

**INSTALLATION MANUAL
FOR**

**ATIS ENCODER
WITH
AF MUTE FUNCTION**

TYPE NO.
728655

ATIS ENCODER WITH AF MUTE FUNCTION

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FOR YOUR INFORMATION

All information and illustrations in this manual are based on the information available when this manual was printed.

We make reservations concerning errors in this manual, and all specifications are subject to change without further notice.

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1 GENERAL INFORMATION

1.1 INTRODUCTION

The ATIS system, an abbreviation of **A**utomatic **T**ransmitter **I**dentification **S**ystem, has been developed by the Telecommunication Administrations of the Rhine border States and Belgium.

By the adoption of an amendment to the „Regional Convention of the Radiotelephone service on the Rhine (Munich 1976)“, it was decided that all mobile maritime VHF-transceivers must have an ATIS signal generator included. This unit will transmit a FSK-modulated identification signal, each time the transmitter has been keyed, or at least one time for each 5 minutes of continuous transmission.

To fulfil this requirement, S.P.Radio A/S has developed a general ATIS signalling module, which include an encoder as well as a decoder function. The decoder facility is used to mute out (or kill) received ATIS transmissions. This ATIS module may be incorporated in any of the VHF transceivers which are delivered, or formerly has been delivered, from S.P.Radio A/S.

1.2 TECHNICAL DATA

The technical performance for the ATIS-option is in accordance with the:

**PERFORMANCE SPECIFICATIONS FOR THE
AUTOMATIC TRANSMITTER IDENTIFICATION SYSTEM
FOR
VHF RADIOTELEPHONE INSTALLATIONS
USED IN THE RHINE RADIOTELEPHONE SERVICE**

as described in e.g. KSR 152.

Besides the module includes a FSK mute facility, or in popular language - an ATIS killer.

1.2.1 ATIS FSK MODULATION FACILITY

Technical specification :

GENERAL

Coding:	Based on CCIR Rec. 493 for DSC-systems and recommendation 7 of the Regional Rhine Agreement.	
Programming:	By means of S.P. RADIO VHF-transceiver RT2048	
Power supply:	12 V _{DC} -10% to +30%	
Power consumption:	Receive condition type.	15 mA
	Activetransmit cond.	30 mA
Temperature range:	-20°C to +55°C	
Dimensions app.:	Length:	55 mm
	Width:	32 mm
	Height:	15 mm
Weight:	20 gr.	

ENCODER

Modulation:	1700 Hz ± 400 Hz, 1200 Baud ± 30 ppm	
Output impedance:	Below 100 Ohm	
Output level:	Adjustable between 5 mVRMS and 200 mVRMS in a 200 Ohm load.	
PTT input:	Non-keyed condition 3.7 V < VIN-DC < 15.6 V	
	Keyed condition 0.0 V < VIN-DC < 0.9 V	
PTT output:	Open collector, I _{SINK,MAX.} 50 mA.	
PTT keyhold delay:	Max. 0.5 mSec.	

1.2.2 ATIS FSK DETECTION FACILITY

FSK detection:	CCIR Rec. 493 signal format.
Mute delay:	Typical 15 msec. Maximum 25 msec.
Mute release:	Maximum 80 msec.
Mute threshold:	Below receiver 12 dB SINAD level
Mute output:	5 V logic levels, active high and low.
Mute switch:	On resistance below 250 ohm
	Off resistance above 100 kohm

1.3 PRINCIPLE OF OPERATION

ATIS TRANSMISSION

When the transmitter has been keyed, and the operator release the PTT key, the ATIS takes over the VHF transmitter. The microphone signal is switched off, and the coded identification number - stored in the EEPROM - is transmitted as a FSK modulated signal.

The ATIS transmission takes about 300 mSec. When the ATIS processor has finished the transmission, the VHF transmitter key is released, and the VHF switches to its receiving mode.

MUTE OPERATION

When the transceiver is in its receiving mode, the channel is continuously monitored for a FSK signal. When a signal with the correct format is detected, a mute output for the receiver AF signal path will be active. The FSK signal is monitored continuously, so when the signal disappears the mute output is released. If PTT is pressed at power up, the mute facility is disabled.

TEST MODES

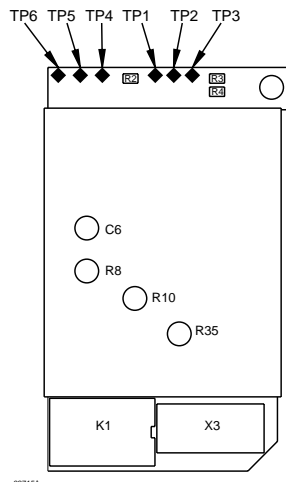
The ATIS module has two test mode input pins on the microcomputer.

If the test point TP1 is connected to ground, when the power supply is switched on, the transceiver will start to transmit a continuous "space" - tone (2100 Hz).

If the test point TP2 is connected to ground, when the power supply is switched on, the transceiver will start to transmit a continuous "mark" - tone (1300 Hz).

If the both test points TP1 and TP2 is connected to ground, when the power supply is switched on, the transceiver will start to transmit a continuous dot pattern (alternating 1300 Hz and 2100 Hz tones).

The test mode can only be stopped by switching off the equipment.



2 INSTALLATION

When an ATIS option is build into a VHF transceiver, two steps must be carried out; the ship call sign must be programmed into the ATIS module, and the module must be connected to the internal signal path's of the transceiver. The procedure for doing these steps, for different kinds of transceivers, are described below.

2.1 PROGRAMMING OF SHIP IDENTITY (Call Sign)

The ATIS module must be programmed with the Ship-ID number before installation. The programming must be done by means of a RT2048 (with a microcomputer of revision level **C1106 or higher**).

Programming procedure in RT2048 :

1. Insert the ATIS-module into the RT2048 for programming.
2. Insert jumper to select service mode on RT2048.
3. Press PTT switch on hook
4. Turn on the VHF transceiver RT2048.
5. Release PTT.
6. Open for the programming facility, by enabling the ATIS module as described on pages 9 and 10 in the RT2048 Identity and Service Programming Manual (SI-manual).
7. Program the Ship-ID number by means of service program **E**, as described in the SI-manual pages 30 and 31.
8. Switch off the transceiver, remove the service jumper; and the ATIS-module if it shall be installed in another transceiver.

Programming example:

The Ship-ID number consist of a three digit country code, MID-number as per RR App. 43, and a ship call sign with two characters and four digits.

The ship call sign must be converted to a six digit ship code, before programming. This is done by converting the second character of the ship call sign to a two digit code, as per the table shown below. These two digits are inserted between the country code digits (MID - number), and the four digits in the ship call sign.

Call sign prefix conversion table:

A	- Alfa	01	N	- November	14
B	- Bravo	02	O	- Oskar	15
C	- Charlie	03	P	- Papa	16
D	- Delta	04	Q	- Quebec	17
E	- Echo	05	R	- Romeo	18
F	- Foxtrot	06	S	- Sierra	19
G	- Golf	07	T	- Tango	20
H	- Hotel	08	U	- Uniform	21
I	- India	09	V	- Victor	22
J	- Juliett	10	W	- Whiskey	23
K	- Kilo	11	X	- X-ray	24
L	- Lima	12	Y	- Yankee	25
M	- Mike (Majk)	13	Z	- Zulu	26

I.e. a **Dutch** (MID-number 244) ship with call sign **SP2048**, should be programmed with the following number:

M I D P 2 0 4 8
2 4 4 1 6 2 0 4 8

with the digit **2** entered as the first digit, and digit **8** as the ninth and last digit.

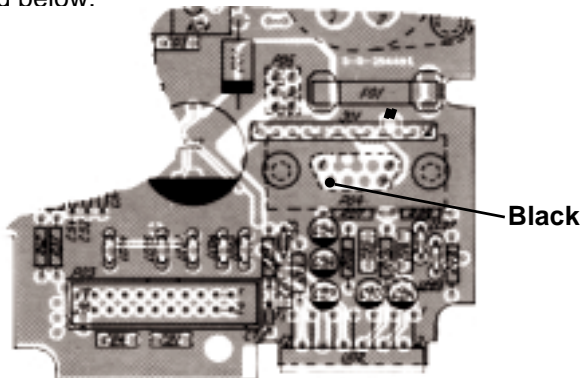
2.2 INSTALLATION OF ATIS MODULE IN RT2048 (728655)

The ATIS module fits directly into the mating socket on the Rx/Tx-board in the RT2048.

Programming of the ship-ID number can be done directly from the keyboard on the RT2048, when service mode are selected. The microcomputer in the RT2048, used for programming, **must** be of revision **C1106 or higher**.

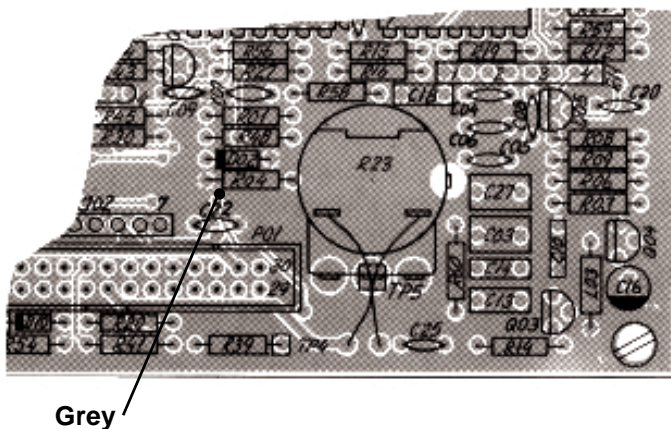
Installation of ATIS module :

1. Remove cover of the RT2048.
2. Remove metal shield above the Rx/Tx module.
3. Cut away the printed short-circuit between pin no.'s 9 and 10 in J01, as shown on the drawing below.



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4. Remove the screw in the Rx/Tx board indicated on the drawing above.
5. Reduce the length of the black wire, in the ribbon flat cable, to app. 8 cm. Connect, by soldering, the black wire to the solder point of pin 6 on P04 (See section of Rx/Tx board above).
6. Insert the ATIS-module into the 12 pole connector J01.
7. Fasten the ATIS-module by means of the enclosed screw, **with the enclosed brass spacer inserted between the ATIS-module and the Rx/Tx module.**
8. Connect, by soldering, the grey wire in the ribbon flat cable to the plated through hole beside C22 on the Interface Unit Module, as shown on the section shown below.
9. Cut away the 8 unused wires in the ATIS flat cable.



Alignment of ATIS module :

The ATIS-module with SP no. 728655, are factory adjusted to suit the standard adjustment of the RT2048 and RT2047/D.

This means that the AF-output level from the module is adjusted to produce a modulation index of 1, when the microphone input sensitivity are adjusted to 100 mVRMS ($f_{\text{Modulation}} = 1 \text{ kHz}$ and $\Delta f = 3 \text{ kHz}$). And the threshold for the input to the FSK detector is adjusted for proper detection.

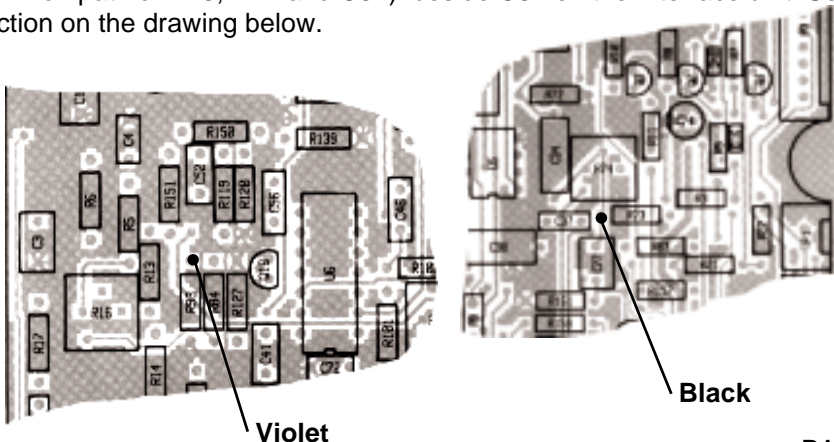
However, if necessary, a performance check and/or module alignment may be carried out as described in the service section 3.

2.3 INSTALLATION OF ATIS MODULE IN RT2047/D

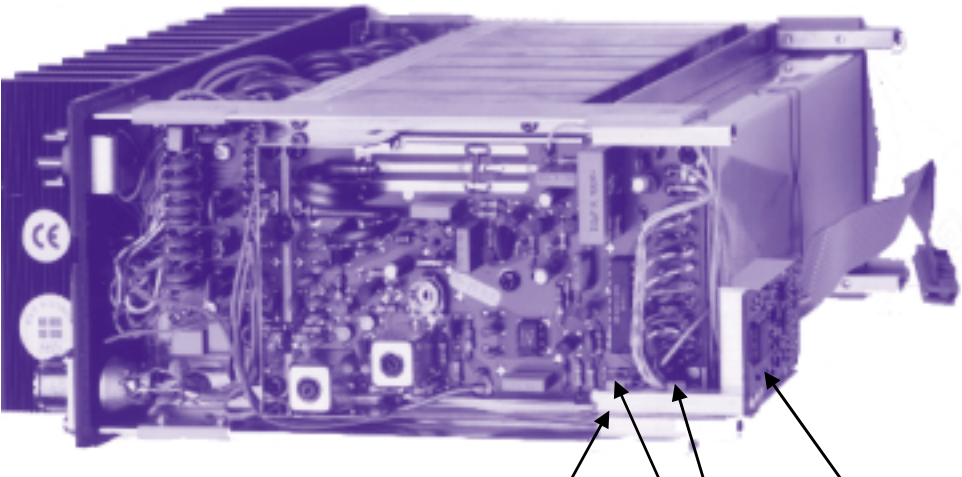
Before installation in RT2047/D, the ATIS module must be programmed with the appropriate call sign. For programming information see part 2.1.

Remove the front plate and the cabinet of the RT2047/D.

1. Assemble the ATIS module with spacer, insulation plate etc. Look at the photo shown below.
Mount the 10 pole ribbon flat cable plug on the ATIS module socket.
2. Remove the blue wire between Mic. plug J803/4 and P19 on the Filter unit (Mic. signal in).
3. Solder the blue wire in the ATIS flat cable to the solder lug P20 (Microphone) on the Filter unit where the blue wire was removed.
4. Solder the red wire in the ATIS flat cable to the solder lug P26 (+ 13V) on the Filter unit, with the existing orange/brown wire.
5. Solder the orange wire in the ATIS flat cable to the solder lug P2 (- 13V) on the Filter unit, with the existing black wire.
6. Solder the yellow wire in the ATIS flat cable to the solder lug P22 (Key) on the Filter unit, with the existing brown wire.
7. Cut away the green wire on the ATIS flat cable near to the plug.
8. Solder the brown wire in the ATIS flat cable to the handset connector plug J803/4 (Microphone), instead of the blue wire which was removed.
9. Solder the violet wire in the ATIS flat cable to the end terminal of R93 (the common path of R93, R84 and Q18) beside C52 on the Interface unit. See the section on the drawing below.
11. Cut away the grey and the white wire on the ATIS flat cable near to the plug.
12. Solder the black wire in the ATIS flat cable to the end terminal of R73 (the common path of R73, R74 and C34) beside C37 on the Interface unit. See the section on the drawing below.



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501571

Isulationplate

ATIS module

Plastic screws

3 SERVICE

3.1 PERFORMANCE CHECK OF ATIS MODULE

The ATIS option, do not need any special maintenance. However the reference oscillator, which secure a correct baud-rate, should be checked if the VHF transceiver undergoes a normal service check. Likewise, the modulation index for an ATIS transmission should be checked.

The procedures to be carried out are described below.

Adjustment of baud-rate ref.-oscillator:

1. Connect a power attenuator to the RF connector of the VHF transceiver.
2. Connect test points TP1 **and** TP2 ground.
3. Turn on the transceiver, and a continuous transmission of a dot pattern will start.
4. Connect a frequency counter to TP5.
5. Adjust trimming capacitor C6, through the trimming hole in the metal cover, until the measured frequency equals $600 \text{ Hz} \pm 0.01 \text{ Hz}$.

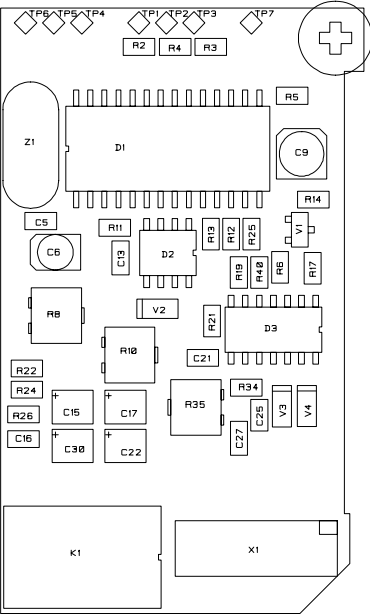
Adjustment/check of modulation index:

1. Connect the VHF transceiver to a modulation meter.
2. Connect TP1 to ground.
3. Turn on the transceiver. The transmitter will automatically be keyed and at the same time modulated with the „Space“ frequency of 2100 Hz.
4. Check that the frequency deviation equals $2.1 \text{ kHz} \pm 100 \text{ Hz}$. If necessary, adjust the Tx-AF output level trimming potentiometer (R8) through the hole in the metal cover, until the frequency deviation falls inside the limits.
5. Turn off the transceiver.
6. Connect TP2 to ground.
7. Turn on the transceiver. The transmitter will automatically be keyed and at the same time modulated with the „Mark“ frequency of 1300 Hz.
8. Check that the frequency deviation equals $1.3 \text{ kHz} \pm 130 \text{ Hz}$. If necessary, adjust the Tx-AF output level trimming potentiometer (R8) through the hole in the metal cover, until the frequency deviation falls inside the limits, repeat steps 2, 3 and 4.

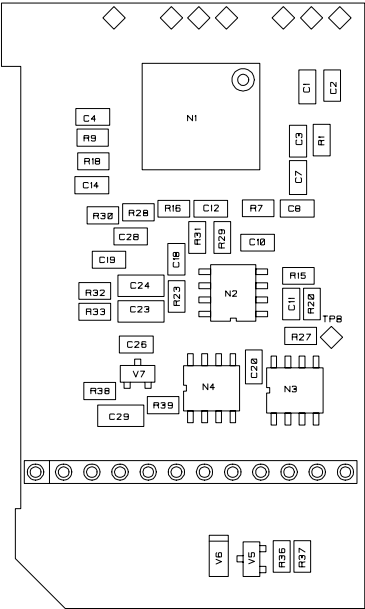
Adjustment of FSK detector (“killer”) input level:

1. Connect the VHF receiver to a generator able to transmit a continuous dot pattern (I.e. an ATIS module or a VHF DSC receiver modem RM2042).
2. Turn the trimming potentiometer R35 fully counter clock wise, the dot pattern alternating tones should be heard in the loudspeaker.
3. Turn the trimming potentiometer R35 clock wise until the VHF receiver AF output is muted. Turn the potentiometer slightly further clock wise.

4 COMPONENT LOCATION ATIS ENCODER



View from component side
with upper side tracks.
PCB rev. 28655F



View from soldering side
with lower side tracks.

5 PARTSLIST

ATIS ENCODER WITH AF MUTE FUNCTION

ATIS w. KILLER RT2048			ECI A/S	0-0-28655	728655
POSITION	DESCRIPTION		MANUFACTUR	TYPE	PART NO.
VARIOUS -7	CABLE 10 POL L=400mm ATIS SUPPRESSOR UNIT		ECI A/S ECI A/S	3-0-32616A 5-0-28655E / 4-0-28655G	532616 628655
ATIS SUPPRESSOR UNIT			ECI A/S	5-5-28655F / 4-0-28655G	628655
POSITION	DESCRIPTION		MANUFACTUR	TYPE	PART NO.
C1	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C2	CAPACITOR CERAM. SMD 0805	18pF 5% NPO 50VDC	TDK	C2012 COG 1H 180 J T	323.077
C3	CAPACITOR CERAM. SMD 0805	220pF 5% NPO 50VDC	TDK	C2012 COG 1H 221 J T	323.090
C4	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C5	CAPACITOR CERAM. SMD 0805	15pF 5% NPO 50VDC	TDK	C2012 COG 1H 150 J T	323.076
C6	CAPACITOR TRIMMER SMD	4.5-20pF NPO	SCIMAREC	TC03C200ATP02 ID: RED	335.008
C7	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C8	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C9	CAPACITOR ELECTROLYTIC SMD	10uF 20% 16VDC	EUROPE CHEMICON	AL-CHIP-MKV 16V/10 M	333.079
C10	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C11	CAPACITOR CERAM. SMD 0805	330pF 5% NPO 50VDC	TDK	C2012 COG 1H 331 J T	323.092
C12	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C13	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C14	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C15	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C16	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C17	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C18	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C19	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C20	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C21	CAPACITOR CERAM. SMD 0805	1n0F 10% X7R 50VDC	MURATA	GRM40 X7R 102 K 50 PT	328.324
C22	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
C23	CAPACITOR CERAM. SMD 1206	3n9F 5% NPO 50VDC	MURATA	GRM42-6COG392J 50PT	324.105
C24	CAPACITOR CERAM. SMD 1206	3n9F 5% NPO 50VDC	MURATA	GRM42-6COG392J 50PT	324.105
C25	CAPACITOR CERAM. SMD 0805	10nF 10% X7R 50VDC	MURATA	GRM40 X7R 103 K 50 PT	328.336
C26	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C27	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C28	CAPACITOR CERAM. SMD 0805	100nF 10% X7R 25VDC	MURATA	GRM40 X7R 104 K 25 PT	328.348
C29	CAPACITOR CERAM. SMD 1206	1u0F -20/80% Y5V 16VDC	MURATA	GRM42-6 Y5V 105 Z 16 PT10	328.806
C30	CAPACITOR TANTALUM 3528	2u2F 20% 16VDC	ERO	CB 225020 M E17	334.028
D1	PROGRAMMED PROCESSOR	C1141	ECI A/S	0-0-32590 / C1141B	732590
D2	EEPROM 1k BIT SERIAL	NM93C46, XL93LC46	NATIONAL	NM 93C46 M8X	356.350
D3	SCHMITT-TRIGGER INVERTER	S 74HC14	TEXAS*	SN74HC14DR	355.213
K1	RELAY DPDT	12VDC/1ADC	MEISEI	P-12	21.074
N1	1200 bps FSK MODEM	MSM6927	OKI	MSM6927GS-K	356.620
N2	DUAL LOW POW. OP AMP	LM358	MOTOROLA	LM358D R2 (LM358AD R2)	350.525
N3	VOLTAGE REG. ADJUSTABLE Io=0.1A,	LP2951C	NATIONAL	LP2951CM (LP2951ACM)	350.050
N4	VOLTAGE REGULATOR FIXED 5V/0.1A	78L05A	MOTOROLA	MC78L05ACD R2	350.100
R1	RESISTOR SMD 0805	1M0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 105	302.084
R2	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R3	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R4	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R5	RESISTOR SMD 0805	680 OHM 5% 0.1W	ROHM	MCR 10 EZH J 681	302.046
R6	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R7	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R8	PRESET SEALED	50k OHM 20% 1/4W	BOURNS	3314J-1-503-E(G)	310.411
R9	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.068
R10	PRESET SEALED	50k OHM 20% 1/4W	BOURNS	3314J-1-503-E(G)	310.411
R11	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R12	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R13	RESISTOR SMD 0805	1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048
R14	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R15	RESISTOR SMD 0805	1M0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 105	302.084
R16	RESISTOR SMD 0805	68k OHM 5% 0.1W	ROHM	MCR 10 EZH J 683	302.070
R17	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R18	RESISTOR SMD 0805	47k OHM 5% 0.1W	ROHM	MCR 10 EZH J 473	302.060
R19	RESISTOR SMD 0805	1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048
R20	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R21	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060

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POSITION	DESCRIPTION		MANUFACTOR	TYPE	PART NO.
R22	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R23	RESISTOR SMD 0805	82k OHM 5% 0.1W	ROHM	MCR 10 EZH J 823	302.071
R24	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R25	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R26	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R27	RESISTOR SMD 0805	1k0 OHM 5% 0.1W	ROHM	MCR 10 EZH J 102	302.048
R28	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R29	RESISTOR SMD 0805	27k OHM 5% 0.1W	ROHM	MCR 10 EZH J 273	302.065
R30	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R31	RESISTOR SMD 0805	2k7 OHM 5% 0.1W	ROHM	MCR 10 EZH J 272	302.053
R32	RESISTOR SMD 0805	39k OHM 5% 0.1W	ROHM	MCR 10 EZH J 393	302.067
R33	RESISTOR SMD 0805	68k OHM 5% 0.1W	ROHM	MCR 10 EZH J 683	302.070
R34	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R35	PRESET SEALED	5k0 OHM 20% 1/4W	BOURNS	3314J-1-502-E(G)	310.408
R36	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R37	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R38	RESISTOR SMD 0805	10k OHM 5% 0.1W	ROHM	MCR 10 EZH J 103	302.060
R39	RESISTOR SMD 0805	100k OHM 5% 0.1W	ROHM	MCR 10 EZH J 104	302.072
R40	RESISTOR SMD 0805	0 OHM 2A	ROHM	MCR 10 EZH JUMPER	302.000
V1	TRANS. AF SMALL SIGNAL NPN,	BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
V2	DIODE SWITCH HIGH SPEED	PMLL4148, 4446, 4448	PHILIPS	PMLL4148(4446)/(4448)	83710000
V3	DIODE SWITCH HIGH SPEED	PMLL4148, 4446, 4448	PHILIPS	PMLL4148(4446)/(4448)	83710000
V4	DIODE SWITCH HIGH SPEED	PMLL4148, 4446, 4448	PHILIPS	PMLL4148(4446)/(4448)	83710000
V5	TRANS. AF SMALL SIGNAL NPN,	BC848B	MOTOROLA	BC848BLT1 (T3)	345.048
V6	DIODE SWITCH HIGH SPEED	PMLL4148, 4446, 4448	PHILIPS	PMLL4148(4446)/(4448)	83710000
V7	TRANSISTOR N-CH.J-FET	SOT-23 SST310,MMBFJ310	NATIONAL	MM BfJ 310	84760200
X1	SOCKET PCB VERSION	2x5 POLES u-MATCH	AMP	1-215079-0	78.194
X2	1/10" SOCKET STRIP	12 POLES	ADV.INTERCONNECKSS	012-85 T G	78.817
Z1	CRYSTAL	3.579545MHz 50ppm	NDK	LN-P-0002-3.579545MHz	39.767