

TECHNICAL MANUAL FOR AERIAL COUPLER AT2112
PART NO. 802112

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1 GENERAL INFORMATION

1.1 INTRODUCTION

This section gives you all necessary information to make service of this unit down to component level.

1.2 PRINCIPLE OF OPERATION AND BLOCK DIAGRAM

The aerial coupler is controlled from the TX processor.

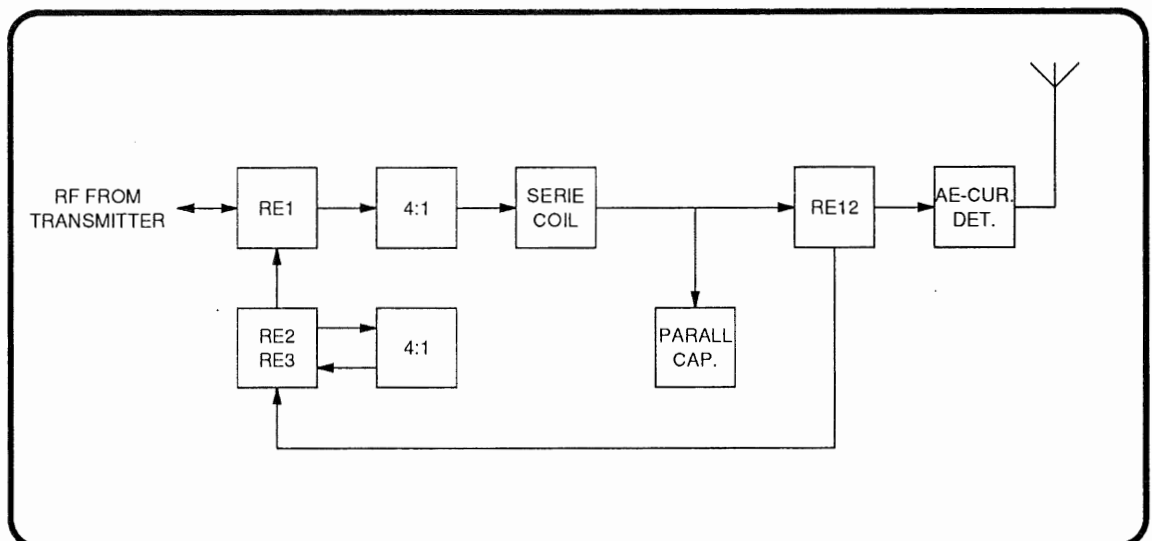
The aerial coupler tunes the aerial impedance to fit the 50 ohm impedance of the PA unit.

The impedance is measured at the output of the PA unit. It is always possible to tune an SWR less than 2, typically SWR = 1.4.

The aerial coupler has three main parts, a 4:1 impedance transformer at the input at the coupler, then a series coil, which can be tuned in steps as well as continuously, and at last a parallel capacitor, which can be tuned in steps. The value of the coil and the capacitor is controlled in the TX processor.

The aerial coupler has an impedance matching transformer (TR1-1) for the receiver for frequencies lower than 4MHz.

At the output there is a current transformer (TR2-1) and a detector. The output voltage is fed to the aerial current meter at RE2100.



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1.3 TECHNICAL DATA

Max handling Power: 1200W PEP

Aerial: Wire or whip aerial, 9 - 16 metres length

Temperature Range: -25°C to +70°C

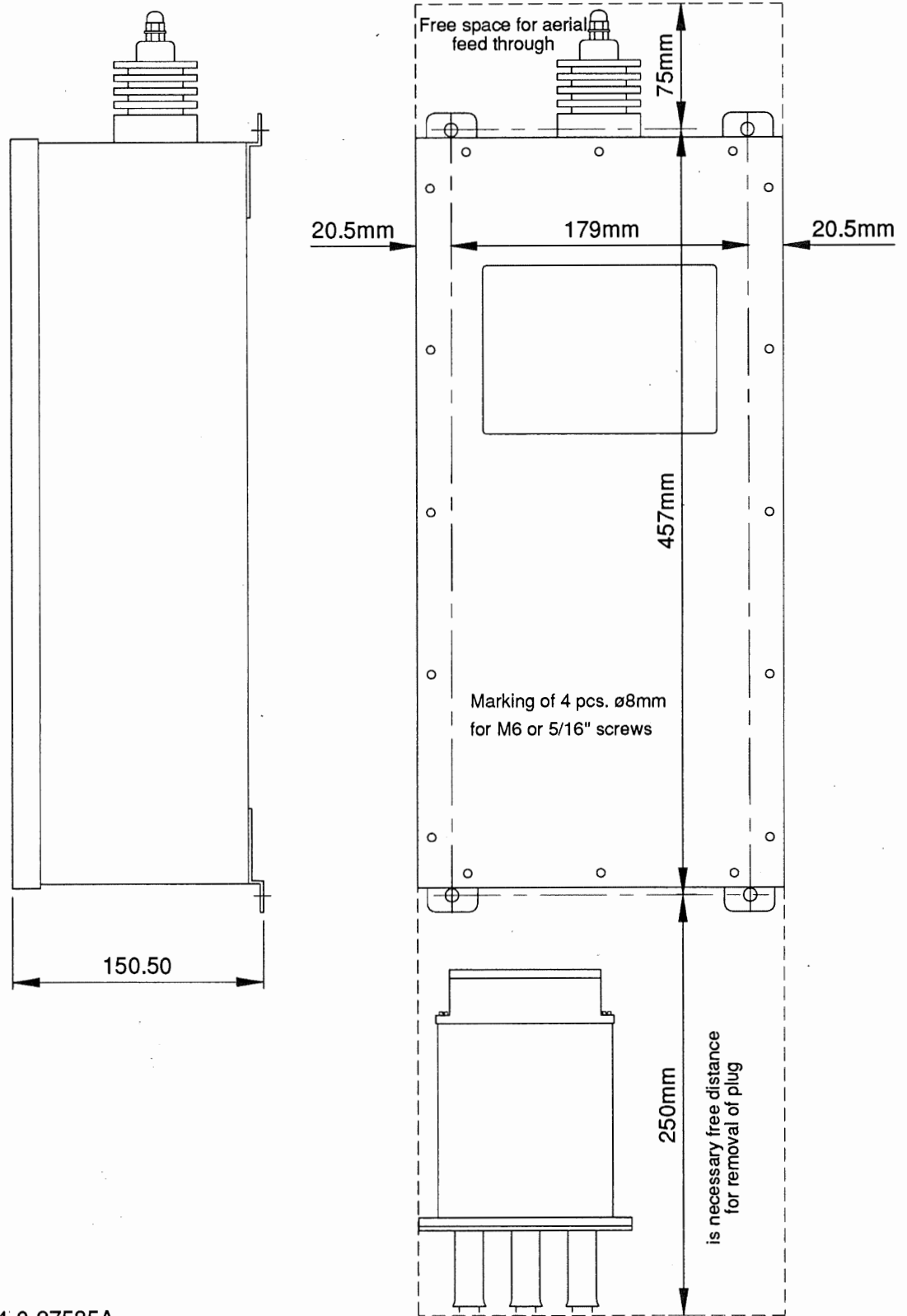
Tuning Time: Typical less than 2 sec.
Learn mode up to approx. 3 minutes

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2 INSTALLATION

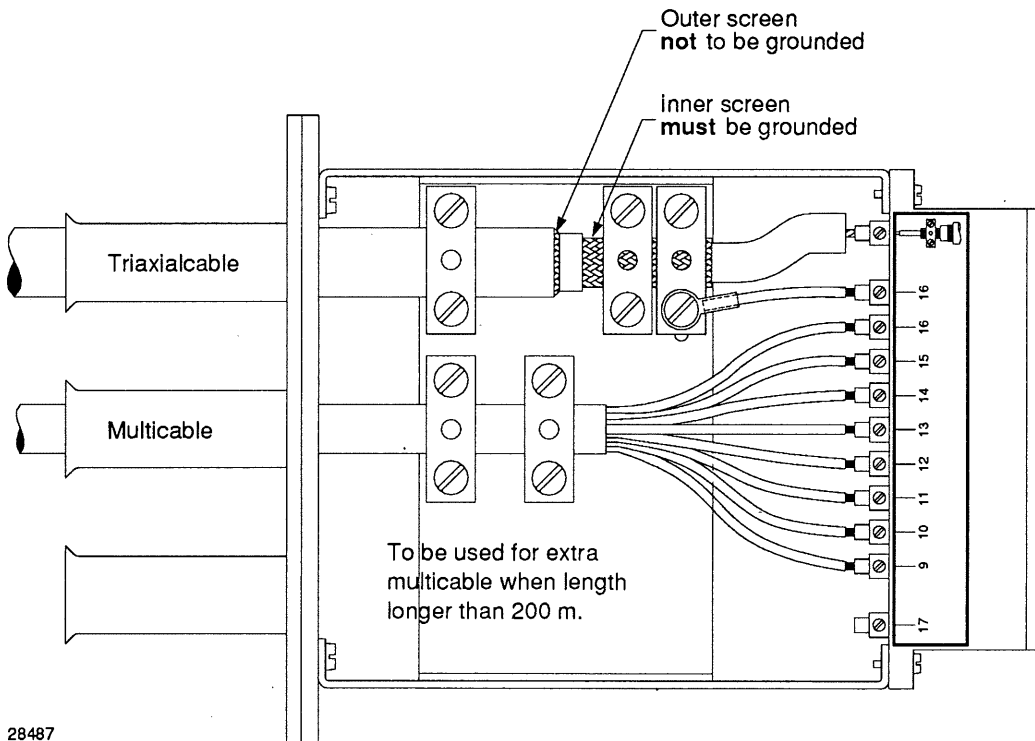
2.1 DIMENSIONS AND DRILLING PLAN



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2.2 ELECTRICAL CONNECTION AND ASSEMBLING

CABLE MOUNTING DETAILS FOR AT2112



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MULTICABLE:

Lead 9-16 incl. to be connected on this side. Lead 1-8 incl. to be connected on rear side.
 The numbers in plug for AT2112 correspond with the numbers on the terminal block at the connection board in question (control 1, control 2, etc.).

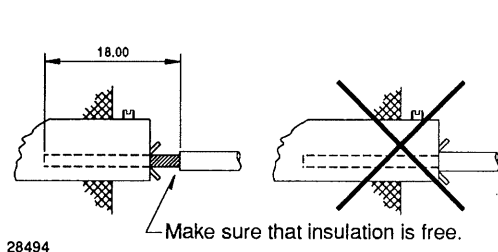
MULTICABLE: Max. diameter ° 14.5 mm.

length	type
1 - 100 m	16 x 0.5°
100 - 200 m	18 x 0.5°

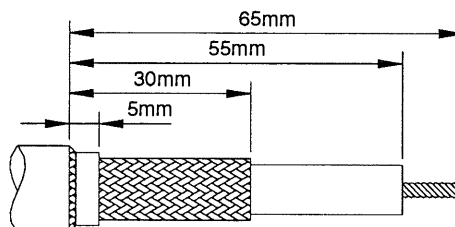
Terminal 15 have 3 leads in parralel.

WIRE STRIPPING FOR MULTICABLE.

WIRE STRIPPING FOR TRIAXIAL CABLE H1213.



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2.3 AERIAL AND GROUND

AERIAL

Most important for good communication is the aerial. The best efficiency of the aerial will be with the aerial coupler AT2112 mounted outdoors, close to the footpoint of the aerial and the aerial placed as high and free as possible. The aerial coupler AT2112 has to be grounded carefully.

AERIAL LENGTH

Max. length 16 meters, min. length 9 meters. The aerial length is measured from the insulator on AT2112 to the top of the aerial.

If the transmitter has to work mainly on frequencies below 4 MHz a total aerial length of 15 meters is recommended.

If the transmitter has to work mainly on frequencies higher than 4 MHz an 8.5 meters whip aerial is recommended.

GROUND

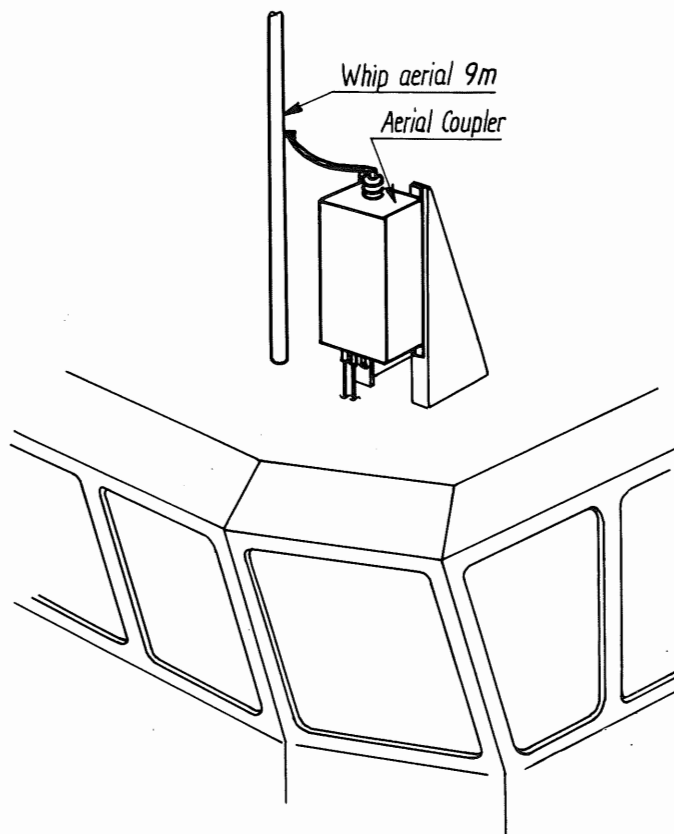
The grounding points on AT2112 are the four mounting feet. It is most important that these are in good contact with the ground, eg. the wheel house.

AT2112 has to be grounded at the footpoint of the aerial.

If a metal wheel house, weld up a pillar for AT2112 and bolt it to the pillar. This way you get the best ground for your antenna system.

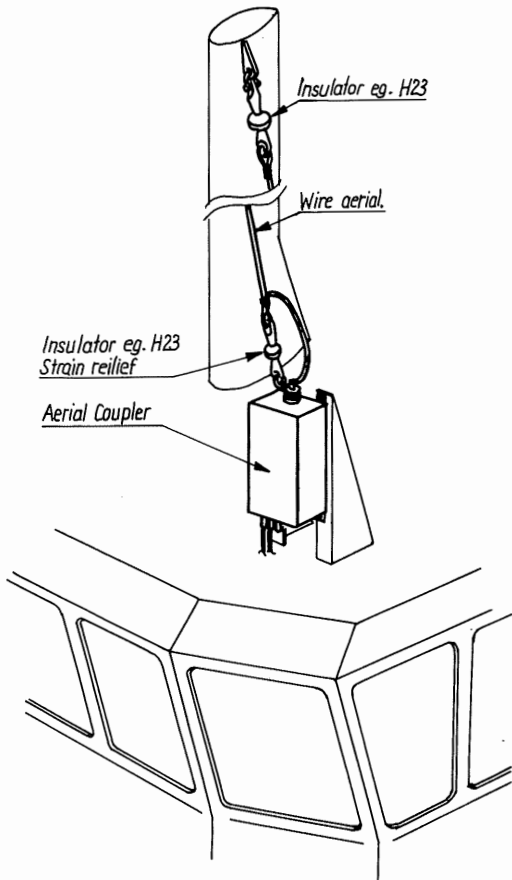
If a wooden or fibre glass boat, connect all accessible metal parts together and connect them to the aerial coupler with a copper strip (100 x 0.5 mm), making the copper strip as short as possible. You can also make an artificial ground under the aerial coupler as shown in example 5.

Example 1. AT2112 mounted on top of a wheel house with a whip aerial.



AT2112 has to be grounded through the two lower mounting holes.

Example 2. AT2112 mounted on top of a wheel house with wire aerial.



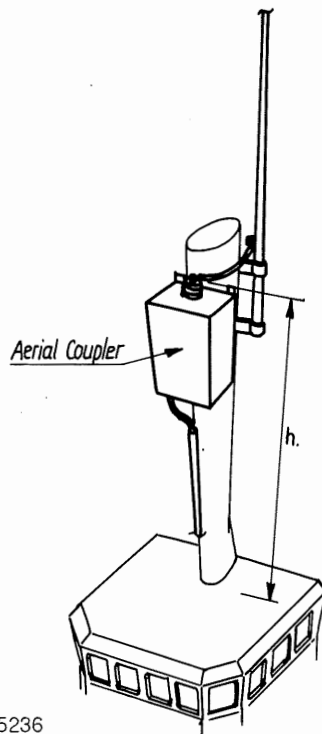
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Example 3. AT2112 mounted on top of a mast.

AT 2112 has to be grounded to the mast if a metal mast.

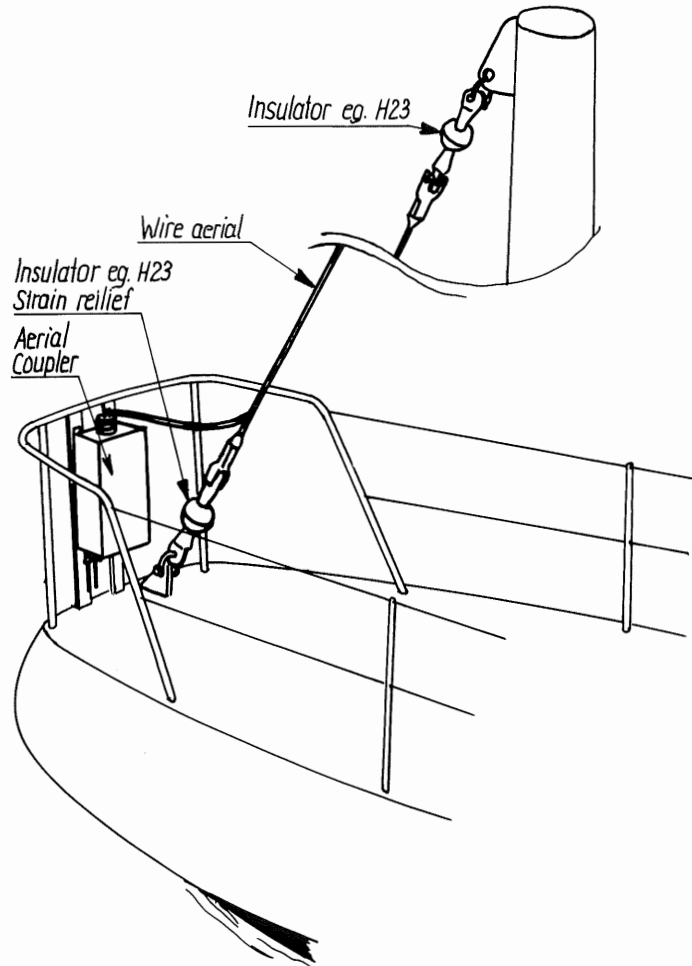
If the mast is higher than 8 meters, then the coax cable works as ground and acceptable performance will be obtained.

If the mast is less than 8 meters, then a copper strip (100 x 0.5 mm) has to be connected from AT2112 to ground.



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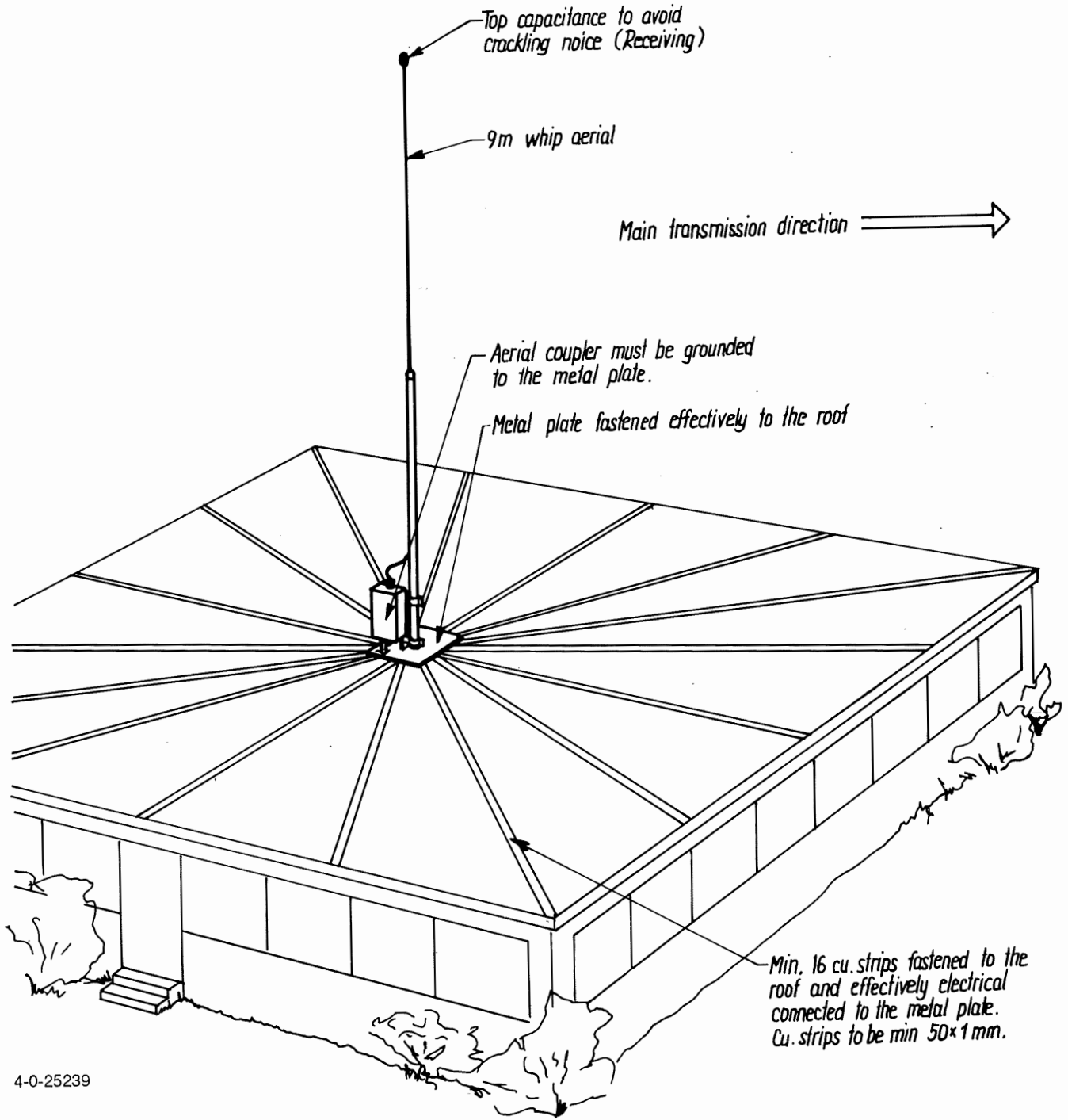
Example 4. AT2112 mounted on a sailing ship.



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AT2112 has to be grounded to the metal handrail or other metal parts.

Example 5. AT2112 mounted on top of building.



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3 SERVICE

3.1 MAINTENANCE

PREVENTIVE MAINTENANCE

If the HF SSB system has been installed properly the maintenance can, dependent on the environments and working hours, be reduced to a performance check at intervals, not exceeding 12 months. A complete performance check is enclosed in this manual, chapter 3.5. PERFORMANCE CHECK.

Inspection of the antenna, cables, and plugs for mechanical defects, salt deposits, corrosion, and any foreign bodies shall be done at regular intervals not exceeding 12 months.

Along with each HF SSB system test sheets are delivered in which all the measurements made in the test department of the factory, are listed. If the control mesurings made in the service workshop should not show the same values as those listed in the test sheet, the set must be adjusted as specified in the parts concerning the units in question.

3.2 ALIGNMENT INSTRUCTIONS

INTRODUCTION

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

3.3 PROPOSAL FOR NECESSARY MEASURING INSTRUMENTS

Tone Generator type PM5107	PHILIPS
Electronic Multimeter type PM2505	PHILIPS
RF Directional Wattmeter model 43	BIRD
Oscilloscope type PM321	PHILIPS
Dummy load 50 ohm/600W	
Power supply 21-32V,	50A (600W transmitter)
	100A (1200W transmitter)

3.4 TROUBLE SHOOTING

Trouble shouting in a high power circuit where high voltage are preset, can normally be done by looking into the circuit, and spot the defective component. Only if it is one of the relays or semiconductors that are defective, you have to make measurements.

3.4.1 CHECKS OF RELAYS

To check the relays, AT2112 must be connected to the transmitter.

Select serve programme SP-30-0 to SP-30-9 and SP-31-0 to SP-31-4, please see part I paragraph 3.8.2. The service programme will enable you to activate each relay in the aerial coupler, so you can see if it works.

3.4.2 CHECK OF THE TUNE MOTOR.

Select service programme SP-32-1 see part I paragraph 3.8.2, and check that the tune motor are running with low speed.

Select SP-32_2, and check that the tune motor are running full speed.

Select SP-32-0, and check that the tune motor stops.

3.4.3 CHECK OF THE 180° PULSE CIRCUIT.

Select SP-32-1 and connect a oscilloscope to P3 on the aerial detector module (1) (chassis as reference), and check that it goes high once every turn of the tune motor.

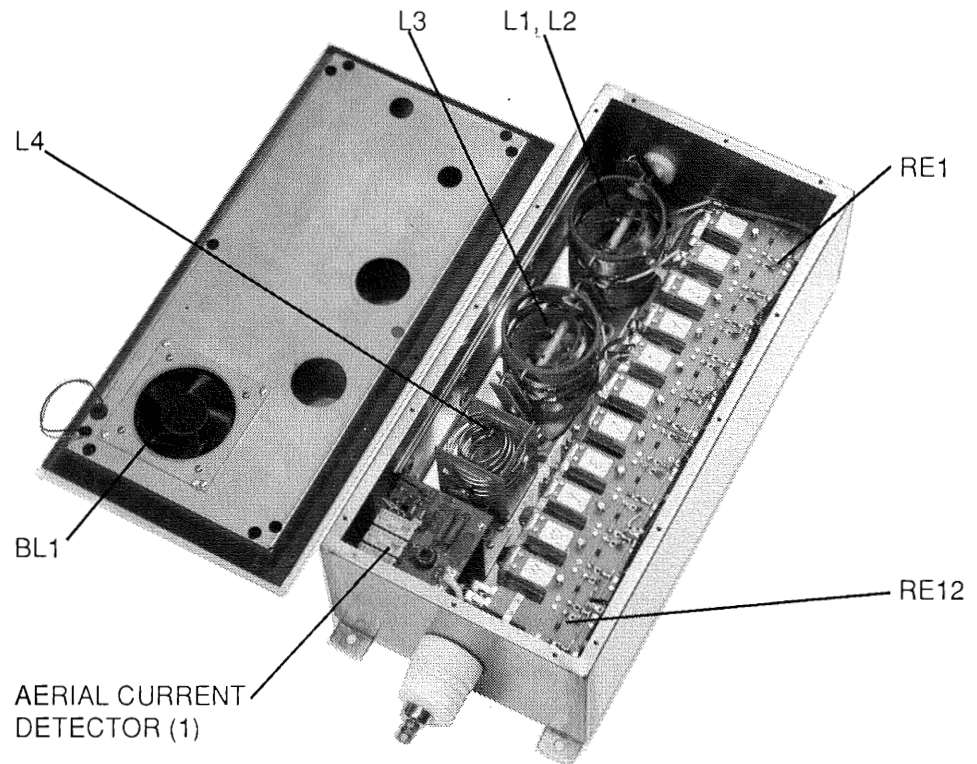
3.5 FUNCTION CHECK

To perform a function check, it is necessary to have a complete station, and it must be connected to a suitable aerial. Then you must perform the function check described in part I paragraph 3.7.

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4.1 MECHANICAL ASSEMBLING / DISASSEMBLING AND UNITS LOCATION



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5 CIRCUIT DESCRIPTION AND SCHEMATIC DIAGRAMS

5.1 AERIAL CURRENT DETECTOR (1)

This module contains three main circuits:

1. Aerial current detector
2. 180° pulse circuit.
3. RF switching circuit.

5.1.1 AERIAL CURRENT DETECTOR

The current to the aerial is fed through TR2. On the secondary side of TR2 there will be a voltage proportional to the aerial current. This voltage is rectified by D2 and C3, and fed to the TX-processor.

5.1.2 180° PULSE CIRCUIT

When the motor is running, current flows through the light emitting diode of OC1, and the detector transistor is turned on, and thus Q1 will be on, giving a low level on P3.

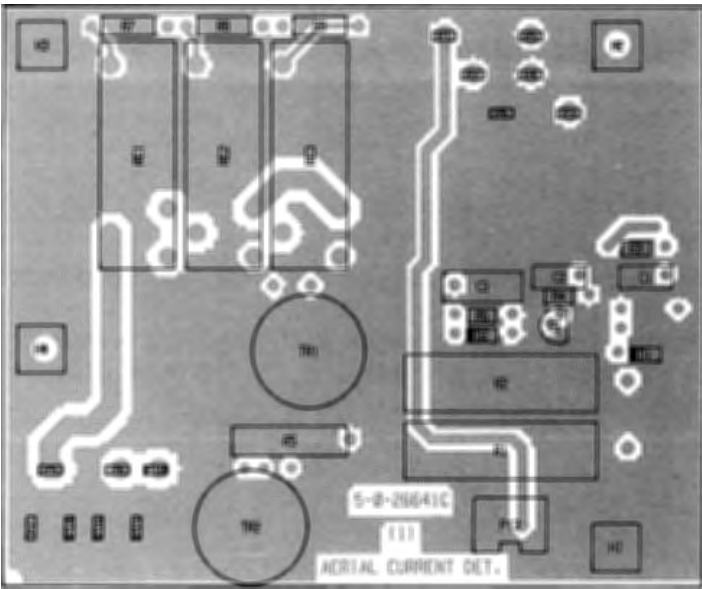
For every turn the light from the light emitting diode is cut off mechanically, causing the detector transistor of OC1 to turn off, and thus Q1 will be off, giving a high level at P3. This pulse is used to determine when to change the relay settings.

5.1.3 RF SWITCHING CIRCUIT.

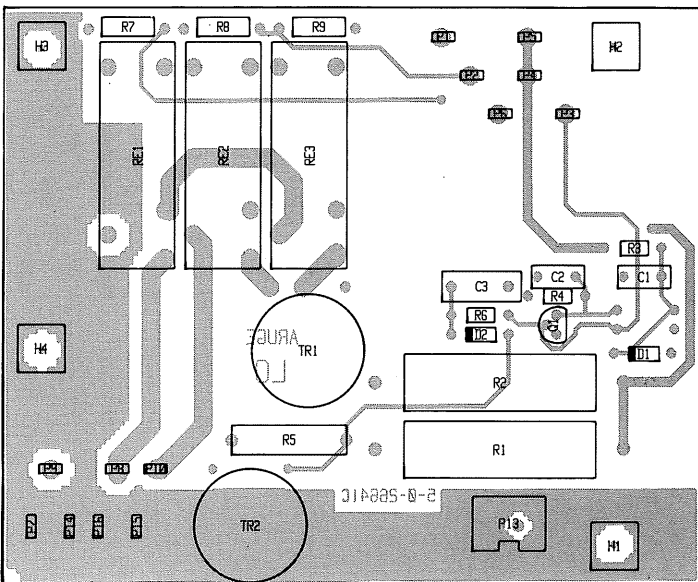
Depending on the mode (refer to 5.2) in which the aerial coupler is working the relays will be activated in accordance with the table below.

MODE		RE1	RE2	RE3
RECEIVE MODE	simplex F>4 Mhz	off	on	off
	simplex F<4 Mhz	off	on	on
	simplex, TX tuned	on	off	off
TRANSMIT MODE	straight through	off	off	off
	tuned	on	off	off
OPEN AERIAL		on	off	on
GROUNDING AERIAL		off	off	off

COMPONENT LOCATION AERIAL CURRENT DETECTOR MODULE 1



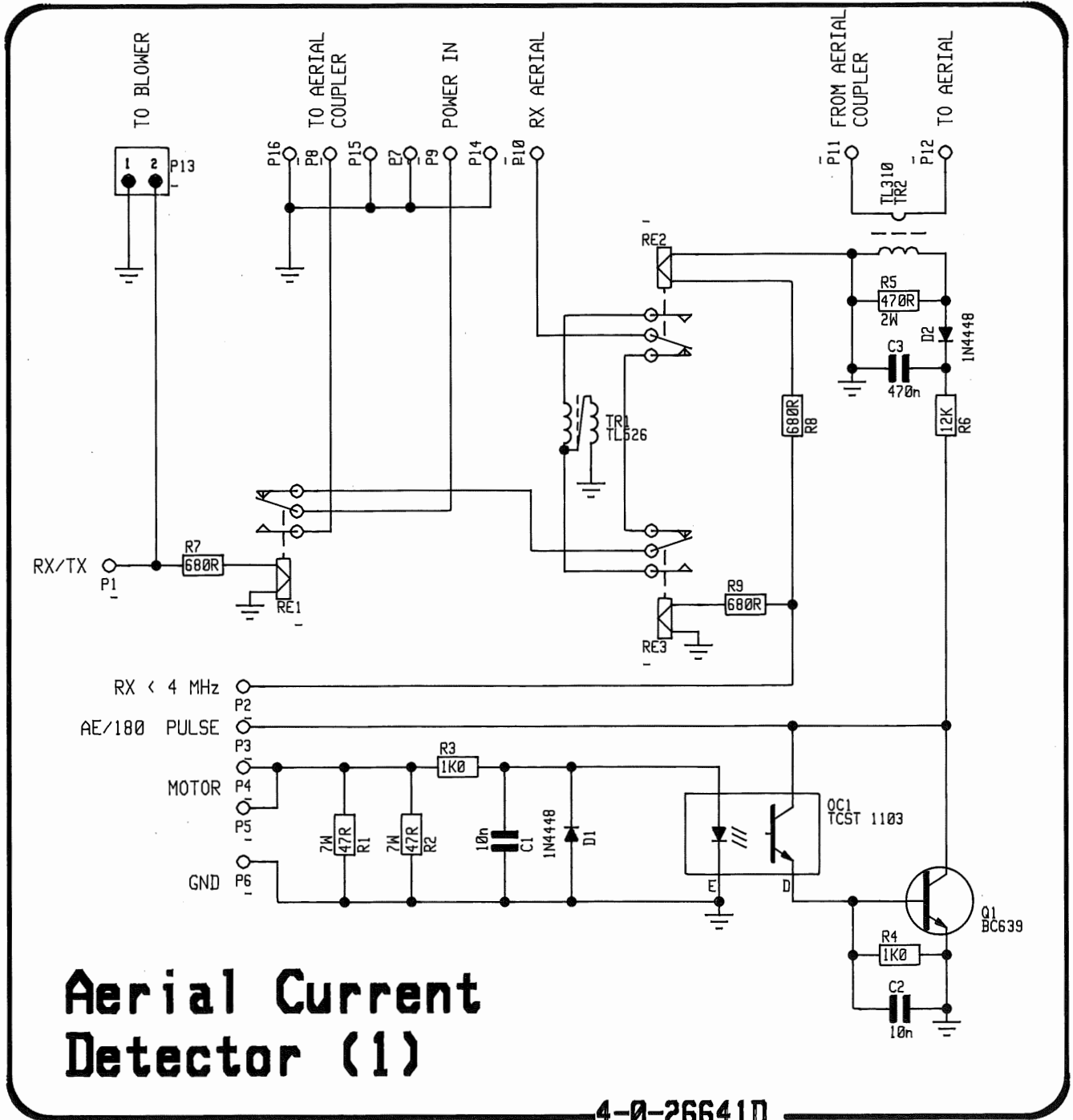
View from component side with upper side tracks.



View from component side with lower side tracks.

AERIAL CURRENT DETECTOR MODULE 1

4-0-26641D



5.2 MAIN SCHEMATIC DIAGRAM AT2112

The aerial coupler AT2112 is controlled from the TX - processor in the transmitter. The aerial coupler can be in two different modes:

1. Receive mode.
2. Transmit mode.

5.2.1 RECEIVE MODE.

In this mode there are two different settings, one is simplex the other is semiduplex.

5.2.1.1 SEMIDUPLEX MODE AND THE FREQUENCY HIGHER THAN 4 MHZ.

The signal is feed from the aerial trough RE12-RE2-RE3 and RE1 to the receiver via the connection board in the transmitter.

5.2.1.2 SIMPLEX MODE AND THE FREQ. LOWER THAN OR EQUAL TO 4 MHZ.

In this mode RE2 and RE3 are activated. The signal from the aerial is feed trough RE12 -RE2 to TR1 (module 1) then further through RE3 - RE1 to the receiver via the connection board in the transmitter.

TR1 is transforming the high aerial impedance down to the lower impedance of the receiver. This gives the receiver a improved sensitivity on short aerials.

5.2.1.3 SIMPLEX MODE. RECEIVE FREQUENCY EQUAL TO TRANSMIT FREQ.

In this mode, is the receiver using the tuning. which has been done by the transmitter. This will only take place after the transmitter has performed a tuning. This gives a perfect match of the aerial impedance to the receiver input impedance, this will improve the receiver sensitivity by approx. 10 dB.

5.2.2 TRANSMIT MODE

Here there are two different modes:

1. Straight trough
2. Tuning.

5.2.2.1 STRAIGHT TROUGH MODE.

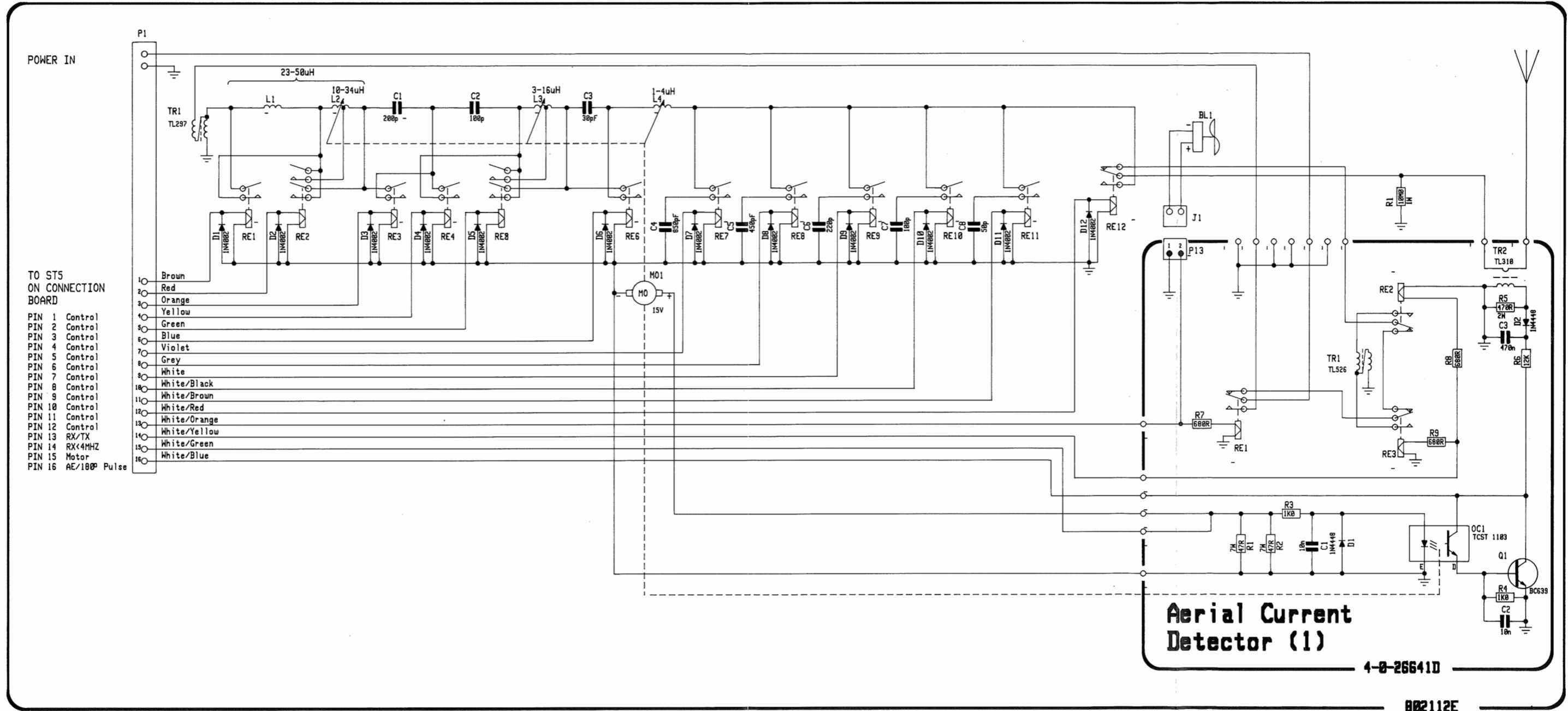
This mode is always selected as first choice by the TX-processor in the transmitter. In this mode the signal from the transmitter is feed trough RE1-RE3-RE4-RE2 to the aerial. This mode is used when the aerial impedance is 50 ohms.

5.2.2.2 TUNING MODE.

This mode is selected if the aerial impedance is different from 50 ohm. The tuning sequence is controlled by the TX-processor, please refer also to PART I paragraph 3.5.3 tuning the AT2112. RE1 and RE12 will always be activated in tune mode. The signal from the transmitter will be feed to TR1 and the impedance will be transformed to 12.5 ohm, this is the impedance for which the tuning circuit will tune.

MAIN SCHEMATIC DIAGRAM AT2112

4-0-26641D / 802112E



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6 PARTS LISTS

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6 PARTS LISTS

BASE UNIT AT2112			ECI A/S	702112	
POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
VARIOUS	CABLE AT2112		ECI A/S	0-0-27413	527413
VARIOUS			PADRE	Nr:30 Ø4x125mm B=4mm	66.526
-1	AERIAL CURRENT DET.MODULE	AT2112	ECI A/S	5-0-26641C / 4-0-26641D	626641
BL1	FAN 24VDC	80x80mm	ELINA FAN	HDF 8025L-24MB	60.050
C1	CAPACITOR CERAMIC	200pF 20% N470 5kVDC	LCC	WA04T00201M	18.065
C2	CAPACITOR CERAMIC	100pF 20% N33 5kVDC	LCC	WA04H00101M	18.050
C3	CAPACITOR CERAMIC	30pF 20% N33 5kVDC	LCC	WA03H00300M	18.015
C4	STAK CAPACITOR 850pF	AT150x	ECI A/S	STAKKOND.1 850pF	707779
C5	STAK CAPACITOR 450pF	AT150x	ECI A/S	STAKKOND. 2 450pF	707780
C6	CAPACITOR CERAMIC	220pF 20% N470 5kVDC	LCC	WA04T00221M	18.070
C7	CAPACITOR CERAMIC	100pF 20% N33 5kVDC	LCC	WA04H00101M	18.050
C8	CAPACITOR CERAMIC	50pF 20% N33 5kVDC	LCC	WA03H00500M	18.020
J1	RECEPTACLE (FEMALE)	2 POLE	AMP	0-826371-2	78.122
L1+L2	VARIOMETER I AT1500		ECI A/S	VARIOMETER 1	707756
L3	VARIOMETER II AT1500		ECI A/S	VARIOMETER 2	707757
L4	VARIOMETER III AT1500		ECI A/S	VARIOMETER 3	707758
MO1	MOTOR W. GEARBOX	C1065	MAXON	SP SPEC.: C1065	60.010
P1	PLUG		ECI A/S	KEJSERSTIK	707773
R1	RESISTOR HIGH VOLTAGE	10M OHM 10% 10kVDC	PHILIPS	2322 244 13106	06.050
RE1	RELAY	ORF1501	ECI A/S	ORF1501 SLUTTERELÆ	705051
RE2	RELAY ORF1503		ECI A/S	ORF1503 SLUTTER.m/HVILEK.	705068
RE3	RELAY	ORF1501	ECI A/S	ORF1501 SLUTTERELÆ	705051
RE4	RELAY	ORF1501	ECI A/S	ORF1501 SLUTTERELÆ	705051
RE5	RELAY ORF1503		ECI A/S	ORF1503 SLUTTER.m/HVILEK.	705068
RE6	RELAY	ORF1501	ECI A/S	ORF1501 SLUTTERELÆ	705051
RE7	RELAY	ORF1501	ECI A/S	ORF1501 SLUTTERELÆ	705051
RE8	RELAY	ORF1501	ECI A/S	ORF1501 SLUTTERELÆ	705051
RE9	RELAY	ORF1501	ECI A/S	ORF1501 SLUTTERELÆ	705051
RE10	RELAY	ORF1501	ECI A/S	ORF1501 SLUTTERELÆ	705051
RE11	RELAY	ORF1501	ECI A/S	ORF1501 SLUTTERELÆ	705051
RE12	RELAY	ORF1502	ECI A/S	ORF1502 SKIFTERELÆ	705061
TR1	TRANSFORMER	TL297	ECI A/S	6-0-22611	400297

AERIAL CURRENT DET.MODULE			AT2112	ECI A/S	5-0-26641C / 4-0-26641D	626641
POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.	
C1-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	KCK	RT-HE70 SK YF 103 Z	15.170	
C2-1	CAPACITOR CERAMIC	10nF -20/+80% CL2 50VDC	KCK	RT-HE70 SK YF 103 Z	15.170	
C3-1	CAPACITOR MKT	470nF 10% 63V	ERO*	MKT 1818-447/065	11.185	
D1-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147	
D2-1	DIODE HIGH SPEED	1N4448	PHILIPS	1N4448	25.147	
OC1-1	PHOTO INTERRUPTER		TELEFUNKEN	TCST 1103	32.521	
P13-1	PLUG	2 POLES	AMP	0-826375-2	78.102	
Q1-1	TRANSISTOR AF	NPN BC639 TO-92	PHILIPS	BC639	28.120	
R1-1	RESISTOR	47 OHM 5% 7W	PHILIPS	2322 329 07479	05.866	
R2-1	RESISTOR	47 OHM 5% 7W	PHILIPS	2322 329 07479	05.866	
R3-1	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 187 73102	02.472	
R4-1	RESISTOR MF	1k0 OHM 5% 0.33W	PHILIPS	2322 187 73102	02.472	
R5-1	RESISTOR PMF	470 OHM 5% 2W	PHILIPS	2322 194 13471	04.191	
R6-1	RESISTOR MF	12k OHM 5% 0.33W	PHILIPS	2322 187 73123	02.498	
R7-1	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195	
R8-1	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195	
R9-1	RESISTOR MF	680 OHM 5% 0.4W	PHILIPS	2322 181 53681	01.195	
RE1-1	RELAY	12VDC 1SH. 8A.	SCHRACK	RY S 12 012	21.031	
RE2-1	RELAY	12VDC 1SH. 8A.	SCHRACK	RY S 12 012	21.031	
RE3-1	RELAY	12VDC 1SH. 8A.	SCHRACK	RY S 12 012	21.031	
TR1-1	TRANSFORMER	TL526	ECI A/S	6-0-25867B	400526	
TR2-1	TRANSFORMER	TL310	BB	6-0-23162E	400310	