

# SAILOR



TECHNICAL MANUAL  
FOR  
COMPACT SP-BUS INTERFACE H2186



S.P. RADIO A/S · AALBORG · DENMARK

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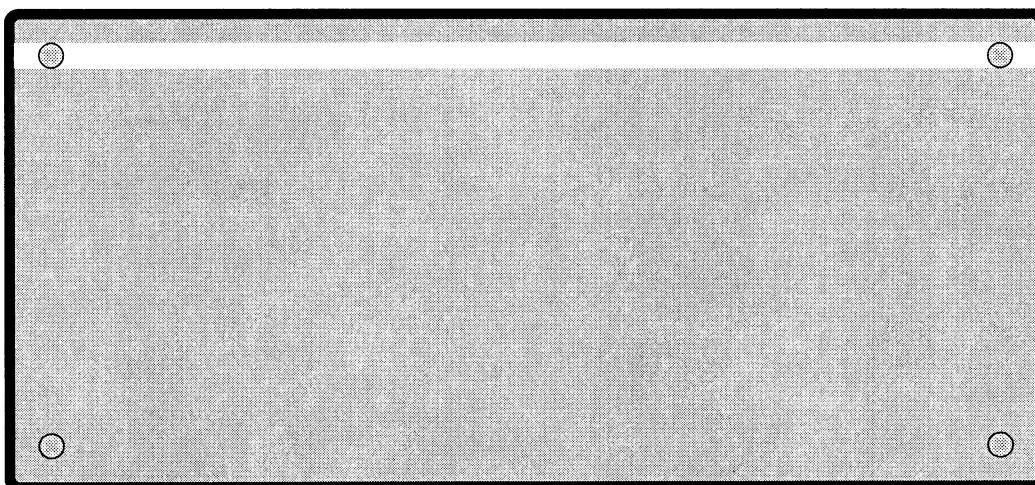
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## 1 GENERAL INFORMATION

### 1.1 INTRODUCTION

- H2186 is a part of the Compact HF SSB System
- H2186 is an interface box used to connect the Compact HF SSB System to other systems
- H2186 is equipped with a standard RS232 interface
- H2186 is equipped with a T-BUS interface and two SP-BUS interfaces
- H2186 is equipped with a 25 pin parallel port, an ADC and a DAC for signal strength and Tx power indication



29194

H2186 can be configured in several ways. The following figures show the different configurations. The configurations in Fig. 1 and Fig. 2 show H2186 used to control a RE2100 with a PC connected at the controller site. The first Fig. 1 shows a PC connected directly to a H2186 which is connected to a RE2100. The second Fig. 2 shows a PC connected to a H2186 via a datalink using two modems. It is possible from the remote PC to control all the functions in the RE2100. The PC has exactly the same control functions as a Compact HF SSB REMOTE CONTROLLER C2140, and with a phone patch it is possible to use the PC as if it was a C2140, but with a more advanced user interface.

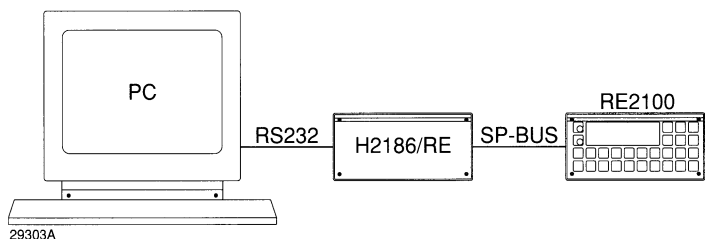


Fig. 1

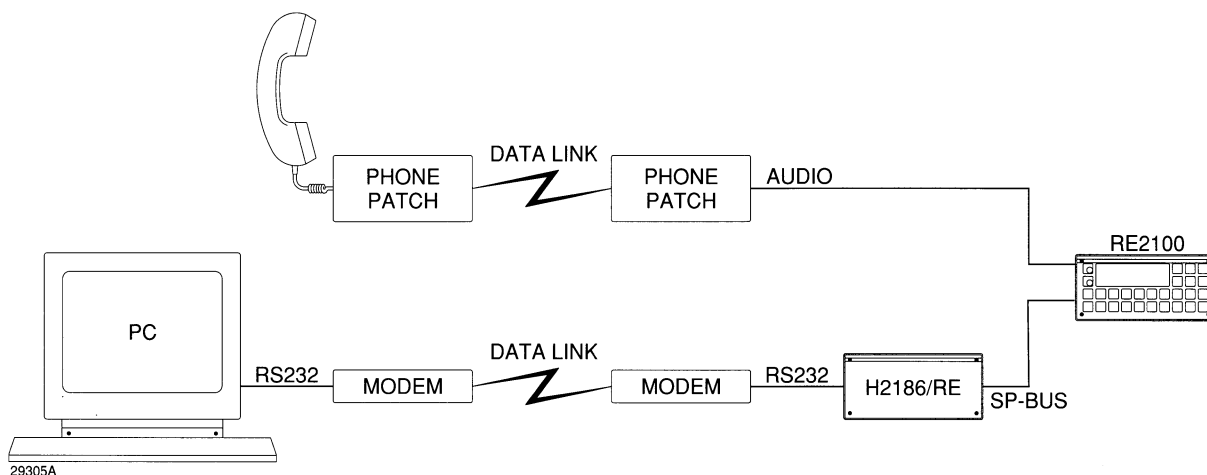


Fig. 2

In Fig. 3 a H2186/R is used to interface a R2120 to a RS232 interface.

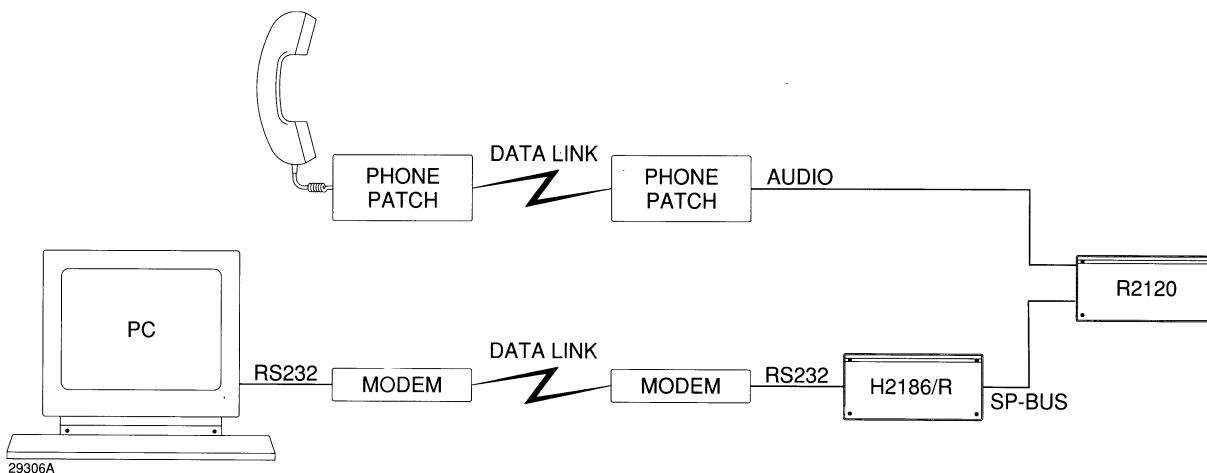


Fig. 3



Fig. 4 shows a H2186/T as a T-BUS/SP-BUS interface. The telex modem H1240 controls the RE2100 (Tx frequency) and the R2120/T (Rx frequency) with commands transmitted on the T-BUS. The H2186/T converts the T-BUS commands to SP-BUS commands which controls the RE2100 and the R2120/T.

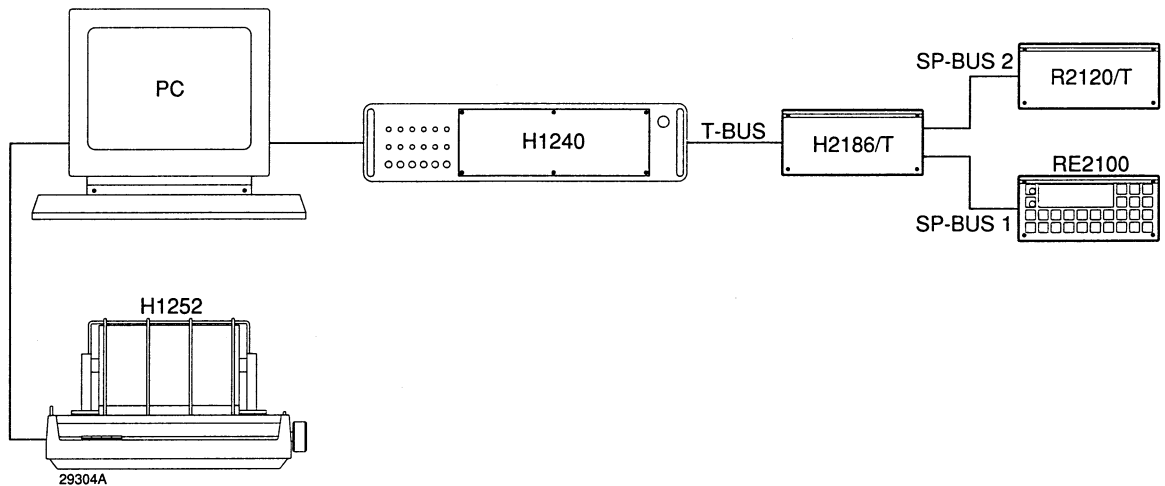


Fig. 4

Fig. 5 shows the H2186/RT which is used to interface one to seven RT2048 or RT2047 to a RS232 interface. In the test of the manual it is only the RT2048 which is mentioned, but unless other is noted the description is valid for both the RT2048 and the RT2047/D.

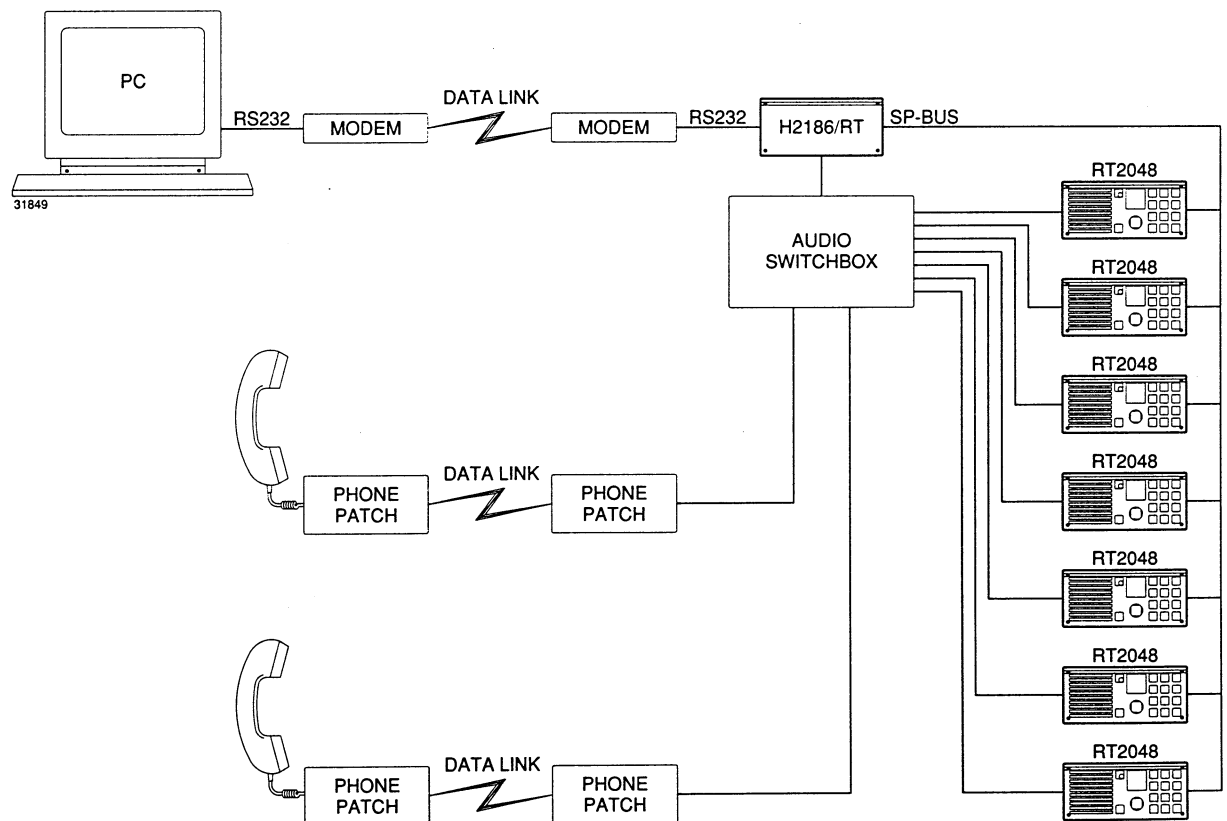


Fig. 5

More detailed connection diagrams are shown in the Operating and Installation Book.

Fig. 6 shows the different configurations of the H2186.

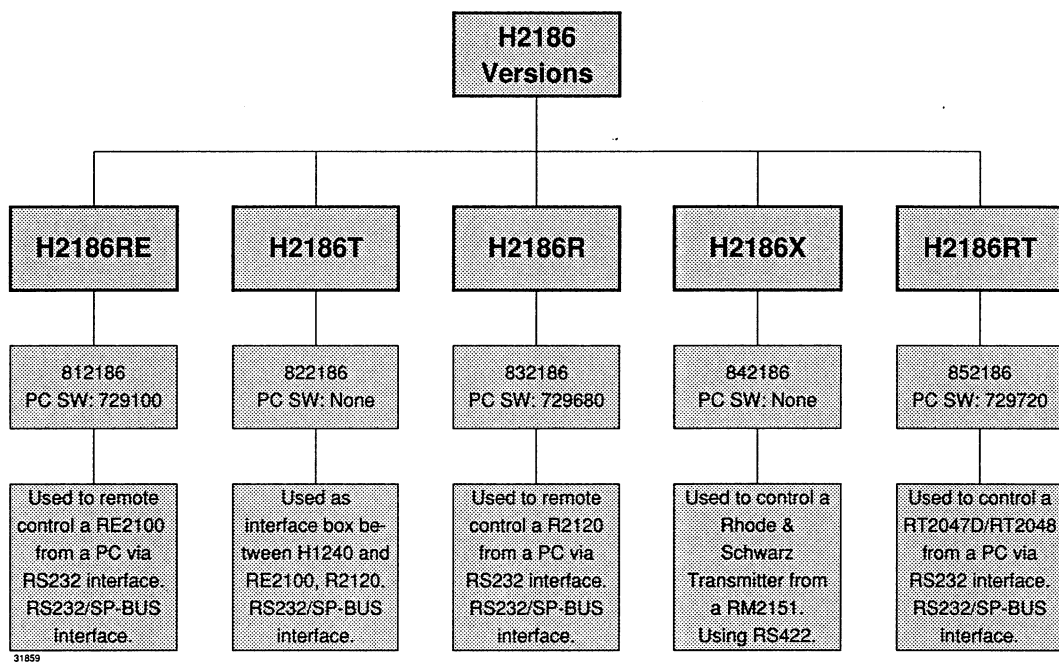


Fig 6

## 1.2 TECHNICAL DATA

### Compact HF SSB SP-BUS INTERFACE H2186

**Supply Voltage** +18 V, -18 V and +9 V.

**Power consumption:** Stand-by: 150 mA.  
Max: 500 mA.

**Operating Temperature Range:** -15°C to +55°C

**Storage Temperature Range:** -25°C to +75°C

**Weight:** 1.5 kg.

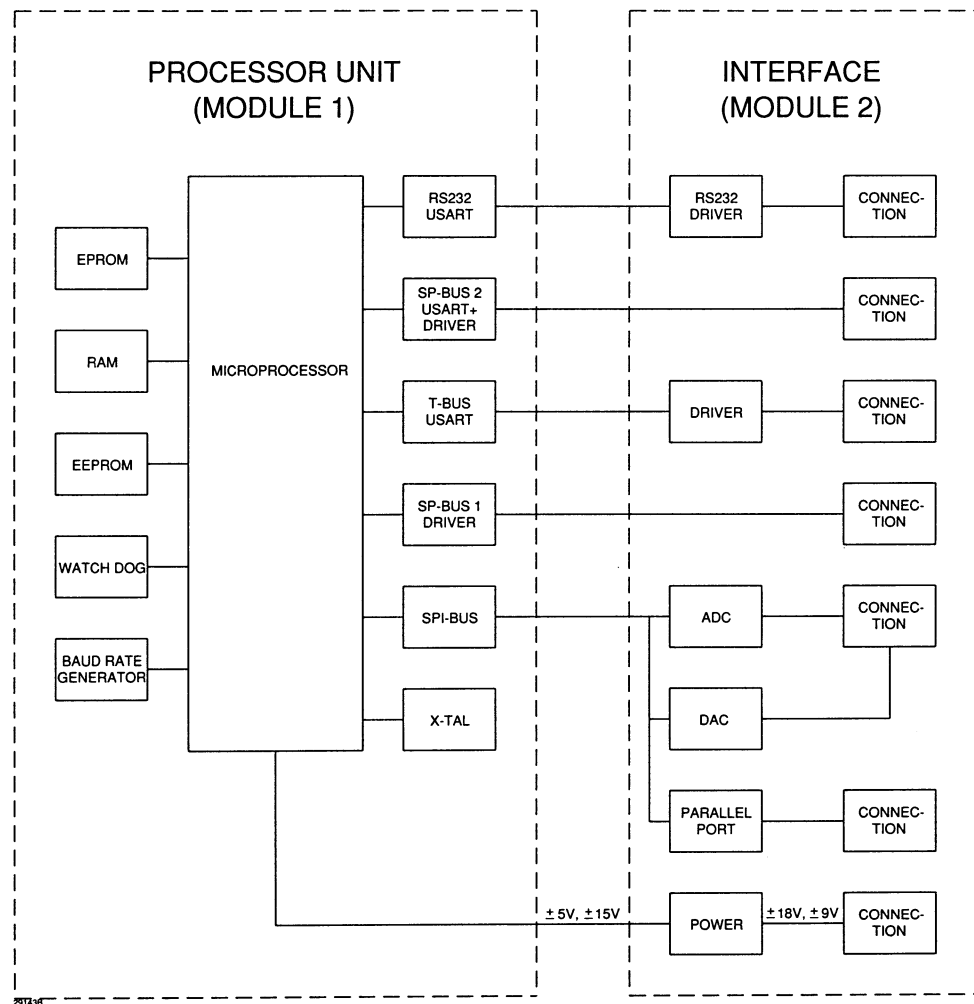
**Dimensions:** Height: 98 mm  
Width: 225 mm  
Depth: 122 mm

### 1.3 PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

The H2186 contains two hardware modules: a processor unit module and an interface module. The processor unit module contains a microprocessor, memory, USARTs and I/O devices. The interface module contains power supply, busdrivers, ADC and DAC.

The two modules with their hardware blocks are shown in the block diagram. The elements in the block diagram are explained in detail in chapter 5.

#### BLOCK DIAGRAM



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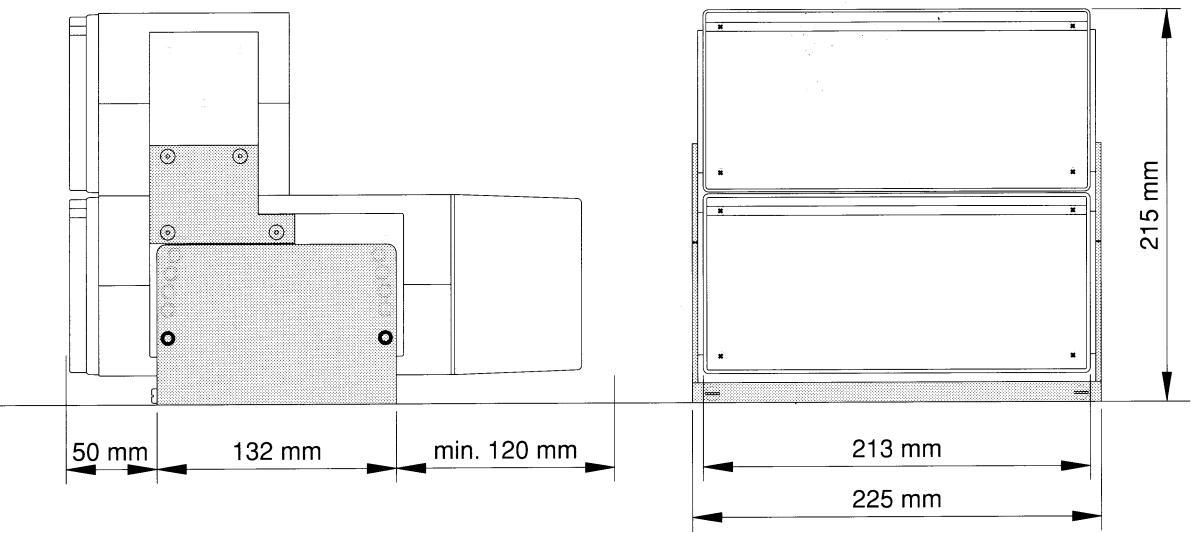
2 INSTALLATION

2.1 MOUNTING POSSIBILITIES

The COMPACT SP-BUS INTERFACE H2186 cabinet is designed in a module called a mini 1/4 box. For this module we can supply a wide variety of installation kits etc. which will be described below. We have made a drawing including dimensions and drilling plan for each type and we kindly ask you to look at the drawing for the type in question.

**SP-BUS INTERFACE H2186 AND DUPLEX RECEIVER R2120 MOUNTED ON TOP OF EACH OTHER USING H2055 MOUNTING KIT FOR TABLETOP, BULKHEAD OR DECKHEAD FOR 1/4 BOX AND H2073 LASHING KIT.**

This mounting kit H2055 and lashing kit H2073 is used when the R2120 and the H2186 is to be mounted on top of each other and next to other units in the Compact 2000 programme mounted in the H2055 mounting kit.

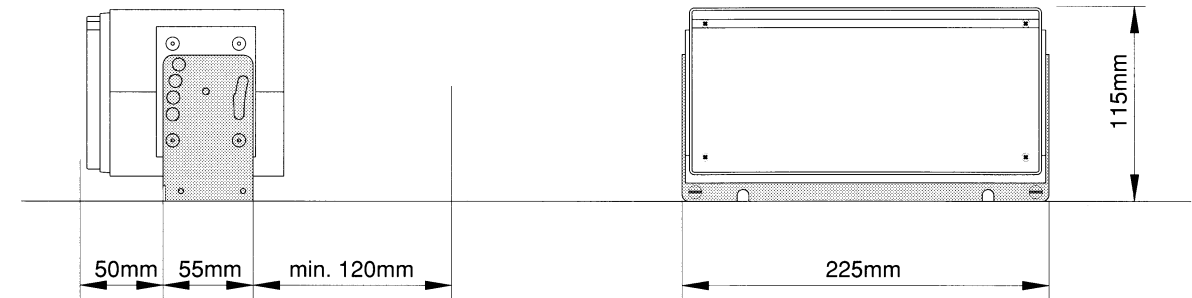


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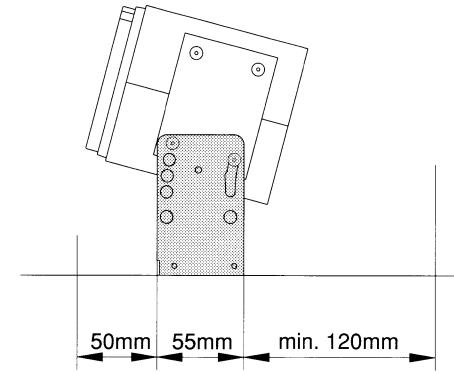
Weight:	
Mounting kit H2055:	1.5 kg
Lashing kit H2073:	0.1 kg
Duplex Receiver R2120:	3.7 kg
SP-BUS INTERFACE H2186:	1.5 kg

**H2067 MOUNTING KIT FOR TABLETOP, BULKHEAD OR DECKHEAD MOUNTING FOR MINI 1/4 BOX**

This mounting kit is used when the H2186 is to be mounted next to other units in the Compact 2000 programme mounted in the H2055 mounting kit. For example when installing the H2186 next to the HF SSB RE2100 it is possible to tilt both units in the same angle.



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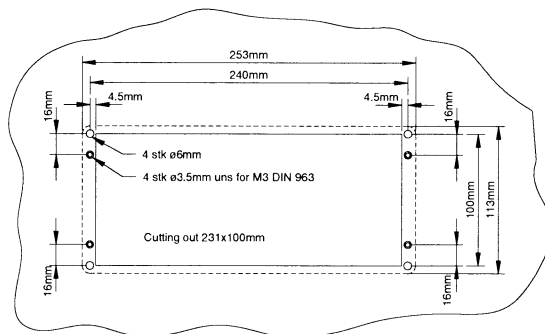
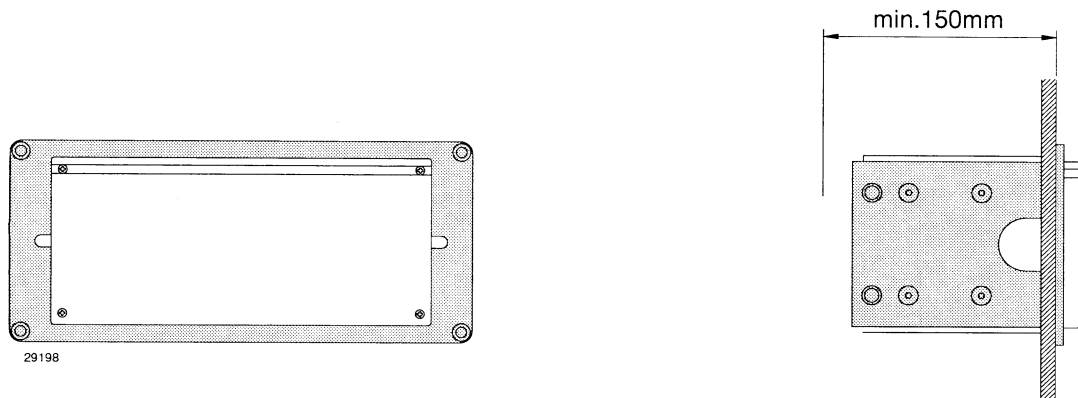
29334A

Weight:

Mounting kit H2067:	0.5 kg
SP-BUS INTERFACE H2186:	1.5 kg

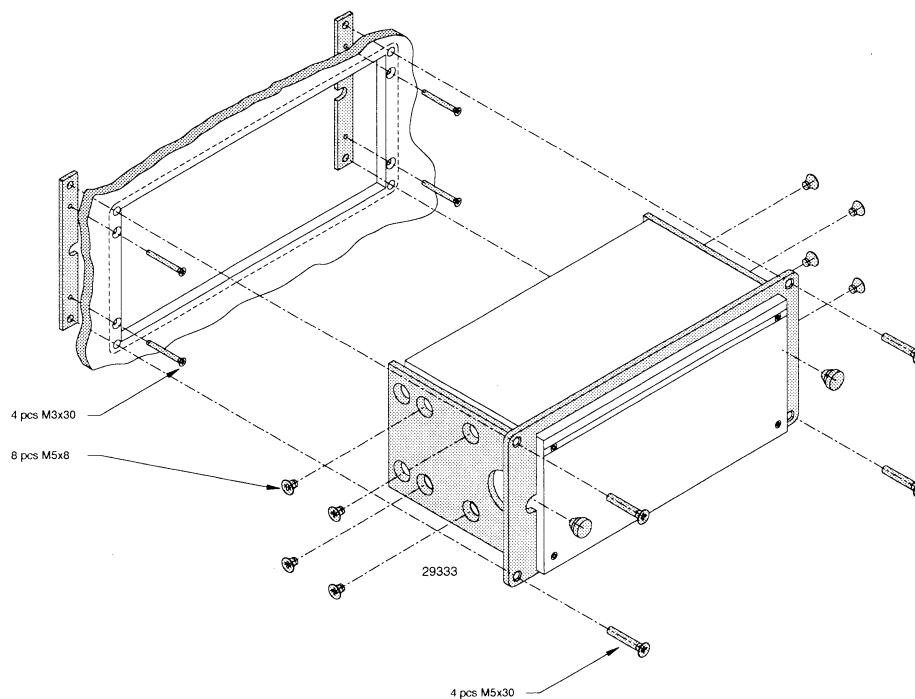
**H2063 CONSOLE MOUNTING KIT FOR 1/4 BOX**

This mounting kit is used for console flush mounting of 1/4 box and mini 1/4 box.  
Free distance must be kept to allow free air circulation, ambient temperature max. 40°C.

**H2063**

Weight:  
Mounting kit H2063:  
SP-BUS INTERFACE H2186:

1.0 kg  
1.5 kg



## **CONTENTS**

### **5    CIRCUITS DESCRIPTION AND SCHEMATIC DIAGRAM**

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## 5 CIRCUITS DESCRIPTION AND SCHEMATIC DIAGRAM

The H2186 contains two hardware modules: a processor unit module and an interface module. The processor unit module contains a microprocessor, memory, USARTs and I/O devices. The interface module contains power supply, busdrivers, ADC and DAC.

### 5.1 PROCESSOR UNIT MODULE 1

#### MICROPROCESSOR

The processor module has been built up around a microprocessor with 4.9152 MHz clock oscillator. The purpose of the microprocessor module is to control the RS232, the SP-BUS or the T-BUS. The internal clock frequency of the processor is 1.2288 MHz.

#### WATCH DOG

The microprocessor supervising circuit U8-1 contains a watch dog and a power sensor. The watch dog input U8-1 pin 6 must change level (high/low) at least every 1.6 secs. If not the U8-1 generates a reset pulse for the microprocessor.

#### MEMORY

The processor module has three memory circuits. One for the programme, one for data and one for setup data.

The programme memory U6-1 is a 32 kbyte EPROM. Data memory consists of a 8 kbyte RAM, U5-1. And finally the setup data memory is a 128 byte EEPROM, U13-1. The EEPROM is accessed by using the Serial Peripheral Interface Bus (SPI BUS).

#### SERIAL PERIPHERAL INTERFACE BUS (SPI BUS)

The SPI-BUS is a synchronous serial bus supplying the EEPROM, the ADC, DAC and the parallel port with data. The clock speed is 38.5 kHz. Through two drivers U12-1/1 and U12-1/2 the clock and data are passed on to the interface module. The strobes are generated in SPI address select (U11-1). Through the 3 ports P60 - P62, an address is set up for the party that has to read the serial data.

#### SP-BUS TRANSMITTERS AND RECEIVERS

The SP-BUS 1 is used to communicate the RE2100. The bus is implemented as a time multiplexed data bus, using a coaxial cable, terminated in both ends, and a transmitter and a receiver in each connected unit.

The RE2100 is the master and a number of slaves e.g. a H2186 may be connected to the SP-BUS. When a H2186 has a character to transmit to the RE2100, it sends an interrupt to the RE2100 on the SP-BUS INTERRUPT wire. When the RE2100 is polling the H2186 it answers back with the identity and the type. The transmitter output is normally in high impedance state except when transmitting on the SP-BUS. The transmitter consists of two gates, U4-1/1 and U4-1/2, a transistor Q2-1 for level shifting, and two complementary output transistors Q1-1 and Q3-1. The transmitter is connected to the microprocessor U7-1 P13 (SCI TX), and U7-1 P19 (SCI TX ENABLE). It is possible to choose SP-BUS output levels +5V or 0-5V. If the strap in P4-1 is mounted between pin 2 and pin 3 the levels are +5V.

The receiver consists of an op-amp, (U10-1/2) which is configured as a Schmitt Trigger - and two diodes D6-1 and D7-1 for level conditioning. The receiver is connected to the microprocessor U7-1 P12 (SCI RX). It is possible to choose between two input levels +5V and 0-5V. If the strap in P5-1 is mounted between pin 1 and pin 2 the input level must be +5V.

The SP-BUS interrupt consists of an open collector Q4-1. When an interrupt is active the port P27 on the microprocessor U7-1 P16 goes high and the output from Q4-1 will go low. It is possible to configure the SP-BUS interrupt as either an output or an input. If the strap in P3-1 is mounted between pin 2 and pin 3 the SP-BUS interrupt is an output, but if the strap is mounted between pin 1 and pin 2 the SP-BUS interrupt is an input to the interrupt receiver U3-1/3 which is connected to port P54 on the microprocessor U7-1 P21.

The processor module contains another SP-BUS transmitter/receiver (SP-BUS 2) - consisting of Q5-1, Q6-1 and Q7-1, U16-1/1, U16-1/2 and U10-1/1. The SP-BUS 2 Transmitter/receiver is connected to the microprocessor U7-1 via the USART (U15-1) and the internal data bus.

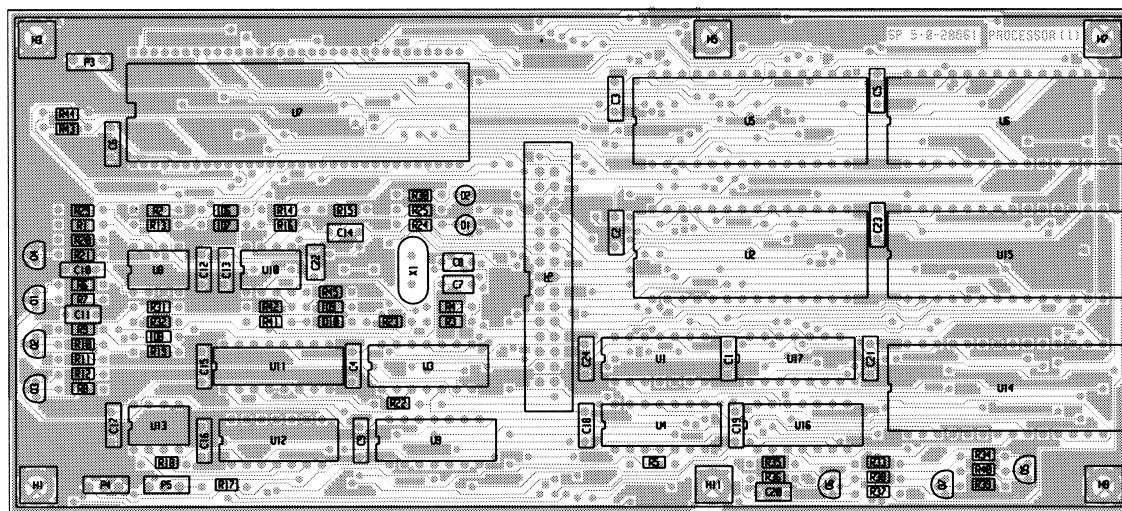
### BAUD RATE GENERATOR

The clock signals to the USARTs are generated by the divider (U9-1) the input to the divider is the clock frequency 4.9152 MHz. The clock signal to the SP-BUS 2 USARTs is  $16 \times 4800 \text{ Hz} = 76800 \text{ Hz}$  and clock signal to the T-BUS USART is  $16 \times 2400 = 38400 \text{ Hz}$ .

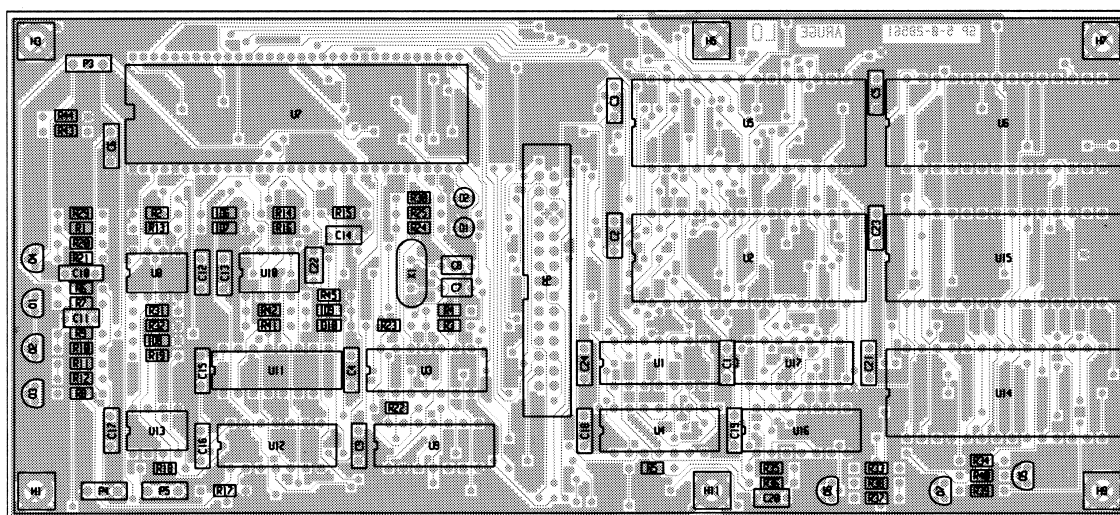
### USARTS

The module contains three USARTs (U2-1, U14-1, U15-1) and one USART in the microprocessor U7-1. The microprocessor USART (U7-1) is used for SP-BUS 1, the USART (U15-1) is used for the SP-BUS 2 communication. The USART (U2-1) is used for the RS232 interface and the USART (U14-1) is used for the T-BUS. The USART used to communicate on the T-BUS has a \*RTS signal (U14-1 P23) to enable the T-BUS transmitter (placed on module 2).

### COMPONENT LOCATION PROCESSOR UNIT MODULE 1



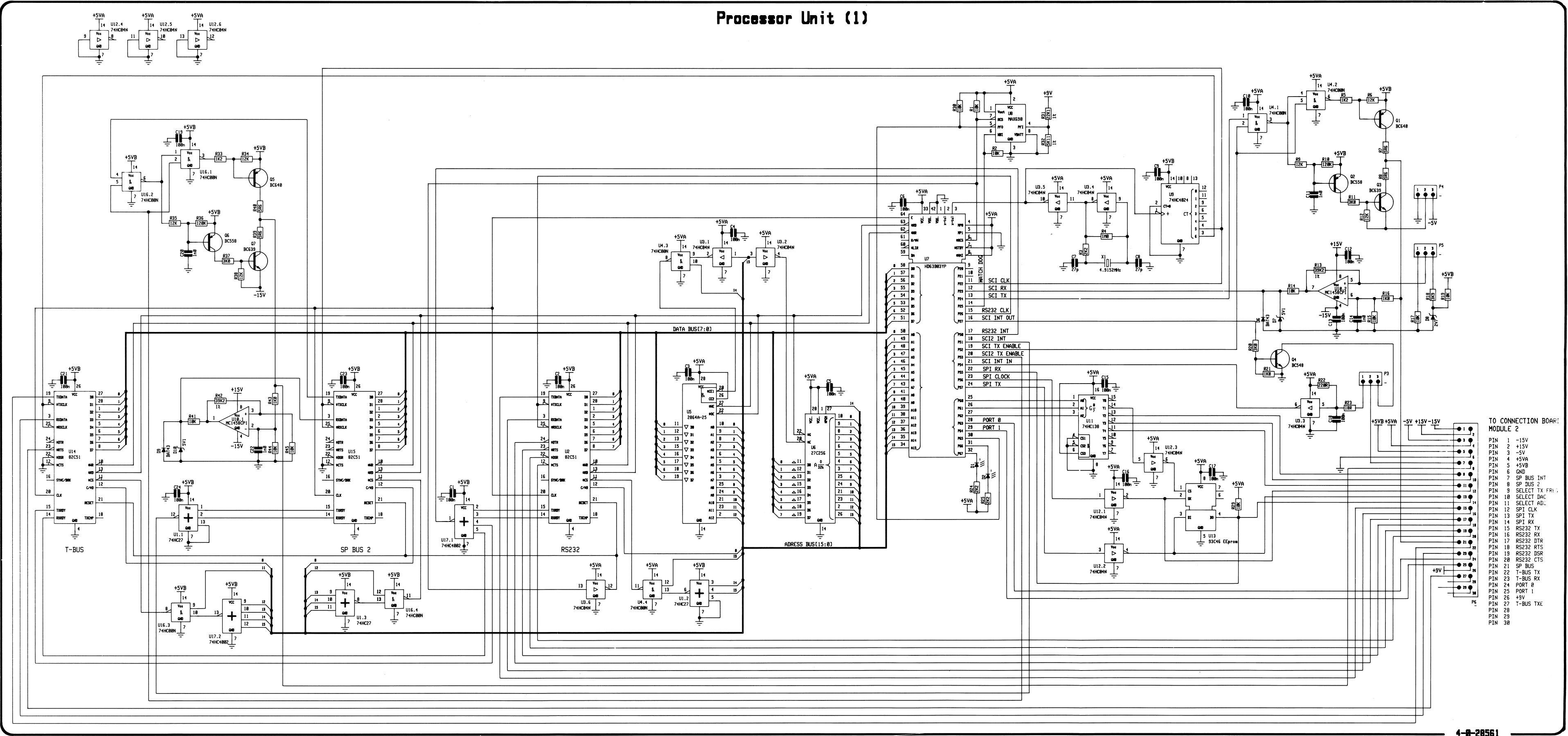
View from component side with upper side tracks.



View from component side with lower side tracks.

PCB rev. 28561

DIAGRAM PROCESSOR UNIT MODULE1



## 5.2 INTERFACE UNIT MODULE 2

### ON BOARD POWER SUPPLY

This module contains 5 power supplies. +5VA, +5VB, -5V, +15V and -15V.

+5VA (U9-2) supplies the microprocessor, memory, watch dog, baud rate generator and address select.

+5VB (U10) supplies the remaining circuits using +5V.

-5V (U8-2) supplies the half of the SP-BUS transmitter.

+15V (U6-2) and -15V (U7-2) supplies for the SP-BUS receiver and the T-BUS transmitter.

### A/D AND D/A CONVERTER

The A/D converter is U11. Data is read from, and setup is written to the ADC via the SPI BUS. The 4 bit D/A converter is build as a 4 bit shift register (U3-2) and a summation amplifier (U2-2/2) and finally an inverting amplifier (U2-2/1).

### RS232 DRIVERS

U1-2 and U5-2 are used as RS232 drivers. Transmitted signals are inverted and stepped up to +-15V, and received signals are converted to TTL levels. U5-2 is used as the T-BUS receiver too.

### PARALLEL PORT

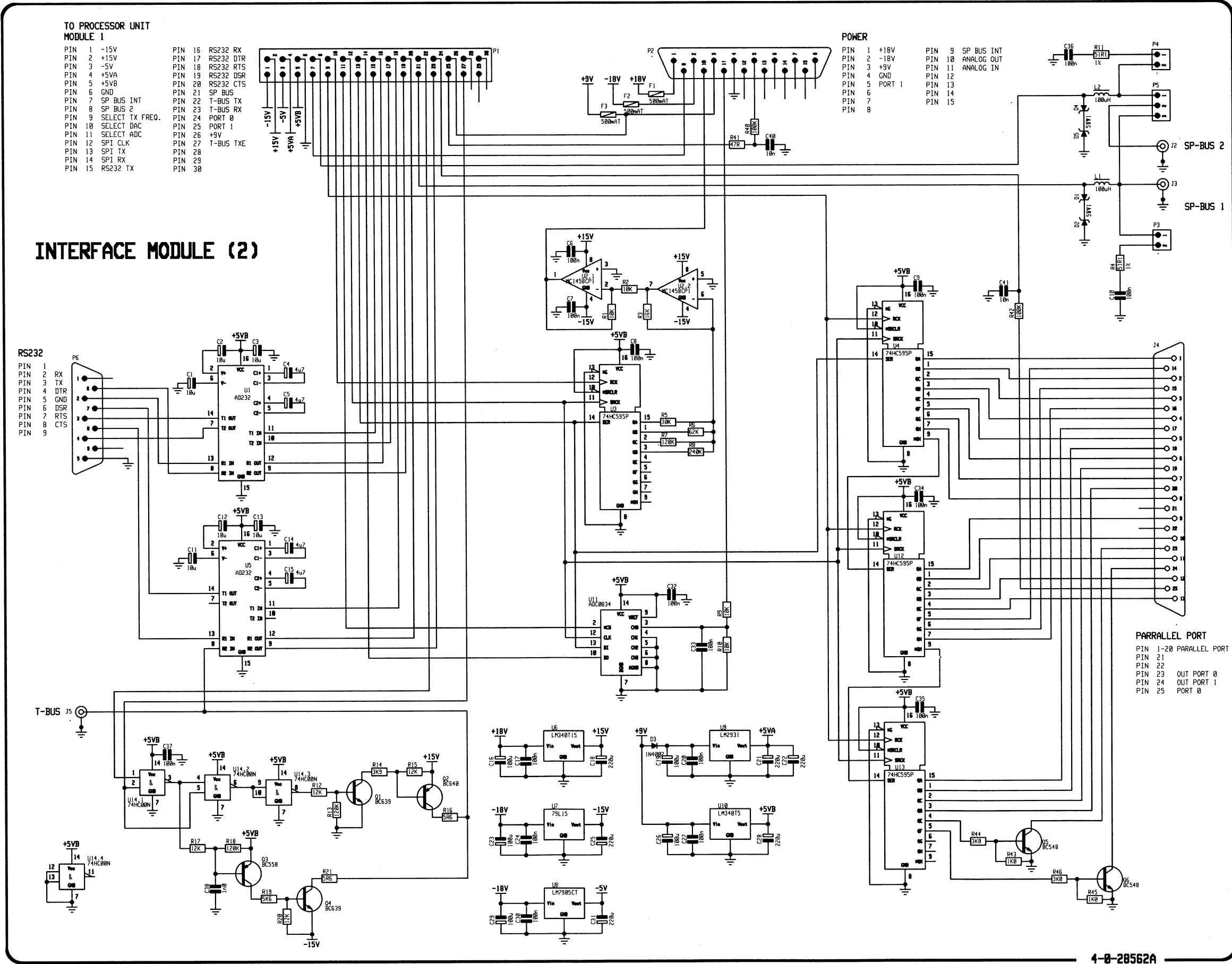
Data to the parallel port (U4-2, U12-2, U13-2) are send on the SPI BUS.

### SP-BUS CONNECTIONS

There are two SP-BUS connections. When the strap in P5-2 is mounted between pin 2 and pin 3 the two connections J2-2 and J3-2 are connected to the same SP-BUS. If the strap is mounted between pin 1 and pin 2 they are separated. If the H2186 is connected at the end of the SP-BUS the SP-BUS cable must be terminated properly. This is done by mounting a strap between pin 1 and pin 2 on P3-2. If the two SP-BUSes are separated the strap on P4-2 must be mounted too.



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**CONTENTS**

**6 PARTS LISTS**

## 6 PARTS LISTS

SP-BUS INTERFACE H2186		SAILOR GREEN	S.P.RADIO A/S H2186		812186
POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	SPARE FUSES FOR H2185/86 MANUAL R2186 ENGLISH	H2185/86	S.P.RADIO S.P.RADIO A/S	0-0-28986	728986 M2186GB

PROCESSOR UNIT H2186		MODULE (1)	5-0-28561 / 4-0-28561		628561
POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
VARIOUS	SHUNT CONNECTOR	FEMALE 2 POLES	SAMTEC	SNT-100-BK-G	78.325
C1-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C2-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C3-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C4-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C5-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C6-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C7-1	CAPACITOR CERAMIC	27pF 5% N150 50VDC	NKE	DT 350 758S PH 270 J 50V FLAT PACK	15.076
C8-1	CAPACITOR CERAMIC	27pF 5% N150 50VDC	NKE	DT 350 758S PH 270 J 50V FLAT PACK	15.076
C9-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C10-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C11-1	CAPACITOR CERAMIC	1nOF 10% CL2 500VDC	NKE	DT 360 758L B 102 K 500V FLAT PACK	15.160
C12-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C13-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C14-1	CAPACITOR CERAMIC	1nOF 10% CL2 500VDC	NKE	DT 360 758L B 102 K 500V FLAT PACK	15.160
C15-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C16-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C17-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C18-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C19-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C20-1	CAPACITOR CERAMIC	1nOF 10% CL2 500VDC	NKE	DT 360 758L B 102 K 500V FLAT PACK	15.160
C21-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C22-1	CAPACITOR CERAMIC	1nOF 10% CL2 500VDC	NKE	DT 360 758L B 102 K 500V FLAT PACK	15.160
C23-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C24-1	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
D1-1	DIODE LIGHT EMITTING	Ø3mm RED LOW CURRENT	H.P.	HLMP-K150-OPTION 002	25.662
D2-1	DIODE LIGHT EMITTING	Ø3mm RED LOW CURRENT	H.P.	HLMP-K150-OPTION 002	25.662
D6-1	DIODE SCHOTTKY	BAT 43	THOMSON-CSF	BAT43	27.600
D7-1	DIODE ZENER	5.1V 2% 0.4W BZX79B5V1	PHILIPS	BZX79B5V1	26.497
D8-1	DIODE ZENER	2V7 5% 0.4W BZX79C2V7	PHILIPS	BZX79C2V7	26.506
D9-1	DIODE SCHOTTKY	BAT 43	THOMSON-CSF	BAT43	27.600
D10-1	DIODE ZENER	5.1V 2% 0.4W BZX79B5V1	PHILIPS	BZX79B5V1	26.497
P3-1	PLUG	1/10" SIL SQ.PINS 3 POLES	AMP	0-826629-3 (0-826647-3)	78.323
P4-1	PLUG	1/10" SIL SQ.PINS 3 POLES	AMP	0-826629-3 (0-826647-3)	78.323
P5-1	PLUG	1/10" SIL SQ.PINS 3 POLES	AMP	0-826629-3 (0-826647-3)	78.323
P6-1	MULTIPLUG	2x15 POLES PCB VERSION	3M	3531-6002 / 7630-6002 JL	78.253
Q1-1	TRANSISTOR	BC640	PHILIPS	BC640	28.124
Q2-1	TRANSISTOR AF	BC558 PNP TO-92	PHILIPS	BC558 (-A/-B/-C)	28.095
Q3-1	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120
Q4-1	TRANSISTOR AF	BC548 NPN TO-92	PHILIPS	BC548 (-A/-B/-C)	28.070
Q5-1	TRANSISTOR	BC640	PHILIPS	BC640	28.124
Q6-1	TRANSISTOR AF	BC558 PNP TO-92	PHILIPS	BC558 (-A/-B/-C)	28.095
Q7-1	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120
R1-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R2-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R3-1	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R4-1	RESISTOR MF	1M OHM 5% 0.33W	PHILIPS	2322 180 73105	02.544
R5-1	RESISTOR MF	1k2 OHM 5% 0.33W	PHILIPS	2322 180 73122	02.474
R6-1	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R7-1	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 180 73568	02.418
R8-1	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 180 73568	02.418



POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R9-1	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R10-1	RESISTOR MF	120k OHM 5% 0.33W	PHILIPS	2322 180 73124	02.522
R11-1	RESISTOR MF	3kO OHM 5% 0.33W	PHILIPS	2322 180 73302	02.483
R12-1	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R13-1	RESISTOR MF	39k2 OHM 1% 0.25W	PHILIPS	2322 157 13923	02.239
R14-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R15-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R16-1	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R17-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R18-1	RESISTOR MF	3k9 OHM 5% 0.33W	PHILIPS	2322 180 73392	02.486
R19-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R20-1	RESISTOR MF	3kO OHM 5% 0.33W	PHILIPS	2322 180 73302	02.483
R21-1	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R22-1	RESISTOR MF	22O OHM 5% 0.33W	PHILIPS	2322 180 73221	02.456
R23-1	RESISTOR MF	18 OHM 5% 0.33W	PHILIPS	2322 180 73189	02.430
R24-1	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R25-1	RESISTOR MF	2k2 OHM 5% 0.33W	PHILIPS	2322 180 73222	02.480
R29-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R30-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R31-1	RESISTOR MF	22k1 OHM 1% 0.25W	PHILIPS	2322 157 12213	02.234
R32-1	RESISTOR MF	5k11 OHM 1% 0.25W	PHILIPS	2322 157 15112	02.228
R33-1	RESISTOR MF	1k2 OHM 5% 0.33W	PHILIPS	2322 180 73122	02.474
R34-1	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R35-1	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R36-1	RESISTOR MF	120k OHM 5% 0.33W	PHILIPS	2322 180 73124	02.522
R37-1	RESISTOR MF	3kO OHM 5% 0.33W	PHILIPS	2322 180 73302	02.483
R38-1	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R39-1	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 180 73568	02.418
R40-1	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 180 73568	02.418
R41-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R42-1	RESISTOR MF	39k2 OHM 1% 0.25W	PHILIPS	2322 157 13923	02.239
R43-1	RESISTOR MF	1kO OHM 5% 0.33W	PHILIPS	2322 180 73102	02.472
R44-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R45-1	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
U1-1	TRIPLE 3-INPUT NOR GATE	74HC27	TEXAS	SN74HC27N	34.516
U2-1	UNIVERSAL SYNCHRON. ASYN-	CHRON. RECEIVER/TRANSMITT	OKI	MSM82C51A-2RS	32.572
U3-1	HEX INVERTERS	74HC04	TEXAS	SN74HC04N	34.520
U4-1	QUAD 2-INPUT NAND GATE	74HC00	TEXAS	SN74HC00N	34.515
U5-1	STATIC RAM 8kx8	TC5565A HM6264A MSM5165A	OKI	MSM5165AL RS	32.766
U6-1	PROGRAMMED EPROM U6-1	H2186	S.P.RADIO A/S	0-0-29051 / C1120 - ????	729051
U7-1	MASTER PROCESSOR UNIT	8 BIT SERIAL INTERFACE	HITACHI	HD63B03YP	32.575
U8-1	uC SUPERVISORY CIRCUIT	MAX 690	MAXIM	MAX 690 CPA (EJA-MJA)	32.585
U9-1	COUNTER 7 STATE BIN.RIPP.	74HC4024	TEXAS	SN74HC4024	34.555
U10-1	DUAL OPERATIONAL AMP.	MC1458/LM1458	TEXAS	MC1458P	31.215
U11-1	INTEGR.CIRCUIT 74HC138	3-TO-8 LINE DECODER	MOTOROLA	MC74HC138N	34.533
U12-1	HEX INVERTERS	74HC04	TEXAS	SN74HC04N	34.520
U13-1	EEPROM	1k BIT SERIAL	OKI	MSM16811RS	32.708
U14-1	UNIVERSAL SYNCHRON. ASYN-	CHRON. RECEIVER/TRANSMITT	OKI	MSM82C51A-2RS	32.572
U15-1	UNIVERSAL SYNCHRON. ASYN-	CHRON. RECEIVER/TRANSMITT	OKI	MSM82C51A-2RS	32.572
U16-1	QUAD 2-INPUT NAND GATE	74HC00	TEXAS	SN74HC00N	34.515
U17-1	DUAL 4-INPUT NOR GATE		MOTOROLA	MC74HC4002N	34.552
X1-1	CRYSTAL	4.9152 MHz HC-49/U	NDK	LN-P-0001 4.9152MHz	39.769
				Cload = 20pF	

## INTERFACE MODULE H2186

## MODULE (2)

5-0-28562A / 4-0-28562A

628562

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
VARIOUS	FUSE COVER	5x20mm FUSE SIZE	ELU	199016	48.716
VARIOUS	SHUNT CONNECTOR	FEMALE 2 POLES	SAMTEC	SNT-100-BK-G	78.325
VARIOUS	FUSE HOLDER	1 POLE 5x20mm PCB VERSION	ELU	199015	78.398
C1-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T34	14.512
C2-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T34	14.512
C3-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T34	14.512
C4-2	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T34	14.510
C5-2	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T34	14.510
C6-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C7-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C8-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C9-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C10-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C11-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T34	14.512
C12-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T34	14.512
C13-2	CAPACITOR ELECTROLYTIC	10uF 20% 35VDC	ELNA	RJ2-35-V-100-M-T34	14.512
C14-2	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T34	14.510
C15-2	CAPACITOR ELECTROLYTIC	4.7uF 20% 50VDC	ELNA	RJ2-50-V-4R7-M-T34	14.510
C16-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C17-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C18-2	CAPACITOR ELECTROLYTIC	220uF -20/+50% 16VDC	ELNA	RJ2-16-V-221-M-T2	14.640
C19-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C20-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C21-2	CAPACITOR ELECTROLYTIC	220uF -20/+50% 16VDC	ELNA	RJ2-16-V-221-M-T2	14.640
C22-2	CAPACITOR ELECTROLYTIC	220uF -20/+50% 16VDC	ELNA	RJ2-16-V-221-M-T2	14.640
C23-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C24-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C25-2	CAPACITOR ELECTROLYTIC	220uF -20/+50% 16VDC	ELNA	RJ2-16-V-221-M-T2	14.640
C26-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C27-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C28-2	CAPACITOR ELECTROLYTIC	220uF -20/+50% 16VDC	ELNA	RJ2-16-V-221-M-T2	14.640
C29-2	CAPACITOR ELECTROLYTIC	100uF -10/+50% 25VDC	ERO	EKM 00 CC 310 E G5	14.610
C30-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C31-2	CAPACITOR ELECTROLYTIC	220uF -20/+50% 16VDC	ELNA	RJ2-16-V-221-M-T2	14.640
C32-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C33-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C34-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C35-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C36-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C37-2	CAPACITOR MKT	0.1uF 10% 63VDC	PHILIPS	2222 370 78104	11.136
C38-2	CAPACITOR CERAMIC	1nOF 10% CL2 500VDC	NKE	DT 360 758L B 102 K 500V FLAT PACK	15.160
D1-2	DIODE ZENER	5.1V 2% 0.4W BZX79B5V1	PHILIPS	BZX79B5V1	26.497
D2-2	DIODE ZENER	5.1V 2% 0.4W BZX79B5V1	PHILIPS	BZX79B5V1	26.497
D3-2	DIODE RECTIFIER	1N4002 100V/1A	THOMSON	1N4002 (03/04/05/06/07)	25.100
D4-2	DIODE ZENER	5.1V 2% 0.4W BZX79B5V1	PHILIPS	BZX79B5V1	26.497
D5-2	DIODE ZENER	5.1V 2% 0.4W BZX79B5V1	PHILIPS	BZX79B5V1	26.497
F1-2	FUSE	500mA 250V 5x20mm	ELU	179 120 500mA T	45.504
F2-2	FUSE	500mA 250V 5x20mm	ELU	179 120 500mA T	45.504
F3-2	FUSE	500mA 250V 5x20mm	ELU	179 120 500mA T	45.504
J2-2	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400 A4	78.444
J3-2	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400 A4	78.444
J4-2	SOCKET SUB D	25 POLES PCB VERSION	EDA INC.	8TO-025SS-244T	78.166
J5-2	SOCKET BNC	PCB VERSION	ROSENBERGER	51K102-400 A4	78.444
L1-2	CHOKE FIXED	100uH 10%	FASTRON	MICCS-101K-02	20.371
L2-2	CHOKE FIXED	100uH 10%	FASTRON	MICCS-101K-02	20.371
P1-2	MULTIPLUG	2x15 POLES PCB VERSION	3M	3531-6002 / 7630-6002 JL	78.253
P2-2	PLUG SUB D 15 POLES	4-40 NUTS PCB VERSION	CONEC	CDS 15 PFUNSN 163 A 11379 X	78.179
P3-2	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
P4-2	PLUG	1/10" SIL SQ.PINS 2 POLES	AMP	0-826629-2 (0-826647-2)	78.322
P5-2	PLUG	1/10" SIL SQ.PINS 3 POLES	AMP	0-826629-3 (0-826647-3)	78.323
P6-2	PLUG SUB D	9 POLES PCB VERSION	EDA INC.	8TO-009PS-241T	78.163
Q1-2	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120
Q2-2	TRANSISTOR	BC640	PHILIPS	BC640	28.124
Q3-2	TRANSISTOR AF	BC558 PNP TO-92	PHILIPS	BC558 (-A/-B/-C)	28.095
Q4-2	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120
R1-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R2-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R3-2	RESISTOR MF	16k OHM 5% 0.4W	PHILIPS	2322 181 53163	01.230
R4-2	RESISTOR MF	51.1 OHM 1% 0.25W	PHILIPS	2322 157 15119	02.221
R5-2	RESISTOR MF	30k OHM 5% 0.33W	PHILIPS	2322 180 73303	02.507
R6-2	RESISTOR MF	62k OHM 5% 0.33W	PHILIPS	2322 180 73623	02.515
R7-2	RESISTOR MF	120k OHM 5% 0.33W	PHILIPS	2322 180 73124	02.522
R8-2	RESISTOR MF	240k OHM 5% 0.33W	PHILIPS	2322 180 73244	02.529
R9-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R10-2	RESISTOR MF	10k OHM 5% 0.33W	PHILIPS	2322 180 73103	02.496
R11-2	RESISTOR MF	51.1 OHM 1% 0.25W	PHILIPS	2322 157 15119	02.221
R12-2	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R13-2	RESISTOR MF	120k OHM 5% 0.33W	PHILIPS	2322 180 73124	02.522
R14-2	RESISTOR MF	3k9 OHM 5% 0.33W	PHILIPS	2322 180 73392	02.486
R15-2	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R16-2	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 180 73568	02.418
R17-2	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R18-2	RESISTOR MF	120k OHM 5% 0.33W	PHILIPS	2322 180 73124	02.522
R19-2	RESISTOR MF	5k6 OHM 5% 0.33W	PHILIPS	2322 180 73562	02.490
R20-2	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 180 73123	02.498
R21-2	RESISTOR MF	5.6 OHM 5% 0.33W	PHILIPS	2322 180 73568	02.418
U1-2	DUAL RS232 DRIVER/REC.	5V SINGLE SUPPLY, CMOS	ANALOG DEVICES	AD232JN	32.757
U2-2	DUAL OPERATIONAL AMP.	MC1458/LM1458	TEXAS	MC1458P	31.215
U3-2	8 BIT SHIFT REG.SERIAL IO	74HC595	NATIONAL	MM74HC595N	34.502
U4-2	8 BIT SHIFT REG.SERIAL IO	74HC595	NATIONAL	MM74HC595N	34.502
U5-2	DUAL RS232 DRIVER/REC.	5V SINGLE SUPPLY, CMOS	ANALOG DEVICES	AD232JN	32.757
U6-2	POS. VOLTAGE REG. FIXED	15V/1A MC7815/LM340T	MOTOROLA	MC7815CT	31.090
U7-2	NEG. VOLTAGE REG. FIXED	-15V 5% 0.1A 79L15AC	MOTOROLA	MC79L15ACP	31.143
U8-2	NEG. VOLTAGE REG. FIXED	-5V/1A 7905CT/LM320T-5.0	MOTOROLA	MC7905CT	31.071
U9-2	POS. VOLTAGE REG. FIXED	5V 5% 0.1A LM2931AZ-5.0	MOTOROLA	LM2931AZ-5.0	31.134
U10-2	POS. VOLTAGE REG. FIXED	5V/1A 7805CT/LM340T-5.0	MOTOROLA	MC7805CT	31.250
U11-2	A/D CONVERTER ADC 0834N		TEXAS	ADC 0834 N	32.805
U12-2	8 BIT SHIFT REG.SERIAL IO	74HC595	NATIONAL	MM74HC595N	34.502
U13-2	8 BIT SHIFT REG.SERIAL IO	74HC595	NATIONAL	MM74HC595N	34.502
U14-2	QUAD 2-INPUT NAND GATE	74HC00	TEXAS	SN74HC00N	34.515

**CONTENTS PART II**

**ADDITIONAL INFORMATION FOR H2186/T**

<b>1</b>	<b>GENERAL INFORMATION</b>	
1.1	INTRODUCTION	1-1
1.2	TECHNICAL DATA	1-1
1.3	PRINCIPLE OF OPERATION AND BLOCK DIAGRAM	1-2
<b>2</b>	<b>INSTALLATION</b>	
2.1	ELECTRICAL CONNECTION AND ASSEMBLING	2-1
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2.3	INSTALLATION WITH H2185	2-4

**CONTENTS****1 GENERAL INFORMATION**

1.1 INTRODUCTION	1-1
1.2 TECHNICAL DATA	1-1
1.3 PRINCIPLE OF OPERATION AND BLOCK DIAGRAM	1-2

## 1 GENERAL INFORMATION

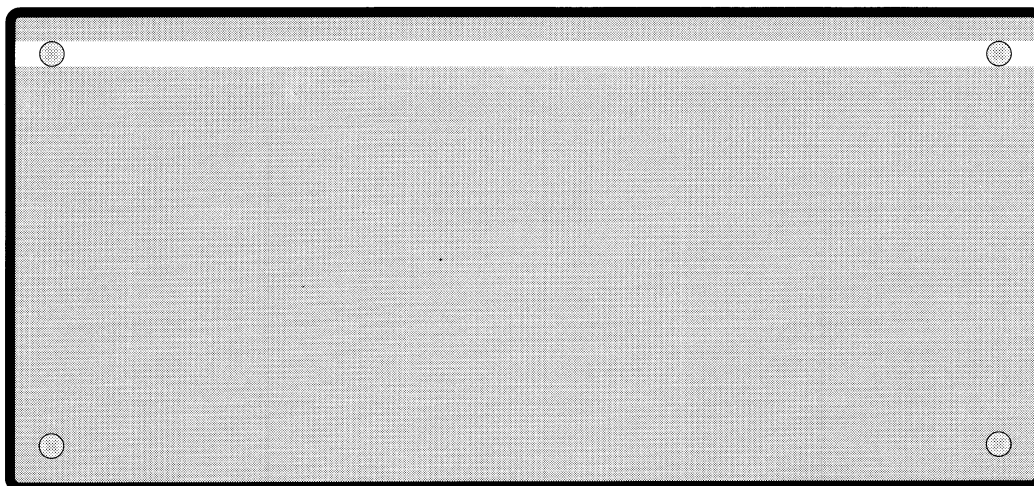
### 1.1 INTRODUCTION

H2186/T is a special version of H2186 designed for interfacing the Compact HF SSB System to the radio telex modem H1240.

H2186/T makes it possible to perform automatic telex system with all the features of H1240 in connection with the Compact HF SSB System.

The normal preference system of the HF SSB SYSTEM is not in function with respect to telex. Is not possible to automatically stop a on going telex connection when a DSC distress is initiated.

For more detailed information about the features of the telex system please refer to the manuals for H1240.



29194

### 1.2 TECHNICAL DATA

#### Compact HF SSB SP-BUS INTERFACE H2186/T

**Supply Voltage:** +18 V, -18 V and +9 V.

**Power consumption:** Stand-by: 150 mA.  
Max: 500 mA.

**Operating Temperature Range:** -15°C to +55°C

**Storage Temperature Range:** -25°C to +75°C

**Weight:** 1.5 kg.

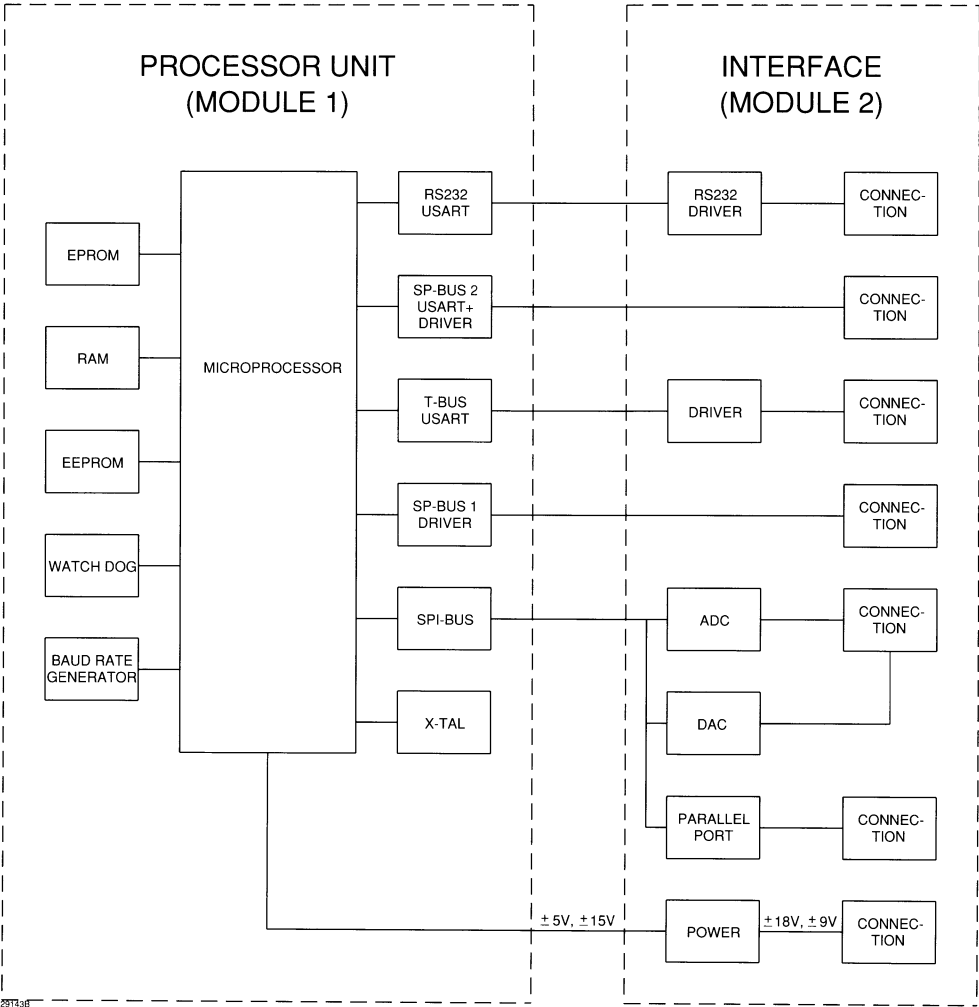
**Dimensions:** Height: 98 mm  
Width: 225 mm  
Depth: 122 mm

1.3 PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

The H2186/T contains two hardware modules: a processor unit module and an interface module. The processor unit module contains a microprocessor, memory, USARTs and I/O devices. The interface module contains power supply, busdrivers, ADC and DAC.

The two modules with their hardware blocks are shown in the block diagram. The elements in the block diagram are explained in detail in H2186/PART I chapter 5.

BLOCK DIAGRAM



**CONTENTS****2 INSTALLATION**

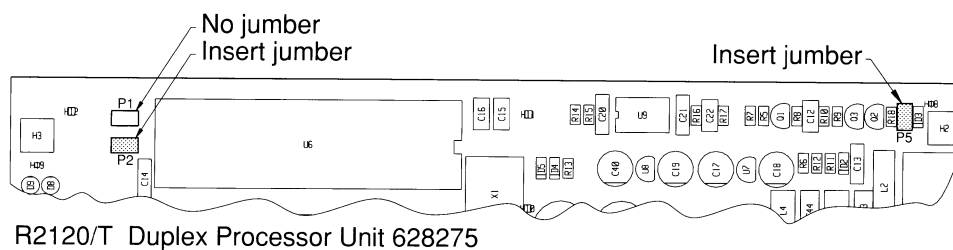
2.1	ELECTRICAL CONNECTION AND ASSEMBLING	2-1
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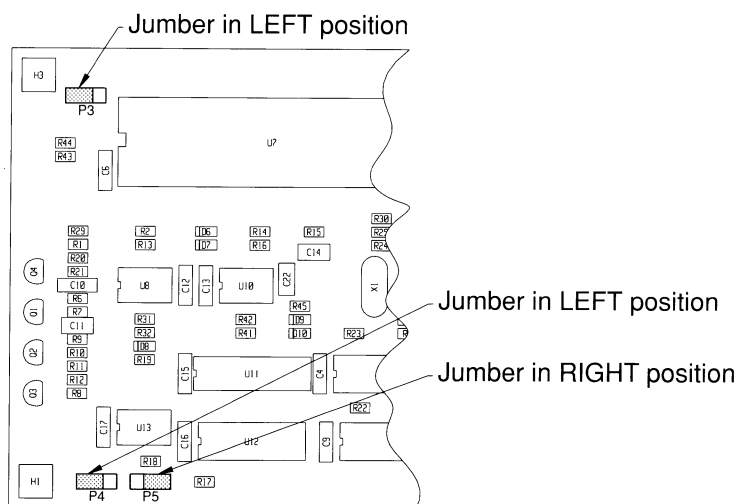
## 2 INSTALLATION

### 2.1 ELECTRICAL CONNECTION AND ASSEMBLING

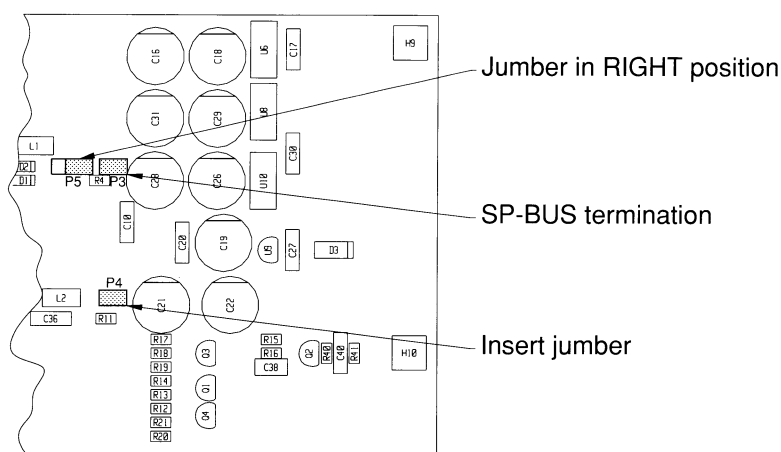
- Before starting the installation make sure that the straps in the H2186/T and the R2120/T ( software version A or higher only) are in accordance with the figures below.



R2120/T Duplex Processor Unit 628275



H2186 Processor Unit 628561

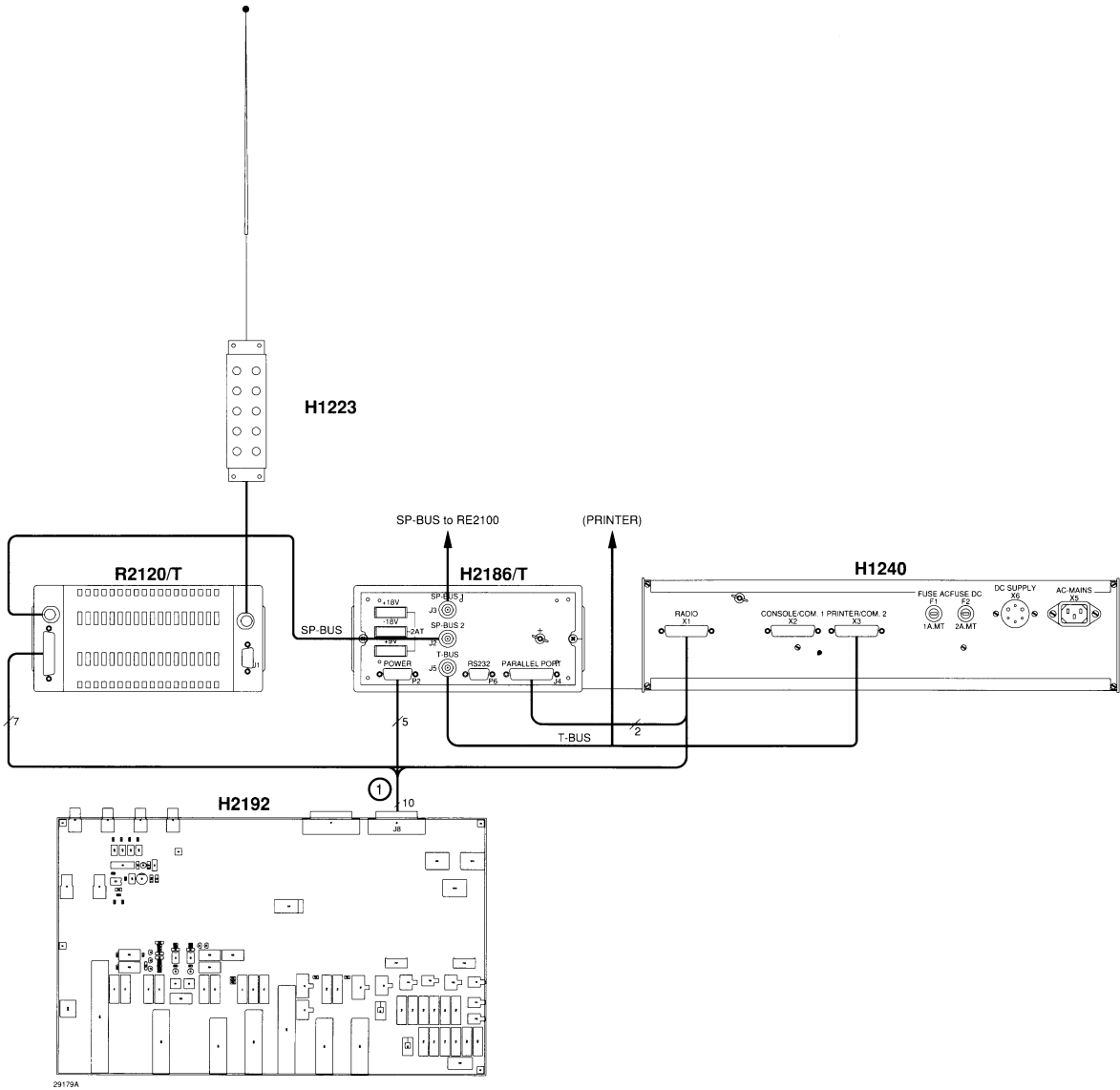


H2186 Interface Module 628562

29195A

- Connect the units as described in chapter 2.2 and 2.3.
- Turn on the system.
- Prepare the H1240 as described in the manual for H1240. Be aware! You have to select external radio control.
- Prepare the RE2100. Select service programming mode by pressing **0** and **1** simultaneously (the display will now show SP-) then press **0** **7** **3** **3** **STOP** **ENT**.
- Turn off the RE2100 and then on, no ERROR code must be displayed.

2.2 INSTALLATION WITH H2192



**CABLE 1**

H2192	R2120/T	H2186/T			H1240		SIGNAL
J8	J1	P2 POWER	J5 T-BUS	J4 PARALLEL PORT	X1	X3	
6		9					SP-BUS INTERRUPT
9					4		AUX AF TO TX
10	10	2					-18V
11	11	3					+9V
12	12	1					+18V
15					24		TX-KEY
18					5		AUX AF TO TX
19	17				1		0 dBm OUT
20	18				2		0 dBm OUT
22	5	4			7		GROUND
14	21				22		RX MUTE
				25	23		HT-ON
				23	8		TX-READY
			SCREEN			1 + 7	GROUND
			INTER CORE			3 + 2	T-BUS
25 POLES MALE	25 POLES MALE	15 POLES FEMALE	BNC	25 POLES MALE	25 POLES FEMALE	25 POLES MALE	CONNECTOR TYPE

The diagram illustrates the wiring for the T213X system. A vertical antenna labeled H1223 is connected to the top of the main unit T213X. The main unit T213X is a large rectangular box on the right. To its left are three smaller modules: R2120/T (top), H2186/T (middle), and H2140 (bottom). The R2120/T module has a connector labeled '1' and is connected to the main unit via a cable labeled '1'. The H2186/T module has connectors labeled '2', '3', and '4'. It is connected to the main unit via a cable labeled '2' (SP-BUS) and to the R2120/T module via a cable labeled '3' (SP-BUS). The H2140 module has connectors labeled 'X1', 'X2', 'X3', 'X4', 'X5', and 'X6'. It is connected to the main unit via a cable labeled '2' (SP-BUS) and to the H2186/T module via a cable labeled '4' (RS232). The H2140 module also has a 'PARALLEL PORT' connector labeled 'X5'.

**CABLE 1**  
H2185 TO R2120/T, SP. NO. 528977

H2185	R2120/T	SIGNAL
TO R2120 J3	J1	
2	15	VF/AE-CURRENT
3	19	EXT. RF CONTROL
4	21	TX-KEY
5	5	SHIELD
6		NC
7	17	0 dBm
8	18	0 dBm
9		NC
10	10	-18V
11	11	+9V
12	12	+19V
13		NC
14	6	DUPLEX MODE RE2100
15	22	GND
15 POLES MALE	25 POLES MALE	CONNECTOR TYPE

**CABLE 2**

H2186/T TO H1240 TO H2185 TO T213X

H2186/T	H1240	H2185	T2130		T2131/T2135		SIGNAL
PARALLEL PORT J4	X1	TO T213X J2	ST7	ST2	ST8	ST6	
25	23						HT-ON
23	8						TX-READY
	7	5					GROUND
	1	17					0 dBm COMMON
	2	18					0 dBm
	24	21		13		13	TX-KEY
	4	4	1		1		AUX AF TO TX
	5	2	2		2		AUX AF TO TX
		6	7		7		SP-BUS INTERRUPT
		7	9		9		+ BATT
		8	8		8		- BATT
		13		5		5	SUPPLY ON/OFF
		25		15		15	- BATT ON/OFF
		10		14		14	-18V
		11		3		3	+9V
		12		4		4	+18V
25 POLES MALE	25 POLES FEMALE	25 POLES MALE					CONNECTOR TYPE

**CABLE 3**

H2185 TO H2186/T

H2185	H2186/T	SIGNAL
TO RE2100 P6	POWER P2	
5	4	GND
6	9	SP-BUS INTERRUPT
10	2	-18V
11	3	+9V
12	1	+18V
25 POLES FEMALE	15 POLES FEMALE	CONNECTOR TYPE

**CABLE 4**

H2186/T TO H1240

Coax cable RG58U

H2186/T	H1240	SIGNAL
T-BUS J5	X3	
OUTER CORE	1 + 7	GROUND
INTER CORE	3 + 2	T-BUS
BNC	25 POLES MALE	CONNECTOR TYPE

**CONTENTS PART III****ADDITIONAL INFORMATION FOR H2186/RE**

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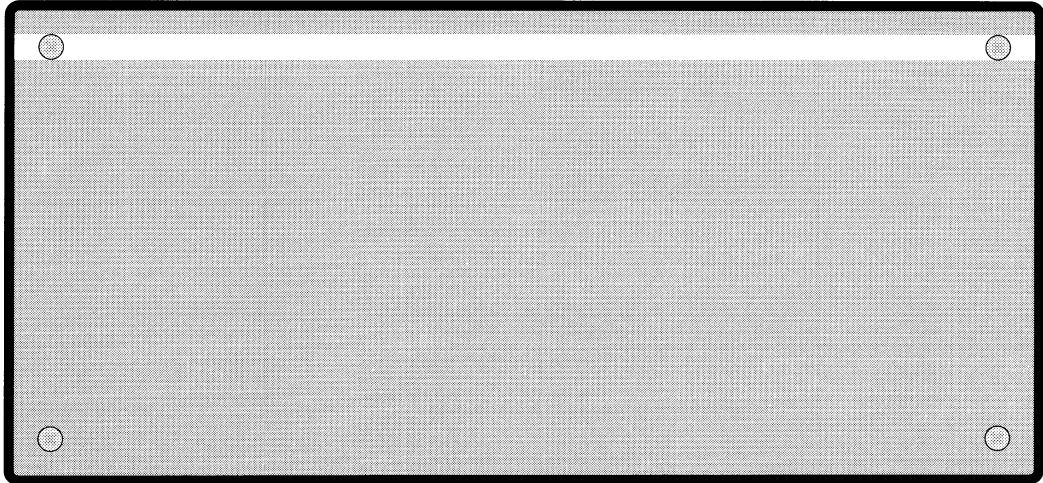
**CONTENTS****1 GENERAL INFORMATION**

1.1 INTRODUCTION	1-1
1.2 TECHNICAL DATA	1-1
1.3 PRINCIPLE OF OPERATION AND BLOCK DIAGRAM	1-2

1 GENERAL INFORMATION

1.1 INTRODUCTION

H2186/RE is designed for interfacing the Compact HF SSB System to a PC or a modem. H2186/RE makes it possible to remote control all the functions of the RE2100 from a PC.



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1.2 TECHNICAL DATA

Compact HF SSB SP-BUS INTERFACE H2186/RE

Supply Voltage:	+18 V, -18 V and +9 V.	
Power consumption:	Stand-by:	150 mA.
	Max:	500 mA.
Operating Temperature Range:	-15°C to +55°C	
Storage Temperature Range:	-25°C to +75°C	
Weight:	1.5 kg.	
Dimensions:	Height:	98 mm
	Width:	225 mm
	Depth:	122 mm

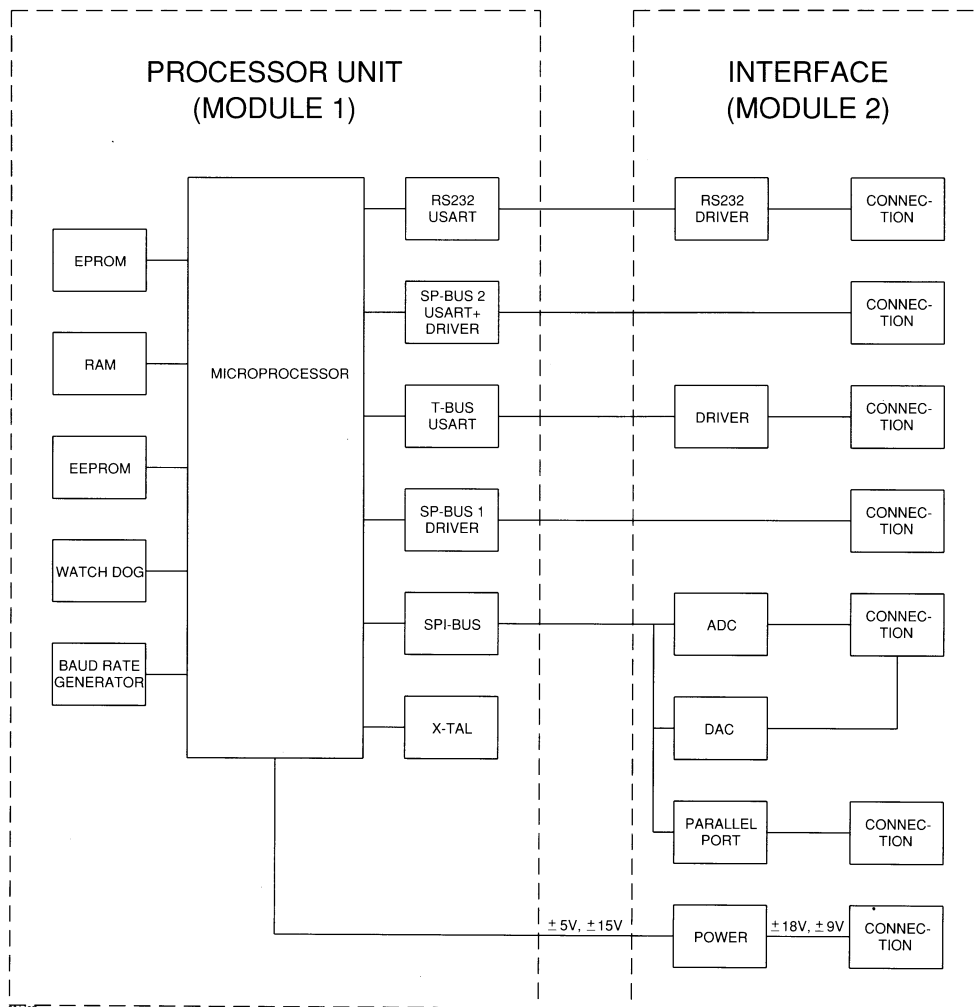


### 1.3 PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

The H2186/RE contains two hardware modules: a processor unit module and an interface module. The processor unit module contains a microprocessor, memory, USARTs and I/O devices. The interface module contains power supply, busdrivers, ADC and DAC.

The two modules with their hardware blocks are shown in the block diagram. The elements in the block diagram are explained in detail in H2186/PART I chapter 5.

#### BLOCK DIAGRAM



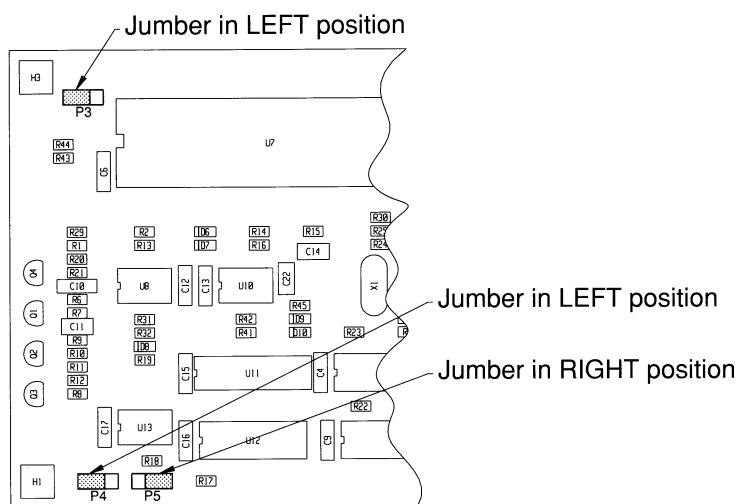
**CONTENTS****2 INSTALLATION**

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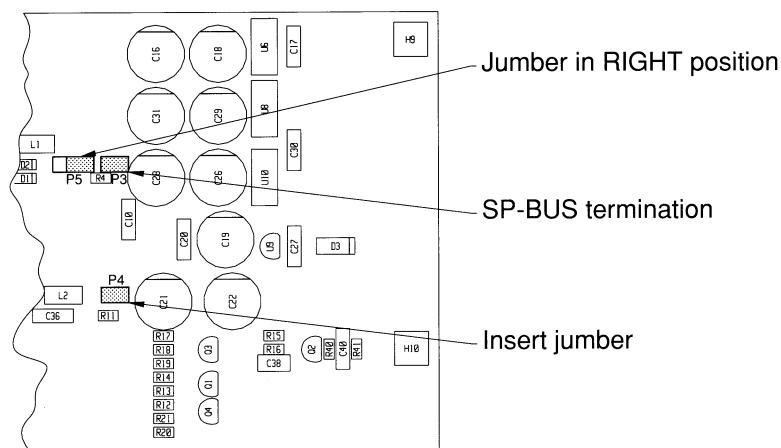
## 2 INSTALLATION

### 2.1 ELECTRICAL CONNECTION AND ASSEMBLING

- Before starting the installation make sure that the straps in the H2186/RE are in accordance with the figures below.



H2186 Processor Unit 628561

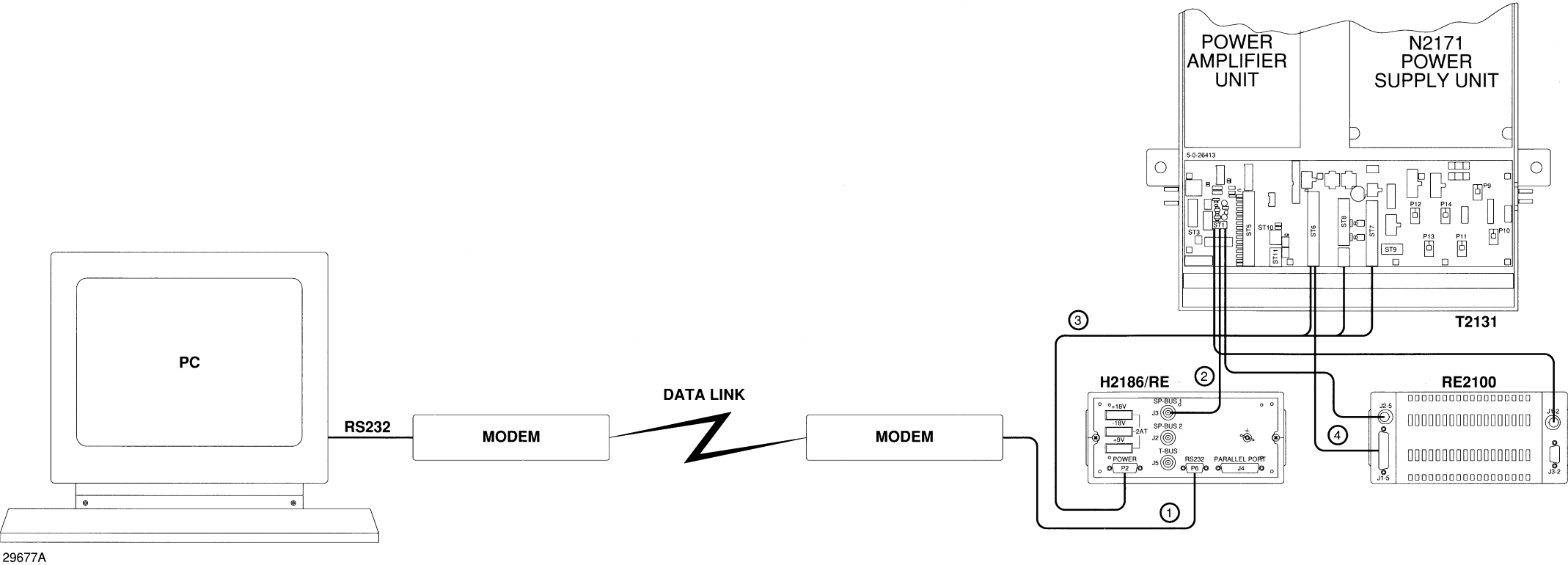


H2186 Interface Module 628562

29676

- Connect the units as described below.
- Turn on the system.
- Prepare the RE2100. Select service programming mode by pressing **0** and **1** simultaneously (the display will now show SP-) then press **0** **7** **3** **3** **STOP** **ENT**.
- Turn off the RE2100 and then on, no ERROR code must be displayed.

2.2 INSTALLATION WITH RE2100



**CABLE 1**  
See chapter 2.4 Telephone Modem in the manual and make the necessary connections to H2186 in accordance with the table below.

H2186/RE	SIGNAL
P6 RS232	
2	RX
3	TX
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9 POLES FEMALE	CONNECTOR TYPE

**CABLE 2**  
Connect SP-BUS 1 (J3 BNC H2186) to T2131, module 13 ST1 pin 3.

H2186/ RE	T2131			SIGNAL
P2 POWER	ST6	ST7	ST8	
1		2		+18V
2		3		-18V
3		1		+9V
4			10	GND
9		12		SP-BUS INT.
10	11			ANALOG OUT
11	2			ANALOG IN
15 POLES FEMALE				CONNECTOR TYPE

**CABLE 4**  
Standard connections, please refer to the manual for T2131 chapter 2.

## 2.3 INSTALLATION OF THE MODEM

This installation procedure can be used to set up a Hayes compatible modem. As modem it can be recommended to use a Nokia ECM QUAD, built in a metal box.

The RS232 interface has the following parameters:

RS232                      2400 Baud, 8 Data bit, 1 Start Bit, 1 Stop Bit and Even Parity.

The following is a list of the commands used to install a Hayes compatible modem:

AT&L1	Select a leased telephone line
<OK>	Answer from modem
ATN	Error correction disabled (cannot be used in leased line mode)
<OK>	
AT%C	Disable Data Compression MNP5
<OK>	
ATA0	Select Minimum MNP Block size
<OK>	
ATQ	Disable Flow Control
<OK>	

Select one of the two modems and send the following command:

ATS0=3	This modem is the answering modem, the other modem is the calling modem.
<OK>	

If you want to store the configuration, send command:

AT&W

If you want a list of the set-up, use the command:

AT\S

It is possible to set a jumper in the modem so it is configured to use the DTR (Data Terminal Ready) control signal to check whether it has to be on-line or off-line, because the H2186 changes the DTR from passive to active when it is powered on, and changes the DTR from active to passive when it is powered off. It is important that the modem and the H2186 is powered from the same source because after a power down, the H2186 will automatically set the modem on-line.

For further information, consult the Modem Manual.

## 2.4 INSTALLATION OF THE PC PROGRAMME

To install the PC programme supplied, just copy H2186.EXE and H2186XXX.HLP to the harddisk or copy the two files to another floppy disk. The DOS version has to be a 3.20 or higher. To run the programme using comport 1 to communicate with the modem, just write

H2186      and return.

If the PC/modem has to use comport 2, just write

H2186 2    and return.

It is possible to use a PC with a monochrome screen, but the result is not good because the user interface makes use of highlighted characters.

The parallel port J4 can be used to set up the Tx frequency of an external transmitter. The Tx frequency is in BCD.

The Tx Frequency 12345 kHz would look like this:

The Tx Frequency 4529 kHz would look like this:

PAGE 2-4

## CONTENTS

### 3 PC USER INTERFACE TO CONTROL THE RE2100

### 3 PC USER INTERFACE TO CONTROL THE RE2100

The H2186 Remote Control Programme makes it possible for you to remote control the RE2100 from a PC and a H2186 either with or without a modem.

The programme consists of two main windows from where it is possible to control the RE2100. The first main window is the Menu Window, which only contains the most frequently used commands. An extended window is the Keyboard Window which simulates the RE2100 keyboard. From this window, you can control all the RE2100 functions.

After the Welcome Window you enter the Menu Window. To control the RE2100 you hit the highlighted keys on the PC keyboard, or clicks the buttons with the mouse. As a response you get a display updating every time you hit a key, and it is possible to check if the remote control went right. If the line is broken, you receive an Error Message. If the RE2100 is powered off, you will not get a display updating. So what is monitored on the PC screen is actually what is shown on the RE2100 display.

If you want to use another function not available from the Menu Window, a press on 'F3' or a mouse click on the status-line at the button will make the Keyboard Window visible with all the functions to control the RE2100.

As with the Menu Window, you simply hit the highlighted keys or click the mouse buttons. If you want to change channel to channel 1, the following procedure is used:

Hit the 'C' - key or click the mouse on the 'CH' - button.

The screen gets updated according to the user interface of the RE2100.

Hit the '1' - key or click the mouse on the '1' - button.

Again the screen gets updated, showing that the RE2100 has received the command.

Finally, you hit the 'ENTER' - key or click the mouse on the 'ENT' - button.

The RE2100 has now selected channel 1.

All the other functions available from the Keyboard Window have the same syntax as the user interface for the RE2100.

If you want to go back to the Menu Window, hit the 'F4' - key or click the mouse on the status-line at the button. The syntax in the Menu Window is almost the same as in the Keyboard Window, but to change power is different. Instead of hitting the 'T' - key (TX) and the 'A' - key (AGC/POWER) and finally the 'ENTER' - key, it is sufficient to hit the 'P' - key. This makes a one step power change.

In both Windows, you can reduce the RF Gain of the system. The 'RF GAIN Up/Down' - buttons or the 'F/W' - keys make it possible to reduce the RF Gain of the system. The minimum gain level is -15 and maximum gain level is -0, ie no gain reduction.

Press on 'F1' will always bring up a Help Window - ESC closes the Help Window.

Press on 'F2' makes you leave the control programme temporarily, and it is now possible to perform a DOS command. To return to the control programme, type 'exit' at the DOS prompt and press enter.

Press on 'F3' makes a switch to the Keyboard Window, and 'F4' switch back to the Menu Window.

With 'F5' it is possible to change the colours.

To exit the programme, press 'ALT X' simultaneously.



If you want to check if the display on the RE2100 and the PC screen agree, you can get a new display updating to the PC by hitting the 'ENTER' - key.

If someone is using the RE2100 keyboard, you can monitor the display changes on the PC screen too, which makes it certain that you are not interrupting anyone when you are remote controlling the RE2100.

**CONTENTS****4 SOFTWARE PROTOCOLS**

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## 4 SOFTWARE PROTOCOLS

This chapter describes the software protocol used to communicate with the interface box H2186 and H2186R via the RS232 interface.

This chapter deals with the general format of the protocol and the type of the protocol. The next passages treat the specific protocol for the H2186 based on the general protocol.

### 4.1 RS232 PROTOCOL

Information is sent as packets. If a packet is well received, the receiver sends an Acknowledgement to the transmitter. If an error occurred and a packet is received with an error, it is possible to transmit a Negative Acknowledgement, a NACK, but it is not necessary. If the Transmitter receives a NACK, it will re-transmit the packet. If the transmitter does not receive an ACK within a certain time limit, it will re-transmit the packet because it is assumed that the packet is lost. To prevent the receiver from receiving the same packet twice as a result of an erroneous ACK, a packet number is a part of the packet. This packet number is transmitted as a part of the ACK and NACK too. The maximum number of re-transmissions is 10.

Though the modem is designed to operate in full duplex, the data transmission in this application is in half duplex. That is, a command is sent from a PC, the H2186 sends an ACK if the packet is received without error. Then the H2186 sends the command to the RE2100/R2120 and the display updating received from the RE2100/R2120 is transmitted back to the PC. The PC sends an ACK and is now ready to send the next packet. If the PC does not receive a display updating within a certain time limit, it will enter the transmit ready state nevertheless.

To check the telephone line the PC continuously sends a command and check the answer. If no answer is received after 10 re-transmissions there is a system error.

A CRC (1 byte) is applied to check for transmission errors. The CRC is an EX-OR of all the data transmitted in the packet.

The telephone line has to be a leased line.

### 4.2 PROTOCOL FORMATE

The general format is as follows:

<b>TYPE</b>	: 3 bit.
<b>LENGTH</b>	: 5 bit.
<b>H2186ADR</b>	: 4 bit. Only used with two or more H2186 on the line. Not implemented
<b>PACKETNR</b>	: 4 bit.
<b>DATA</b>	: 1 - 31 bytes.
<b>CRC</b>	: 1 byte. EX-OR of Type, Length and H2186Adr, PacketNumber and the data bytes transmitted in the packet.

The LENGTH field denotes the number of the succeeding bytes, without the CRC field. The TYPE field denotes the following packet types:

000:	The packet contains data from the RE2100 or R2120.
001:	The packet contains a bus interrupt request to the RE2100.
010:	The packet contains a string command to RE2100 or R2120.
011:	Not used.
100:	Not used.
101:	The packet contains an ACK.
110:	The packet contains a BUSY. Not used.
111:	The packet contains a NACK.

TYPE 0 packets contain data from RE2100 or R2120 to the PC. It will typically be a display updating. TYPE 1 packets contain a key-code and an interrupt request to the RE2100. TYPE 2 packets contain string data

to the R2120 or a Tx/Rx frequency to the RE2100 or a key-code sequence like set power, which demands three key-codes if they were sent separately. Type 5 and 7 packets are one byte packets used as described above.

### 4.3 BUS-TIMING AND DATA FORMATE

Only two timing constants are essential. The ACK receiving time and the maximum display updating time.

ACKReceiveTime  $\geq 128$  ms

MaxDispOpdTime  $\geq 800$  ms

#### TRANSMISSION RATE

On the telephone line the modems will control the data rate but from the PC and the H2186 to the modems, the Baud rate is always 2400.

#### DATA FORMATE

1 start-bit, 8 data bits, 1 stop-bit and even parity. MSB is transmitted first.

### 4.4 H2186/RE PROTOCOL TO CONTROL THE RE2100

Commands from the PC to control the RE2100 are type 1 and type 2 packets. The type 1 packets are used to send one character a time, just like a C2140 sends one character when the user presses a button. The formate of the type 1 packets are the following:

**TYPE 1** [Type+Length][0+PacketNumber][InterruptAdr][KeyCode][CRC]

where Type and Length are according to the specifications in chapter 1 and PacketNumber is the actual packetNumber, InterruptAdr is the address of the remote control just like a C2140 has an address and finally the Key-code which is the code that has to be sent to the RE2100.

A list of all possible Key-codes is shown at the end of this chapter.

### 4.5 H2186/RE COMMAND EXAMPLE

A remote PC with an address-number 3 wants to send a CH-Key to the RE2100, it has to send the following packet to the H2186: (all digits are hexadecimal)

[23][00][03][48][68]

[A0] Acknowledgement from H2186

When the packet is received by the H2186 it will make an interrupt-request and the communication between H2186 and RE2100 will pass off like it is specified for the communication between a RE2100 and a C2140 in the SP-BUS specification.

The display updating (and all other information like HF-OCCUPIED) is sent to H2186 from RE2100 and transmitted to the PC as a type 0 packet. For details see the passage about the diaplay updating.

**TYPE 0** [Type+Length][0+PacketNumber][D0][D1].....[Dn][CRC]

In this case, this packet would be like this:

[12][00][C8][5F][XX][43][48][47][47][47][47][47][20][20][20][20][20][20][XX][CRC]

[A0] Acknowledgement from PC

Then the PC sends a character '1'

[23][01][03][31][10]

[A1] Acknowledgement from H2186

The H2186 sends a display updating to the PC

[12][01][C8][5F][XX][43][48][20][20][20][20][31][20][20][20][20][20][XX][CRC]

[A1] Acknowledgement from PC

And at last the PC sends an ENTER

[23][02][03][45][64]

[A2] Acknowledgement from H2186

The H2186 sends a display updating to the PC

[12][02][C8][5F][XX][43][48][47][20][20][20][31][20][20][20][20][20][XX][CRC]

[A2] Acknowledgement from PC

The PC is not allowed to send a new packet until it has received a display updating, or until the MaxDispOpdTime has elapsed.

## 4.6 ENHANCED H2186/RE COMMANDS

It can be rather circumstantial to change the power or to change the Tx/ Rx frequency in this way, so for these particular commands, there is a shorter way. To change the power, Tx/Rx frequency or RFGain, it is possible to send a packet type 2:

**TYPE 2** [Type+Length][PacketNumber][OPCODE1][InterruptAdr][D0][D1]...[Dn][CRC]

### SET TX FREQUENCY

To change Tx frequency with one packet use this packet:

[47][PacketNumber][01][InterruptAdr][00][10M,1M][100k,10k][1k,0.1k][CRC]

where 10M are the Tx Frequency in 10 MHz in packed BCD code, and 1M the 1 MHz frequency and so on.

The H2186 will only transmit the last display updating to the PC.

### EXAMPLE

To change the Tx frequency to 11111 kHz use the following packet:

[47][00][01][03][11][11][10][55]

where the InterruptAdr is 3 and the PacketNumber is 0.

### SET RX FREQUENCY

To change Rx frequency with one packet, use this packet:

[47][PacketNumber][01][InterruptAdr][01][10M,1M][100k,10k][1k,0.1k][CRC]

where 10M is the Rx Frequency in 10 MHz in packed BCD code, and 1M the 1 MHz frequency and so on.

The H2186 will only transmit the last display updating to the PC.

### CHANGE POWER ONE STEP

To change the power one step with one packet use this packet:

[44][PacketNumber][01][InterruptAdr][02][CRC]

The H2186 will only transmit the last display updating to the PC.

### SET RFGAIN

To set the RFGain use the following packet:

[45][PacketNumber][01][InterruptAdr][03][RFGainValue][CRC]

where RFGainValue is a number between 00 and 0F.

The H2186 sends a display updating back to the PC.

## 4.7 DISPLAY UPDATING

It is possible to force the H2186 to send a display updating by sending an ENTER key in a packet type 1. Then the PC can get the latest state of the RE2100, eg at the beginning of the PC programme. If anything happens on the RE2100 site, eg a person pressing a button, the resulting display updating is transmitted to the PC, ie everything that happens on the RE2100 site is monitored on the PC site. When the TX-Key is pressed, the point in the Tx frequency display starts flashing, but to avoid transmission of every display updating, the H2186 only transmits a display updating if there is a change besides the flashing Tx frequency point!

The display updating consists of 17 bytes, where the 15 bytes contain information about RX/TX frequency, Mode, AGC, Squelch and Power choice. The information is placed in the following data bytes:

D0: = C8 or E3. C8 means broadcast to all remote units. E3 is data only for the PC.

D1: = 5F. 5F means that it is a display updating containing 15 data bytes.

D2:

7	6	5	4	3	2	1	0	D2 bit0->bit7
X	X	X	X	X	X	L	L	Display light off
X	X	X	X	X	X	L	H	Display light low
X	X	X	X	X	X	H	L	Display light middle
X	X	X	X	X	X	H	H	Display light high
X	X	X	L	L	H	X	X	Mode J3E-LSB
X	X	X	L	H	L	X	X	Mode J3E-USB
X	X	X	L	H	H	X	X	Mode R3E
X	X	X	H	L	L	X	X	Mode H3E-
X	X	X	H	L	H	X	X	Mode Telex
L	L	H	X	X	X	X	X	Low power
L	H	H	X	X	X	X	X	2/5 power
L	H	L	X	X	X	X	X	Half power
H	H	L	X	X	X	X	X	4/5 power
H	L	L	X	X	X	X	X	Max. power

D3 : ASCII code to 10 MHz in RX-frequency.  
 D4 : ASCII code to 1 MHz in RX-frequency.  
 D5 : ASCII code to 100 KHz in RX-frequency.  
 D6 : ASCII code to 10 KHz in RX-frequency.  
 D7 : ASCII code to 1 KHz in RX-frequency.  
 D8 : ASCII code to 100 Hz in RX-frequency.  
 D9 : ASCII code to 10 Hz in RX-frequency.  
 D10: ASCII code to 10 MHz in Tx-frequency.  
 D11: ASCII code to 1 MHz in TX-frequency.  
 D12: ASCII code to 100 KHz in TX-frequency.  
 D13: ASCII code to 10 KHz in TX-frequency.  
 D14: ASCII code to 1 KHz in TX-frequency.  
 D15: ASCII code to 100 Hz in TX-frequency.  
 D16:

7	6	5	4	3	2	1	0	D16 bit7->bit0
X	X	X	X	X	X	X	L	AGC off
X	X	X	X	X	X	X	H	AGC on
X	X	X	X	X	X	L	X	Squelch on
X	X	X	X	X	X	H	X	Squelch off
X	X	X	X	X	L	X	X	"." in RX-display off
X	X	X	X	X	H	X	X	"." in RX-display on
X	X	X	X	L	X	X	X	"." in TX-display off
X	X	X	X	H	X	X	X	"." in TX-display on
X	X	X	L	X	X	X	X	Tune off
X	X	X	H	X	X	X	X	Tune on
X	X	L	X	X	X	X	X	Dummy load off
X	X	H	X	X	X	X	X	Dummy load on
X	L	X	X	X	X	X	X	No distress
X	H	X	X	X	X	X	X	TX-frekevens 2182.0 kHz

Besides the RX-frequency various error codes and HF OCC in D3 to D9 will also be written.

#### 4.8 CHECKING THE TELEPHONE LINE

To check the telephone line, the PC sends an ENTER-Key every minute or one minute after the last key was pressed. If the telephone line is intact, the H2186 will return a display updating to the PC. If the PC has switched on the transmitter, the PC has to send a TxOnKey for every 10 seconds, until the PC switches off the transmitter. If the telephone line breaks down when the transmitter is switched on, the RE2100 will switch the transmitter off after 15 seconds.

## 4.9 KEY-CODES

Key-codes which can be used in the type 1 packet:

Key	ASCII code	Funktion Description
0-9	30-39 0-9	Numerical keys
FULL STOP	50 P	Decimal marking
STOP/ENT	45 E	Stop process/End keying
FREQDOWN	4F O	Step frequency down
FREQUP	4E N	Step frequency up
TUNE/CLAR	43 C	TX tune/Selection of clarifier
RX	52 R	RX mode
CH	48 H	Channel mode
AGC/POWER	4C L	AGC on-off/Toggel power
DIM/DUMMY	53 S	Toggel dimmer/Dummy load select
SEND ALM	47 G	Send alarm
2182	56 V	Select distress 2182 kHz
TEST ALM	42 B	Test alarm
TX	54 T	TX mode
SC	4B K	Scan mode
SQ/ADD	41 A	Squelch on-off/Add in connection with programming
MODE/DEL	44 D	Select mode/Delete in connection with programming
SEND ALM + TEST ALM	46 F	Start send alarm function
RX + FREQDOWN	4A J	Select Ground Aerial
RX + FREQUP	49 I	Select Open Aerial
1 + 0	51 Q	Select QUICK service programme
	5A Z	Select service programme
	6B k	Handkey off/No System Request
	6C l	Handkey off/System Request
	6D m	Handkey on/System Request
	6E n	Handkey on/No System Request



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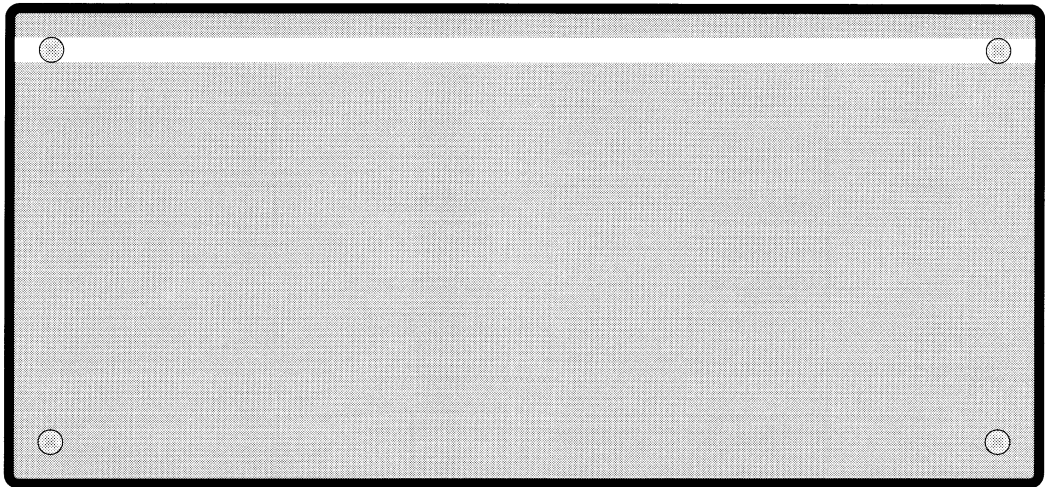
**CONTENTS****1 GENERAL INFORMATION**

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1 GENERAL INFORMATION

1.1 INTRODUCTION

H2186/R is designed for interfacing the Compact HF SSB System to a PC or a modem. H2186/R makes it possible to remote control all the functions of the R2120 from a PC.



29194

1.2 TECHNICAL DATA

Compact HF SSB SP-BUS INTERFACE H2186/R

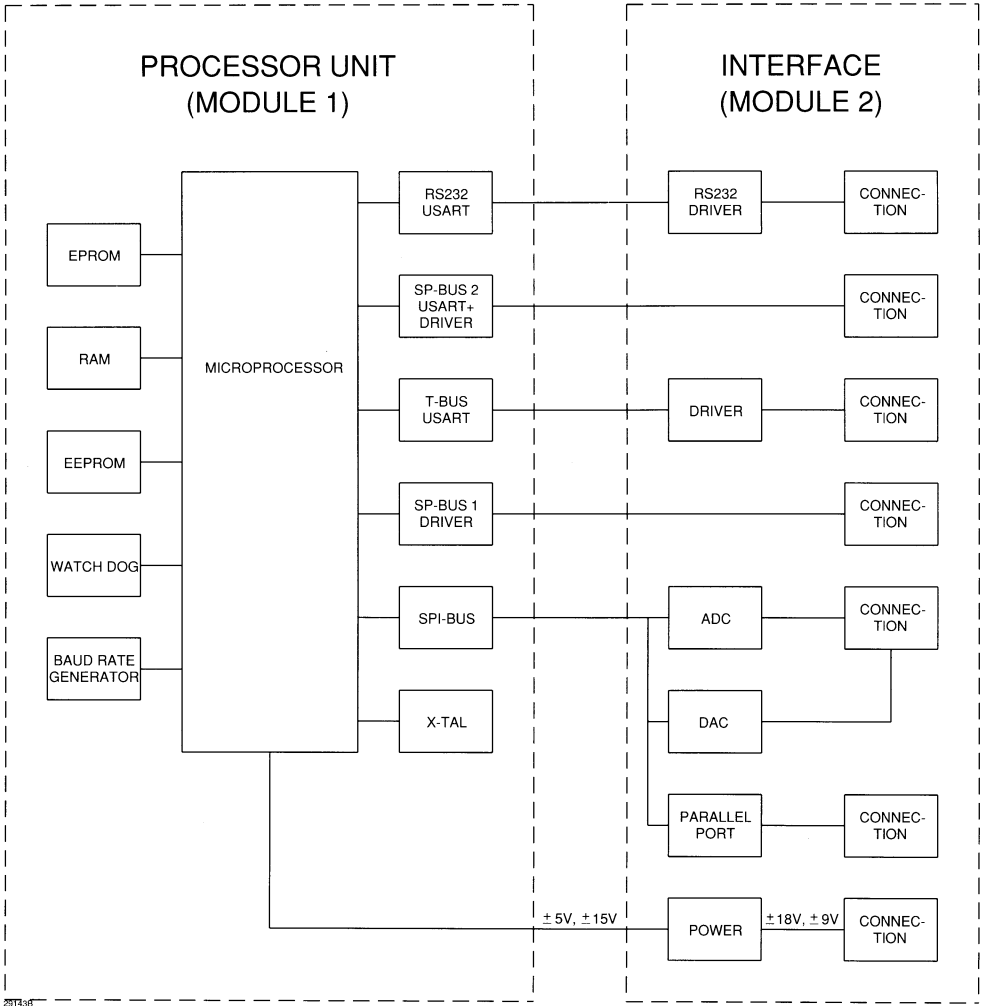
Supply Voltage:	+18 V, -18 V and +9 V.	
Power consumption:	Stand-by:	150 mA.
	Max:	500 mA.
Operating Temperature Range:	-15°C to +55°C	
Storage Temperature Range:	-25°C to +75°C	
Weight:	1.5 kg.	
Dimensions:	Height:	98 mm
	Width:	225 mm
	Depth:	122 mm

1.3 PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

The H2186/R contains two hardware modules: a processor unit module and an interface module. The processor unit module contains a microprocessor, memory, USARTs and I/O devices. The interface module contains power supply, busdrivers, ADC and DAC.

The two modules with their hardware blocks are shown in the block diagram. The elements in the block diagram are explained in detail in H2186/PART I chapter 5.

BLOCK DIAGRAM



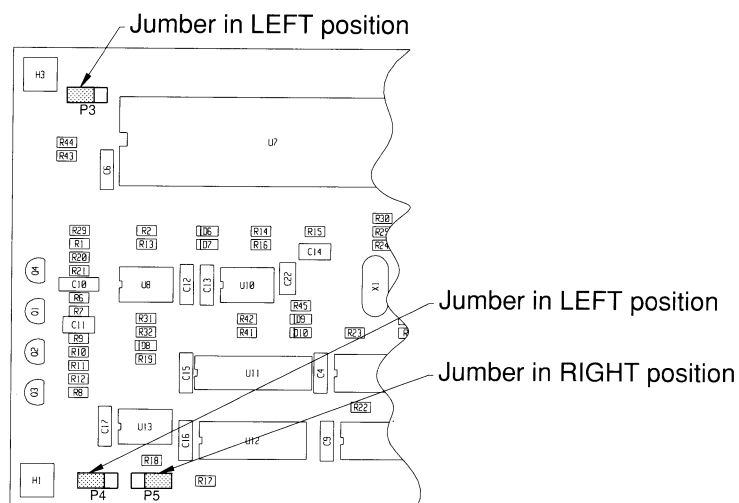
**CONTENTS****2 INSTALLATION**

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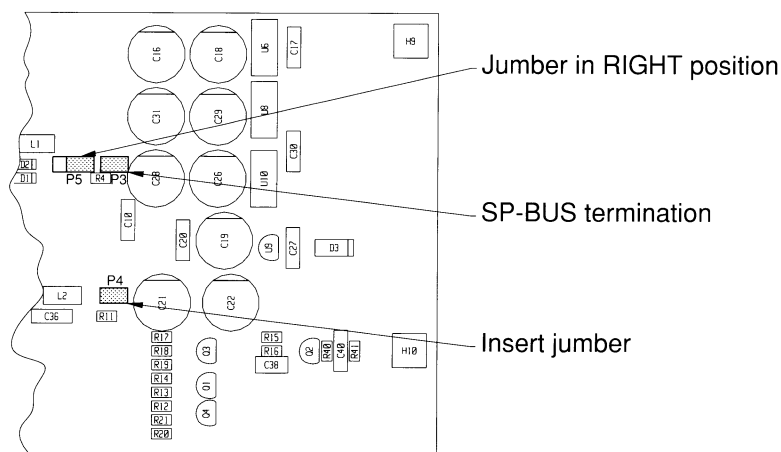
## 2 INSTALLATION

## 2.1 ELECTRICAL CONNECTION AND ASSEMBLING

1. Before starting the installation make sure that the straps in H2186/R are in accordance with the figures below.



H2186 Processor Unit 628561



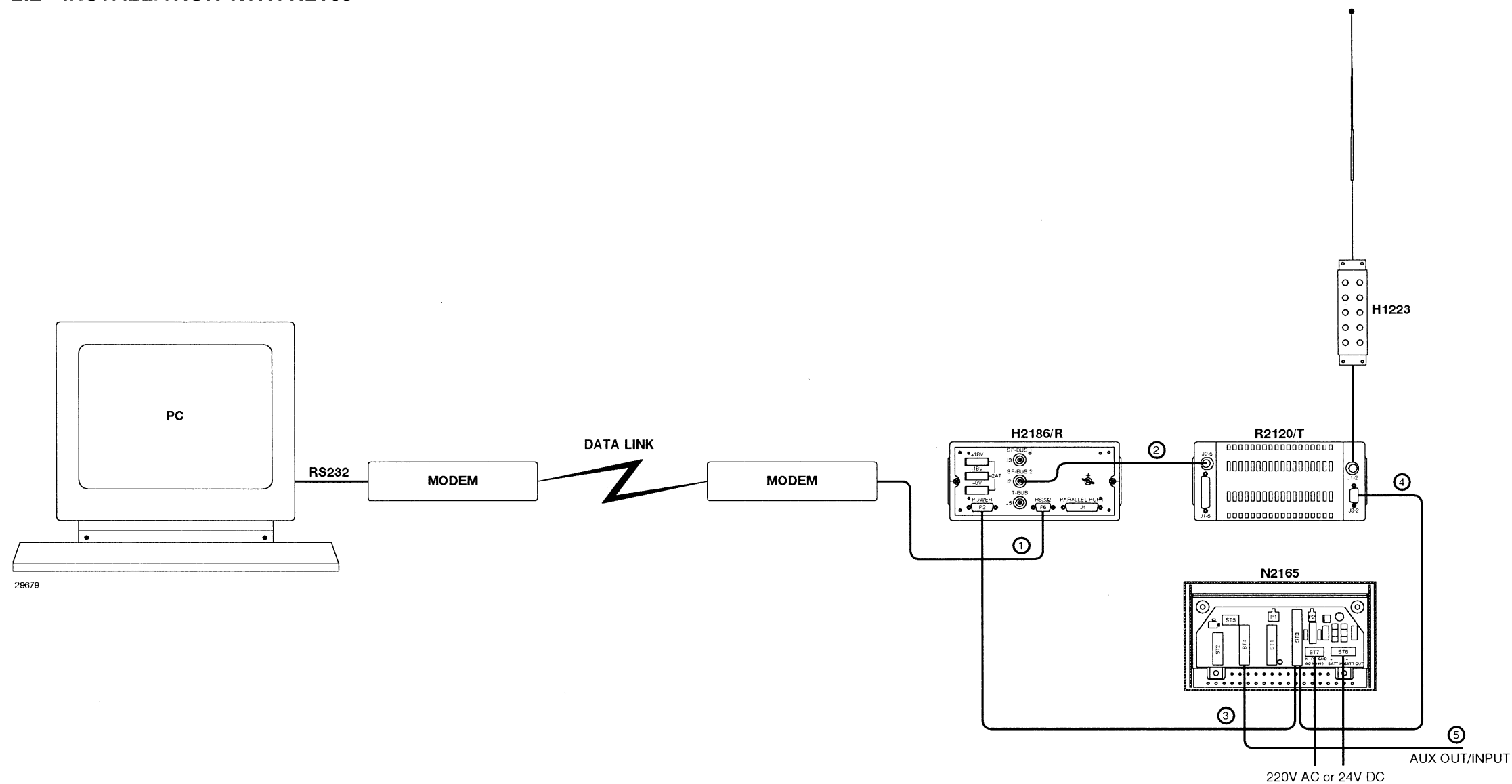
H2186 Interface Module 628562

29676

2. Connect the units as described below.
3. Switch on the system.
4. Connect only one R2120 the first time and programme each one separately according to the description in the user interface.



## 2.2 INSTALLATION WITH N2165



### CABLE 1

See chapter 2.4 Telephone Modem and make the necessary connections to the H2186/R in accordance with the table below.

H2186/R	SIGNAL
P6 RS232	
2	RX
3	TX
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9 POLES FEMALE	CONNECTOR TYPE

## CABLE 2

Connect SP-BUS 2 (J2 BNC H2186/R) to SP-BUS (J2-5 BNC R2120/T).

**CABLE 3**

H2186/R	N2165	SIGNAL
P2 POWER	ST3	
1	3	+18V
2	4	-18V
3	5	+9V
4	6	GND
10	8	ANALOG OUT
11	9	ANALOG IN
15 POLES FEMALE		CONNECTOR TYPE

**Note:**

To switch on the N2165 make a connection from ST3 pin 1 to ST3 pin 2, please refer to the manual for N2165 and R2120/T.

**CABLE 4**

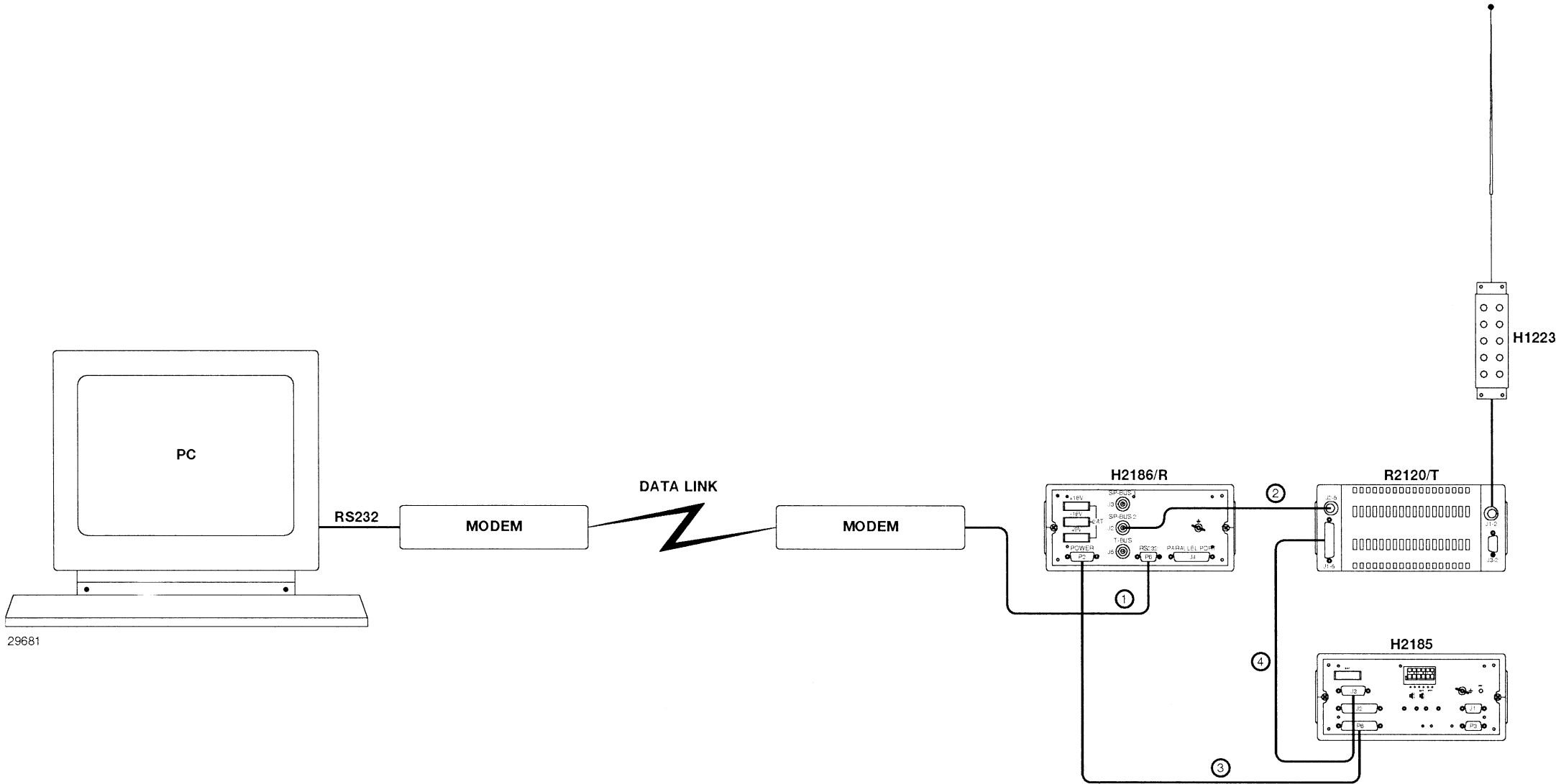
R2120	N2165	SIGNAL
J1	ST3	
5	6	GND
10	4	-18V
11	5	+9V
12	3	+18V
17	12	0 dBm OUT
18	13	0 dBm OUT
21	14	RX MUTE
25 POLES MALE		CONNECTOR TYPE

**CABLE 5**

N2165	SIGNAL
ST4	
1	0 dBm OUT
2	0 dBm OUT
3	RX MUTE
6	GND



2.3 INSTALLATION WITH H2185



**CABLE 1**  
See the chapter 2.4 Telephone Modem and make the necessary connections to the H2186/R in accordance with the table below.

H2186/R	SIGNAL
P6 RS232	
2	RX
3	TX
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9 POLES FEMALE	CONNECTOR TYPE

**CABLE 2**  
Connect SP-BUS 2 (J2 BNC H2186/R) to SP-BUS (J2-5 BNC R2120/T).

H2186/R	H2185	SIGNAL
P2 POWER	TO RE2100 P6	
1	12	+18V
2	10	-18V
3	11	+9V
4	5	GND
9	6	SP-BUS INTERRUPT
15 POLES FEMALE	25 POLES FEMALE	CONNECTOR TYPE

H2185	R2120/T	SIGNAL
TO R2120 J3	J1	
2	15	VF/AE-CURRENT
3	19	EXT. RF CONTROL
4	21	TX-KEY
5	5	SHIELD
6		NC
7	17	0 dBm
8	18	0 dBm
9		NC
10	10	-18V
11	11	+9V
12	12	+19V
13		NC
14	6	DUPLEX MODE RE2100
15	22	GND
15 POLES MALE	25 POLES MALE	CONNECTOR TYPE

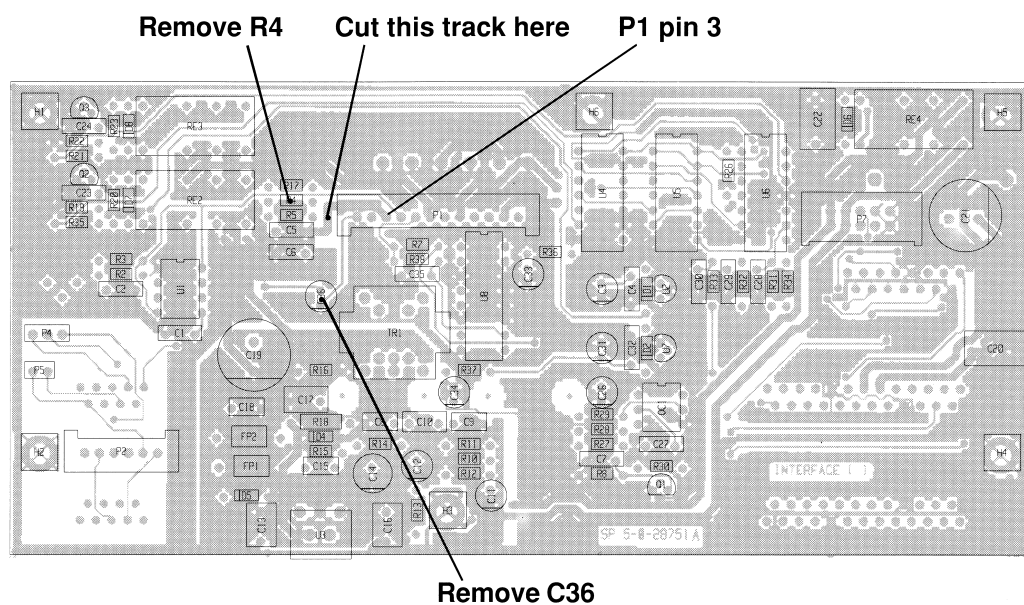
**IMPORTANT!**  
You have to modify H2185 as described in chapter 2.3.1.

### 2.3.1 MODIFICATION OF H2185

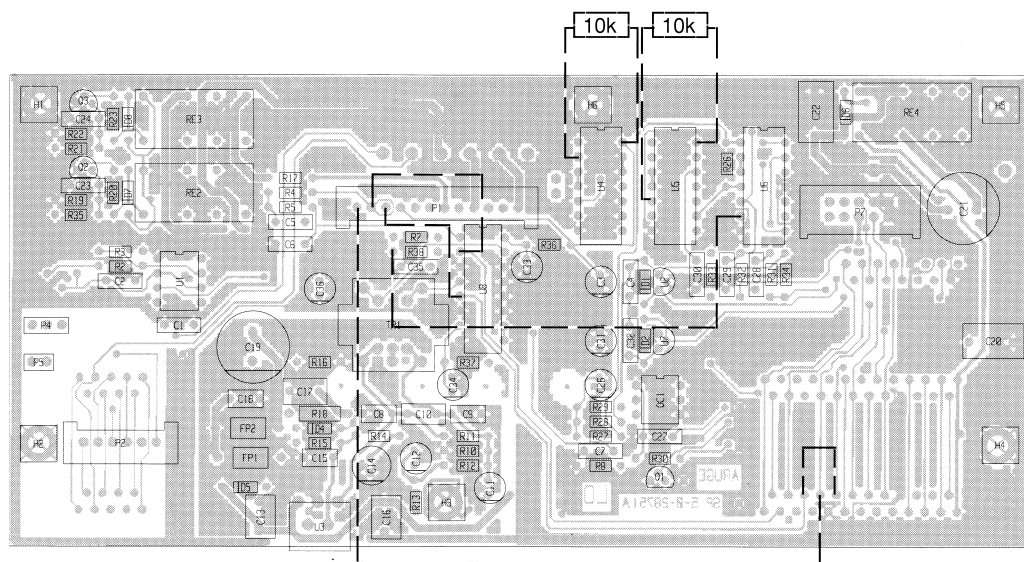
When the H2185 is to be used in conjunction with the R2120/T as power supply and audio amplifier, then it has to be modified as described below.

1. Remove R4 and C36.
2. Cut the printed circuit track from pin 3 of P1 to ground on the upper side.
3. Make the connections as shown on the component locations and the schematic diagrams on the following pages below.
4. Connect a 10 kohms resistor from pin 2 to pin 14 on U4.
5. Connect a 10 kohms resistor from pin 5 to pin 14 on U5.

#### COMPONENT LOCATION INTERFACE AND AF AMPLIFIER MODULE 1



View from component side with upper side tracks.

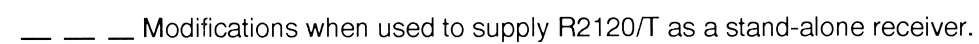


View from component side with lower side tracks.

PCB rev. 28751A

— — — Modifications when used to supply R2120/T as a stand-alone receiver.

## Interface and AF-amplifier (1)



## 2.3 INSTALLATION OF THE MODEM

This installation procedure can be used to set up a Hayes compatible modem. As modem it can be recommended to use a Nokia ECM QUAD, built in a metal box.

The RS232 interface has the following parameters:

RS232                      2400 Baud, 8 Data bit, 1 Start Bit, 1 Stop Bit and Even Parity.

The following is a list of the commands used to install a Hayes compatible modem:

AT&L1	Select a leased telephone line
<OK>	Answer from modem
ATN	Error correction disabled (cannot be used in leased line mode)
<OK>	
AT%C	Disable Data Compression MNP5
<OK>	
ATA0	Select Minimum MNP Block size
<OK>	
ATQ	Disable Flow Control
<OK>	

Select one of the two modems and send the following command:

ATS0=3	This modem is the answering modem, the other modem is the calling modem.
<OK>	

If you want to store the configuration, send command:

AT&W

If you want a list of the set-up, use the command:

AT\S

It is possible to set a jumper in the modem so it is configured to use the DTR (Data Terminal Ready) control signal to check whether it has to be on-line or off-line, because the H2186 changes the DTR from passive to active when it is powered on, and changes the DTR from active to passive when it is powered off. It is important that the modem and the H2186 is powered from the same source because after a power down, the H2186 will automatically set the modem on-line.

For further information, consult the Modem Manual.

## 2.4 INSTALLATION OF THE PC PROGRAMME

To install the PC programme supplied, just copy H2186.EXE and H2186XXX.HLP to the harddisk or copy the two files to another floppy disk. The DOS version has to be a 3.20 or higher. To run the programme using comport 1 to communicate with the modem, just write

H2186      and return.

If the PC/modem has to use comport 2, just write

H2186 2    and return.

It is possible to use a PC with a monochrome screen, but the result is not good because the user interface makes use of highlighted characters.

The parallel port J4 can be used to set up the Tx frequency of an external transmitter. The Tx frequency is in BCD.

The Tx Frequency 12345 kHz would look like this:

The Tx Frequency 4529 kHz would look like this:

9125

**CONTENTS**

**3 PC USER INTERFACE TO CONTROL THE R2120**

### 3 PC USER INTERFACE TO CONTROL THE R2120

The H2186/R Remote Control Programme makes it possible for you to control an R2120 Duplex Receiver from a PC and an H2186/R with or without a modem and without any need for an RE2100.

After the Welcome Window you enter the Control Window from where it is possible to control all the functions in the R2120. All the keys can be activated directly from the PC keyboard by pressing the highlighted letter or by pressing the buttons with the mouse. For example, the 'AGC' can be selected by pressing the 'G' - key on the keyboard or by pressing the 'AGC' - button with the mouse. As a response you get a display updating every time you hit a key, and it is possible to check if the remote control went right. If the line is broken you receive an Error Message. If the R2120 is powered off, you will not get a display updating. So what is monitored on the PC screen is actually the state of the R2120.

The digits in the Address field show which R2120 the PC Programme is communicating with. So it is important that the number in the address field is correct. To change the Address, hit the 'A' - key or press the 'Address' - button with the mouse. Then Key in, or press, the digits and finish with an 'ENTER' - key or an 'ENTER' - button. You can communicate with 15 different R2120 units - the addresses from 1 to 15 in the Address field.

Changing the Rx Frequency is done by entering the digit from the keyboard or pressing the buttons with the mouse. When the Rx Frequency is correct hit the 'ENTER' - key or press the 'ENTER' - button with the mouse. The maximum legal frequency is 30000 kHz. The minimum legal frequency is 100 kHz. If you enter an illegal Rx Frequency the Rx Frequency field will be cleared.

To change the Rx Mode hit the 'R' - key or press the 'RxMode' - button with the mouse. The four RxMode indicators show the Rx Mode.

The 'CLARIFIER STEP' - button or the 'S' - key is used to change the resolution of the clarifier. Two resolutions can be selected: 10 z and 100 Hz resolution.

The 'CLARIFIER UP/DOWN' - buttons or the 'U/I' - keys are used to tune the Rx Frequency with the resolution selected by Clarifier Step. If the solution is 10 Hz it is only possible to tune +-150 Hz.

With the 'BFO Up/Down' - buttons or the 'B/N' - keys it is possible to tune the BFO Frequency. Maximum BFO Frequency is 1500 Hz. Minimum BFO Frequency is -1500 Hz. It is only possible to change the BFO Frequency in telegraphy mode.

The 'AGC' - button or the 'G' - key is used to switch on or switch off the AGC. The status of the AGC is shown in the Status field next to the 'AGC' - button.

The 'RF GAIN Up/Down' - buttons or the 'F/D' - keys make it possible to reduce the RF Gain of the system. The minimum gain level is -15 and maximum gain level is -0, i.e. no gain reduction.

With the Help command, F1, you can get a Help Window - ESC closes the Help Window.

With the DOS-Shell command, F2, you can leave the R2120 Control Programme temporarily and perform a DOS command. To return to the R2120 Control Programme type 'exit' at the DOS prompt then press Enter.

The colour command, F5, can be used to customize the colours in the windows.

With the BFOSetup command, F6, you can change the BFO Frequency. When the command is selected you can make the changes with the keyboard or with the mouse. The legal BFO Frequency domain is from -1500 Hz to +1500 Hz. Use the '+' - key or the '-' - key on the keyboard, or press the '+' - button or the '-' - button with the mouse, to select the sign. Remember no sign means '+'. It is only possible to change the BFO Frequency in telegraphy mode.

The ProgAdr, F7, command has to be used very carefully. With this command you programme the address in the R2120. After selecting the command you can key in the new address in the address field with the keyboard or with the mouse. When the address is correct you hit the 'ENTER' - key or press the 'ENTER' - button with the mouse.

**WARNING: IT IS VERY IMPORTANT THAT THERE IS ONLY ONE R2120 CONNECTED WHEN  
YOU PROGRAMME THE ADDRESS !!!  
IF NOT YOU CAN DAMAGE THE WHOLE SYSTEM !!!!**

If you want to check if the state on the R2120 and the data on the PC screen agree, you can get a new display updating to the PC by hitting the 'ENTER' - key.

To exit the R2120 Control Programme press 'ALT-X'



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4.4	H2186/R PROTOCOL TO CONTROL THE R2120	4-2
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4.6	CHECKING THE TELEPHONE LINE	4-3
4.7	EXAMPLES	4-4

## 4 SOFTWARE PROTOCOLS

This chapter describes the software protocol used to communicate with the interface box H2186 and H2186/R via the RS232 interface.

This chapter deals with the general formate of the protocol and the type of the protocol. The next passages treat the specific protocol for the H2186/R based on the general protocol.

### 4.1 RS232 PROTOCOL

Information is sent as packets. If a packet is well received, the receiver sends an ACKnowledge to the transmitter. If an error occurred, and a packet is received with an error, it is possible to transmit a Negative ACKnowledge, a NACK, but it is not necessary. If the Transmitter receives a NACK it will re-transmit the packet. If the transmitter does not receive an ACK within a certain time limit, it will re-transmit the packet because it is assumed that the packet is lost. To prevent the receiver from receiving the same packet twice, as a result of an erroneous ACK, a packet number is a part of the packet. This packet number is transmitted as a part of the ACK and NACK too. The maximum number of re-transmissions is 10.

Though the modem is designed to operate in full duplex, the data-transmission in this application is in half duplex. That is, a command is sent from a PC, the H2186 sends an ACK if the packet is received without error. Then the H2186 sends the command to the RE2100/R2120 and the display updating received from the RE2100/R2120 is transmitted back to the PC. The PC sends an ACK and is now ready to send the next packet. If the PC does not receive a display updating within a certain time limit, it will enter the transmit ready state nevertheless.

To check the telephone line the PC continuously sends a command and checks the answer. If no answer is received after 10 re-transmissions there is a system error.

A CRC (1 byte) is applied to check for transmission errors. The CRC is an EX-OR of all the data transmitted in the packet.

The telephone line has to be a leased line.

### 4.2 PROTOCOL FORMATE

The general formate is as follows:

<b>TYPE</b>	: 3 bit.
<b>LENGTH</b>	: 5 bit.
<b>H2186ADR</b>	: 4 bit. Only used with two or more H2186 on the line. Not implemented
<b>PACKETNR</b>	: 4 bit.
<b>DATA</b>	: 1 - 31 bytes.
<b>CRC</b>	: 1 byte. EX-OR of Type, Length and H2186Adr, PacketNumber and the data bytes transmitted in the packet.

The LENGTH field denotes the number of the succeeding bytes, without the CRC field. The TYPE field denotes the following packet types:

000:	The packet contains data from the RE2100 or R2120.
001:	The packet contains a bus interrupt request to the RE2100.
010:	The packet contains a string command to RE2100 or R2120.
011:	Not used.
100:	Not used.
101:	The packet contains an ACK.
110:	The packet contains a BUSY. Not used.
111:	The packet contains a NACK.

TYPE 0 packets contain data from RE2100 or R2120 to the PC. It will typically be a display updating. TYPE 1 packets contain a Key-code and an interrupt request to the RE2100. TYPE 2 packets contain string data

to the R2120 or a Tx/Rx frequency to the RE2100, or a Key-code sequence like set power, which demands three key-codes if they were sent separately. Type 5 and 7 packets are one byte packets used as described above.

### 4.3 BUS-TIMING AND DATA FORMATE

Only two timing constants are essential. The ACK receiving time, and the maximum display updating time.

ACKReceiveTime  $\geq 128$  ms

MaxDispOpdTime  $\geq 800$  ms

#### TRANSMISSION RATE

On the telephone line the modems will control the data rate, but from the PC and the H2186, to the modems, the Baud rate is always 2400.

#### DATA FORMATE

1 start-bit, 8 data bits, 1 stop-bit and even parity. MSB is transmitted first.

### 4.4 H2186/R PROTOCOL TO CONTROL THE R2120

Commands from the PC to control the R2120 are type 2 packets.

**TYPE 2** [Type+Length][0+PacketNumber][OPCODE1][D0][D1]...[Dn][CRC]

where Type and Length is according to the specifications in chapter 1, PacketNumber is the actual PacketNumber and so on.

It is possible to send six different packets to the H2186/R to control the R2120. Every time a packet is sent the H2186/R will send a display updating to the PC. The PC is not allowed to send a new packet until it has received a display updating, or until the MaxDispOpdTime has elapsed.

See the SP-BUS specification for the details of the R2120 protocol.

### 4.5 H2186/R COMMANDS

#### RECEIVER ACTIVE COMMAND

To send the Receiver Active Command Block (RAC) from the PC use the following packet:

[48][PacketNumber][00][Bx][74][yhigh][ymed][ylow][z][CRC]

where x is the R2120 Address [\$01 - \$1F]  
y is the Rx frequency (Assign Frequency) the formate is binary with a 10 Hz resolution .  
z is the Mode Code (see the SP-BUS spec).

See examples in the end of the chapter.

[A+PacketNumber] Acknowledge from H2186/R

The H2186/R sends the display updating to the PC from the R2120

[0B][PacketNumber][00][58][07][0x][yhigh][ymed][ylow][z][BFOhigh][BFOlow][CRC]

where BFO is the BFO frequency

[A+PacketNumber]

Acknowledge from PC

The following is a list of the other commands which can be transmitted to the H2186/R

#### TELEGRAPHY ACTIVE COMMAND

To send the Telegraphy Active Command Block (TAC) from the PC use the following packet:

[48][PacketNumber][00][Bx][A4][yhigh][ymed][ylow][z][CRC]

#### SET BFO FREQUENCY COMMAND

To change the BFO frequency from the PC use the following packet:

[46][PacketNumber][00][Bx][92][BFOhigh][BFOlow][CRC]

#### FORCED DISPLAY UPDATING COMMAND

To force a display updating from the R2120 to the PC use the following packet:

[44][PacketNumber][00][Bx][10][CRC]

#### SET ADDRESS COMMAND

To change the R2120 address from the PC use the following packet, but it is important that there is only one R2120 connected to the SP-BUS when this packet is sent!!

[45][PacketNumber][00][B0][31][0x][CRC]

where x is the new R2120 address.

#### GET ADDRESS COMMAND

To get the R2120 address from the PC use the following packet, but it is important that there is only one R2120 connected to the SP-BUS when this packet is sent!!

[44][PacketNumber][00][B0][20][CRC]

Then the H2186/R sends a display updating back to the PC.

#### SET RF GAIN COMMAND

To change the RF GAIN in the system use the following packet:

[45][PacketNumber][00][Bx][41][RFGainValue][CRC]

where RFGainValue is a number between 00 and 0F.

The H2186/R sends a display updating back to the PC.

### 4.6 CHECKING THE TELEPHONE LINE

To check the telephone line the PC sends a forced display updating request every minute, or one minute after the last key was pressed. If the telephone line is intact the H2186/R will return a display updating to the PC.

## 4.7 EXAMPLES

Here are some examples of the packets to control the R2120 from the H2186/R.

To set up the Rx Frequency use the following packet if the mode of operation is different from Telegraphi:

RAC Receiver Active Command

[48][PacketNumber][00][Bx][74][yhigh][ymed][ylow][z][CRC]

where x is the R2120 Address [\$01 - \$1F]

y is the Rx frequency (Assign Frequency) the format is binary with a 10 Hz resolution .

z is the Mode Code

The Mode Code has the following format:

Bit 0	Always 1	
Bit 1	Telegraphi	0 = On; 1 = Off
Bit 2	J3E LSB	0 = On; 1 = Off
Bit 3	J3E USB	0 = On; 1 = Off
Bit 4	AGC	0 = On; 1 = Off
Bit 5	Always 1	
Bit 6	Telex	0 = On; 1 = Off
Bit 7	Always 0	

### EXAMPLE 1

To set up the receiver to Rx Frequency = 12345 kHz, in J3E LSB with AGC on, use this packet: (Assume that the R2120 Address of the receiver is 4)

[48][PacketNumber][00][B4][74][12][D6][44][6B][CRC]

and with AGC Off

[48][PacketNumber][00][B4][74][12][D6][44][7B][CRC]

Remember the RxFrequency has a resolution of 10 Hz, ie. 12345 kHz => 1234500 = 12D644 in Hexadecimal.

### EXAMPLE 2

To set up the receiver to Rx Frequency = 12345 kHz, in J3E USB with AGC on, use this packet:

[48][PacketNumber][00][B4][74][12][D6][44][67][CRC]

and with AGC Off

[48][PacketNumber][00][B4][74][12][D6][44][77][CRC]

### EXAMPLE 3

To set up the receiver to Rx Frequency = 12345 kHz, in TELEX with AGC on, use this packet:

[48][PacketNumber][00][B4][74][12][D6][44][2F][CRC]

and with AGC Off

[48][PacketNumber][00][B4][74][12][D6][44][3F][CRC]

**EXAMPLE 4**

To set up the receiver in Telegraphi mode use a TAC Telegraphi Active Command.

[48][PacketNumber][00][Bx][A4][yhigh][ymed][ylow][z][CRC]

To set up the receiver to Rx Frequency = 12345 kHz, in TELEGRAPHI with AGC on, use this packet:

[48][PacketNumber][00][B4][A4][12][D6][44][6D][CRC]

and with AGC Off

[48][PacketNumber][00][B4][A4][12][D6][44][7D][CRC]

**EXAMPLE 5**

To set up the receiver to Rx Frequency = 1234 kHz, in J3E LSB with AGC on, use this packet:

[48][PacketNumber][00][B4][74][01][E2][08][6B][CRC]

To set up the receiver to Rx Frequency = 123 kHz, in J3E LSB with AGC on, use this packet:

[48][PacketNumber][00][B4][74][00][30][0C][6B][CRC]

**EXAMPLE 6**

To set up the receiver to Rx Frequency = 123.4 kHz, in J3E LSB with AGC on, use this packet:

[48][PacketNumber][00][B4][74][00][30][34][6B][CRC]

123.4 kHz => 12340 in 10 Hz resolution 12340 = 3034 Hex.

**EXAMPLE 7**

To change the BFO frequency use the Set BFOFrequency Packet

[46][PacketNumber][00][Bx][92][BFOhigh][BFOlow][CRC]

If you want to change the BFO Frequency to 1000 Hz use the following packet:

[46][Packet Number][00][B4][92][00][64][CRC]

If you want to change the BFO Frequency to -1000 Hz use the following packet:

[46][Packet Number][00][B4][92][80][64][CRC]

Bit 7 of BFO High is used as a sign bit. If this bit is 0 then the sign is '+', and if this bit is 1 then the sign is '-'. The BFO frequency has a resolution of 10 Hz just like the Rx Frequency. 1000 Hz => 100 with 10 Hz resolution 100 = 64 Hex.

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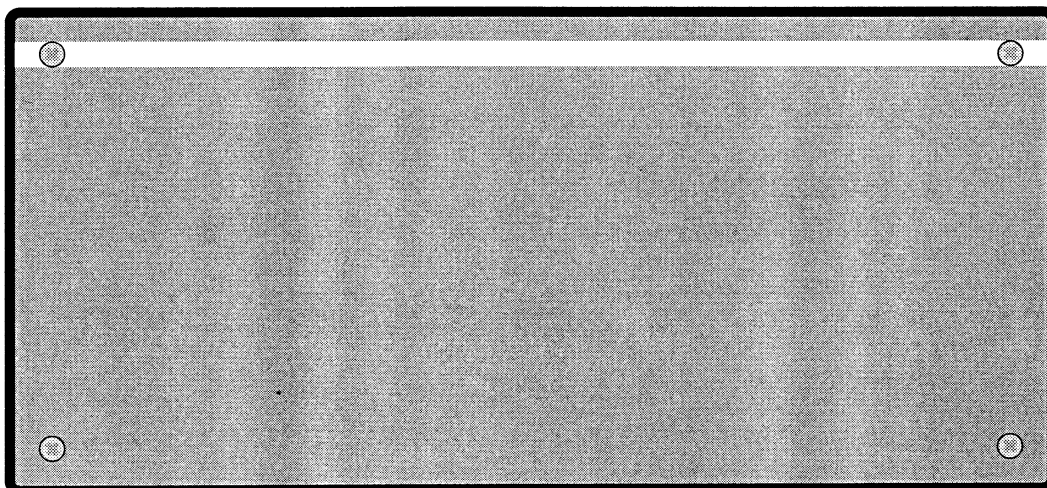


## 1 GENERAL INFORMATION

### 1.1 INTRODUCTION

H2186/RT is designed for interfacing the VHF System to a PC or a modem.

H2186/RT makes it possible to remote control the most important functions of the RT2047D/RT2048 from a PC.



29194

### 1.2 TECHNICAL DATA

#### Compact VHF SP-BUS INTERFACE H2186/RT

**Supply Voltage:** +18 V, -18 V and +9 V.

**Power consumption:** Stand-by: 150 mA.  
Max: 500 mA.

**Operating Temperature Range:** -15°C to +55°C  
**Storage Temperature Range:** -25°C to +75°C

**Weight:** 1.5 kg.

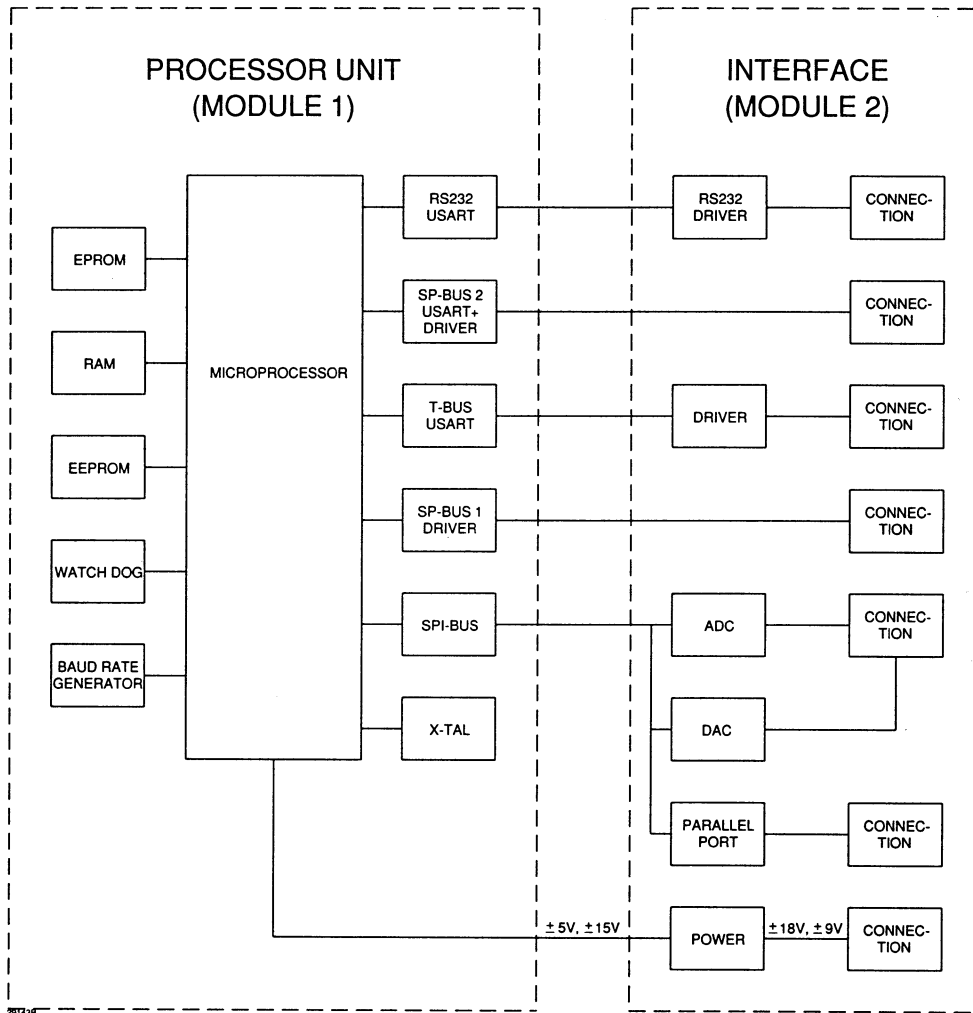
**Dimensions:** Height: 98 mm  
Width: 225 mm  
Depth: 122 mm

### 1.3 PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

The H2186/RT contains two hardware modules: a processor unit module and an interface module. The processor unit module contains a microprocessor, memory, USARTs and I/O devices. The interface module contains power supply, busdrivers, ADC and DAC.

The two modules with their hardware blocks are shown in the block diagram. The elements in the block diagram are explained in detail in H2186/PART I chapter 5.

#### BLOCK DIAGRAM



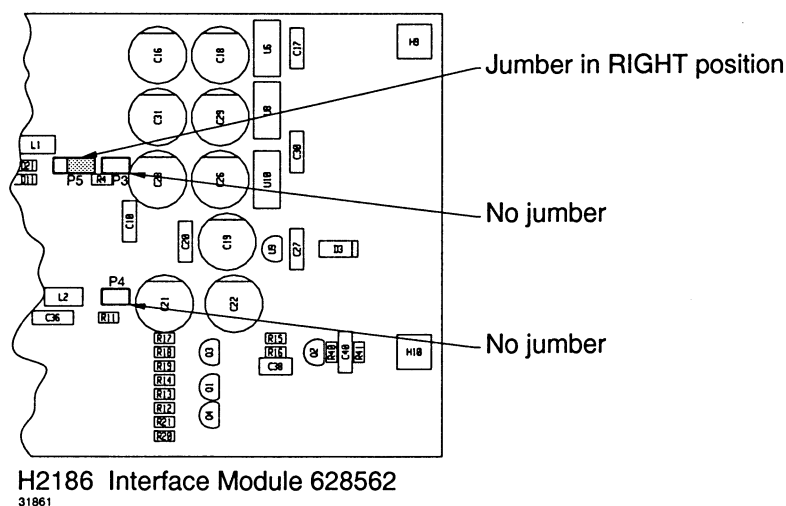
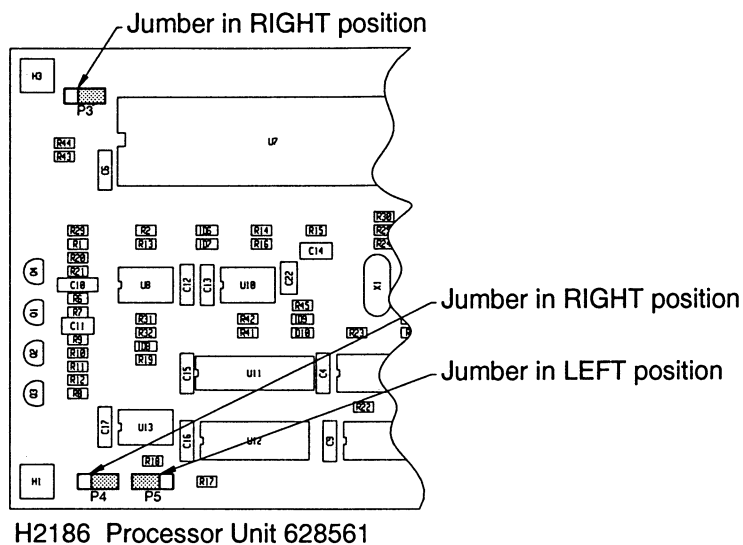
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## 2 INSTALLATION

### 2.1 ELECTRICAL CONNECTION AND ASSEMBLING

1. Before starting the installation make sure that the straps in H2186/RT are in accordance with the figures below.



2. Program the addresses of the RT2048 if there are more than one unit.
3. Connect the system as described below.
4. Turn on the system as described below.

31862

PC

RS232

MODEM

DATA LINK

MODEM

H2186/RT

RT2048

N2165

220V AC or 24V DC

See chapter 2.4 Telephone Modem and make the necessary connections to the H2186/RT in accordance with the table below.

H2186/RT	SIGNAL
P6 RS232	
2	RX
3	TX
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9 POLES FEMALE	CONNECTOR TYPE

Connect SP-BUS 1 (J3 BNC H2186/RT) to RT2048 (P4 SUB-D).

H2186/RT	RT2048	SIGNAL
J3	P4	
COAX CORE	8	SER +
COAX SCREEN	2	GND
BNC FEMALE	9 POLES MALE	CONNECTOR TYPE

H2186/RT	N2165	RT2048	SIGNAL
P2 POWER	ST3	P4	
1	3		+18V
2	4		-18V
3	5		+9V
4	6		GND
9		7	SP-BUS INT.
15 POLES FEMALE		9 POLES MALE	CONNECTOR TYPE

To switch on the N2165 make a connection from ST3 pin 1 to ST3 pin 2, please refer to the manual for N2165 and RT2048.

## 2.3 INSTALLATION OF THE MODEM

This installation procedure can be used to setup a Hayes compatible modem. As modem it can be recommended to use a Nokia ECM QUAD, build in a metal box.

The RS232 interface has the following parameters:

RS232                      2400 Baud, 8 Data bit, 1 Start Bit, 1 Stop Bit and Even Parity.

The following is a list of the commands used to install a Hayes compatible modem:

AT&L1	Select a leased telephone line
<OK>	Answer from modem
AT&N	Error correction disabled (can not be used in leased line mode)
<OK>	
AT%C	Disable Data Compression MNP5
<OK>	
AT&A0	Select Minimum MNP Block size
<OK>	
AT&Q	Disable Flow Control
<OK>	

Select one of the two modems, and send the following command:

ATS0=3	This modem is the answering modem, the other modem is the calling modem.
<OK>	

If You want to store the configuration send command:

AT&W

If You want a list of the setup use the command:

AT&S

It is possible to set a jumper in the modem so it is configured to use the DTR (Data Terminal Ready) control signal to check whether it has to be on-line or off-line, because the H2186/RT change the DTR from passive to active when it is powered on, and change the DTR from active to passive when it is powered off. It is important that the modem and the H2186/RT is powered from the same source, because after a power down the H2186/RT will automatically set the modem on-line.

For further information consult the Modem Manual.

## 2.4 INSTALLING THE PC PROGRAM

To install the PC program just copy H2186RT.EXE and H2186XXX.HLP to the harddisk or copy the two files to another floppy disk. The DOS version must be a 3.20 or a higher version.

To run the program write:

H2186RT (Comport number 1 or 2) (Available AF lines 1 or 2)                      and Return

If one AF line is available and comport 1 is to be used to communicate with the modem write:

H2186RT 1 1      or    just H2186RT      and Return.

If the PC/modem has to use comport 2 and there is one AF line available write:

H2186RT 2 1      or    just H2186RT 2      and Return.

If the PC/modem has to use comport 1 and there are two AF lines available write:

H2186RT 1 2      and Return

It is important that the program is not executed from Microsoft Windows!!!!

It is possible to use a PC with a monochrome screen, but the result is not good because the user interface makes use of highlighted characters.

## 2.5 STARTING THE REMOTE CONTROL SYSTEM

To start the remote control system, switch on all the RT2048 unit and the H2186/RT. Then switch on the RT2047/D units. When all the units on the remote site has been switched on, the controller site can be connected. When the PC program is started, it makes a request from all the seven possible units, and the state of the units can be monitored on the screen. The remote control system is now ready for use.

## 2.6 THE PARALLEL PORT AS AF SWITCH CONTROLLER

The 25 pins Parallel port can be used as a AF switch controller. This makes it possible to control the AF from the PC. A separate switch box must be connected to the Parallel port. For details see chapter 4.5.

## CONTENTS

### 3 PC USER INTERFACE TO CONTROL THE RT2048



### 3 PC USER INTERFACE TO CONTROL THE RT2048

The H2186RT Remote Control Programme allows the user to control a RT2048 VHF Transceiver from a PC and a H2186/RT either with or without a modem.

To exit the RT2048 Control Programme press 'ALT-X'

The - menu is accessed by pressing Alt-Space.

With the DOS-Shell command (F2) you can leave the RT2048 Control Programme temporarily and perform a DOS command. To return to the RT2048 Control Programme type 'exit' at the DOS prompt then press Enter.

It is possible to switch between the Setup window and the Control window by means of F3 and F4.

The colour command, activated by F5, can be used to customize the colours in the windows.

Pressing F6 will open a window that is used to control the AF switches with the Parallel port of H2186/RT. From this window it is also possible to request a complete updating of the state of all the connected VHF units.

The PC programme enables the user to control some of the functions in the VHF transceivers RT2048 and RT2047/D.

To change channel, power level or switch the Tx on or off you simply press the button with the mouse or hit the number on the keyboard. If you want to control VHF unit number 1 - you press with the mouse on the button named 'UNIT #1' or you can hit the '1-Key'. When you have activated the button or key, a new window is coming up, from where it is possible to control the VHF unit.

In the black text fields on the screen, you can monitor the state of the different units. You can monitor the channel number, the power level and watch whether you have switched on or off the Tx.

The small indicators on the right of the screen, in the same column as 'UNIT ON', show which units are switched on or off. A red indicator means that this special unit is switched on, and a black indicator means that the unit is switched off.

The other indicators, in the same column as 'AUDIO', show which unit is connected to the AF line. If there is only one AF line available, only one indicator is red, the rest is black. If two AF lines are available it is possible to select between unit number 1 or 2 or 3 and 4 or 5 or 6 or 7.

That is, it is not possible to switch both unit number 1 and unit number 3 on the AF line at the same time.

From the Audio Menu it is possible to control the audio switch connected to the Parallel port on H2186/RT. It is possible to select whether there is one or two AF lines connected to a phone patch (see the technical manual for H2186/RT, about installation and setup).

In this case there is only one AF line available. The indicators show which unit is selected. A red indicator shows a selected unit, the rest is black.

To select which unit has to be connected to the AF line, press with the mouse on the corresponding button, or hit highlighted key on the keyboard. When you have selected the correct unit hit the 'Enter-Key' or press with the mouse on the 'OK-Button', then you return to the control menu, where you can monitor the AF status in the 'AUDIO'-column.

The Audio Menu can be used to make a request to H2186/RT to send a new update of all the unit. To make this request press the 'Get All Units State-Button' or hit the 'G-Key'.

From the PC programme there is access to control two output ports on the Parallel port. From the Audio Menu you can control Pin #23 and Pin #24. If you hit the 'A-Key' or press the 'On #A-Button' Pin #23 will be set high (+5V). And if you hit the 'O-Key' or press the 'Off #A-Button' Pin #23 will be cleared (0V). To control Pin #24 use the 'B-Key', 'On #B-Button' and the 'F-Key', press the 'Off #B-Button'.

From the Unit Menu you can change channel, change the power level between high and low power and switch the Tx on or off. You have activated the Unit Menu from the Control Menu and when you have finished the changes you want to do, you will return to the Control Menu, by pressing the 'OK-Button' or hitting the 'ENTER- Key'. You will not send the command to change the channel etc. until you leave the Unit Menu. So you can continue changing channel etc. until you want to leave this menu.

To change the channel number you can use keyboard on the right of this menu with the mouse, or you can use the keyboard on the PC. The letters 'A','E','F' and 'P' are for the private channels. With the 'W-Key' or the 'POWER-Button' you can toggle between High and Low Power. With the 'T-Key' or the 'Tx-Button' you can toggle between Tx On and Tx Off. What you see on the screen is what you will send to RT2048 when you leave this menu with an 'OK-Button' or an 'ENTER-Key'. If you regret that you have entered this menu you can leave it without sending anything to the RT2048 by hitting the 'ESC-Key' or pressing the upper left corner on the frame of the menu, the little green square, with the mouse.

If you want to know which channel is selected on the RT2048 and what power level is selected and whether the Tx is on or off, you can get the state of the particular unit. Press the 'Get State-Button' or the 'G-Key'. Then you will return to the Control Menu, and after a moment you can monitor the state of the RT2048 on the monitor line.

**REMARK !!! THE SETUP MENU CAN ONLY BE USED TO READ/WRITE DATA TO THE RT2048, NOT THE RT2047/D.**

The Setup Menu can be used to read and write the nonvolatile memory of the RT2048. The red indicator show you which part is active. Before you start reading or writing the data it is important that you have selected the number of the unit you want to read to/write from. When you have selected a unit number you hit the 'ENTER-KEY' or press the 'ENTER-Button' and the next step is to key-in the address. After keying in the address you hit Enter again, and after a moment you receive the data of the selected address. The data will be shown in the data fields named High Byte and Low Byte. The indicators will now show that you can change the data in the High Byte. If you want to change the value of the High Byte you can do it now. When you have changed the data you hit Enter and now you can change the value of the Low Byte. If you do not want to change the values of the High Byte and Low Byte you hit Enter until the indicator show that the address field is active. Then you can key in the next address.

If you want to read to/write from a different unit you hit the 'U-Key' or press the 'Unit #-Button'. Then you can change the number of the unit.

After you have changed the nonvolatile memory of the RT2048 you can make a reset of the RT2048, when you hit the 'R-Key' or press the 'RESET UNIT-Button'.

If you want to reset the whole system you can do that by hitting the 'S-Key' or pressing the 'RESET SYSTEM-Button'.

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## 4 SOFTWARE PROTOCOLS

This chapter describes the software protocol used to communicate with the interface box H2186 via the RS232 interface.

This chapter deals with the general format of the protocol and the type of the protocol. The next passages treat the specific protocol for the H2186/RT based on the general protocol.

### 4.1 RS232 PROTOCOL

Information are send as packets. If a packet is well received, the receiver sends an ACKnowledge to the transmitter. If an error occured, and a packet is received with an error, it is possible to transmit a Negativ ACKnowledge, a NACK, but it is not necessary. If the Transmitter receives a NACK it will retransmit the packet. If the transmitter do not receive an ACK within a certain time limit, it will re-transmit the packet because it is assumed that the packet is lost. To prevent the receiver to receive the same packet twice, as a result of an erroneous ACK, a packet number is a part of the packet. This packet number is transmitted as a part of the ACK and NACK too. The maximum number of re-transmissions is 10.

Though the modem is designed to operate in full duplex, the datatransmission in this application is in semi duplex. That is, a command is send from a PC, the H2186/RT sends an ACK if the packet is received without error. Then the H2186/RT sends the command to the RT2048 and a display updating is transmitted back to the PC from the H2186/RT. The PC sends an ACK and is now ready to send the next packet. If the PC does not receive a display updating in a certain time limit, it will enter the transmit ready state nevertheless.

To check the telephone line the PC continously sends a command and check the answer. If no answer is received after 10 re-transmissions there is a system error.

A CRC (1 byte) is applied to check for transmissions errors. The CRC is an EX-OR of all the data transmitted in the packet.

The telephone line has to be a leased line.

### 4.2 PROTOCOL FORMAT

The general format is as follows:

<b>TYPE</b>	: 3 bit.
<b>LENGTH</b>	: 5 bit.
<b>H2186ADR</b>	: 4 bit. Only used with two or more H2186 on the line. Not implemented
<b>PACKETNR</b>	: 4 bit.
<b>DATA</b>	: 1 - 31 bytes.
<b>CRC</b>	: 1 byte. EX-OR of Type,Length and H2186Adr, PacketNumber and the data bytes transmitted in the packet.

The LENGTH field denotes the number of the succeeding bytes, without the CRC field. The TYPE field denote the following packet types:

000:	The packet contains data from the RE2100, R2120 or RT2048.
001:	The packet contains a bus interrupt request to the RE2100.
010:	The packet contains a string command to RE2100 or R2120.
011:	The packet contains a command to or RT2048.
100:	Not used.
101:	The packet contains an ACK.
110:	The packet contains a BUSY. Not used.
111:	The packet contains a NACK. Not necessary.

TYPE 0 packets contain data from RE2100, R2120 or RT2048 to the PC. It will typical be a display updating. TYPE 1 packets contain a keycode and an interrupt request to the RE2100. TYPE 2 packets

contain string data to the R2120 or a Tx/Rx frequency to the RE2100, or a keycode sequence like set power, which demands three keycodes if they were send separately. Type 3 packets contain data to the RT2047 or RT2048. Type 5 and 7 packets are one byte packets used as described above. Type 4 and Type 6 packets are not used.

### 4.3 BUS-TIMING AND DATA FORMATE

Only two timing constants are essential. The ACK receiving time, and the maximum display updating time.

ACKReceiveTime  $\geq 128$  ms

MaxDispOpdTime  $\geq 800$  ms

#### TRANSMISION RATE

On the telephone line the modems will control the data rate, but from the PC and the H2186/RT, to the modems, the Baud rate is always 2400.

#### DATA FORMATE

1 startbit, 8 data bits, 1 stopbit and even parity. LSB is transmitted first.

### 4.4 H2186/RT PROTOCOL TO CONTROL THE RT2048

Commands from the PC to control the RT2048 are type 3 packets.

**TYPE 3** [Type+Length][0+PacketNumber][VHFUnitAddress][D0][D1]...[Dn][CRC]

where Type and Length are according to the specifications in chapter 1, PacketNumber are the actual packetnumber and so on.

### 4.5 H2186/RT COMMANDS

#### 4.5.1 COMMANDS FROM THE PC TO H2186/RT

##### CHANGE CHANNEL, SET POWER AND SET Tx ON/OFF

[66][PacketNumber][0,VHFUnitAddress][D0][D1][D2][D3][CRC]

The VHFUnitAddress is a number between 1 and 7.

D0..D2 are the channel number - D0 can only be 'A', 'E', 'F', 'P', ' ' or '0'. D1 and D2 can be in the range from '0' to '9' in ASCII format, ie. from \$30 to \$39 in binary format. All digits in the examples will be in hexadecimal.

D3 is used to change power level and switch on/off the Tx. If the higher nibble of D3 is 0001 B then the power level is high else it will be low. If the lower nibble of D3 is 0001 B then the Tx will be on, else the Tx will be off.

D3 = \$00 => Low power and Tx off.

D3 = \$10 => High power and Tx off.

D3 = \$01 => Low power and Tx on.

D3 = \$11 => High power and Tx on.

The 'Change Channel' function is followed by a display updating from the H2186/RT. This display updating can be used to check if there has been an error in the system, or it can be used as an acknowledgement indicating that the VHF unit has changed the channel, power or Tx on/off.

The format of the display updating will be described later.

example 1:

To change the VHF unit number 1 to channel 70 with high power and Tx off, use the following packet:

[66][01][01][20][37][30][10][51]

with PacketNumber = 1.

To change the VHF unit number 3 to channel 16 with low power and Tx on, use the following packet:

[66][01][03][20][31][36][01][82]

with PacketNumber = 1.

Within 128 ms from the transmission of the packet, the PC will receive an acknowledge from H2186/RT. If not the packet has to be re-transmitted. If after 10 re-transmissions H2186/RT has not made an acknowledge there is no contact with H2186/RT.

[A1] Acknowledge from H2186/RT

#### RESET H2186/RT

[62][PacketNumber][20][CRC]

When H2186/RT has received a ResetH2186/RT it will make a software reset. When H2186/RT has been reset, it will start to take the control of the SP-BUS, by locking the keyboards and the handsets of all the connected VHF units.

#### REQUEST FOR DISPLAY UPDATE

[62][PacketNumber][1,VHFUnitAddress][CRC]

where the VHFUnitAdress is a number between 1 and 7.

After this request from the PC the H2186/RT will send a display updating, that shows the state of the VHF unit. This display update has the same format as the display update followed by the 'Change Channel' function.

#### SETUP PARALLEL PORT

The 25 pins Parallel port on the H2186/RT can be controlled from the PC. To control the Parallel port a special packet is used:

[65][PacketNumber][30][Data1][Data2][Data3][CRC]

The Parallel port is used as an AF switch controller. If Data3, Bit #0 is 0, there are two AF lines (telephone lines) available. When Data3, Bit #0 is 1 there is only one AF line. Data3 Bit #1-7 indicates which VHF unit is switched on the AF line. Data3 = 82 means there are two AF lines, and two units are connected to the lines. Unit number 1 is connected to AF line number 1, and unit number 7 is connected to AF line number 2. If there is one AF line available only one unit can be connected. If there are two AF lines, two units can be connected. But only one of the units 1, 2 and 3 can be connected at the same time, because they can only be connected to AF line 2. And only one of the units 4, 5, 6 and 7 can be connected at the same time, because they can only be connected to AF line 2.

Bit #4,5 of Data1 are used to control the two external transistors conected to the Parallel port on pin #23,24.

The three bytes Data1, Data2 and Data3 are send to the Parallel port by means of a serial bus from the micro processor.

Data1 Bit #7 is not used  
 Data1 Bit #6 is not used  
 Data1 Bit #5 is send to Pin #24  
 Data1 Bit #4 is send to Pin #23  
 Data1 Bit #3 is send to Pin #20  
 Data1 Bit #2 is send to Pin #19  
 Data1 Bit #1 is send to Pin #18  
 Data1 Bit #0 is send to Pin #17

Control external transistor  
 Control external transistor

Data2 Bit #7 is send to Pin #16  
 Data2 Bit #6 is send to Pin #15  
 Data2 Bit #5 is send to Pin #14  
 Data2 Bit #4 is send to Pin #13  
 Data2 Bit #3 is send to Pin #12  
 Data2 Bit #2 is send to Pin #11  
 Data2 Bit #1 is send to Pin #10  
 Data2 Bit #0 is send to Pin #09

Data3 Bit #7 is send to Pin #08  
 Data3 Bit #6 is send to Pin #07  
 Data3 Bit #5 is send to Pin #06  
 Data3 Bit #4 is send to Pin #05  
 Data3 Bit #3 is send to Pin #04  
 Data3 Bit #2 is send to Pin #03  
 Data3 Bit #1 is send to Pin #02  
 Data3 Bit #0 is send to Pin #01

Unit 7 connected to AF line  
 Unit 6 connected to AF line  
 Unit 5 connected to AF line  
 Unit 4 connected to AF line  
 Unit 3 connected to AF line  
 Unit 2 connected to AF line  
 Unit 1 connected to AF line  
 Select one or two AF lines

Pin #02 - #08 selects which units that are switched on the telephone lines. Pin #01 select whether there are one or two telephone lines for the AF signals.

## GET SYSTEM STATE

[62][PacketNumber][40][CRC]

This command can be used as a check of the telephone line and a check of the SP-BUS. The H2186/RT will return a special display updating, that shows a list of which VHF units are connected to the SP-BUS, and a list of the state of Pin #01 - #08 on the Parallel port.

## WRITE MEMORY DATA

It is possible to write data to the nonvolatile memory of the RT2048. Note that this packet can only be used with a RT2048!

The format for a write operation to the memory of the RT2048 is:

[69][PacketNumber][5,VHFUnitAddress][MemAdr1][MemAdr2][MemAdr3]  
 [HighData1][HighData2][LowData1][LowData2][CRC]

MemAdr1-3, HighData1,2 and LowData1,2 are all ASCII characters.

example 3:

Writing 3E7D to the memory address 2A of VHF unit number 4 can be done by using this packet:

[69][01][54][' '][2]['A']['3']['E']['7']['D'][6A] =

[69][01][54][20][32][41][33][45][37][44][6A]

The PacketNumber is 1.

**READ MEMORY DATA**

Data can be read from the nonvolatile memory of RT2048. Note that this packet can only be used with a RT2048!

The packet that make a read request to the RT2048 is:

[65][PacketNumber][6,VHFUnitAddress][MemAdr1][MemAdr2][MemAdr3][CRC]

MemAdr1-3 are ASCII characters.

The answer from RT2048 is send as a special display updating. See the passage about 'Answers from H2186/RT to PC'.

example 4:

To read the data in address 5F in VHF unit number 7 use this packet:

[65][01][67][' ']['5']['F'][50] =

[65][01][67][20][35][46][50]

**RESET VHF UNIT**

After writing to the nonvolatile memory of the RT2048 it is necessary to reset the unit. A reset to a VHF unit has this format:

[62][PacketNumber][7,VHFUnitAddress][CRC]

**4.5.2 ANSWERS FROM H2186/RT TO PC****DISPLAY UPDATING TO THE PC FROM THE H2186/RT**

[07][PacketNumber][State,VHFUnitAddress][54][D0][D1][D2][D3][CRC]

The State has the following interpretation:

- 0 => No Error.
- 1 => No connection to VHF unit.
- 2 => SP-BUS Error.
- 3 => Illegal channel number.
- 4 => Only low power allowed on this channel.
- 5 => Device has been reset.
- F => State of VHF units and Parallel port (in this case the VHFUnitAddress is always F)

In example 1 VHF unit 1 was changed to channel 70 with power = high and Tx off. The following packet could be the display updating from H2186/RT as a result of example 1. If the PC make a request for a display updating the same packet will be received.

[07][0E][01][54][20][37][30][10][68]

The state nibble is 0, ie. there has been no errors.

The PacketNumber is E. The packet number in the packets from the PC is not necessarily the same as the PacketNumber from H2186/RT.

After receiving a display updating the PC sends an acknowledge to H2186/RT:

[AE]

If the following packet is received:



[07][0E][11][54][20][37][30][10][78]

the state nibble is 1, which means that VHF unit number 1 is not connected to the SP-BUS.

If the PC has send a 'GetSystemState' it will receive a display updating with the state nibble = F.

[07][0E][FF][54][AE][82][XX][XX][CRC]

Note that the VHFUnitAddress is F, which indicate that it is not a display update from a special unit.

D0 (in this example AE) denotes all the connected VHF units. If D0, Bit #1 is 0 then the VHF unit with adress number 1 is not connected to the SP-BUS. If D0, Bit #1 is 1 the VHF unit with adress number 1 is connected to the SP-BUS. The bits from 1 to 7 are used for the VHF addresses 1 to 7. D0, Bit # 0 is not used. D0 = AE can be interpreted as: VHF unit number 1,2,3,5 and 7 are connected to the SP-BUS.

D1 shows the state of the Parallel port. D1 has the same format as Data3 in 'Setup Parallel Port'.

D2 and D3 are spare bytes.

#### MEMORY DATA FROM RT2048

After sending 'ReadMemoryData' the PC receives memory data from RT2048.

[0A][PacketNumber][State,VHFUnitAddress][57][MemAdr1][MemAdr2][MemAdr3]  
[HighData1][HighData2][LowData1][LowData2][CRC]

MemAdr1-3, HighData1,2 and LowData1,2 are all ASCII characters.

As an answer for the request to read the content of address 5F in unit number 7 the following packet could be received:

[0A][0E][07][57][20][35][46][34][42][37][38][CRC] =

[0A][0E][07][57][' ']['5']['F']['4']['B']['7']['8']['CRC]

This means that in address 5F of RT2048 with unit number 7 the content is 4B78.

If the State is different from 0, there has been an error and the data should be ignored.

#### 4.6 CHECKING THE TELEPHONE LINE

To check the telephone line the PC sends a 'GetSystemState' every minute, or one minute after the last key was pressed. If the telephone line is intact the H2186/RT will return a list of all the connected VHF units to the PC. If H2186/RT does not receive any data from the PC in 5 minutes, it will make a software reset. That makes sure that no RT2048 will be transmitting without any control from the PC.