with no bent or missing pins.
- Check that the locking button mechanism operates correctly with one press to lock the radio in place and a second press to release the radio.
- It is recommended that the interior electronic circuitry is NOT inspected on a routine basis.

3.2 Cleaning Procedures

The following procedures describe the recommended cleaning agents and the methods to be used when cleaning the external surfaces of the vehicle adapter. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime.

NOTE Internal surfaces should be cleaned only when the vehicle adapter is disassembled for service or repair.

The only recommended agent for cleaning the external vehicle adapter surfaces is a 0.5% solution of a mild dishwashing detergent in water.



CAUTION: The effects of certain chemicals and their vapors can have harmful results on certain plastics. Avoid using aerosol sprays, tuner cleaners, and other chemicals.

Cleaning External Plastic Surfaces

Apply the 0.5% detergent-water solution sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the vehicle adaptor. Use a soft, absorbent, lintless cloth or tissue to remove the solution and dry the vehicle adaptor. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

Cleaning of connectors and contacts

Clean all connector pin and battery charge contact surfaces of the vehicle adapter, the ring contact surfaces of the antenna adapter and the side connector contact surfaces of the portable radio.

NOTE Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material (from previous usage).

3.3 Diagnostics

Some basic functional tests can be performed by the use of the "Service" screen in the configuration tool. These tests will help with diagnostics of the battery and the charging circuits. Refer to Chapter 2 for details of the Software Configuration Tool.

4.0 Theory of Operation

4.1 Introduction

The following paragraphs provide a description of the various functional blocks for the vehicle adapter. These functional blocks may have the corresponding components or block sections located on one or more boards.

The vehicle adapter consists of the following five boards:

- the processor main board,
- the PSU / charger/ speaker amplifier board,
- the side connector board,
- the battery contact board and,
- the sub-D (RS232 Interface) board.

4.2 Circuit Functional Elements

The key functional elements of the vehicle adapter are:

1. **Power supply circuit** - consisting of input filtering and reverse / overvoltage protection, a DC/DC converter for the battery charge circuit, a DC/DC converter providing auxiliary switched 12Vdc (maximum 250mA) for optional accessories, a 5V regulator and the power down circuitry.
2. **Battery charger circuit** - consisting of a regulated current source and the analog to digital converter.
3. **Microprocessor circuit** - with all the necessary peripheral circuitry.
4. **External speaker amplifier** - providing the required amplification of the portable radio audio into 5 watts at 4 Ohms.
5. **Microphone circuits** - providing adequate amplification or attenuation for the selected microphone.
6. **RS232 interface** - allowing the connection of a PC to the vehicle adapter for various operating modes.

4.3 Power Supply Circuit

The power supply has input filtering and provides protection against reverse polarity and over voltage supply input. In case of reverse polarity or over voltage the input fuse will blow and separate the vehicle adapter from the power source.

The DC/DC converter for the battery charge circuit operates in “step down” mode and provides a regulated supply for the linear current source stage. For input voltages below 13Vdc the converter is bridged to allow full charging current for the fast charge mode.

An additional DC/DC converter provides a regulated 12Vdc (max. 250mA) supply for optional accessories without their own power source.

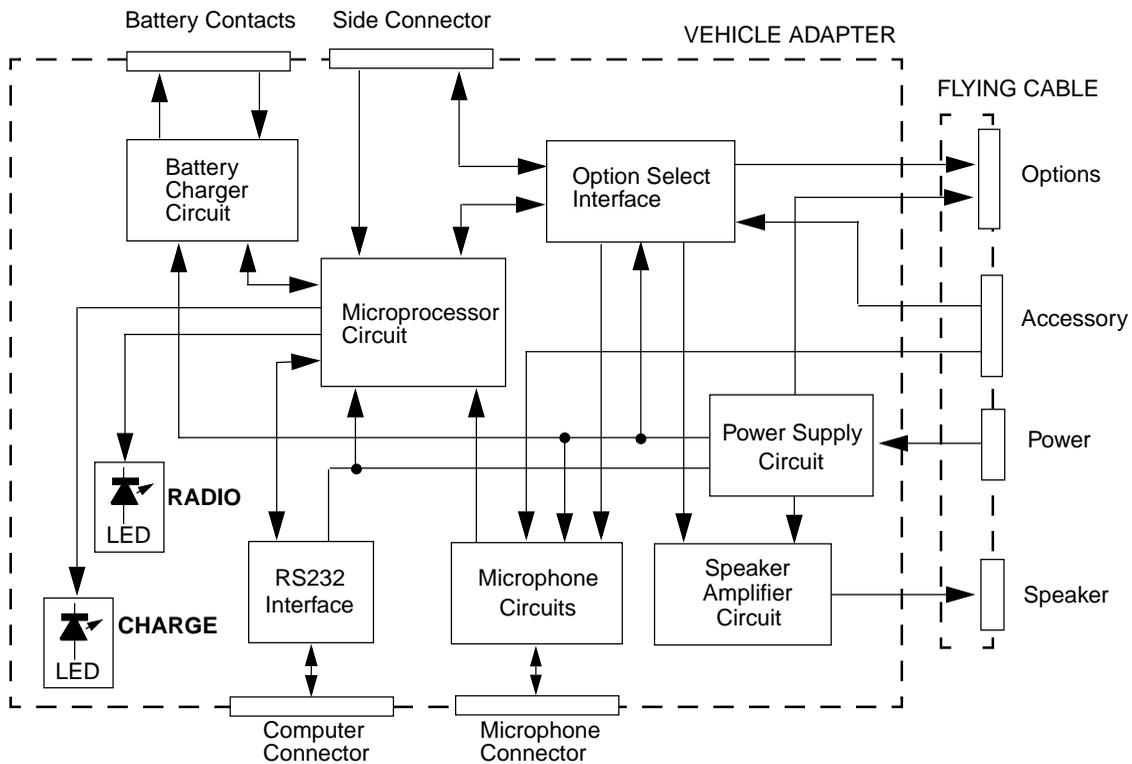


Figure 3-1 Vehicle Adapter Simplified Block Schematic Diagram

The 5V regulator is driven from the regulated 12Vdc and supplies the integrated circuits like the microprocessor, analog switches and most of the operational amplifiers.

The power down circuit detects a voltage drop below 5Vdc and causes the microprocessor to reset and perform a controlled start-up.

4.3.1 Power Connections

The power connections are shown in Table 3-1 below, the connector pin-outs are shown in Figure 3-2.

Table 3-1 Power connections

Terminal	Description	Function
DC Ground	Battery -ve	Ground
Supply	Battery +ve	4A fused supply from vehicle battery

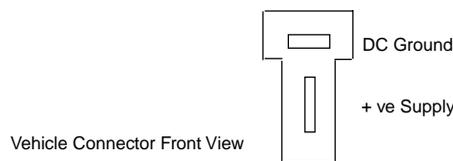


Figure 3-2 Power Connector Pin-out Details

4.4 Battery Charger Circuit

The battery charger circuit uses the stabilized voltage from the output of the “step down” DC/DC converter to deliver a constant charge current to the battery of the radio. This constant charge current is generated by a linear transistor stage within a control loop formed by series current sense resistors, current amplifier and comparator also fed with a reference signal.

This reference signal provides the necessary input from the charging program in the microprocessor setting the current required via a digital to analogue converter.

4.4.1 Charging routine

When the portable radio, with a battery attached, is inserted into the vehicle adapter the microprocessor reads the EPROM in the battery and commences automatically with the appropriate charging routine required for that type of battery.

While the microprocessor circuits are reading the EPROM the “BATTERY” LED flashes green.

If a relatively discharged battery (within the environmental limits for fast charge) has been inserted into the vehicle adapter, the charger circuit ramps up the charge current from approximately 0.1A to 1.2A within the first 3 minutes.

This fast charge continues for Ni-type batteries until one of the various criteria for fast charge termination causes the charge status to change.

Under normal conditions, the Top Off charge phase follows the Fast charge phase when the battery has reached approximately 90% of it's rated capacity. The Top Off charge delivers a much lower current (approximately 200mA) for 2 hours.

Finally, after having fully charged the battery, the charger will begin the Maintenance charge phase, providing only the current (below 100mA) required to maintain the battery in a fully charged condition.

Compared to the Ni-type batteries the Li-type battery sees a different charging routine after ramp up from approximately 0.1A to 0.9A. The current is stepped down continuously to maintain the battery voltage below the maximum limit, until the charging stabilizes at the Maintenance current.

In daily use, where the battery temperature or voltage may be outside permitted limits, the battery charger will automatically make decisions on the way to proceed to maintain the best battery charge conditions without damage to the battery. In practice therefore the Fast charge, Top Off charge, Maintenance charge sequence may not proceed in that order if damage to the battery is a risk.

The charger circuits operate as a fully separate function from the portable radio functionality and are not controlled by the radio controls.

4.4.2 Battery Charging Contacts

The battery charger connections are shown in Table 3-2 and Figure 3-3 below:

Table 3-2 Battery Terminal Functions

Pin #	Assignment	Description
1	+ve	positive terminal for charging voltage (internally protected via diode)
2	TC	temperature sense resistor (thermistor)
3	EPROM	EPROM access (this port defines the type and status of the selected battery)
4	-ve	negative terminal for charging voltage and functional ground

Battery Rear View

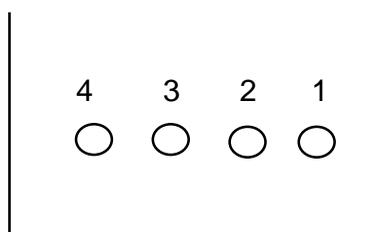


Figure 3-3 Battery Charger Terminals

4.5 Microprocessor Circuit

The microprocessor controls the battery charging routines and all communication from and to the portable radio and the attached battery. It also supports the inputs and outputs for the associated accessories and switches according to the vehicle adapter firmware configuration program.

4.6 Speaker Amplifier

The speaker audio amplifier consists of an LM4752 integrated circuit connected for operation in bridge-mode. This IC is directly supplied from the DC power source without routing through the DC/DC converter. This supply is switched by FETs controlled by the switched B+ from the portable radio, thus reducing the high quiescent current of the IC during idle mode of the vehicle adapter.

The two phase outputs of the portable radio speaker audio, SPKR+ and SPKR-, are attenuated and routed to the two input ports of this audio amplifier IC. The amplifier provides a maximum of 5 watts audio into a 4 ohm speaker. The audio level is adjusted via the portable radio volume control.

During transmit mode the inputs to the audio amplifier are muted via audio gates.

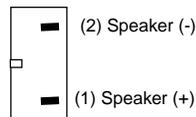
NOTE Grounding either of the speaker lines may permanently damage the speaker amplifier in the vehicle adapter.

4.6.1 Speaker Connections

The speaker connections are shown in Table 3-3 and Figure 3-4 below:

Table 3-3 Speaker Connections

Terminal	Description	Function
1	Speaker + Output	5watt 4ohm speaker
2	Speaker - Output	5watt 4ohm speaker



Vehicle Connector Front View

Figure 3-4 Speaker Connector Pin-out Details

4.7 Accessory Interface

4.7.1 Microphone Circuit

The microphone amplifier/buffer stage adds the two different microphone inputs. One is routed from the palm microphone via the TELCO connector on the bottom of the vehicle adapter, the other is routed from the accessory connector at the end of the flying cable. The buffer stage matches the normal mobile microphone level of 80mV to the portable microphone level of 8mV.

4.7.2 Microphone Level

The microphone sensitivity can be adjusted in steps of 6dB within the range -18dB to +24dB. The adjustment may be performed with the aid of the configuration software running on an external PC connected via programming cable ENKN4002 to the vehicle adapter 9 pin type "D" connector.

4.7.3 Accessory Connections

The Accessory connections are shown in Table 3-4 and Figure 3-5 below:

Table 3-4 Accessory Connections

Terminal	Description	Function
1	External microphone input	80mV Mic audio i/p
2	AF Ground	Ground
3	Hang up Box input	Ground to de-activate
4	External PTT input	Ground to activate

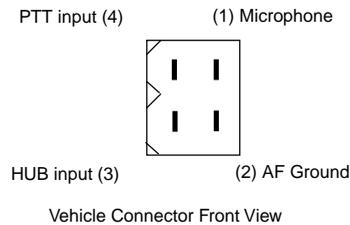


Figure 3-5 Accessory Connector Pin-out Details

4.8 RS232 Interface

The RS232 interface consists of a MAX232 integrated circuit followed by switching gates providing the selection of the data port operating modes for Service, MAP27 (not available) and Boot. It also provides the buffer for the TXdata and the driver for the RXdata from the portable radio. An additional reed relay switch bridges the two ports TXdata and RXdata from the portable radio, to simulate a standard RIB single line connection as shown in Figure 3-6 below.

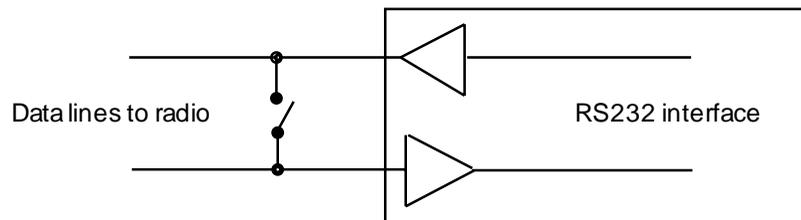


Figure 3-6 RS232 Interface

4.8.1 Option Select Interface

The Option Select inputs to the portable radio are automatically controlled by the VA microprocessor according to the radio operating mode required.

4.8.2 Data Port Operating Modes

The computer interface is switched between the available operating modes according to Table 3-5 below. The Option Select inputs to the radio are automatically set to those appropriate for the selected operating mode.

Table 3-5 Data Port Operating Modes

Functionality	Service Select Pin 7	*MAP27 Select Pin 9	Boot Control Pin 8
Normal operation - Data lines isolated - Option select set to either Normal Operation, External Speaker or External PTT as appropriate	1	1	1
*MAP27 mode - Data lines to radio - Option select set to *MAP27 Enable	1	0	1
VA Service mode - Data lines to μ P - Option select set to Normal Operation	0	1	1
Radio Service mode - Data lines from RS232 interface to radio, but TX and RX lines connected together, as in diagram below - Option select set to Normal Operation	0	0	1
Radio Flash mode - Data lines from RS232 interface to radio, but TX and RX lines connected together, as in Figure 3-6. Option select set to Normal Operation	X	X	0

***NOTE:** MAP27 is not available.

4.9 Computer Programming / Service Connector

The Computer programming / Service connector provides connections between the vehicle adapter and a PC via the Programming cable ENKN4002. The connector functions are shown in Table 3-6.

Table 3-6 Computer Service Connector Functions

Pin	Description	Function
1	External Mic input	80mV Mic audio i/p
2	Rx data input	RS232 Rx data
3	Tx data input	RS232 Tx data
4	Ground	Screens and DC ground
5	12V switched output	250mA max
6	RX audio	AF Screened
7	Service select input	Ground to activate
8	Boot Control	Ground to activate
9	*MAP27 select input	Ground to activate

***NOTE:** MAP27 is not available.

See Table 3-5 for the functionality of pins 7, 8, and 9.

4.10 Accessory Interface connection

The accessory interface connector provides two functions; the Car Radio Mute Signal (CRMS) and an auxiliary 12V supply.

4.10.1 Car Radio Mute Signal (CRMS)

The CRMS function provides a suitable signal to operate an external relay that can mute an entertainment system mounted in the vehicle.

The CRMS output switches to ground when the vehicle entertainment system is required to be muted. It has a maximum sink current of 1 Amp and is reverse polarity protected to 60 Vdc.

Consult the manual for the entertainment system to see if a direct mute function is available that works from a ground signal.

If the entertainment system has this functionality it may be possible to connect the CRMS output of the VA directly to the mute input of the entertainment system.

If no such facility is available or it does not function from a ground signal an external relay interface must be used.

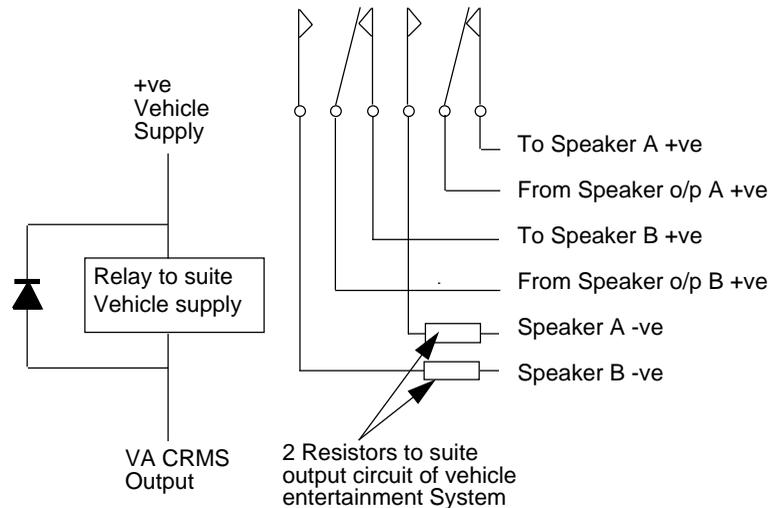


Figure 3-7 CRMS Circuits

The CRMS function is activated when the receiver squelch is opened, the microphone PTT is pressed or the microphone is taken off hook. It is possible to remove either the palm microphone hook or the hook switch for the external microphone from this function. The selection can be performed with the aid of the configuration software running on an external PC connected via the programming cable ENKN4002 to the vehicle adapter 9pin type "D" connector.

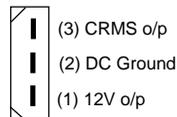
A variable deactivating delay of between 1 and 10 seconds will prevent unintended reactivation of the vehicle entertainment system.

4.10.2 Auxiliary 12v supply

The Auxiliary regulated 12V DC supply (maximum 250 mA) provides a supply to power accessories without their own power source.

Table 3-7 Option Connector

Terminal	Description	Function
1	12V switched output	250mA max
2	DC ground	Ground
3	CRMS output	1A to ground max when active

**Figure 3-8** Option Connector Pin-out Details

4.11 Antenna Connections

The antenna connection to the vehicle adapter is via a BNC connector, crimp plug with a strain relief sleeve. The connections are shown in Table 3-8 below.

Table 3-8 Antenna Connector

Pin	Description	Cable Type
1	Tx / Rx Antenna RF	Core (RF screened cable)
2	Screen	Screen (RF screened cable)

4.12 Spare Connectors

A kit of replacement vehicle adapter connector parts is available from Motorola for the Power connector, the VA options connector, the VA Accessory connector and the Speaker connectors. The kit number is ENLN4117.

4.13 Spare Battery Spacers

A kit of replacement battery spacer parts is available from Motorola. The kit number is WALN4078.

5.0 Test Equipment

Table 3-9 lists test equipment recommended to test the service the vehicle adapter with the portable radio.

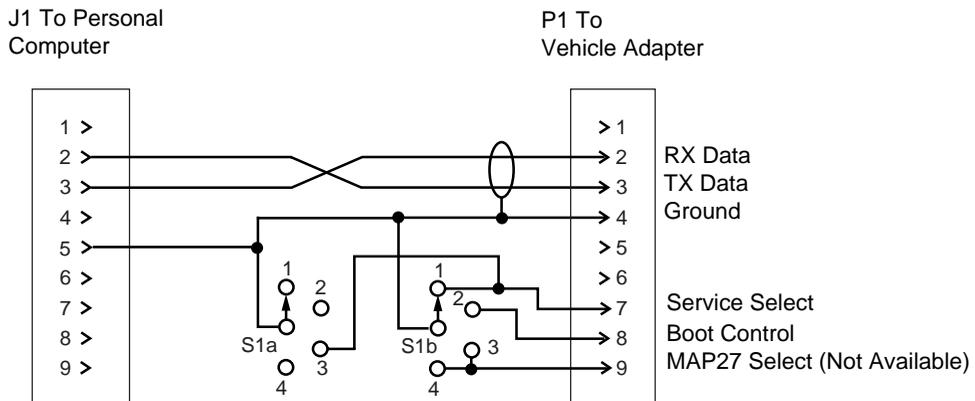
Table 3-9 Recommended Test Equipment

Motorola Part No.	Description	Characteristics	Application
R2600CNT	Comms System Analyzer (non MPT)	This monitor will substitute for items with an asterisk *	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
R2680ANT	Comms System Analyzer (MPT1327) to be ordered with RLN1022A (H/W) RLN1023A (S/W)	This monitor will substitute for items with an asterisk *	Frequency/deviation meter and signal generator for wide-range troubleshooting and alignment
*R1072	Digital Multimeter		AC/DC voltage and current measurements
*R-1377A	AC Voltmeter	100 μ V to 300 V, 5Hz-1MHz, 10 Megohm input impedance	Audio voltage measurements
WADN4133A	Delay Oscilloscope	2 Channel 40 MHz bandwidth, 5 mV/cm - 20 V/cm	Waveform measurements
R1440A 0180305F14 0180305F30 0180305F39 RLN4610A T1013	Wattmeter, Plug-in Elements Plug-in Elements Plug-in Elements Carry case RF Dummy Load	Thru-line 50-Ohm, \pm 5% accuracy 10W, 25 - 60 MHz 10W, 100 - 250 MHz 10W, 200 - 500 MHz Wattmeter and 6 elements	Transmitter power output measurements
S1339	RF Millivolt Meter	100mV to 3 VRF, 10 kHz to 1.2 GHz	RF level measurements
RLN4460	Mobile/Portable Test Set		Audio and DC testing
ENKN4002	Programming Cable		Interface cable for VA configuration and portable radio programming and flashing
ENKN4003	Service Cable		Interface cable for audio and DC testing in conjunction with RLN4460
ENLN4114	Vehicle Adapter Product Manual/ Configuration Tool		Setting parameters in the vehicle adapter

6.0 Programming Cable ENKN4002

6.1 General Information

The ENKN4002 Programming Cable connects the vehicle adapter to a personal computer for radio programming, radio flashing, MAP27 (Not Available) testing or vehicle adapter configuration.



ZWG0130135-B

Figure 3-9 Programming Cable ENKN4002

The switch within the cable assembly is used to configure the cable to the appropriate functionality as shown in Table 3-10 below:

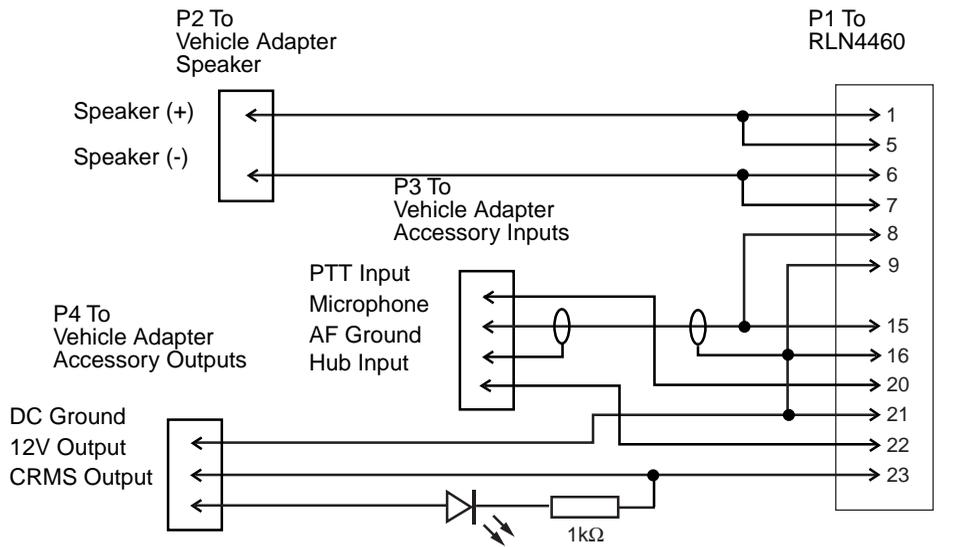
Table 3-10 Programming Cable Mode Selection

Switch Position	Mode
1	Vehicle Adapter Configuration
2	Radio Flash
3	Radio Service
4	MAP 27 (Not Available)

7.0 Service Cable ENKN4003

7.1 General Information

The ENKN4003 Service Cable permits the vehicle adapter to be connected to the RLN4460 mobile / portable test box.



ZWG0130133-B

Figure 3-10 Service Cable ENKN4003

The LED in the 25 pin "D" shell is connected to the Vehicle Adapter Options connector CRMS output and is illuminated when the CRMS function is active.

8.0 RLN4460 Mobile / Portable Test Set

The RLN4460 can be used to perform audio and DC testing of the vehicle adapter. The Service cable ENKN4003 is used to connect the vehicle adapter to the test set.

Some of the test set controls and terminals on the RLN4460 Test box function differently with the vehicle adapter than when used with a standard mobile or portable radio. This section describes those differences.

8.1 Items having No Function with the VA

The following items have no function with the vehicle adapter:

1. External Load connector
2. Load Selector Switch
3. Meter In switch Volume position
 Disc position
4. Meter Out switch Disc position
 Volume position

8.2 Items having a Different Function with the VA

The following items have different functions with the vehicle adapter:

1. Opt Sel switch Functions as the hang up box switch of the accessory microphone.
 ON - microphone on hook.
 OFF - microphone off hook.
2. MT B+ connector Connected to the Options Connector 12V DC switched output.

8.3 Items having Similar Function with the VA

The following items have similar functions with the vehicle adapter:

1. Audio In BNC Connected to the VA accessory microphone input via an attenuator in the test set.
2. Meter In switch and connector PTT position
 Connects to the VA accessory PTT input.
3. Meter Out switch and connector Mic position
 Connects to either the Audio In BNC or the VA accessory microphone input, depending upon the position of the Meter Out switch.
4. Meter Out switch and connector RX position
 Connects to the VA speaker output via an isolating transformer in the test set

9.0 Programming

It is possible to program a portable radio when it is inserted in the vehicle adapter and also to program the vehicle adapter settings. First connect the programming cable ENKN4002 between the 9pin type “D” connector of the vehicle adapter and the PC. The switch of the cable box allows selection of the following modes:

Position “VA Config”:	configuration of the vehicle adapter settings
Position “Radio Flash”:	flashing of the portable radio
Position “Radio Serv.”:	programming of the portable radio
Position “MAP27” (Not Available):	operation with MAP27 protocol (Not Available).

9.1 Configuration of Vehicle Adapter

Using the vehicle adapter configuration software on a PC you can select the following functions via the “Settings” screen:

1. Car Radio Mute Signal enable, with “off hook” enable for either the palm microphone or a separate microphone that is connected to the accessory connector of the vehicle adapter flying cable
2. External speaker enable, routing the received audio (max. 5 watts) to an optional installed external speaker (4 ohms)
3. Car Radio Mute Signal delay allowing a variable deactivation delay of between 1 and 10 seconds this will prevent unintended reactivation of the car radio
4. Microphone gain setting in 6dB steps between -18dB and +18dB gain, allowing sensitivity adjustment of externally connected microphones.

In addition to the “Settings” described above a “Service” screen can be opened that provides additional information for the different charge states of the applicable battery.

NOTE Refer to Chapter 2 - Software Configuration Tool for details of VA configuration.

9.2 Programming / Flashing the Portable Radio

For programming and/or flashing of the portable radio refer to the Service Manual for the portable radio.

10.0 Schematic Diagrams and Board Overlays

10.1 Safe Handling of CMOS and LDMOS Devices

Complementary metal-oxide semiconductor (CMOS) devices are used in this family of radios, and are susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair.

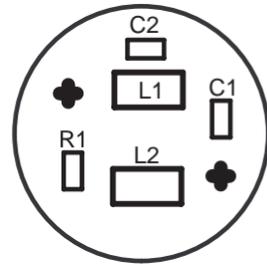
Handling precautions are mandatory for CMOS circuits and are especially important in low humidity conditions. DO NOT attempt to disassemble the vehicle adapter without first referring to the following CAUTION statement.



CAUTION: This vehicle adaptor contains static-sensitive devices. Do not open the vehicle adaptor unless you are properly grounded. Take the following precautions when working on this unit:

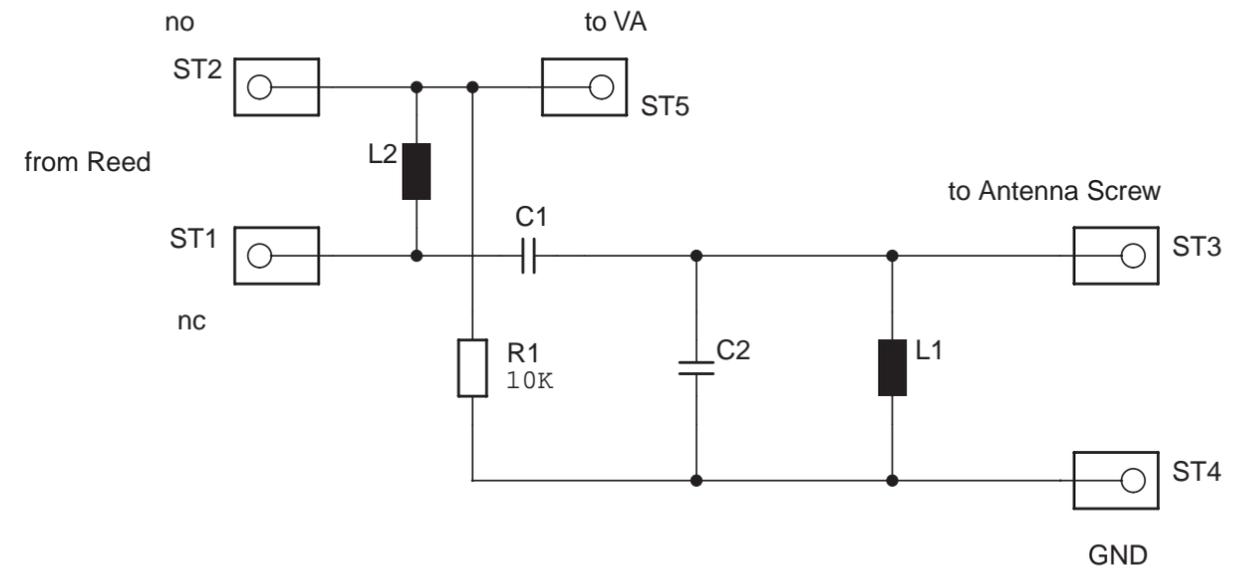
- Store and transport all CMOS devices in conductive material so that all exposed leads are shorted together. Do not insert CMOS devices into conventional plastic “snow” trays used for storage and transportation of other semiconductor devices.
- Ground the working surface of the service bench to protect the CMOS device. We recommend using the Motorola Static Protection Assembly (part number 0180386A82), which includes a wrist strap, two ground cords, a table mat, and a floor mat.
- Wear a conductive wrist strap in series with a 100k resistor to ground. (Replacement wrist straps that connect to the bench top covering are Motorola part number RSX-4015.)
- Do not wear nylon clothing while handling CMOS devices.
- Do not insert or remove CMOS devices with power applied. Check all power supplies used for testing CMOS devices to be certain that there are no voltage transients present.
- When straightening CMOS pins, provide ground straps for the apparatus used.
- When soldering, use a grounded soldering iron.
- If at all possible, handle CMOS devices by the package and not by the leads. Prior to touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.

1.2 RF Adapter PCB



ZWG0130160-O

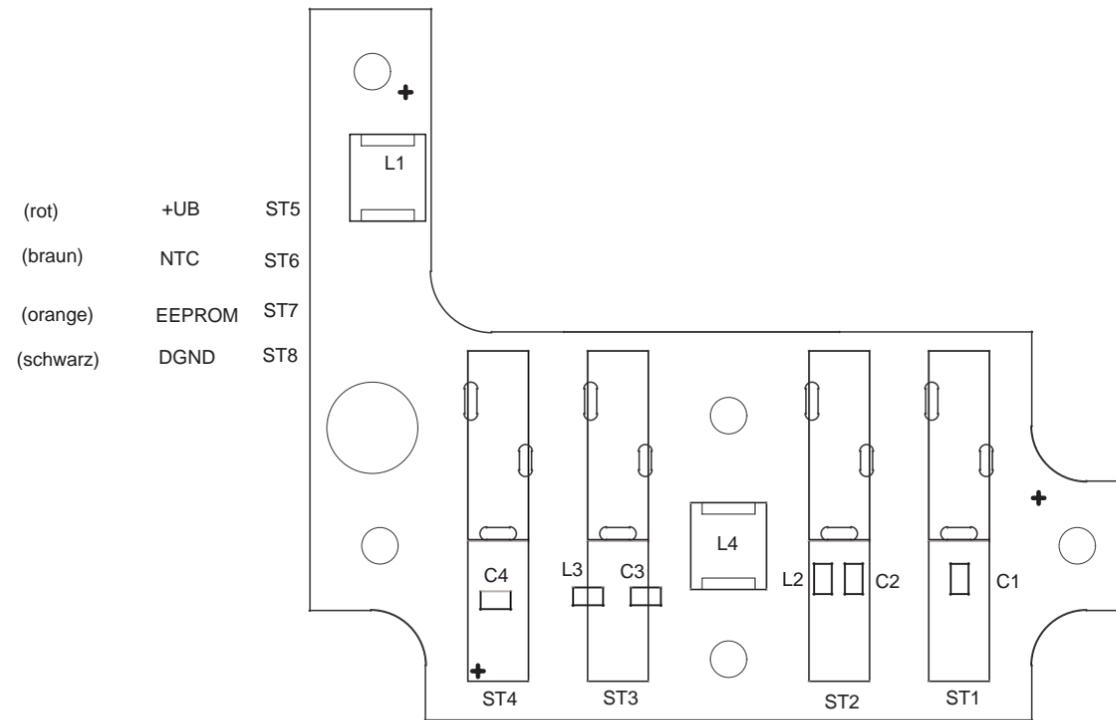
RF Adapter - PCB



ZWG0130161-O

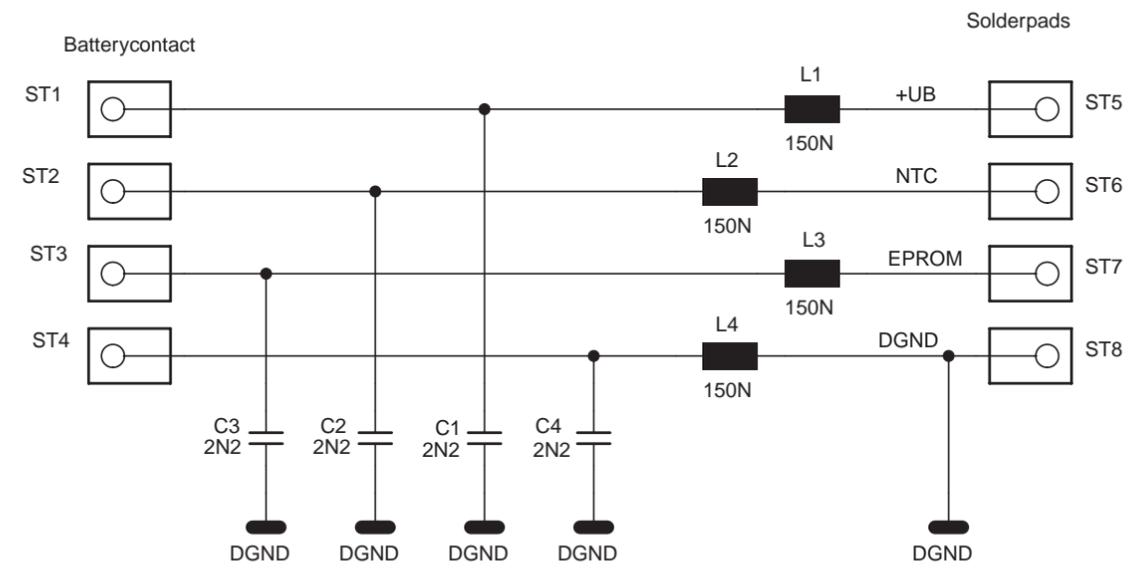
RF Adapter - Schematic

1.3 Battery Contact PCB



ZWG0130162-O

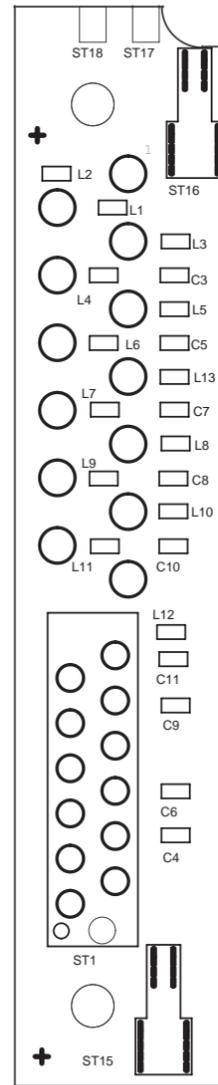
Battery Contact - PCB



ZWG0130163-O

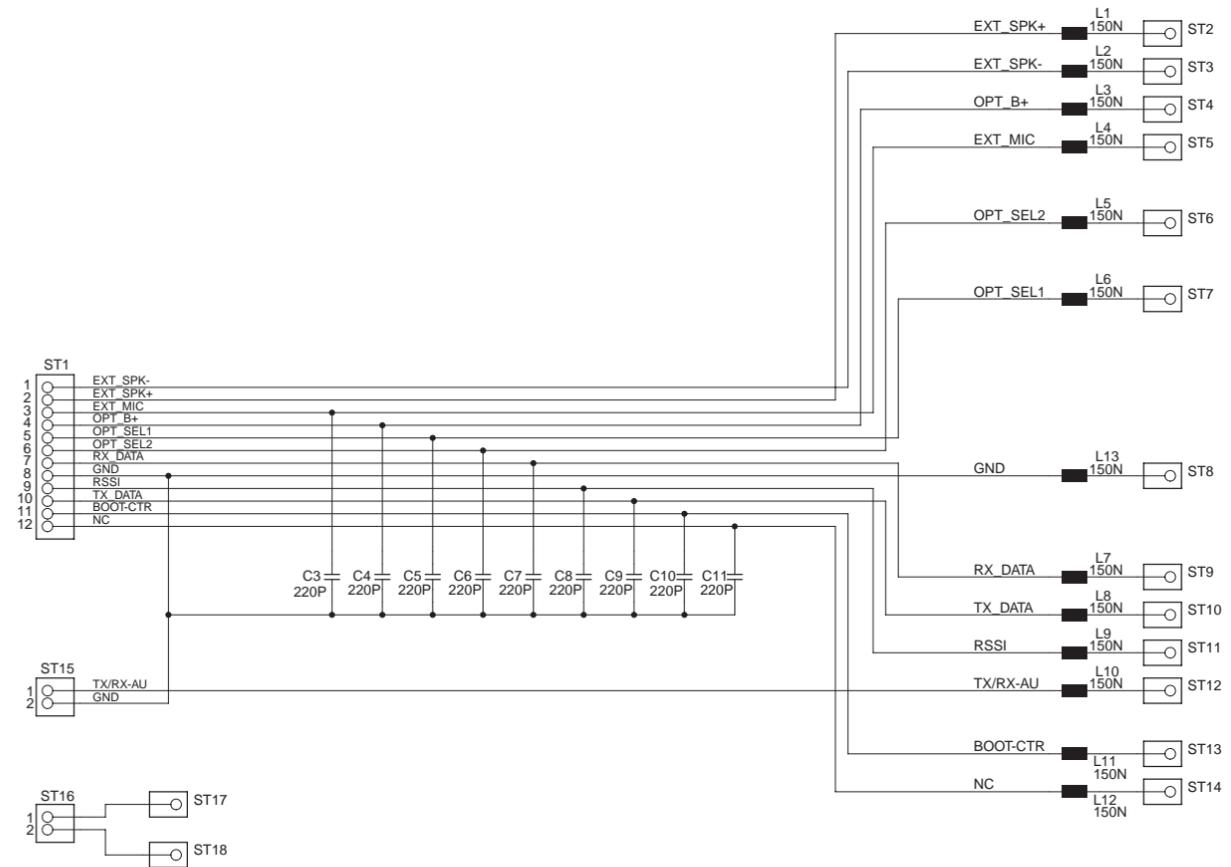
Battery Contact - Schematic

1.4 Side Connector PCB



ZWG0130163-O

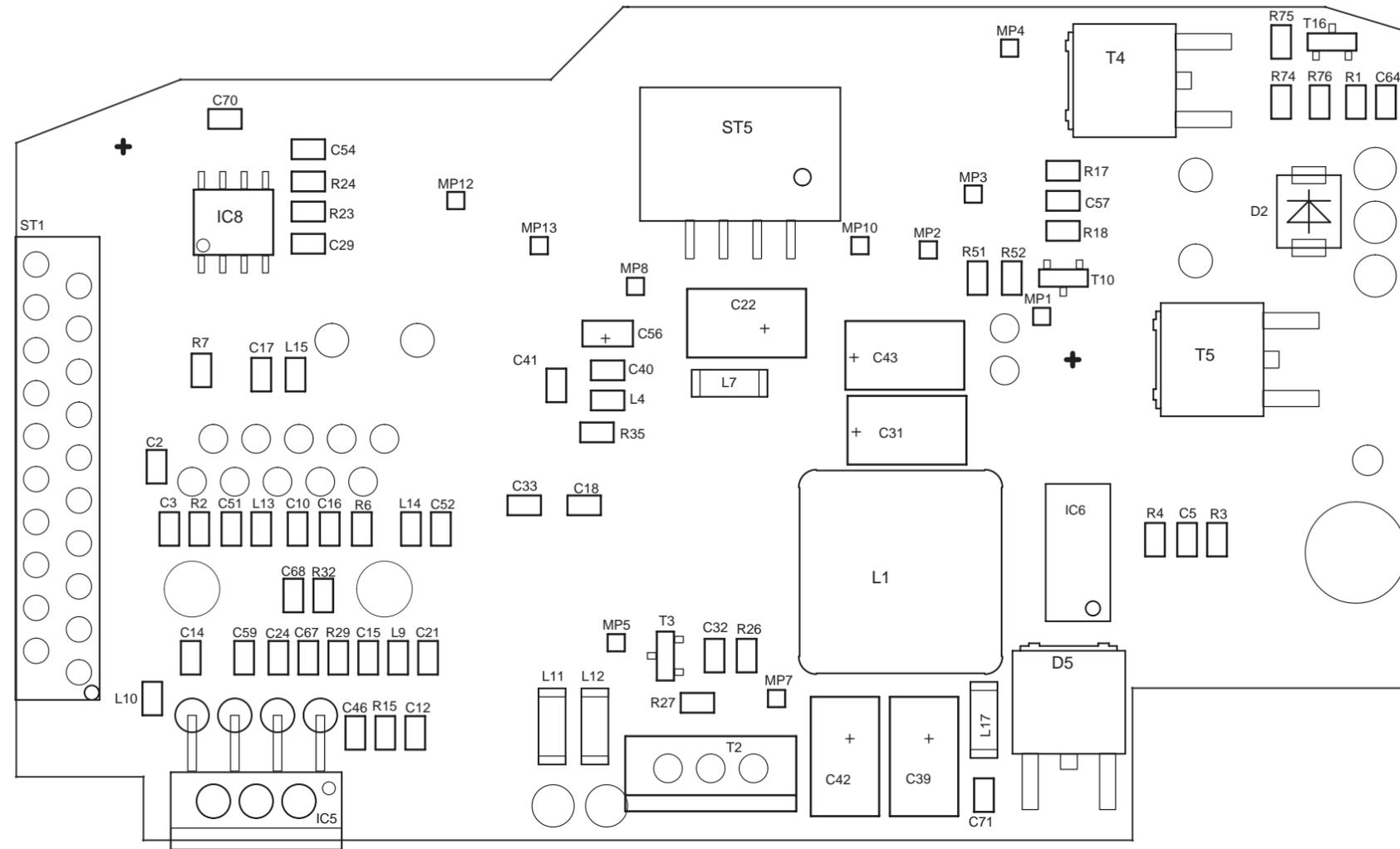
Side Connector - PCB



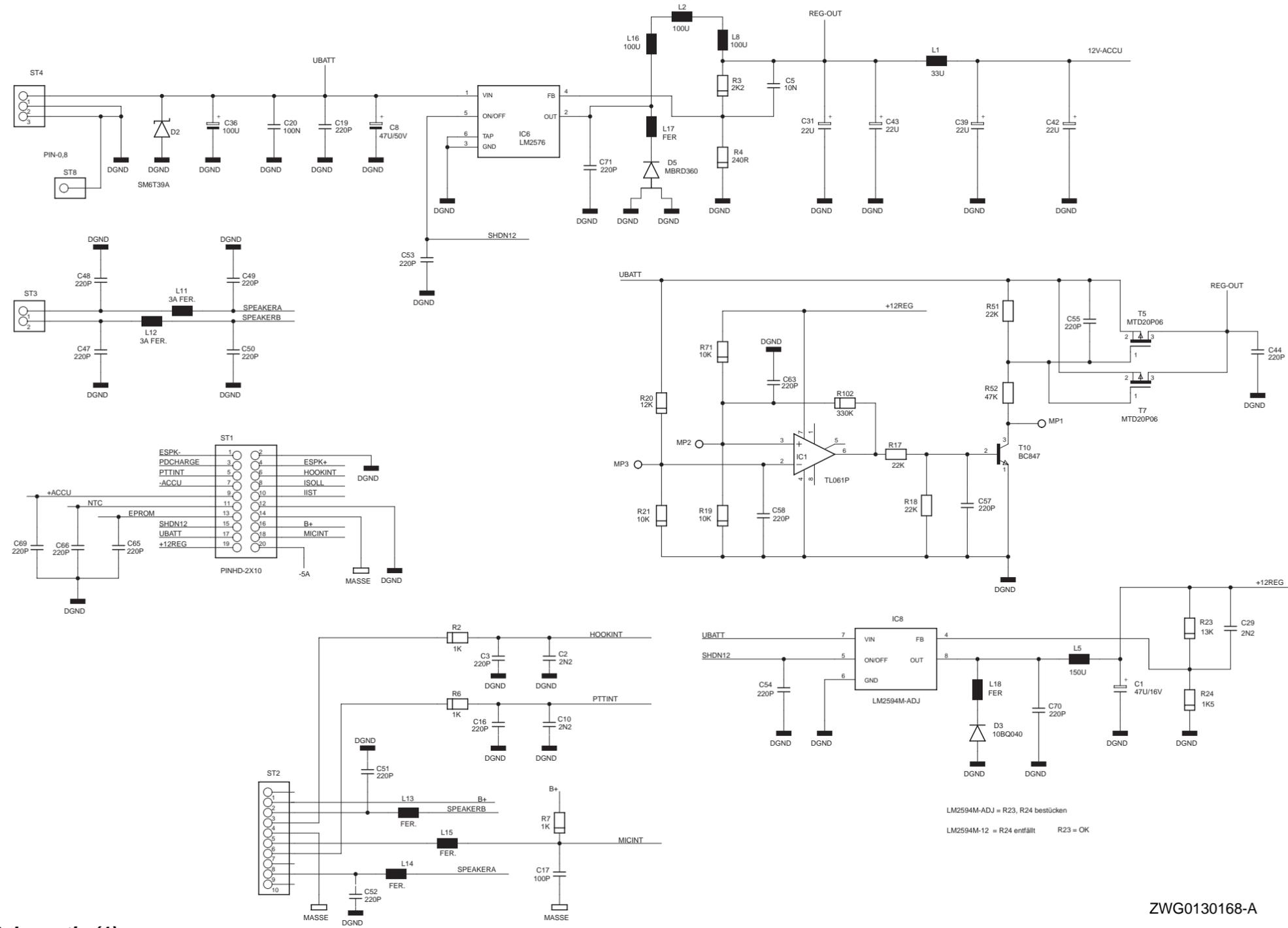
ZWG013065-O

Side Connector - Schematic

1.5 Sub Board PCB

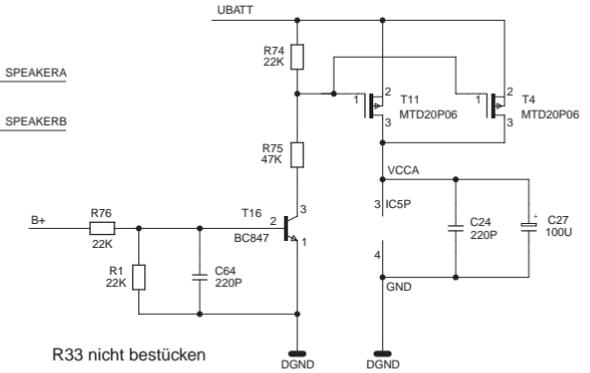
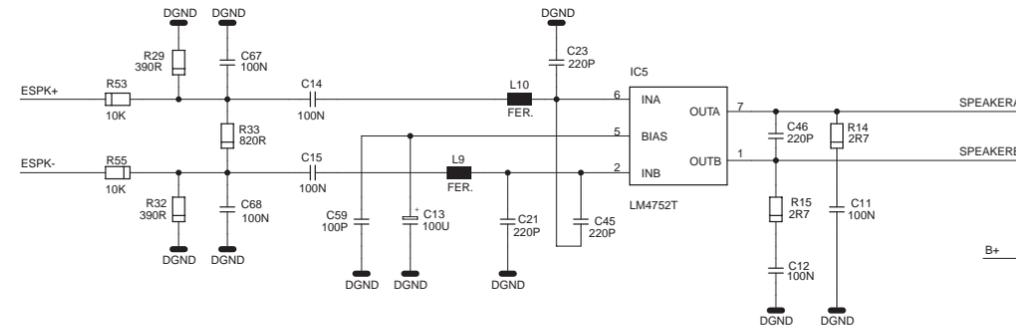


Sub Board - Top Side



Sub Board - Power Supply Schematic (1)

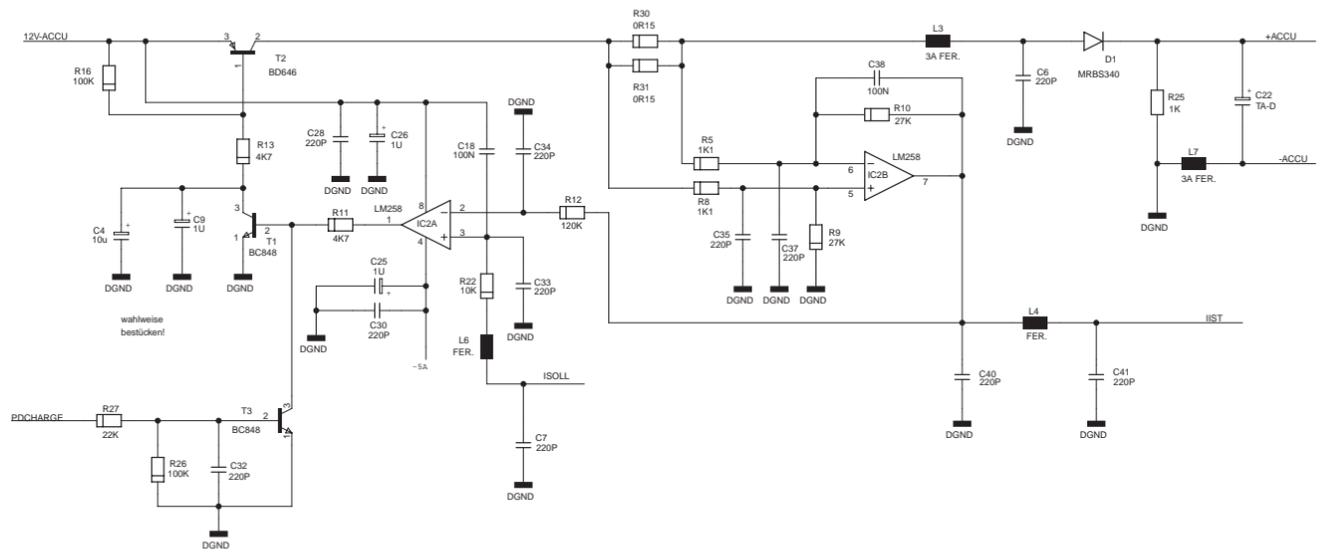
ZWG0130168-A



R33 nicht bestücken

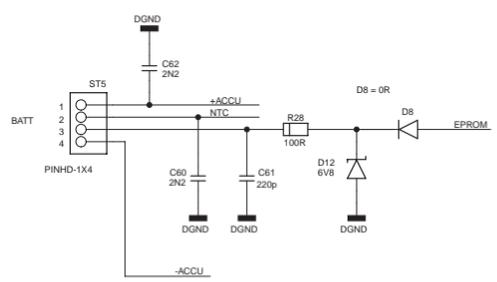
ZWG0130169-A

Sub Board - Audio Amplifier Schematic

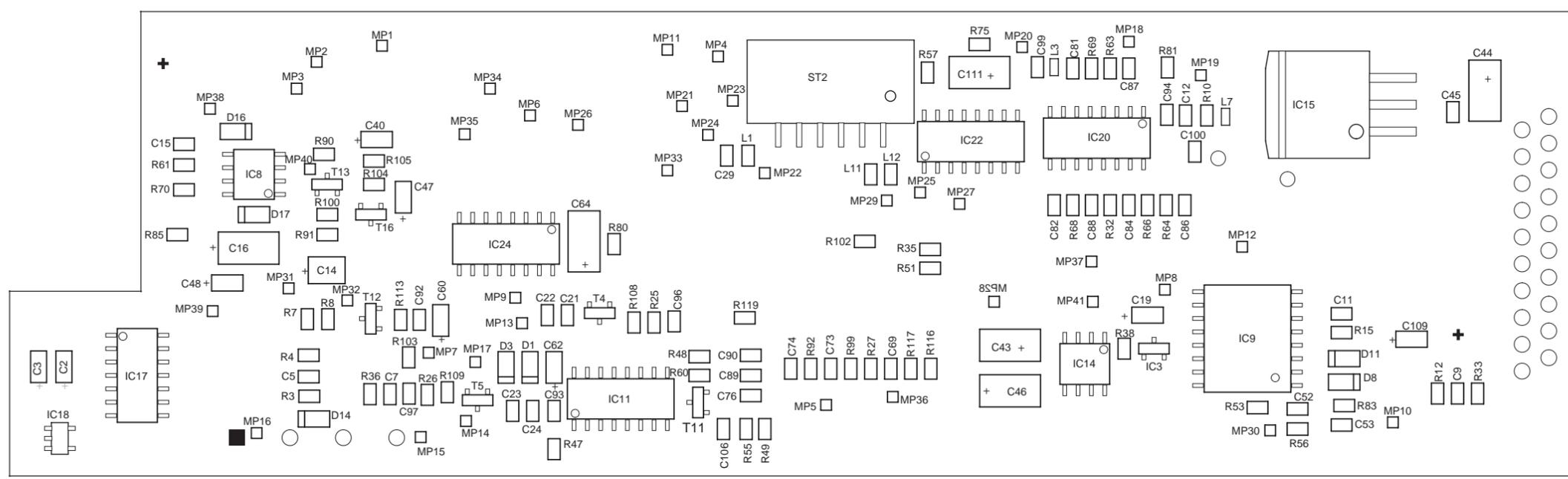


wahlweise bestücken!

ZWG0130170-A

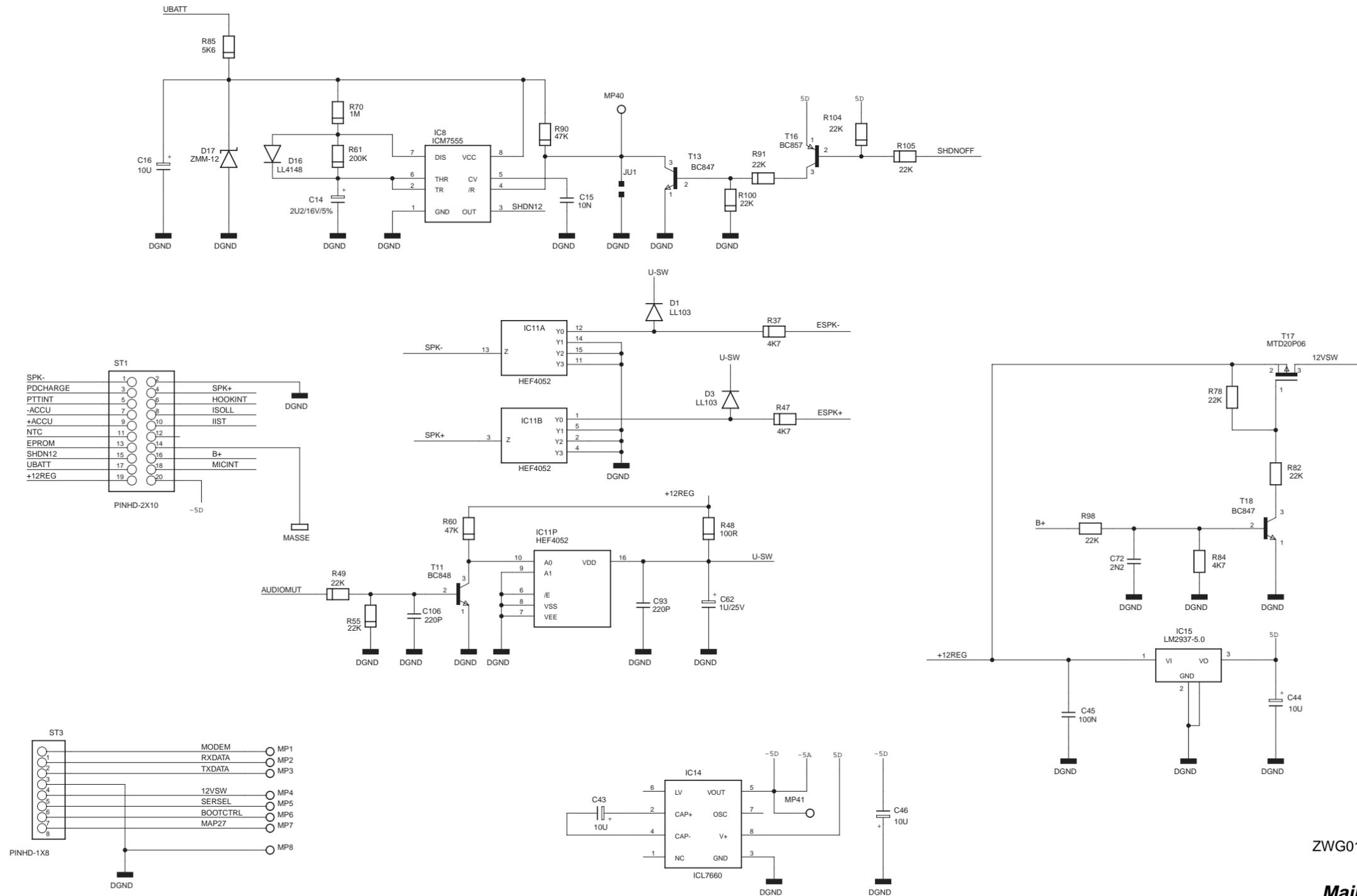


Sub Board - Charger Schematic (1)



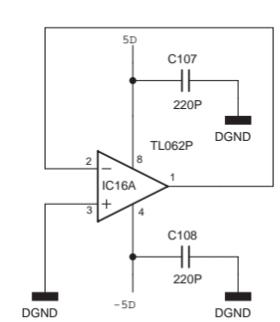
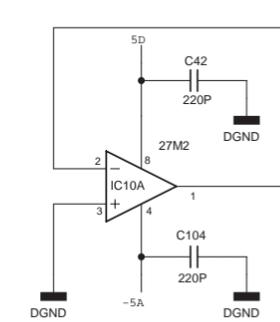
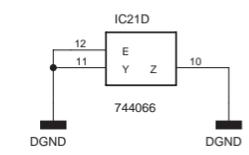
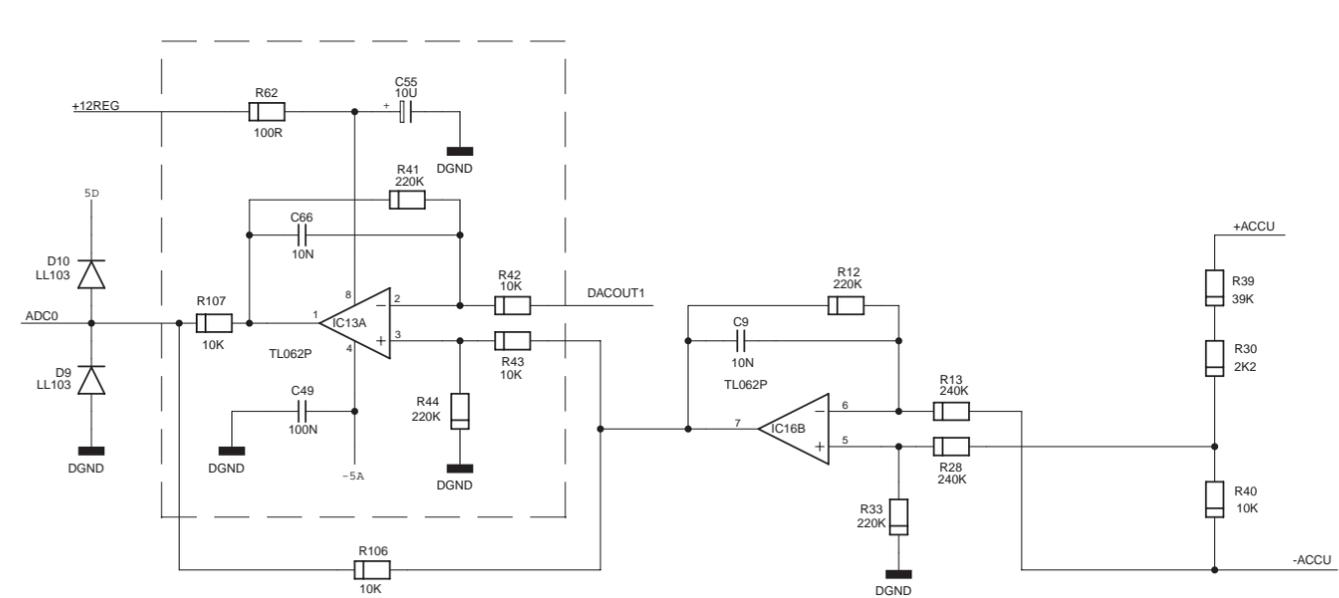
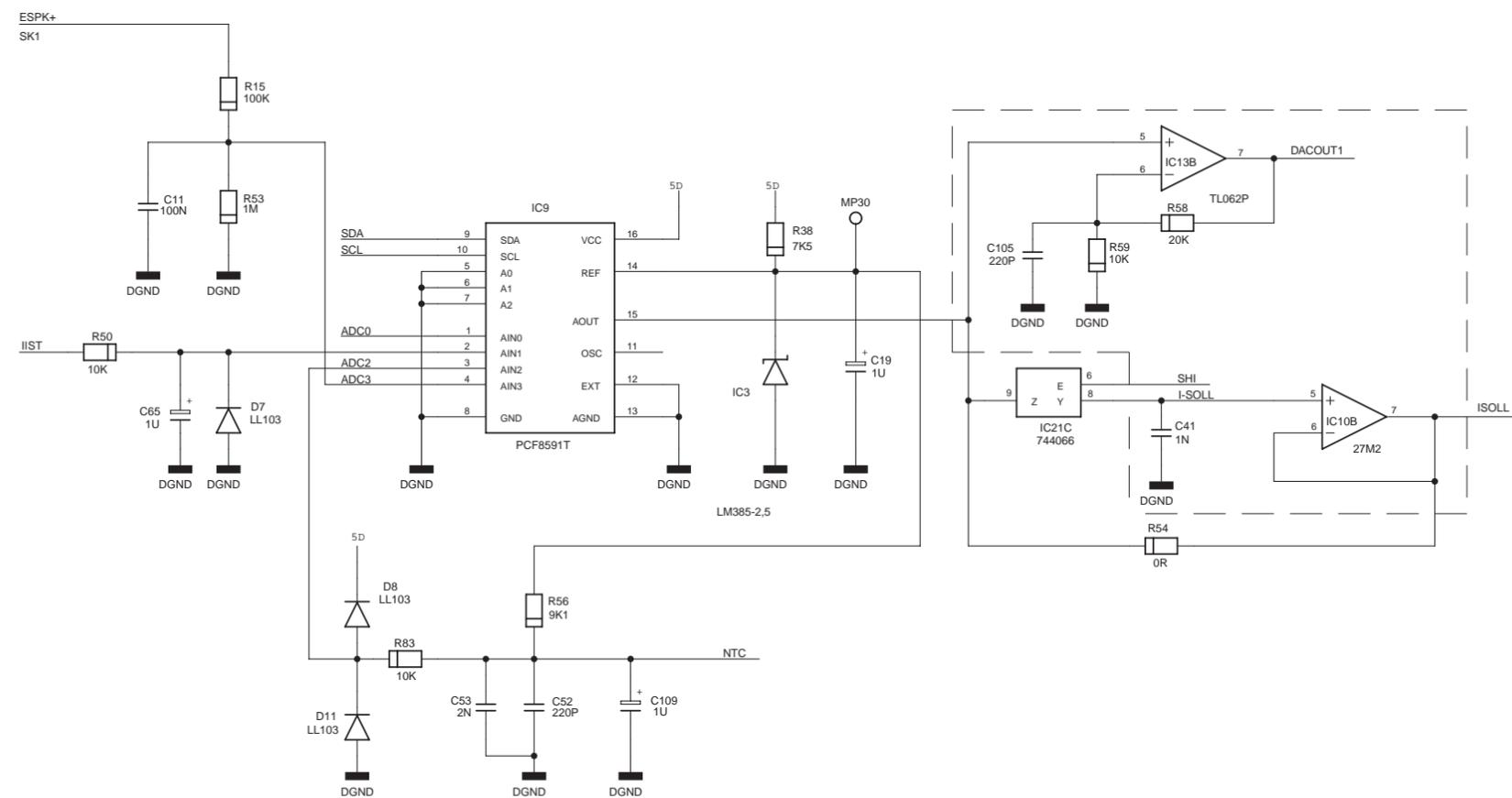
ZWG0130178-A

Main Board - Bottom Side



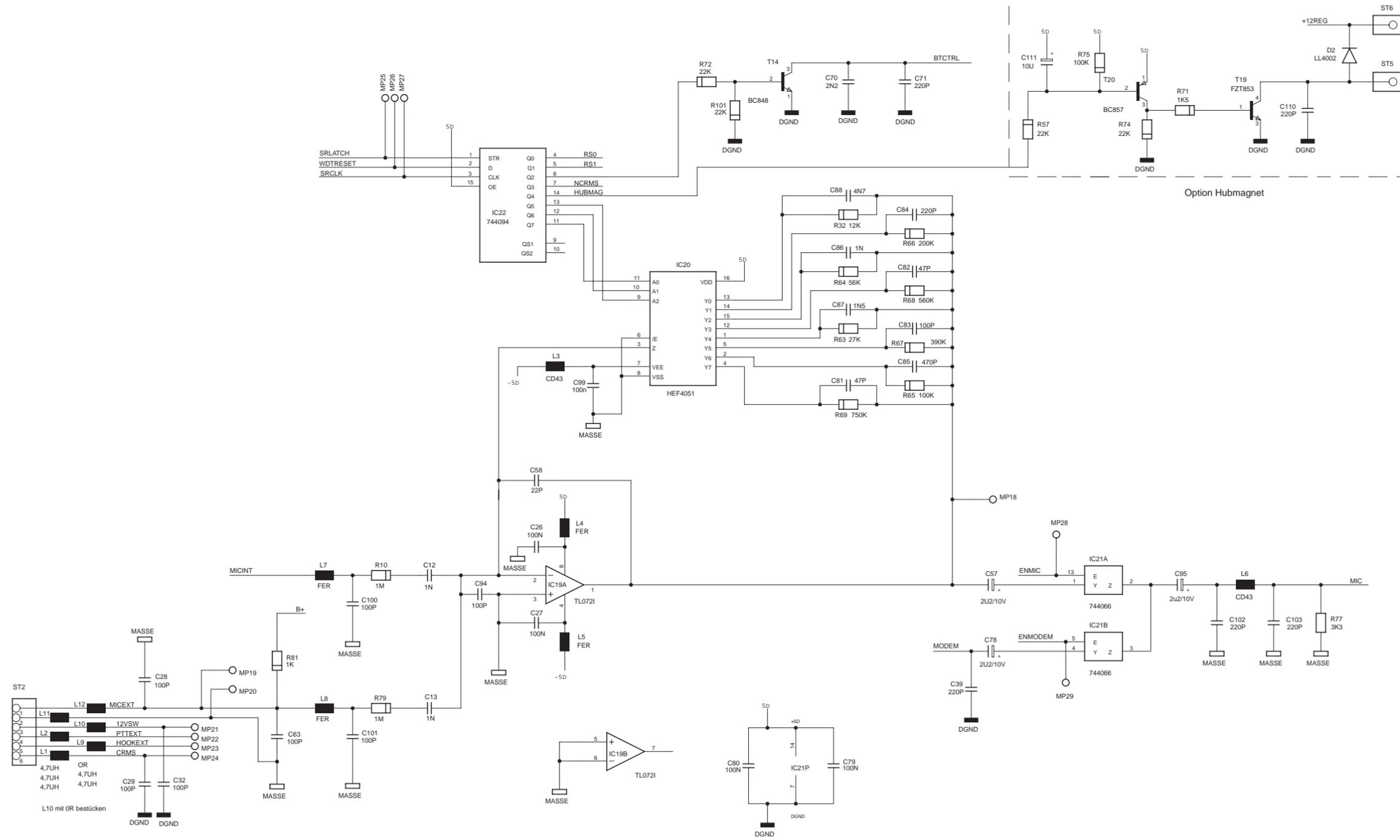
ZWG0130176-A

Main Board - Power Supply Schematic (2)



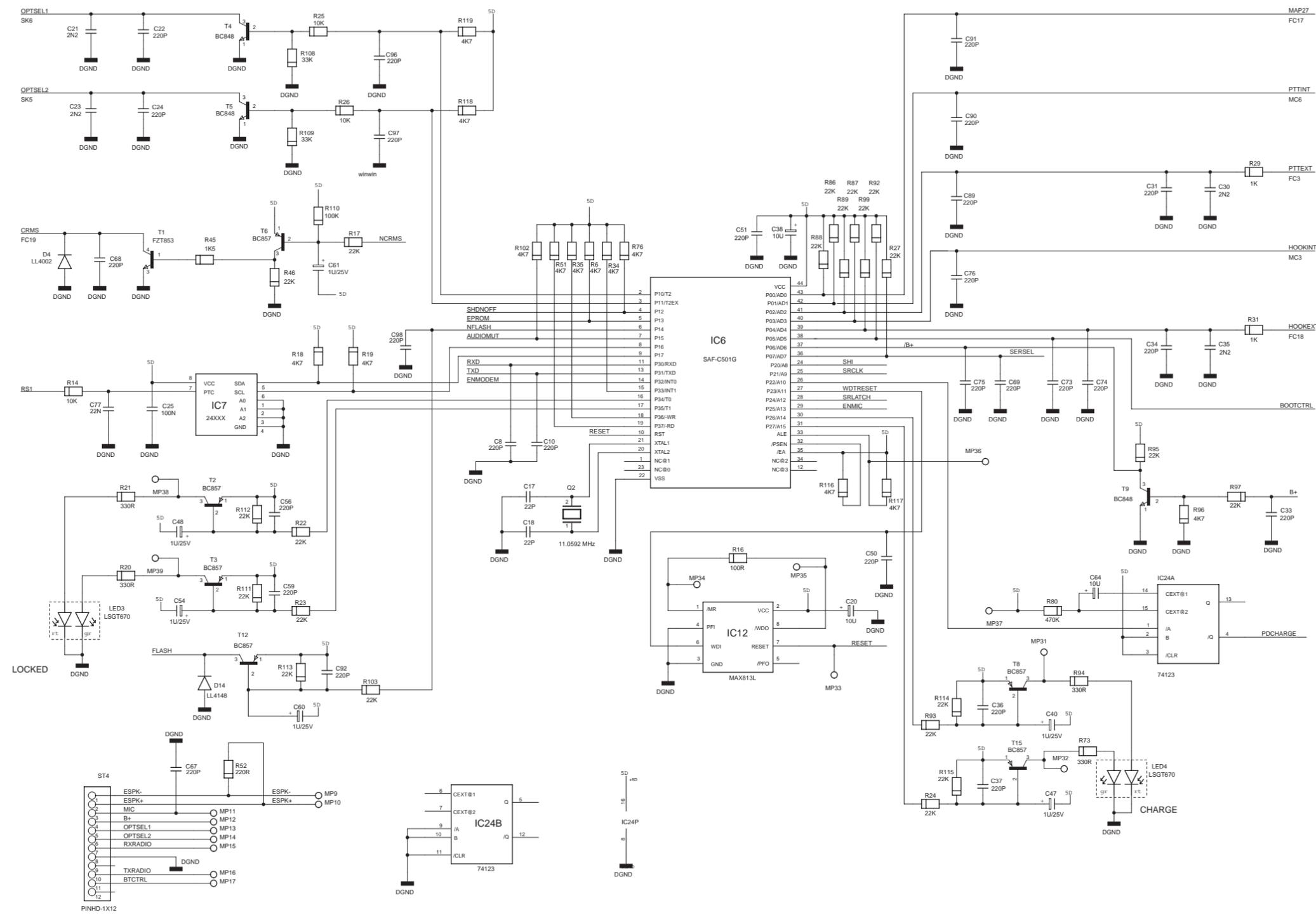
ZWG0130173-A

Main Board - Charger Schematic (2)



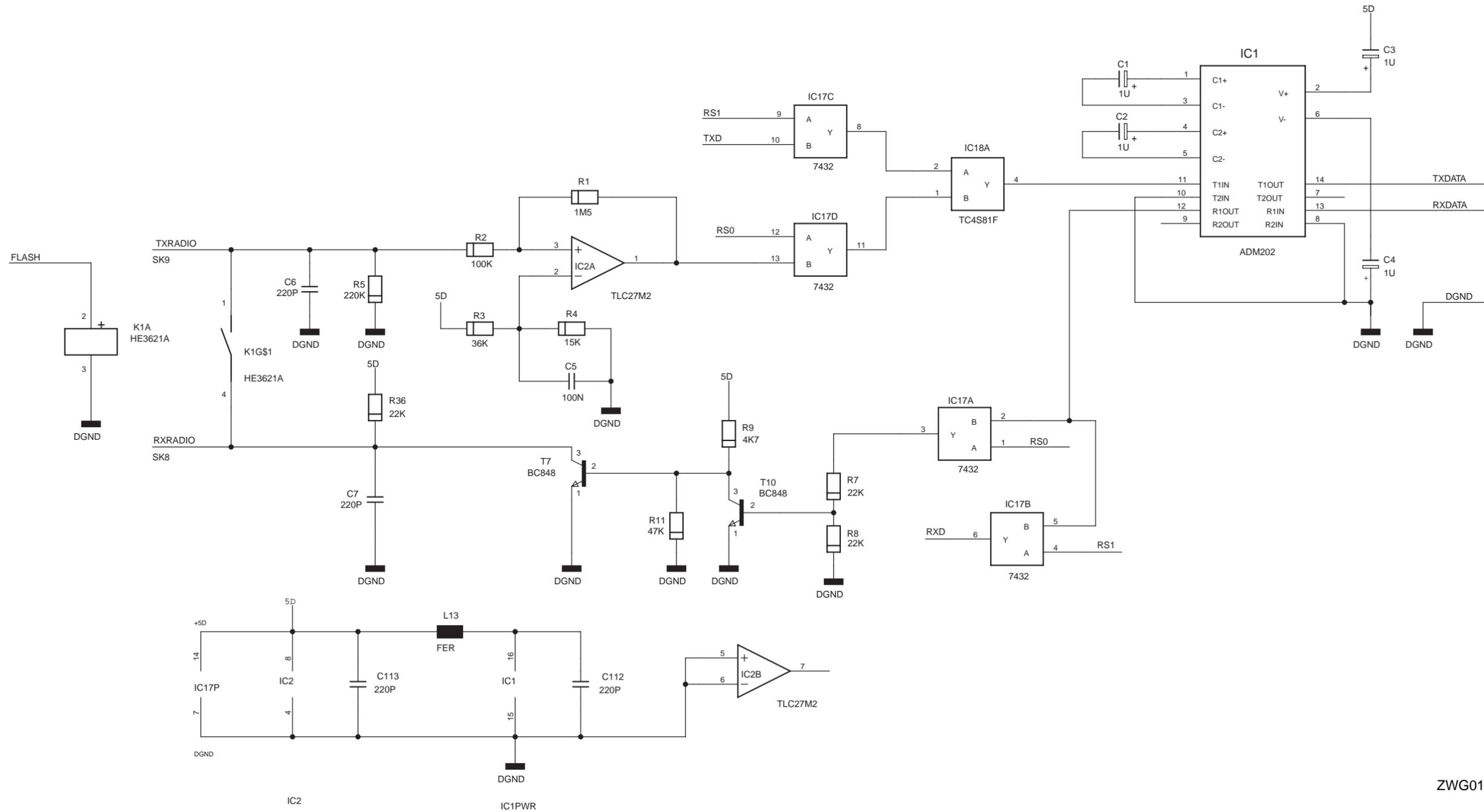
ZWG0130174-A

Main Board - Microphone Preamplifier Schematic



ZWG0130175-A

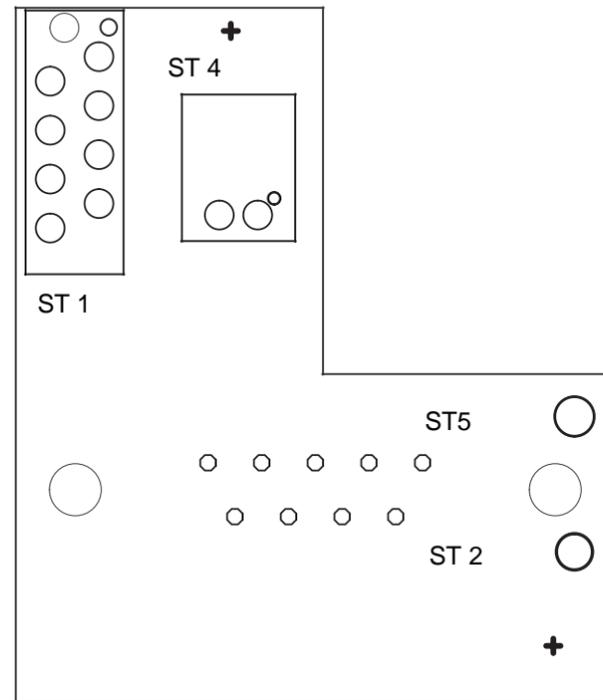
Main Board - Microprocessor Schematic



ZWG0130172-A

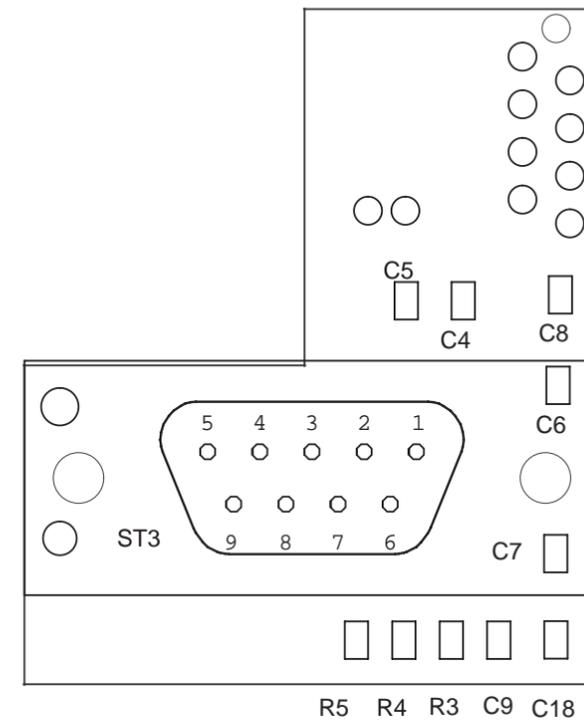
Main Board - RS232 Interface Schematic (1)

1.7 RS232 Interface PCB



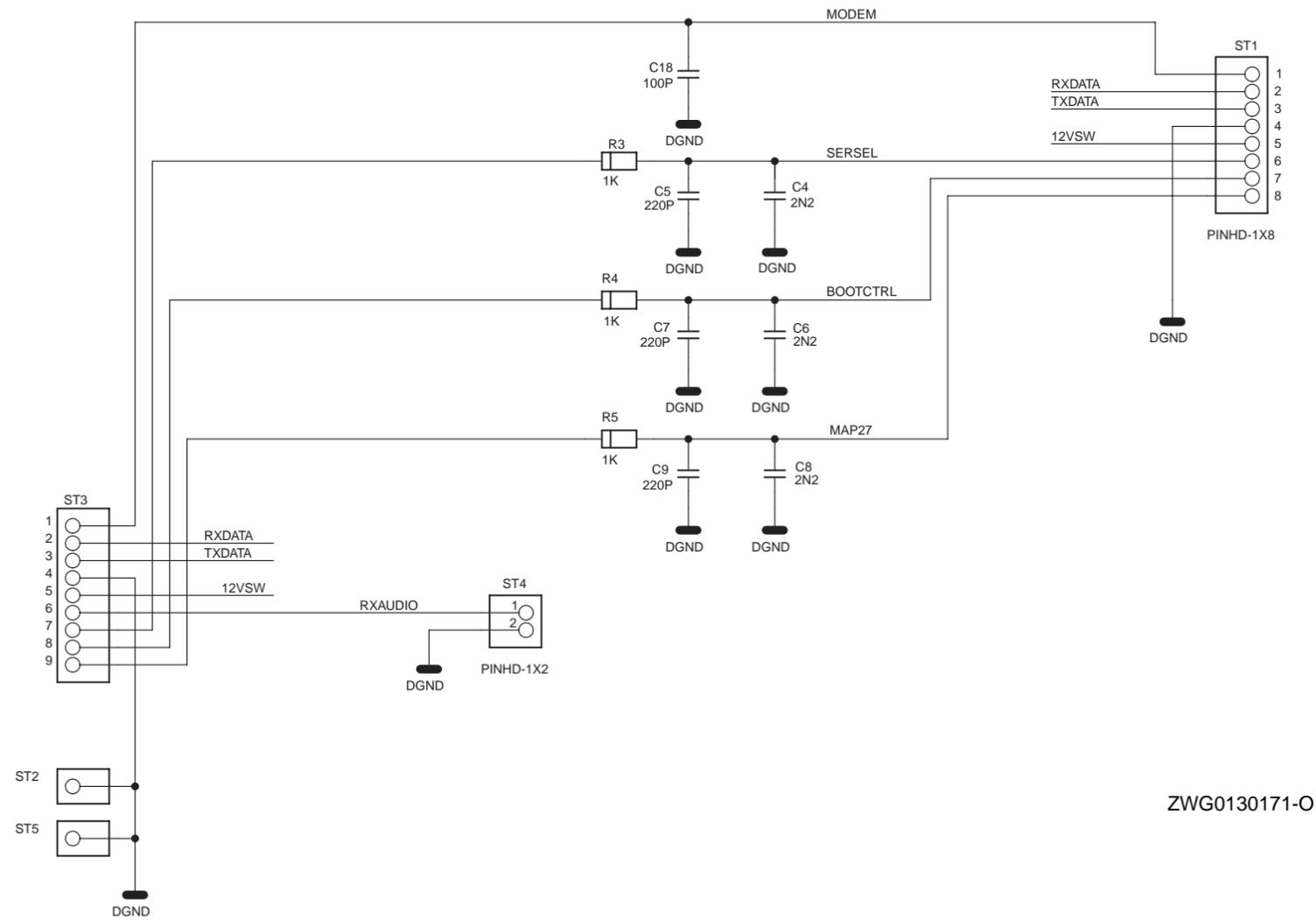
ZWG0130179-O

RS232 Interface PCB - Top Side



ZWG0130180-O

RS232 Interface PCB - Bottom Side



ZWG0130171-O

RS232 Interface - Schematic (2)

© 2000 by Motorola, Inc.
8000 W. Sunrise Blvd., Ft. Lauderdale, FL 33322

Ⓜ, Motorola, and Professional Radio are marks of Motorola, Inc.
Printed in U.S.A. 09/00. All Rights Reserved

Ⓜ, Motorola, y Radios Profesionales son marcas de Motorola, Inc.
Impreso en EE.UU. 09/00. Todos los derechos reservados.

Ⓜ, Motorola, e Rádios Profissionais são marcas da Motorola, Inc.
Impresso nos EUA 09/00. Todos os direitos reservados.

Ⓜ, Motorola, et Radio Professionnel sont des marques de Motorola, Inc.
Imprimé aux Etats-Unis. 09/00. Tous droits réservés.



68P81093C79-O