SEATRACK III

TAILBUOY AND VESSEL CONTROL UNIT

Technical Manual

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1. INTRODUCTION

This manual contains technical information intended for engineers and operators of the Seatrack Tailbuoy Tracking System. The Seatrack system consists of two different units, the TBU (Tail Buoy Transponder Unit) and the VCU (Vessel Control Unit). It contains information on the unit's mechanical and electrical assembly, features, configuration, installation and operation.

The following improvements compared to the previous version (Seatrack II) are made:

- A high speed communication link between the TBU and VCU is utilised. The improved link enables 8 TBUs to share the same frequency maintaining an update rate of 0.5Hz.
- A wide range of frequencies can easily be programmed by the handheld terminal.
- Software modifications have improved satellite selection and position quality.
- The GPS receiver is changed improving accuracy and tracking performance.

1.1. Seatex Technical Support

SEATEX, with head office, laboratories and production facilities in Trondheim, Norway, intends to offer our customers the best service and technical support. If problems occur, you can contact us at the following address:

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Telex : 5102 seatx n

2. EQUIPMENT DESCRIPTION

The TBU measures GPS observables like time and pseudorange. The GPS data is decoded and re-transmitted via an UHF telemetry link using a proprietary, compact data format developed by Seatex.

The TBU consists of:

- a motherboard for the electronics and the DC/DC power supply
- an Intel 386SX equivalent processor with three RS 232C ports
- a GPS receiver
- a GPS antenna
- an UHF telemetry transceiver
- an UHF antenna
- interconnecting cables

All units are assembled in a polyethylene housing.

In addition to the TBU the following items are delivered with the units:

- power cable, 6 m
- handheld terminal with cable and connector

The VCU receive data from up to 8 TBUs simultaneously. If more than 8 TBUs are used in the configuration, additional VCUs can be used in parallel. Data from the TBUs are available by a RS232C port at the VCU.

The VCU consists of:

- an AC/DC power supply
- a telemetry transceiver
- an UHF antenna

The VCU components are assembled in a 19", 1U (4.44cm) unit for rack mounting. The UHF antenna has to be externally connected.

2.1. Mechanical Assembly

The internal assemblies are described in appendix A. For optimum reliability of the TBU, all electronic components including antennas are located in a splash proof (IP67) polyethylene housing. The internal mechanics are supported with anti-vibration, and shock absorbing materials. When leaving the assembly line or maintenance at Seatex the TBU will be filled with Nitrogen to prevent internal condensing.

Power and handheld terminal is connected via two different connectors at the bottom of the TBU. The connector types are:

- Impulse IE.BH-4MP (power)
- Impulse IE.BH-8FS (terminal)

2.2. TBU Motherboard

The TBU motherboard contains the following :

- Power supply - 5 and 12 V switch mode DC/DC
- Power supervisory circuits
- Signal interfacing circuits
- "Watchdog"

The watchdog is monitoring the transmission of data to the UHF transmitter. If no activity is detected within 2 minutes the watchdog reset the unit by toggling the power OFF / ON.

2.3. TBU Processor

The Ampro Core Module CM/386 is a compact, high performance, PC-compatible CPU module. The CPU is a CMOS equivalent to the Intel 80386 microprocessor.

Figure 2-1 in appendix B shows the location of the processor board's interface connectors, and jumper locations.

The correct jumper configuration is described in table 2.1.

Jumper Group	Configuration
W1	1-5, 2-3, 4-8, 7-11, 9-10
W2, W5, W6	Unshorted

Table 2.1: Processor board jumper configuration

2.3.1. Mini Module SSP

The Ampro Mini module/SSP (MM/SSP) is a compact, low power module with two serial ports, and one parallel port. It is installed directly on the CM/386 processor board. Both serial ports conform to the RS 232C standard, and are identical to the serial port on the CM/386 board.

Figure 2-2 in appendix B shows the location of the SSP board's interface connectors and jumper locations.

The configuration of the SSP board is described below:

PORT	BASE ADDRESS	IRQ	CONNECTOR	JUMPER GROUP
LPT2	0278h	5	J3	W3,W6
COM2	02F8h	3	J1	W1,W4
COM3	03E8h	3	J2	W2,W5

Table 2.2: SSP Basic Configuration

Jumper Group	Jumper Configuration
W1	3-4
W2	11-12
W3	3-4,5-6
W4	3-4,13-14
W5	7-8,13-14
W6,W15,W17,W20	unshorted
W19	shorted
W11,W12,W13,W14	2-3

Table 2.3: SSP Jumper Configuration

Note! In addition W20 pin 1 must be shorted to J5B pin 29.

2.4. GPS Receiver

The GPS receiver is a Trimble DMS 8 or 12 channel receiver. The receiver can be configured to track up to 8 satellites by sequencing between two satellites on two channels. This feature is, however, turned OFF to improve signal-to-noise ratios and tracking performance. Integrated Doppler is utilised internally in the GPS receiver to smooth the pseudo-range measurements.

The GPS antenna is mounted inside the TBU housing and is a Trimble Bullet compact GPS antenna.

2.5. UHF Radio Transceiver

The Jotron DTR-401/4800 Telemetry transceiver contains a modem and an UHF synthesised FM transceiver. Error free data transmission is possible over distances up to 10 km provided line-of-sight.

The transmitted power is 500 m W in the 457-459 MHz frequency band in the standard configuration.

2.6. Handheld Terminal

The Termiflex ST 2000 works as a simple ASCII terminal, capable of simultaneously transmitting and receiving ASCII characters via one of the RS232C ports of the TBU. Once power is connected, the terminal undergoes a series of self-tests to verify proper unit operation. No input is required during the self-test (approx. 3 seconds duration).

The terminal set-up mode is entered by holding the lower left and lower right keys (**Z** and **ENTER**) while the unit is undergoing the power up self test. While in set-up mode, incoming data is ignored.

When The Main Menu is entered, the text '**MAIN MENU**' will be shown on the top display line and the soft key labels **'COM DSP KBD EXIT '** will be shown on the bottom line. Switch between the different options be pressing **NXT** or **PRV**. All parameters must be set-up as listed in table 2.4.

Communication (COM) Set-up:

Baud rate	9600
Parity	NONE
Data, Stop bits	8,1
Display serial errors ?	YES
Aud serial errors ?	NO
Support XON/XOFF ?	NO

Display (DSP) Set-up:

Disp ctl chars ?	NO
Disp esc chars ?	NO
Cursor visible ?	YES
Auto line wrap ?	YES
New line on cr ?	NO
Display self-test ?	YES
Backlight on ?	YES

Keyboard (KBD) Set-up:

Local echo ?	NO
Key repeat	SLOW
Audible keys ?	YES
Simplified KB ?	NO
Program function key F1?	< MAIN >
Exit the Main Menu by pressing	< EXIT>.
Save Changes ?	YES
Leave the Set-up by pressing	<EXIT>

Table 2.4: Handheld Terminal Configuration Parameters

2.7. The UHF Antenna

The UHF antenna used is a Procom FLX 70/h-N. This antenna needs a ground plane, witch is provided by the screening canister round the TBU.

3. OPERATING

3.1. Getting Started

The TBU can be operated via the handheld terminal, but no interaction is required to start normal operation.

The terminal is powered by the SEATRACK unit, and does not need any charging.

If the sequence number or the GPS receiver elevation mask has to be altered a detailed description can be found in chapter 4.2.

The sequence number is identifying the time-slot allocation for TBUs operating at the same frequency. TBUs sharing the same frequency must not be configured with the same sequence number!

The procedure for starting operation of a TBU is:

- Mount the TBU in a mast or a suitable location where the satellite signals will not be obstructed
- Connect the handheld terminal
- Connect power (12V or 24V DC)
- ca. 30 sec. after power is connected text will appear at the display and several diagnostic tests performed
- 1-5 minutes after power is connected PRN numbers will appear at the display indicating that the GPS receiver is tracking satellites

The procedure for starting operation of a VCU is:

- Mount the VCU in at 19" rack
- Mount radio antennas and connect antenna cable
- Connect power (230V AC)
- When data is received and decoded from a TBU an indicator light at the front of the unit will start to flash
- Connect a computer to the RS232C port at 4800 baud, no parity, 8 data bits and 1 stop bit. No null modem or crossing of signal lines is required of the interconnecting RS232 cable because the VCU is configured as DTE equipment.

Note! When leaving SEATEX, the TBU is prepared for use, and inert with Nitrogen. The unit must not be disassembled unless Nitrogen is available to inert after service.

3.2. TBU Software Configuration

When leaving SEATEX, all set-up and program configuration is done. The unit will start automatically when power is connected.

Min. 30 seconds after power up text will appear at the terminal. First the software version will be prompted followed by the TBU's identification number (TBID) and the sequence number. The TBID is a unique number for the TBU, and will be in accordance with the serial number. A normal display on the terminal during operation could be as shown below:

GPStime: 17:43:31	- GPS real time clock
14.5V Cycl: 2.03	- Input voltage, and cycle time in sec.
13 24 12 09 18 07	- List of tracked satellites.

If the GPS receiver is unable to track satellites, the following text could be shown on the display:

PCtime: 00:01:14 **14.5V Cycl: :00** **NO GPS DATA !** **NO TIMING !**	(This message also occur when starting up the program, and when leaving the debug modus.)

3.3. Radio Set-Up

The radio frequency is configured by the terminal. Use the following procedure:

- Abort the TBU program and go to DOS (<shift><ESC>)
- In DOS start the frequency setting program "F"
- The program will after a while give you the following menu:

C	**TRANSCEIVER FREQ.**
P	**TRANSMITTER FREQ.**
R	**READ FREQ.**
Q	**QUIT**

- On the TBU you must choose to program the transmitter frequency, not the transceiver frequency.
- The program will now prompt you for the frequency. The frequency can be set from 457.0 to 459.0 MHz in 25 kHz steps (if you enter on illegal freq. the program will prompt you again.)
- To verify your settings you might use the read command. This will give you the radio settings (when the radio is set in transmitter mode you can se that the RX freq. is 70 MHz above the TX freq.)
- When leaving the program you have to wait for a hardware reset before you use the radio again.

Note! When the normal TBU navigation software is not running, you will automatically have a hardware reset within 3 minutes. This means that configuration changes has to be finished within 2 minutes, if not you have repeat the re-configuration.

3.4. VCU Frequency Configuration

The VCU configuration is described below:

- Connect the VCU's parallel port to a PC's parallel port (address 378h).
- Start the program F401.
- Select the correct parallel port address for your PC by using F9 (Standard IBM is 378h).
- Change the switch setting on the back on the VCU from RX to the middle position. Power will now be removed from the radio. Wait 10 seconds before you switch to PROGRAM position.
- Press F1 to set the transceiver frequency, and follow the screen instructions.
- The frequency can be set fro 457.0 to 459.0 MHz in 25 kHz steps.
- Use the F3 - read frequency to verify your settings.
- Change the switch setting on the back on the VCU from PROGRAM to the middle position.
- Remove the parallel port connection fron the VCU.
- Wait 10 seconds before you switch to RX position.
- The VCU is now ready to receive data on the new frequency.

4. TROUBLESHOOTING HINTS

4.1. Hardware Troubleshooting.

No Booting

- Turn the power OFF / ON by removing/reconnecting the power cable.
- Check power by measuring on the front connectors referring to the connector board diagram.

Communication Problems between TBU and VCU

- Check that every TBU is correctly configured.
- There may also be a jamming problem with the mobile phone because it is transmitting in the same frequency area. When a jamming problem occur , you can try to change frequency on the tailbuoy units and the vessel control unit (VCU), see chapter 3.3 and 3.4. It is also important to set the VCU UHF antenna as far away as possible from other transmitting antennas.
- Connect a power meter between the TBU and the UHF antenna, and measure the forward effect. Use the debug **E** command (see next section). The effect should be 0.5 W.

No Position Fix / No GPS Data

- Turn the power OFF / ON to restart the GPS receiver by removing the power cable. The power must be OFF for more than 5 seconds before the unit is re powered!
- Check the GPS antenna, try to replace it if necessary. A good way of testing the antenna is to measure the resistance between the shield and the inner core. The normal value is about 1.970 kΩ.
- Reset the GPS receiver by pressing buttons **R** and **S** in sequence (fast) on the terminal while the program is running in normal mode. If the TBU has been transported long distances, this often reduces the time before the first position fix.

Watchdog

- When the SEATEX navigation software is not running, or you do not have GPS data the system will be reset every third minute by the watchdog.

- You can press **W D** fast when the navigation program is running in normal mode. You should now be prompted **WATCHDOG DISABLED FOR ONE HOUR** when you have pressed **WATCHDOG DISABLE** (Note! Any terminal entry will disable this function).

4.2. Handheld Terminal Commands for Troubleshooting.

When the Seatex navigation software is running, type **D B** fast on the handhold terminal. Now the prompt **SEATRACK DEBUG MODUS** will appear on the handhold terminal. In debug modus there are some commands listed below that is useful for trouble shooting. To return to normal operation press **SHIFT ESC** and the unit is operating in normal mode again.

Display GPS Raw Data:

Press **R**. You should now be prompted **GPS DEBUG OUTPUT RAWDATA**. If you are prompted messages here, you know that the communication between the GPS receiver and the processor unit is OK, and that the GPS receiver are tracking satellites.

GPS Receiver Test

Press **G**. You should now be prompted **GPS DEBUG RECEIVER TEST**. It will be followed by a test sequence for checking the GPS receiver.

Transmit Time Tag

Press **L** . You should now be prompted **GPS DEBUG SEND TIME TAG**. The processor unit is now updating the units identity number and voltage every second.

Datalink Carrier ON

Press **E**. You should now be prompted **DATALINK DEBUG CARRIER ON**. This option is very useful to check that the transmitter is working. You could set up a power meter to measure the forward effect of the transmitter, and with a spectrum analyser it can be verified that the selected frequency is used (the carrier is ON for about 20 seconds).

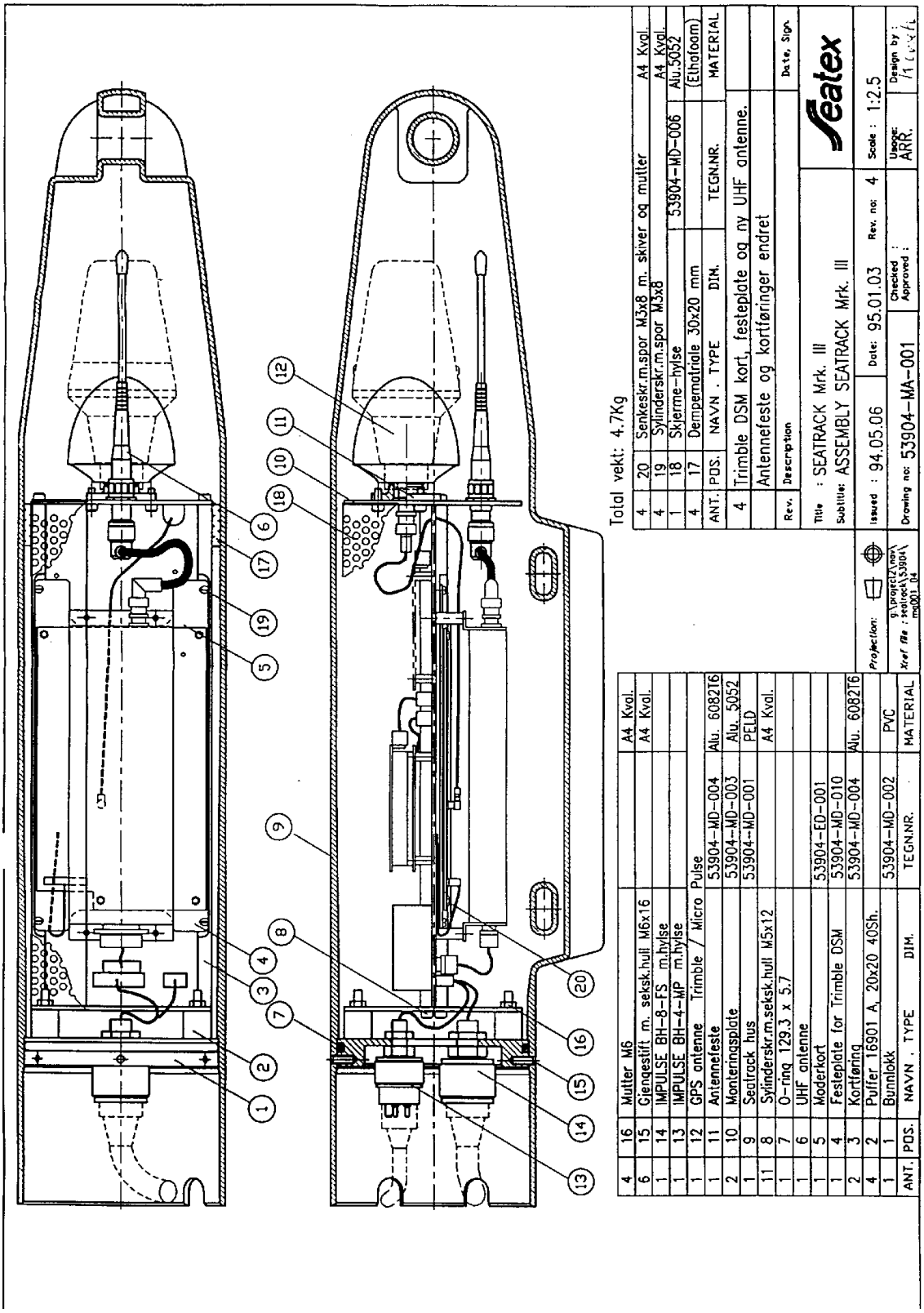
TBU Set-up

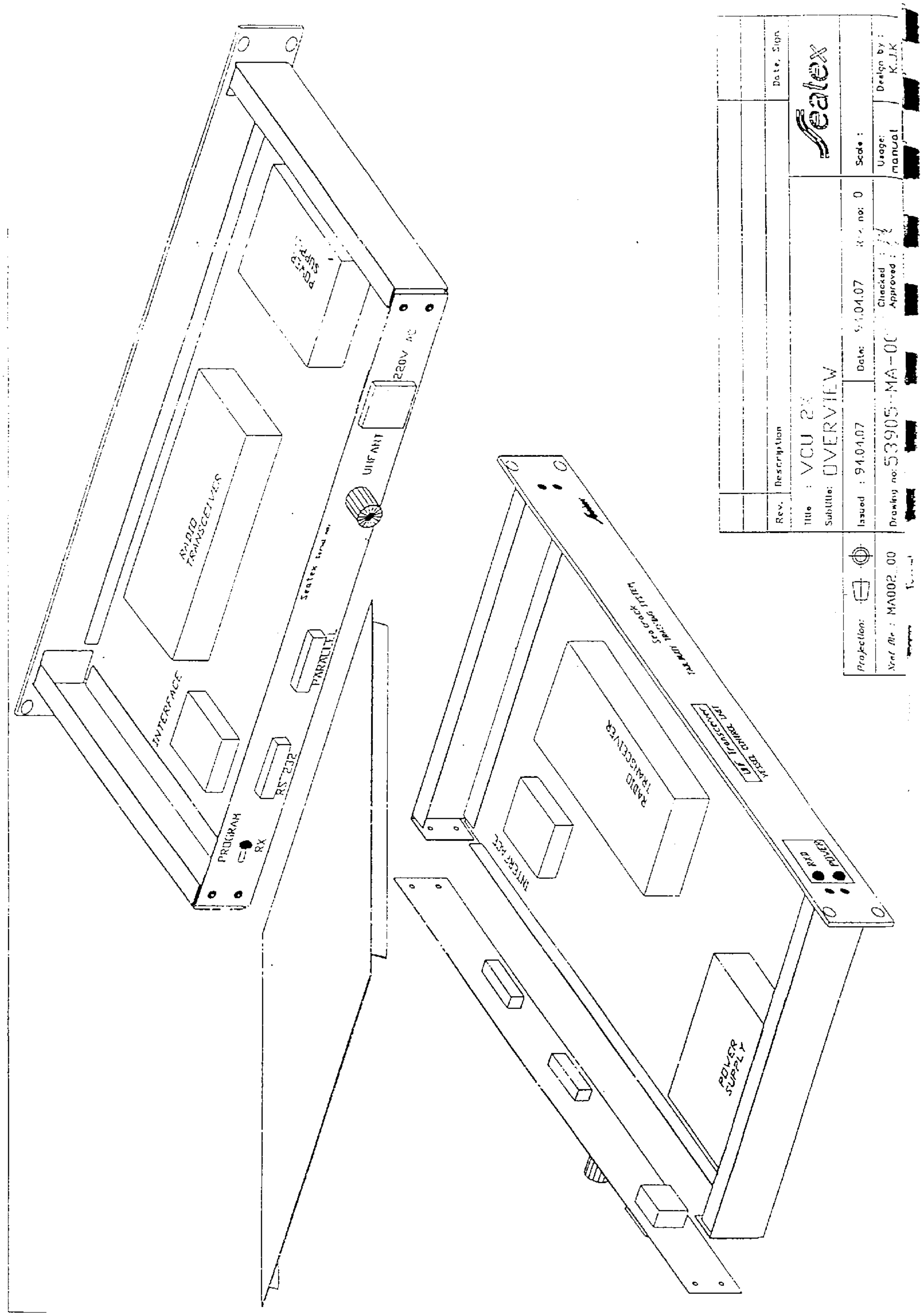
Press **T.** You should now be prompted **SEATRACK SET-UP MENU**. Here you can change the sequence number and the elevation mask.

Assembling TBU after repair:

- Make sure all connectors are correctly connected
- Check soldering on power-shielding-box
- Fit shielding canister around the unit
- Add EMC tape around shielding canister ends
- Check the four pieces of gasket tape used as chock absorbers at the antenna end
- Check o-ring
- Flush with nitrogen before closing the unit

APPENDIX A: MECHANICAL LAYOUT TBU / VCU


Total vekt: 4.7Kg
Seatex
Title : SEATRACK Mrk. III
Subtitle: ASSEMBLY SEATRACK Mrk. III
Issued : 94.05.06
Date: 95.01.03
Rev. no: 4
Scale : 1:2.5
Drawing no: 53904-MA-001
Checked :
Approved :
Design by : ARR.
Projection:
Antennefeste og kortføringer endret
Trimble DSM kort, festeplate og ny UHF antenne.
Senkeskr.m.spor M3x8 m. skiver og mutter A4 Kvl.
Sylinderskr.m.spor M3x8 A4 Kvl.
Skjerme-hylse 53904-MD-006 Alu.5052
Dempermatrigle 30x20 mm (Ethafoam)
Mutter M6 A4 Kvl.
Gjengestift m. seksk.hull M6x16 A4 Kvl.
IMPULSE BH-8-FS m.hylse
IMPULSE BH-4-MP m.hylse
GPS antenne Trimble / Micro Pulse
Antennefeste 53904-MD-004 Alu. 608216
Monteringsplate 53904-MD-003 Alu. 5052
Seatrack hus 53904-MD-001 PELD
Sylinderskr.m.seksk.hull M5x12 A4 Kvl.
O-ring 129.3 x 5.7
UHF antenne
Moderkort 53904-ED-001
Festeplate for Trimble DSM 53904-MD-010
Kortføring 53904-MD-004 Alu. 608216
Puffer 16901 A, 20x20 40Sh.
Bunnlokk 53904-MD-002 PVC
ANT. POS. NAVN , TYPE DIM. TEGN.NR. MATERIAL



RADIO TRANSCEIVER
INTERFACE
PARALLEL
RS-232
PROGRAM
RX
UHF ANT
220V AC
POWER SUPPLY
Rev.
Description
Date, Sign
Title : VCU 2X
Subtitle: OVERVIEW
Issued : 94.01.07
Date: 94.01.07
Scale :
Checked
Approved
Usage: manual
Design by : KJK
Projection:

APPENDIX B: PROCESSOR JUMPER LOCATIONS

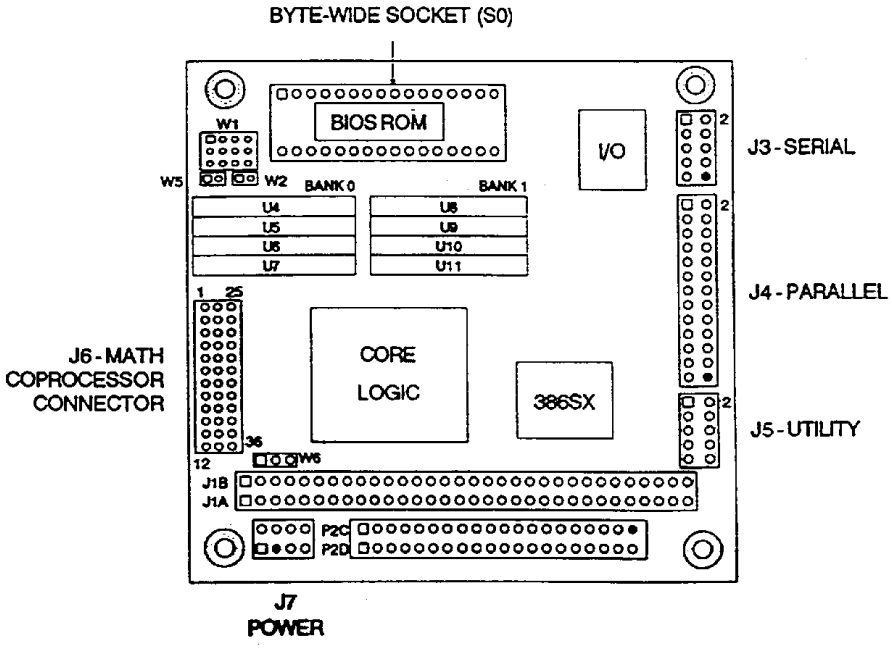
HARDWARE

Introduction

This chapter describes the hardware aspects of the CoreModule/386SX and tells you how to integrate it as a system component. It includes information about the devices and interfaces on the module, induding the DRAM, configuring the byte-wide socket, and installing a byte-wide device.

This chapter touches on standard PC/AT features and functions, and focuses on the functions-unique to the CoreModule/3865X. As many of the module's functions are initialised and controlled by software, this manual presumes use of the factory installed ROM BIOS.

Figure 2-1 shows the location of the CoreModule/386SSX's major components and connectors, the byte-wide socket, and its configuration jumpers.



□ Pin 1

• Key: This pin is removed. Block the corresponding socket for proper assembly.

Figure 2-1. Connector and Jumper Locations

SSP BOARD :

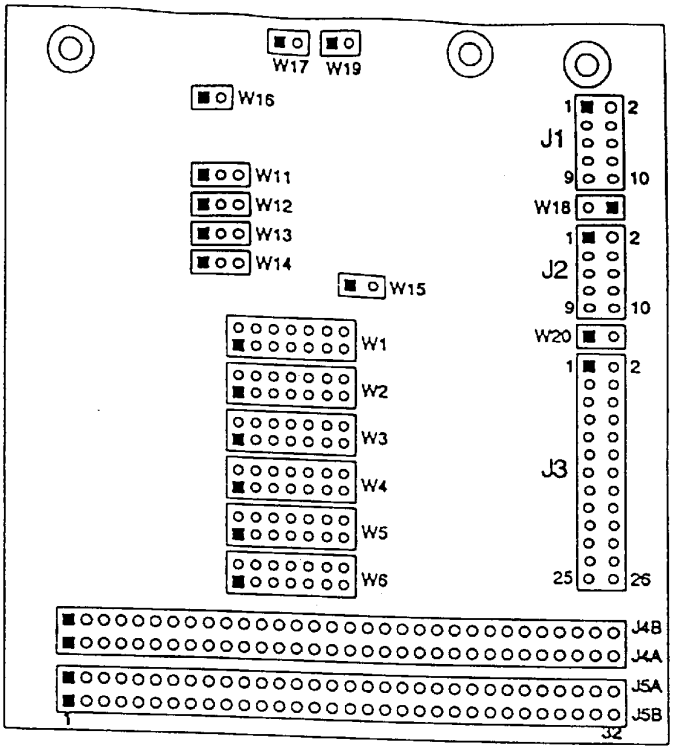
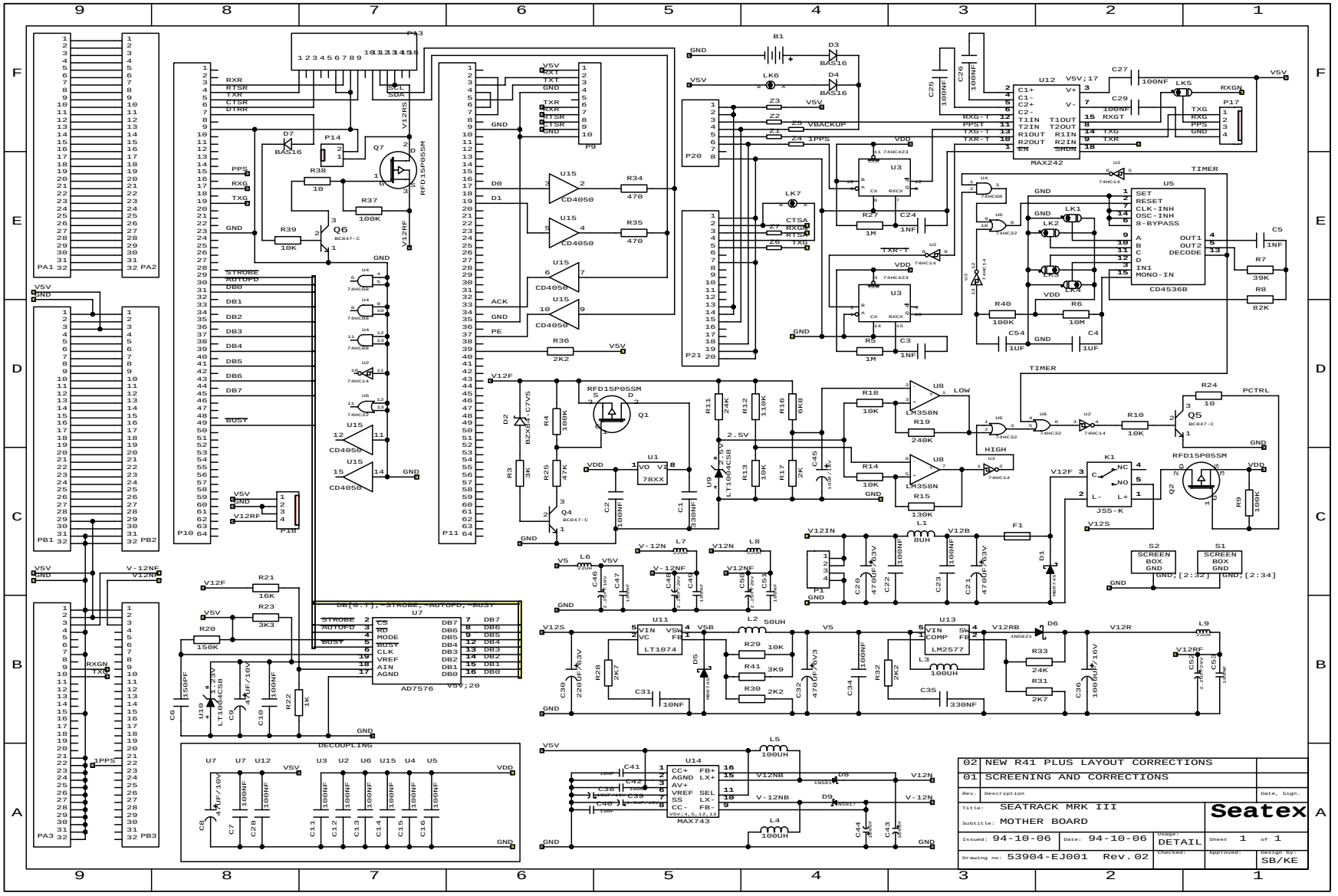


Figure 2-1. Connector and Jumper Locations

APPENDIX C: ELECTRICAL DIAGRAMS


02 NEW R41 PLUS LAYOUT CORRECTIONS
01 SCREENING AND CORRECTIONS
Title: SEATRACK MRK III
Subtitle: MOTHER BOARD
Seatex
Issued: 94-10-06
Date: 94-10-06
Usage: DETAIL
Sheet 1 of 1
Drawing no: 53904-EJ001 Rev. 02
Design by: SB/KE
MAX242
CD4536B
LM358N
LT1074
LM2577
MAX743
AD7576
78XX
LT1004CS8
JS5-K
TIMER
DECOUPLING

APPENDIX D: CABLE LIST

DOCUMENT :	53905-EL-001
REVISION	01
FUNCTION:	POWER TBU
CABLE TYPE:	**SO 16/4**
LENGTH:	**600 cm**
CONNECTOR A TYPE:	**IE.IL-4-FS**
CONNECTOR B TYPE:	***CUSTOMER***

Comment: If the cable is spliced / spider cable, colours of the second part of the cable is given under CONN. B COLOUR.

SIGNAL SYMBOL	CONN. A	CONN. A COLOUR	CONN. B	CONN. B COLOUR	Comments
+ 12V	1	BLACK			
+ 12V	2	WHITE			
GND	3	RED			
GND	4	GREEN			

Additional comments:

DOCUMENT :	53905-EL-003
REVISION	01
FUNCTION:	TERMINAL CHASSIS
CABLE TYPE:	**SO 16/8**
LENGTH:	**100 cm**
CONNECTOR A TYPE:	**IE.IL-8-MP**
CONNECTOR B TYPE:	***INSIDE TERMINAL***

Comment: If the cable is spliced / spider cable, colours of the second part of the cable is given under CONN. B COLOUR.

SIGNAL SYMBOL	CONN. A	CONN. A COLOUR	CONN. B	CONN. B COLOUR	Comments
TXD(TBU)	1	BLACK		GREY	
RXD(TBU)	2	WHITE		YELLOW	
5V	3	RED		RED	
GND	4	GREEN		BLACK	
RTS				BROWN	SHORT TO CTS
CTS				WHITE	SHORT TO RTS

Additional comments:

DOCUMENT :	53905-EL-003
REVISION	01
FUNCTION:	TERMINAL CONN. - PC
CABLE TYPE:	**SO 16/8**
LENGTH:	**ANY**
CONNECTOR A TYPE:	**IE.IL-8-MP**
CONNECTOR B TYPE:	**D-SUB 9 PIN FEMALE**

Comment: If the cable is spliced / spider cable, colours of the second part of the cable is given under CONN. B COLOUR.

SIGNAL SYMBOL	CONN. A	CONN. A COLOUR	CONN. B	CONN. B COLOUR	Comments
TXD(TBU)	1	BLACK	2		RXD PC
RXD(TBU)	2	WHITE	3		TXD PC
5V	3	RED			
GND	4	GREEN	5		

Additional comments:

APPENDIX E: TECHNICAL SPECIFICATIONS

Technical specifications:

System Configuration
The Seatrack System configuration comprises 1 to 16 Tail Buoy Units, 1 to 2 VCU rack units and a PC running the Seadiff software.

Performance

Accuracy	3m (2D, 95%%)
Update rate	0.5Hz
Sequencing	8 units sharing one frequency

Environment

Operational temperature	-10C - +40C
Storage temperature	-40C - +70C
Humidity	100%, fully sealed
Water proof	IP67

Physical

Weight	4.7 kg
Diameter	150 mm
Overall diameter	190 mm
Length	800 mm
Input voltage	11 -30 VDC
Power consumption	6W

Bracket for mast mounting

GPS receiver
- Trimble SVeeSix CM2
- 6 parallel channels

Radio

Modem	4800 bps GMSK
Antenna	Procom FLX 70/h
Frequency	457-459 MHz
Channel separation	25KHz
Transmission power	0.5W
Range	min. 15km (line-of-sight)

Features
- Rack mounted VCU for onboard reception of data
- Accurate position of up to 16 units can be calculated simultaneously within a 2 second update rate
- GPS receiver, radio, processor and antennas contained in physical unit
- Software configurable frequency
- Continuous battery voltage monitoring
- Fully automatic operation of the transponder units

Options
Ashtech 12 channel OEM GPS receiver
Trimble DSM 8/12 channel OEM GPS receiver

Specifications subject to change without prior notice.