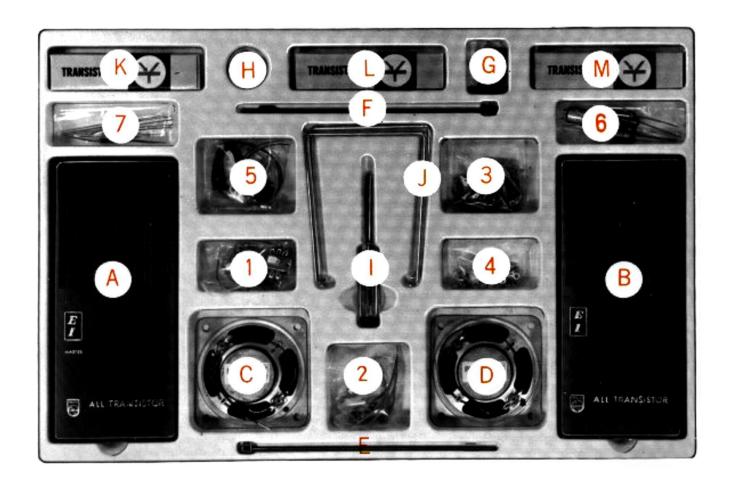


Instruction book





Down through the ages man has sought new ways of carrying messages across great distances. Most of these ways are known to everybody; just think of the fires on the hilltops, the drums which were, and are still, used by African negroes and the homing pigeon. In our modern times we have more modern and much better methods of communication at our disposal.

Nowadays many people have a telephone in their homes, by means of which they can practically cover the whole world if necessary. Ships and aircraft, which cannot possibly be connected to a telephone line, call the shore or are called from the shore by means of wireless telegraphy or telephony. This IE 2000 kit enables its owner to build a house telephone installation. He can use it to speak with friends who are in other rooms of the house or even in another house nearby. This interphone can also be used as a babyphone. In short, the IE 2000 offers many possibilities and is certain to give its owner a great deal of pleasure.

## Kit IE 2000 contains the following parts:

- A Housing for the "master"
- B Housing for the "slave"
- C Loudspeaker
- D Loudspeaker
- E "Aerial" rod
- F "Aerial" rod
- G Two switch triggers
- H Two foam plastic pads for loudspeaker mounting
- I Screwdriver
- J Two metal supports for the housings
- K Transistor AC 126
- L Transistor AC 128
- M Transistor AC 128

## Bag Nr. 1 contains:

Three springs for the switch triggers

Two change-over switches

## Bag Nr. 2 contains:

A double-pole contact for the batteries

Two single-pole contacts for the batteries

(with blue wire)

A change-over contact (with red wire)

Two sockets.

## Bag Nr. 3 contains:

27 screws 3 x 20 mm

- 5 screws 3 x 6 mm
- 2 counter sunk screws 3 mm
- 2 special screws 3 mm
- 3 screws 2 x 10 mm

## Bag Nr. 4 contains:

- 32 nuts 3 mm
- 27 toothed washers for 3 mm screws
- 3 nuts 2 mm
- 2 rubber washers for counter sunk screws
- 2 rectangular foam plastic cushions for "aerials"

## Bag Nr. 5 contains:

- 1 transformer
- 1 metre of insulated wire
- 11 insulating sleeves Ø 1 mm
- 3 insulating sleeves Ø 6 mm

## Bag Nr. 6 contains:

- 1 electrolytic capacitor 16 μF
- 1 electrolytic capacitor 64 µF
- 3 electrolytic capacitors 100 µF
- 1 electrolytic capacitor 320 μF

## Bag Nr. 7 contains:

- 2 resistors 2.2 Ω (red-red-gold)
- 3 resistors 47  $\Omega$  (yellow-purple-black)
- 1 resistor 470 Ω (yellow-purple-brown)
- 2 resistors 820 Ω (grey-red-brown)
- resistor 8.200 Ω (grey-red-red)
- 1 resistor 15.000  $\Omega$  (brown-green-orange)
- 1 connecting cable 10 m long (in the bottom of the box)

Note: The bags 3 and 4 contain a few spare screws and nuts.

## How to go about constructing the kit

When building do as follows: Start with the simplest cabinet (the slave) and first fit a switch, a contact socket and a number of screws and nuts. The various wires are fixed by sliding them under the heads of the screws after which the latter are turned tight.

Finally we finish the cabinet by fitting the lid. Once the "slave" is ready, the "master" apparatus is assembled. As in the slave, the switch and the contact socket are fitted first. Then the battery connectors are positioned. At the bottom the nuts are placed into the holes and kept in their positions by the battery compartment cover. On the other side toothed washers are placed over the holes and then a screw is pushed through the holes. (See fig. page 5.) In this way the master is provided with 20 contacts points. These contact points are numbered from 1 to 20. These figures also indicate the work sequence. This means that first you connect all the required wires and components under screw 1 which is then tightened. Then move over to point 2, fit all components and wires and tighten the screw. Go on in this way till you arrive at point 20 and everything is in its correct position. Do not forget to study the drawings carefully lest components and wires should be wrongly connected. Always check before moving a step further whether all components are correctly fitted. Take special care that the wires do not touch each other except where they are supposed to. Otherwise you will get a short circuit and your apparatus will not work since the batteries will be flat in a very short time. If the batteries have been inserted and the cover has been screwed on to the battery compartment, the long twin wire can be connected to both units. Do not bring the two units too close together, otherwise you will hear a high whistling note. Should your interphone fail to operate, read the chapter "Trouble shooting".

#### Practical hints

Before starting to build the installation, it is wise to read the following hints carefully, after which it will be quite easy for you to recognise the various components.

## Assembling and stripping the cabinets

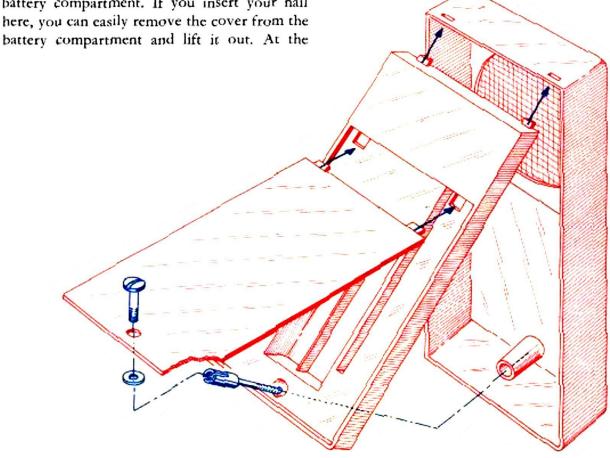
The interphone consists of two cabinets, which from the mechanical point of view, are exactly the same. Each cabinet consists of three parts:

- The front, which at the same time is the cover.
- The rear, which carries the components and is provided with a battery compartment.
- 3. The cover for the battery compartment.

To open the cabinet, hold the front in your hand and carefully lift out the rear. This is done by first lifting it and then drawing it towards you. This must be done in this way because at the top of the lower part there are two little lugs which lock in the holes in the top of the cover. They ensure a good interlock. At the bottom the cabinet has a little hollow near the battery compartment. If you insert your nail here, you can easily remove the cover from the battery compartment and lift it out. At the

bottom of the cover there are also two little lugs and when the cabinet is assembled again, care should be taken that the lugs on the rear and those on the cover of the battery compartment lock exactly in the holes provided for that purpose. If this is not the case, the components will not fit properly.



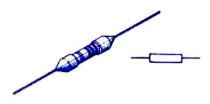


## Making the connections

The various components are connected by means of special terminals. These consist of a nut, a toothed washer and a screw, which fit into the holes in the pillars mounted on the assembly plate. The nuts are hexagonal and fit exactly into the hexagonal holes in the bottom of the assembly plate. The screws are provided with large heads which fit exactly in the upper hollows of the pillars. The kit contains a screw-driver to tighten the screws. The connecting wires of the various components are placed between the toothed washer and the head of the screw.

## Connecting the resistors

The intercom must be fitted with ten resistors, which look like small cylinders with connecting wires at each end. The resistance values are printed on these cylinders in a colour code. So if you look at a resistor you will see a number of coloured rings. Usually there are four such rings. The last one is gold or silver. The first coloured ring indicates the first figure of



the value of the resistor. The second ring stands for the second figure, and the third ring indicates the number of noughts that should follow (the factor). The fourth and last coloured ring, the gold or silver one, indicates the percentage by which this resistor may deviate from its value. For gold this is 5%, for silver 10%. This is called the tolerance. Finally we give a list of resistors with the corresponding colour code:

2 × 2.2 Ohm red, red, gold

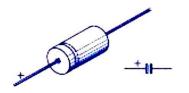
3 × 47 Ohm yellow, violet, black

1 × 470 Ohm yellow, violet, brown

 $_{2}$   $\times$  820 Ohm grey, red, brown

1 × 8200 Ohm grey, red, red

1 × 15000 Ohm brown, green, orange.



## Connecting the capacitors

The interphone set contains six capacitors.

These are electrolytic capacitors. They consist of an aluminium container covered with a protective layer of plastic which prevents short circuits. At one end the housing of these capacitors is provided with a ridge and, moreover, by the side of this ridge a "+" mark is usually printed. With these capacitors it is very important how they are connected, that is to say, the "+" and "-" should always be connected to the positive and negative voltages respectively. If you were to connect them the other way round, they would not perform their function and, what is worse, they would break down.

The capacitances used are:

16 µF (micro farad)

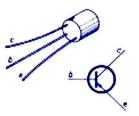
64 µF (micro farad)

 $3 \times 100 \ \mu F$  (micro farad)

320 µF (micro farad)

## Connecting the transistors

We would advise you to read this part thoroughly before beginning to work, since it is very important. Three transistors are to be connected in the interphone. Two of them are of the AC 128 type, and the other is of the AC 126 type. The interior of the transistor consists of three parts; the collector, the base and the emitter. The wires connected to it are indicated as c, b and e respectively. With all three transistors the type number is printed on the body. Moreover the body bears a red dot. The wire nearest this red dot is the wire connected to the collector; indicated by c. Of the remaining two wires the one nearest the collec-



tor lead is the base wire, while the wire further away from it is the emitter wire. They are indicated as b and e respectively. When mounting, make sure that each wire is connected in its right position. If you were to connect a transistor the wrong way, your apparatus would not only fail to work, but it would almost certainly mean the end of your transistor.





## Fitting the transformer

When fitting the transformer, it is necessary to study the drawing well. One of the corners of the transformer is painted red. This corner is clearly indicated on the drawing. When fitting, ensure that this red dot comes in the correct place. Furthermore, be careful not to take the wrong wire. If you work strictly according to the drawing, you cannot go wrong.

## Fitting the loudspeakers

The interphone set contains two loudspeakers. One is fitted in each cabinet. Since the wires are



already cut to the correct length, it is impossible to connect the loudspeaker wrongly. The loudspeaker is a rather expensive component, so handle it carefully. The paper cone is rather weak and if you were to perforate it with your screwdriver, it would certainly lose much of its sound quality, since sound is produced by this membrane of paper vibrating.



#### Fitting the switches

The interphone operates with two switches, which are clearly different since they possess a different number of wires. When fitting the switches, carefully follow the instruction on the drawing.

## Assembling the first unit (the slave)

In the box all the components are distributed over the various sections. Page 3 shows which section contains what component. When building first take the cabinet which from now on we shall call the slave. This is the cabinet not carrying the word "master". Remove the red cover and also the flap from the bottom. Except for the word "master" the two cabinets in the slave is not used; nor are various connecting points. The base plate, that is the plate on which you will mount the components, is placed as shown on page 10.

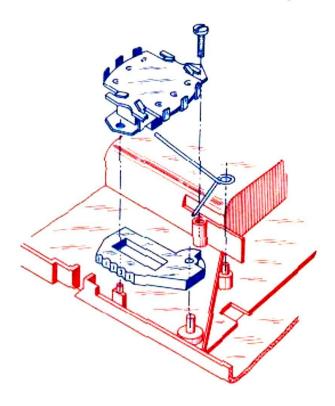
#### The switch

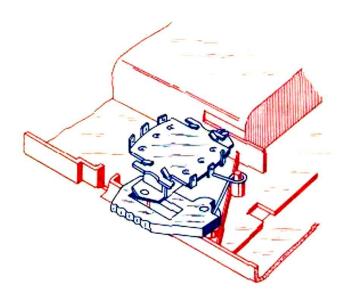
Now pick up one of the two switch triggers and put it in its place, as shown in the figures on page 8.

The small round hole in the upper corner fits over the corresponding spigot on the base plate.

Than take the switch with only two blue connecting wires. These two connecting wires should point upwards, towards the side where the loudspeaker will later be positioned.

The left hand hole in the metal part of the switch will fit over a spigot on the base plate





located at the edge; the other hole will coincide with the hole in the base plate. Insert 2 × 10 mm screw through this last hole and retain it underneath with a 2 mm nut. Then take the spring with a long and a short leg and fit the longer leg under the switch, so that it comes to between the switch knob and battery housing. The eye of the spring is slid over the round spigot on the base plate, as shown in the drawing. By means of a screwdriver bend the shorter leg of the spring and ease it into the groove on top of the trigger. If everything has been mounted the right way wou will see that by operating the trigger the switch slides to and fro. The switch is made to slide away by the trigger while it is returned by the spring.

## Adjusting the changeover switches

When the switches are first used you may find that the slider is rather stiff, thus preventing the spring from returning the switch trigger to its rest position. The result may be a constant buzzing (the calling tone) in the other intercom set.

To ease the slider movements:

- Push the kit screwdriver gently into the gap between the brown insulating wafer and the metal housing, moving the slider along as you do so.
- When the slider reaches the end of its travel, carefully move the screwdriver so that it very slightly levers the wafer further away

from the housing. The amount of movement required is only a fraction of a millimetre.

#### The socket

Take one of the two contact sockets wich will be found in the bag in section N. Place it over the two short pillars in the left hand bottom corner of the base plate. Fix the whole assembly with two large headed 3 × 6 mm screws.

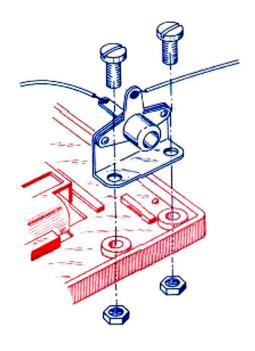
## Fixing screws and nuts

If everything is in its right place, turn over the base plate and place a hexagonal nut in holes 21, 23, 24, 25 and 26 (see drawing beneath.) In order to keep these nuts in their places, put the cover of the battery compartment in its place and fix it with a piece of sticky tape. Now return the base plate to its original position and place toothed washers over the holes below which there are nuts, insert the 3 × 20 mm screws through them and loosely engage the screws with the nuts.

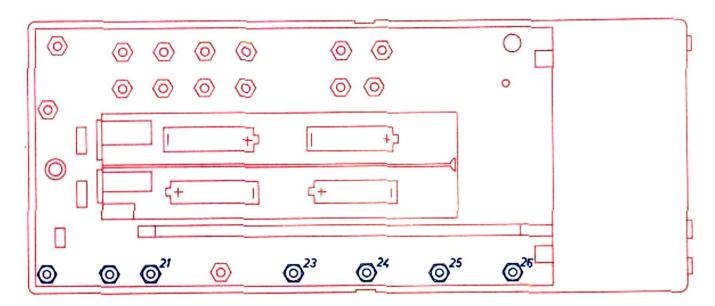
## Wiring up

Now take a good look at the drawing and start fitting the components and wires. The wire is in bag 5.

First you take a wire 3" long and remove about ½" of insulation from both ends. Push one side of this wire between screw head







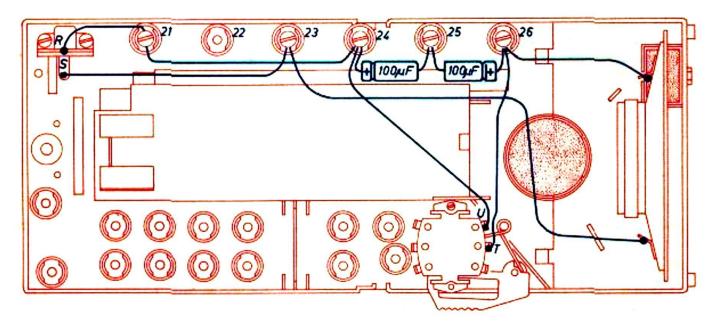
and washer 21. The same screw will also receive the red connecting wire (R) of the contact socket. If both wires are in their position, you may tighten the screw. First take the blue connecting wire (S) of the contact socket and place it under the screw 23. The other end of the red wire can be now pushed under the screw 24. The long red wire from the loudspeaker will also be connected to this same screw. The screw can now be turned tight. Apart from the wire we have already positioned the connecting wire of the switch and the + wire of a 100 µF capacitor will be connected under screw 24. Now turn this screw tight.

The other wire of this capacitor is taken under screw 25 and the negative terminal of another 100 µF capacitor is also taken under the same screw. This screw can be tightened now. Under the last remaining screw we first place the + wire of the last mentioned capacitor and afterwards the lower connection of the switch unit is ready where the electrical components are concerned.

We now place a square piece of foam plastic in the compartment in the top right hand corner of the base plate and then fit the aerial, as shown. The antenna lies on top of the foam pad.

## The loudspeaker

Now place a round piece of foam plastic in the circular compartment near the switch (see diag. P 10) and put the loudspeaker, magnet downwards upon it. Now apply the cover to the cabinet. The rectangular lugs on the base plate must fit into the two rectangular holes in the cover. Once the cover is in its place, turn over the complete apparatus and fit the screw with the hollow cylindrical upper section in the hole in the middle below the battery compartment. (see fig. page 5). Finally take the battery flap and the screw with thread only at the end. Insert this screw through the hole in the flap. From the other side you can slide a rubber washer over the screw. Everything is now in its correct position and the screw is tightened into the top of the other one.



The fitting of the stand is shown on page 12.

## Assembling the second unit (the master)

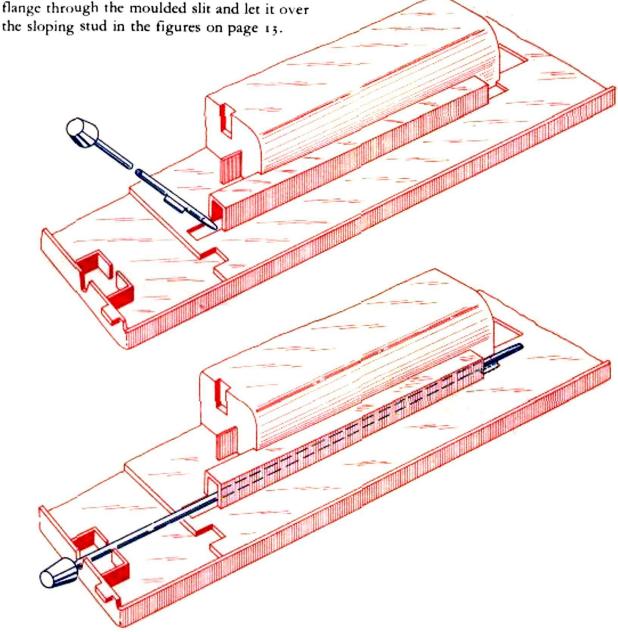
You can now start the assembly of the "master". First of all you must fit the switch. This is done in the way already described for the first unit.

The switch is so fitted that the long yellow connecting wire is in the position F (fig. page 15).

## Battery contacts

First fix the special contact with the red wire which you will find in bag 2. Slide the slotted flange through the moulded slit and let it over the sloping stud in the figures on page 17.

Now turn over the cabinet and fit the three components which make contact with the battery. (See figs page 14.) The two contacts with the bleu wires are to be mounted at the bottomend of the battery compartment. The wire and the tag, to which this has been soldered from underneath, should first be pushed through the rectangular hole in the battery compartment. The tapered end of the contact hook must be pushed through the narrow rectangular slot at the extreme end of the battery compartment so far that it locks with a definite click. Place the base plate so that the battery compartment

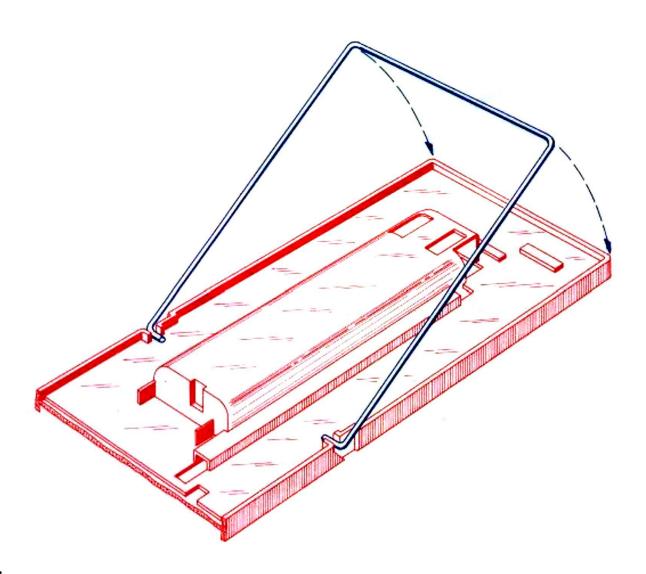


faces upwards. Nuts are now inserted in the holes 1-20 and by putting the cover of the battery compartment in its place and fixing it with a piece of sticky tape, these nuts are also kept in their places. Now replace the cabinet in its original position.

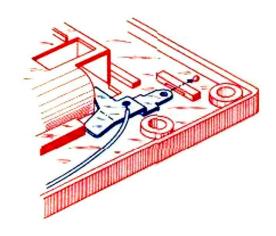
## Wiring up

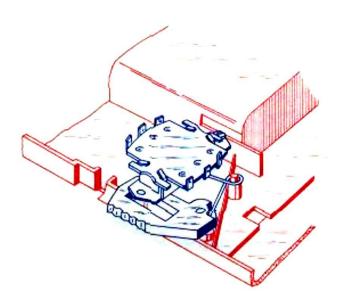
On the connecting points 1-20 you first place toothed washers and afterwards 3 × 20 mm screws are inserted through them to engage in the nuts below. Referring to the illustration on p. 15, start with contact point no. 1. First slide the red wire from the contact socket under the head of the screw and then the

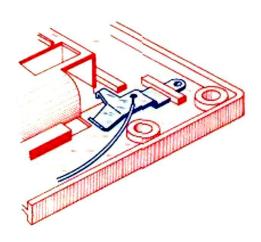
red wire from point M. Then cut a piece of 3" long from the ends of which about 1/2" of insulation is removed, and then fit one of the ends under this screw. The other end is slid under screw no. 4. Now take the 470 Ohm resistor with the colour code, yellow, purple brown, a 64 µF capacitor and an 8200 Ohm resistor with the colour code grey, red, red. These three components are also slid under the screw on contact point No. 1. Take extra care that the groove in the capacitor points to contact no. 1. If this capacitor were to be connected the other way round the apparatus would not work and this capacitor would break down. If all six connecting wires are brought under the screw of contact point 1, tighten it.



Now move over to contact point 2. First connect the wire from point Q, then cut off a piece of mounting wire 3¼" long and remove ½" of insulation from both ends. One end of this wire is now also placed under screw 2, and the other end is placed under screw 14. Then take a 15000 Ohm resistor, with the colour code brown, green, orange, and one 820 Ohm resistor, with the colour code grey, red, brown and also connect them to point 2. Finally take a 320 µF capacitor and connect the wire, that is the one at the opposite end to the groove, to contact point 2. If all five wires are now connected to contact point 2, the screw can be tightened.

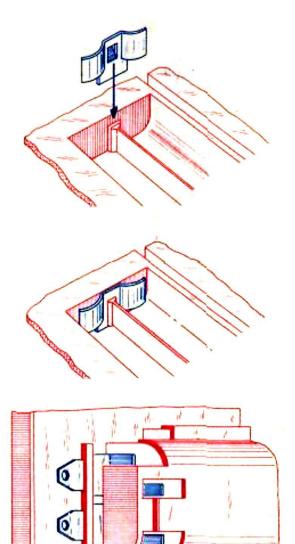






Now contact point 3 follows. Begin by cutting off a wire about  $4\frac{1}{2}$ " long, and removing about  $\frac{1}{2}$ " of insulation from both ends. This wire will interconnect contact 3 and contact 20, so you can already take it to the correct positions. Other components which must also be connected to contact point 3 are in the first place a 47 Ohm resistor with the colour code yellow, purple, black and a 2.2 Ohm resistor, colour code red, red, gold, and finally an 820 Ohm resistor with the colour code grey, red, brown. So if four wires leave contact socket 3, everything is in its right position and the screw

can be tightened. Check from time to time whether all components have been correctly fitted and that the wires are firmly trapped. Now move over to point 4. The 320 µF capacitor which is connected to point 2 at one end, is now connected to the screw at point 4 by its + end, that is to say, the end with the groove. There is already a wire from point 1 under this screw. The long wire coming from the loud-speaker is also slid under point 4. Furthermore, the screw at point 4 will hold a 47 Ohm resistor, colour code yellow, violet, black and a 2.2 Ohm resistor, colour code red, red, gold. There must



now be five wires under the head of the screw. The screw can now be tightened.

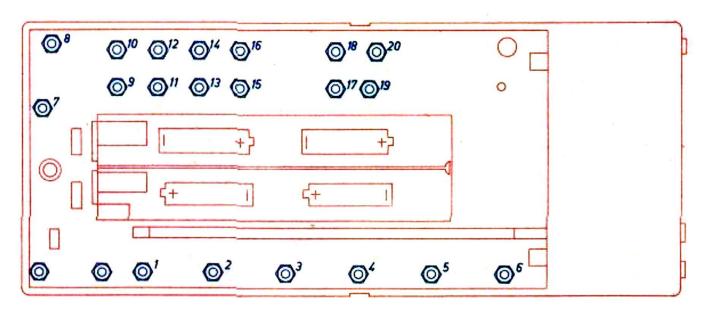
The white wire from the switch, coming from point A, is connected under the screw at point 5. This point will also carry the + wire from the 100 µF capacitor. Note that this is the wire connected to the grooved end of the capacitor.



Under the screw at 5 there are now two wires. This is enough, so tighten the screw firmly.

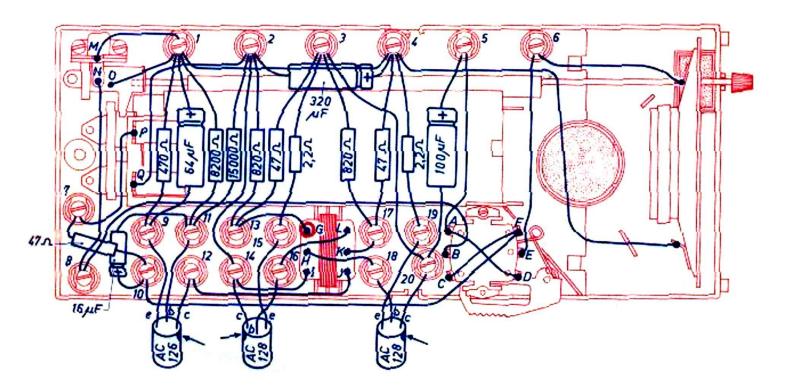
The short wire from the loudspeaker is now connected under the screw at 6, as is the blue wire from the switch, point E. This screw can now also be tightened.

Now take the wire coming from battery contact P under the screw of contact point 7. Then



take a 47 Ohm resistor, with the colour code yellow, purple, black. This is also connected under screw 7 after which the screw is tightened.

At point 8 we connect the blue wire from the contact socket N and the wire from tag B of the the switch, which is also blue. Afterwards 8 can be turned tight. Contact point 9 receives the other end of the 470 Ohm resistor already connected to point 1, and also the other end of



the 64 µF capacitor also connected to contact point 1. This screw, however, is not tightened yet, since the transistor must also be connected to it later. To contact point 10 we connect the other end of the 47 Ohm resistor already connected to contact point 7 and the + end, that is to say, the end with the groove of capacitor 16 µF. Finally point 10 will take the wire from tag F of the switch, which is coloured yellow. Now the screw can be tightened.

11 first receives the—end of the 16 µF capacitor whose + end is already connected to 10. Then connect the other end of the 8200 Ohm resistor which is already attached to 1, and afterwards the other end of the 15000 Ohm resistor already connected to 2. This screw is

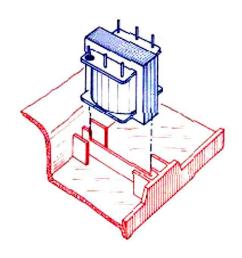
not tightened yet, since a wire from a transistor must be connected to it. Now place the transformer in its position. It should be fitted so that the red dot comes next to contact point 15. See the diagram. Wire J of the transformer, this is a red wire, is now taken to contact point 12. This is also left open for the time being. Wire G of the transformer, this is the blue wire near the red spot, is slid under the screw of contact point 13. Furthermore the resistors 820 Ohm and 47 Ohm coming from the contact points 2 and 3 respectively, are connected under this screw. Then the screw can be tightened.

Under the screw of contact point 14 there is already the wire coming from 2. This is followed by the red wire from the transformer, and then you should leave the screw open for a transistor which is to follow. The 2.2 Ohm resistor, coming from point 3, is slid under 15 and this point is also left open for the time being. Wire L, that is the yellow wire coming from the transformer, is slid under 16 and 16 is not tightened yet. Under 17 we first place wire K from the transformer, then the resistors 820 Ohm and 47 Ohm coming from 3 and 4 respectively. This screw can now be tightened. Wire H from the transformer is a yellow wire, and is connected to 18 which is not tightened vet. The 2.2 Ohm resistor, coming from 4 is placed under 19, and 19 is left open for a transistor. Finally we come to point 20. To this point we connect the loose wire which is connected to point 3, and also a 100 µF capacitor coming from 5.

#### Fitting the transistors

In the chapter "Practical hints" it has already been explained what the emitter, the base and collector leads of the transistor are, and how they can be recognised. We shall now restrict ourselves to fitting the transistors.

Bag P contains a number of thin and a few thick tubes (sleeving). These thin sleeves are first slid over the connecting wires of the transistors. Then each wire is brought to its position as shown in the diagram. For the first transistor, the AC 126, the emitter wire



comes under the screw of contact point 9, after which this screw can be tightened. The base wire of AC 126 comes under contact point 11 which can now also be tightened, and the collector wire, that is the wire nearest the red dot, comes to point 12.

The following transistor is an AC 128. Ensure that this transistor is fitted the other way round compared with the preceding transistor. Their collector leads should run side by side. With this transistor too, first slide the sleeves over the connecting wires and then attach the collector lead (the wire near the red dot) to contact point 14; 14 can now be tightened. The base wire of this transistor is connected to contact point 16 and the emitter wire is connected to contact point 15.

The last transistor is connected on the other side of the transformer. This is also an AC 128. With this transistor too, the connecting wires must be provided with thin sleeves. Then the base wire is connected to contact point 18. The emitter wire is connected to point 19 and the collector wire to point 20. All screws can now be tightened. The last thing you have to do is to slide the thick sleeves over the whole transistor. This must be done with all three transistors. Before you finish the job, we advise you to check everything thoroughly by means of the drawings and the description. Once you have fitted all components, insert the aerial. You already know how this is done as you have already done this for the first unit. Before the cabinet is closed, first check if everything

works properly. For that purpose place the batteries in their compartments and apply the lid. Nothing needs to be tightened as yet. The long wire at the bottom of your box must now be inserted in the contact sockets. Place the first unit (slave) you have made some distance away, otherwise there will be acoustic feedback. This results in the loudspeaker producing a loud wailing sound. This is caused by a soft noise coming from the loudspeaker of the master, which is received by the loudspeaker of the slave and the latter transmits this noise to

the master again, where it is amplified and reproduced by the loudspeaker of the master. This continues until a high wailing sound can be heard. This takes place in a very short time. If you pull out the master aerial, the apparatus is switched on. If you speak into the master while pressing the switch trigger, you should be clearly heard from the loudspeaker of the slave. If you hear nothing at all, you must read the chapter on "Fault finding". Finally fit the cover and finish the unit just as you did with the first one.

## Fault finding

If the interphone does not work properly, switch off the batteries immediately by pushing the acrial of the master down. Then check the following points.

- Ensure that the four batteries are inscrted properly and see that they make good contact. If your batteries are flat, the apparatus will not work.
- Ensure that all screws, nuts and connecting points are firmly tightened, so as to guarantee a good electrical contact. Make sure that all wires are actually gripped by the screw.
- Ensure that when the aerial of the master is drawn out, the contact of this switch establishes a good connection with the corresponding contact of the battery compartement.
- 4. Check the various connections and see if the wires are connected correctly. The best thing to do is to check one connecting point after another. See that the wires cannot come into contact with each other where this is not permissible. This could cause a short circuit and in that case too, your apparatus will not work.
- Check that you have not forgotten a single connection or component. Then check if the capacitors and transistors have been connected the right way.
- See if you have made a mistake in selecting the values of the resistors.
- Ensure that the wires of the switches, transformer and loudspeakers are connected to the correct points.

#### DIRECTIONS FOR USE

## Placing the batteries

Place the four 1.5 V batteries, so termed "penlight" cells, into the battery compartment of the master. The battery positions are clearly shown in the compartment. The batteries should never be turned upside down. No batteries are needed in the slave unit.

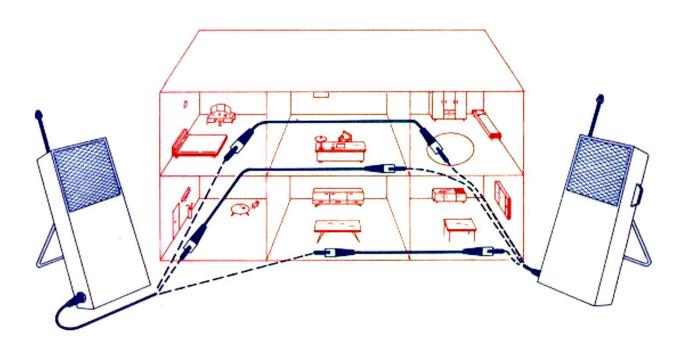
## Switching on the set

Before the set can be put into operation, the flex at the bottom of the box should be connected to both units. The plug connected to the end of the wire must be inserted in the socket located at the left hand lower side of the unit. The "Aerial" of the master unit is the switch which puts the set into operation. If the aerial is completely pushed down, the set will not consume current.

#### Call signal

If the two units are placed in different places and a person in one of these places wishes to talk with the person at the other end, he pushes the black trigger on his unit. The loudspeaker of the other unit will now produce a loud buzzing sound. The person near this unit is then warned that somebody wishes to speak to him. If the person operating the slave has depressed the trigger, so that the person with the master has heard the call signal, the person at the master must pull out the "aerial" from his apparatus in order to switch on. The person with the slave can now speak into his apparatus and his voice will be heard from the master. When he has finished speaking and the person with the master wishes to say something in return, he must depress the black trigger. So now it works the other way round.

In the first case the loudspeaker of the slave



was the microphone and the sound came from the loudspeaker of the master. In the second case the loudspeaker of the master becomes the microphone and the sound comes from the loudspeaker of the slave. It is not possible for both persons to speak at the same time. When the conversation is finished, the aerial of the master should be depressed again to switch off the amplifier. No current is then consumed. If the aerial of the master is pulled out, the control switch of the slave is put out of operation. Depressing it will now be of no use.

## The IE 2000 as a babyphone

If your parents have gone out and you are minding your little brother or sister, you can place the slave by his or her bedside. You then place the master in the room where you are sitting. From time to time you can pull out the aerial of the master and listen. If the baby is crying you will immediately hear it. To check if your set is still working, we advise you to try the following trick.

Place a clock near the slave in baby's bedroom.

If you now switch on the master and baby is not crying, there will not be dead silence, but the quiet ticking of the clock.

## The interphone as an apparatus with numerous possibilities

The quality of this interphone means that it can be used for numerous domestic and other purposes. It offers the facility, for instance, of carrying on conversations from the parents' room to that of the childeren, from the kitchen to the dining room, from one office to another etc. The electric connecting lead between the two units can very easily be fitted: with a simple piece of twin flex, this wire can be lengthened to 20 or 30 metres. The two interphone units can easily be detached from one wire and attached to another one. The plug used is of a standard type. In this way several wires can be led through the house, and several connections can be made by means of two units only.

## Electricity

An electric current can flow easily through copper wires. You can think of an electric current as being made up of little drops of electricity, just as a stream of water is made up of little drops of water. These drops of electricity are called electrons. In order to make water flow through a pipe, we apply pressure to it by placing a pump in the pipe. With electrons we also need something like a pump to make them flow, and in electricity a battery is this pump. We can compare a battery with a pressure tank full of electrons. The strength of a battery pump is expressed in Volts and the small penlight cell we use in this kit has a voltage of 11 V. Four such cells connected up in series have a voltage of 6 V., since when batteries are connected up in series the voltages are added up  $(1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} + 1\frac{1}{2} = 6 \text{ V}).$ The electric current supplied by a battery always flows in one direction. No matter for

The electric current supplied by a battery always flows in one direction. No matter for what purpose the battery is used, electrons always flow from the minus pole of the battery to the plus pole of it. A current which always flows in one direction is called a direct current (D.C.) and the voltage which causes such a D.C. is called a direct voltage.

Apart from direct voltages there are also alternating voltages and consequently apart from direct currents there are alternating currents (A.C.).

#### Alternating currents

With alternating currents, the electrons in the copper wire or the component to which an alternating voltage is applied move to an fro. They may change direction only a few times per second or much more frequently. If, for example, the current changes direction a thousand times per second this is still called slow.

An alternating current is not considered fast until the electrons change direction about 50.000 times per second. The number of times a second the A.C. goes first in one way and then the other is called the frequency. This is termed cycles per second (c/s) or Herz, after the great scientist. If for example the current moves 50 times a second it has a frequency of

50 c/s or 50 Herz. This in most countries, is the case with the A.C. supplied by the mains. Slow alternating currents are called low frequency currents and fast A.C. is said to be high frequency.

#### DESCRIPTION OF THE CIRCUIT

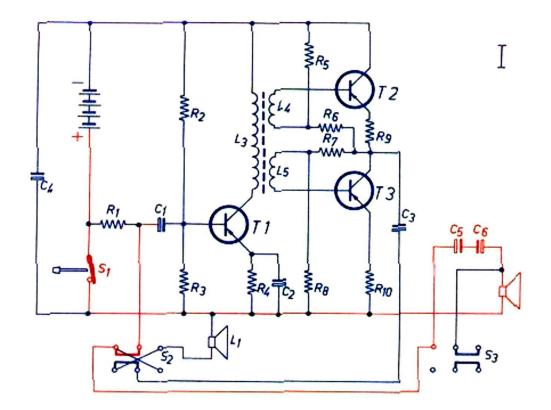
Let us, in accordance with its function, consider the circuit in three parts, viz.:

 The "Slave" unit working as a transmitter (the antenna of the master box is now been pulled out, but the switch is not yet pressed).

In this case the loudspeaker of the slave works as a microphone (This loudspeaker is shown in the diagram below as L2 and the loudspeaker of the master apparatus is represented by L1). Because the antenna of the master apparatus has been pulled out, the switch S1 is closed. If now the sound of a voice reaches the loudspeaker of the slave, this sound will make the paper cone of the loudspeaker vibrate. A coil is fixed to this cone which can vibrate with the cone. A magnet is fixed to the housing of the loudspeaker and the coil lies in the field of the magnet. This magnetic field has a constant strength at every point. If now the cone and with it the coil, is made to vibrate, the movement of the coil in the magnetic field will generate in it an alternating current. The result of this is that there will be an electric alternating voltage between the ends of the coil. If one of the ends of the coil is now connected to earth and the other to an amplifier, then an alternating current will flow into the amplifier. This alternating current is very weak and therefore requires amplification before it can be reproduced.

This particular circuit diagram shows that the plus pole of the battery is connected to earth.

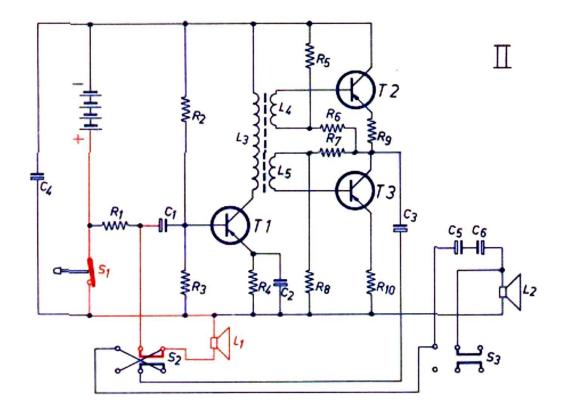
The alternating currents from the loudspeaker L2 of the slave are passed via the two series-connected capacitors C5 and C6 and the switch S3 through one core of the connecting cable.



In the master box these alternating currents flow, via the switch S2 and the capacitor C1 (16µF) to the base connection of the transistor T1 (AC 126). The direct currents also flowing through this base lead are passed via the emitter connection and the resistor R4 to earth. The fact that an alternating currents reaches the base of Ti has the consequence that a very much stronger alternating current will flow out through the collector lead of T1. This shows that the transistor T1 is being used for the amplification of alternating currents. The alternating current coming from the collector lead is, however, not yet strong enough to make the cone of the loudspeaker of the master move sufficiently. This is why the collector current is first passed through the windings of the coil L<sub>3</sub> of the transformer. The alternating current through L3 generates an alternating magnetic field in the core of the transformer and this field in turn generates an alternating voltage in the windings L4 and L5 of the transformer. As has been mentioned previously, an alternating current consists

of a positive and a negative part. Because of the way in which the two transistors T2 and T3 are connected to the transformer, the two parts of the alternating current are tapped separately from the transformer and passed to T2 and T3. In the one transistor the "plus" part is now amplified and in the other transistor the "minus" part of the alternating current is amplified. The amplified output currents are passed via separate circuits to the loudspeaker L1 of the master. The output current of T2 reaches the loudspeaker via the emitter lead and C3, while that of T3 passes from the collector lead via the capacitor C3 (100 µF) and the switch S2. In the loudspeaker both the phases of the alternating current are put together again and now form a powerful signal, so that the loudspeaker can produce a strong sound. The great advantage of this circuit is that, if no signal is provided by the microphone, only very little current is consumed from the battery.

II. The master as the transmitter (the antenna of the master apparatus is still pulled out



but its switch is now pressed).

Now the master is the transmitter with its switch pressed in. The equipment works in just the same way as in the first case, except that L<sub>I</sub> now acts as the microphone and L<sub>2</sub> reproduces the sound.

This change is brought about by the pressing in of S2. In this mode the master can speak to the slave.

III. Calling up (the antenna of the master is pushed home and the switch of either master or the slave is pressed).

In the rest position the antenna of the master is completely pushed in, so that the battery switch is in the off-position. If now switch S2 or S3 is pressed, the plus pole of the battery is connected to the earth lead via the resistor R1, the relevent switch, and one of the loudspeakers. The transistor T1 will in that case be connected to the battery. (Through R3, the relevant switch, a loudspeaker and R1). At the moment when a switch is pressed, current begins to flow through T1. The switching-on current flows also through the coil L3 of the trans-

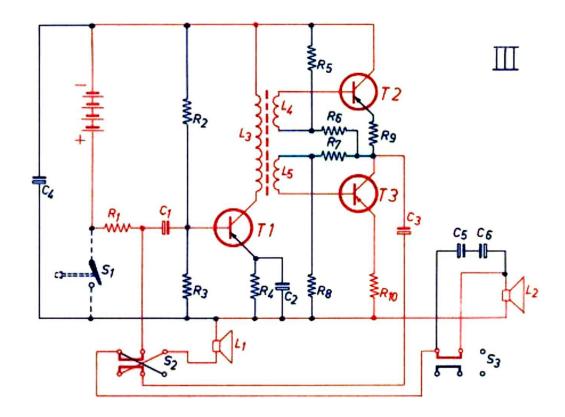
former and consequently brings about a current pulse in coils L4 and L5. This in turn cause a current pulse to flow through the transistor T2 and then return via the battery. The switch S1 is open, so that this current pulse can only pass to the earth lead through R1, C1 and R3. But then the pulse again reaches the base of T1 and is amplified there, thus again causing a current pulse to flow through the transformer, and so on. Thus from the transistor T3 small current pulses are put out regularly, which then flow through C3 and thence via the switch and loudspeaker of the called-up apparatus L1 to the earth lead. This series of current pulses can, however, also be considered as an alternating current superimposed on a direct current. In this way the buzzing sound of the call-up signal is produced. As long as neither of the two switches is pressed, the battery supplies no current, for the plus pole of the battery then has no direct connection with the earth lead, since the electrolytic capacitors, such as C1, which are always connected to the plus pole of the battery do not permit a direct current to pass.

Finally let us consider a few details and in this way explain the working of the other components.

The resistor R2 ensures that the base of T1 is given the right bias voltage. This is done in co-operation with R3. R4 together with C2, forms a decoupling filter separating the direct current from the alternating and at the same time R4 supplies the right positive voltage to the emitter of T1. The re-

sistor R<sub>5</sub> provides T<sub>2</sub> with the right base voltage and, together with R<sub>6</sub> and R<sub>7</sub> it does the same for the base of T<sub>3</sub>. T<sub>3</sub> receives the right collector voltage from R<sub>5</sub> and R<sub>6</sub>. R<sub>10</sub> ensures that the emitter of T<sub>3</sub> has the right positive voltage. R<sub>7</sub>, R<sub>8</sub> and R<sub>9</sub> do the same for T<sub>2</sub>.

The capacitor C<sub>3</sub> (100  $\mu$ F), with R<sub>9</sub>, ensures that the alternating current of the collector of T<sub>3</sub> follows the right path. C<sub>4</sub> is a by-pass capacitor which passes any leaking alternating current to earth.



If the installation of this electronic interphone should have awakened your interest for electronics, we would like to advise you to take a look at the electronic building sets EE8 and EE20. From these sets many different models can be made. (An electronic organ, a radio receiver etc). These kits contain a manual describing everything about the construction, the various components and their functions, about electronics in general and about the operation of the various circuits you have built. Who knows, perhaps these electronic sets will set you thinking again about your future. We for our part hope that in this age in which electronics has found such wide range of applications, in all directions, electronics will open the door to your future.

Colour	rst band (rst digit)	2nd band (2nd digit)	3rd band (factor)	4th band (tolerance)
gold		- 1	x 0.01	10%
silver	-	-	x 0.1	5%
black	0	。	x -	-
brown	t	1 1	<b>x</b> 10	-
red	2	2	X 100	-
orange	3	3	X 1000	-
yellow	4	4	× 10.000	-
green	5	5	x 100.000	
blue	6	6	x 1.000,000	
violet	7	7	X 10,000,000	-
grey	8	8		-
white	1 9	] 9 }		_

# **PHILIPS**

