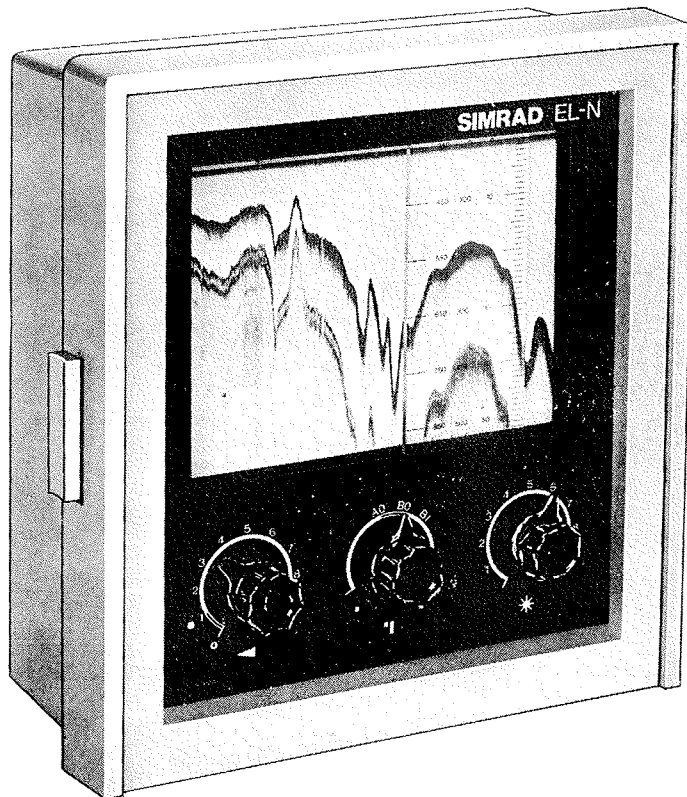


SIMRAD EL-N Navigation Sounder

SERVICE MANUAL

P1021E

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SIMRAD

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1. INTRODUCTION

1.1 GENERAL

SIMRAD EL-N is a modern echo sounder intended for coastal navigation. The Navigation Sounder provides accurate depth information down to 850 metres (425 fathoms) and meets IMCO specifications.

1.2 CABINET

The cabinet may be mounted on the bulkhead or in a panel, as required. The cabinet is splash proof and it is moulded in dyed polyester, armed by fibre glass. The main units in the cabinet are the recorder and the transmitter/receiver unit. The recorder is of the belt type with reversible paper cassette, designed for recording on dry echogram paper type T-16 which has a length 20 metres (65 ft) and a width 15.3 cm (6 in.). Paper speed, line density and duration per roll are given in the table 1.1. Varying with the choice of main range, the paper speed can be reduced to approximately half values by mechanical setting, as described in the maintenance section.

The echo sounder is delivered with easily replaceable scales in metres and fathoms. The recording speed is adapted to the chosen scale by means of a switch on the recorder unit, refer to the maintenance section.

1.3 TRANSDUCER

The best performance of SIMRAD EL is achieved by connecting the 10x20 cm transducer with 20x10° beam angles. It may, however, also be connected to a 10x10 cm transducer with 20x20° beam angles.

The transducer is delivered with plastic blister or steel blister, or for flushmounting in steel tank.

1.4 TRANSMITTER/RECEIVER DATA

Transmitter

Frequency 38 kHz
 Pulse power 100 watts
 Acoustic source level:
 10x10 cm transducer . . . 104 dB//1 µbar ref. 1 meter
 10x20 cm transducer . . . 107 dB//1 µbar ref. 1 meter
 Pulse duration 0.7 m.sec.

Receiver

Frequency 38 kHz
 Bandwidth 1.2 kHz
 Recording mode Normal
 TVG-ranges 3-250 meter, continuously adjustable to 3-50 metres
 Gain Continuously adjustable, approximately 30 dB.

1.5 POWER SUPPLY

SIMRAD EL-N is designed for operation from 12, 24 or 32 volt dc mains. It is connected for 32 volts at delivery. Setting for 12 or 24 volt supply is made by moving a plug on the converter board, as described in the installation section. For operation from 110 or 220 volt ac, a supplementary power unit must be utilized. SIMRAD may deliver Mascot type 7410 for 220 V or for 110 V ac on separate order. Voltage must be specified when ordering the power unit.

The power consumption is approximately 30 watts.

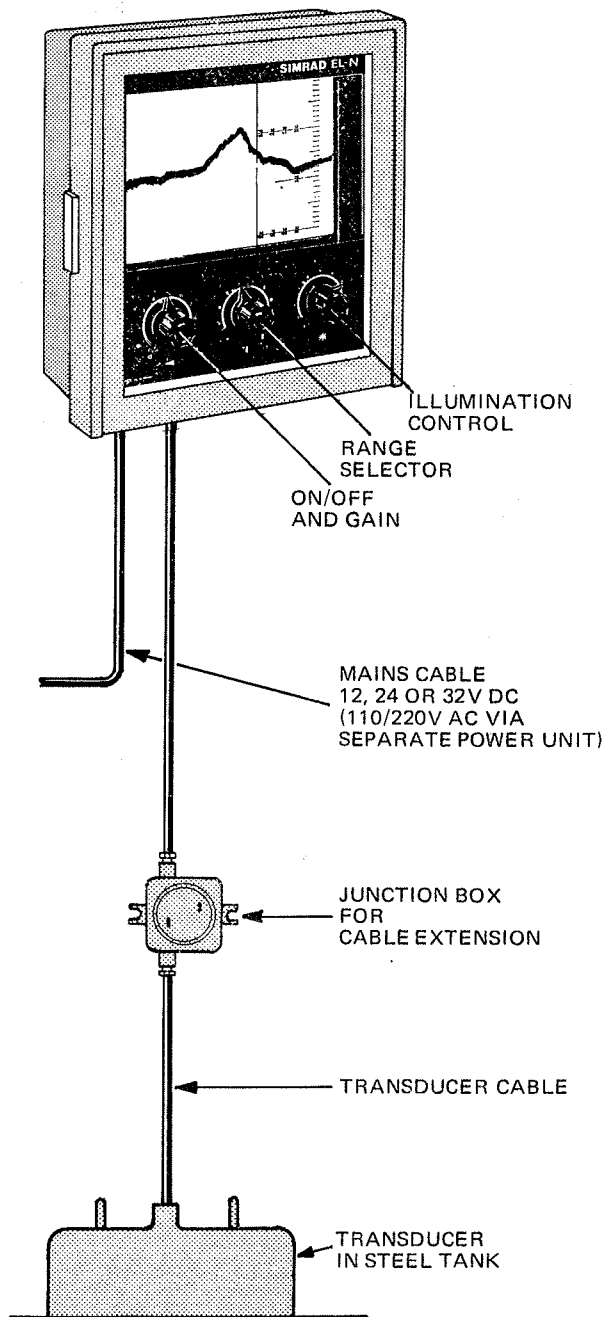


Figure 1.1 SIMRAD EL-N Navigation Sounder

1.6 MAIN UNITS

	Part No.
Cabinet	125 - 038343.0
Transducers, 10 x 20 cm:	
- type in steel tank	100 - 038681.3
- type 65T in steel blister	100 - 033039.9
- type 65R in plastic blister	100 - 022031.9
Transducers, 10 x 10 cm:	
- in steel tank	100 - 040027.5
- type 65S in steel blister	100 - 033027.7
- type 65K in plastic blister	100 - 018674.2
Transducer selectors:	
- 1 cabinet/2 transducers, panel mounting	299 - 036480.2
- 1 cabinet/2 transducers, bulkhead moun	299 - 021961.8
- 2 cabinets/2 transducers	299 - 021962.6
- 2 cabinets/1 transducer	299 - 021963.4
Junction box type TEF 2079	108 - 011790.3

EL-N Navigation Sounder	Meter version			Feet/fathom version		
	A0	B0	BI	A0	B0	BI
Depth ranges	0-50	0-500	350-850	0-150 feet	0-250 f	175-425 f
Pulse rate, pulses/min.	215	21.5		235	23.5	
Paper speed, mm/min.	14 (6.5)	1.4 (0.65)		15 (7)	1.5 (0.7)	
Duration per roll in hours	24 (51)	240 (510)		22 (47)	220 (470)	
Line density, lines/mm	16 (34)					

The figures in parenthesis are applicable when the recorder is set for the lowest paper drive speed.

Table 1.1 SIMRAD EL-N, recorder data

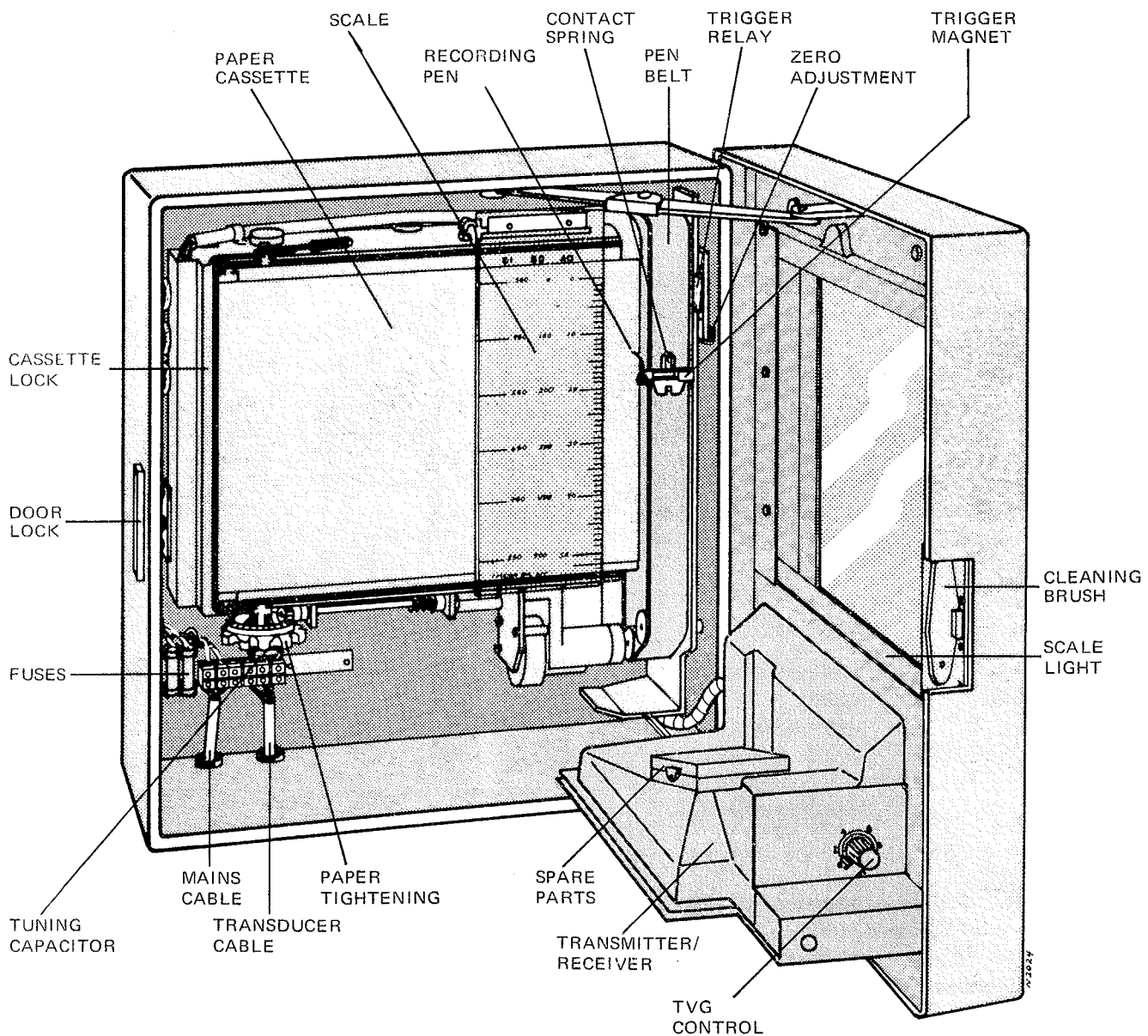


Figure 1.2 SIMRAD EL-N, cabinet interior

2. TECHNICAL DESCRIPTION

2.1 GENERAL

The SIMRAD EL-N cabinet contains the recorder unit with detachable paper cassette, and the transmitter-receiver unit. The recorder unit houses two printed circuit boards: the motor speed regulator and the dc/dc mains converter.

In addition comes the transducer unit with junction box if extra long cable is used. For other mains voltages than 12/24/32V dc a separate power unit will be incorporated.

A summary of important type designations are given in table 1 on page 7.

2.2 MECHANICAL DETAILS

The receiver-transmitter is located inside the cabinet door. It comprises a plug-in printed circuit board and separately mounted operating controls. The printed circuit board is held in place by three screws accessible from underneath the transmitter-receiver chassis. Test points are accessible without the use of an extension board.

The recorder unit comprises four main sections; the chassis, the reversible paper cassette, the driving unit, and the dc/dc mains converter. The latter can be divided in two parts: the printed circuit board connected by a multipole plug and the power transistor bracket to which the printed circuit board is attached with two screws. The driving unit consists of a separate chassis housing the recorder motor, the transmission unit with pen belt driving pulley and paper drive gear, pen belt, pen belt running pulley, the motor regulator printed circuit board, the reed trigger board, and the zero-line adjuster. The pen belt carries the recording pen, the contact spring and the reed trigger operating magnet. Apart from the paper cassette, the driving unit and the mains converter the recorder chassis carries the paper drive mechanism which through suitable gearing winds the paper cassette.

With constant speed of rotation the rubber roller, which is pressed against the magazine spool, maintains constant paper speed regardless of reduction in the paper spool diameter. On the take-up spool end, a friction coupling ensures winding up of the recording paper with constant force.

Note that the recorder unit provides the choice between two basic paper speeds, achieved by shifting the position of the rubber roller and thus changing the gear ratio, refer to table 1.1.

2.3 DESCRIPTION OF THE BLOCK DIAGRAM

The block diagram 824 - 038337.2 shows all circuits of SIMRAD EL-N, simplified by the use of block symbols. The

diagram is divided in five main sections:

- the dc/dc converter PCB 382 - 009398.9 with components numbers starting from 100,
- the transmitter-receiver PCB 382 - 009405.2 starting from 200,
- the motor regulator PCB 382 - 038333.1 starting from 300,
- the reed contact unit PCB 382 - 038333.1 starting from 300,
- the reed contact unit PCB 382 - 009231.2 starting from 400, and
- the cabinet-mounted components starting from 500.

Note that on the actual printed circuit board the first digit of the component number, i.e. the section number, is deleted.

For complete details regarding circuit connections etc. refer to the main circuit diagram 824 - 038337.2.

Dc/dc-converter, PCB 382 - 009398.9

The EL-N converter is designed for operation from 12, 24 or 34V dc mains, selectable by shifting the position of the multiconnector J102 on the converter board. For connection to 110 or 220V ac, a separate power supply unit is utilized.

The output voltages are +26 volts stabilized and +39 volts unstabilized, and the output power is maximum 40 watts. The converter comprises the integrated circuit IC101 and five transistors Q101 through Q105. IC101 operates as an astable multivibrator, the frequency of which is set to 21 kHz by means of the adjustment potentiometer R105. The square pulse output from IC101 is amplified in Q101 before being fed to the complementary driver transistors Q102 and Q103. The driver transformer T101 operates the output transistors Q104 and Q105.

The collector voltage of the output transistors is supplied through the transformer T102, which has tapings for 12, 24 and 32V dc operating voltage, selected as mentioned above. Proper operating current for the zener diode D102, which provides stabilized voltage for the astable multivibrator, is determined by the resistor network R116, R117 and R118. On the secondary of the output transformer T102 the rectifiers D105 and D106 provide 39V positive for the motor regulator, whereas stabilized 26V positive for the transmitter-receiver is supplied by Q106.

Note that the diode D101 (see circuit diagram 824 - 038336.4) short circuits the supply voltage if this is accidentally connected with the wrong polarity. Shortcircuit protection of the converter is provided by the transistor Q107.

Transmitter-receiver, PCB 382 - 009405.2

The transmitter comprises the monostable multivibrator Q207-Q208, the switching transistor Q206, the 38 kHz oscillator Q205 and the output transistors Q201 and Q202.

At each revolution of the pen belt, the reed trigger contacts S505 or S401-402-403 are operated by the permanent magnet on the recording pen (stylus) holder. The reed contacts are selected by means of the range selector S503, S505 providing the basic ranges (position I) and S401-402-403 providing the phased ranges (position II, III and IV).

Through operation of the reed contact the monostable multivibrator switches to its other state, cutting off the transistor Q206. The oscillator Q205 now operates for a period of approximately 0.8 milliseconds, until the multivibrator switches back to its stable state and again turns on Q206, thereby blocking the oscillator.

The output power is approximately 100 watts at a transducer impedance of 60 ohms.

The receiver comprises the following stages.

- the 38 kHz preamplifier Q216-Q217 and damping transistor Q215,
- the time-varied-gain circuit Q218-Q219,
- the 38 kHz active filter IC201 and wide band amplifier IC 202,
- the 48 kHz local oscillator Q209 and mixer Q210
- the 10 kHz active filter IC203 and lowpass amplifier IC202,
- the recorder amplifier IC204.

Note! The transistors Q211, Q212, Q213, Q214, Q220 and associated circuits are disabled.

Echo signals arriving from the transducer are applied across the 3-4 winding of input/output transformer T201. From the 1-2 winding, the signal is coupled via the tuned series circuit L201-C218-C219 to the preamplifier Q216-Q217. The coil L201 represents a high impedance to the transmitter pulse, as the capacitors C218 and C219 are virtually short-circuited by the diodes D201 and D202 during the transmission. In order to provide a stable zero line on the recording paper, the PNP transistor Q215 is brought into conduction by a negative 0.8 millisecond pulse from the transmitter multivibrator Q207-Q208, thus providing positive clamp for the transmitter pulse through the diode D208.

The positive-going trailing edge of the negative pulse from the transmitter multivibrator Q207-Q208, is fed to the TVG transistor Q219 which discharges the capacitor C224, bringing the gate potential of the field-effect transistor Q218 down to zero. Q218 forms a variable series resistor which is nonconductive at zero gate potential, providing an initial signal attenuation of approximately 50 dB (a parallel resistor of 2.2 M Ω now carries the signal current to the next stage alone). When Q218 is cut off, the capacitor C224 charges through the resistor R259 and the diodes D213-D212, towards a potential set by means of the TVG adjustment potentiometer R262. The attenuation time is determined by the setting of the TVG control R501, which in position 0 gives a time-varied-gain curve related to 30 log R.

After regulation by the TVG circuit Q218, the echo signal passes through an active filter. The center frequency of the filter is 38 kHz and the bandwidth 4 kHz at 3 dB-points.

At the output of the 38 kHz filter, the gain control R503 provides an adjustment range of 30 dB, before the echo signal is fed to the wide band amplifier IC202. A local oscillator signal of 48 kHz is introduced at the output of IC202 from Q209 via Q210, the resultant 10 kHz signal being filtered out by the active filter IC203. The lowpass amplifier following the 10 kHz filter is a smaller section of the integrated circuit IC202, tuned for an upper limiting frequency of 17 kHz. The signal output from the amplifier section IC202 is fed to the recorder amplifier IC204.

After amplification in the recorder amplifier IC204, the echo signal is coupled via the output transformer T204 to the recording pen. If required, the degree of blackness on the recording paper may be increased by strapping the series resistor R295.

Motor-regulator PCB 382 - 038333.1

Refer to circuit diagram no. 824 - 038764.7.

The EL-N recorder unit is operated by a 36 V dc-motor which provides two basic recording speeds through the setting of the two separate resistor networks R304/R305 and R306/R307.

Appropriate speed is adjusted by the factory according to meter readings providing the basic ranges of 0–50 metres and 0–500 metres.

If a fathom scale is installed, appropriate speed is achieved by moving the speed selector S301 from position "M" to "F".

Speed regulation is performed by use of an ac-tacho signal which is generated by an assembly of two magnetic resistors connected in a bridge circuit. Regulated voltages are supplied to the bridge circuit from the transistors Q301–Q302. The sinusoidal tacho signal with a frequency proportional to the motor speed is fed through the lowpass filter R302–C301 to IC301. The IC301 amplifies the tacho signal and provides a squarewave output (TP301) at twice the frequency of the sinewave input. Doubling of the sinewave frequency is of great importance and can be adjusted with R301. After frequency-doubling the signal triggers a monostable multivibrator (part of IC301), the resistor networks R304–R305 and R306–R307 and capacitor network C305–C306–C307 of which form the speed reference (C307 is disconnected by S301 when fathom scale is utilized). When in lock condition the monostable multivibrator produces pulse train with a duty cycle of 50%. The pulse train is filtered through a lowpass filter comprising a resistor which is part of IC301 and the capacitor C309.

The operational amplifier IC302 amplifies the dc-component of the signal whereas the ac-component (ripple) remains relatively constant.

The output from IC302 is then fed to a comparator which is part of IC301 and which produces a square wave signal with a duty cycle varying with the motor speed.

The square wave output is amplified by the darlington transistor Q303 before being fed to the armature winding of the dc-motor.

3. SERVICE

3.1 GENERAL

If trouble should occur in SIMRAD EL-N, always attempt to isolate the fault by a quick operational and visual check. Make sure that any apparent trouble is actually due to malfunction in the equipment and not improper control settings, expired battery, damaged transducer or similar causes.

Note that replacements and adjustments described in the Operating and Installation Manual are not included in this publication.

3.2 ORDERING PARTS

Apart from the stock number and a description of the required component, remember to include the name of the equipment, type designation and serial number.

Furthermore, the following should be noted:

- repairs are mainly based on unit replacements
- stock numbers of electrical components/units are given in the parts list
- stock numbers of mechanical units/parts are given on drawings N1911 and N1912 for the cabinet and the recorder unit respectively.

3.3 CONNECTIONS FOR SERVICE ASHORE

When SIMRAD EL-N is disconnected for repairs or adjustments ashore, the echo sounder may be put into operation by connections as shown in figure 3.1. With the illustrated set-up it is possible to measure the transmitter pulse and to apply test echoes.

Remember to remove the transducer tuning capacitor C501 as well as the recording pen. Disconnect the contact J301-9 in order to stop the recorder motor during receiver testing.

3.4 REPLACING PARTS

The printed circuit boards are intended for unit replacements, whereas associated components such as potentiometers etc. may be subject to individual replacements.

It is preferable to check the printed circuit boards by substitution, but if not on hand, the signals/voltages shown on the block diagram 824 - 038337.2 must be checked with an amplifier-voltmeter and an oscilloscope. The conditions for the measurements are notified on the diagram. Where single contacts are used the colour of leads are specified.

3.5 MISCELLANEOUS PARTS NUMBERS

UNIT	PART NO.
SIMRAD EL-N cabinet, complete	125 - 038343.0
Recorder unit, complete	300 - 038335.6
Scale in feet/fathoms	592 - 038379.4
Scale in metres	592 - 038378.6
Transmission unit	811 - 010356.4
Gear unit	811 - 010355.6
Recorder motor	330 - 038197.0
Motor brushes	379 - 021600.2
Motor regulator pcb	382 - 038333.1
Converter unit assembly	382 - 009177.7
Converter pcb	382 - 009398.9
Reed board pcb	811 - 010351.5
Pen belt assembly	529 - 010367.1
Recording pen	499 - 002162.6
Contact spring	379 - 010364.8
Paper cassette, complete	499 - 009122.3
Paper spool	609 - 002170.9
End disc	529 - 008973.0
Recording paper type T-16	600 - 001683.2
Transmitter-receiver pcb	382 - 009405.2
Cabinet less recorder unit	299 - 009528.1

REF. No.	U _{in} dB	U _{gen} mV	TEST POINT	APPROXIMATE VALUES	
				dB	mV/V
1	-100	2.2	TP202	-59	1.12 mV
2	-100	2.2	TP203	-39	11.2 mV
3	-120	0.22	TP204	-26	50 mV
4	-120	0.22	TP205	-28	40 mV
5	-130	0.07	TP206	-30	32 mV
6	-130	0.07	*J201/22-19	+ 30	32V

* Measured with 15 kΩ across the amplifier voltmeter
 SETTINGS: gain ◀ : 10, TVG ▲ : 0.

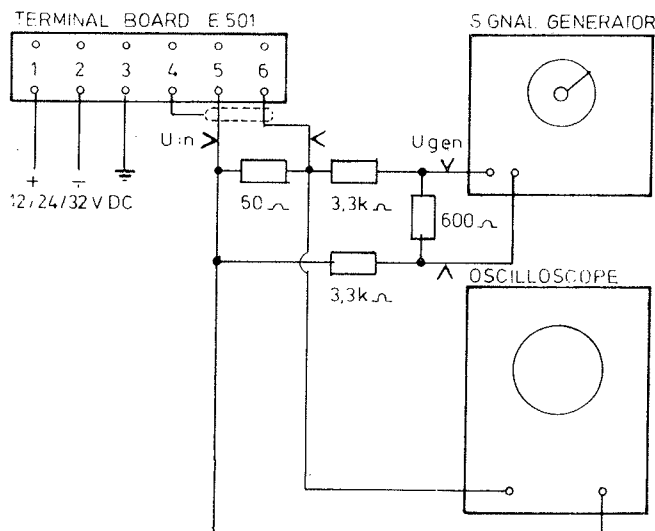


Figure 3.1 Connections for testing

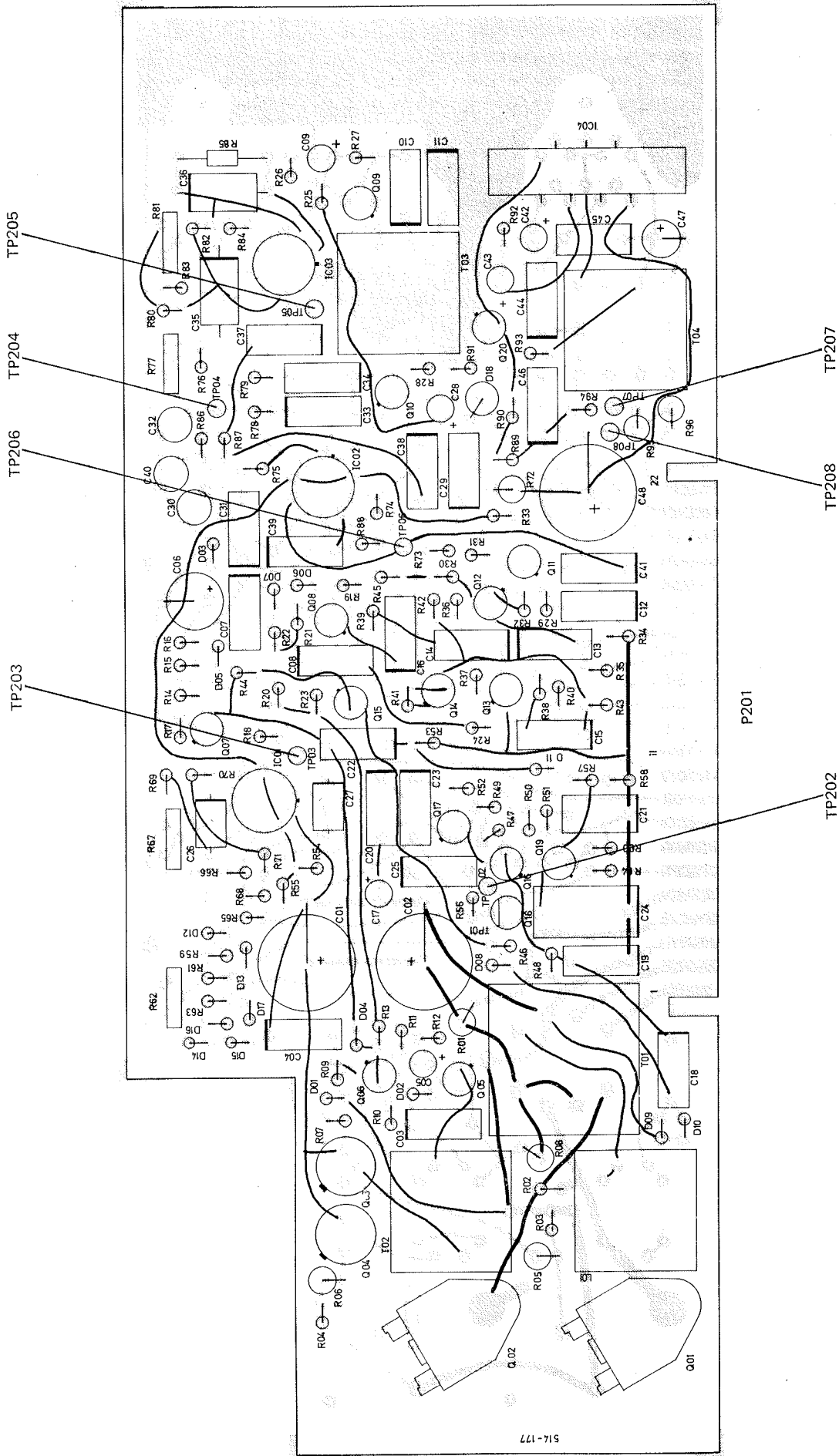


Figure 3.2 SIMRAD EL-N, transmitter-receiver PCB 382 - 009405.2. Test points and component layout.

PART NO.	QTY.	STOCK NO.	DESCRIPTION
			NOTE: Component types and values may be subject to minor changes without notice.
			PRINTED CIRCUIT BOARDS
	1	382 - 009231.2	Reed Board
	1	382 - 038333.1	Motor Regulator
	1	382 - 009398.9	Converter
	1	290 - 009399.7	Converter Heatsink
	1	382 - 009405.2	Transmitter/Receiver
			CAPACITORS
C501	1	212 - 018641.1	0.22 μ F \pm 10% Eromet MKT 1813--422/2
			TERMINAL BOARD
E501	1	371 - 009526.5	Weidmuller C.A.W. MK 3/12 2436.2
			FUSES
F501	1	251 - 022764.5	3.15A slow blow 6x31 mm For 24V and
F502	1	251 - 022764.5	3.15A slow blow 6x31 mm 32V operation
F501	1	251 - 022788.4	5 A slow blow 6x31 mm For 12V
F502	1	251 - 022788.4	5 A slow blow 6x31 mm operation
			SOCKETS
J101	1	370 - 022889.0	STOCKO MPF 304
J102	1	370 - 022887.4	STOCKO MGF 407
J104	1	370 - 022886.6	STOCKO MGF 409
J201	1	371 - 023020.1	MOLEX 09-02-222 Socket
	22	370 - 022892.4	MOLEX 08-30-0102 Terminal
J301	1	372 - 020111.1	AMP 160 321-2 (QTY. = 9)
J401	1	370 - 009380.7	SOCKET SIMRAD 9380
	9	379 - 019223.7	STOCKO RBF 5682
J402	1	372 - 020111.1	AMP 160 321-2 (Qty. = 3)
			LAMPS
LP501	1	250 - 023057.3	Taunuslicht TSL 7110 24V 50 mA
LP502	1	250 - 023057.3	Taunuslicht TSL 7110 24V 50 mA
LP503	1	250 - 023057.3	Taunuslicht TSL 7110 24V 50 mA

PARTS LIST

CIRCUIT DIAGRAM 824 - 038336.4
SIMRAD EL-N

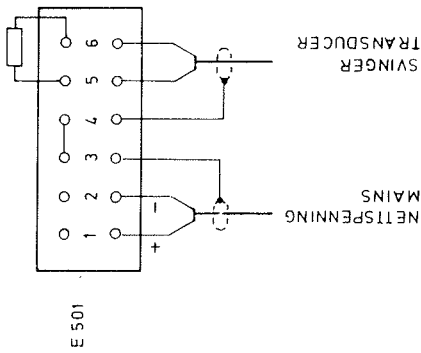
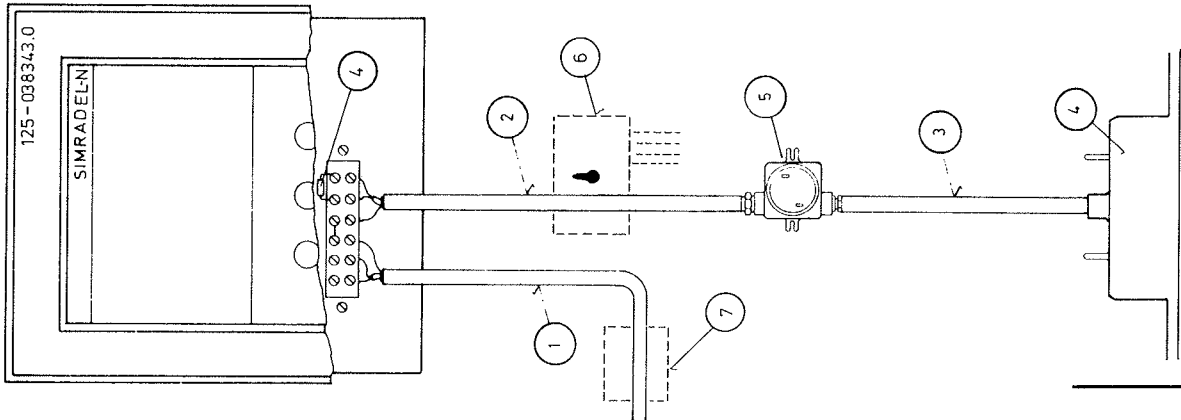


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		CONTR.	76.11.24	S.J.	
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		PAGE NO.	1	OF	2
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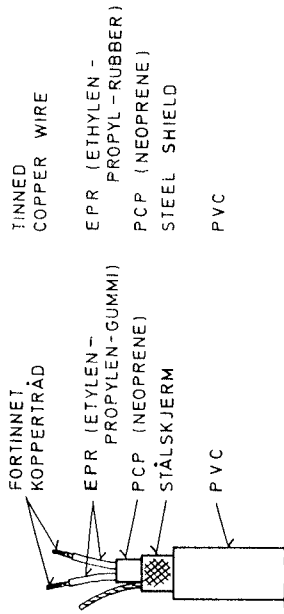
PART NO.	QTY.	STOCK NO.	DESCRIPTION
M501	1	330 - 038197.0	MOTOR Engel Type GNM 2145 ELR 36V, with Simrad tacho
R501	1	203 - 009555.4	RESISTORS Potmeter RUWIDO 802/25 k Ω Lin. Potmeter LESA RB1 470 Ω 4 W Potmeter RUWIDO 802/5 k Ω + log. 270 Ω 1/4 W \pm 5%
R502	1	203 - 038473.5	
R503	1	203 - 009557.0	
R504	1	201 - 021473.4	
S502	1	203 - 009557.0	SWITCHES AND SELECTORS On/off switch incl. gain control R503 Range selector Reed switch RIFA RBC 50201
S503	1	351 - 038514.6	
S505	1	352 - 019900.0	

PARTS LIST			CIRCUIT DIAGRAM 824 - 038336.4 SIMRAD EL-N		SIMRAD		
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- ④ AVSTEMNINGSKONDENSATOR : 0.22 μ F
TUNING CAPACITOR: 0.22 μ F



REF NO.	ANB. KABELT RECOMMENDED CABLE TYPE	DIM. mm ²	ANT. LEDERE NUMBER OF CORES	KABEL DIA. CABLE DIAMETRE mm	MERKNADER REMARKS
①, ②	RCCP 220V	1.5	2	13	
③	SPECIAL	2.5	2	12	LEVERES AV SIMRAD SUPPLIED BY SIMRAD



- ① MAINS CABLE. Power consumption approx. 30 W. Check dc polarity.
② ③ TRANSDUCER CABLE must be run separate from other electrical cables and preferably in a steel pipe.

- ④ SIMRAD EL-N is tuned for connection of the following type transducers:
65S, 10x10 cm in steel blister, reg. nr. 100 - 033021.7
65K, 10x10 cm in fibre glass blister, reg. nr. 100 - 018674.2
65T, 10x20 cm in steel blister, reg. nr. 100 - 033039.9
65R, 10x20 cm in fibre glass blister, reg. nr. 100 - 022031.9

When connecting a transducer with integral tuning capacitor:
10x10 cm in steel tank, reg. nr. 100 - 040027.5
10x20 cm in steel tank, reg. nr. 100 - 038681.3
the tuning capacitor across the sounder input terminals must be removed.

- ⑤ JUNCTION BOX. Shields of transducer cables should be interconnected — must not be grounded in the junction box.
NB! No tuning capacitor in the junction box.

- ⑥ SELECTOR UNIT. Supplied if more than one cabinet or one transducer are to be installed. NB! The shield must also be switched.

- ⑦ POWER UNIT. For connection to ac mains. SIMRAD may deliver Mascot type: 7410 for 220 V or 110 V. Voltage to be specified.

- ① NETTKABEL. Kraftforbruk maks. ca 30 W. Kontroller polariteten.
② ③ SVINGERKABEL. Må føres adskilt fra andre elektriske kabler og helst i eget rør.

- ④ SIMRAD EL-N er avstemt for tilkopling av følgende type svingere:
65S, 10x10 cm i stålsko reg. nr. 100 - 033021.7
65K, 10x10 cm i glassfibersko reg. nr. 100 - 018674.2
65T, 10x20 cm i stålsko reg. nr. 100 - 033039.9
65R, 10x20 cm i glassfibersko reg. nr. 100 - 022031.9

Ved tilkopling av svinger med egen avstemningskondensator:
10x10 cm i ståltank, reg. nr. 100 - 040027.5
10x20 cm i ståltank, reg. nr. 100 - 038681.3
må kondensatoren på loddets inngangsterminaler fjernes.

- ⑤ KOPLINGSBOKS TYPE TEF2079, reg. nr. 108 - 011790.3
Skjerm for svingerkabler sammenkoples, men må ikke jordes i koplingsboksen.
NB! Ingen avstemningskondensator i koplingsboksen.

- ⑥ VELGERENHET. Leveres dersom mer enn ett kabinet eller en svinger skal installeres. NB! Skjermen må også vendes.

- ⑦ KRAFTFORSYNINGSENHET. For tilknytning til vekselstrømsnett kan SIMRAD levere Mascot type 7410 for 220 V eller 110 V. Spenning må spesifiseres.

2175	0224	
NR.	SIGN	
ENDRINGS-MELDING		

MALEST	
TEGN	76.08.31. SE
KONTR	76.09.22 S. J.
GODKJ	76.09.23 ØS.

SIMRAD EL-N		824-036437.2 1
KABELPLAN		
CABLE PLAN		ARKIV NR.

