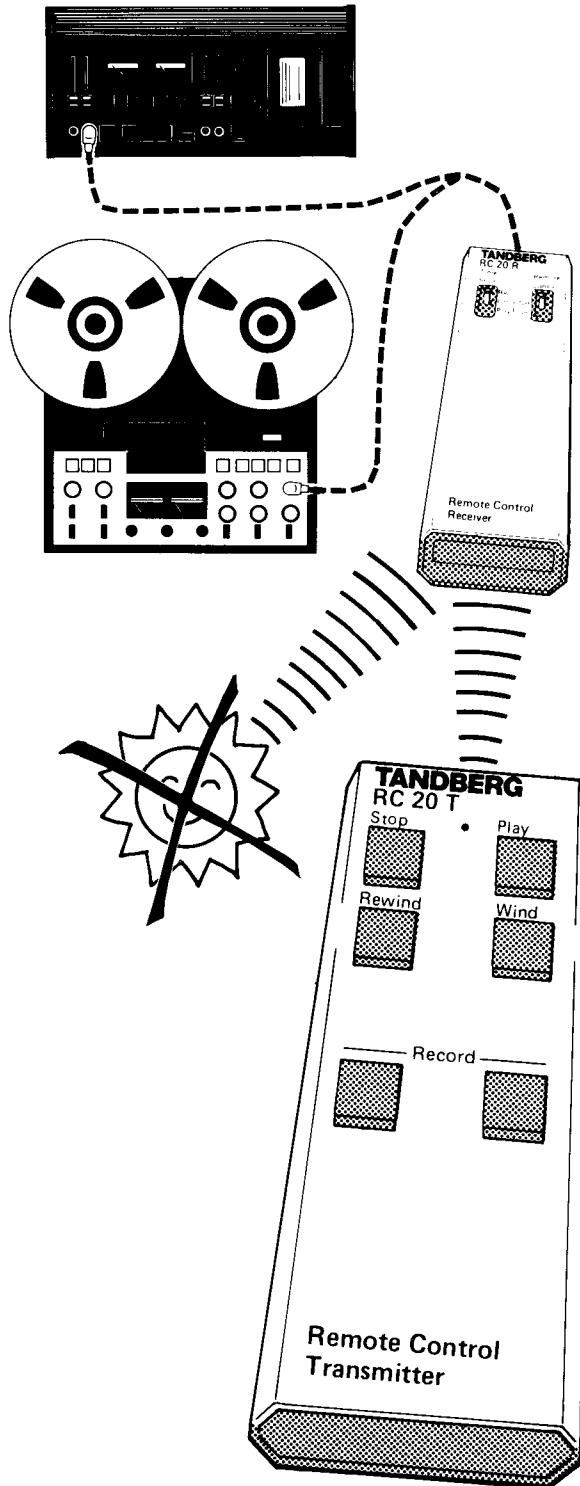


# TANDBERG

## Remote Control RC 20

### Service Manual



## Remote Control Unit RC 20

The RC 20 remote control system uses a cordless, infra-red unit to control the latest Tandberg tape and cassette decks.

The system consists of a battery-driven transmitter, and a receiver which is connected to and gets its supply voltage from the tape/cassette deck.

The RC 20 transmits information with the aid of infra-red light (IR light) which is invisible to the human eye.

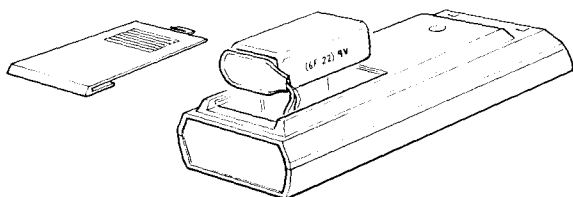
### The transmitter unit RC 20T

#### Battery life

The current consumption for the transmitter during use is 12 mA approximately. The battery has a capacity of about 200 mA hours. So the battery will transmit continuously for about 17 hours.

#### Mechanical dismantling

The transmitter is held together by two screws. One of these screws is located under the battery.



#### Electrical description

- The electronics in the transmitter consists of two circuit boards, one board for the push buttons (A1-1) and one board for the IR unit (A1-2).
- The heart of the transmitter is a MOS device SAB 3210 (U1).
- When the push buttons are operated, the transmitter is activated and current is applied to U1.
- The oscillator frequency is about 43 kHz and it is given by L1, C2 and C3.
- The IR output, pin 8, is now active and the command signals are applied to the base of Q2.
- Transistor Q2 is a buffer the output IR, pin 8, and the current generator consisting of CR4, Q3, R8, and R9.
- The purpose of the current generator is to regulate the current through the infra-red light-emitting diodes to about 1.3 A in each pulse.

**NOTE!** The transmitter must not be operated with diode CR4 disconnected. If it is operated with CR4 disconnected, a heavy current will flow through diodes CR1 – CR3 and they will be destroyed.

- CR4, which is a red light-emitting diode, will flash in step with the current through diodes CR1 – CR4.
- The IR signal consists of one start-bit and six information bits. An overview of the pulse sequence is given in table 1.

Transmitter – RC 20T		Receiver – RC 20R								
Control operated	Bit sequence at the output of U1, pin 8 (transmitter)	Logic levels at the outputs of U1 (receiver)				Logic levels at connector pin No.:				
		A	B	C	D	1	2	4	5	7
Wind and Rewind		0	0	0	0	1	1	0	0	1
Stop		1	0	0	0	1	0	1	1	1
Stop and Wind										
Stop and Rewind										
Stop and Play		0	1	0	0	1	0	1	1	0
Rewind		0	0	1	0	1	1	0	1	1
Record (both)		1	0	1	0	0	1	1	1	0
Play		0	1	1	0	1	1	1	1	0
Wind		0	0	0	1	1	1	1	0	1

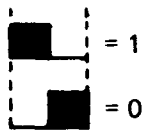


Table 1

## Receiver unit RC 20R

### Functional description

The receiver has two main functions:

- One function is to convert the IR light from the transmitter to electrical signals which operate the tape deck according to a system of command signals.
- The second function is to select (with the aid of other controls) whether the tape deck goes over to Play or Record when a Timer is used. A Timer switches on the power to the tape deck automatically at a chosen time.

### Electrical description

- The IR amplifier is located on the top circuit board (A2–1) in the receiver unit.
- The receiver diode CR1 is very sensitive to IR light and the diode is equipped with an optical filter which makes it insensitive to visible light.

The circuit is designed to suppress 100/120 Hz light from incandescent lamps. This is important since tape decks are often used near to strong artificial light. An incandescent lamp radiates 30% of its power within the sensitive spectrum of CR1.

## The Decoder

- The heart of the decoder is U1 a MOS integrated circuit, type SAB 3209, which has a built-in clock. The clock frequency is about 43 kHz and it is determined by L1, C1, and C2.
- In this application special programmable outputs are used – A, B, C, and D. The levels at these outputs for the different modes of operation are shown in table 1.
- Logic circuits U2 to U6 provide the interface between U1 and the Remote Control input on the tape deck. All the line outputs terminate in gates in U6.
- Table 2 shows which remote control outputs are activated when particular buttons are pressed. Active outputs mean that they go to logic low (0), between about + 0.1 V and + 0.3 V.
- Diodes CR3 and CR4 provide an extra function which sends the Play output to low (0) when the Record button is operated.

Button operated on the transmitter	Output activated in the receiver
PLAY	PLAY
STOP	STOP
WIND	WIND
REWIND	REWIND
RECORD* (both)	RECORD and PLAY
WIND and REWIND	WIND and REWIND
STOP and WIND	STOP and PLAY**
STOP and REWIND	STOP and PLAY**
STOP and PLAY	STOP and PLAY**

*Overview of the relation between operation buttons and remote control outputs*

- \* When the Record button is pressed, both the Record and Play outputs will always be activated. This avoids the need for a separate button on the transmitter for the "flying start record" facility. If both Rec. Select buttons are in the Off position and the Record buttons on the transmitter are operated, the tape deck will remain in the Stop mode. If the Record buttons are released the tape deck will go into the Play mode.
- \*\* This combination at the output is used only on individual models.

## Fault finding tips

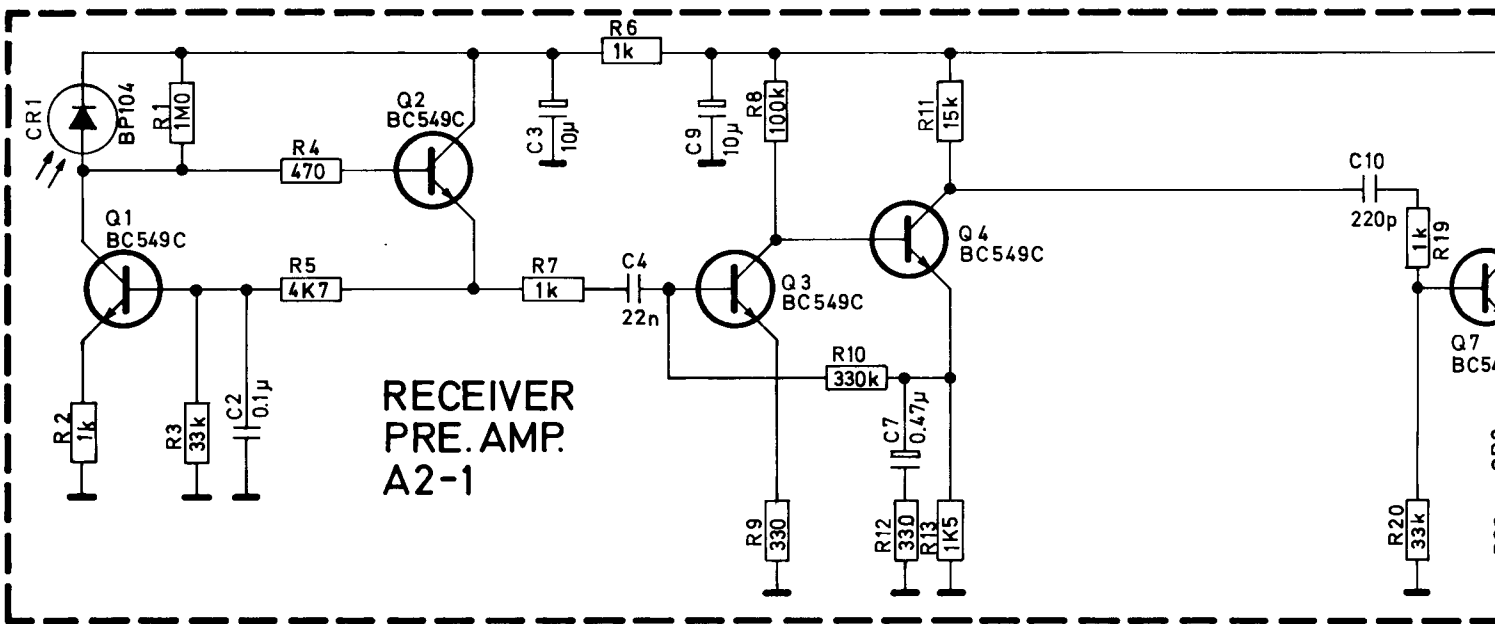
Equipment required: Oscilloscope, frequency counter, voltmeter, high impedance measurement probe.

### Transmitter RC 20T

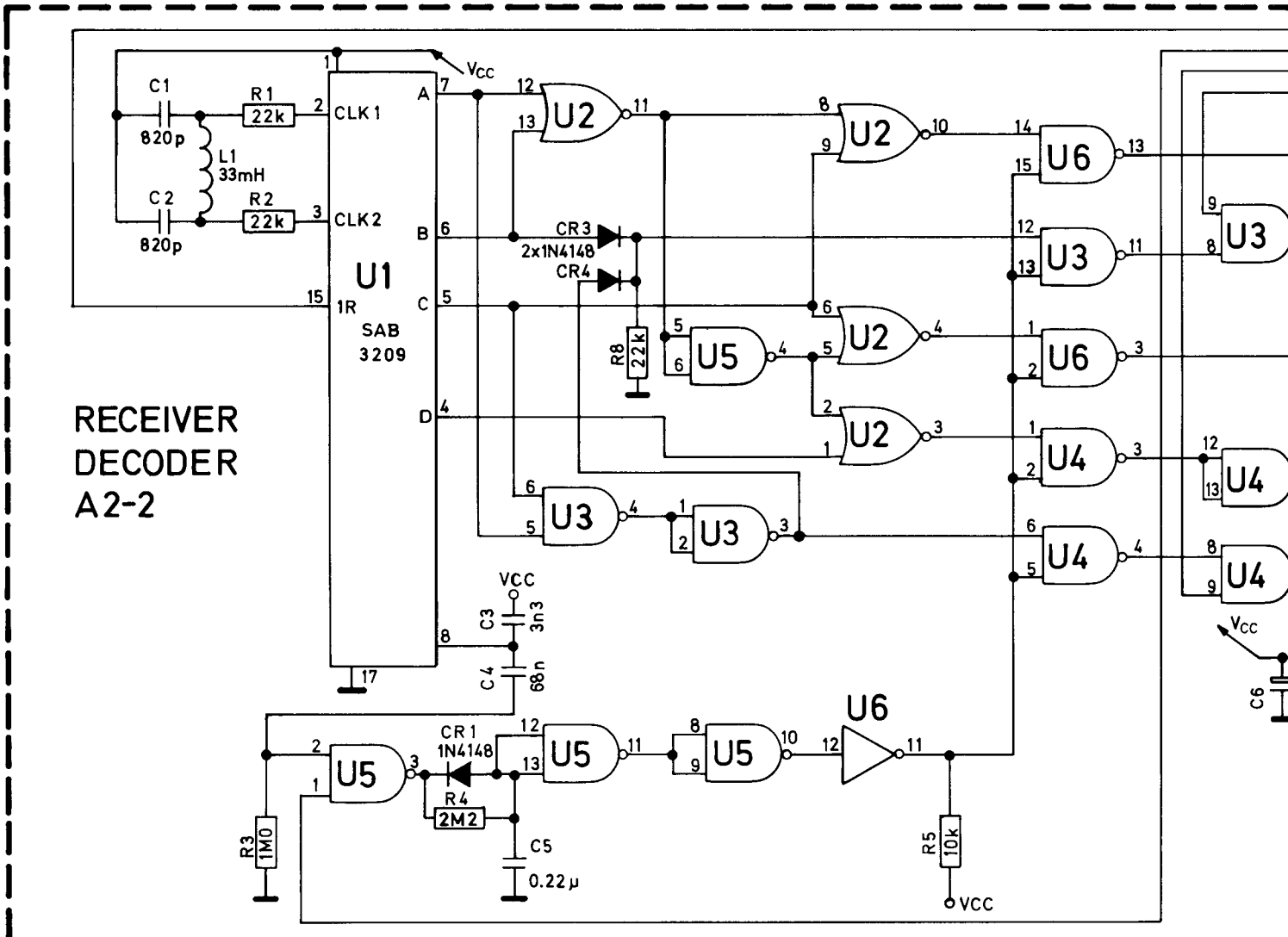
1. The light diode on the operating panel does not blink when the buttons are operated. Replace the battery.
2. Use the high impedance probe ( $> 1 \text{ M}\Omega$ ) on pin 18, U1. The circuit should oscillate at about 43 kHz when the buttons are pressed. If it does not oscillate, see point 3.
3. Check that pin 6, U1 goes low when the buttons are operated. If pin 6 goes low, see point 4.
4. Use an oscilloscope to check that pin 8, U1 has a bit sequence as shown in the table. If not, check the supply leads from the operation buttons and if necessary change U1.
5. Use an oscilloscope to measure the voltage across R8 and R9. The voltage amplitude of the pulses should be between 0.55 V and 0.75 V. If not, check the diodes and Q3.

### Receiver RC 20R

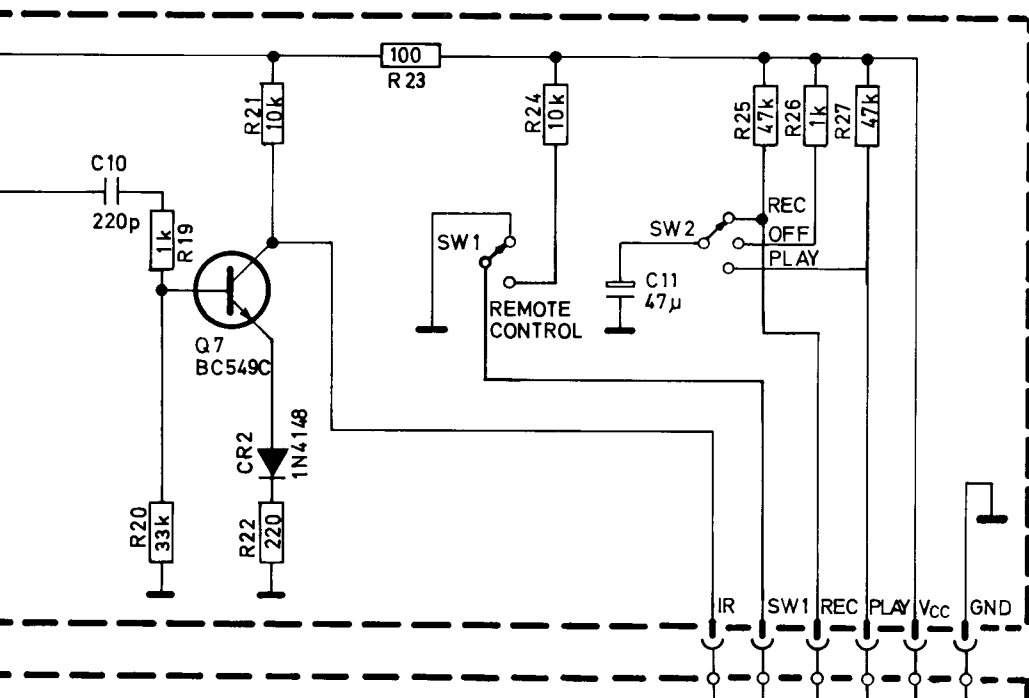
1. The receiver is supplied with an unregulated voltage of about 14 V d.c. Check at C6 that Q1 regulates the voltage to about 10.5 V d.c.
2. Check the receiver pre-amplifier with an oscilloscope probe on the collector of Q7. The pulse sequence should be in opposite phase to the pulse sequence shown in table 1.
3. Check U1 with a probe on outputs A, B, C, and D. See table 1.



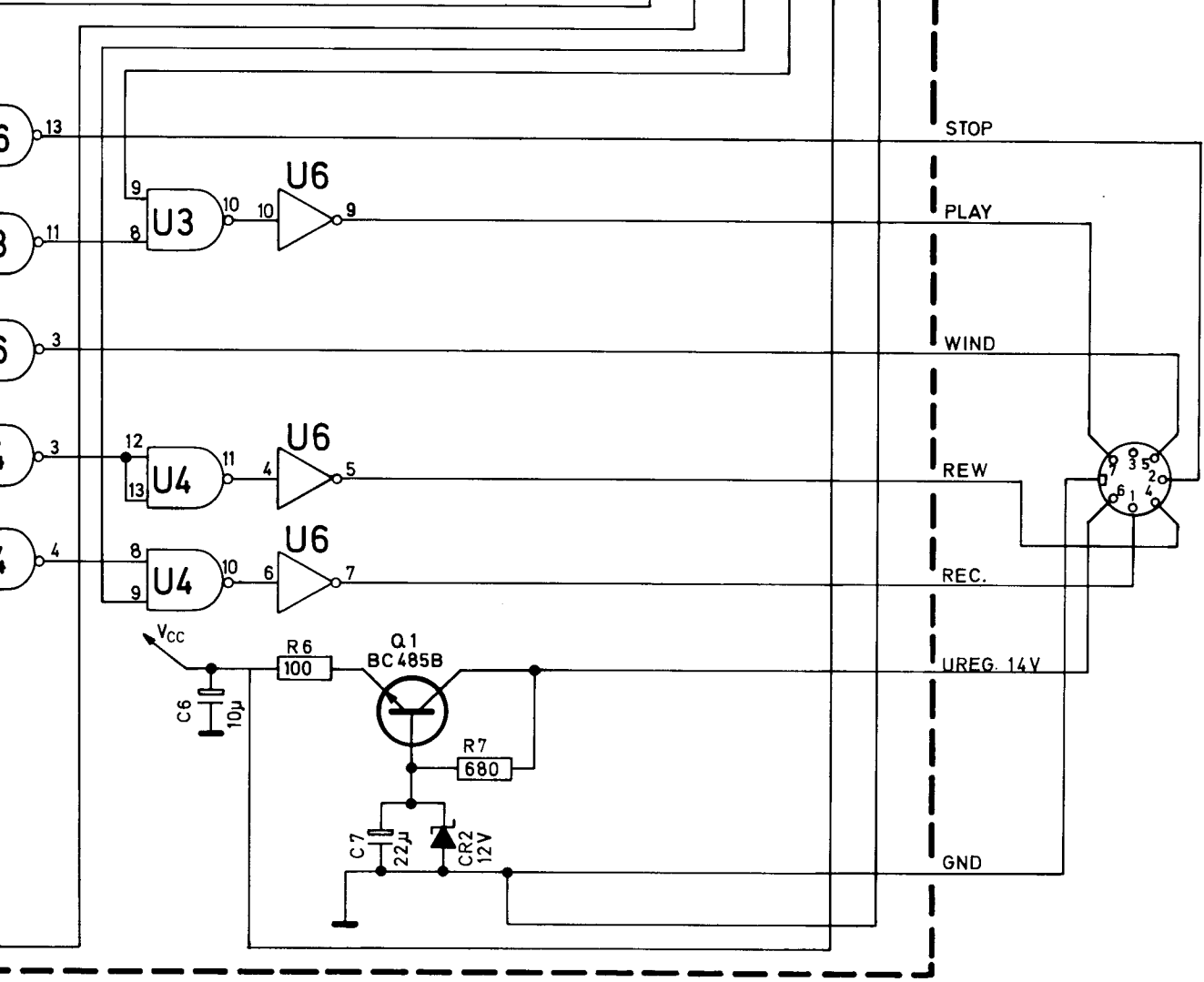
RECEIVER  
PRE. AMP.  
A2-1



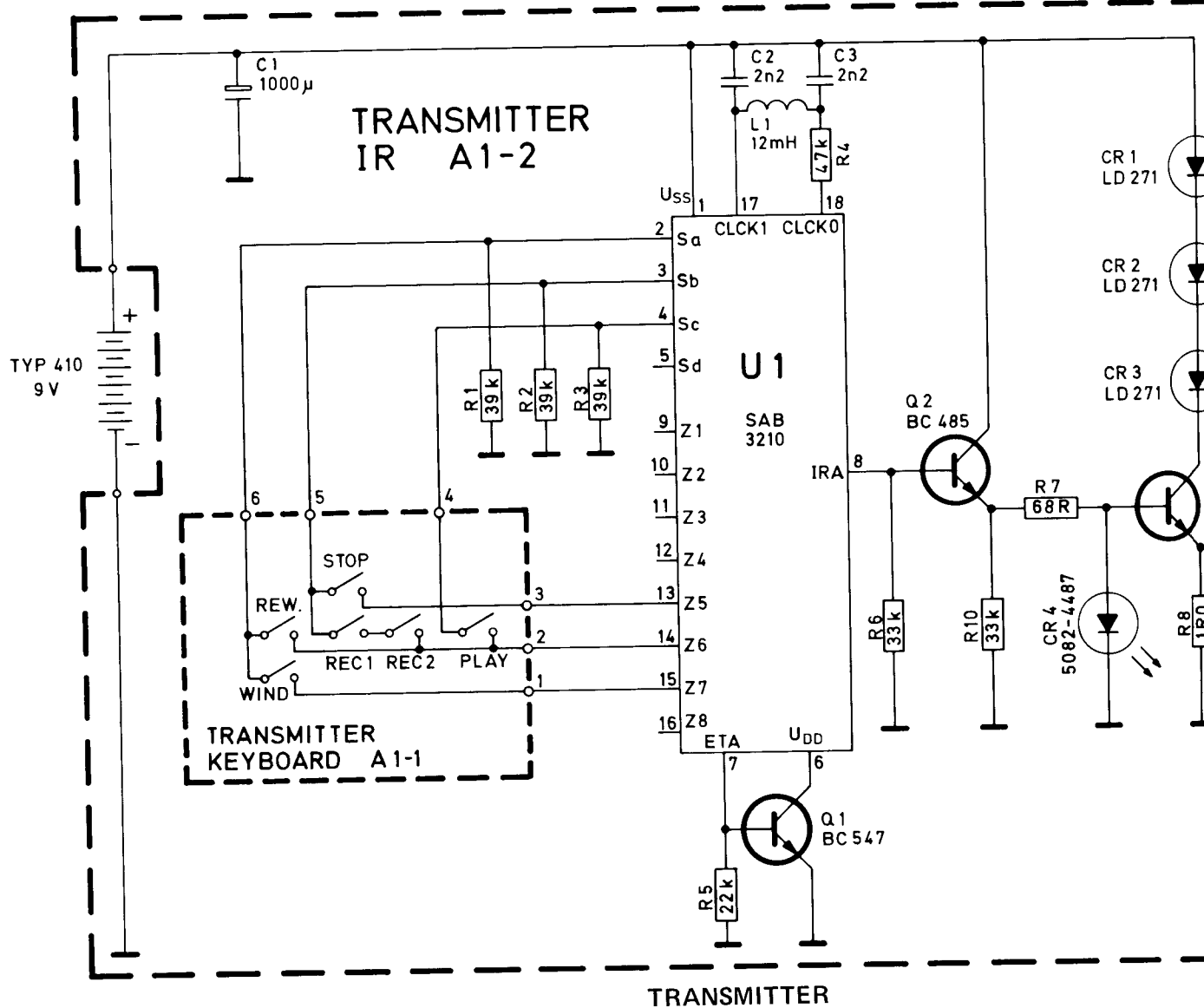
RECEIVER  
DECODER  
A2-2



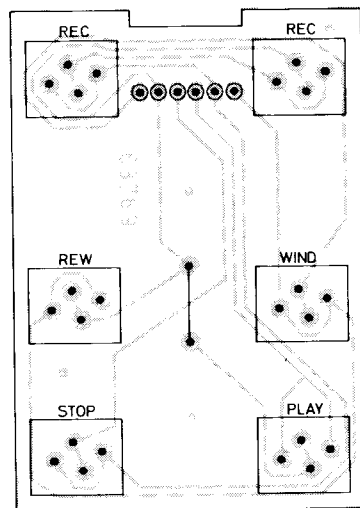
- INTERGRATED CIRCUITS USED
- U1 -SAB 3209 , IR RECEIVER
  - U2 -MC14001B, QUAD 2-INPUT NOR GATE (CMOS)
  - U3-5 -MC14011B, QUAD 2-INPUT NANDGATE (CMOS)
  - U6 -HINIL 332 , HEX INVERTER GATE ,OC



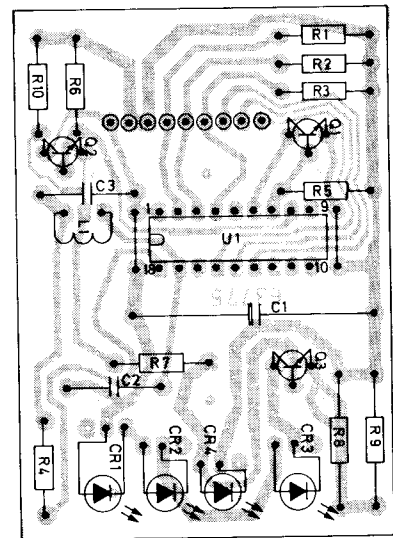
ER  
UT NORGATE  
UT NANDGATE  
TERGATE, OC



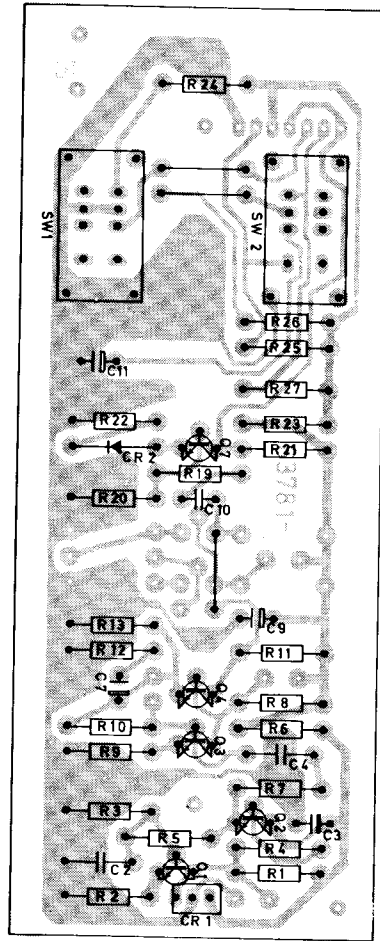
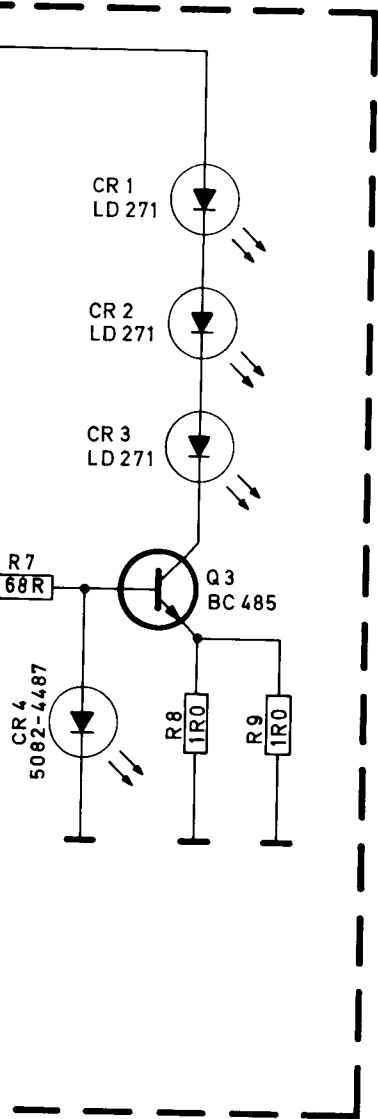
TRANSMITTER



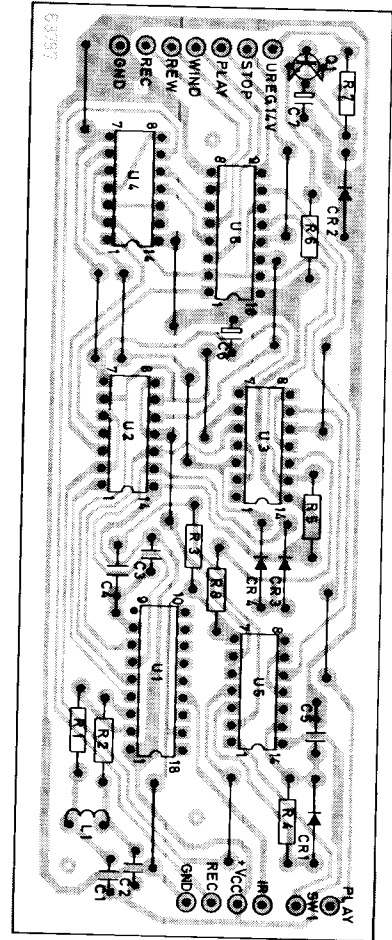
Transmitter, Keyboard  
seen from solder side.



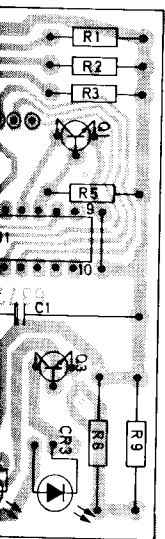
Transmitter, IR-board  
seen from solder side.



Receiver, Pre. amp. board,  
seen from solder side.



Receiver, Decoder board  
seen from solder side.



board  
side.