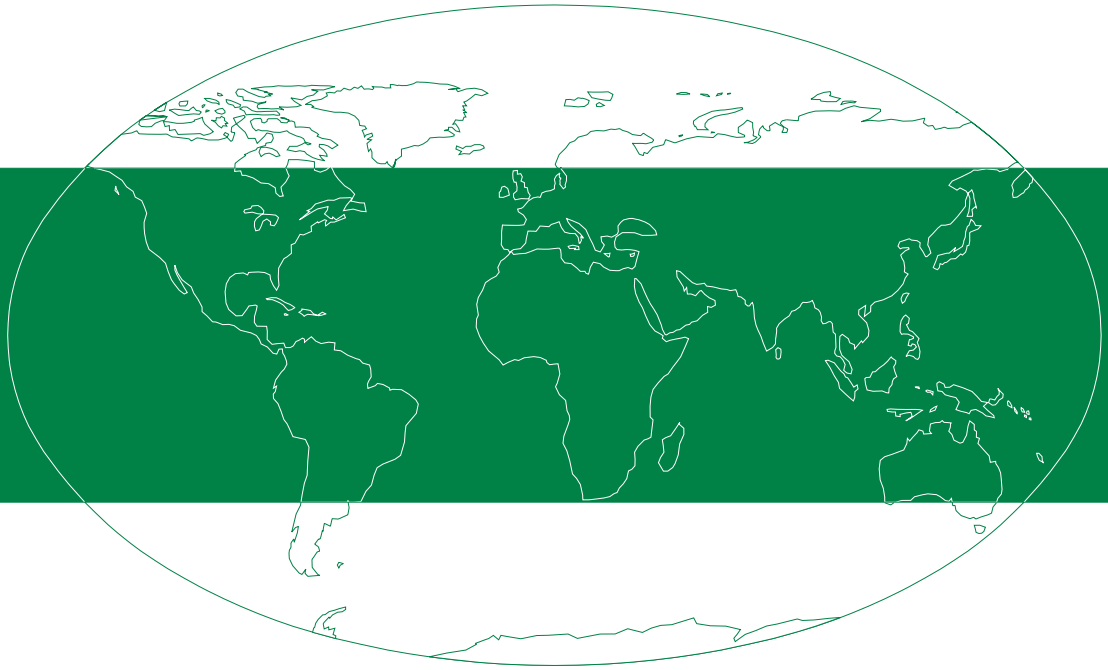
SAILOR



TECHNICAL MANUAL
FOR
GMDSS ALARM UNIT C2149

S.P. RADIO A/S · AALBORG · DENMARK

Please note

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Doc. no.: M2149GB Issue: B/9839

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1 INTRODUCTION

1.1 GENERAL DESCRIPTION GMDSS SYSTEM

C2149 is a part of the GMDSS system.

C2149 is the remote alarm unit.

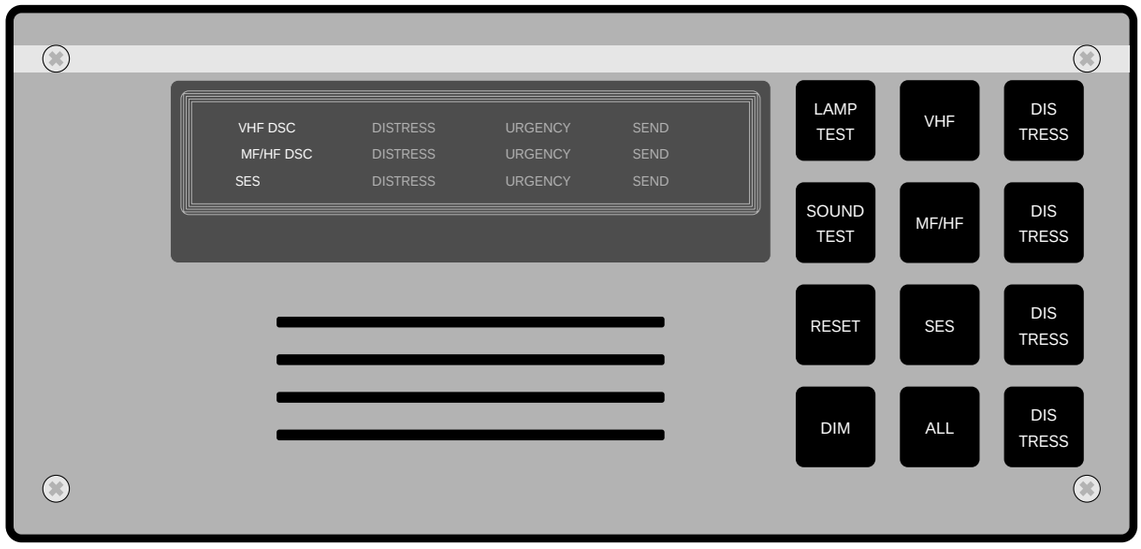
C2149 will display all incoming distress calls from MF/HF DSC watchkeepingreceiver, VHF DSC receiver and Inmarsat-C Satellite (SES) receiver.
(SES) Ship Earth Station.

C2149 is the remote alarm unit from which you can initiate a distress call on MF/HF, VHF and Inmarsat-C.

C2149 can be supplied from both the primary and secondary battery supply.

C2149 has inputs for both primary and secondary VHF DSC.

C2149 has input for satellite navigator (NMEA183).



27025A

1.2 TECHNICAL DATA

Primary Voltages:	24 volt DC -10% +30% (21.6-32V)	
Secundary Voltages:	24 volt DC -10% +30% (21.6-32V)	
Power Consumption:	Standby:	125 mA
	Max:	500 mA
Operating Temperature Range:	-15°C to +55°C	
Storage Temperature Range:	-25°C to +75°C	
Weight:	1.8 kg	
Dimensions:	Height:	98 mm
	Width:	225 mm
	Depth:	122 mm

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3 SERVICE

3.1 MAINTENANCE

PREVENTIVE MAINTENANCE

If C2149 has been installed in a proper way the maintenance can be reduced to an overhaul at each visit of the service staff. Then inspect the set, the cables, and plugs for mechanical damages, salt deposits, corrosion, and any foreign material. Owing to its traditional structure, the C2149 has a long lifetime, but it must always be carefully checked at intervals not exceeding 12 months - dependent on the conditions under which the set is working. The set must be brought to the service workshop to be tested.

3.2 ALIGNMENT INSTRUCTIONS

INTRODUCTION

The measuring values indicated in chapter 5. CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS are typical values and as indicated it will be necessary to use instruments in absolute conformity with the below list:

3.3 PROPOSAL FOR NECESSARY MEASURING INSTRUMENTS

Electronic Multimeter type PM2505	PHILIPS
Digitizing Oscilloscope type 2430/40	TEKTRONIC
Power Supply 21-32 Volt, 0.5A	
Power Supply 5-9 Volt, 10mA	

3.4 TROUBLE SHOOTING

3.4.1 KEYBOARD (Module 1)

None.

3.4.2 DISPLAY (Module2)

None.

3.4.3 MICROPROCESSOR (Module 3)

Check all incoming and outgoing voltages.

A. Supply voltages. Measured with voltmeter.

Incoming:	PLUG	PIN	Meas. ref.
GND	P2	18,20	
CHASSIS	P2	14	
+5 volt	P2	17	GND
+15 volt	P2	16	GND

Outgoing	PLUG	PIN	Meas. ref.
+6- +15 volt	J1	1	GND
+15 volt	J2	1	GND

Internal generated	Meas.point	Meas. ref.
+6.5 volt +-1 volt	Cathode D6	CHASSIS
-6.5 volt +-1 volt	Anode D7	CHASSIS

The upper side off the jumper (P1) can be used as GND.

VHF DSC (PRIMARY) RM2042
Switch ON the VHF DSC (PRIMARY) RM2042 and press **RESET** on the KEYBOARD.
After 10 sec. a pulse train 4 msec. long, can be seen on the oscilloscope at U13 pin 19 and U13 pin 3. Starting and ending at a high level (5 volt).
Test that P2 pin 12 (VHF P ON) is low < 2.0 volt.

VHF DSC (SECONDARY)
Switch OFF the VHF DSC (PRIMARY) RM2042 and switch ON the VHF DSC (SECONDARY) RM2042, press **RESET** on the KEYBOARD. After 10 sec. a pulse train 4 msec. long, can be seen on the oscilloscope at U12 pin 19 and U12 pin 3. Starting and ending at a high level (5 volt).
Test that P2 pin 11 (VHF S ON) is low < 2.0 volt.

MF/HF DSC RM2150/51
Switch ON the MF/HF DSC RM2150/51 and press **RESET** on the KEYBOARD. After 10 sec. a pulse train 800 msec. long, can be seen on the oscilloscope at U9 pin 29, starting and ending at a low level (0 volt). One sec. later a pulse train 800 msec. long, can be seen at U9 pin 17, starting and ending at a high level (5 volt). Test that P2 pin 10 (HF ON) is low < 2.0 volt.

SES H2095
Switch ON the SES H2095. The signal on U9 pin 12 is an endless stream of data. This is because the H2095 is polling for answer every 500 msec. When a pulse occur on U9 pin 9, the C2149 is transmitting data to the H2095 (SES). Test that P2 pin 13 (SES ON) is low < 2.0 volt.

Satellite Navigator
Switch ON the Satellite Navigator (NMEA 183). The signal on U12 pin 3 (P2 pin 2) is an endless stream of data. This is because the navigator is sending many types of data.

Sound signal
Press **SOUND TEST** on the KEYBOARD. The signal on U9 pin 15 consists of 4 pulses. Each pulse is 140 msec long and contains the frequentcy 2.1 kHZ.

Data and Clock for the Display driver
The serial bus occupied 3 bit of port 6 on the microprocessor.
U9 pin 25 is data, U9 pin 26 is clock and U9 pin 27 is select.

Press **DIM** on the KEYBOARD, 16 data bits can be seen simultaneously with 16 clock bits, subsequently by the select pulse.

3.4.4 Interface (Module 3)
Check all incoming and outgoing voltages.

A. Supply voltages. Measured with voltmeter.

Incoming	PLUG	PIN	Meas ref.	PIN
+ 21.6-32 volt	P2	2	P2	5
+ 21.6-32 volt	P3	2	P3	5
+ 5 volt	J1	9	J1	5
+ 5 volt	J2	9	J2	5
+ 9 volt	J5	9	J5	5
-12 volt	J4	Conductor		Chassis

Check the input current: (75mA- 160 mA)

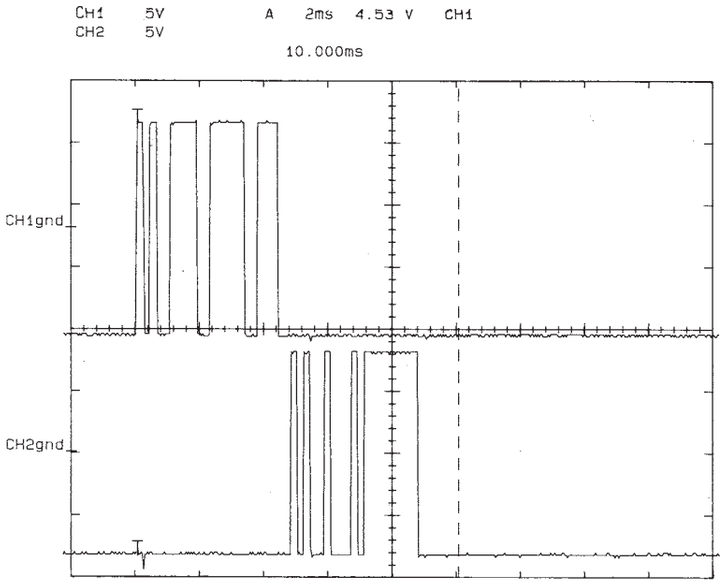
Outgoing:	PLUG	PIN	Meas. ref.
GND	P1	18,20	
CHASSIS	P1	14	
+5 volt	P1	17	GND
+15 volt	P1	16	GND

The Anode off D3 (upper right) can be used as GND.

Incoming and Outgoing signals to other units in the GMDSS system.

VHF DSC (PRIMARY) RM2042
Switch ON the VHF DSC (PRIMARY) RM2042 and press **RESET** on the KEYBOARD.
After 10 secs., the following signal can be seen on the oscilloscope.

CH1 connected to J1 pin 3 Meas. ref J1 pin 5
CH2 connected to J1 pin 2 Meas. ref J1 pin 5
5 Volt/div and 2 msek/div.



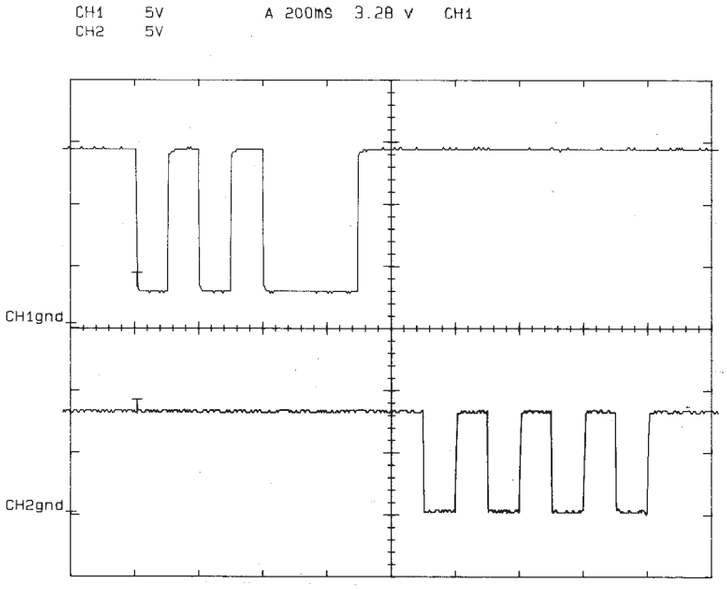
PLOT1

VHF DSC (SECONDARY) RM2042
Switch OFF the VHF DSC (PRIMARY) RM2042 and switch ON the VHF DSC (SECONDARY) RM2042, press **RESET** on the KEYBOARD.

After 10 secs., the same as PLOT 1 can be seen.

MF/HF DSC RM2150/51
Switch ON the MF/HF DSC RM2150/51 and press **RESET** on the KEYBOARD.
After 10 secs., the following signal can be seen on the oscilloscope.

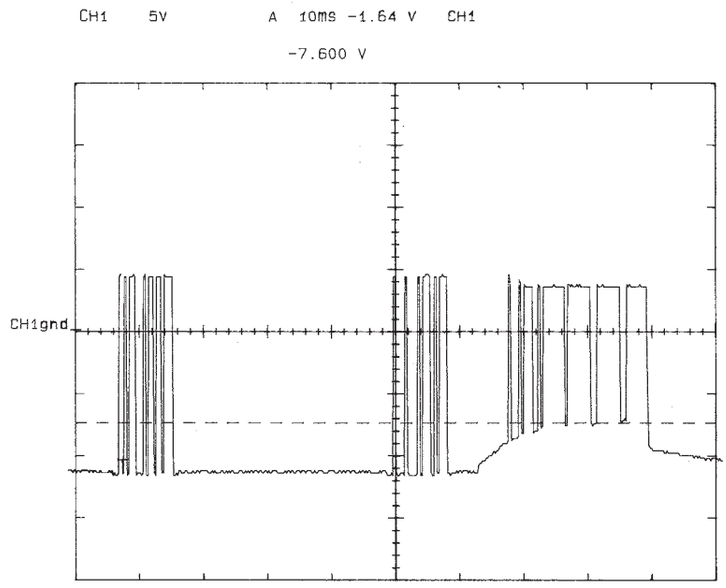
CH1 connected to J5 pin 3 Meas. ref J5 pin 5
CH2 connected to J5 pin 2 Meas. ref J5 pin 5
5 Volt/div and 200 msek/div.



PLOT2

SES H2095
Switch ON the SES H2095. The following signal can be seen on the oscilloscope.

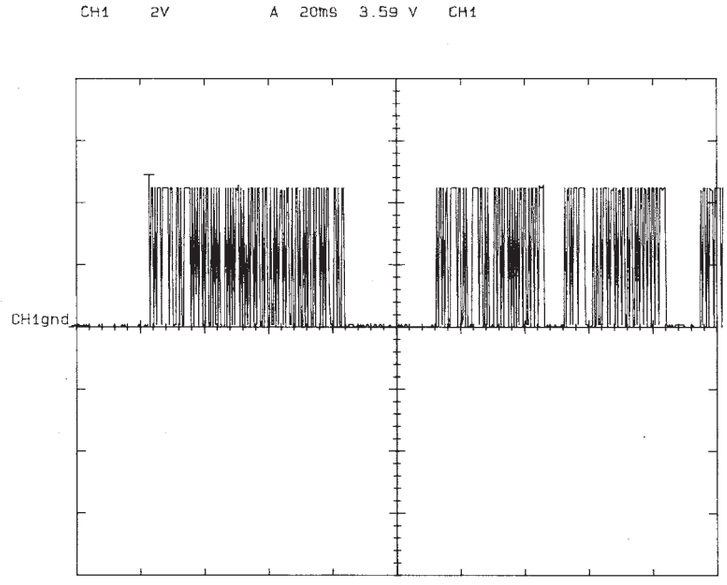
CH1 connected to J4.
5 Volt/div and 10 msek/div.



PLOT3.

SAT NAVTEX G.P.S. NMEA183
The following signal can be seen on the oscilloscope typical.

CH1 connected to J3.
2 Volt/div and 20 msek/div.



PLOT 4.

Incoming and Outgoing signals to the Microprocessor (Module 3) in the ALARM UNIT C2149.

The PLUG P1 is the connection between the Interface (Module 4) and the Microprocessor (Module 3).
All ---signals are described in section 3.4.

3.5 PERFORMANCE CHECK

Follow the SERVICE TROUBLE SHOOTING chapter 3.3 and 3.4.

3.6 ADJUSTMENT PROCEDURE

None

3.7 NECESSARY ADJUSTMENT AFTER REPAIR

None

3.8 FUNCTION CHECK

3.8.1 DISPLAY

Press **LAMP TEST** on the KEYBOARD.
Check that all lamps in the display is blinking 3 times.

3.8.2 SOUND TEST

Press **SOUND TEST** on the KEYBOARD.
Check that the alarm sound is laud and clear.

3.8.3 COMMUNICATION TO OTHER UNITS

Switch ON the VHF DSC PRIMARY, and switch OFF the VHF DSC SECONDARY. Press **RESET** on the KEYBOARD. Check that the display lamp VHF DSC is on, after 10 secs.

Switch OFF the VHF DSC PRIMARY, and switch ON the VHF DSC SECONDARY. Press **RESET** on the KEYBOARD. Check that the display lamp VHF DSC is ON, after 10 secs.

Switch ON the MF/HF DSC. Press **RESET** on the KEYBOARD.
After 10 secs. Check that the display lamp MF/HF DSC is flashing, and after 2 sec. the display lamp is ON constantly.

Switch ON the SES.
Check that the display lamp SES is ON after maximum 42 sec.

3.8.4 DIMMER

Press **DIM** on the KEYBOARD 5 times.
Check that the light in the display can be increased, and be switch OFF.

3.9 SERVICE PROGRAMS

None

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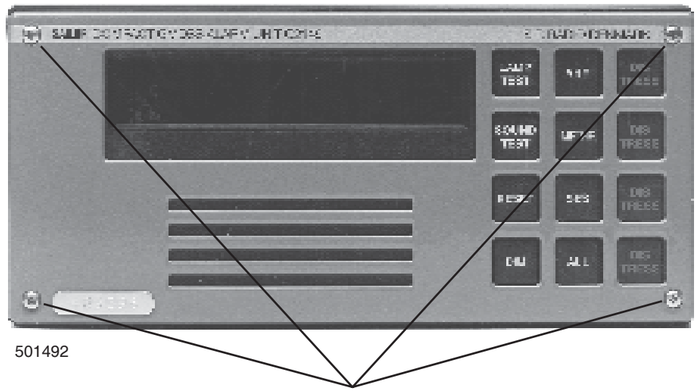
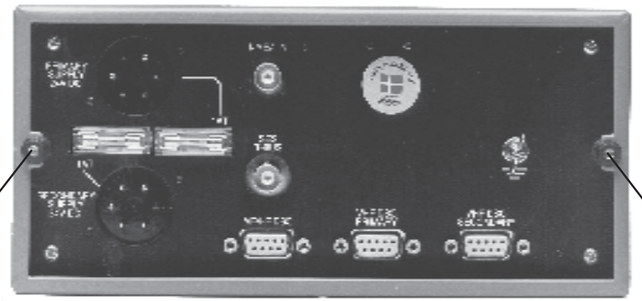
4.1 MECHANICAL DISASSEMBLING AND UNITS LOCATION



501492

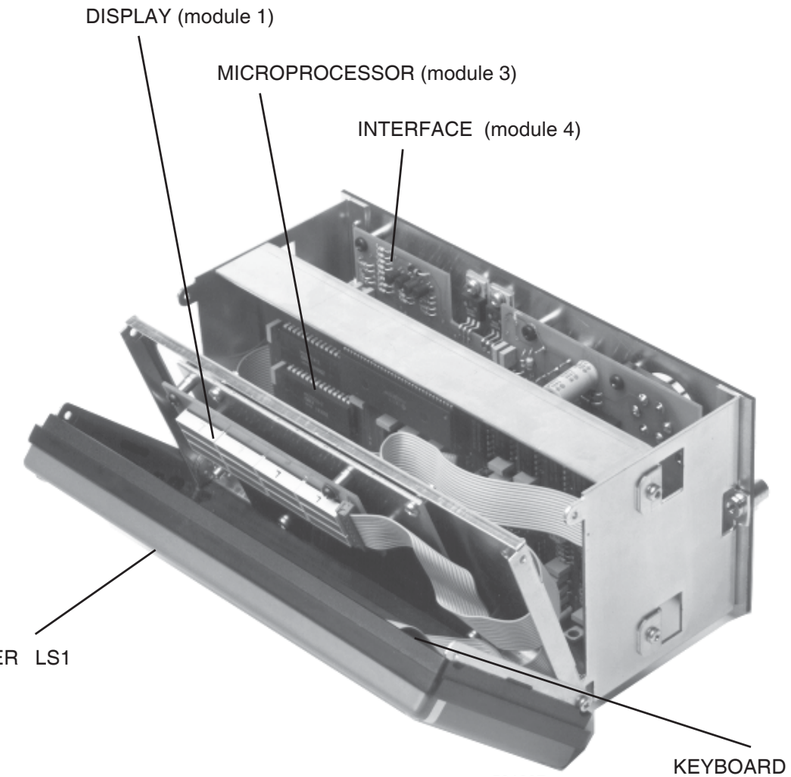
Remove to disassemble the front plate



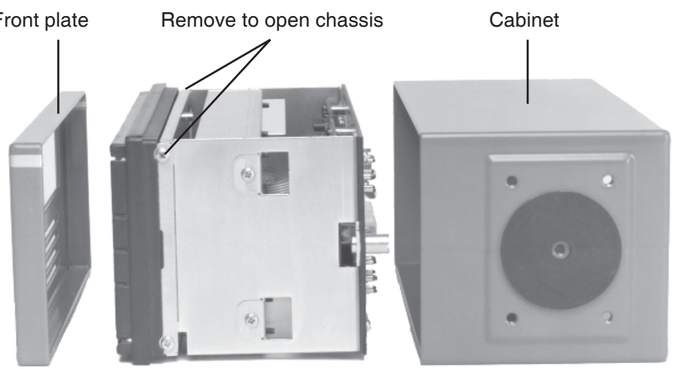
501493

Remove
to disassemble C2149

Remove
to disassemble C2149



501207



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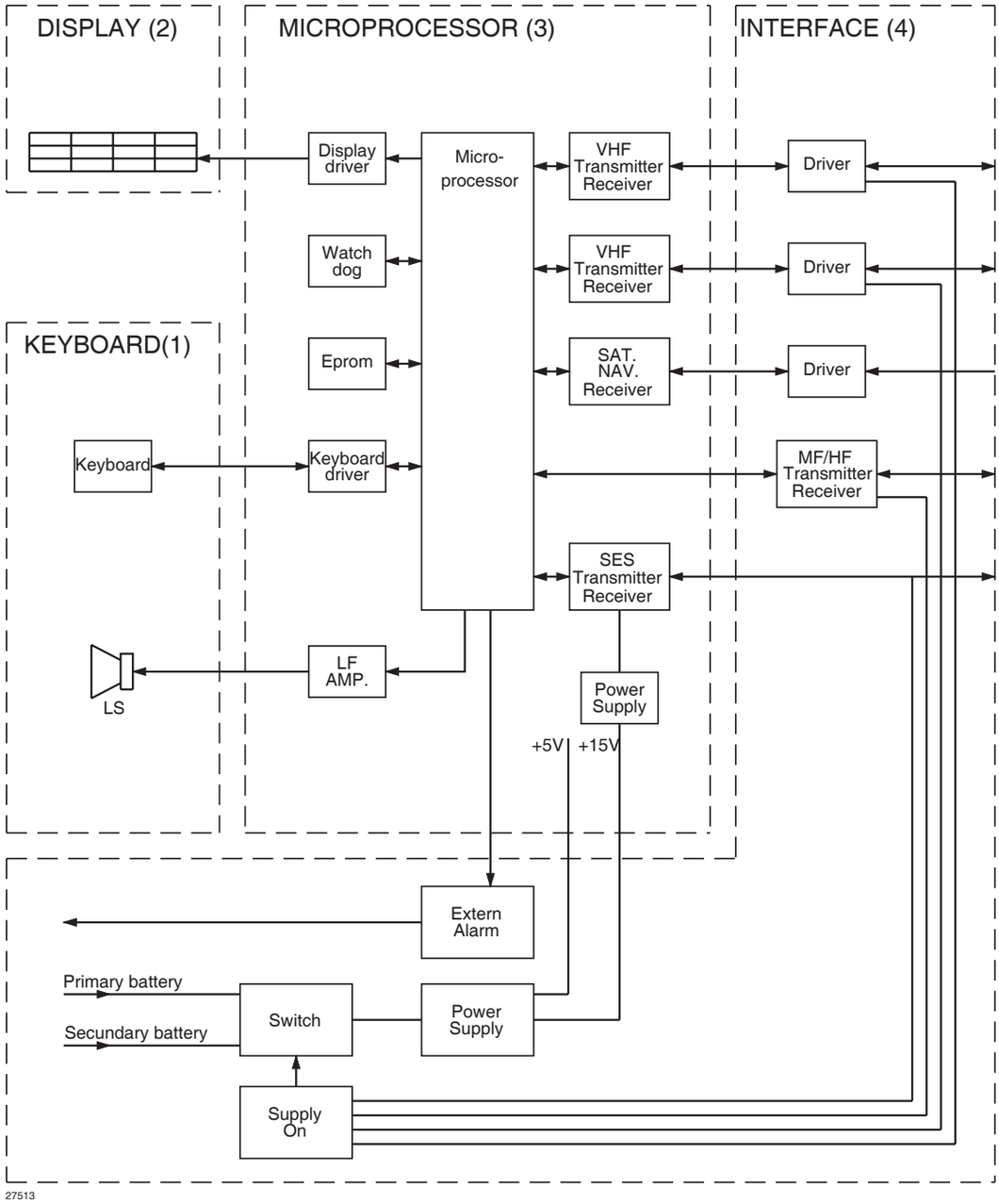
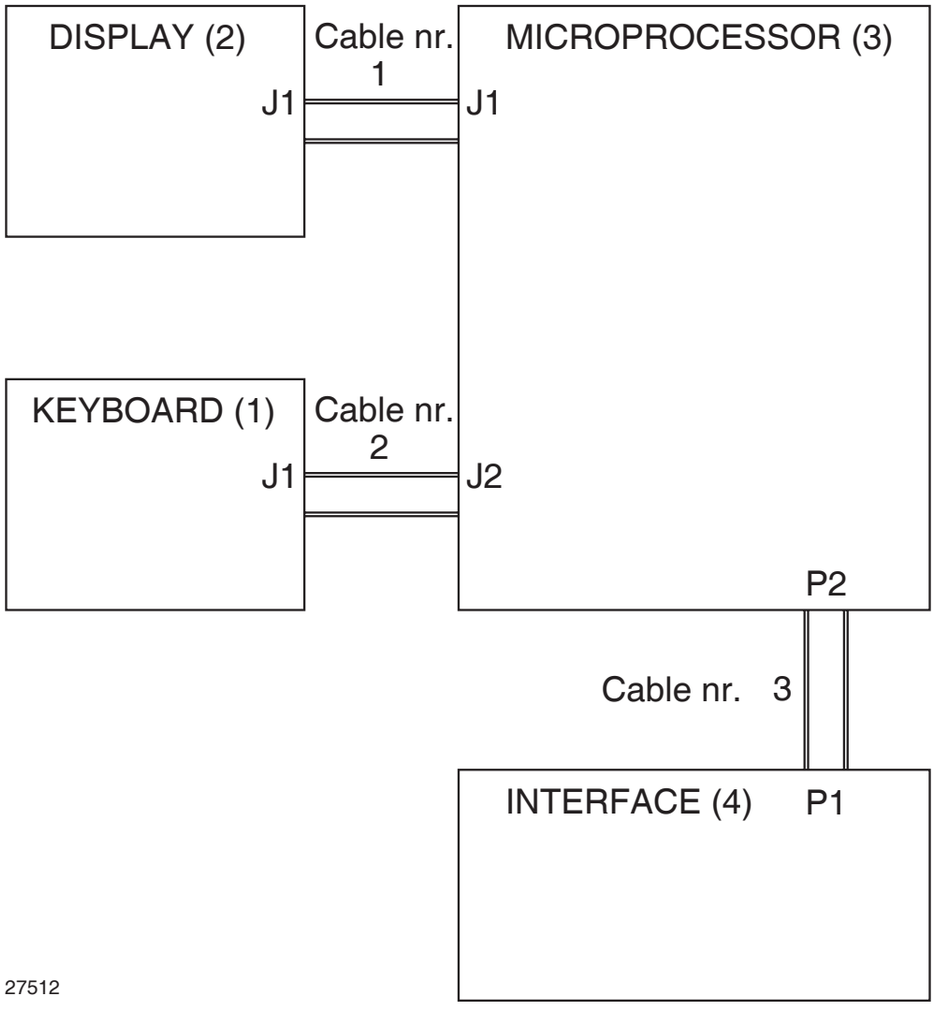
CONTENTS

5 CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

The schematic block diagram.



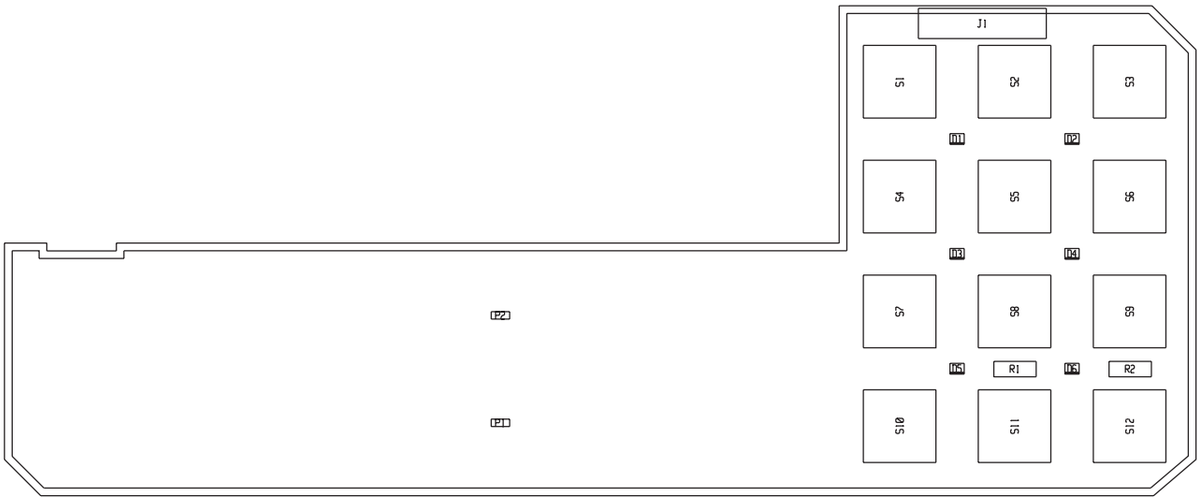
The cable connection between units.



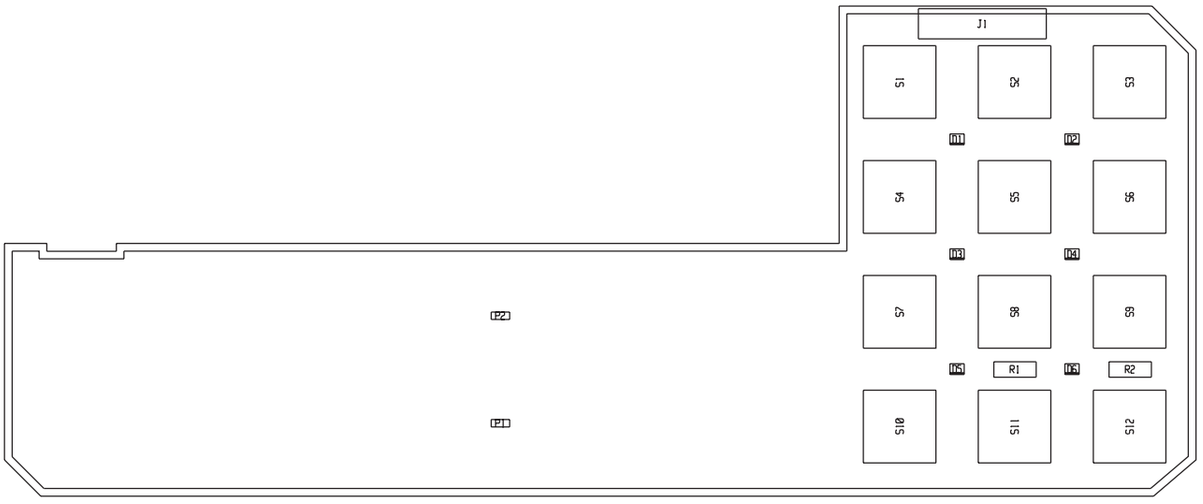
The cable connection between units.

INTERNAL FLAT CABLE					
Flat cable nr. 1 Between Display(2) and Microprocessor (3). The cable is a part of the Display module(2). SP nr. 627052		Flat cable nr.2 Between Keyboard(1) and Microprocessor(3) . SP nr. 56.057		Flat cable nr. 3 Between Interface(4) and Microprocessor(3). SP nr. 56.059	
PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
1	6-15 volt	1	15 VOLT	1	T-BUS IN/OUT
2	VHF DSC ON	2	Y1 IN	2	NMEA183 IN
3	VHF DISTRESS	3	Y2 IN	3	MF/HF IN
4	VHF URGENCY	4	Y3 IN	4	MF/HF OUT
5	VHF SEND	5	Y4 IN	5	EXTERNAL ALARM
6	MF/HF DSC ON	6	X1 OUT	6	VHF S OUT
7	MF/HF DISTRESS	7	X2 OUT	7	VHF S IN
8	MF/HF URGENCY	8	X3 OUT	8	VHF P OUT
9	MF/HF SEND	9	KEY LIGHT	9	VHF P IN
10	SES ON	10	GND	10	MF/HF ON
11	SES DISTRESS	11	NC	11	VHF S ON
12	SES URGENCY	12	NC	12	VHF P ON
13	SES SEND	13	LS	13	SES ON
14	GND	14	LS	14	T-BUS GROUND
				15	NC
				16	+15 VOLT
				17	+5 VOLT
				18	GND
				19	NC
				20	GND

5.1 COMPONENT LOCATION KEYBOARD (MODULE 1)



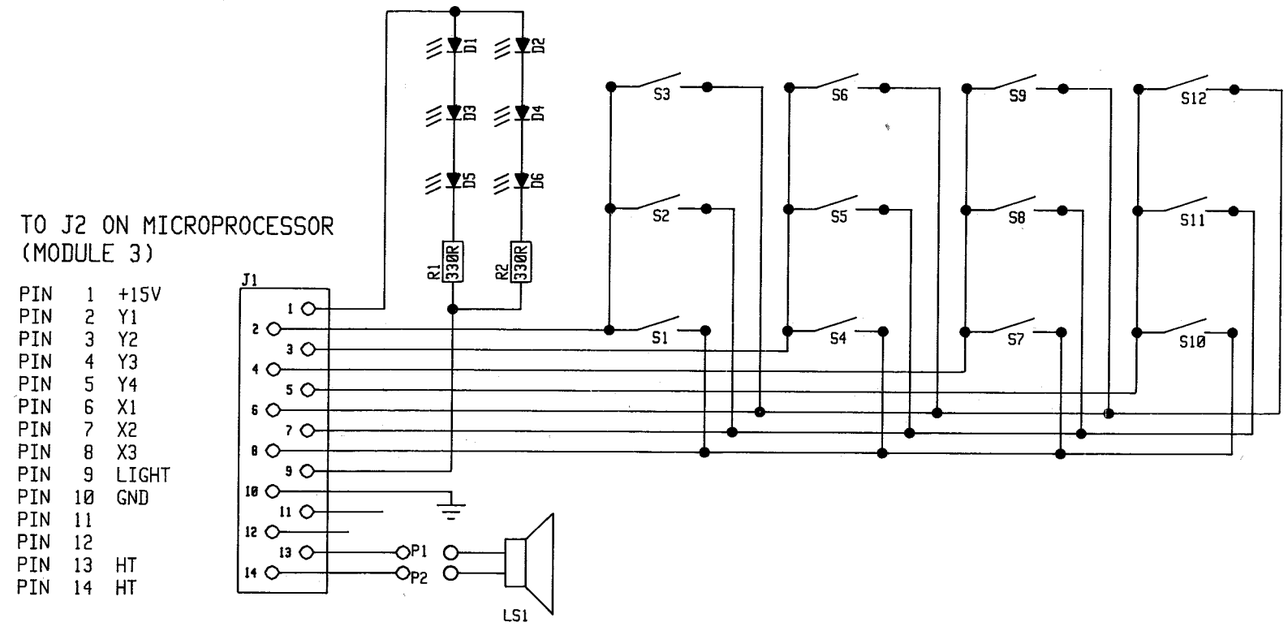
Seen from component side with upper side tracks.



Seen from component side with lower side tracks.
PCB rev. 27051A

KEYBOARD MODULE 1

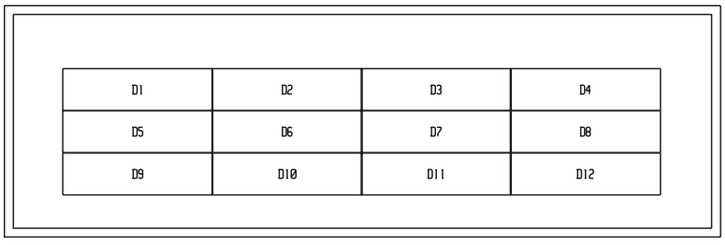
Keyboard (1)



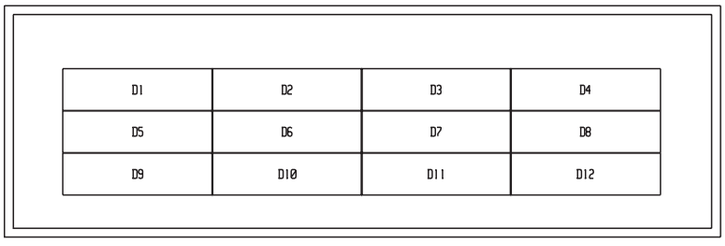
4-0-27051C

This diagram is valid for PCB rev. 27051A

5.2 COMPONENT LOCATION DISPLAY (MODULE 2)



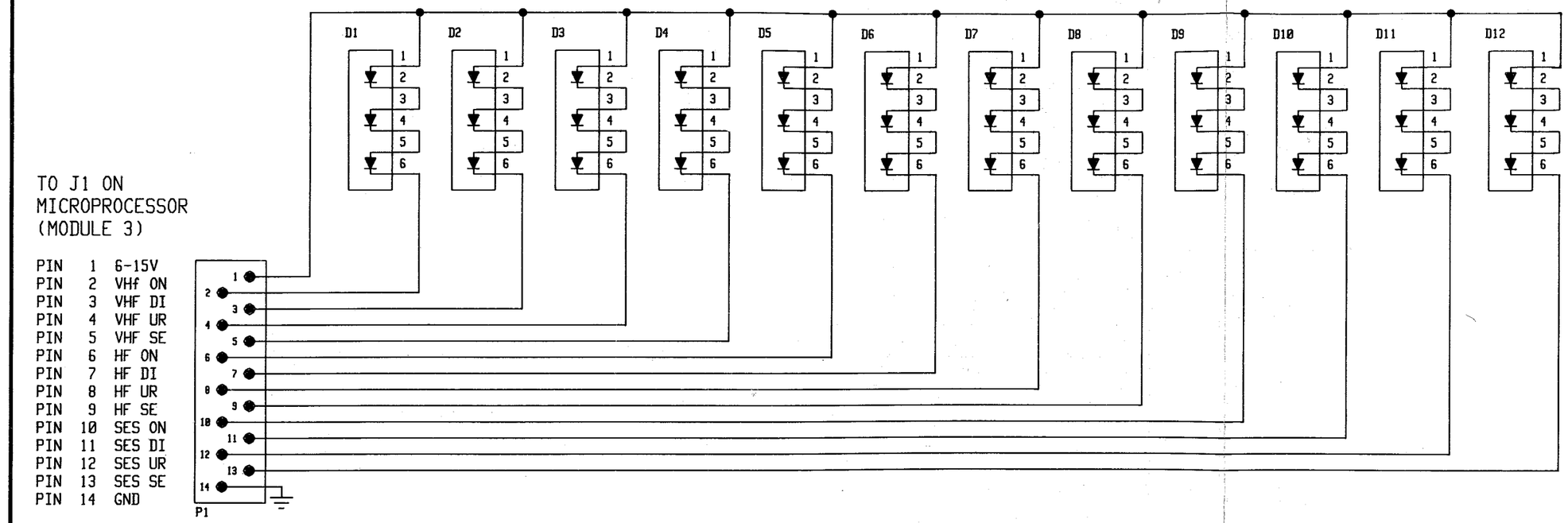
Seen from component side with upper side tracks.



Seen from component side with lower side tracks.
PCB rev. 27052B

DISPLAY MODULE 2

Display module (2)



5-0-27052A

This diagram is valid for PCB rev. 27052B

5.3 MICROPROCESSOR (MODULE 3)

Functional description.

The Microprocessor (Module 3) has the following main function:

- **RECEIVE AND SEND DISTRESS**
- communication with the Standard C Terminal (SES)
- and galvanic isolation to the SES.
- communication with the MF/HF DSC
- communication with the VHF DSC
- receiving data from the Satellite Navigator G.P.S
- control the display
- read the keyboard
- make the acoustic alarm signal

These functions are implemented partially in hardware and partially in software.
The software to GMDSS ALARM UNIT C2149 is C1100x SP nr. 727497. (x= , ,A,B,C,D,E,..)

The Microprocessor (module 3) hardware is separated in a number of circuits, referring to the diagram:
- microcomputer
- clock oscillator
- watch dog
- power supply to the SES driver
- communication bus driver and receiver (T-BUS).
- display driver
- light dimmer
- LF amplifier
- usart's for serial communication
- chip select

MICROCOMPUTER
The purpose of the Microcomputer bloc is to run the program properly. It consists of the following:

- An 8 bit Hitachi microprocessor, U9
- An EPROM, carrying the program, U8
- Chip select circuit for the EPROM U6.4
- A Watch Dog U10.
- Jumpers P3

CLOCK OSCILLATOR AND A BINARY COUNTER
The clock frequent is generated of the crystal (4.9152 Mhz) X1, C21, C22, and U14.3 and U14.2. The binary counter U20 convert the clock frequent into two lower frequent (76.8 Khz, 38.4 Khz) used for Baud Rate.

WATCH DOG
The MAX 690 (U10) has the following purposes:

- Ensure a proper Reset for the microprocessor when
- the +5Volt is stable.
- Watch Dog.

During normal operation the microprocessor resets the watch dog at known locations in the program. If the microprocessor stays too long time in an unintentional loop, the Watch Dog will not be reset.
The Watch Dog will then activate the Reset pin on the microprocessor.
This may happen if the microprocessor is waiting for an event that never comes (failure in hardware) or noise has disturbed the program execution.

Jumper	Inserted	Out
1	NC	NC
2	Do not insert.	.
3	Do not insert.	.
4	NC	
5	Do not insert. For self test use.	Normal operation.

Jumper 1 is the Jumper placed in the right side.

The upper part of jumper 1-5 can be used as GND for measurements in the Microprocessor (module 3).

POWER SUPPLY FOR THE SES DRIVER
The power supply make a galvanic isolation between the SES GROUND and the C2149 GND, it deliver the voltages app. +/- 6.5 volt.
R28 and C12 make the switch frequent of app. 83.0 Khz.

T-BUS DRIVER & RECEIVER
The communication to the SES is a time multiplexed data bus. The SES is the Master and a number of Slaves may be connected to the T-Bus. The Driver output is normally in high impedance state except when transmitting on the T-Bus. The Driver consists of two gates, U6/1 & U6/2 (74HC132), two opto coupler OC1.1 & OC1.2 (for galvanic isolation) and two complementary output transistors Q2 (BC640), Q3 (BC639). D4 and D5 is placed to protect the T-BUS driver/receiver. The Driver is connected to the Microprocessor U9, pin 13 (Port 2, bit 4, Transmit Data), and pin 10 (Port 2, bit 1, Driver Enable. The Receiver consists of a opto coupler OC2.1 which is used for galvanic isolation. The Receiver is connected to the Microprocessor U9, pin12 (Port 2, bit 3, Receive Data). As the levels on the T-Bus approximately matches to the RS232C Standard, it is possible to connect a RS232C to the T-Bus.

DISPLAY DRIVER
This driver activates all LAMPS (LED diodes) on the Display (Module 1).
It consists of two serial to parallel shift register U2, U5 (74HC595) and two darlington drivers, located in U1 and U4 (MC1413). R1, R2 and R3 reduce the current in the Display.

LIGHT DIMMER
The functions of this circuit is to control the LIGHT in the Display at four levels. The level of the Light is selected from the microprocessor via the shift register U5, (High level pin 15), (High Middle level pin 1), (Low Middle level pin 2) and (Low level none). The signal from U5 is divided by R9,R10,R7 and added with the signal from R8. Applied to the non-inverting input of the op-amp. The op-amp. U3/2 has a gain of app.2 . The output voltage is buffed by the output transistors Q1.

KEYBOARD DRIVER.
The keyboard (Module 1) has been built up as a 3*4 matrix of whits all 12 keys are used. The keyboard is scanned every 10 msec. by means of 3 ports from the microprocessor, and received trough U17 on the data bus.

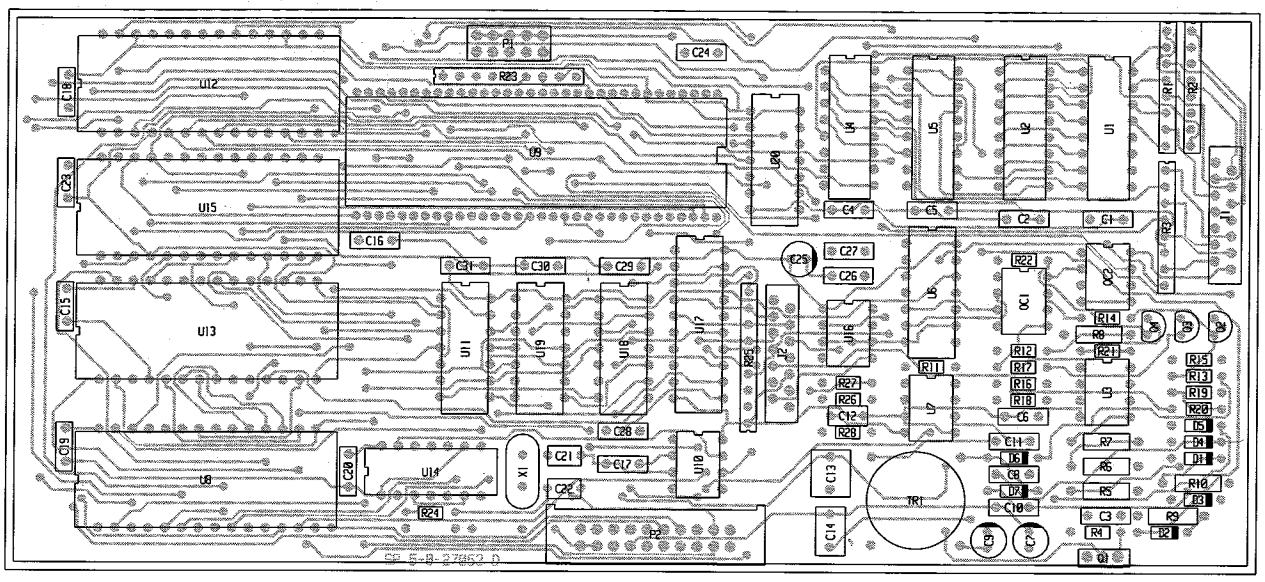
LF AMPLIFIER
The U16 (TDA7052) LF Amplifier deliver app 1 WATT to the 8 ohm's LS on the Keyboard (Module 2). The signal is deliver from U9 pin 15, and divided trough R27,C27 and R26,C26.

USART'S FOR SERIAL COMMUNICATION
The Usart's U12, U13 and U15 is used for serial communication with the G.P.S (nmea183) and two VHF DSC. The TXready and RXready outputs are added trough a logical OR circuit, consist of U11.2, U14.5 and U11.1. This output is used as input to the processor.

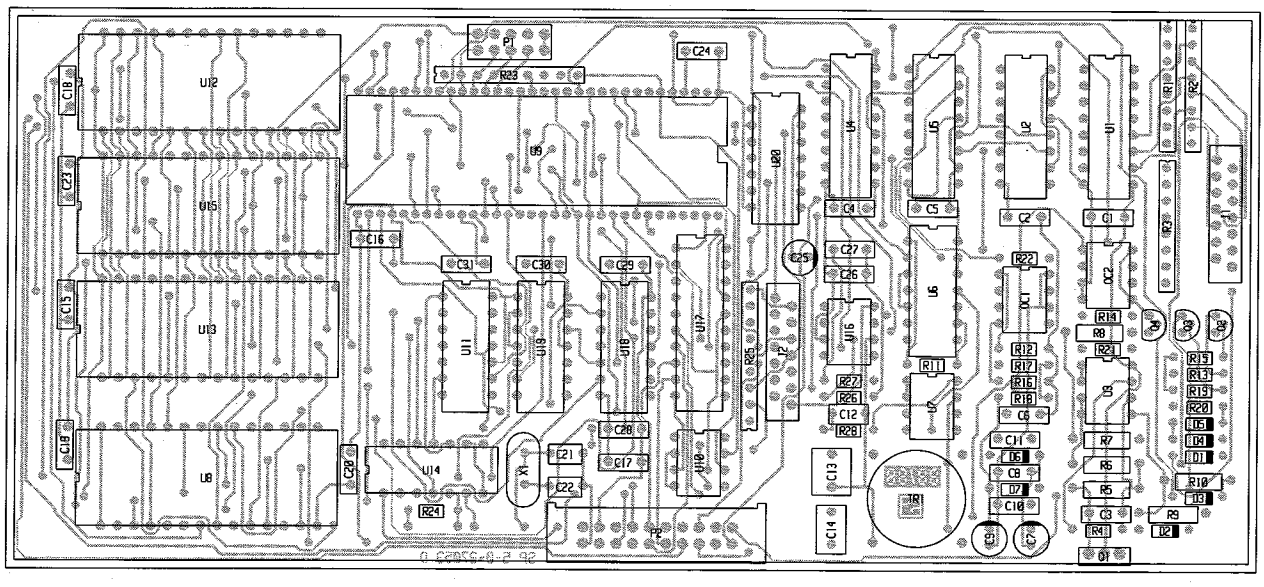
CHIP SELECT CIRCUIT
The four chip select circuits is used for:

1.	Keyboard and supply	U17	U18.1 and U11.3
2.	Secondary VHF DSC	U15	U18.2 and U19.1
3.	Primary VHF DSC	U13	U19.3 and U18.3
4.	G.P.S. (NMEA183)	U12	U19.2 and U18.4

COMPONENT LOCATION MICROPROCESSOR (MODULE 3)



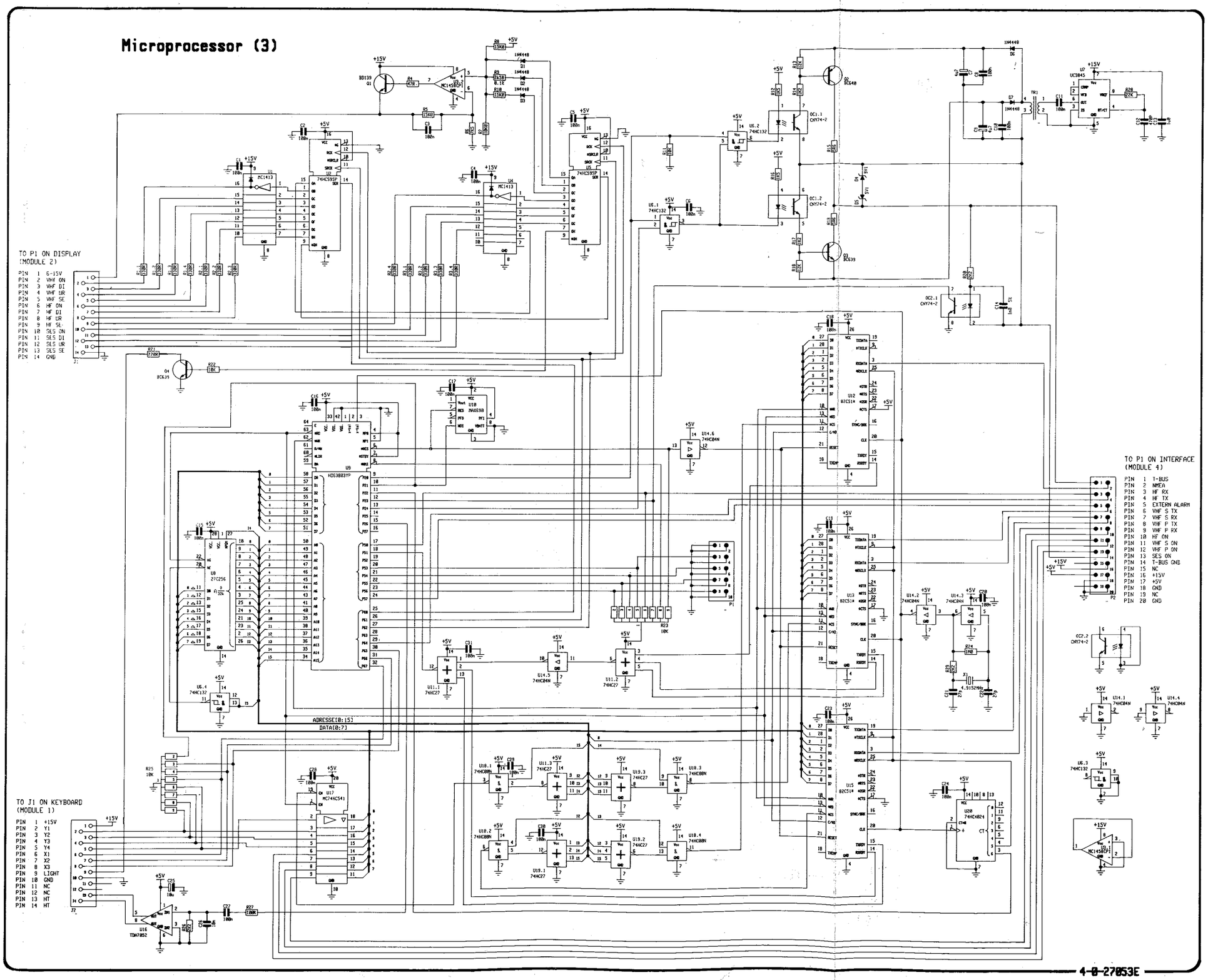
Seen from component side with upper side tracks.



Seen from component side with lower side tracks.

PCB rev. 27053D

MICROPROCESSOR MODULE 3



This diagram is valid for PCB rev. 27053D

5.4 INTERFACE (MODULE 4)

The main function of the Interface (Module 4) is to make the galvanic isolation between the Battery minus and the ground of all the connected units. This function is separated in a number of circuits, referring to the diagrams.

- primary and secondary supply
- switch ON circuit
- internal power supply
- extern alarm
- MF/HF DSC transmitter/receiver
- NMEA interface
- VHF DSC driver (transmitter/receiver)

PRIMARY AND SECONDARY SUPPLY
The voltages from the Primary Battery is OR'ed to the voltages from the Secondary battery trough D3,D4,F1,F2,D6,D7 and D8, in order to deliver a stable supply to the C2149. The diodes D3 and D4 secure that there is no connection between the two Ship batteries. If the Voltage from one of the batteries or the difference between the batteries becomes grater than 40 volts the thyrister D26 goes on and stays on until the Fuse blow. This is done en order to protect the C2149.

SWITCH ON CIRCUIT
The switch on circuit secure that the C2149 is switch ON if one or more, of the connected units is switch on.
The relay RE2 is activated from transistor Q4 trough R40. Q4 is sourced from one of the opto couplers OC2.1, OC3.2, OC4.2 or OC5.2, trough D12, D13, D14 or D15. The diodes D16,D17,D18 and D19 secure that the current is app. 0 Amp. when the C2149 is switch off. The transistor Q5,Q6,Q7 and Q8 reduce the off voltages down to 5 volt in order to protect the CPU unit.

INTERNAL SUPPLY
The C2149 is supplied from the ship battery 24 volt (20-32volt) and converted into 2 internal supplies in U2 (15 volt) and U3 (5 volt).

EXTERNAL ALARM
The relay RE1 can be used to drive an external alarm indicator. RE1 is soused direct from the CPU pin 24 trough Q3.

MF/HF DSC INTERFACE
The serial communication between the C2149 and the MF/HF DSC RM2150/51 is a slow asynchronous transmitter-receiver (10 Baud).

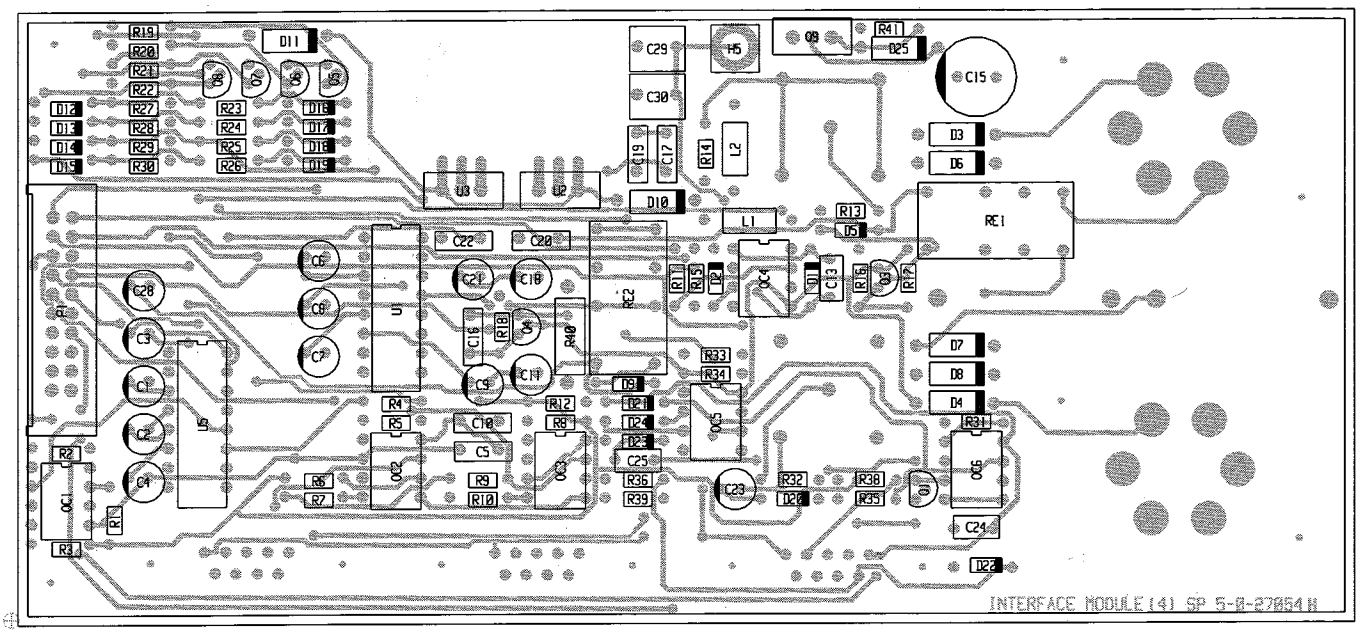
Transmitter
The open collector output, Collector of OC6.1 is pulled up by the RM2150/51. The Opto coupler OC6.1 is controlled from the CPU pin 29 trough Q1. D21, D22, C24 and R35 is for protection propose.

Receiver
The open collector output from the RM2150/51 is used sa drive for the opto coupler OC5.1. R36 reduce the current in the opto coupler. D23, D24, R38 and C25 is for protection propose. The receiver is supplied from the N2165 with +9 volt.

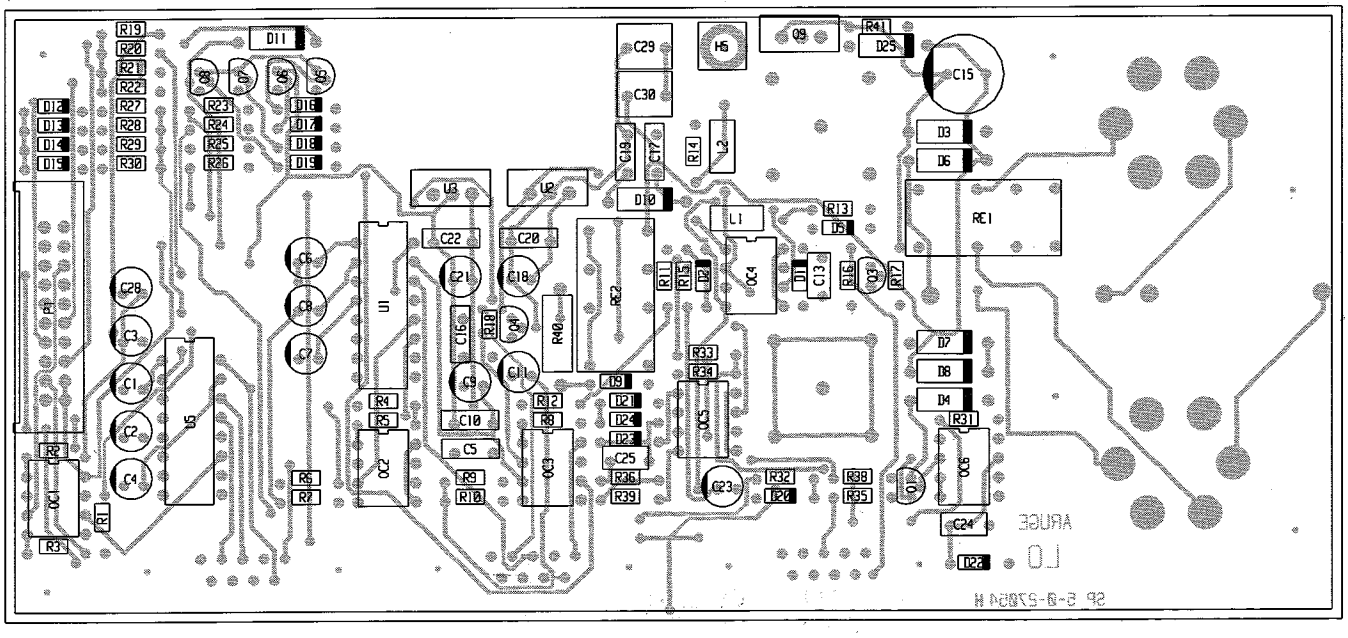
G.P.S NMEA183 INTERFACE
The opto coupler OC4.1 is for galvanic isolation, and C13, D1, L1, L2, R13 and R14 is for protection the opto coupler.

VHF DSC INTERFACE
The primary and secondary VHF DSC interface are identical, and only the Primary interface is explain. The RS232 receiver-transmitter driver U5 is supplied direct from the VHF DSC RM2042. C5 and C28 is placed to stabilize the +5 volt supply, and C1, C2, C3, C4 and C5 is placed to stabilize the internal generated voltages + 7.5 volt and -7.5 volt. The opto coupler OC1.1 and OC1.2 is for galvanic isolation.

COMPONENT LOCATION INTERFACE MODULE 4



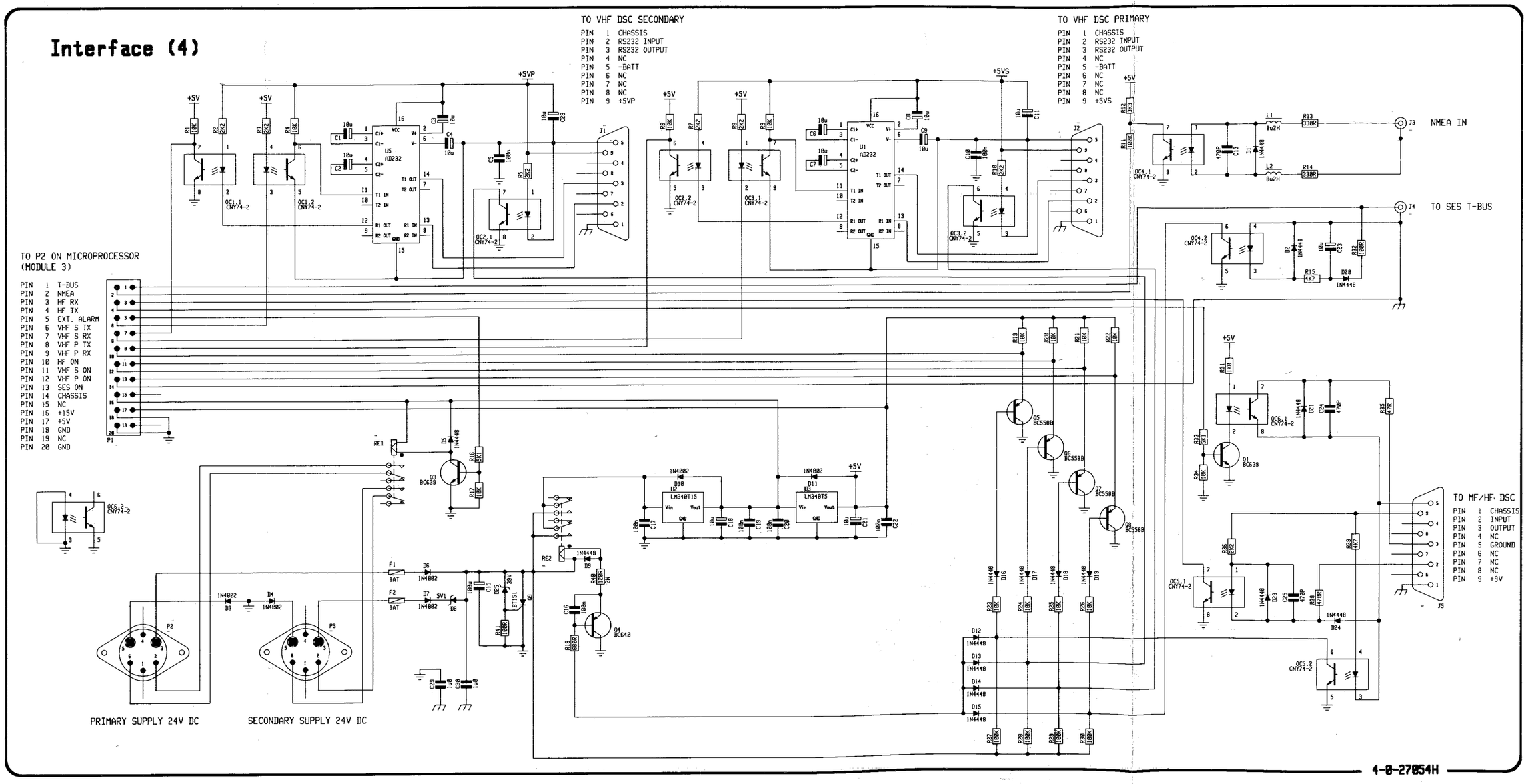
Seen from component side with upper side tracks.



Seen from component side with lower side tracks.

PCB rev. 27054H

INTERFACE MODULE 4



This diagram is valid for PCB rev. 27054H

CONTENTS

6 PARTS LIST

GMDSS ALARM UNIT C2149 — S.P. RADIO A/S — GMDSS ALARM UNIT C2149 — 802149

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOUS	MINI 1/4 BOX CABINET	SAILOR GREEN		225435 GR•N RILSAN	22543500
VARIOUS	FRONTPLATE C2149	SAILOR GREEN		227059 LAK	22705900
VARIOUS	POWER CABLE WITH PLUG		ECIA/S	503758 POWERKABEL	503758
VARIOUS	SERVICE AND SALES AGENTS	ADRESSES WORLD WIDE	S.P.RADIOA/S		F1000GB
VARIOUS	MANUAL C2149 ENGLISH		S.P.RADIOA/S	Ver.:	M2149GB

BASE UNIT C2149 STD. — ECI A/S — 702149

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOUS	KEYBOARD FOIL C2149		ESPERA	1-0-27224/9-3-27224B	227224
VARIOUS	HOLE PLUG, M5, BLACK		A.SANDER	TG.0-3-24252	48.549
VARIOUS	COVER FOR ALLEN SCREW		SANDER PLAST	0-3-25350A	48.699
VARIOUS	INTERCONNECTION CABLE	14 POLES L=305mm	ECIA/S	3-0-27479A	527479
VARIOUS	INTERCONNECTION CABLE	20 POLES L=470mm	ECIA/S	3-0-27481B	527481
VARIOUS	PLUG KIT FOR C2149		S.P.RADIOA/S	0-0-28612	728612
-1	KEYBOARD MODULE (1)	C2149/H2184	ECIA/S	5-0-27051A/4-0-27051C	627051
-2	DISPLAY MODULE (2)	C2149	S.P.RADIOA/S	5-0-27052B/4-0-27052A	627052
-3	CPU UNIT MODULE (3)	C2149	S.P.RADIOA/S	5-0-27053D/4-0-27053E	627053
-4	INTERFACE UNIT MODULE (4)	C2149	ECIA/S	5-0-27054H/4-0-27054H	627054
LS1-1	LOUDSPEAKER	8 OHMS 1W •45mm	PEITONE	45S02A4	46.053
U2-4	POS. VOLTAGE REG. 15V/1A	MC7815, LM340T-15	MOTOROLA	MC7815CT (MC7815BT)	31.090
U3-4	POS. VOLTAGE REG. 5V/1A	MC7805, LM340T-5.0	MOTOROLA	MC7805CT (MC7805BT)	31.250

KEYBOARD MODULE (1) — C2149/H2184 — ECI A/S — 5-0-27051A / 4-0-27051C — 627051

POSITION	DESCRIPTION		MANUFACTOR	TYPE	627051-AC PART NO.
-1	KEYBOARD MODULE (1)			5-0-27051A/1-0-27051	52.071
D1-1	LED SUB. MIN YELLOW	0.4mCd/2mA	H.P.	HLMP-7019 OPTION 1S1	25.649
D2-1	LED SUB. MIN YELLOW	0.4mCd/2mA	H.P.	HLMP-7019 OPTION 1S1	25.649
D3-1	LED SUB. MIN YELLOW	0.4mCd/2mA	H.P.	HLMP-7019 OPTION 1S1	25.649
D4-1	LED SUB. MIN YELLOW	0.4mCd/2mA	H.P.	HLMP-7019 OPTION 1S1	25.649
D5-1	LED SUB. MIN YELLOW	0.4mCd/2mA	H.P.	HLMP-7019 OPTION 1S1	25.649
D6-1	LED SUB. MIN YELLOW	0.4mCd/2mA	H.P.	HLMP-7019 OPTION 1S1	25.649
J1-1	SOCKET PCB VERSION	2x7 POLES u-MATCH	AMP	1-215079-4	78.196
P1-1	SOLDER LUG	PCB VERSION	VOGT AG	01015/Bz-Sn	82.005
P2-1	SOLDER LUG	PCB VERSION	VOGT AG	01015/Bz-Sn	82.005
R1-1	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
R2-1	RESISTOR MF	330 OHM 5% 0.4W	PHILIPS	2322 181 53331	01.187
S1-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S2-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S3-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S4-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S5-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S6-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S7-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S8-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S9-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S10-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S11-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601
S12-1	SWITCH KEYBOARD	12x12mm	OMRON	B3F-4005	43.601

DISPLAY MODULE (2) — C2149 — S.P.RADIO A/S — 5-0-27052B / 4-0-27052A — 627052

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
D1-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D2-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D3-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D4-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D5-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
D6-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D7-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D8-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D9-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D10-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D11-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
D12-2	LIGHT BAR	RED 4.5x20mm	ROHM	LD701VR	25.700
P1-2	INTERCONNECTION CABLE	14 POLES L=350mm	ECIA/S	3-0-27480A	527480

CPU UNIT MODULE (3) C2149 S.P.RADIO A/S 5-0-27053D / 4-0-27053E 627053

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
3	CPU UNIT MODULE (3)			5-0-27053D/1-0-27053	52.073
C1-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C2-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C3-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C4-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C5-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C6-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C7-3	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T58	14.510
C8-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C9-3	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T58	14.510
C10-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C11-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C12-3	CAPACITOR CERAMIC	470pF 10% 500VDC	KCK	RT-HM60 SK YB 471 K	16.095
C13-3	CAPACITOR MKT	1u0F 5% 63VDC	ERO	MKT 1826-510/06 4-G	11.190
C14-3	CAPACITOR POLYPROPYLENE	1n0F 5% 100VDC	ERO	KP 1830-210/01-4-GW	13.398
C15-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C16-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C17-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C18-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C19-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C20-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C21-3	CAPACITOR CERAMIC	27pF 5% N150 50VDC	KCK	RT-HE50-SK PH 270 J	15.076
C22-3	CAPACITOR CERAMIC	27pF 5% N150 50VDC	KCK	RT-HE50-SK PH 270 J	15.076
C23-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C24-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C25-3	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C26-3	CAPACITOR MKT	10nF 5% 63VDC	PHILIPS	2222 370 89103	11.134
C27-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C28-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C29-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C30-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C31-3	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
D1-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D2-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D4-3	DIODE ZENER	9V1 5% 0.4W BZX79C9V1	PHILIPS	BZX79C9V1	26.546
D5-3	DIODE ZENER	5.1V 5% 0.4W BZX79C5V1	PHILIPS	BZX79C5V1	26.527
D6-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D7-3	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
J1-3	SOCKET PCB VERSION	2x7 POLES u-MATCH	AMP	1-215079-4	78.196
J2-3	SOCKET PCB VERSION	2x7 POLES u-MATCH	AMP	1-215079-4	78.196
OC1-3	OPTO COUPLER	CNY74-2	TELEFUNKEN	CNY74-2	32.529
OC2-3	OPTO COUPLER	CNY74-2	TELEFUNKEN	CNY74-2	32.529
P1-3	MULTIPLUG	1/10" DIL SQ PINS 5x2 POL	AMP	826656-5	78.321
P2-3	PLUG	2x10 POLES	3M	3592-6002 / 7620-6002 JL	78.250
Q1-3	TRANSISTOR AF	POWER NPN BD139 SOT-32	PHILIPS	BD139	29.060
Q2-3	TRANSISTOR AF SMALL SIGNA	BC640	PHILIPS	BC640-126	28.124
Q3-3	TRANSISTOR AF	NPN BC639 TO-92	MOTOROLA	BC639ZL1	28.120
Q4-3	TRANSISTOR AF	NPN BC639 TO-92	MOTOROLA	BC639ZL1	28.120
R1-3	RESISTOR ARRAY	4x330 OHM 5% 1/4W	BOURNS	4608X-102-331	08.608
R2-3	RESISTOR ARRAY	4x330 OHM 5% 1/4W	BOURNS	4608X-102-331	08.608
R3-3	RESISTOR ARRAY	4x330 OHM 5% 1/4W	BOURNS	4608X-102-331	08.608
R4-3	RESISTOR MF	47 OHM 5% 0.33W	PHILIPS	2322 187 73479	02.440
R5-3	RESISTOR MF	15k0 OHM 1% 0.6W	PHILIPS	2322 156 11503	03.429
R6-3	RESISTOR MF	7k50 OHM 1% 0.6W	*PHILIPS	2322 156 17502	03.448
R7-3	RESISTOR MF	10k0 OHM 1% 0.6W	PHILIPS	2322 156 11003	03.427
R8-3	RESISTOR MF	15k0 OHM 1% 0.6W	PHILIPS	2322 156 11503	03.429
R9-3	RESISTOR MF PRECISION	2k58 OHM 0.1% 75mW	DRALORIC	SMA 0207S-TK25-2k58-0.1%	06.120

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
R10-3	RESISTOR MF	15k0 OHM 1% 0.6W	PHILIPS	2322 156 11503	03.429
R11-3	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R12-3	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 187 73152	02.476
R13-3	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 187 73123	02.498
R14-3	RESISTOR MF	1k2 OHM 5% 0.33W	PHILIPS	2322 187 73122	02.474
R15-3	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 187 73568	02.418
R16-3	RESISTOR MF	1k5 OHM 5% 0.33W	PHILIPS	2322 187 73152	02.476
R17-3	RESISTOR MF	1k2 OHM 5% 0.33W	PHILIPS	2322 187 73122	02.474
R18-3	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 187 73123	02.498
R19-3	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 187 73568	02.418
R20-3	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
R21-3	RESISTOR MF	220 OHM 5% 0.33W	PHILIPS	2322 187 73221	02.456
R22-3	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R23-3	RESISTOR ARRAY	8x10k OHM 5% 1/8W	PANASONIC	EXB-F9E-103 J	08.630
R24-3	RESISTOR MF	1M OHM 5% 0.33W	PHILIPS	2322 187 73105	02.544
R25-3	RESISTOR ARRAY	8x10k OHM 5% 1/8W	PANASONIC	EXB-F9E-103 J	08.630
R26-3	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
R27-3	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 187 73104	02.520
R28-3	RESISTOR MF	22k OHM 5% 0.33W	PHILIPS	2322 187 73223	02.504
R29-3	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
TR1-3	BALUN FOR C2149	TL574	ECI A/S	6-0-27236	400574
U1-3	DARL.DRIVERS HI.CURR/VOLT	ULN2003/MC1413	MOTOROLA	MC1413P	31.077
U2-3	8 BIT SHIFT REG.SERIAL IO	74HC595	MOTOROLA	MC74HC595P / MC74HC595AN	34.502
U3-3	DUAL OPERATIONAL AMP.	MC1458/LM1458	MOTOROLA	MC1458CP1	31.215
U4-3	DARL.DRIVERS HI.CURR/VOLT	ULN2003/MC1413	MOTOROLA	MC1413P	31.077
U5-3	8 BIT SHIFT REG.SERIAL IO	74HC595	MOTOROLA	MC74HC595P / MC74HC595AN	34.502
U6-3	NAND SCHMIDT TRIGGER	74HC132	TEXAS	74HC132N	34.521
U7-3	PWM CONTROLLER	CURRENT MODE, UC3845	TEXAS	UC3845P (UC2845P)	31.176
U8-3	PROGRAMMED PROM U8-3	C2149	S.P. RADIOA/S	0-0-27497/C1100I-520F	727497
U9-3	MASTER PROCESSOR UNIT	8 BIT SERIAL INTERFACE	HITACHI	HD63B03YP	32.575
U10-3	uC SUPERVISORY CIRCUIT	MAX 690	MAXIM	MAX 690 CPA (EJA-MJA)	32.585
U11-3	TRIPLE 3-INPUT NOR GATE	74HC27	MOTOROLA	MC74HC27N	34.516
U12-3	UNIVERSAL SYNCHRON. ASYN-	CHRON. RECEIVER/TRANSMITT	OKI	MSM82C51A-2RS	32.572
U13-3	UNIVERSAL SYNCHRON. ASYN-	CHRON. RECEIVER/TRANSMITT	OKI	MSM82C51A-2RS	32.572
U14-3	HEX INVERTERS	74HC04	TEXAS	SN74HC04N	34.520
U15-3	UNIVERSAL SYNCHRON. ASYN-	CHRON. RECEIVER/TRANSMITT	OKI	MSM82C51A-2RS	32.572
U16-3	AF POWER AMPLIFIER	DIL8 1WBTL.	PHILIPS	TDA7052	31.432
U17-3	OCTAL BUFF.& LINE DRIVERS	74HC541	TEXAS	SN74HC541N	34.510
U18-3	QUAD 2-INPUT NAND GATE	74HC00	TEXAS	SN74HC00N	34.515
U19-3	TRIPLE 3-INPUT NOR GATE	74HC27	MOTOROLA	MC74HC27N	34.516
U20-3	COUNTER 7 STATE BIN.RIPP.	74HC4024	MOTOROLA	MC74HC4024N	34.555
X1-3	CRYSTAL	4.9152MHz HC-49/U	NDK	LN-P-0001 4.9152MHz	39.769

INTERFACE UNIT MODULE (4) C2149 ECI A/S 5-0-27054H/4-0-27054H 627054

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOUS	FUSE COVER	5x20mm FUSE SIZE	WICKMANN	19648	48.716
VARIOUS	FUSE HOLDER	1 POLE 5x20mm PCB VERSION	ELU	199015	78.398
4	INTERFACE UNIT MODULE (4)			5-0-27054H/1-0-27054A	52.074
C1-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C2-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C3-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C4-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C5-4	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C6-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C7-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C8-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C9-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C10-4	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C11-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C13-4	CAPACITOR CERAMIC	470pF 10% 500VDC	KCK	RT-HM60 SK YB 471 K	16.095
C15-4	CAPACITOR ELECTROLYTIC	100uF -20/+50% 63VDC	ELNA	RJ2-63-V-101-M-F	14.620
C16-4	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C17-4	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C18-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C19-4	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C20-4	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C21-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C22-4	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 75104 (78104)	11.136
C23-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
C24-4	CAPACITOR CERAMIC	470pF 10% 500VDC	KCK	RT-HM60 SK YB 471 K	16.095
C25-4	CAPACITOR CERAMIC	470pF 10% 500VDC	KCK	RT-HM60 SK YB 471 K	16.095
C28-4	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T58	14.512
C29-4	CAPACITOR MKT	1uF 10% 63VDC	PHILIPS	2222 370 78105	11.137
C30-4	CAPACITOR MKT	1uF 10% 63VDC	PHILIPS	2222 370 78105	11.137
D1-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D2-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D3-4	DIODE RECTIFIER	1N4002 100V/1A	MOTOROLA	1N4002(03/04/05/06/07)RL	25.100
D4-4	DIODE RECTIFIER	1N4002 100V/1A	MOTOROLA	1N4002(03/04/05/06/07)RL	25.100
D5-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D6-4	DIODE RECTIFIER	1N4002 100V/1A	MOTOROLA	1N4002(03/04/05/06/07)RL	25.100
D7-4	DIODE RECTIFIER	1N4002 100V/1A	MOTOROLA	1N4002(03/04/05/06/07)RL	25.100
D8-4	DIODE ZENER 5V1 5% 2W	BZD23C5V1 BZV47C5V1	ITT	ZY5,1	26.727
D9-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D10-4	DIODE RECTIFIER	1N4002 100V/1A	MOTOROLA	1N4002(03/04/05/06/07)RL	25.100
D11-4	DIODE RECTIFIER	1N4002 100V/1A	MOTOROLA	1N4002(03/04/05/06/07)RL	25.100
D12-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D13-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D14-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D15-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D16-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D17-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D18-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D19-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D20-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D21-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D23-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D24-4	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147
D25-4	DIODE ZENER	39V BZV47C39	THOMSON-CSF	BZV47C39	26.783
F1-4	FUSE	1AT 250V 5x20mm	LITTELFUSE	218001.	45.506
F2-4	FUSE	1AT 250V 5x20mm	LITTELFUSE	218001.	45.506
J1-4	SOCKET SUB D 9 POLES	PCB VERSION 2x 4-40 NUT	EDAC INC.	8TO-009SS-244T(144T,344T)	78.164
J2-4	SOCKET SUB D 9 POLES	PCB VERSION 2x 4-40 NUT	EDAC INC.	8TO-009SS-244T(144T,344T)	78.164
J3-4	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400A4	78.444
J4-4	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400A4	78.444
J5-4	SOCKET SUB D 9 POLES	PCB VERSION 2x 4-40 NUT	EDAC INC.	8TO-009SS-244T(144T,344T)	78.164
L1-4	CHOKE FIXED	8u2H 10%	SIEMENS	B78108-T1822-K	20.358
L2-4	CHOKE FIXED	8u2H 10%	SIEMENS	B78108-T1822-K	20.358
OC1-4	OPTO COUPLER	CNY74-2	TELEFUNKEN	CNY74-2	32.529
OC2-4	OPTO COUPLER	CNY74-2	TELEFUNKEN	CNY74-2	32.529
OC3-4	OPTO COUPLER	CNY74-2	TELEFUNKEN	CNY74-2	32.529
OC4-4	OPTO COUPLER	CNY74-2	TELEFUNKEN	CNY74-2	32.529
OC5-4	OPTO COUPLER	CNY74-2	TELEFUNKEN	CNY74-2	32.529
OC6-4	OPTO COUPLER	CNY74-2	TELEFUNKEN	CNY74-2	32.529
P1-4	PLUG	2x10 POLES	3M	3592-6002/7620-6002JL	78.250
P2-4	PLUG	6 POLES	HIRSCHMANN	973 887-100	78.315
P3-4	PLUG	6 POLES	HIRSCHMANN	973 887-100	78.315
Q1-4	TRANSISTOR AF	NPN BC639 TO-92	MOTOROLA	BC639ZL1	28.120
Q3-4	TRANSISTOR AF	NPN BC639 TO-92	MOTOROLA	BC639ZL1	28.120
Q4-4	TRANSISTOR AF SMALL SIGNA	BC640	PHILIPS	BC640-126	28.124
Q5-4	TRANSISTOR AF	BC558B	PHILIPS	BC558B-126	28.100
Q6-4	TRANSISTOR AF	BC558B	PHILIPS	BC558B-126	28.100
Q7-4	TRANSISTOR AF	BC558B	PHILIPS	BC558B-126	28.100
Q8-4	TRANSISTOR AF	BC558B	PHILIPS	BC558B-126	28.100
Q9-4	THYRISTOR	BT151-500R	PHILIPS	BT151-500R	29.912
R1-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R2-4	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
R3-3	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
R4-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R5-4	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
R6-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R7-4	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
R8-4	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
R9-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R10-4	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
R11-4	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 187 73104	02.520
R12-4	RESISTOR MF	3k3 OHM 5% 0.33W	PHILIPS	2322 187 73332	02.484
R13-4	RESISTOR MF	330 OHM 5% 0.33W	PHILIPS	2322 187 73331	02.460
R14-4	RESISTOR MF	330 OHM 5% 0.33W	PHILIPS	2322 187 73331	02.460
R15-4	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 187 73472	02.488
R16-4	RESISTOR MF	5k1 OHM 5% 0.33W	PHILIPS	2322 187 73512	02.489
R17-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R18-4	RESISTOR MF	680 OHM 5% 0.33W	PHILIPS	2322 187 73681	02.468

POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
R19-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R20-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R21-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R22-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R23-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R24-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R25-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R26-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R27-4	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 187 73104	02.520
R28-4	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 187 73104	02.520
R29-4	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 187 73104	02.520
R30-4	RESISTOR MF	100k OHM 5% 0.33W	PHILIPS	2322 187 73104	02.520
R31-4	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 187 73102	02.472
R32-4	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 187 73101	02.448
R33-4	RESISTOR MF	5k1 OHM 5% 0.33W	PHILIPS	2322 187 73512	02.489
R34-4	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 187 73103	02.496
R35-4	RESISTOR MF	47 OHM 5% 0.33W	PHILIPS	2322 187 73479	02.440
R36-4	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 187 73222	02.480
R38-4	RESISTOR MF	470 OHM 5% 0.33W	PHILIPS	2322 187 73471	02.464
R39-4	RESISTOR MF	4k7 OHM 5% 0.33W	PHILIPS	2322 187 73472	02.488
R40-4	RESISTOR PMF	120 OHM 5% 2W	PHILIPS	2322 191 31201	04.178
R41-4	RESISTOR MF	100 OHM 5% 0.33W	PHILIPS	2322 187 73101	02.448
RE1-4	RELAY 12VDC DPDT 1.25A	M1B-12-H/AZ820-2C212DE	MEISEI	M1B-12-H	21.295
RE2-4	RELAY 12VDC DPDT 1.25A	M1B-12-H/AZ820-2C212DE	MEISEI	M1B-12-H	21.295
U1-4	DUAL RS232 DRIVER/REC.	AD232, MAX232, ADM232L	ANALOG DEVICES	ADM232LJN	32.757
U2-4	POS. VOLTAGE REG. 15V/1A	MC7815, LM340T-15	MOTOROLA	MC7815CT (MC7815BT)	31.090
U3-4	POS. VOLTAGE REG. 5V/1A	MC7805, LM340T-5.0	MOTOROLA	MC7805CT (MC7805BT)	31.250
U5-4	DUAL RS232 DRIVER/REC.	AD232, MAX232, ADM232L	ANALOG DEVICES	ADM232LJN	32.757