MOTOROLA

POCSAG RADIO PAGER

LX2 *plus* / LX2 *advanced*
LX4 *plus* / LX4 *advanced*
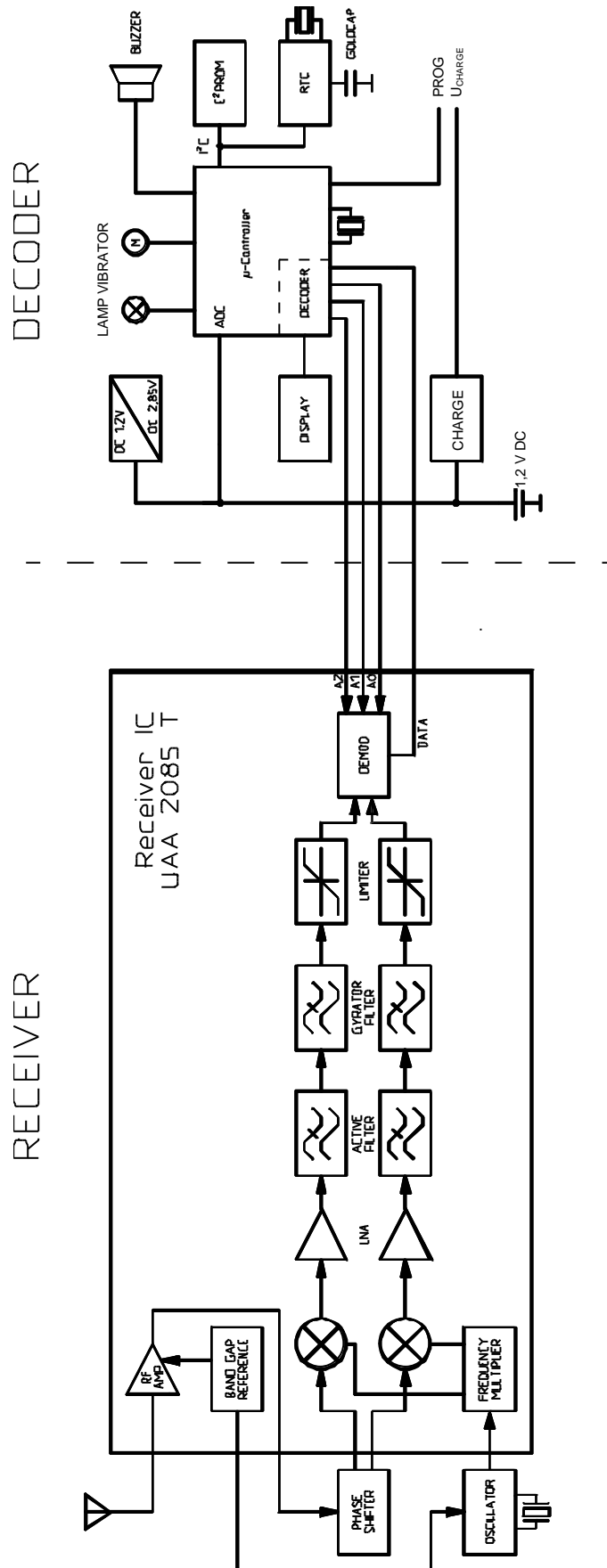
and CHARGING UNITS

Contents

Service and Maintenance/ Repair

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1 Block Schematic Diagram

2 Technical Data

2.1 Pager

PCB No.	**227.02.xx (Decoder)**
	227.10.xx (Receiver)

Frequency Range:	137.975 .. 174MHz
Channel Separation:	20 / 25kHz
No. of Channels:	1
Code Format:	POCSAG
	programmable baud rate
	(512, 1200, 2400 Baud)
Sensitivity body-worn (typ.):	
at 512 Baud	5µV/m
at 1200 Baud	7µV/m
at 2400 Baud	9µV/m
Antenna:	built-in loop antenna
External Connections:	for charging and signalling
	to/ from charger or programmer
Operating Voltage:	1.2V DC (AAA cell)
	NiCd cell e.g.250mAh
	or NiMH cell e.g.500mAh
	or primary cell (not chargeable)
Temperature Range:	
Operation	-10 ... +55°C
Storage without battery	-40 ... +80°C
Degree of Protection:	IP 52
Size:	78mm x 52mm x 19mm
Weight :	65g, battery inclusive
German BOS Approval:	DME II – 14 / 02
Conformaty:	Directive 1999/5/EG

2.2 Charger

PCB No.	**228.01.xx**
AC/ DC Adapter:	
primary	230V AC
secundary	6V DC / 400mA
Charging current of pager cell:	
Accelerated Charge	appr. 100mA
Trickle Charge	appr. 2.5mA
Socket for external Alert Device:.	
Maximum load to relay	30V DC / 1A
Power to external	appr. 6V DC / max. 175mA
Alert Device	
AF output frequency	appr. 1.2kHz
Socket for external antenna:	BNC
Indicators:	
Charge lamp	green / yellow
Alert lamp	red
Size:	appr. 106mm x 93mm x 60mm
Charging Unit with acoustical alert only:	
built-in Alert Buzzer	appr. 2.3kHz

2.3   Pager

PCB No.   **227.01.xx (Decoder)**
                                              or 230.01.xx (Decoder)
                                              227.10.xx (Receiver)

Frequency Range:	137.975 .. 174MHz
Channel Separation:	20 / 25kHz
No. of Channels:	1
Code Format:	POCSAG
	programmable baud rate
	(512, 1200, 2400 Baud)
Sensitivity body-worn (typ.):	
at 512 Baud	3µV/m
at 1200 Baud	4.5µV/m
at 2400 Baud	6µV/m
Antenna:	built-in loop antenna
External Connections:	for charging and signalling
	to/ from charger or programmer
Operating Voltage:	1.2V DC AAA cell (LX2) / AA (LX4)
	NiCd or NiMH cell
	or primary cell (not chargeable)
Temperature Range:	
Operation	-10 ... +55°C
Storage without battery	-40 ... +80°C
Degree of Protection:	IP 52
Size:	LX2: appr. 78 x 52 x 19mm
	LX4: appr. 80 x 54 x 19mm
Weight:	(incl. battery) appr. 65g (LX2) / 85g (LX4)
German BOS Approval:	LX2: DME II – 17 / 04
	LX4: DME II – 18 / 04
Conformaty:	Directive 1999/5/EG

2.4   Charger

PCB No.   **228.06.xx**

AC/ DC Adapter:	
primary	230V AC
secundary	6V DC / 400mA
Charging current of pager cell:	
Accelerated Charge (LX2 / LX4)	max. appr. 100/350mA
Trickle Charge	appr. 2.5mA
Socket for external Alert Device:	
Maximum load to relay	30V DC / 1A
Power to external	appr. 6V DC / max. 175mA
Alert Device	
AF output frequency	appr. 1.2kHz
Socket for external Antenna:	BNC
Indicators:	
Charge lamp	green / yellow
Alert lamp	red
Size:	appr. 106mm x 93mm x 60mm
Charging Unit with acoustical alert only:	
built-in Alert Buzzer	appr. 2.3kHz

3 Theory Of Operation

3.1 Receiver

LX2 plus / advanced, LX4 plus / advanced: PCB. No. 227.10.xx

3.1.1 General

The receiver of the POCSAG pager is a direct conversion receiver. The received radio signal is directly mixed to the AF band and no intermediate frequency exists. A discrete crystal oscillator stage and a frequency tripler stage form the necessary local oscillator for down-mixing. A large scale integrated circuit (UAA2085T) contains the mentioned frequency tripler, a low noise RF amplifier, mixer, low- and high-pass filters, the demodulator, automatic gain control, data filter and mode control function. By using two identical channels with quadrature demodulator demodulating the digital FSK modulated signal is very effective and sensitive.

3.1.2 Antenna, LNA and Mixer

A tuned single loop antenna is used to receive RF signals. The loop and capacitors C112, C185, C111 and the trimming capacitor C110 form a resonance parallel circuit. CR102 is a protecting diode at the LNA input. The RF amplifier is biased via R122 and its output is connected to the tuned parallel circuit consisting of L120 / C121. The amplified and filtered RF signal passes a phase shifter/ balun circuit formed by C126, C131, C132, C133, C134, L121, L131 und L132. The output of the balun has two signals which are equal in amplitude but differ in phase by 180 degrees. The additional phase shift of C131, L131, C134 und L132 creates signals at -45°, 45°, 135°, and 225°. The signals at 45° and 225° become the differential I (In-phase) signals and the signals at –45° and 135° become the differential Q (Quadrature) signals being connected to the I and Q mixers.

3.1.3 Local Oscillator

The parts connected to Q102 form a Pierce oscillator being controlled by Y101. C164 allows trimming the frequency. Resonance of the parallel circuit L161, C165, C164 is below the crystal frequency, so the crystal is forced to oscillate in third overtone mode, not in fundamental mode. The multiplier stage (inside U101) produces the symmetrical oscillator signal (three times the crystal frequency) filtered by the circuit L150, L151, C150 and C154.

3.1.4 Mixer Output / Demodulator / Decoding

The output signals of the I and Q mixers are filtered by highly selective band-pass filters, limited and fed to the demodulator circuit. The demodulator detects the positive or negative phase difference between the I and Q channels. The value of resistor R140 sets the bandwidth of the filters with respect to different channel separation. The resulting recovered Data signal passes a digital filter (Post detection filter, PDF), and is available for the POCSAG decoder at socket J101. Via three line control interface A0, A1, A2 the PDF can be adapted to the used baud rate.

3.2   Decoder

LX2 plus: PCB No. 227.02.xx
LX2 plus / advanced: PCB No. 227.01.xx
LX4 plus / advanced: PCB No. 230.01.xx

3.2.1   Power Supply

PCB No. 227.02.xx:
The DC/DC up-Converter IS5 produces the output voltage of 2.85V supplying the digital section with the help of components L3, D6, C20, C21. The diode D8 protects the converter from too high input voltages or from a battery connected the wrong way round. C23, C24 decouple the converter from the battery.
The components T1, R3, R7, R11 and C10 are necessary for a stable start behavior of the controller.
Transistors T3, T4 turn the receiver on and off.

PCB No. 227.01.xx / PCB No. 230.01.xx:
The DC/DC up-Converter IS5 produces the output voltage of 2.4V suppling the digital section with the help of components L3, D6, C20, C21, R17 and R25. The diode D8 protects the converter from too high input voltages or from a battery connected the wrong way round.

3.2.2   Receiver Interface

All signals necessary to control the receiver are routed to the plug ST1. Resistors R14, R15, R19 und R20 serve as RF decoupling components.

PCB No. 227.02.xx:
High supply voltage 2.85V is decoupled by L1, low supply voltage 1.2V is decoupled by L2, C17 and C22.

PCB No. 227.01.xx / PCB No. 230.01.xx:
High supply voltage 2.40V is decoupled by L1 and R6, low supply voltage 1.2V is decoupled by L2, C17 and C22.

3.2.3   Charger and Programmer Interface, Charging Circuit

There is an asynchronous serial interface allowing data exchange between pager and charger and programming the pager (data, battery voltage, 0V).
The charging Unit controls the charging procedure of the pager`s battery. Charger and pager exchange data regarding the charge level via wire P2.

3.2.4   Real-time Clock and Memory

Real-time clock circuit IS1 provides time and date. The clock continues running after removing the battery for a period of appr. 2 days, because it is buffered by Goldcap C2.

PCB No. 227.02.xx:
IS3 and IS4 are non-volatile memory circuits, holding all necessary parameters for a correct operation of the pager (IS4: RIC addresses, alert key words, activated functions, Menu prompts, ... IS3: selected settings, received messages, ...).

PCB No. 227.01.xx / PCB No. 230.01.xx2:
IS4 is a non-volatile memory holding all necessary parameters for a correct operation of the pager. Additionally, all received messages are stored by IS4.

3.2.5 Display

The display shows the incoming messages and the operator menues. The display is parallel driven. The voltage divider sets the voltage reference of display LCD1. Components C1, C3, C5, C6, C11, C12, C13, C15, C19, R1 and R2 are necessary in order to generate the LCD voltage of appr. 7.2V. The LCD can be back-lighted by lamps H2 and H3.

3.2.6 Controller

PCB No. 227.02.xx:
Microcontroller IS2 controls all functions like decoding radio data , alerting, displaying messages , back-lighting, ...
If self-reception occurs, the controller can be operated with a different crystal frequency of Q2. The following frequencies can be used and recognized by the controller firmware, automatically:

firmware F2270112 and previous	*firmware F2270113 and later*
3.579545 MHz	3.532800 MHz
3.686400 MHz	3.579545 MHz
4.000000 MHz	3.686400 MHz
4.032000 MHz	3.840000 MHz
4.096000 MHz	3.993600 MHz
	4.000000 MHz

PCB No. 227.01.xx / PCB No. 230.01.xx:
There are two microcontrollers IS2 and IS6. Controller IS6 decodes radio data and announces reception towards IS2 via serial interface. Controller IS2 controls all functions: operating, signalling, displaying messages.
If self-reception occurs, the controller can be operated with a different crystal frequency of Q2 = Q3. The following frequencies can be used and recognized by the controller firmware, automatically:

3.532800 MHz
3.579545 MHz
3.686400 MHz
3.840000 MHz
3.993600 MHz
4.000000 MHz

3.3 Charging Unit (PCB No. 228.01.xx)

Charging Unit with PCB No. 228.01.xx

3.3.1 Power Supply

The Charging Unit is powered by an external AC/ DC Adapter plugged into the wall power socket (U_{AC} = 230V, f = 50Hz). The adapter delivers an unstabilized DC voltage $U_=$ = 6V at I_L = 0,4A to supply the Charging Unit.

The adapter is connected to the Charger using socket BU1 of the Charger.
The electrolythic capacitor C12 removes residual noise and buffers the supply voltage so that mechanically caused short connection interrupts cannot lead to malfunction. Additionally components R22 (Varistor) and D7 (Supressor Diode) can be placed to prevent over-voltage problems.

To supply the internal microcontroller an integrated voltage regulator (IS2) produces a stable 3V supply. Capacitors C7, C8 und C9 are necessary for a stable operation of the regulator. Diode D3 prevents supply via the output whenever the cable of the adapter is removed.

C13 is a decoupling capacitor placed near to the microcontroller. Resistor R49 discharges the capacitors quickly if the Charger is turned off by removing the adapter cable. This is to prevent the microcontroller from working with supply voltages outside the specified range.

A decoupled voltage to supply external devices is available on socket BU2. That supply is current-limited by R20 and protected by fuse SI1.

3.3.2 Charge Current

The chargeable battery inside the pager gets charged whenever one of the two current paths is turned on (switching transistor T1 or T10 enabled by the microcontroller). The respective base resistor R5 or R19 is drawn to ground by an open-drain port of the controller. R4 and R18 are used to make sure that the transistors turn off properly.
Charging is done by a more or less constant current. The current is set by the respective limiting resistance. In case of the high charge current (T1 turned on), only resistor R7 is effective:

$I_{L\ accelerated} \approx (U_= - U_{batt}) / R_7 = (6V-1,4V) / 47\Omega = 98mA$,

during normal charging (T10 turned on) the current is:

$I_{L\ normal} \approx (U_= - U_{Akku}) / (R_7 + R_{23} + R_{24}) = (6V-1,4V) / (47\Omega + 56\Omega + 68\Omega) = 27mA$.

Diode D12 prevents the battery from being discharged when no charge current is available and the inductor L3 guards against RF interference.

The microcontroller supervises voltages coming from the divider R34, R35 and serial resistor R12 and smoothed by capacitors C1 and C10, respectively. L5 again is a RF choke. Zener diode D11 limits the voltage to stay below the maximum allowable input value of the microcontroller.
The measured voltage difference is used to calculate a charge account.

Transistor T13 is a current sink, activated during self-diagnostic or in order to discharge the battery. Resistor R43 limits the current and inductor L4 is a RF choke. Transistor T13 is turned on via resistor R45 by means of "active high".

3.3.3   Microcontroller

All the controlling tasks are done by the 8 bit controller circuit IS1. The clock is generatedby the internal oscillator. External components belonging to the oscillator are the capacitors C4 , C5 and crystal Q1. Transistor T3 with additional components R8, R9, R16 and C6 form the necessary reset circuit.

The UART, implemented in the controller, allows communication with the pager. The signals RxD and TxD are coupled to one wire using diode D10. Resistor R15 serves as a „pull-up" resistor connected to the communication wire which is used in both directions. By placing additional components marked * and using a suitable software, the charger can be upgraded to be able to work as a programmer.

3.3.4   Temperature Supervision

The Charging Unit supervises the ambient temperature during the charging procedure and varies the charge current accordingly, i.e. accelerated charge is permitted within a specified temperature range, only. The voltage of the resistive devider R31/ R32 is measured. R31 is a temperature-dependent resistor.

3.3.5   External Alert Devices

After reception of an alert, relay REL1 is activated by T6, R13 and R14. Resistor R30 limits the current and D2 serves as a free-wheeling diode. The time the relay stays active , i.e.the time the working contacts REL1A are closed, can be programmed (pager programming).

Furthermore a square signal of appr. 1.2 kHz is output via transistor T4 (base resistor R2). This transistor can be made up with external components, e.g. loudspeaker.

As an option, a switching circuit (R41, R42 and T12) can be placed which can drive a suitable Buzzer for additional loud alert.

The alert can be erased by pressing button TA1 on the charger. The switching signal is filtered by resistor R47 and capacitor C11.

3.3.6   Indicators

Light emitting diodes D4, D8 or D9 indicate the operation conditions. The necessary current is sinked by the microcontroller via resistors R6, R10 and R33. Transistor T11 together with resistors R38 and R39 form the global switch to supply the LED`s. This would allow a dimming function which is not built in at the moment.

3.3.7   External Antenna

An external antenna can be connected to socket BU3 which is connected to a coupling loop in order to couple the received signal to the pager.

3.4 Charging Unit (PCB No. 228.06.xx)

Charging Unit with PCB No. 228.06.xx

3.4.1 Power Supply

The Charging Unit is powered by an external AC/ DC Adapter plugged into the wall power socket (U_{AC} = 230V, f = 50Hz). The adapter delivers an unstabilized DC voltage $U_=$ = 6V at I_L = 0,4A to supply the Charging Unit.
The adapter is connected to the Charger using socket BU1 of the Charger.
The electrolythic capacitor C12 removes residual noise and buffers the supply voltage so that mechanically caused short connection interrupts cannot lead to malfunction. Additionally components R22 (Varistor) and D7 (Supressor Diode) can be placed to prevent over-voltage problems.
To supply the internal microcontroller an integrated voltage regulator (IS2) produces a stable 3V supply. Capacitors C7, C8 und C9 are necessary for a stable operation of the regulator. Diode D3 prevents supply via the output whenever the cable of the adapter is removed.
C13 is a decoupling capacitor placed near to the microcontroller. Resistor R49 discharges the capacitors quickly if the Charger is turned off by removing the adapter cable. This is to prevent the microcontroller from working with supply voltages outside the specified range. A decoupled voltage to supply external devices is available on socket BU2. That supply is current- limited by R20 and protected by fuse SI1.

3.4.2 Charge Current

The chargeable battery inside the pager gets charged whenever one of the three current paths is turned on (switching transistors T1, T52 or T53 eneabled by the microcontroller). The respective base resistor R50, R51 or R52 is drawn to ground by an open-drain port of the controller.

Charging is done by a more or less constant current. The current is set by the respective limiting resistance. The charge currents are:

$I_{L1} \approx (U_=-U_{batt})/(R57+R7) = (6V-1,4V)/(2,2\Omega+10\Omega) = 375mA$
$I_{L2} \approx (U_=-U_{batt})/(R58+R7) = (6V-1,4V)/(33\Omega+10\Omega) = 105mA$
$I_{L3} \approx (U_=-U_{batt})/(R59+R7) = (6V-1,4V)/(120\Omega+10\Omega) = 35mA$

The current paths are chosen according to the type of pager and the programmed battery capacity. For LX2 and LX4 having battery capacities below 1000mAh only currents I_{L2} and I_{L3} are used. In case of LX4 with larger battery capacity I_{L1} is used additionally.

Resistor R7 is used as an additional "sense" resistor for current measurement. Voltage dividers R54/ R55 and R34/ R35 reduce the voltage taken from the two terminals of R7 to be inside the specified range of the microcontroller. Inductors L4, L5 and capacitors C1 and C10 are used for smoothing and preventing RF interference. The measured voltage difference is used to calculate a charge account.

Transistors T50 and T51 are current sinks, activated during self-diagnostic or discharge of the battery. They are turned on via resistors R45 and R53 by means of "active high".

3.4.3   Microcontroller

All the controlling tasks are done by the 8 bit controller circuit IS1. The clock is generated by the internal oscillator. External components belonging to the oscillator are the capacitors C4 , C5 and crystal Q1. Transistor T3 with additional components R8, R9, R16 and C6 form the necessary reset circuit.

The UART, implemented in the controller, allows communication with the pager. The signals RxD and TxD are coupled to one wire using diode D10. Resistor R15 serves as a „pull-up" resistor connected to the communication wire which is used in both directions.

3.4.4   Temperature Supervision

The Charging Unit supervises the ambient temperature during the charging procedure and varies the charge current accordingly, i.e. accelerated charge is permitted within a specified temperature range, only. The voltage of the resistive devider R31/ R32 is measured. R31 is a temperature-dependent resistor.

3.4.5   External Alert Devices

After reception of an alert, relay REL1 is activated by T6 and R13. Resistor R30 limits the current and D2 serves as a free-wheeling diode. The time the relay stays active , i.e.the time the working contacts REL1A are closed, can be programmed (pager programming).

Furthermore a square signal of appr. 1.2 kHz is output via transistor T4 (base resistor R2). This transistor can be made up with external components, e.g. loudspeaker.

As an option, a switching circuit (R41, R42 and T12) can be placed which can drive a suitable Buzzer SU1 for additional loud alert.

The alert can be erased by pressing button TA1 on the charger. The switching signal is filtered by resistor R47 and capacitor C11.

3.4.6   Indicators

Light emitting diodes D4, D8 or D9 indicate the operation conditions. The necessary current is sinked by the microcontroller via resistors R6, R10 and R33.

3.4.7   External Antenna

An external antenna can be connected to socket BU3 which is connected to a coupling loop in order to couple the received signal to the pager.

4   Disassembly/ Assembly Of The Pager

4.1   LX2 *plus* / LX2 *advanced*

4.1.1   Removing / Replacing The Battery

- Slide the door lock away from the battery door.
- Slide the battery door until the locking tabs release.
- Lift the door up to open and remove the battery.

- Replace the battery with correct polarity (+ and – markings).
- Press down and slide the battery door until it is fully closed. Slide the door lock to its fully locked position.

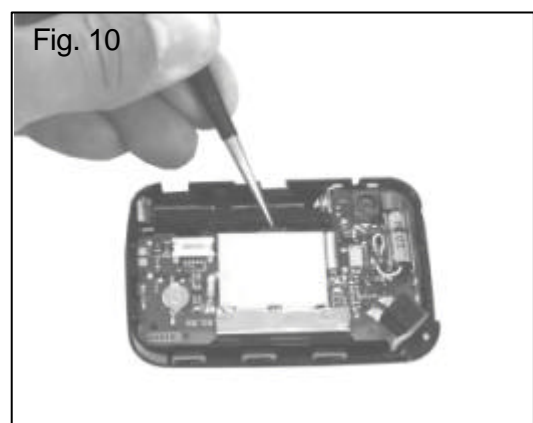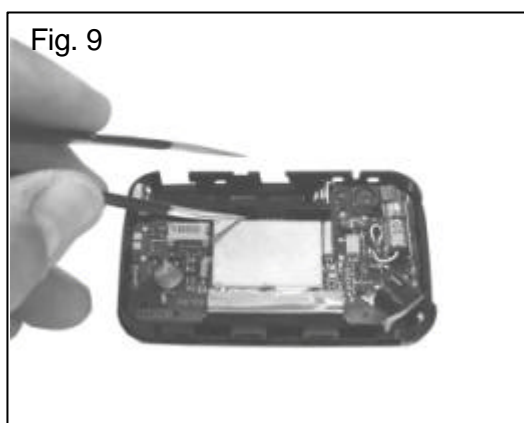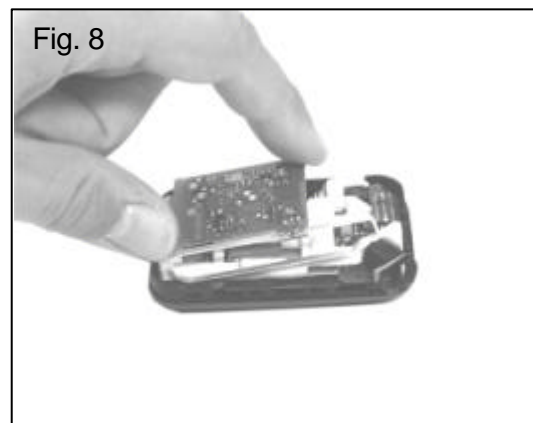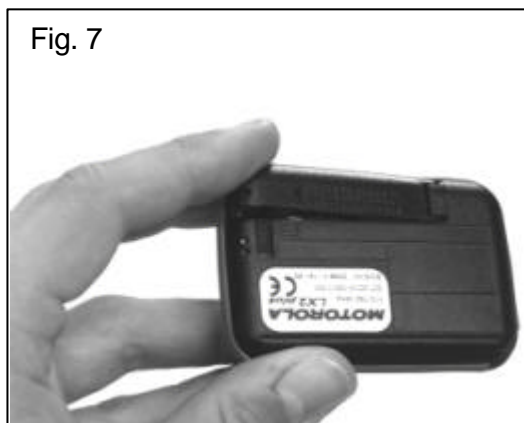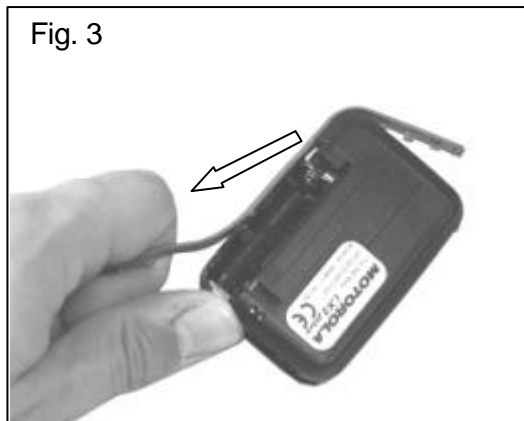### 4.1.2   Removing/ Replacing The Battery Door And Back Housing

- Remove the battery and hold the door open.
- Apply a horizontal force, pull sideways and remove the door (refer to Fig. 1).
- Use a slotted screw driver or similiar to slide both ends of the latch a few millimetres away from the metal pin (refer to Fig. 2) Now lift up the ends of the latch away from the housing. Carefully pull the latch according to the arrow shown in Fig. 3 until it is free.
- Separate the back housing from the front housing (refer to Fig. 4).
  To replace the back housing, align it with the front housing and press back together. The metal pin (for the carrying chain) has to be pushed into the respective hole of the back housing.
- Start replacing the latch at the side opposite to the charging contacts (refer to Fig. 5), place the studs into the zip-holes around the housing (as shown in Fig. 6).
- Align the battery door hinges with the hinge slots on the back housing and push to engage the hinges (refer to Fig. 7). The battery door is properly seated when it can be lifted up and closed easily.
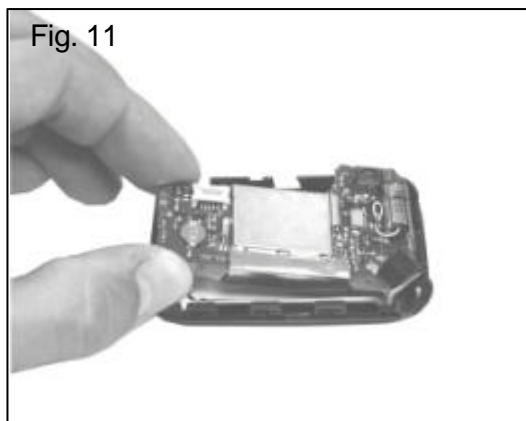
4.1.3   Removing/ Replacing The Receiver Board

- Remove the battery.
- Remove the battery door, the latch and the back housing.
- Gently pry the receiver board up and away from the decoder board (refer to Fig. 8).
- To replace the receiver board, align the interconnect socket on the receiver board with the interconnect plug on the decoder board and press the receiver board down. Do not misalign the shock pad.
- Replace the back housing, the latch and the battery door.
- Replace the battery.

Fig.1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

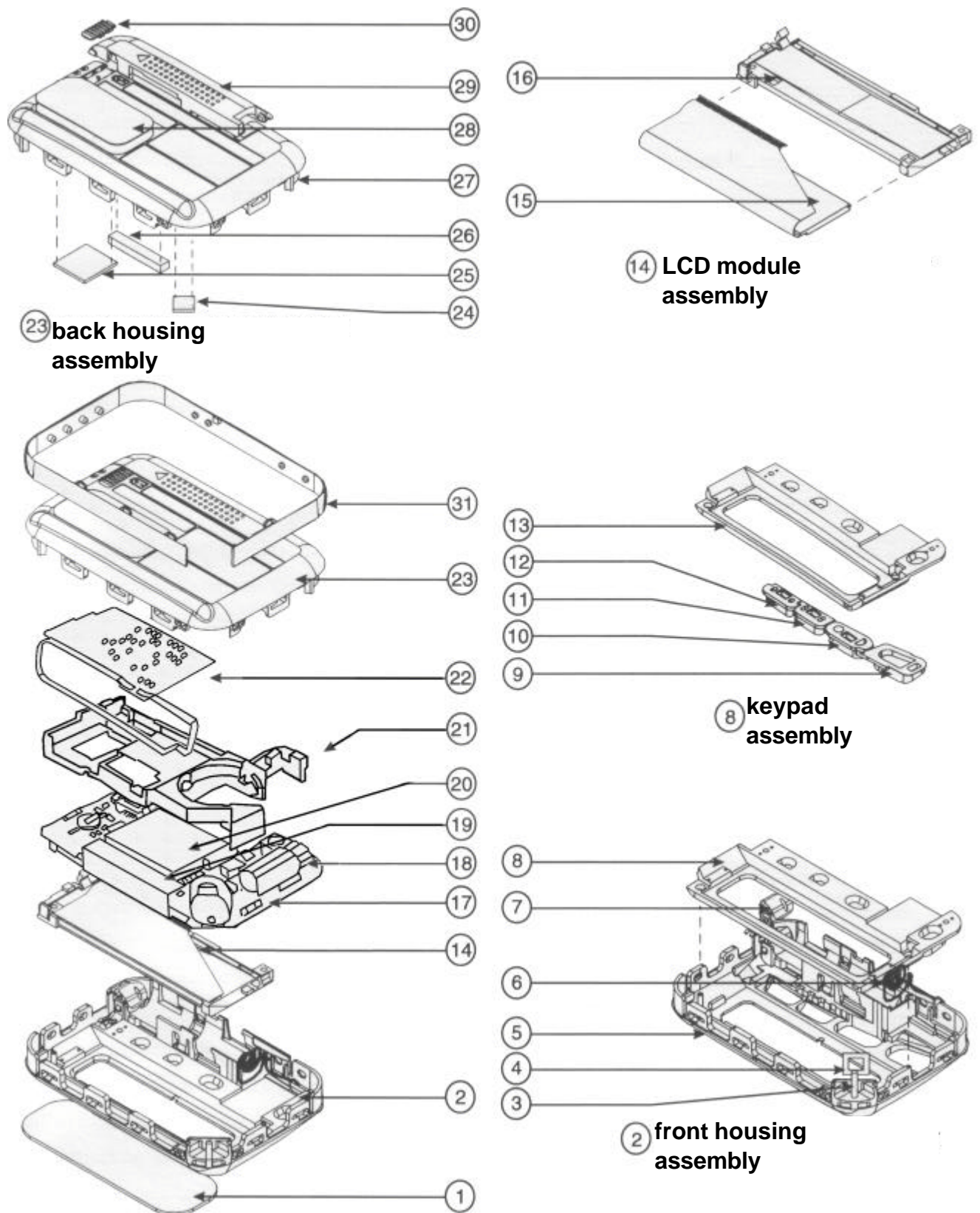Fig. 10

Fig. 11

Fig. 12
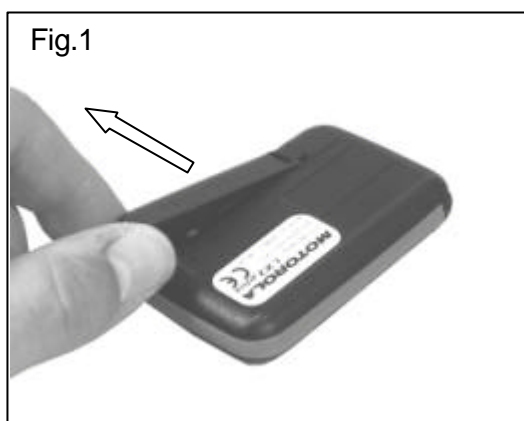
4.1.4 Removing/ Replacing The Decoder Board

- Remove the battery.
- Remove the battery door, the latch and the back housing.
- Remove the receiver board.
- Remove the shock pad.
- Use tweezers or similiar to pull the decoder board catch (refer to Fig. 9).
- Remove the decoder board from the front housing (refer to Fig. 10).

- Starting with the sound transducer insert the decoder board into the front housing and press down (refer to Fig. 11). Be careful: the transducer seal and the keypad must not get out of place!
- Let the decoder board lock to the front housing (catch on the housing, near to the battery compartment).
- Replace the shock pad (refer to Fig. 12).
- Replace the receiver board.
- Replace the back housing, the latch and the battery door.
- Replace the battery.

4.1.5   Exploded View Diagram LX2 *plus* / LX2 *advanced*

(30)
(29)
(28)
(27)
(26)
(25)
(24)

(16)
(15)

(14) **LCD module assembly**

(23) **back housing assembly**

(31)
(23)
(22)
(21)
(20)
(19)
(18)
(17)
(14)
(2)
(1)

(13)
(12)
(11)
(10)
(9)

(8) **keypad assembly**

(8)
(7)
(6)
(5)
(4)
(3)

(2) **front housing assembly**

4.1.6 Spare Parts LX2 *plus* / LX2 *advanced*

Item	Part Number	Description
1	GGM227.06.xx	Lens
2	GGM227.02.xx	Front housing assembly
3	MZS1.6M6X8+0.2	Metal pin 1.6m6X8+0.2 DIN 7
4	GGM227.36.xx +	Grill clothe
	GGM227.39.xx	Transducer seal
5	GGM227.12.xx	Front housing
6	EBM227.15.xx	Contact, battery, negative
7	EBM227.14.xx	Contact, battery, positive
9	GGM227.10.xx	Button "Read", green
10	GGM227.09.xx	Button "Select", red
11	GGM227.08.xx	Button "Right"
12	GGM227.07.xx	Button"Left"
13	GGM227.28.xx	Keypad
14	GGM227.16.xx	LCD LX2 module assembly (complete incl. Driver)
15	OKLCDM227.11.xx	LCD LX2 with flexible PCB and driver
16	GGM227.03.xx	LCD light diffusor assembly
17	UK-227.01.xx	Decoder board
18	JSVM1.3VK1DVH	Vibrator motor
19	GGM227.40.xx	Shielding foil
20	GGM227.17.xx	Shielding cover
21	GGM227.24.xx	Schock pad
22	UK-227.yy.xx	Receiver board
	(yy=10....21)	
23	GGM227.01.xx	Back housing assembly
24	GGM468.28.xx	Adhesive shock pad (1x0.25)
25	GGM468.28.xx	Adhesive shock pad (2x0.5)
26	GGM468.28.xx	Adhesive shock pad (2x0.75)
27	GGM227.13.xx	Back housing
28	BEM227.34.xx +	Label plus
	BEM227.35.xx	Laminate
29	GGM227.26.xx	Battery door
30	GGM227.27.xx	Battery door latch
31	GGM227.04.xx	Housing latch, red
	GGM227.04.xx BL	Housing latch, blue
	GGM227.04.xx GN	Housing latch, green
	GGM227.04.xx SW	Housing latch, black
	GGM227.29.xx	Reflector foil
	GGM227.31.xx	LCD adhesive tape
	JBANICD1.2350M	Chargeable battery
	JB1V5LR03MICRO	Battery

4.2 LX4 *plus* / LX4 *advanced*

4.2.1 Removing/ Replacing The Battery

- Slide the door lock away from the battery door (refer to Fig. 1).
- Slide and open the battery door as shown in figure 1.
- Remove the battery.

- Replace the battery with correct polarity (+ and – markings).
- Close and slide back the battery door. Slide the door lock to its fully locked position.

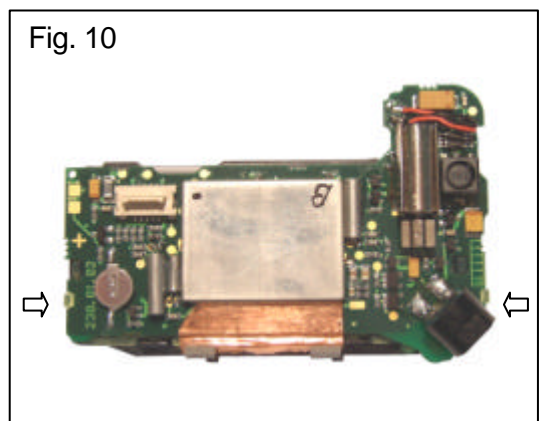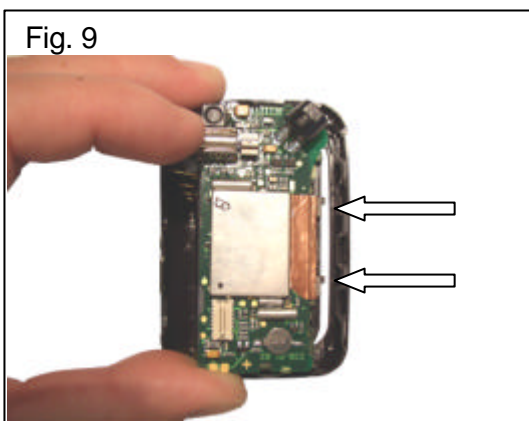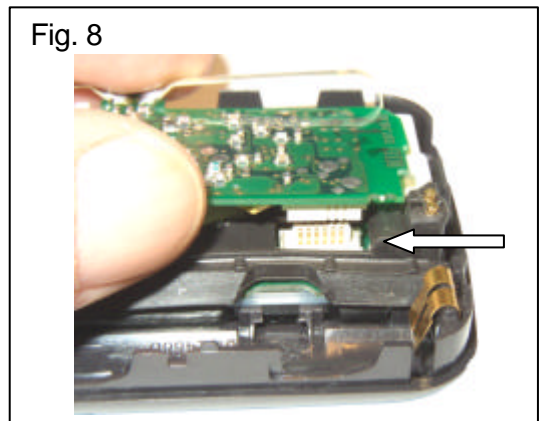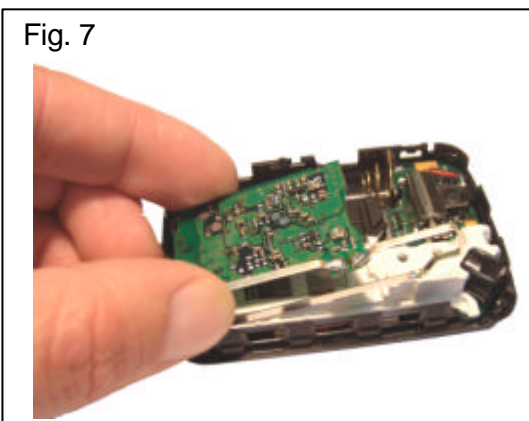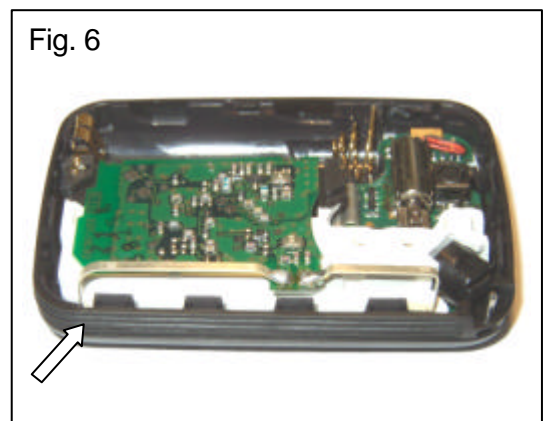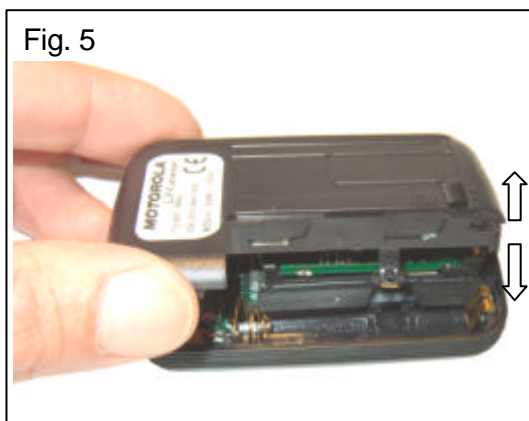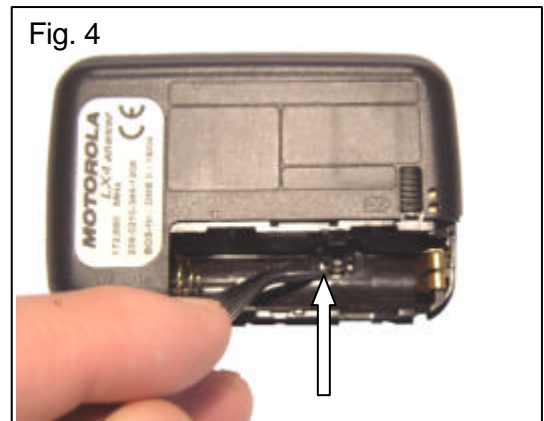### 4.2.2 Removing/ Replacing The Battery Door And Back Housing

- Unlock the battery door (refer to Fig. 1).
- Slide and take off the battery door (refer to Fig. 1).
- Use a slotted screw driver (or similiar) to push the housing latch a few millimetres away from the housing (near to the positive battery contact of the battery compartment (Fig. 2). Move it a little upwards, remove it from the housing and pull it away in the direction of the arrow (refer to Fig. 3).
- Use tweezers (or similiar) to unlock the catch on the back housing from the front housing (refer to Fig. 4).
- Separate the back housing from the front housing (refer to Fig. 5).
- Start re-assembly with the housing latch (refer to Fig. 6). Then align the back housing with the front housing (refer to Fig. 5) and press together until the catch locks.

4.2.3 Removing/ Replacing The Receiver Board

- Open the housing as previously described.
- Gently pry the receiver board up and away from the decoder board (refer to Fig. 7).
- To replace the receiver board, align the interconnect socket and plug (refer to Fig. 8) and press the boards together. Do not misalign the shock pad!
- Re-assemble as described above.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Fig. 9

Fig. 10
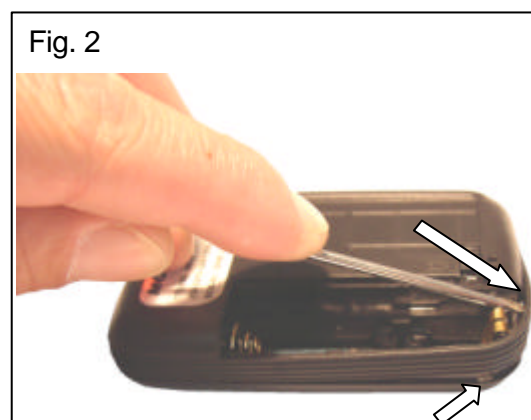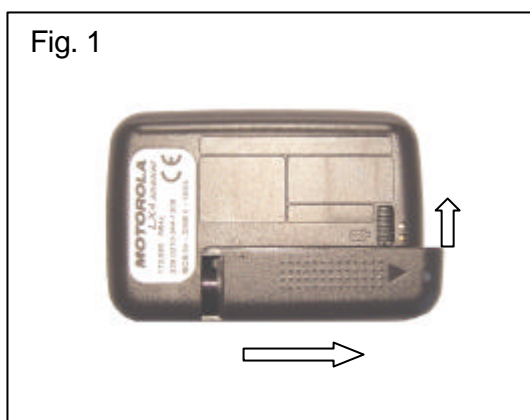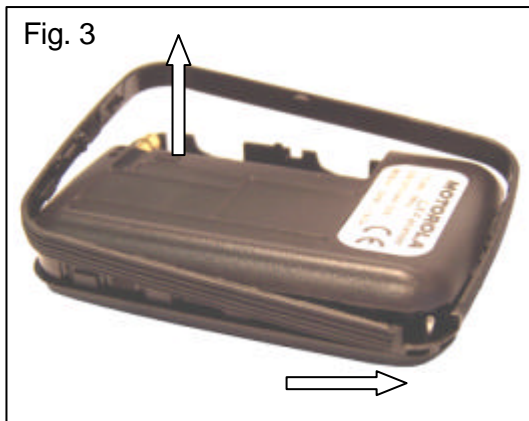
4.2.4   Removing/ Replacing The Decoder Board

- Remove the battery.
- Remove the battery door and the housing latch. Take off the back housing.
- Remove the receiver board (refer to Fig. 7).
- Remove the shock pad.
- In order to remove the decoder board from the front housing slightly push the LCD diffusor near to the battery compartment (refer to Fig. 9).
- Insert the decoder board with the guiding tabs in front into the front housing (refer to Fig. 9) and press down gently.
- Replace the shock pad aligning it correctly. Pay attention to the marked areas 1-3/ Fig. 11
- Replace the receiver board (refer to Fig.7).
- Replace the housing latch, back housing, battery door and battery.

Fig. 11
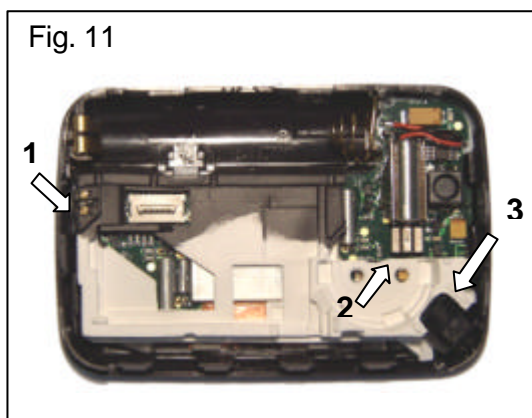
4.2.5   Exploded View Diagram LX4 *plus* / LX4 *advanced*
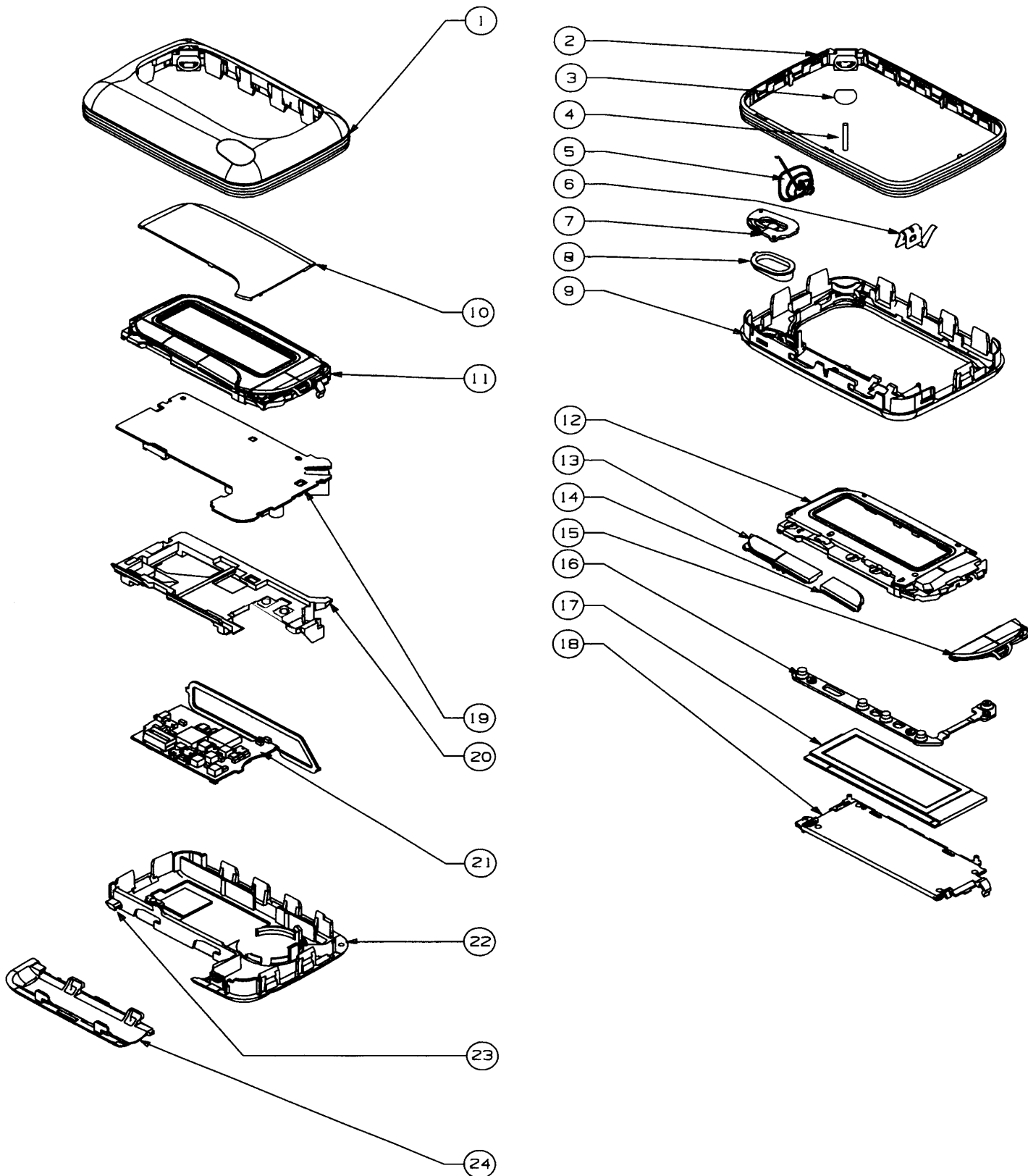
4.2.6   Spare Parts LX4 *plus* / LX4 *advanced*

Item	Part Number	Description
1	GGM230.14.xx	LX4 Front housing assembly (Items 2-9)
2	GGM230.16.xx	LX4 Housing latch
3	GGM230.15.xx	LX4 Grille cloth
4	MZS1.6M6X8+0.2	Metal pin 1.6m6x8+0.2 DIN7NiRo
5	EBM230.12.xx	LX4 Contact battery, negative
6	EBM230.13.xx	LX4 Contact battery, positive
7	GGM230.09.xx	LX4 Keypad for button green
8	GGM230.08.xx	LX4 Button green
9	GGM230.07.xx	LX4 Front housing
10	GGM230.18.xx	LX4 Lens labelled "Motorola"
11	GGM230.17.xx	LX4 Button frame assembly
12	GGM230.22.xx	LX4 Window frame
13	GGM230.19.xx	LX4 Button left/ right white
14	GGM230.21.xx	LX4 Button red
15	GGM230.20.xx	LX4 Button up/ down white
16	GGM230.23.xx	LX4 Keypad window frame
17	OKLCDM230.02.xx	LX4 LCD assembly
18	GGM230.25.xx	LX4 Light diffuser green/ yellow
	GGM230.27.xx	LX4 Reflector foil 49.5 x 18.8 mm
19	UK-230.01.xx	Decoder board
20	GGM230.24.xx	LX4 Shock pad
21	UK-227.yy.xx (yy=10...21)	Receiver board
22	GGM230.06.xx	LX4 back housing assembly
23	GGM230.05.xx	LX4 Battery door latch
24	GGM230.04.xx	LX4 Battery door

4.3 Charging Unit

Work carefully to avoid damaging the PCB and housing.

4.3.1 Removing/ Replacing The Top Housing

- Insert a size No. 2 slotted screw driver vertically into the holes in front of the bottom housing (refer to Fig. 1).
- When it is positioned between the snap and the catch turn the screw driver by max. 1/8 turn and separate bottom and top housing with your fingers at the same time (refer to Fig. 2).
- Insert the screw driver vertically into the holes in the back of the bottom housing (refer to Fig. 3).
- Turn the screw driver by max. 1/8 turn and separate bottom and top housing with your fingers at the same time (refer to Fig. 4).
- Take off the cable connected to the contact pins from the printed circuit board.
- Remove the top housing.

- Before replacing the top housing check that the reset button is positioned correctly.
- Replace the cable connected to the contact pins on the PCB.
- Align the top housing with the PCB so that the reset button matches the hole in the top housing.
- Press the top and bottom housings together with force and let it snap into each other.

Fig. 1

snap

catch

Fig. 2

catch

snap

Fig. 3

Fig. 4
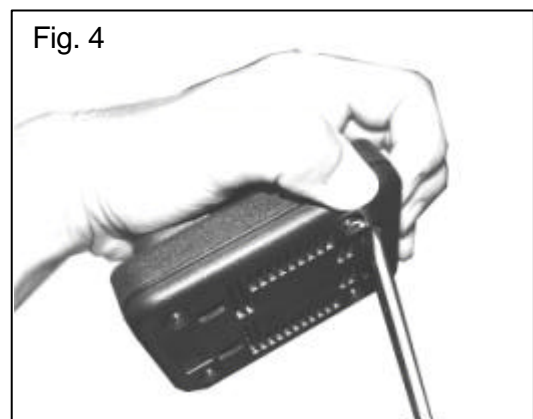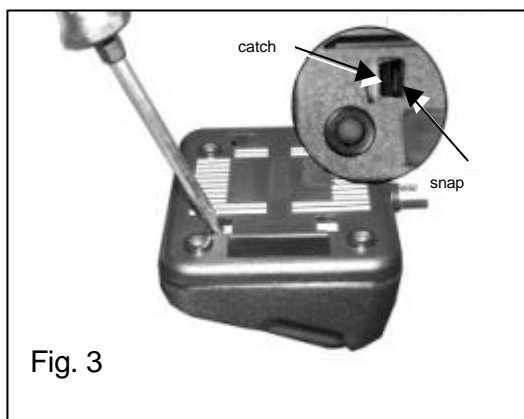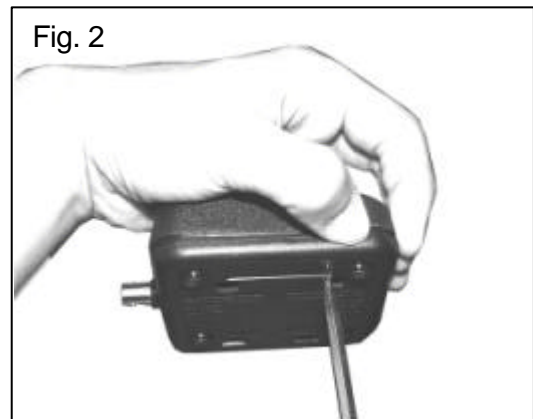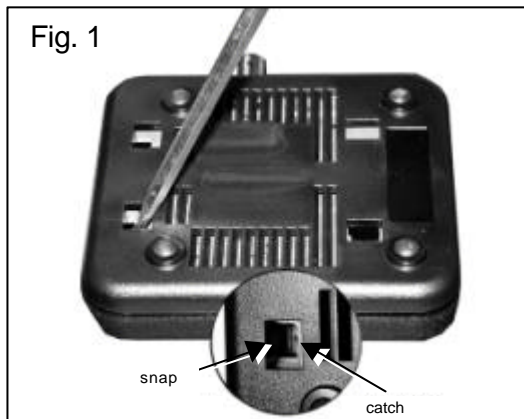
4.3.2   Removing/ Replacing The PCB Of The Charging Unit

- Remove the top housing.
- Remove the Charger PCB from the bottom housing.

- Position the bumper feet in the bottom housing (refer to Fig. 5).
- Position the the PCB on the bumper feet so that the rubber posts fit in the holes on the PCB (refer to Fig. 6).
- Replace the reset button on the PCB.
- Replace the top housing.

Fig. 5

Fig. 6

4.3.3 Exploded View Diagram
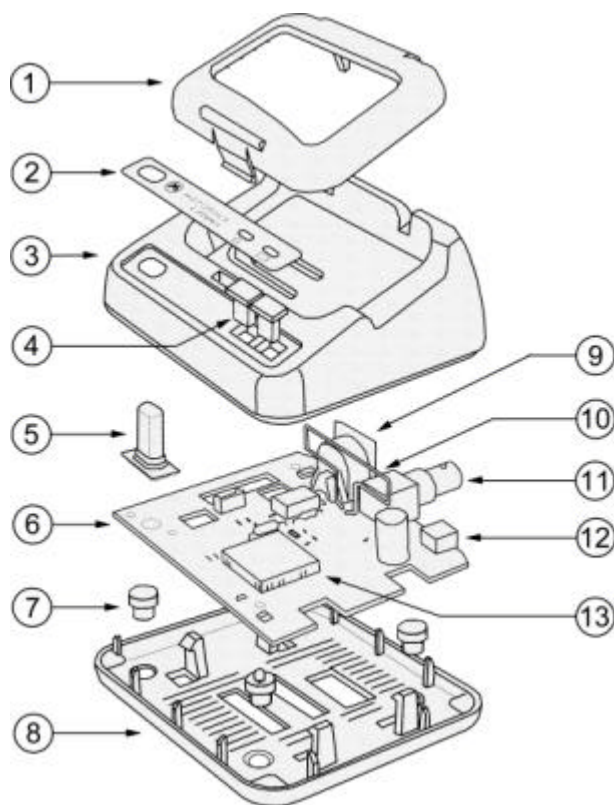
4.2.4 Spare Parts Charging Unit

Item		Part Number	Description
1		GGM228.07.xx	Frame LX2
	or	GGM228.18.01	Frame LX4
2		BEM228.02.xx	Escutcheon
3		GGM228.06.xx	LX2 Top housing with contacts
	or	GGM228.17.01	LX4 Top housing with contacts
4		GGM228.09.xx	LED Guide
5		GGM228.04.xx	Reset Button
6		UF-228.06.xx	PCB Charger
7		GGM228.10.xx	Bumper feet set (4 pieces)
8		GGM469.13.xx	Bottom housing
9		ESDIMAB5SH	DIN socket, 5pole, 90°
10		FA-M228.01.xx	Antenna loop
11		ESBNCBU9050	BNC socket, 90°, 50Ω
12		ESVBUKLDSMT0202	SMD power socket
13		GGM225.02.xx	Shielding cover
14		BEM227.34.xx	Bottom label
15		EBM228.03.xx	Charging contact pin
16		EDZM228.05.xx	Connecting cable
17		LKT11.8040/0.4	AC/ DC Adapter

5 Printed Circuit Boards

5.1 Receiver Schematic PCB No. 227.10.xx
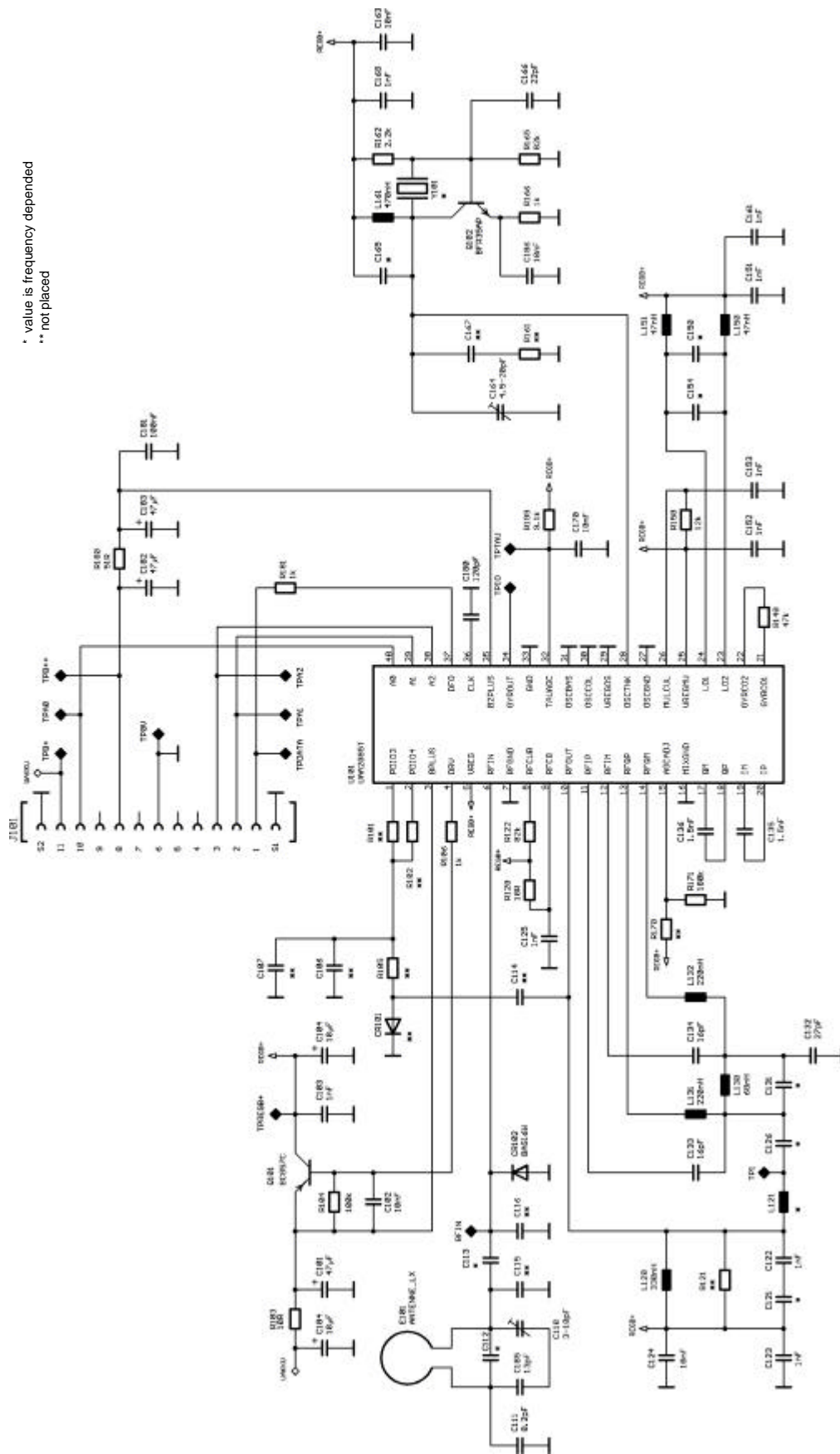
Frequency Range Option	Frequency Range (MHz)	C112 (pF)	C113 (pF)	C121 (pF)	C131 (pF)	C150 (pF)	C154 (pF)	C165 (pF)	L121 (pF)	C126 (pF)
A = 227.10.xx	138...141	10	3,3	3	10	10	0,75	22	330	22
B = 227.11.xx	141...144	10	3	2,7	-	10	1	22	330	20
C = 227.12.xx	144...147	9,1	3	2,4	9,1	9,1	-	16	330	20
D = 227.13.xx	147...150	9,1	2,7	2,4	8,2	7,5	1	16	330	20
E = 227.14.xx	150...153	9,1	2,7	1,8	7,5	7,5	1	15	330	18
F = 227.15.xx	153...156	8,2	2,7	1,8	7,5	7,5	1	18	330	6,8 [A)]
G = 227.16.xx	156...159	7,5	2,7	2,2	6,8	7,5	-	13	270	18
H = 227.17.xx	159...162	7,5	2,4	2,2	6,2	6,8	-	13	270	16
I = 227.18.xx	162...165	6,8	2	1,8	5,6	6,8	-	15	270	16
J = 227.19.xx	165...168	6,2	2	1,8	5,6	6,2	-	10	270	15
K = 227.20.xx	168...171	5,6	2,4	1,2	5,1	5,6	-	10	270	15
L = 227.21.xx	171...174	5,1	2,4	1,2	4,7	5,6	-	12	270	15

5.2 Parts Location Receiver PCB No. 227.10.xx

Side 1
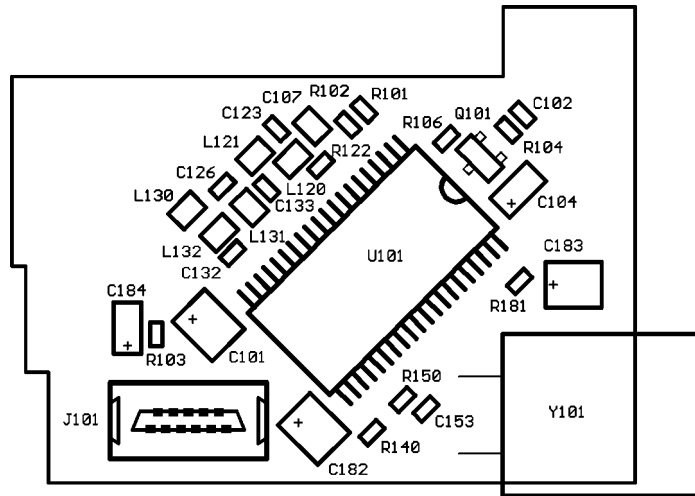
Side 2
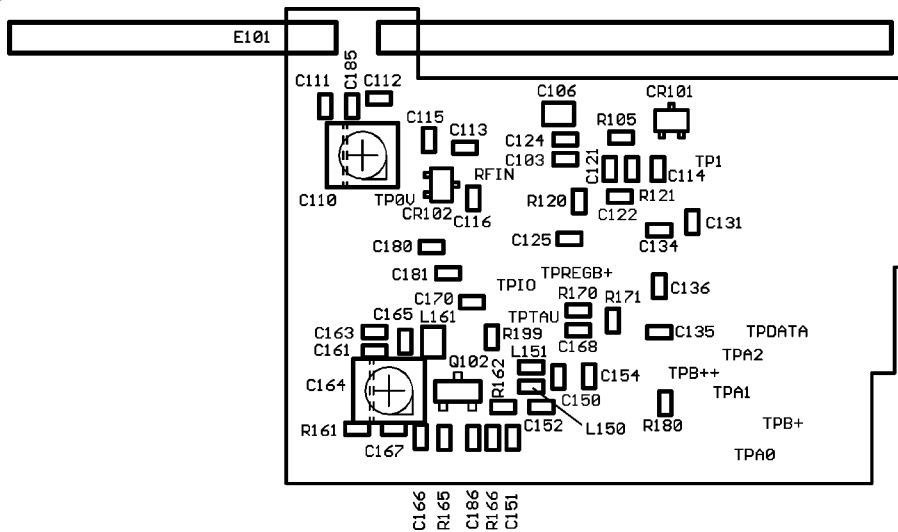
5.3 Bill Of Material Receiver PCB No. 227.10.xx

Item	Part Number	Description
C 101	CSTAB4766	SMDTantalum B, 47µF 6V
C 102	CS0603X7R103	SMD Capacitor 10nF, 0603, X7R
C 103	CS0603NP0102	SMD Capacitor 1nF, 0603, NP0
C 104	CSTAA10610	SMD Tantalum A, 10µF 10V
C 110	CSTR3-10TZVY2Z	SMD Trimming capacitor 3-10pF
C 111	CS0603NP08p20.1	SMD Capacitor 8.2pF±0.1, 0603, NP0
C 112 (A,B)	CS0603NP01000.1	SMD Capacitor 10pF±0.1, 0603, NP0
C 112 (C,D,E)	CS0603NP09p10.1	SMD Capacitor 9.1pF±0.1, 0603, NP0
C 112 (F)	CS0603NP08p20.1	SMD Capacitor 8.2pF±0.1, 0603, NP0
C 112 (G,H)	CS0603NP07p50.1	SMD Capacitor 7.5pF±0.1, 0603, NP0
C 112 (I)	CS0603NP06p80.1	SMD Capacitor 6.8pF±0.1, 0603, NP0
C 112 (J)	CS0603NP06p20.1	SMD Capacitor 6.2pF±0.1, 0603, NP0
C 112 (K)	CS0603NP05p60.1	SMD Capacitor 5.6pF±0.1, 0603, NP0
C 112 (L)	CS0603NP05p10.1	SMD Capacitor 5.1pF±0.1, 0603, NP0
C 113 (A)	CS0603NP03p30.1	SMD Capacitor 3.3pF±0.1, 0603, NP0
C 113 (B,C)	CS0603NP03p00.1	SMD Capacitor 3pF±0.1, 0603, NP0
C 113 (D,E,F,G)	CS0603NP02p70.1	SMD Capacitor 2.7pF±0.1, 0603, NP0
C 113 (H,K,L)	CS0603NP02p40.1	SMD Capacitor 2.4pF±0.1, 0603, NP0
C 113 (I,J)	CS0603NP02p00.1	SMD Capacitor 2.0pF±0.1, 0603, NP0
C 121 (A)	CS0603NP03p00.1	SMD Capacitor 3pF±0.1, 0603, NP0
C 121 (B)	CS0603NP02p70.1	SMD Capacitor 2.7pF±0.1, 0603, NP0
C 121 (C,D)	CS0603NP02p40.1	SMD Capacitor 2.4pF±0.1, 0603, NP0
C 121 (E,F,I,J)	CS0603NP01p80.1	SMD Capacitor 1.8pF±0.1, 0603, NP0
C 121 (G,H)	CS0603NP02p20.1	SMD Capacitor 2.2pF±0.1, 0603, NP0
C 121 (K,L)	CS0603NP01p20.1	SMD Capacitor 1.2pF±0.1, 0603, NP0
C 122, C 123	CS0603NP0102	SMD Capacitor 1nF, 0603, NP0
C 124	CS0603X7R103	SMD Capacitor 10nF, 0603, X7R
C 125	CS0603NP0102	SMD Capacitor 1nF, 0603, NP0
C 126 (A)	CS0603NP02202	SMD Capacitor 22pF±2%, 0603, NP0
C 126 (B,C,D)	CS0603NP02002	SMD Capacitor 20pF±2%, 0603, NP0
C 126 (E,G)	CS0603NP01802	SMD Capacitor 18pF±2%, 0603, NP0
C 126 (F)	CS0603NP06p80.1	SMD Capacitor 6.8pF±0.1, 0603, NP0
C 126 (H,I)	CS0603NP01602	SMD Capacitor 16pF±2%, 0603, NP0
C 126 (J,K,L)	CS0603NP01502	SMD Capacitor 15pF±2%, 0603, NP0
C 131 (A)	CS0603NP01000.1	SMD Capacitor 10pF±0.1, 0603, NP0
C 131 (C)	CS0603NP09p10.1	SMD Capacitor 9.1pF±0.1, 0603, NP0
C 131 (D)	CS0603NP08p20.1	SMD Capacitor 8.2pF±0.1, 0603, NP0
C 131 (E,F)	CS0603NP07p50.1	SMD Capacitor 7.5pF±0.1, 0603, NP0
C 131 (G)	CS0603NP06p80.1	SMD Capacitor 6.8pF±0.1, 0603, NP0
C 131 (H)	CS0603NP06p20.1	SMD Capacitor 6.2pF±0.1, 0603, NP0
C 131 (I,J)	CS0603NP05p60.1	SMD Capacitor 5.6pF±0.1, 0603, NP0
C 131 (K)	CS0603NP05p10.1	SMD Capacitor 5.1pF±0.1, 0603, NP0
C 131 (L)	CS0603NP04p70.1	SMD Capacitor 4.7pF±0.1, 0603, NP0
C 132	CS0603NP0270	SMD Capacitor 27pF, 0603, NP0
C 133, C 134	CS0603NP0160	SMD Capacitor 16pF, 0603, NP0
C 135, C 136	CS0603X7R152	SMD Capacitor 1.5nF, 0603, X7R
C 150 (A,B)	CS0603NP01000.1	SMD Capacitor 10pF±0.1, 0603, NP0
C 150 (C)	CS0603NP09p10.1	SMD Capacitor 9.1pF±0.1, 0603, NP0
C 150 (D,E,F,G)	CS0603NP07p50.1	SMD Capacitor 7.5pF±0.1, 0603, NP0
C 150 (H,I)	CS0603NP06p80.1	SMD Capacitor 6.8pF±0.1, 0603, NP0
C 150 (J)	CS0603NP06p20.1	SMD Capacitor 6.2pF±0.1, 0603, NP0
C 150 (K,L)	CS0603NP05p60.1	SMD Capacitor 5.6pF±0.1, 0603, NP0

Item	Part Number	Description
C 151 - C 153	CS0603NP0102	SMD Capacitor 1nF, 0603, NP0
C 154 (A)	CS0603NP00p75	SMD Capacitor 0.75pF±0.1, 0603, NP0
C 154 (B,D,E,F)	CS0603NP01p00.1	SMD Capacitor 1.0pF±0.1, 0603, NP0
C 161	CS0603NP0102	SMD Capacitor 1nF, 0603, NP0
C 163	CS0603X7R103	SMD Capacitor 10nF, 0603, X7R
C 164	CSTR4.5-20TZVY2	SMD Trimming capacitor 4.5-20pF
C 165 (A,B)	CS0603NP0220	SMD Capacitor 22pF, 0603, NP0
C 165 (C,D)	CS0603NP0160	SMD Capacitor 16pF, 0603, NP0
C 165 (E,I)	CS0603NP0150	SMD Capacitor 15pF, 0603, NP0
C 165 (F)	CS0603NP0180	SMD Capacitor 18pF, 0603, NP0
C 165 (G,H)	CS0603NP0130	SMD Capacitor 13pF, 0603, NP0
C 165 (J,K)	CS0603NP0100	SMD Capacitor 10pF, 0603, NP0
C 165 (L)	CS0603NP0120	SMD Capacitor 12pF, 0603, NP0
C 166	CS0603NP0220	SMD Capacitor 22pF, 0603, NP0
C 168	CS0603NP0102	SMD Capacitor 1nF, 0603, NP0
C 170	CS0603X7R103	SMD Capacitor 10nF, 0603, X7R
C 180	CS0603NP0121	SMD Capacitor 120pF, 0603, NP0
C 181	CS0603Y5V104	SMD Capacitor 100nF, 0603, Y5V
C 182, C 183	CSTAB4766	SMD Tantalum B, 47µF 6V
C 184	CSTAA10610	SMD Tantalum A, 10µF 10V
C 185	CS0603NP0130	SMD Capacitor 13pF, 0603, NP0
C 186	CS0603X7R103	SMD Capacitor 10nF, 0603, X7R
CR 102	DSDBAS16W	SMD Diode, BAS16 "W", SOT323
E 101	FA-M227.23.01	Single loop antenna
J 101	ESFCI7212031111	SMD Socket, 11pole
L 120	LSLL2012FHR33J	SMD Coil, 330nH 0805 LL2012
L 121 (A ... F)	LSLL2012FHR33J	SMD Coil, 330nH 0805 LL2012
L 121 (G ... L)	LSLL2012FHR27J	SMD Coil, 270nH 0805 LL2012
L 130	LSLL2012FH68NJ	SMD Coil, 68nH, 0805 LL2012
L 131, L 132	LSLL2012FHR22J	SMD Coil, 220nH, 0805 LL2012
L 150, L 151	LSLL1608FH47NJ	SMD Coil, 47nH, 0603, LL1608
L 161	LSLL2012FHR47J	SMD Coil, 470nH 0805 LL2012
Q 101	TSBC857C	SMD Transistor, BC857C, SOT23
Q 102	TSBFR35AP	SMD Transistor, BFR35 AP (GE)
R 103	RS06035100	SMD Resistor 10R, 0603, 5%
R 104	RS06035104	SMD Resistor 100k, 0603, 5%
R 106	RS06035102	SMD Resistor 1k, 0603, 5%
R 120	RS06035100	SMD Resistor 10R, 0603, 5%
R 122	RS06035823	SMD Resistor 82k, 0603, 5%
R 140	RS06035473	SMD Resistor 47k, 0603, 5%
R 150	RS06035123	SMD Resistor 12k, 0603, 5%
R 162	RS06035222	SMD Resistor 2k2, 0603, 5%
R 165	RS06035823	SMD Resistor 82k, 0603, 5%
R 166	RS06035102	SMD Resistor 1k, 0603, 5%
R 171	RS06035184	SMD Resistor 180k, 0603, 5%
R 180	RS06035510	SMD Resistor 51R, 0603, 5%
R 181	RS06035102	SMD Resistor 1k, 0603, 5%
R 199	RS060319101	SMD Resistor 9k1, 0603, 1%
U 101	ICSUAA2085T	SMD IC, UAA 2085T
Y 101	QKQOE55/160	Channel Crystal OE55/160

Range Option		Frequency Range	Range Option		Frequency Range
A	= 227.10.xx	138 ... 141 MHz	G	= 227.16.xx	156 ... 159 MHz
B	= 227.11.xx	141 ... 144 MHz	H	= 227.17.xx	159 ... 162 MHz
C	= 227.12.xx	144 ... 147 MHz	I	= 227.18.xx	162 ... 165 MHz
D	= 227.13.xx	147 ... 150 MHz	J	= 227.19.xx	165 ... 168 MHz
E	= 227.14.xx	150 ... 153 MHz	K	= 227.20.xx	168 ... 171 MHz
F	= 227.15.xx	153 ... 156 MHz	L	= 227.21.xx	171 ... 174 MHz

5.4 Decoder Schematic PCB No. 227.02.xx
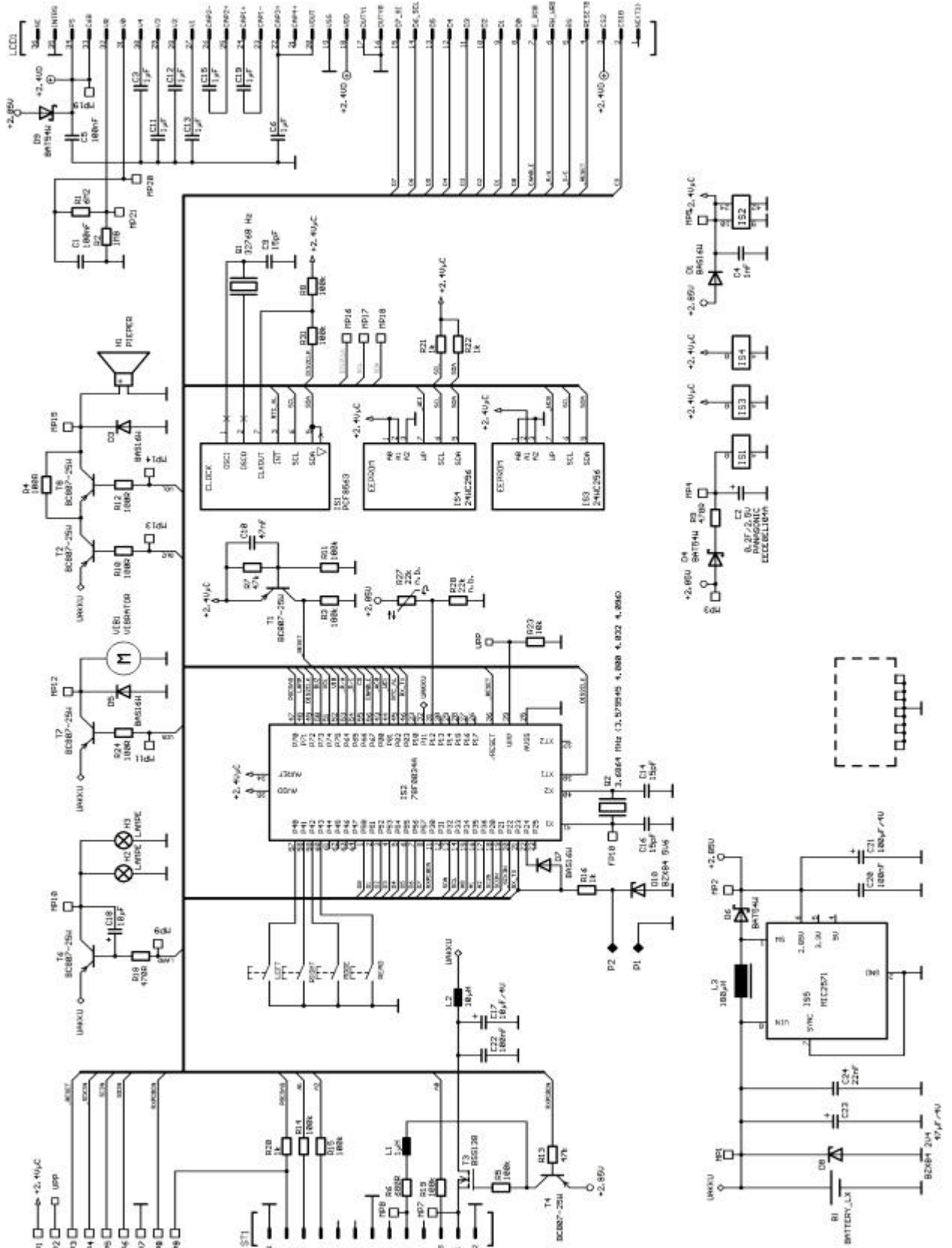
5.5   Parts Location Decoder PCB No. 227.02.xx

Side 1
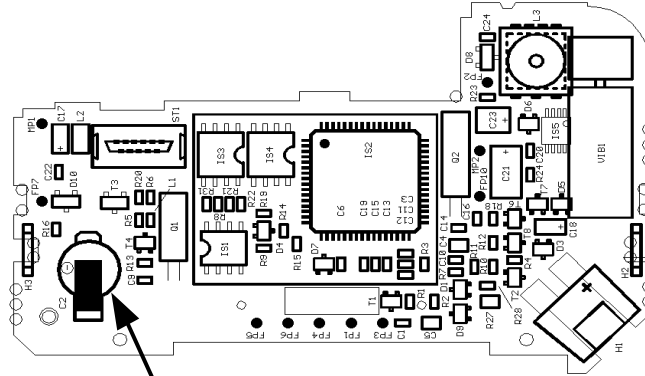
C2 / size x

C2 / size y

Side 2

<u>Attention</u>

Pay attention to the correct polarity of part C2
(+ and – marking!)

5.6 Bill OF Material   Decoder Board PCB No. 227.02.xx

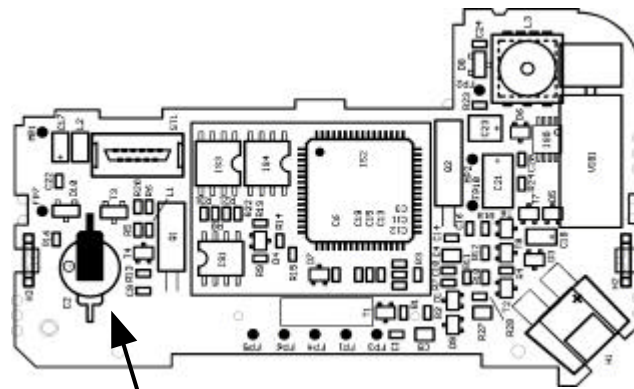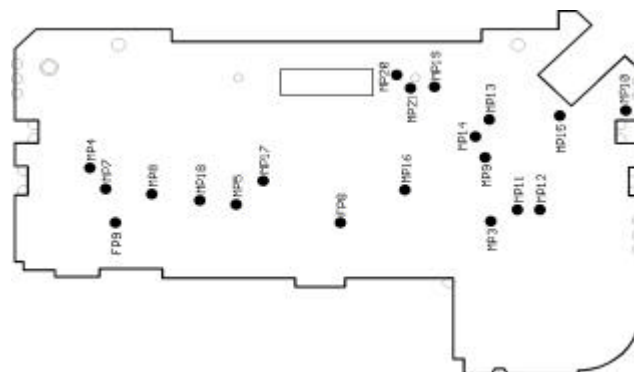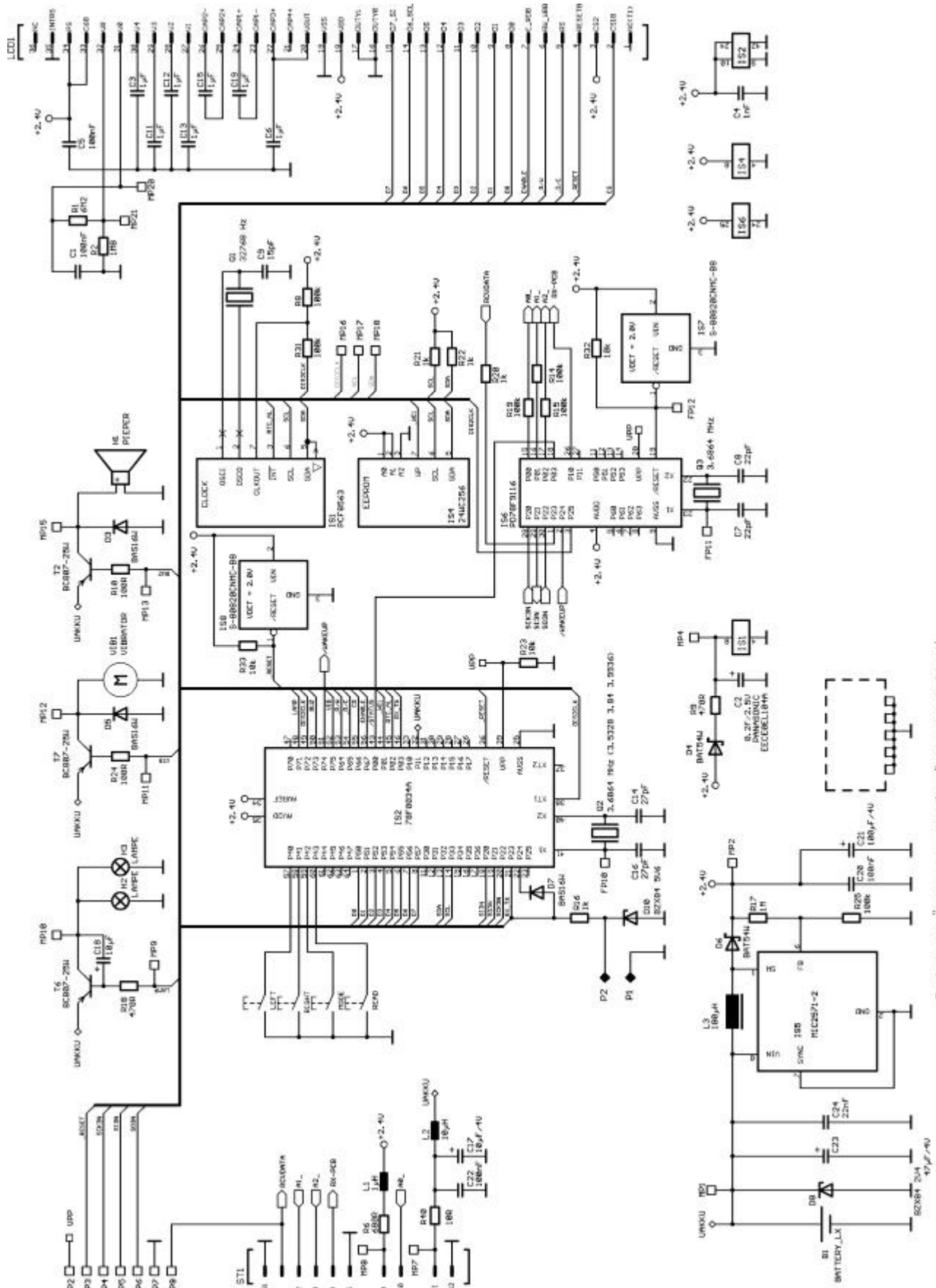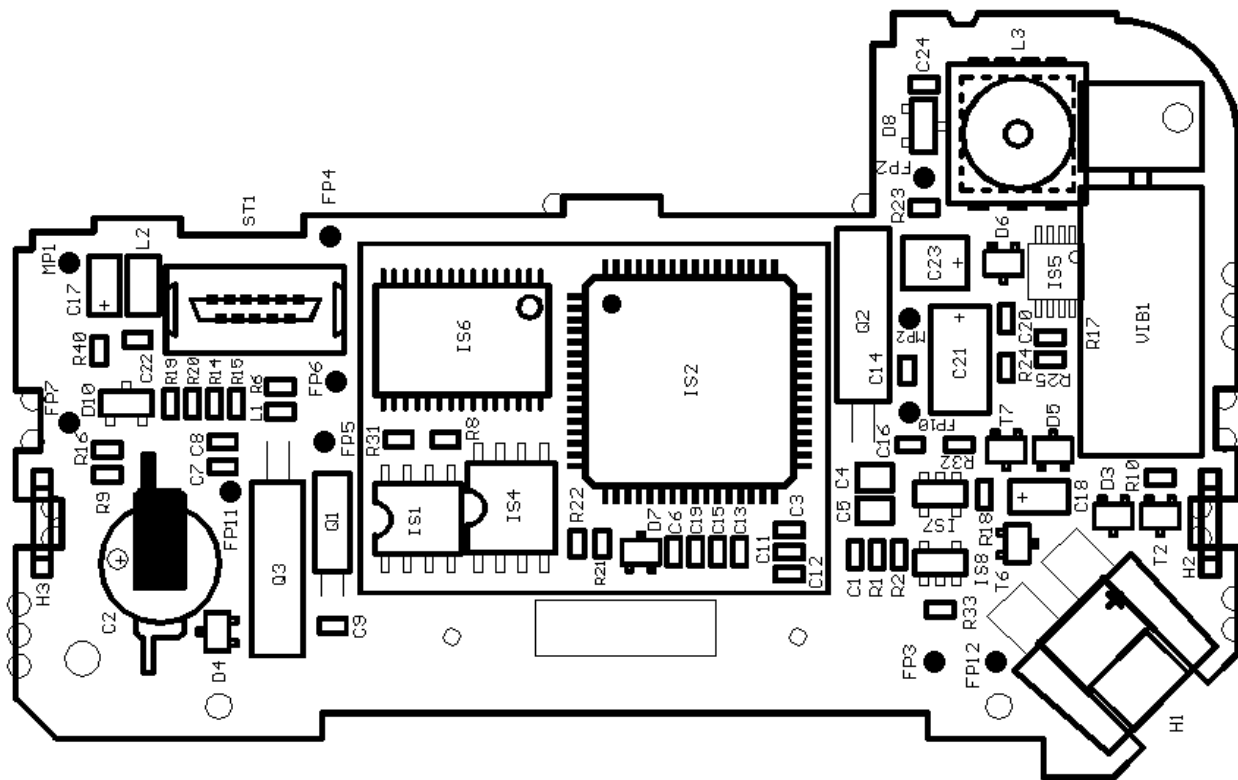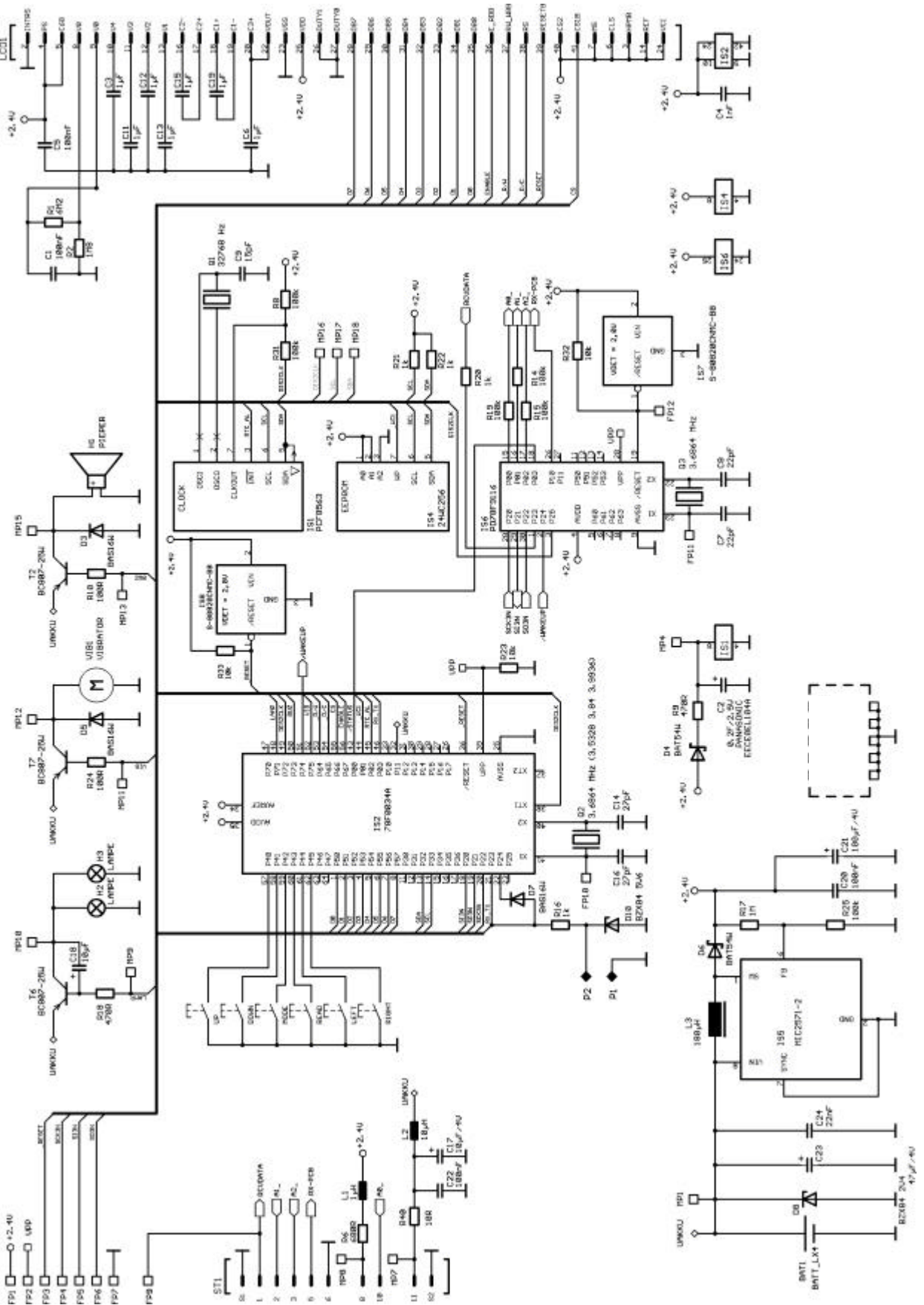| Item	Part Number	Description
H1	AS5002811Y04	Sound Transducer MMX-10M
C9, C14, C16	CS0603NP0150	SMD Capacitor 0603 NP0 15pF
C24	CS0603X7R223	SMD Capacitor 0603 X7R 22nF
C10	CS0603X7R47316	SMD Capacitor 0603 X7R 47nF min.16V
C1, C20, C22	CS0603Y5V104	SMD Capacitor 0603 Y5V 100nF
CS0603Y5V105	C3, C6, C11-C13, C15, C19	SMD Capacitor 0603 Y5V 1µF 10V
C4	CS0805NP0102	SMD Capacitor 0805 NP0 1nF
C5	CS0805X7R104	SMD Capacitor 0805 X7R 100nF
C2	CSSEECEN0F204B	SMD DLC 200mF EECEN0F204B
C17, C18	CSTAA10610	SMD Tantalum A 10µF 10V
C23	CSTAB4766	SMD Tantalum B 47µF 6V
C21	CSTAC1076	SMDTantalum C 100µF 6.3V
D1, D3, D5, D7	DSDBAS16W	SMD Diode BAS16 "W" SOT323
D4, D6, D9	DSDBAT54W	SMD Diode BAT 54 "W" SOT323
D8	DSZBZX84C2V4	SMD Zener Diode BZX84C2V4 SOT23
D10	DSZBZX84C5V6	SMD Zener Diode BZX84C5V6 SOT23
ST1	ESFCI9190131411	SMD Plug 11pole
	GGM227.17.01	01: Shielding Cover LX2-Decoder
IS3, IS4	ICSCAT24WC256KI1.8	SMD E²PROM CAT24WC256KI-1.8
IS5	ICSMIC2571-1BMM	SMD IC MIC2571-1 BMM T&R MSOP
IS1	ICSPCF8563TF4	SMD IC PCF 8563 T/F4 S08
IS2	ICSUPD78F0034AY	SMD IC UPD78F0034AYGK-9ET TQFP
VIB1	JSVM1.3VK1DVH	Vibrator Motor FM-109K1D+Var+Holder
L1	LSLK16081R0K	SMD Coil 0603 10% 1µH
L2	LSLK3216100M106	SMD Coil LK3216100M 10µH
L3	LSSDS0604-181K	SMD Inductor 180µH SDS0604-181K
LCD1	OKLCDM227.16.01	LX2 LCD Assembly
H2, H3	OSLA6504414R01	ITI SMD Lamp axial ""R01""
Q2	QKQ3.6864TC39	Cylind. Crystal 3.6864 MHz 3x9mm
Q1	QKQ32.768KHZ2X6	Cylind. Crystal 32.768kHz TC2x6
R4, R10, R12, R24	RS06035101	SMD Resistor 0603 5% 100R
R16, R20- R22	RS06035102	SMD Resistor 0603 5% 1k0
R23	RS06035103	SMD Resistor 0603 5% 10k
R5, 8, 11, 14, 15, 19, 31	RS06035104	SMD Resistor 0603 5% 100k
R3	RS06035184	SMD Resistor 0603 5% 180k
R2	RS06035185	SMD Resistor 0603 5% 1M8
R28	RS06035223	SMD Resistor 0603 5% 22k
R9, R18	RS06035471	SMD Resistor 0603 5% 470R
R7, R13	RS06035473	SMD Resistor 0603 5% 47k
R1	RS06035625	SMD Resistor 0603 5% 6M2
R6	RS06035681	SMD Resistor 0603 5% 680R
R27	RSVN0805223	SMD NTC Resistor 0805 22k
T1, T2, T4, T6- T8	TSBC807-25W	SMD Trans. BC807-25 "W" SOT323
T3	TSBSS138	SMD Trans. BSS138 SOT23
PCB	P-227.02.05/06/07	LP 227.02.05/06/07 Decoder LX2

5.7 Decoder Schematic PCB No. 227.01.xx

5.8   Parts Location   Decoder PCB No. 227.01.xx

5.9   Bill OF Material Decoder Board PCB No. 227.01.xx

| Item	Part Number	Description
H1	AS5002811Y04	Sound Transducer MMX-10M
C9	CS0603NP0150	SMD Capacitor 0603 NP0 15pF
C7, C8	CS0603NP0220	SMD Capacitor 0603 NP0 22pF 5%
C14, C16	CS0603NP0270	SMD Capacitor 0603 NP0 27pF 5%
C24	CS0603X7R223	SMD Capacitor 0603 X7R 22nF
C1, C20, C22	CS0603Y5V104	SMD Capacitor 0603 Y5V 100nF
C3, C6, C11-C13, C15, C19	CS0603Y5V105	SMD Capacitor 0603 Y5V 1µF 10V
C4	CS0805NP0102	SMD Capacitor 0805 NP0 1nF
C5	CS0805X7R104	SMD Capacitor 0805 X7R 100nF
C2	CSSEECEN0F204B	SMD DLC 200mF EECEN0F204B
C17, C18	CSTAA10610	SMD Tantalum A 10µF 10V
C23	CSTAB4766	SMD Tantalum B 47µF 6V
C21	CSTAC1076	SMD Tantalum C 100µF 6.3V
D3, D5, D7	DSDBAS16W	SMD Diode BAS16 "W" SOT323
D4, D6	DSDBAT54W	SMD Diode BAT 54 "W" SOT323
D8	DSZBZX84C2V4	SMD Zener Diode BZX84C2V4 SOT23
D10	DSZBZX84C5V6	SMD Zener Diode BZX84C5V6 SOT23
ST1	ESFCI9190131411	SMD Plug 11pole
	GGM227.17.01	01: Shielding Cover LX2-Decoder
	GGM227.29.01	LCD Reflector Foil
	GGM227.30.01	LCD Light Diffusor
On H1	GGM468.28.01	Pager adhesive shock pad
IS4	ICSCAT24WC256KI1.8	SMD E²PROM CAT24WC256KI-1.8
IS5	ICSMIC2571-2BMM	SMD-IC MIC2571-2 BMM T+R MSOP
IS1	ICSPCF8563TF4	SMD-IC PCF 8563 T/F4 S08
IS7, IS8	ICSS80820CNMC-B8F-T2	SMD-IC S-80820CNMC-B8F-T2 SOT23-5
IS2	ICSUPD78F0034AY	SMD-IC UPD78F0034AYGK-9ET TQFP
IS6	ICSUPD78F9116BM	SMD-Contr. µPD78F9116BMC-5A4
VIB1 (secured by UHU plus)	JSVM1.3VK1DVH	Vibrator Motor FM-109K1D+Var+Holder
L1	LSLK16081R0K	SMD Coil 0603 10% 1µH
L2	LSLK3216100M106	SMD Coil LK3216100M 10µH
L3 (secured by UHU plus)	LSSDS0604-181K	SMD Inductor 180µH SDS0604-181K
	OKLCDM227.11.01	LCD LX2 Assembly
H2, H3	OSLA6504414R01	ITI SMD Lamp ""R01""
Q2, Q3	QKQ3.6864TC39	Cylind. Crystal 3.6864 MHz 3x9mm
Q1	QKQ32.768KHZ2X6	Cylind. Crystal 32.768kHz TC2x6
R40	RS06035100	SMD Resistor 0603 5% 10R
R10, R24	RS06035101	SMD Resistor 0603 5% 100R
R16, R20-R22	RS06035102	SMD Resistor 0603 5% 1k0
R23, R32, R33	RS06035103	SMD Resistor 0603 5% 10k
R8, 14, 15, 19, 25, 31	RS06035104	SMD Resistor 0603 5% 100k
R17	RS06035105	SMD Resistor 0603 5% 1M
R2	RS06035185	SMD Resistor 0603 5% 1M8
R9, R18	RS06035471	SMD Resistor 0603 5% 470R
R1	RS06035625	SMD Resistor 0603 5% 6M2
R6	RS06035681	SMD Resistor 0603 5% 680R
T2, T6, T7	TSBC807-25W	SMD Trans. BC807-25 "W" SOT323
PCB	P-227.01.02	PCB 227.01.02 Decoder LX2

5.10 Decoder Schematic PCB No. 230.01.xx

5.11 Parts Location Decoder   PCB No. 230.01.xx
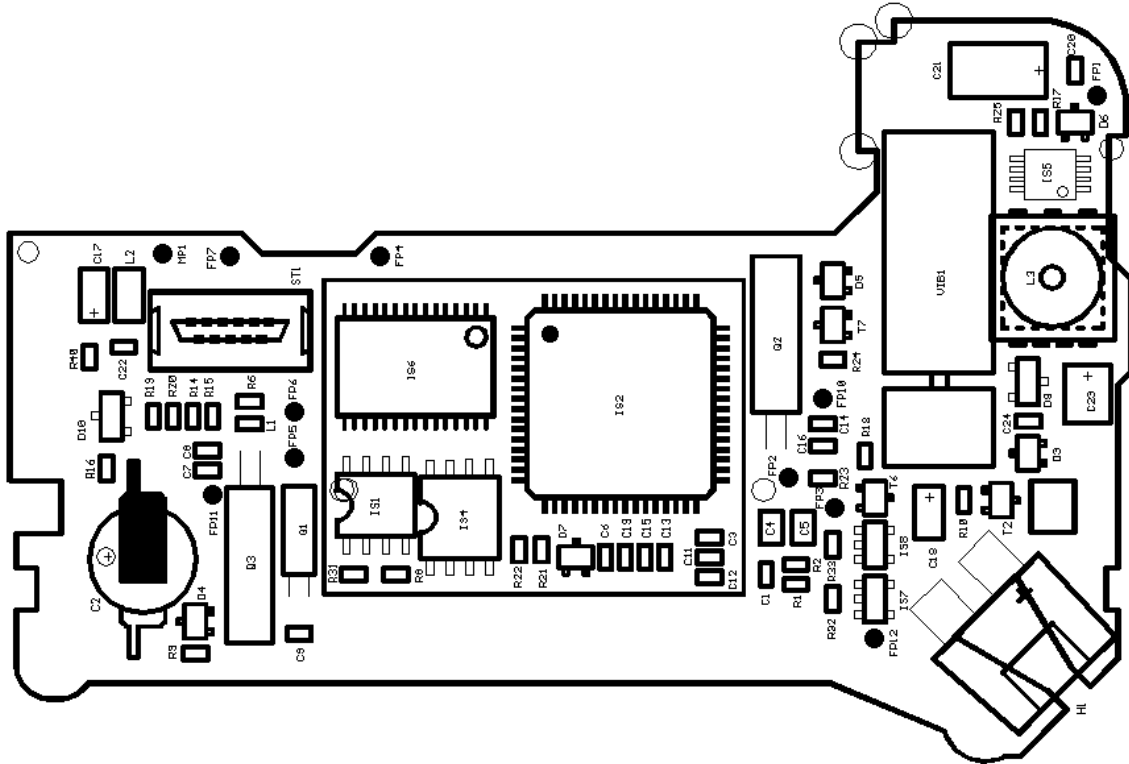
5.12   Bill OF Material   PCB No. 230.01.xx

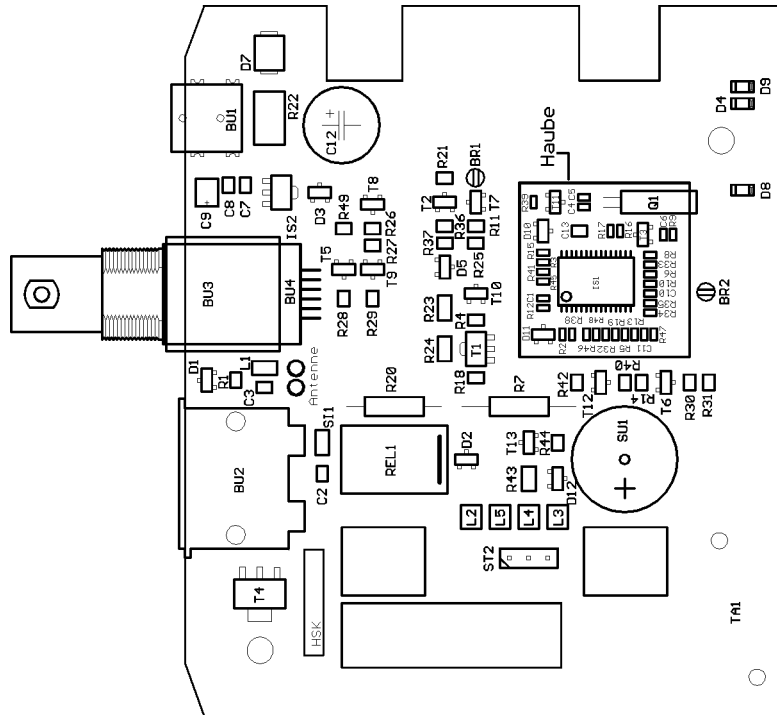| Item	Part Number	Description
C1, C20, C22	CS0603Y5V104	SMD Capacitor 0603 Y5V 100nF
C14, C16	CS0603NP0270	SMD Capacitor 0603 NP0 27pF 5%
C17, C18	CSTAA10610	SMD Tantalum A 10µF 10V
C2	CSSEECEN0F204B	SMD DLC 200mF EECEN0F204B
C21	CSTAC1076	SMD Tantalum C 100µF 6.3V
C23	CSTAB4766	SMDTantalum B 47µF 6V
C24	CS0603X7R223	SMD Capacitor 0603 X7R 22nF
C3, C6, C11 - C13, C15, C19	CS0603Y5V105	SMD Capacitor 0603 Y5V 1µF 10V
C4	CS0805NP0102	SMD Capacitor 0805 NP0 1nF
C5	CS0805X7R104	SMD.Capacitor. 0805 X7R 100nF
C7, C8	CS0603NP0220	SMD Capacitor 0603 NP0 22pF 5%
C9	CS0603NP0150	SMD Capacitor 0603 NP0 15pF
D10	DSZBZX84C5V6	SMD Zener Diode BZX84C5V6 SOT23
D3, D5, D7	DSDBAS16W	SMD Diode BAS16 "W" SOT323
D4, D6	DSDBAT54W	SMD Diode BAT 54 "W" SOT323
D8	DSZBZX84C2V4	SMD Zener Diode BZX84C2V4 SOT23
H1	AS5002811Y04	Sound Transducer MMX-10M
H2, H3	OSLA6504414R01	ITI SMD Lamp ""R01""
IS1	ICSPCF8563TF4	SMD IC PCF 8563 T/F4 S08
IS2	ICSUPD78F0034AY	SMD IC UPD78F0034AYGK-9ET TQFP
IS4	ICSCAT24WC256KI1.8	SMD E²PROM CAT24WC256KI-1.8
IS5	ICSMIC2571-2BMM	SMD IC MIC2571-2 BMM T+R MSOP
IS6	ICSUPD78F9116BM	SMD Controller µPD78F9116BMC-5A4
IS7, IS8	ICSS80820CNMC-B8F-T2	SMD IC S-80820CNMC-B8F-T2 SOT23-5
L1	LSLK16081R0K	SMD Coil 0603 10% 1µH
L2	LSLK3216100M106	SMD Coil LK3216100M 10µH
L3	LSSDS0604-181K	SMD-Inductor 180µH SDS0604-181K
LCD1	OKLCDM230.02.01	LX4 LCD Assembly
Q1	QKQ32.768KHZ2X6	Cylind. Crystal 32.768kHz TC2x6
Q2, Q3	QKQ3.6864TC39	Cylind. Crystal 3.6864 MHz 447.1/03, max. 3,2x10.5 mm
R1	RS06035625	SMD Resistor 0603 5% 6M2
R10, R24	RS06035101	SMD Resistor 0603 5% 100R
R16, R20 - R22	RS06035102	SMD Resistor 0603 5% 1k0
R17	RS06035105	SMD Resistor 0603 5% 1M
R2	RS06035185	SMD Resistor 0603 5% 1M8
R23, R32, R33	RS06035103	SMD Resistor 0603 5% 10k
R40	RS06035100	SMD Resistor 0603 5% 10R
R6	RS06035681	SMD Resistor 0603 5% 680R
R8, R14, R15, R19, R25, R31	RS06035104	SMD Resistor 0603 5% 100k
R9, R18	RS06035471	SMD Resistor 0603 5% 470R
ST1	ESFCI9190131411	SMD Plug 11pole
T2, T6, T7	TSBC807-25W	SMD Trans. BC807-25 "W" SOT323
	GGM227.17.01	01: Shielding Cover LX2-Decoder
VIB1	JSVM1.3VK1DVH	Vibrator Motor FM-109K1D+Var+Holder

5.13 Charger Unit Schematic PCB No. 228.01.xx
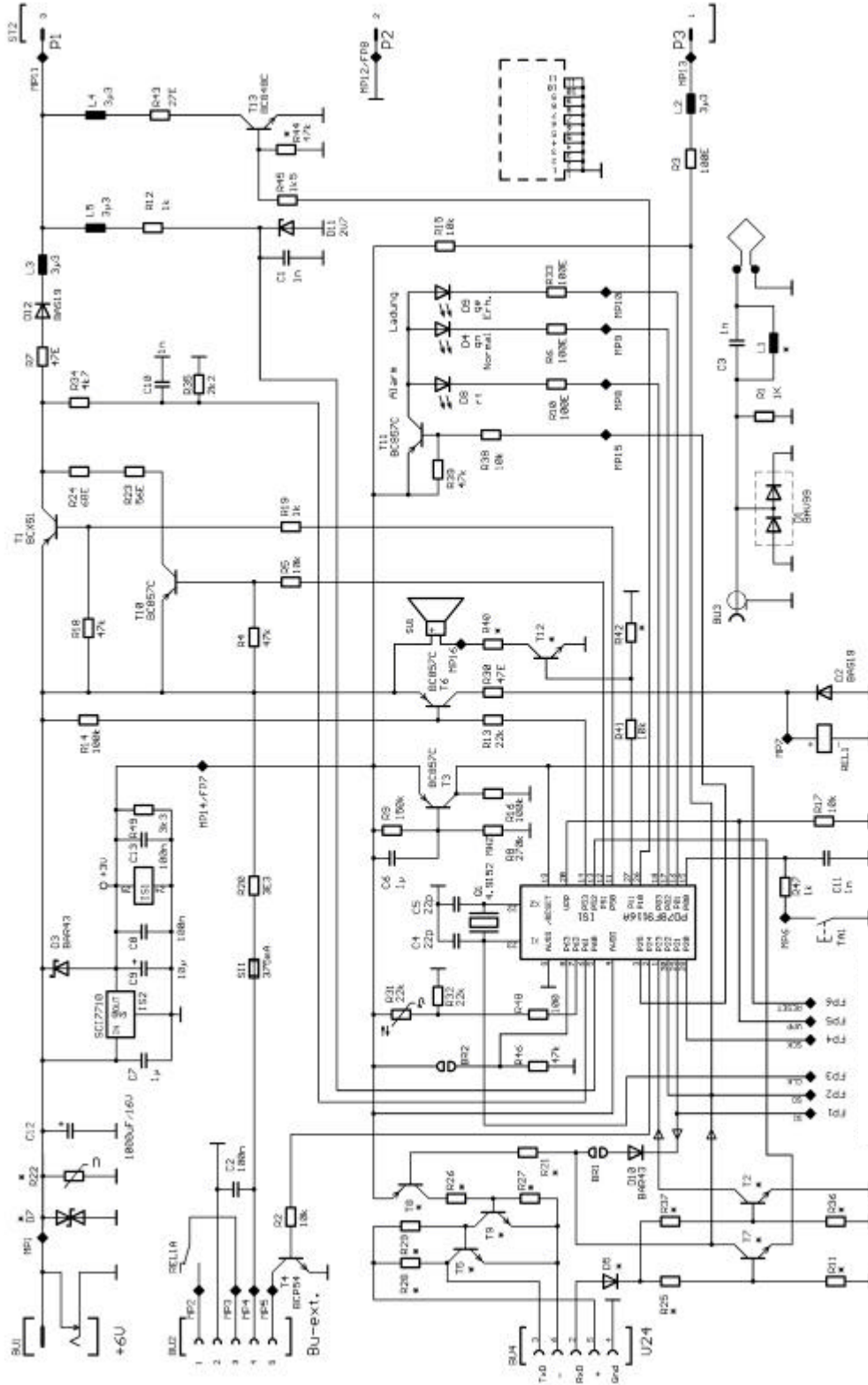
Flash programming

BR1 = close after flash programming
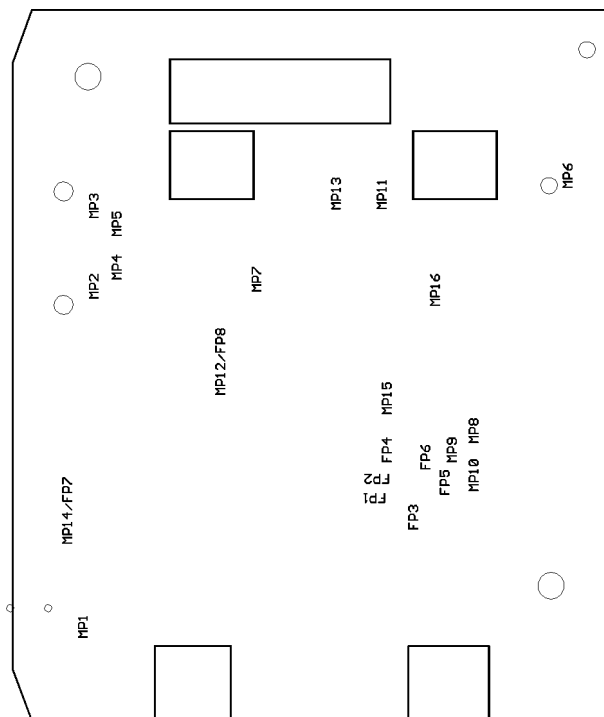BR2 open = relay active until reset
BR2 closed = relay active for 10s

* optional placement

5.14   Parts Location Charger Unit   PCB No. 228.01.xx

Component side

Solder Side

5.15   Bill Of Material Charger Unit   PCB No. 228.01.xx

Item	Part Number	Description
	FA-M228.01.01	Antenna Loop
	GGM225.02.xx	01: Shielding Cover
BU 1	ESVBUKLDSMT0202	SMD Power Socket, KLD 0201L-B
BU 2	ESDIMAB5SH	DIN Socket, MAB 5 SH
BU 3	ESBNCBU9050	BNC Socket 90°, 50 Ohm, PCB Mount
C 1	CS0603NP0102	SMD Capacitor 1nF, 0603 NP0
C 2	CS0805X7R104	SMD Capacitor 100nF, 0805 X7R
C 3	CS0805NP0102	SMD Capacitor 1nF, 0805 NP0
C 4, C 5	CS0603NP0220	SMD Capacitor 22pF, 0603 NP0
C 6	CS0603Y5V105	SMD Capacitor 1µF, 10V, 0603 Y5V
C 7	CS0805X7R105	SMD Capacitor 1µF, 0805 X7R
C 8	CS0805X7R104	SMD.Capacitor 100nF, 0805 X7R
C 9	CSTAA10610	SMD Tantalum A, 10µF, 10V
C 10, C 11	CS0603NP0102	SMD Capacitor 1nF, 0603 NP0
C 12	CKE5.010816	Electrol. Capacitor 1000µF, 16V
C 13	CS0805X7R104	SMD Capacitor 100nF, 0805 X7R
D 1	DSDBAV99	SMD Diode, BAV99, SOT23
D 2	DSDBAS19	SMD Diode, BAS19
D 3	DSDBAR43	SMD Diode, BAR43
D 4	OSLEDQTLP650C4T	SMD LED, green
D 7	DSZSMBJ15C	SMD Transzorb Diode, SMBJ15CA
D 8	OSLEDQTLP650C2T	SMD LED, red
D 9	OSLEDQTLP650C3T	SMD LED, yellow
D 10	DSDBAR43	SMD Diode, BAR43
D 11	DSZBZX84C2V7	SMD Zener Diode, BZX84C2V7, SOT23
D 12	DSDBAS19	SMD Diode, BAS19
IS 1	ICSUPD78F9116AM	SMD IC, µPD78F9116AMC-5A4
IS 2	ICSSCI7710YDAT1	SMD IC, SCI7710YDA/S-81230SGUP
L 1	LSSIMID02223	SMD Coil, 22nH, SIMID02
L 2, L 3, L 4, L 5	LSSIMID02335	SMD Coil, 3.3µH, SIMID02
Q 1	QKQ4.9152TC39	Cylind. Crystal, 4.9152 MHz, 3x9mm
R 1	RS08055102	SMD Resistor 1k0, 0805 5%
R 2	RS06035103	SMD Resistor 10k, 0603 5%
R 3	RS06035101	SMD Resistor 100R, 0603 5%
R 4	RS08055473	SMD Resistor 47k, 0805 5%
R 5	RS06035103	SMD Resistor 10k, 0603 5%
R 6	RS06035101	SMD Resistor 100R, 0603 5%
R 7	RKL4702	Power Resistor , 47R 2W, PR 02
R 8	RS06035274	SMD Resistor 270k, 0603 5%
R 9	RS06035154	SMD Resistor 150k, 0603 5%
R 10	RS06035101	SMD Resistor 100R, 0603 5%
R 12	RS06035102	SMD Resistor 1k0, 0603 5%
R 13	RS06035223	SMD Resistor 22k, 0603 5%
R 14	RS08055104	SMD Resistor 100k, 0805 5%
R 15,	RS06035103	SMD Resistor 10k, 0603 5%
R 16	RS06035104	SMD Resistor 100k, 0603 5%
R 17	RS06035103	SMD Resistor 10k, 0603 5%
R 18	RS08055473	SMD Resistor 47k, 0805 5%
R 19	RS06035102	SMD Resistor 1k0, 0603 5%

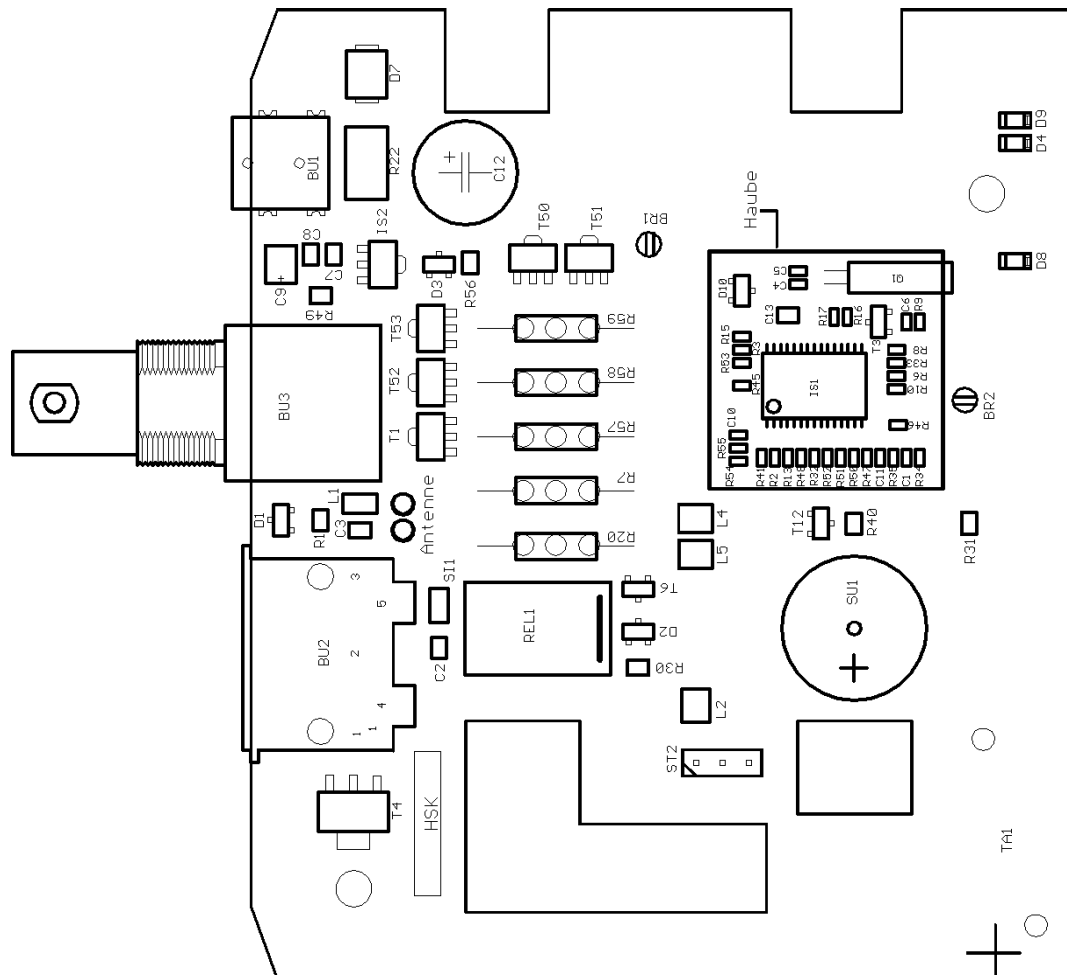| Item	Part Number	Description
R 20	RK0207130R0	Resistor, 30R0, 0207, 1%
R 22	RKVVS05K14	Varistor, S05 K14, Q69X3422
R 23	RS12065560	SMD Resistor 56R, 1206 5%
R 24	RS12065680	SMD Resistor 68R, 1206 5%
R 30	RS08055470	SMD Resistor 47R, 0805 5%
R 35	RS06035222	SMD Resistor 2k2, 0603 5%
R 38	RS06035103	SMD Resistor 10k, 0603 5%
R 39	RS06035473	SMD Resistor 47k, 0603 5%
R 43	RS12065270	SMD Resistor 27R, 1206 5%
R 44	RS08055473	SMD Resistor 47k, 0805 5%
R 45	RS06035152	SMD Resistor 1k5, 0603 5%
R 46	RS06035473	SMD Resistor 47k, 0603 5%
R 47	RS06035102	SMD Resistor 1k0, 0603 5%
R 48	RS06035101	SMD Resistor 100R, 0603 5%
R 49	RS08055332	SMD Resistor 3k3, 0805 5%
REL 1	ERA5WK	Relay, A-5-W-K, Takamisawa
SI 1	SI0.375AELU1206	SMD Fuse 0.375A, F1206A0R375FWR
ST 2	ESJSTB3BEHA	3pin Interconnect B 3B-EH-A
T 1	TSBCX51	SMD Transistor, BCX51
T 3	TSBC857C	SMD Transistor, BC857C, SOT23
T 4	TSBCP54GEG	SMD Transistor, BCP 54
T 6, T 10, T 11	TSBC857C	SMD Transistor, BC857C, SOT23
T 13	TSBC847C	SMD Transistor, BC847C, SOT23

5.16   Charging Unit Schematic   PCB No. 228.06.xx
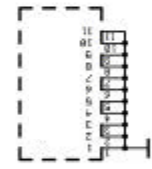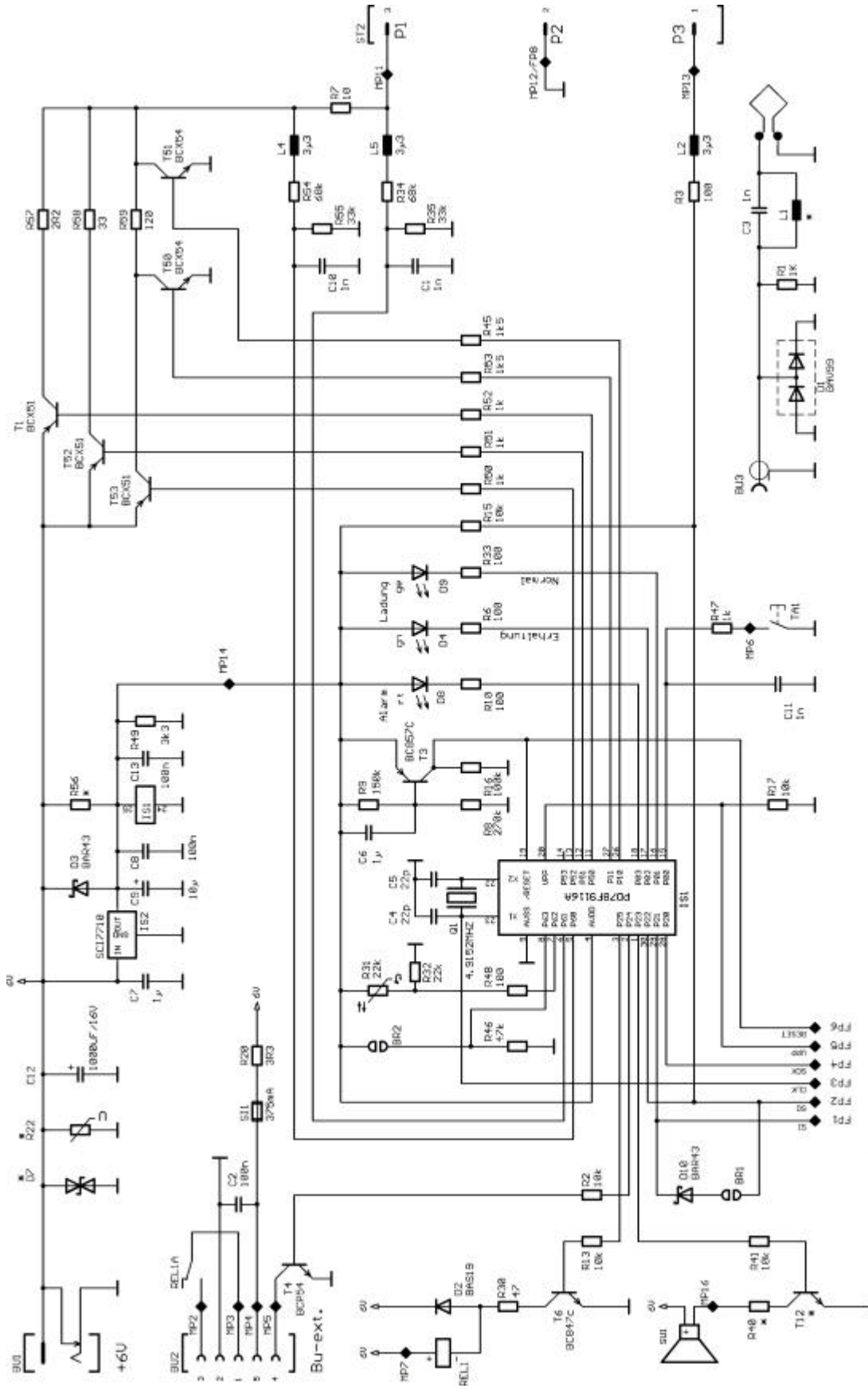
BR1 open = flash programming
BR1 closed = normal operation
BR2 open = relay active until reset
BR2 closed = relay active for 10s
* optional placement

5.17   Parts Location Charging Unit   PCB No. 228.06.xx

5.18   Bill Of Material   Charging Unit   PCB No. 228.06.xx

Item	Part Number	Description
BU1	ESVBUKLDSMT0202	SMD Power Socket KLD 0201L-B
BU2	ESDIMAB5SH	DIN Socket MAB 5 SH
BU3	ESBNCBU9050	BNC Socket 90°,50 Ohm,PCB Mount
C1,10,11	CS0603NP0102	SMD Capacitor 0603 NP0 1nF 5%
C12	CKE5.010816	Electrol. Capacitor 5.0 1000µF 16V
C2,8,13	CS0805X7R104	SMD Capacitor 0805 X7R 100nF
C3	CS0805NP0102	SMD Capacitor 0805 NP0 1nF
C4,5	CS0603NP0220	SMD Capacitor 0603 NP0 22pF
C6	CS0603Y5V105	SMD Capacitor 0603 Y5V 1µF 10V
C9	CSTAA10610	SMD Tantalum A 10µF 10V
D1	DSDBAV99	SMD Diode BAV99 SOT23
D2	DSDBAS19	SMD Diode BAS19
D3,10	DSDBAR43	SMD Diode BAR43
D4	OSLEDQTLP650C4T	SMD LED green QTLP650C-4TR
D7 not placed	DSZSMBJ15C	SMD Transzorb Diode SMBJ15CA
D8	OSLEDQTLP650C2T	SMD LED red QTLP650C-2TR
D9	OSLEDQTLP650C3T	SMD LED yellow QTLP650C-3TR
IS1	ICSUPD78F9116AM	SMD Controller µPD78F9116AMC-5A4
IS2	ICSSCI7710YDAT1	SMD IC SCI7710YDA/S-81230SGUP
L2,4,5	LSSIMID02335	SMD Coil SIMID02 3,300µH
Q1	QKQ4.9152TC39	Cylind. Crystal 4.9152 MHz 3x9mm
R1	RS08055102	SMD Resistor 0805 5% 1k0
R16	RS06035104	SMD Resistor 0603 5% 100k
R2,13,15,17,41	RS06035103	SMD Resistor 0603 5% 10k
R20	RK020713R3	Resistor 0207 1% 3R30
R22 not placed	RKVVS05K14	Varistor 5.0 S05 K14 Q69X3422
R3,6,10,33,48	RS06035101	SMD Resistor 0603 5% 100R
R30	RS08055470	SMD Resistor 0805 5% 47R
R31	RSVN0805223	SMD NTC Resistor 0805 22k
R32	RS06035223	SMD Resistor 0603 5% 22k
R34,54	RS06035683	SMD Resistor 0603 5% 68k
R35,55	RS06035333	SMD Resistor 0603 5% 33k
R45,53	RS06035152	SMD Resistor 0603 5% 1k5
R46	RS06035473	SMD Resistor 0603 5% 47k
R47,50,51,52	RS06035102	SMD Resistor 0603 5% 1k0
R49	RS08055332	SMD Resistor 0805 5% 3k3
R56 not placed	RS080550R0	SMD Resistor 0805 0R0
R57	RKL2R21	Power Resistor 2R2 1W PR01
R58	RKL33R02	Power Resistor 33R0 2W PR2
R59	RKL1211	Power Resistor 120R 1W PR01
R7	RKL10R02	Power Resistor 10R0 2W PR2
R8	RS06035274	SMD Resistor 0603 5% 270k
R9	RS06035154	SMD Resistor 0603 5% 150k
Rel1	ERA5WK	Relay A-5-W-K Takamisawa
SI1	SI0.375AELU1206	SMD Fuse 0A375 F1206A0R375FWR
ST2	ESJSTB3BEHA	3pin Interconnect B 3B-EH-A
T1, 52, 53	TSBCX51	SMD Trans. BCX51
T3	TSBC857C	SMD Trans. BC857C SOT23
T4	TSBCP54GEG	SMD Transistor BCP 54
T50, 51	TSBCX54	SMD Trans. BCX54
T6	TSBC847C	SMD Trans. BC847C SOT23
	GGM225.02.XX	01: Shielding Cover Decoder
	FA-M228.01.01	Antenna Loop Charger LX2

6   Description Of Testmode

Starting Testmode :
Turn off the pager,
Press button   , press button   , press button   , press button

Test Steps in Testmode:
Press button   to start the next test step.
The contrast of the LCD can be altered during Testmode by pressing buttons   and   .

Test Step	Display	Function
1	Line 1: Serial Number Line 2: Frequency	
2	Firmware Issue,Controller Crystal, Addition. Info	Testing the sound transducer (2s)
3	Display Test: checked pattern 1	Testing Vibrator (2s)
4	Display Test: checked pattern 2	Turn backlight on
5	Display Test: checked pattern 1	Turn backlight off
6 (inside charger only)	Display Test: checked pattern 2	Start Testing Charger Alert
7 (inside charger only)	Display Test: checked pattern 1	Stop testing Charger Alert
8	off	Testmode turned off, Pager turned off